

PART 03

Duct Construction

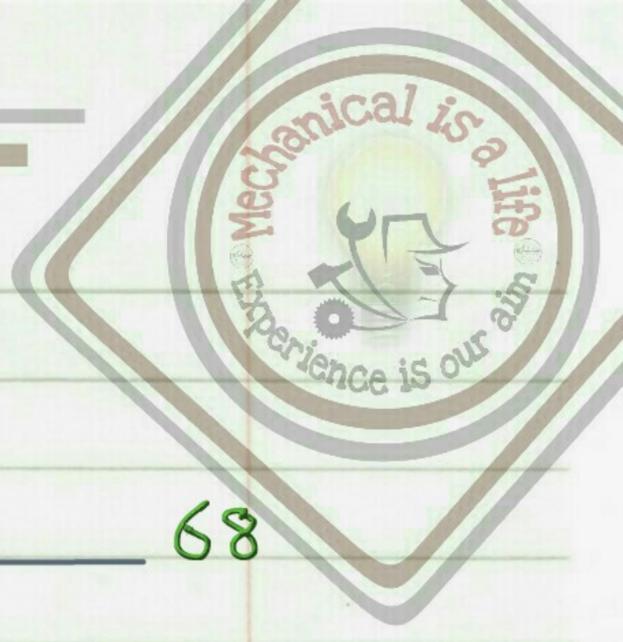
By:

Eng. Ramy Ghoraba



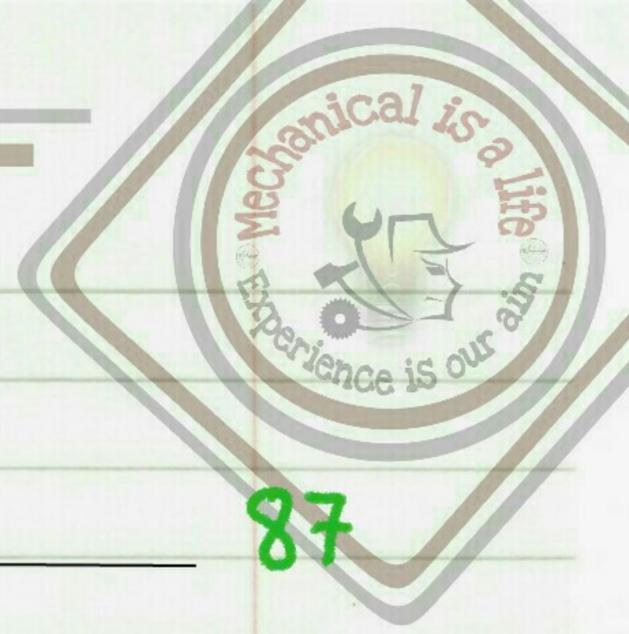


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9. Dampers

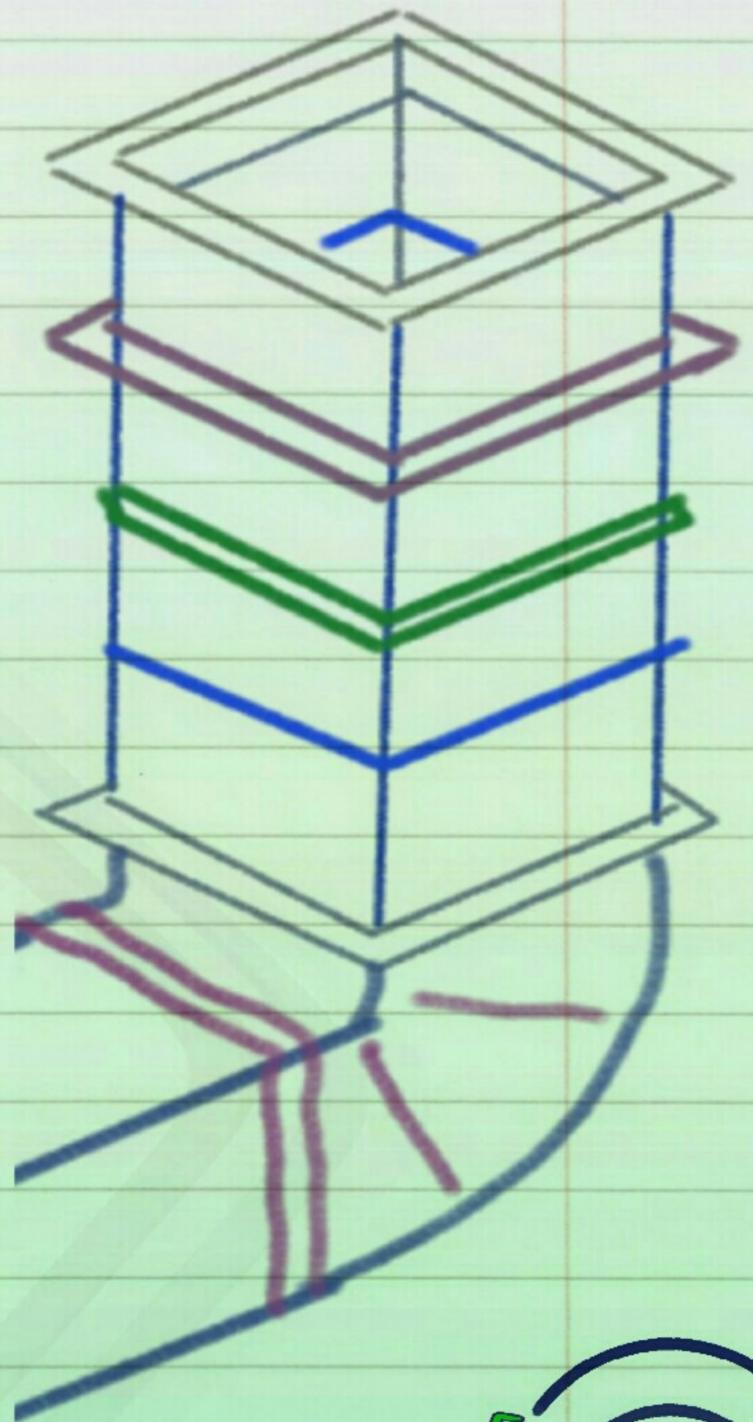
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① Duct

- Types
- Joints
- Gauges

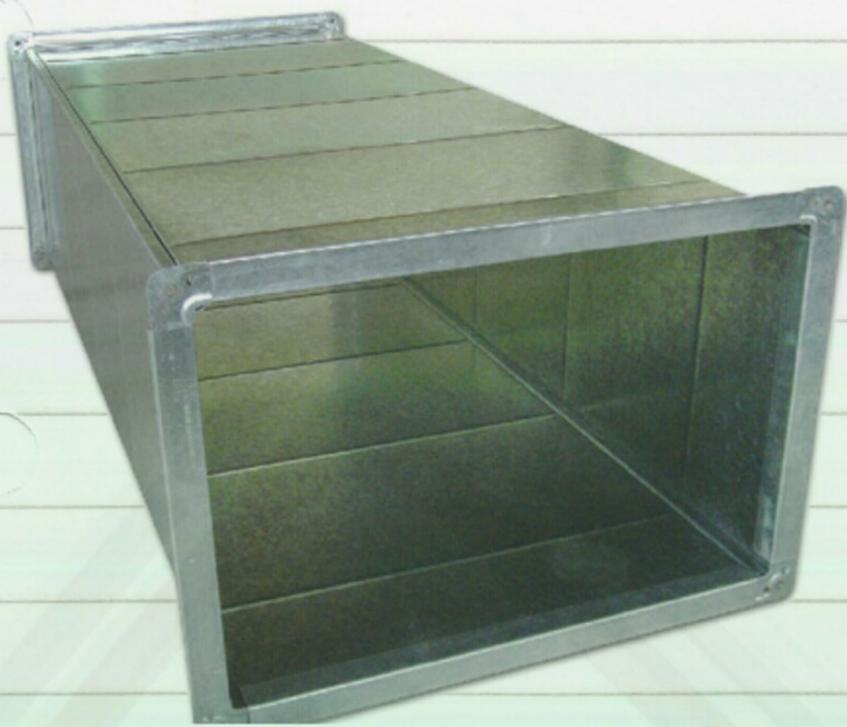




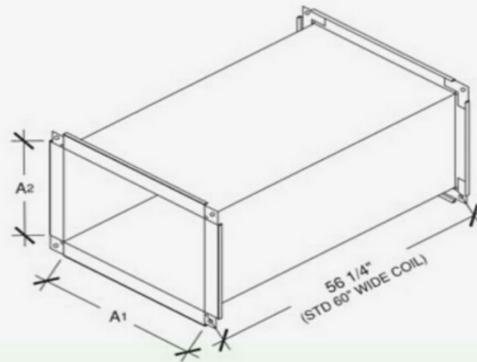
③ Duct Construction

① Duct

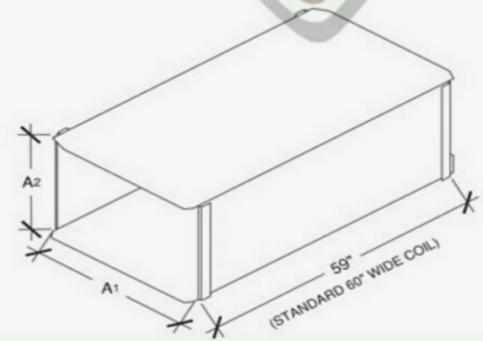
1- Rectangular Duct



DC

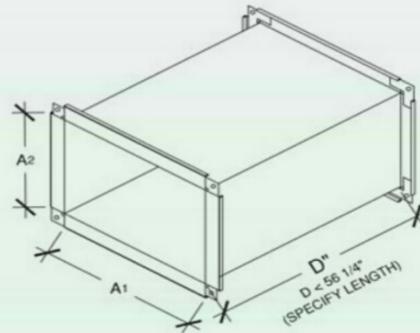


COIL-LINE DUCT
TDC CONNECTION

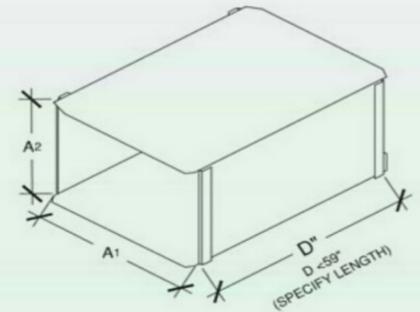


COIL-LINE DUCT
S & DRIVE CONNECTION

DP

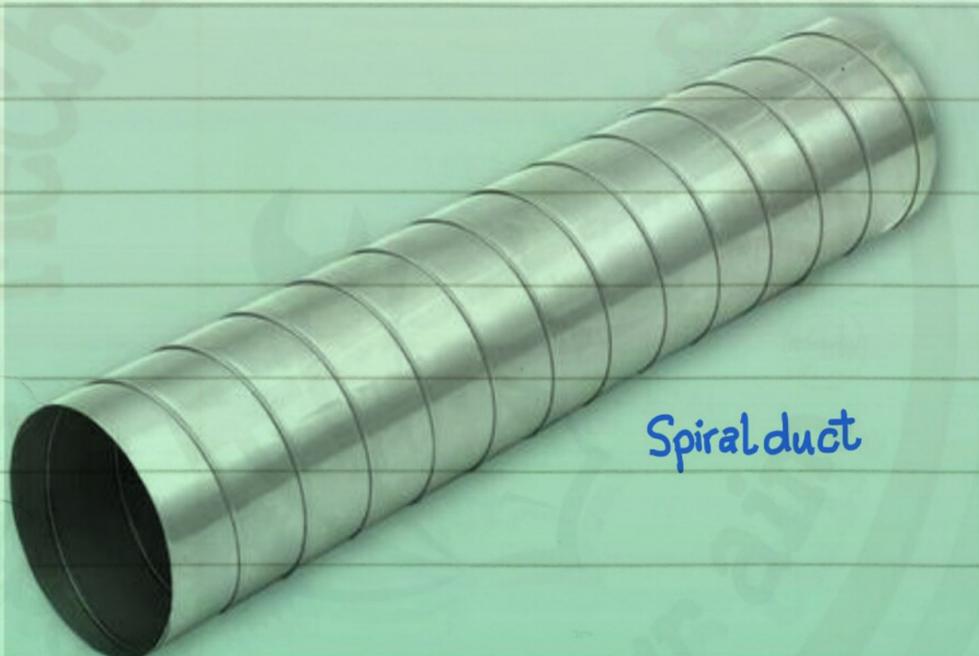


PLASMA DUCT
TDC CONNECTION

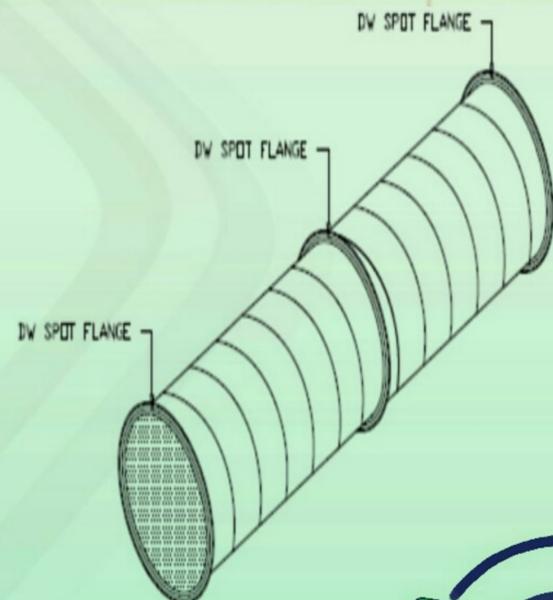


PLASMA DUCT
S & DRIVE CONNECTION

2- Spiral duct

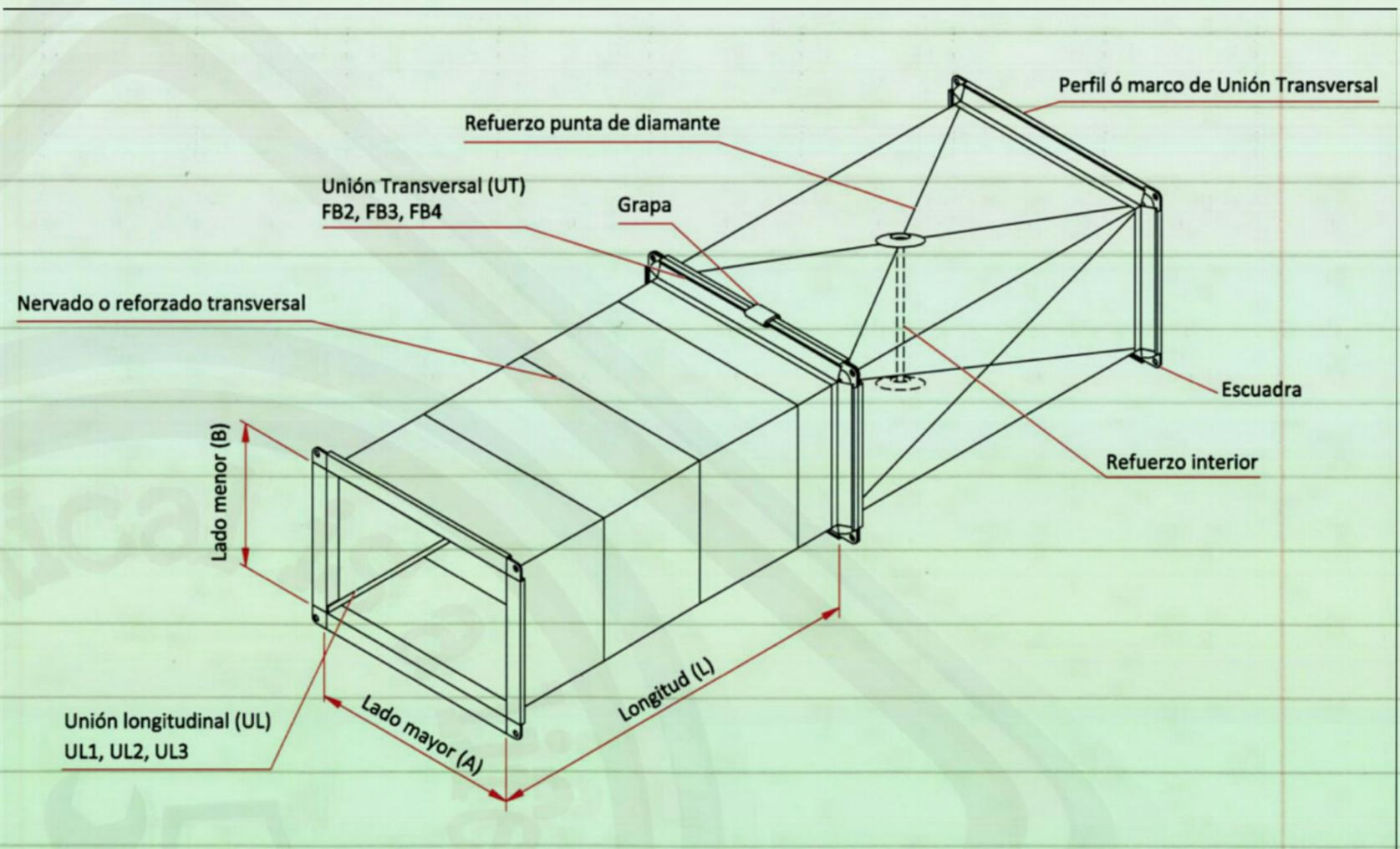


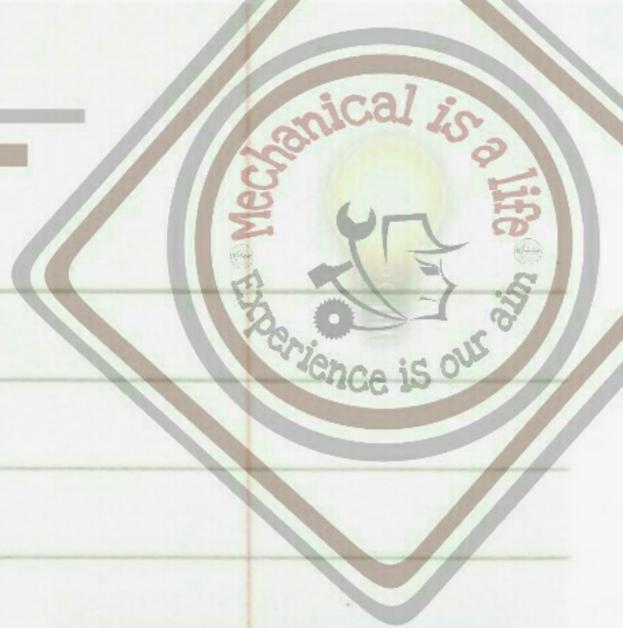
Spiral duct





Duct joints types





Rectangular duct joints

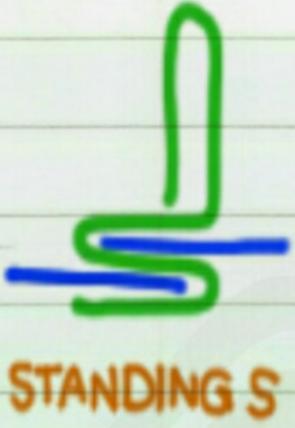
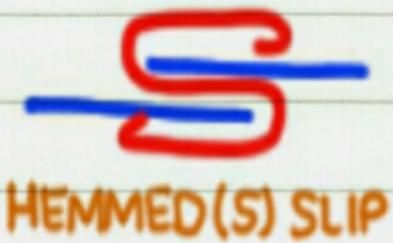
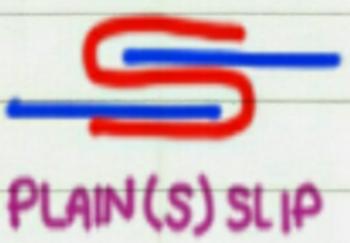
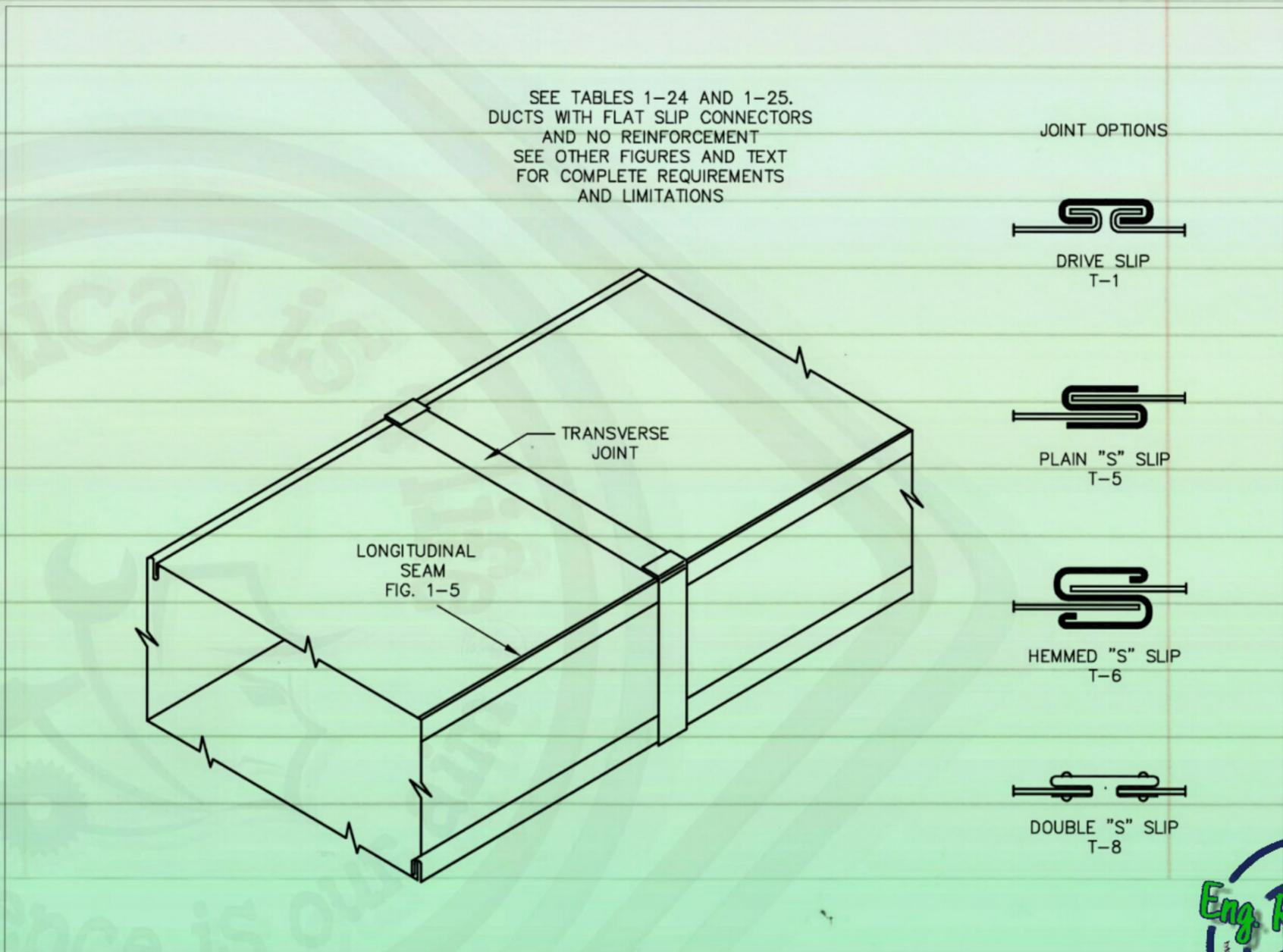
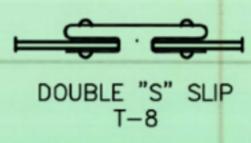
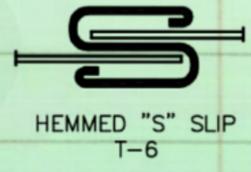
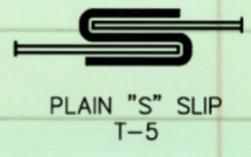


FIGURE 1-7 UNREINFORCED DUCT



SEE TABLES 1-24 AND 1-25.
DUCTS WITH FLAT SLIP CONNECTORS
AND NO REINFORCEMENT
SEE OTHER FIGURES AND TEXT
FOR COMPLETE REQUIREMENTS
AND LIMITATIONS

JOINT OPTIONS



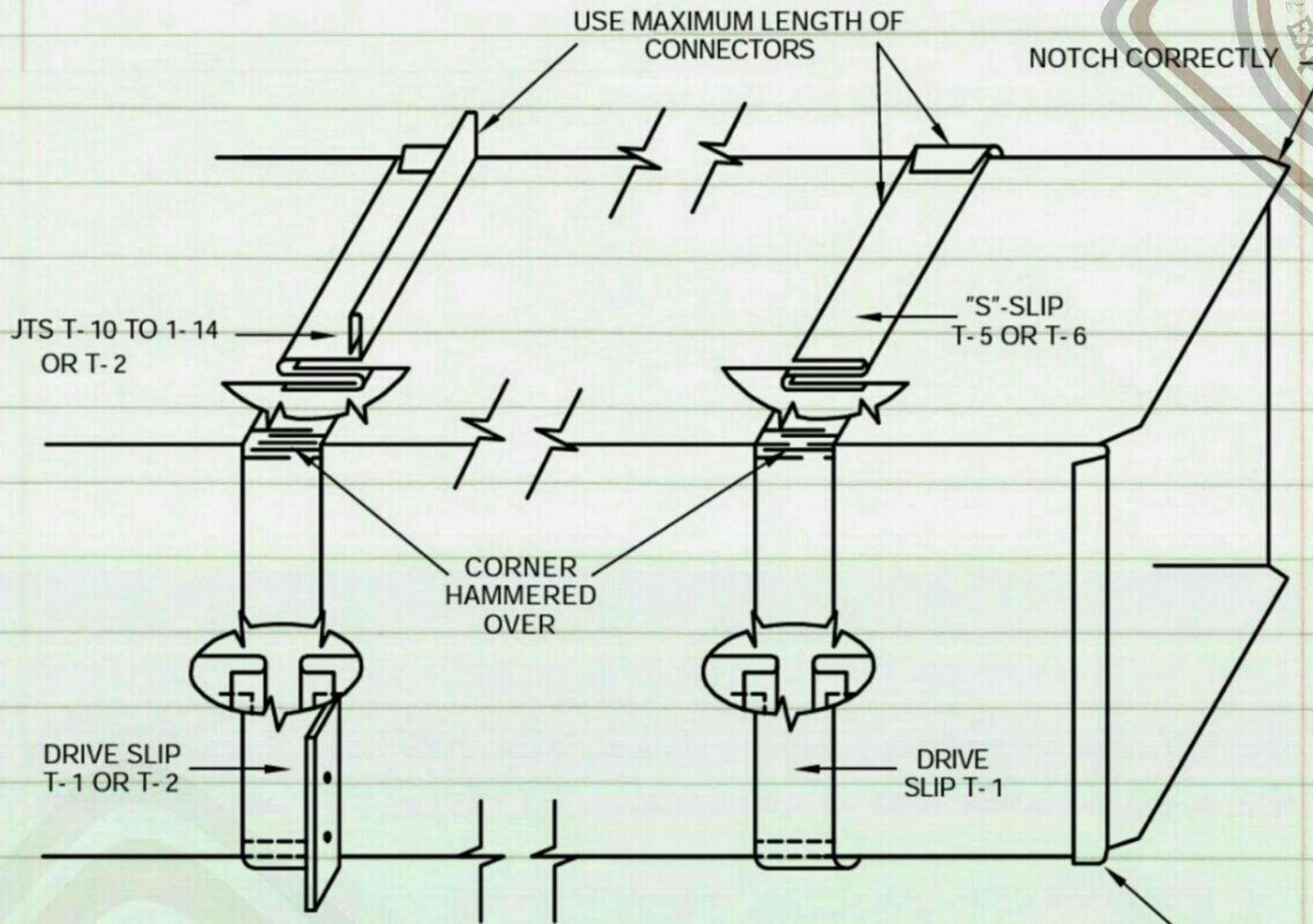
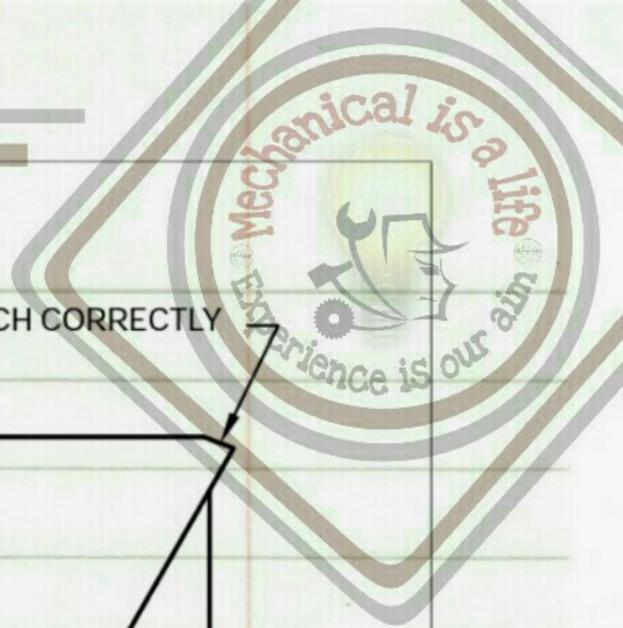
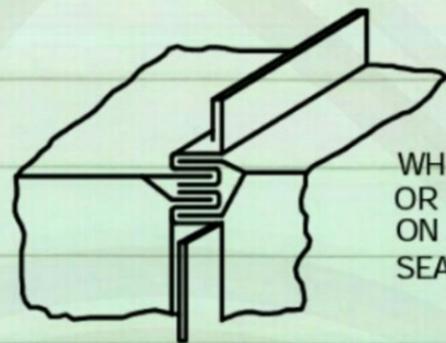


FIGURE A



BUTT OF STANDING S TYPE CONNECTORS

FIGURE B

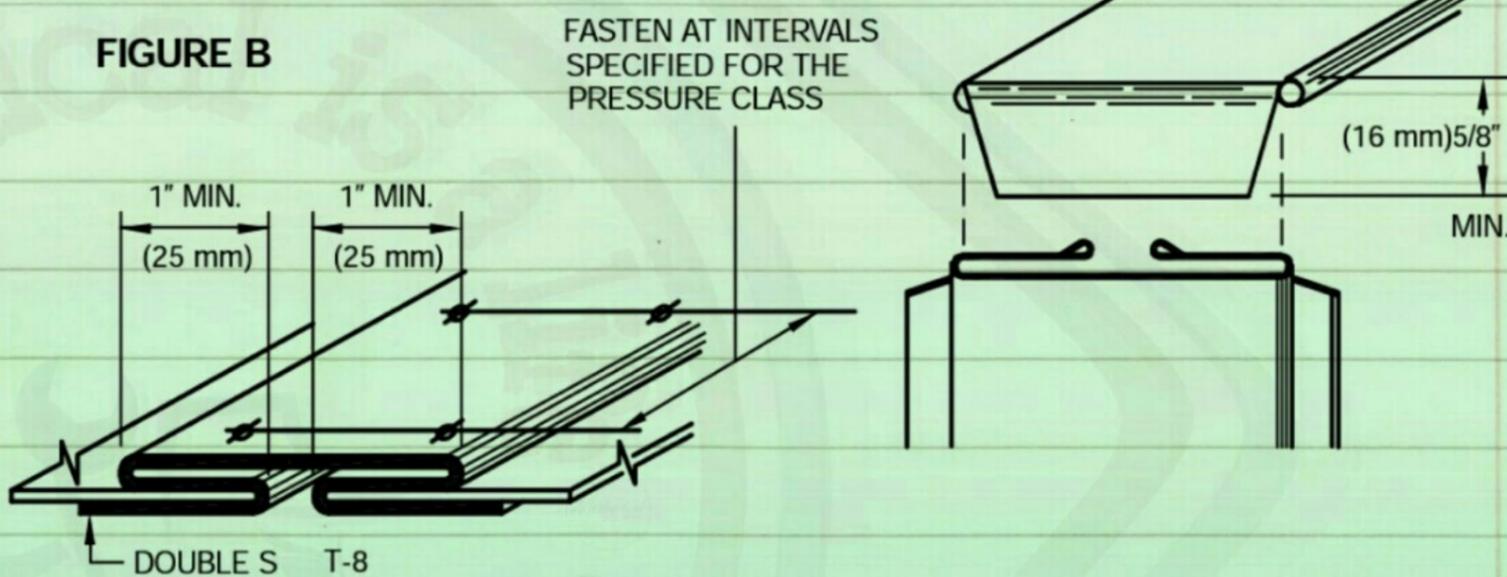
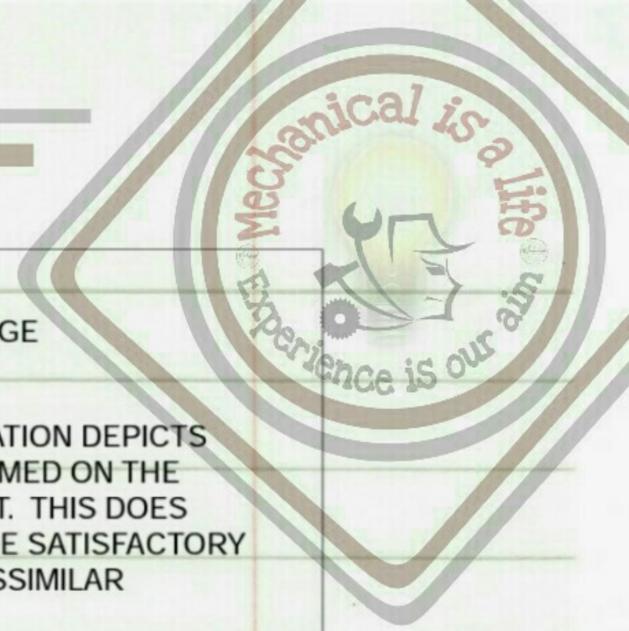


FIGURE C

FIGURE 1-13 CORNER CLOSURES - SLIPS AND DRIVES



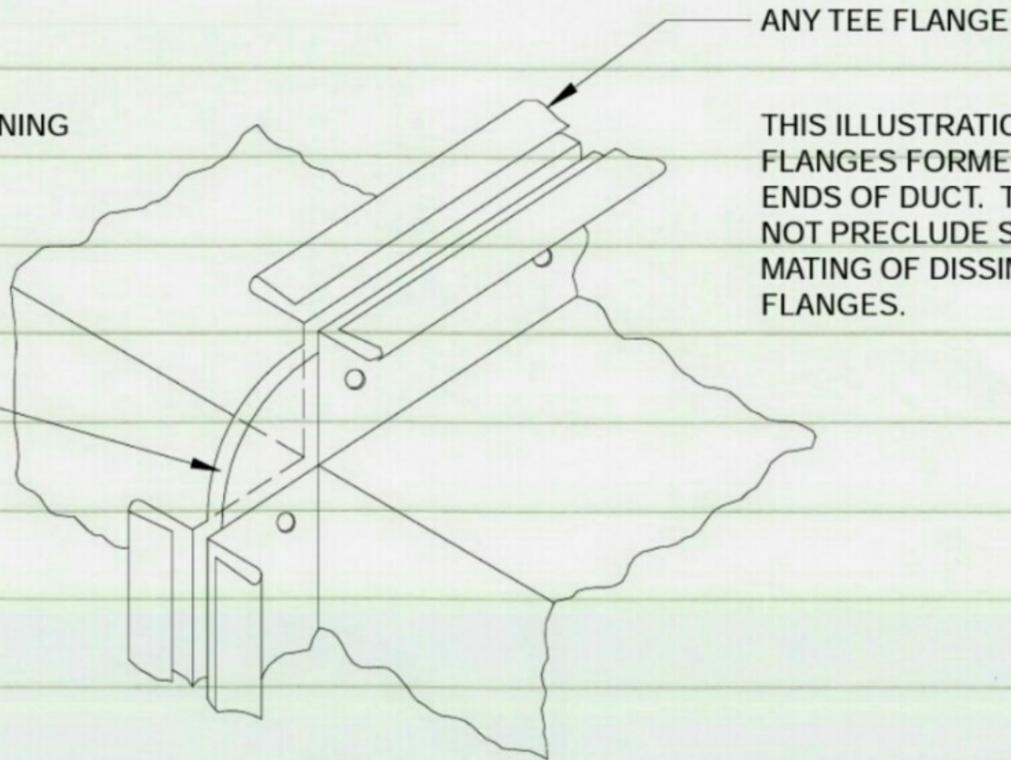


BOLT OR RIVET FASTENING
1" (25 mm) MAX.
FROM THE END AND
AT 6" (150 mm)
MAX. INTERVALS

GASKET IS USED
IN THE JOINT

CONTINUOUS
CLEATS MAY
BE USED

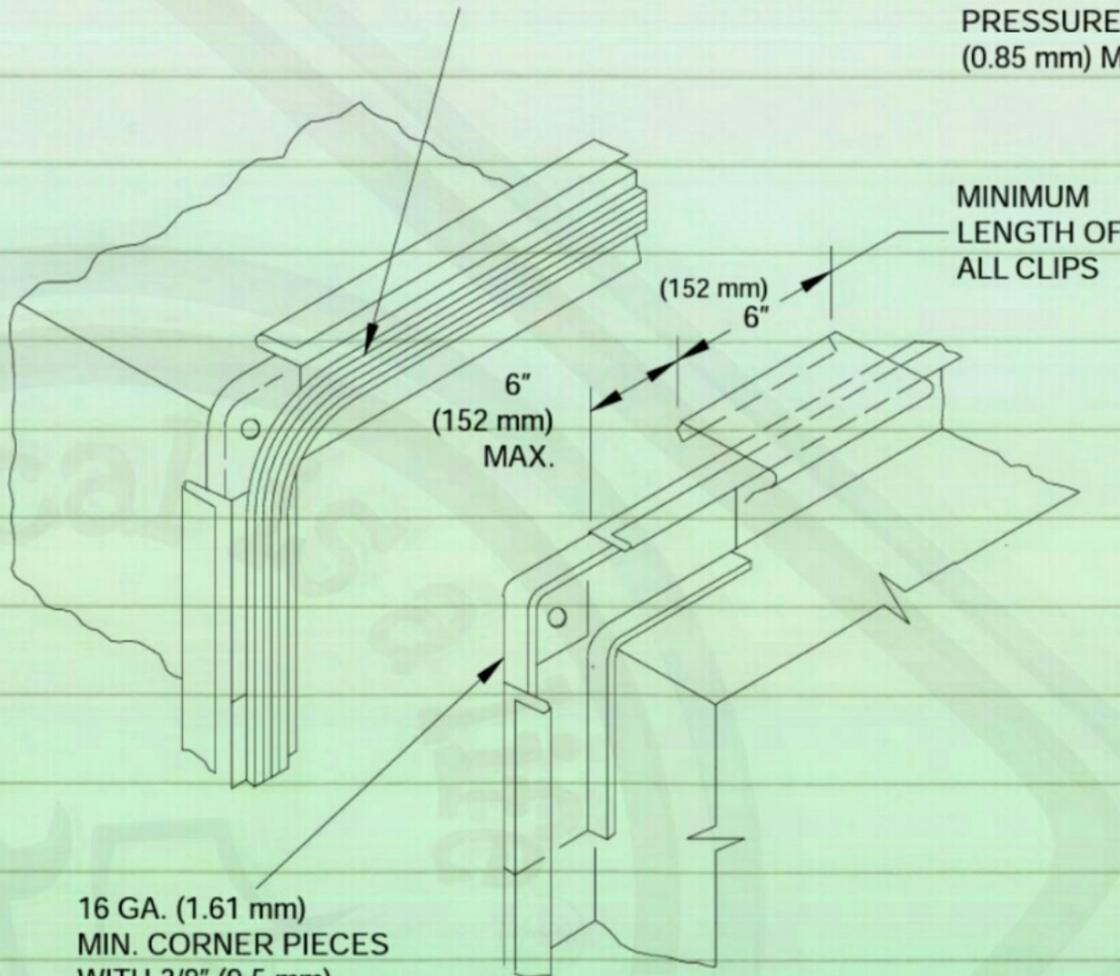
2" W.G. (500 Pa)
MAXIMUM FOR
THIS APPLICATION.
CORNER PIECES
ARE NOT REQUIRED.



(A)

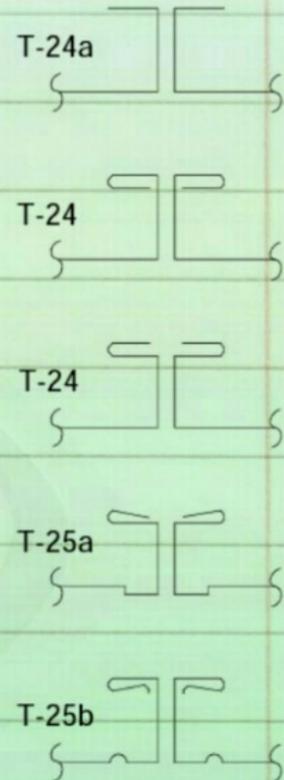
CONTINUOUS
GASKET TO EFFECTIVELY
SEAL FLANGES
AND
CORNERS

SECURELY ATTACH
ADDITIONAL METAL
CLIPS ON FLANGES AT
15" (381 mm) MAXIMUM
CENTERS FOR 3" W.G. (750 Pa)
STATIC OR LESS AND AT
12" (305 mm) MAXIMUM
CENTERS FOR HIGHER
PRESSURES. 22 GA.
(0.85 mm) MINIMUM.



(B)

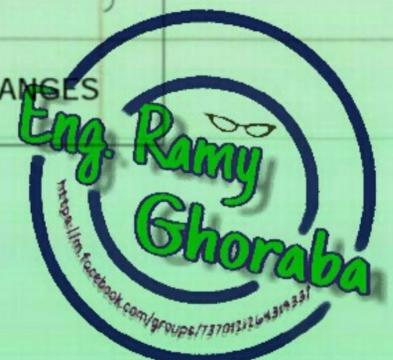
16 GA. (1.61 mm)
MIN. CORNER PIECES
WITH 3/8" (9.5 mm)
MIN. BOLT

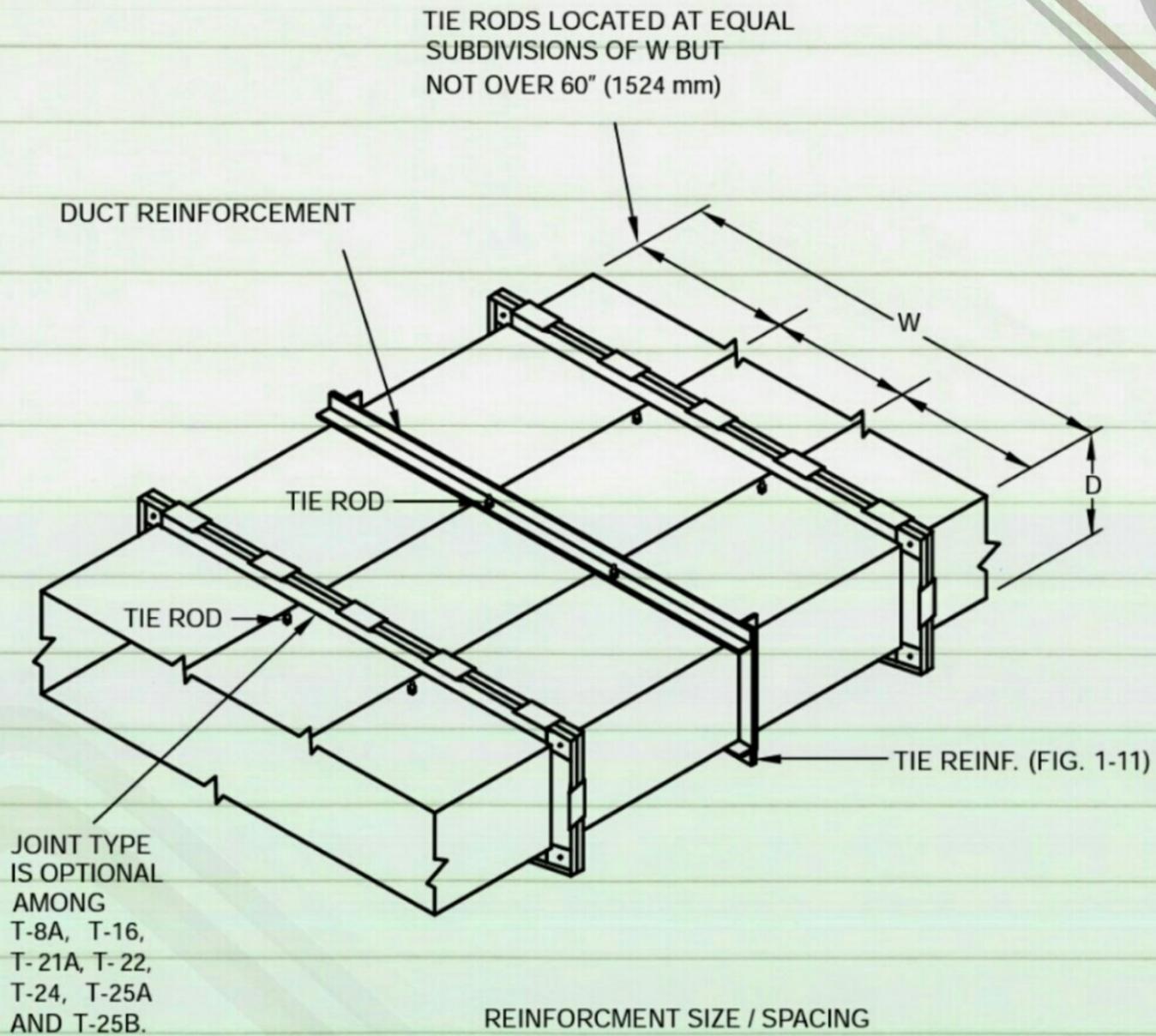
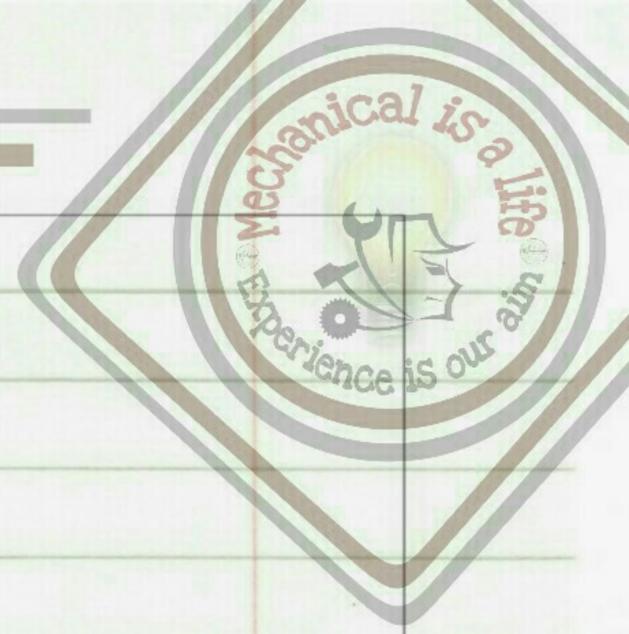


EQUIVALENT FIXATION OF JOINTS MAY BE USED. CONTINUOUS CLEATS MAY BE USED.

TEE FLANGES

FIGURE 1-15 CORNER CLOSURES - FLANGES





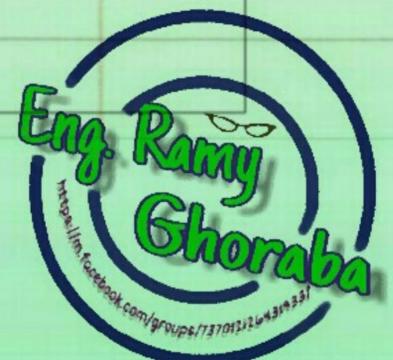
REINFORCEMENT SIZE / SPACING

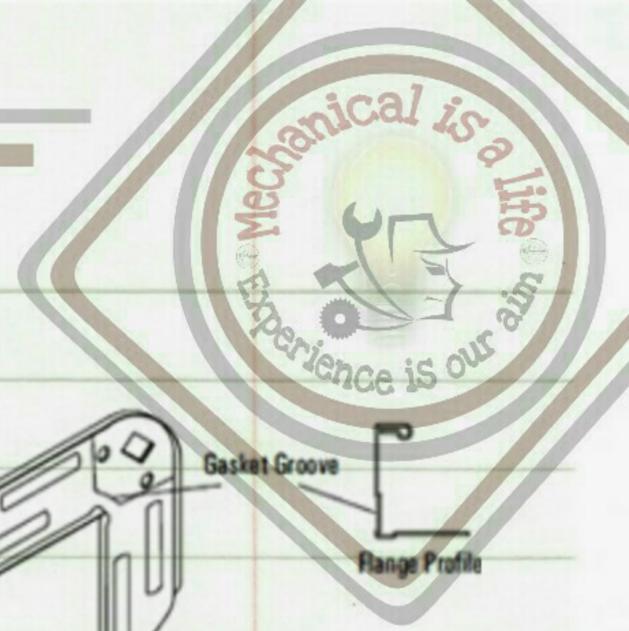
1/2 TO 3" W.G. (125 TO 750 Pa)	I _t @ 2 1/2' (0.75 M)
4" W.G. (1000 Pa)	J _t @ 2 1/2' (0.75 M)
6" W.G. (1500 Pa)	K _t @ 2' (0.60 M)
10" W.G. (2500 Pa)	L _t @ 2' (0.60 M)

NOTES:

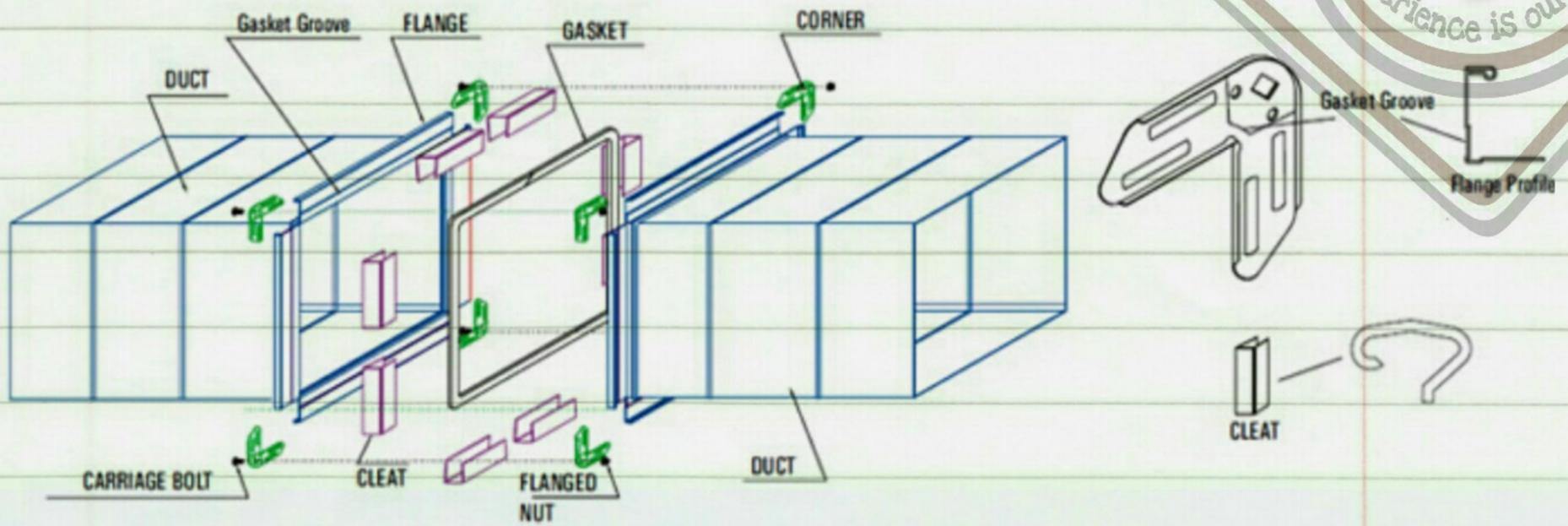
1. SEE TIE ROD TEXT.
2. USE 18 GAGE (1.31 mm) DUCT FOR 6" W.G. (1500 Pa) STATIC OR LESS AND 16 GAGE FOR 10" W.G. (2500 Pa).
3. ON 10" W.G. (2500 Pa) THE MAXIMUM TIE ROD INTERVAL ACROSS THE WIDTH IS 48" (1.2 M).
4. SEE REINFORCEMENT ATTACHMENT IN FIGURE 1-11.
5. SEE SUPPORT OF LARGE DUCTS IN FIGURE 4-6. DUCTS MUCH OVER 100" (2540 mm) WIDTH MAY REQUIRE OTHER INTERNAL SUPPORTS FOR SHAPE RETENTION UNLESS THEY ARE SUPPORTED AS SHOWN IN FIGURE 4-6.

FIGURE 1-12 DUCT OVER 120" (3048 MM) WIDE

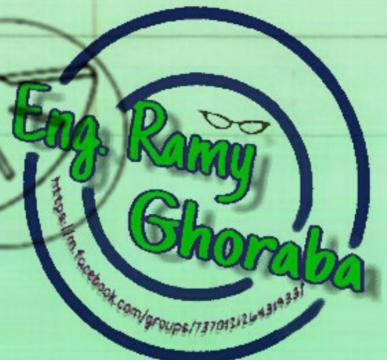
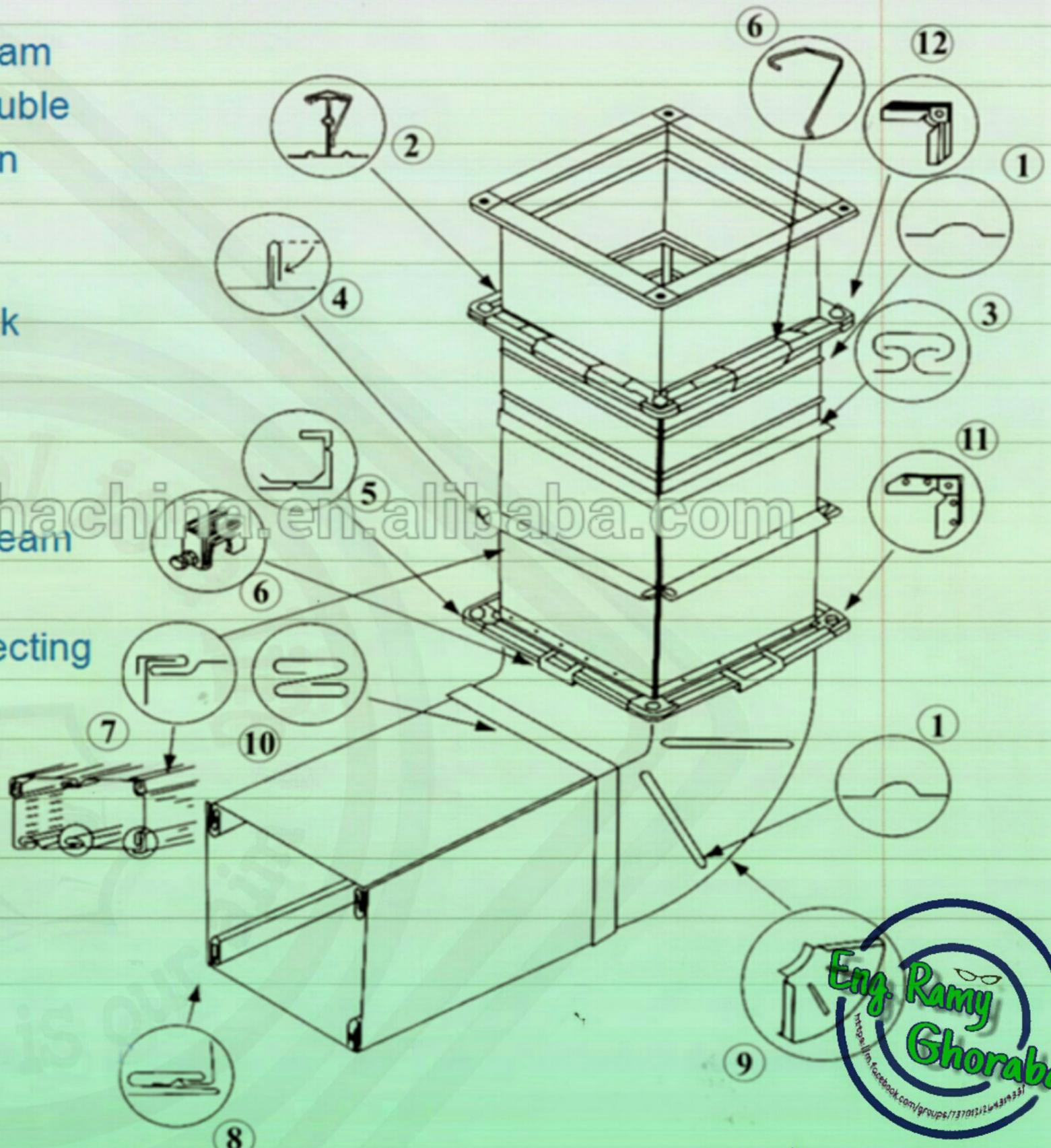


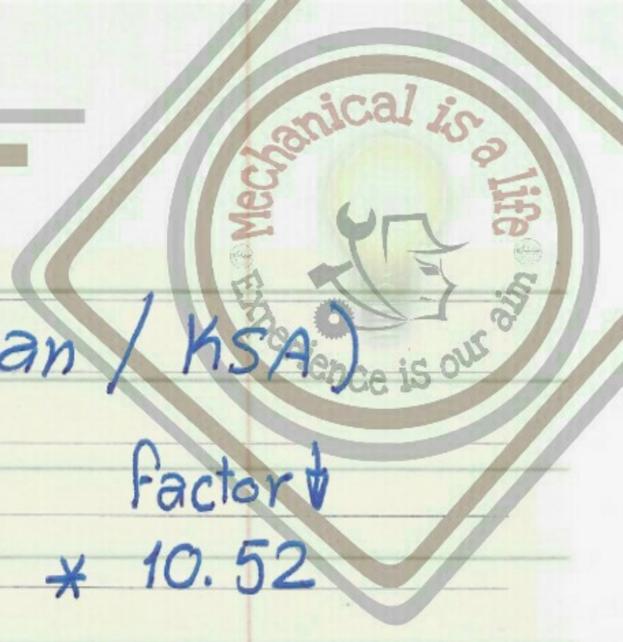


Duct installation with joints



- 1. Glooving
- 2. TDF Flang
- 3. "C" Locking Seam
- 4. Single and Double Hem Locknection
- 5. TDC Flang
- 6. Clip
- 7. Pittsburgh Lock
- 8. Single Lock
- 9. Snap Lock
- 10. Elbow Lock
- 11. "S" Locking Seam
- 12. TPC Corner
- 13. Corner connecting





① Galvanized steel sheet G(90) (Japan / KSA)
 Size (2.4*1.2) or (2*1)m

gauge (18) → ^{1.3} mm thickness * 10.52 Factor ↓

(20) → = 1mm thickness * 8.08

(22) → 0.8 mm * 6.86

(24) → 0.6 mm * 5.64

(26) → 0.5 mm * 4.42 Kg/m²

USG	NOM. T(mm)	lb/ft2	Kg/m2	SHEET AREA(m2)			SHEET WEIGHT			NO. OF SHEETS PER TON		
				(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
26	0.55	0.91	4.42	1.00	1.20	2.00	4.42	5.30	8.84	226.24	188.54	113.12
24	0.7	1.156	5.64	1.00	1.20	2.00	5.64	6.77	11.28	177.30	147.75	88.65
22	0.85	1.4	6.86	1.00	1.20	2.00	6.86	8.23	13.72	145.77	121.48	72.89
20	1	1.66	8.1	1.00	1.20	2.00	8.10	9.72	16.20	123.46	102.88	61.73
18	1.3	2.156	10.52	1.00	1.20	2.00	10.52	12.62	21.04	95.06	79.21	47.53
16	1.61	2.66	12.96	1.00	1.20	2.00	12.96	15.55	25.92	77.16	64.30	38.58
14	1.994	3.28	16.01	1.00	1.20	2.00	16.01	19.21	32.02	62.46	52.05	31.23

Urgent

AS Per SMACNA

D.C.A.2-95

SEC. ED

JANUARY							FEBRUARY						
S	S	M	T	W	T	F	S	S	M	T	W	T	F
1	2	3	4	5	6					1	2	3	
7	8	9	10	11	12	13	4	5	6	7	8	9	10
14	15	16	17	18	19	20	11	12	13	14	15	16	17
21	22	23	24	25	26	27	18	19	20	21	22	23	24

The National Association Sheet Metal Contractors 1929		
RECTANGULAR SIZES	GAGES OF SHEETS FOR	ROUND DIAMETER
Up to 12 in.	26	Up to 12 in.
13 to 30 in.	24	13 to 30 in.
31 to 42 in.	22	31 to 40 in.
43 to 60 in.	20	41 to 60 in.
61 in. and over	18	61 in and over

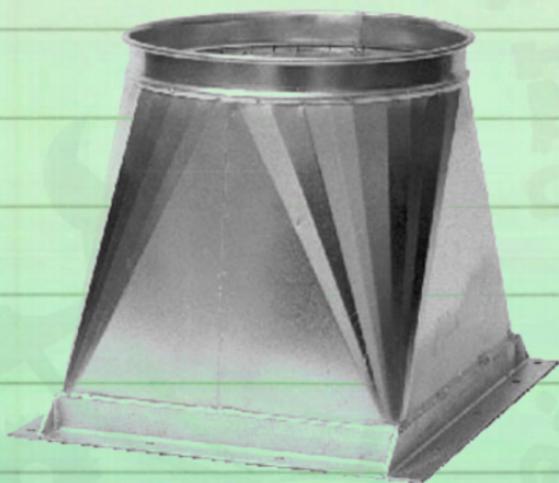
MAY					JUNE					
T	W	T	F	S	S	M	T	W	T	F
2	3	4	5					1	2	
9	10	11	12	3	4	5	6	7	8	9
16	17	18	19	10	11	12	13	14	15	16
22	23	24	25	17	18	19	20	21	22	23





Duct fitting

Ec-Centric reducer

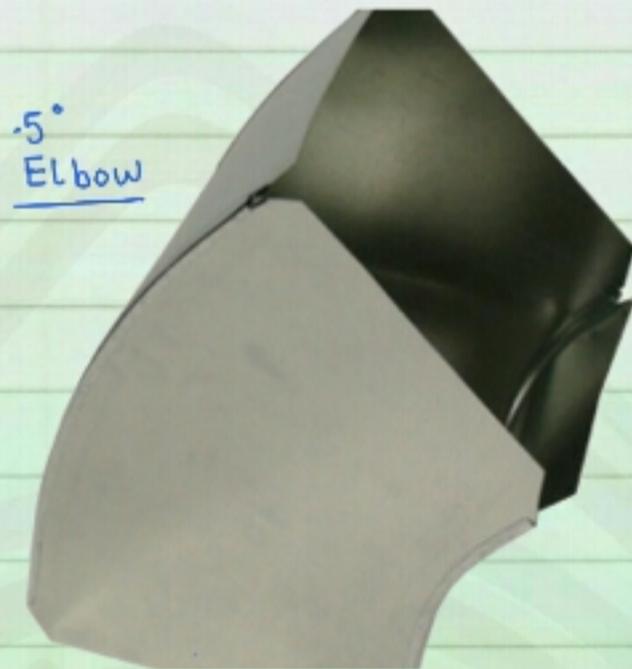




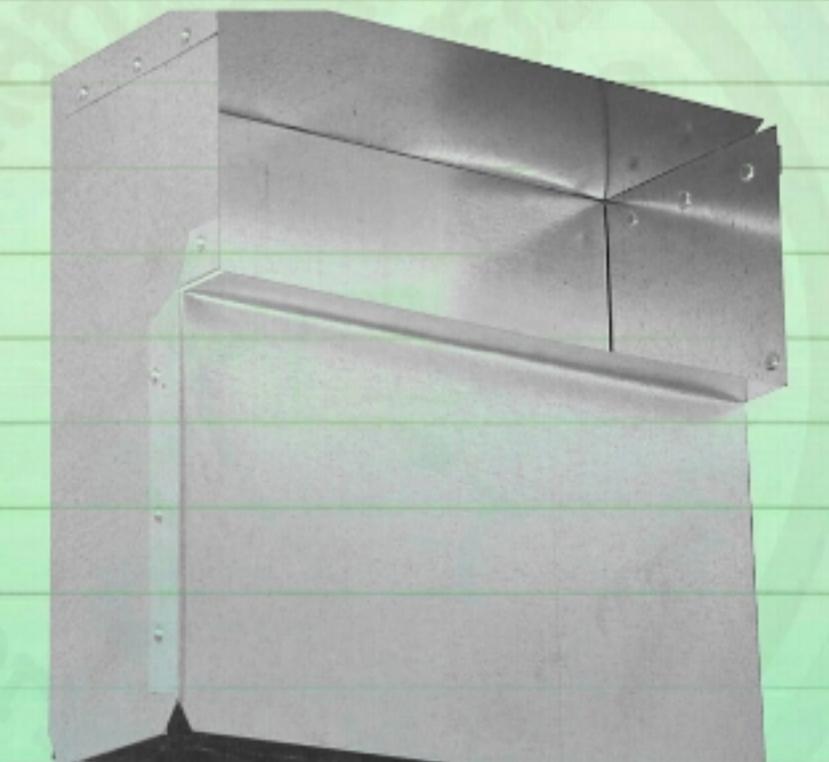
Elbow



Elbow 90 degree

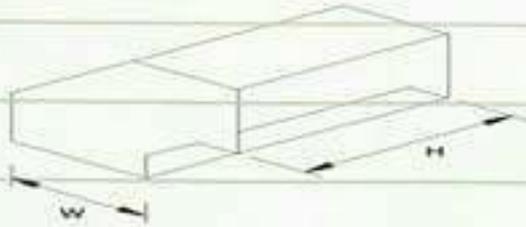
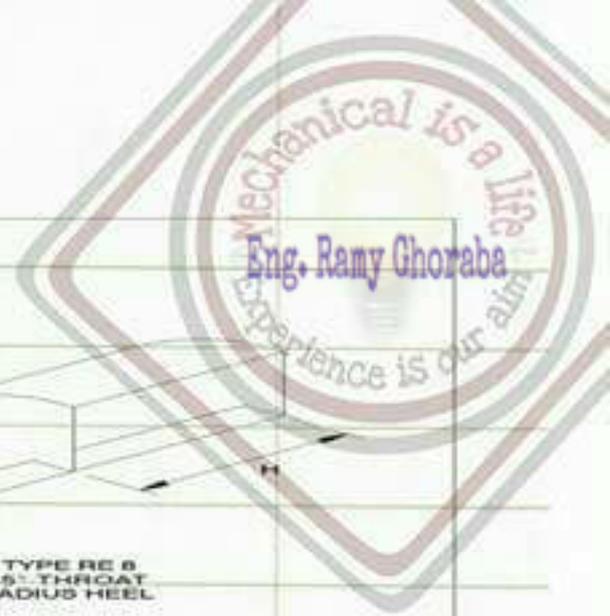


Elbow 45 degree



Rectangular elbow
90 degree

Elbow types

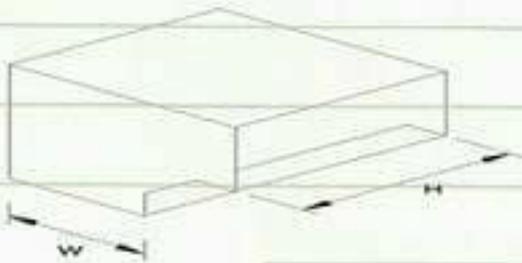


TYPE RE 7
45° THROAT
45° HEEL



TYPE RE 8
45° THROAT
RADIUS HEEL

ALL 45° THROATS ARE 4" (100 MM) MINIMUM



TYPE RE 9
45° THROAT
90° HEEL

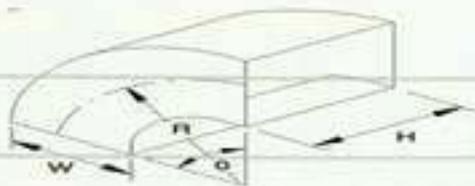


TYPE RE 10
RADIUS THROAT
90° HEEL

BEAD, CROSSBREAK AND REINFORCE FLAT SURFACES AS IN STRAIGHT DUCT

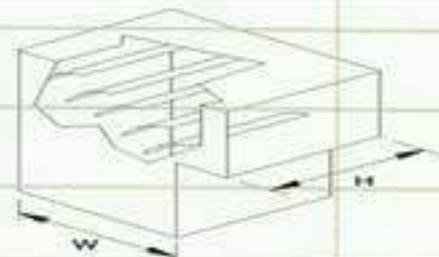
PAGE 2 OF 2

FIGURE 4-2 RECTANGULAR ELBOWS (CONTINUED)

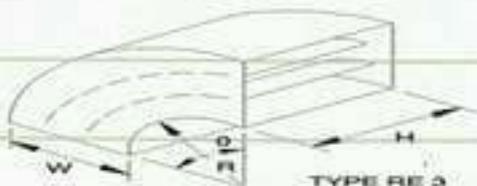


TYPE RE 1
RADIUS ELBOW

CENTERLINE $R = \frac{3W}{2}$ UNLESS OTHERWISE SPECIFIED - IS NOT RESTRICTED TO 90° SQUARE THROAT, $\frac{R}{W} = 0.5$, MAY BE USED, UP TO 1000 FPM (5 mps).

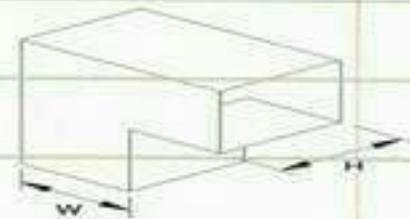


TYPE RE 2
SQUARE THROAT ELBOW
WITH VANES

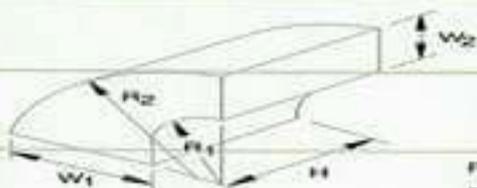


TYPE RE 3
RADIUS ELBOW
WITH VANES

NOTE: FOR RE 3 SEE SPLITTER VANES IN SMACNA HVAC SYSTEMS DUCT DESIGN



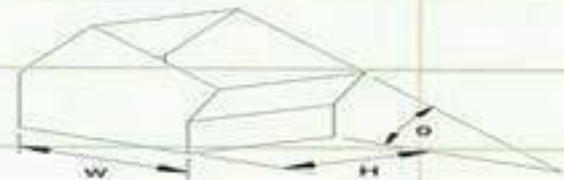
TYPE RE 4
SQUARE THROAT ELBOW
WITHOUT VANES
(1000 FPM (5 mps) MAXIMUM VELOCITY)



TYPE RE 5
DUAL RADIUS ELBOW

$$R_1 = \frac{3}{4} W_1$$

$$R_2 = R_1 + W_2$$



TYPE RE 6
MITERED ELBOW

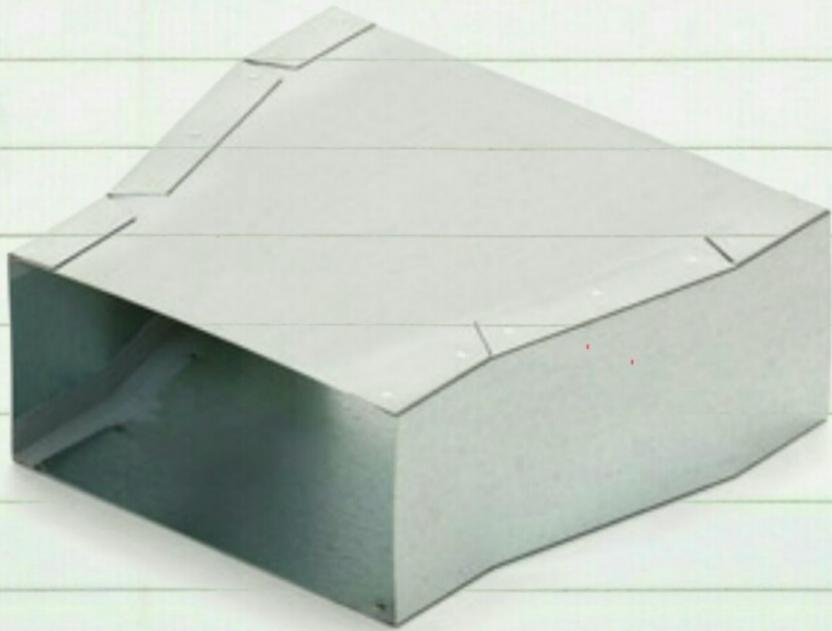
BEAD, CROSSBREAK AND REINFORCE FLAT SURFACES AS IN STRAIGHT DUCT

PAGE 1 OF 2

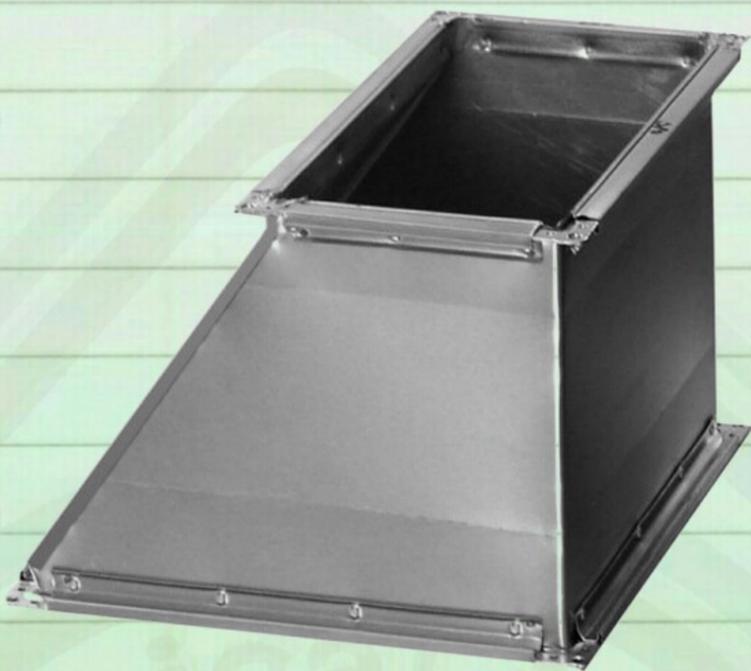
FIGURE 4-2 RECTANGULAR ELBOWS



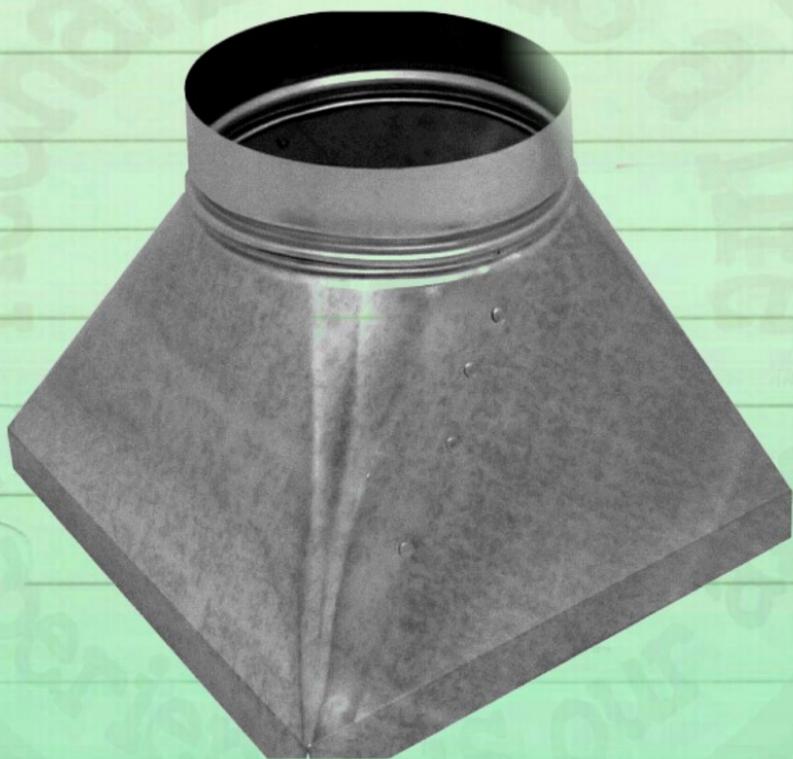
Reducer



Centric Reducer



Eccentric Reducer



Square to Round Reducer

Reducer & Offset types

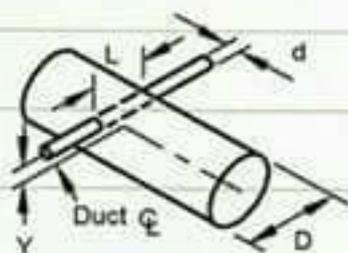


FIG. A IS APPLICABLE FOR UP TO 20% AREA OBSTRUCTION WITH ROUND SHAPED MEMBER AND 10% WITH FLAT PROFILE. Y IS THE DISTANCE FROM DUCT CENTER.

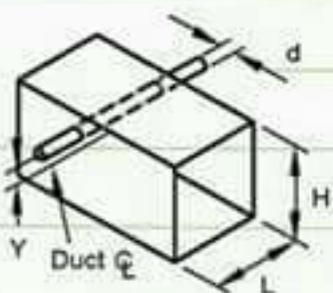
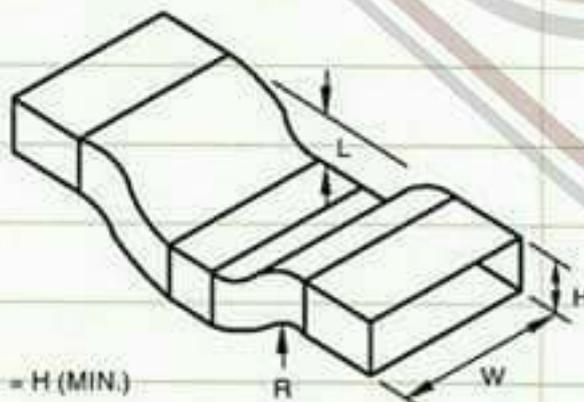


FIG. A



$R = H$ (MIN.)

FIG. B

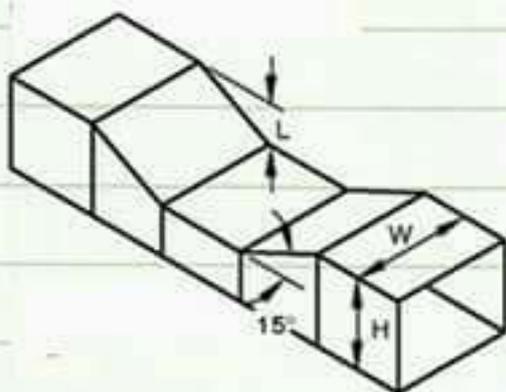
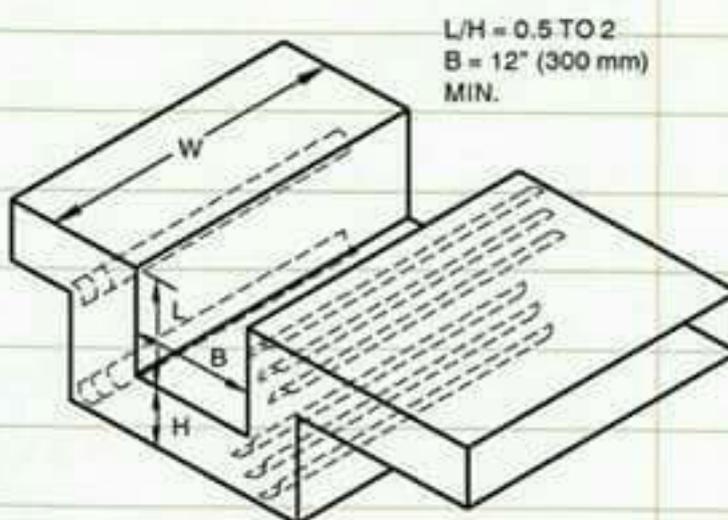


FIG. C

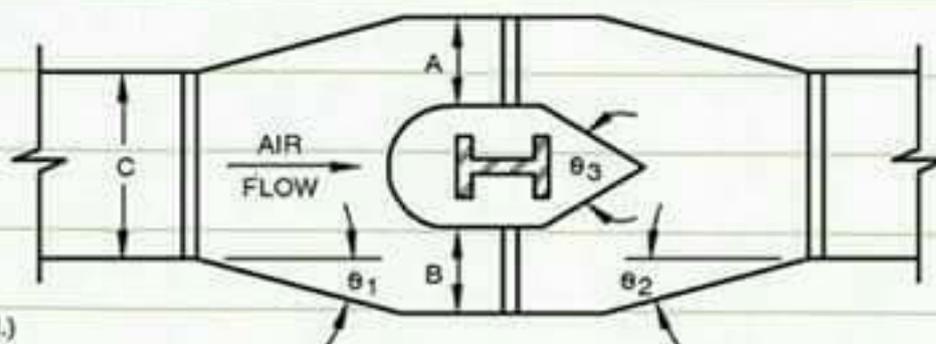
20% MAXIMUM AREA REDUCTION



$L/H = 0.5$ TO 2
 $B = 12"$ (300 mm) MIN.

FIG. D

VANES MUST DIRECT FLOW PARALLEL TO DUCT WALL
 CAUTION: HIGH LOSS COEFFICIENTS



$A+B = 1.25C$ (MIN.) AT CONSTANT DEPTH.

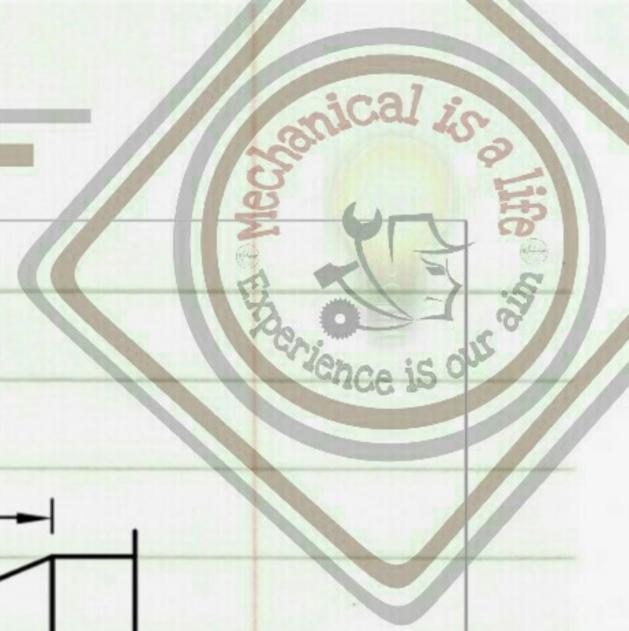
FIG. E

$\theta_1 = 20^\circ$ MAX.
 $\theta_2 = 30^\circ$ MAX.
 $\theta_3 = 60^\circ$ MAX.

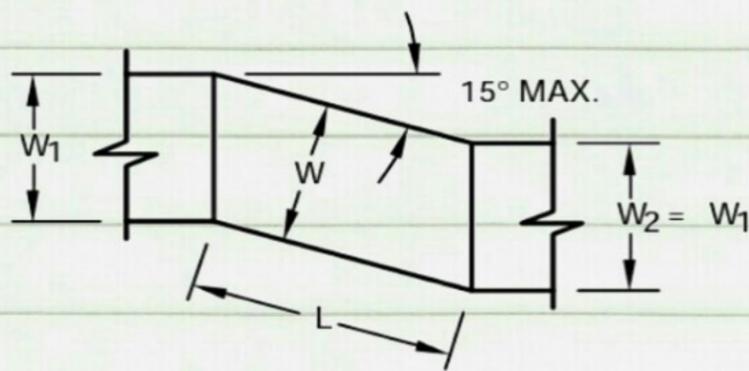
(USED WHEN OBSTRUCTION EXCEEDS 20% OF SECTION AREA AND OFFSETS AROUND ARE NOT POSSIBLE).



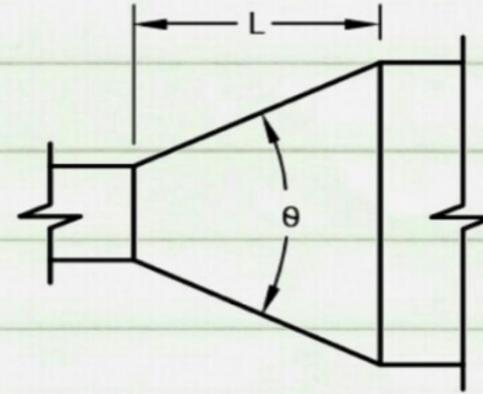
FIGURE 4-8 OBSTRUCTIONS



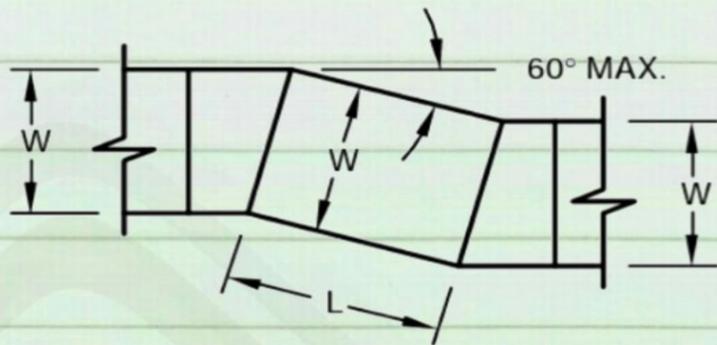
OFFSETS 2 AND 3 AND TRANSITIONS MAY HAVE EQUAL OR UNEQUAL INLET AND OUTLET AREAS. TRANSITIONS MAY CONVERT DUCT PROFILES TO ANY COMBINATION FOR RECTANGULAR, ROUND OR FLAT OVAL SHAPES.



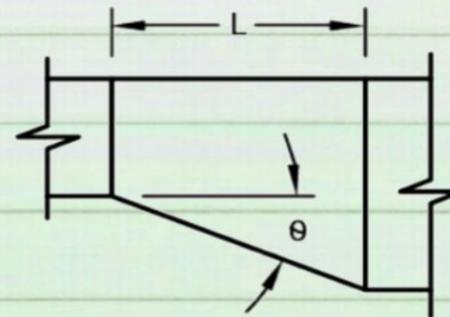
OFFSET TYPE 1 (ANGLED)



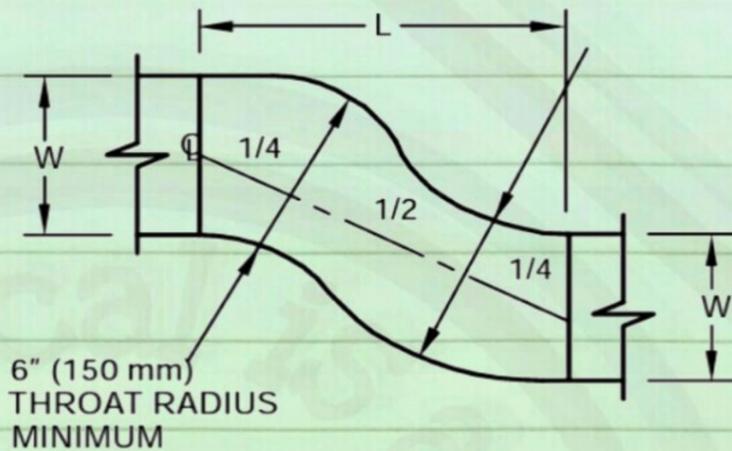
CONCENTRIC TRANSITION
 θ MAX. 45° DIVERGING, 60° CONVERGING



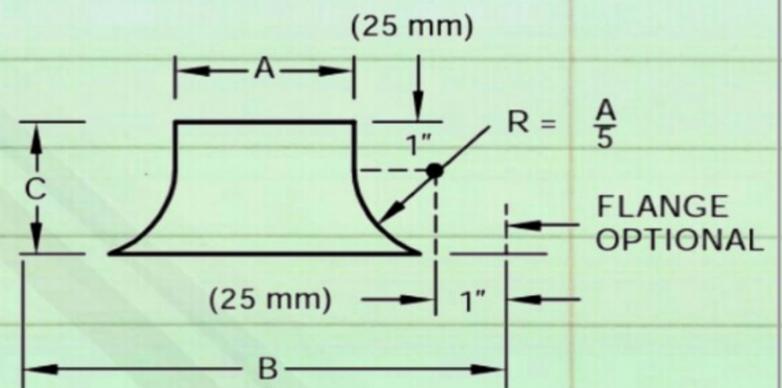
OFFSET TYPE 2 (MITERED)



ECCENTRIC TRANSITION
 θ MAX. 30°
 (EXCEPT 45° IS PERMITTED AT ROUND TO FLAT OVAL)



OFFSET TYPE 3 (RADIUSSED OR OGEE)



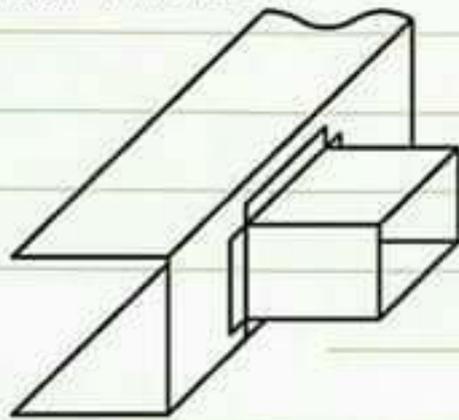
STANDARD BELLMOUTH
 (ON SHORT PATTERN BELL
 $C = 3'' (76 \text{ mm})$
 $B = A + 4'' (102 \text{ mm})$)

FIGURE 2-7 OFFSETS AND TRANSITIONS

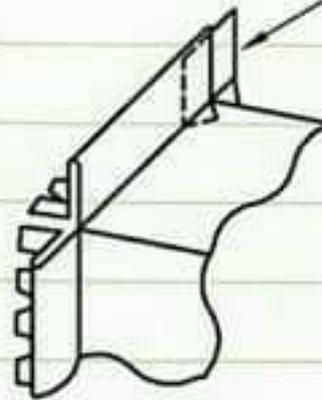


Take off (Branch connection) types

SEE VOLUME DAMPERS IN FIG. 2-1 AND FIG 2-15

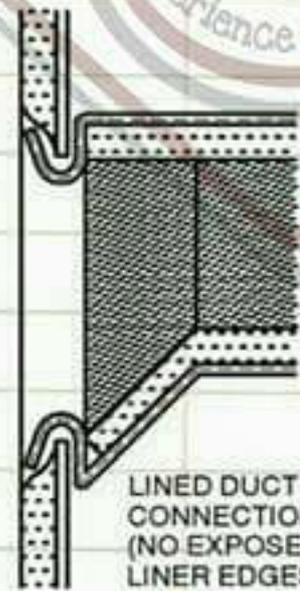


STRAIGHT TAP BUTT FLANGE OR CLINCH LOCK

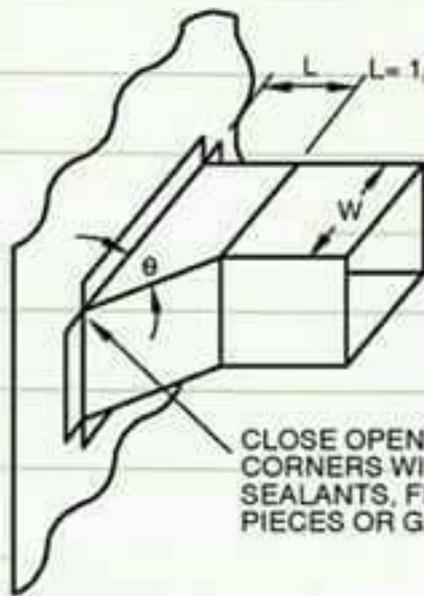


CLINCH LOCK

CORNER FILLER PIECE OR USE GASKET



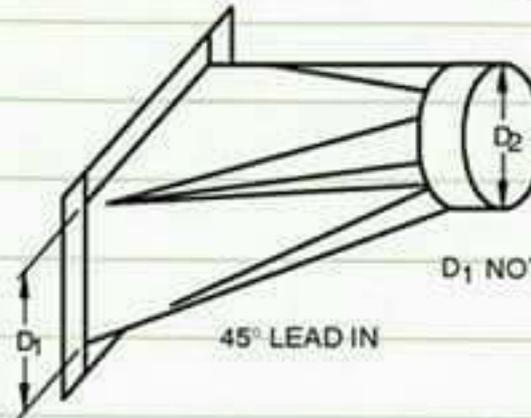
LINED DUCT CONNECTION (NO EXPOSED LINER EDGES)



$L = 1/4W, 4" (102 \text{ mm}) \text{ MIN.}$

CLOSE OPENING AT CORNERS WITH SEALANTS, FILLER PIECES OR GASKET

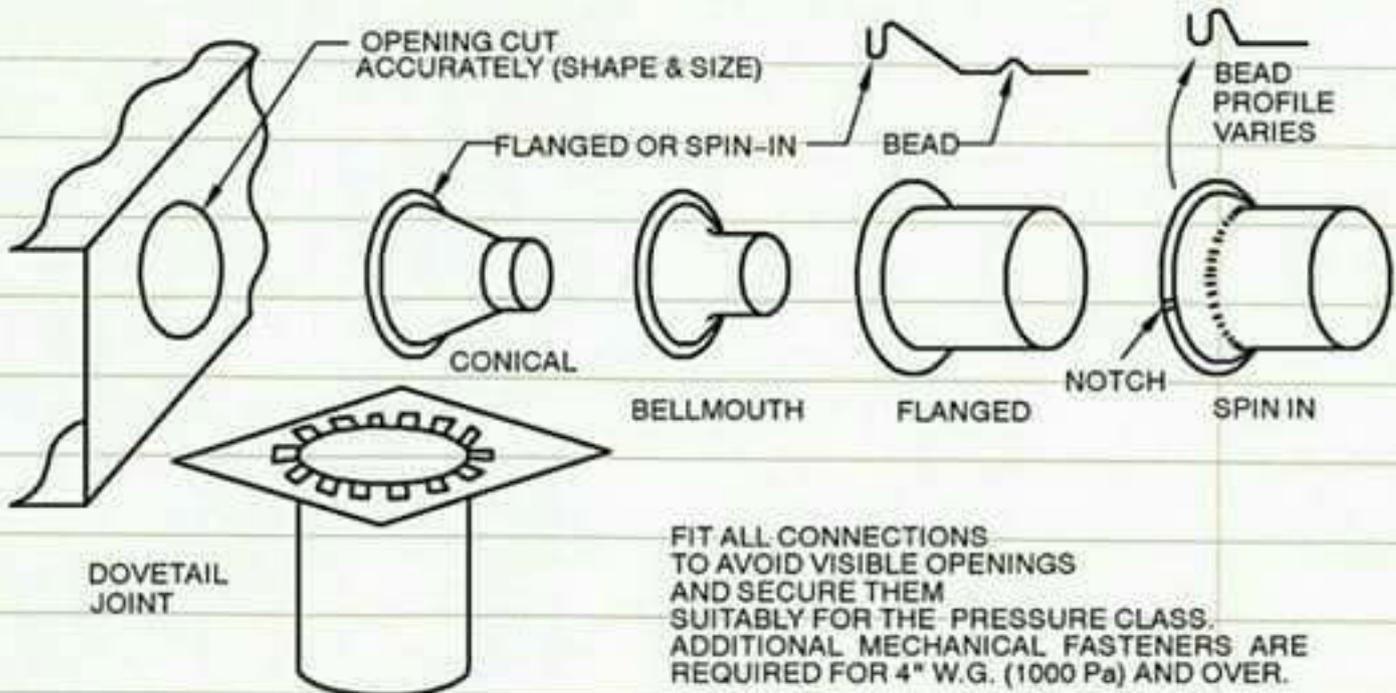
45 DEGREE ENTRY $\theta 45^\circ$



$D_1 \text{ NOT LESS THAN } D_2$

45° LEAD IN

DO NOT USE CONNECTIONS WITH SCOOPS.



OPENING CUT ACCURATELY (SHAPE & SIZE)

FLANGED OR SPIN-IN

BEAD

BEAD PROFILE VARIES

CONICAL

BELLMOUTH

FLANGED

NOTCH

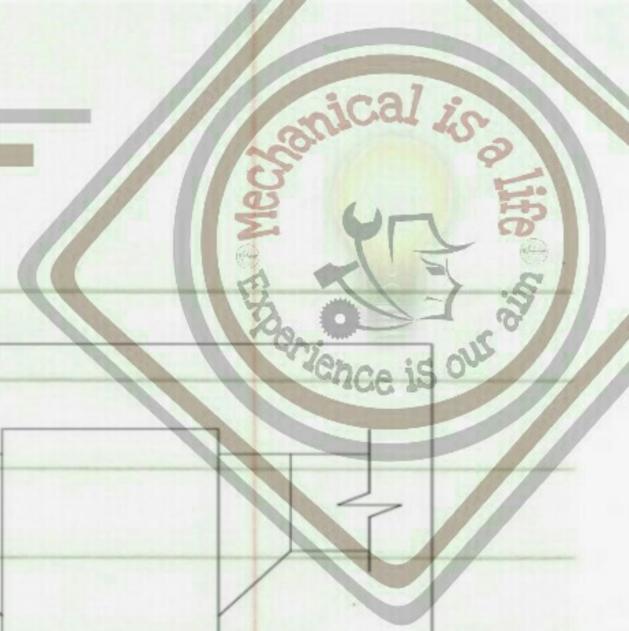
SPIN IN

DOVETAIL JOINT

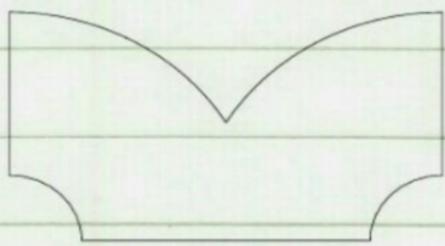
FIT ALL CONNECTIONS TO AVOID VISIBLE OPENINGS AND SECURE THEM SUITABLY FOR THE PRESSURE CLASS. ADDITIONAL MECHANICAL FASTENERS ARE REQUIRED FOR 4" W.G. (1000 Pa) AND OVER.

FIGURE 4-6 BRANCH CONNECTION

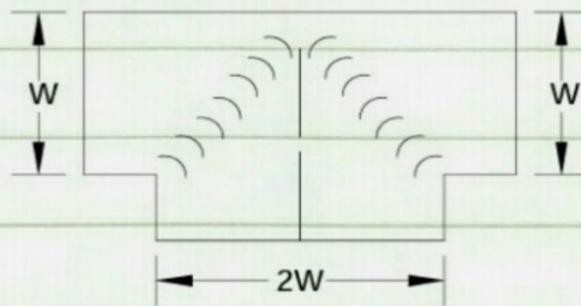




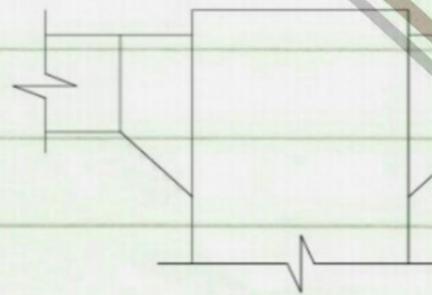
T connection types



TYPE 1



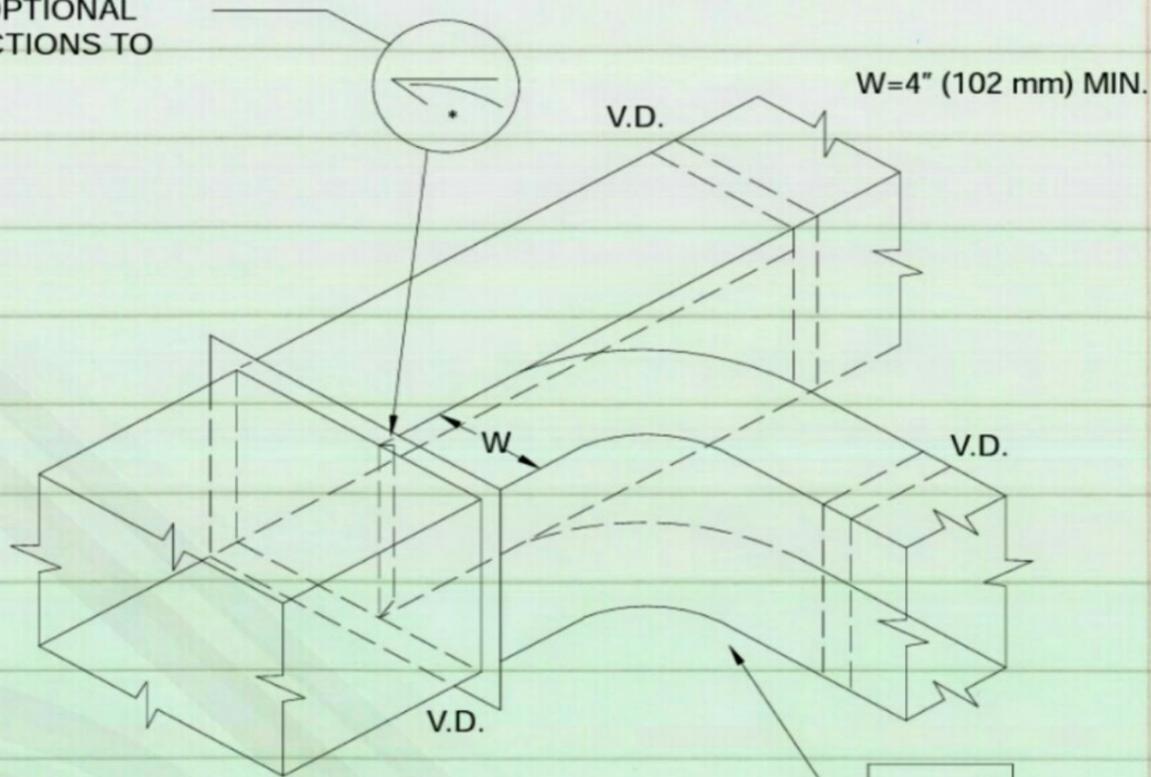
TYPE 2
STATIONARY SPLITTER
IS OPTIONAL



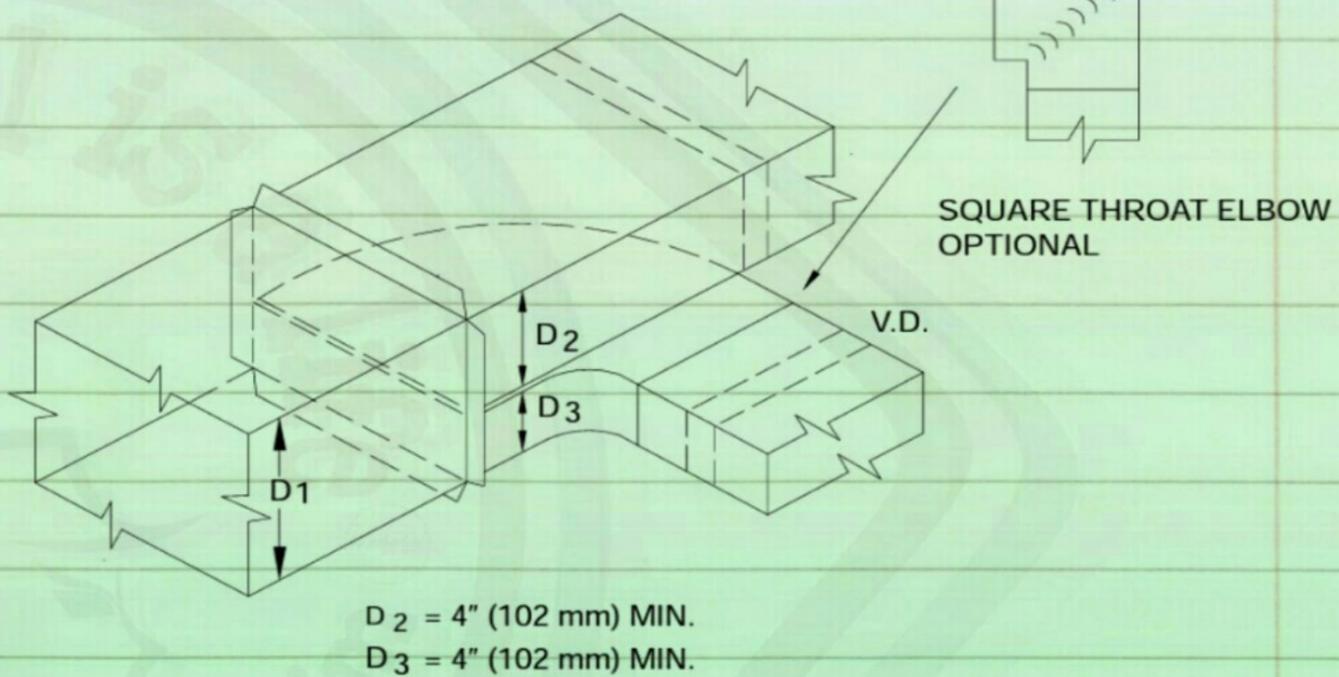
TYPE 3

• S SLIP OR U CLIP OPTIONAL
ALL SUCH CONNECTIONS TO
BE SEALED

TYPE 4A



TYPE 4B



$D_2 = 4'' (102 \text{ mm}) \text{ MIN.}$

$D_3 = 4'' (102 \text{ mm}) \text{ MIN.}$

VOLUME CONTROL SHOULD BE BY BRANCH DAMPERS.
IF A SPLITTER IS SHOWN IN THE DESIGN ITS
LENGTH SHOULD BE $1.5 W$ OR $1.5 D_3$

FIGURE 2-5 DIVIDED FLOW BRANCHES





● Flexible Duct,

● Duct Connector

AND

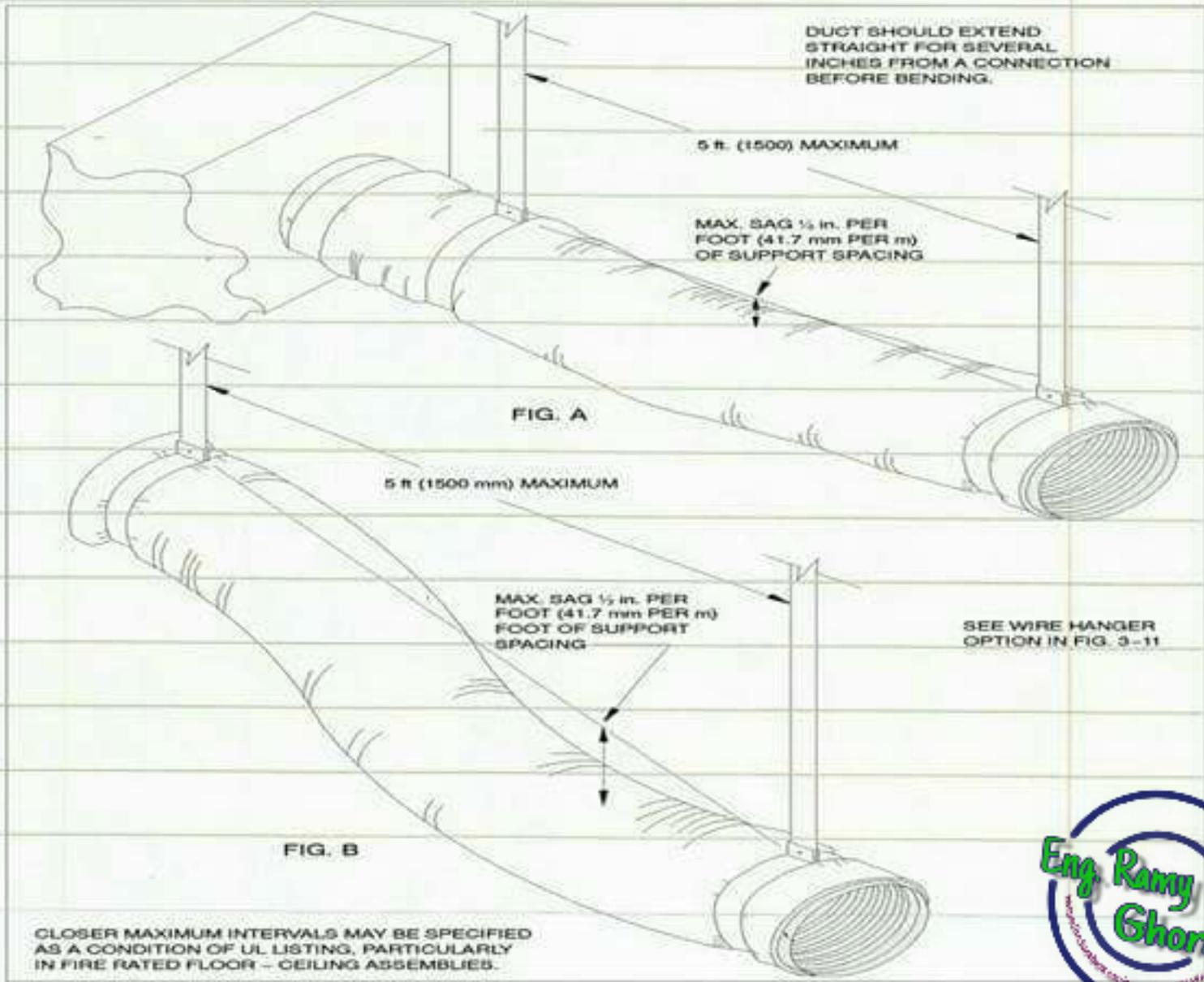
Planum Box



Flexible duct



Aluminium Blanket
Fibreglass
Inner Duct



⊛ Flexible duct Connector

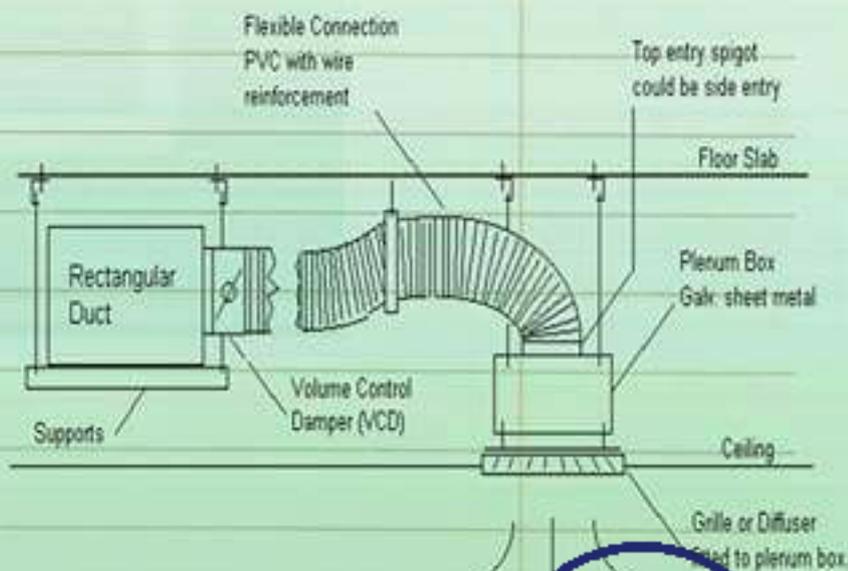
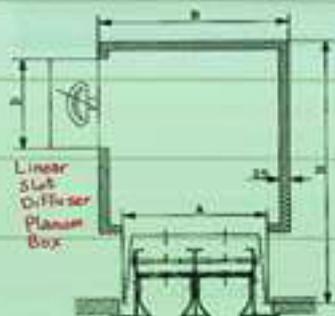
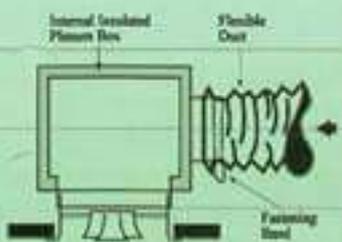
Eng. Ramy Ghoraba

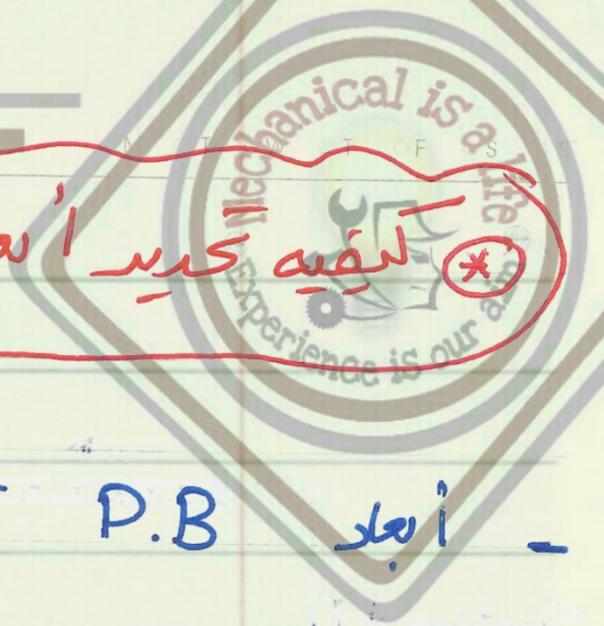
- Function → To prevent vibration transfer from the moving parts (AHU - PACU - Fan) to the duct.
- Location → Install on supply & return duct nearest of the unit.



⊛ Plenum Box

- Function → To collect the air from the main duct and distribute it into the out let
- Location → above the false ceiling at the end of each duct line.



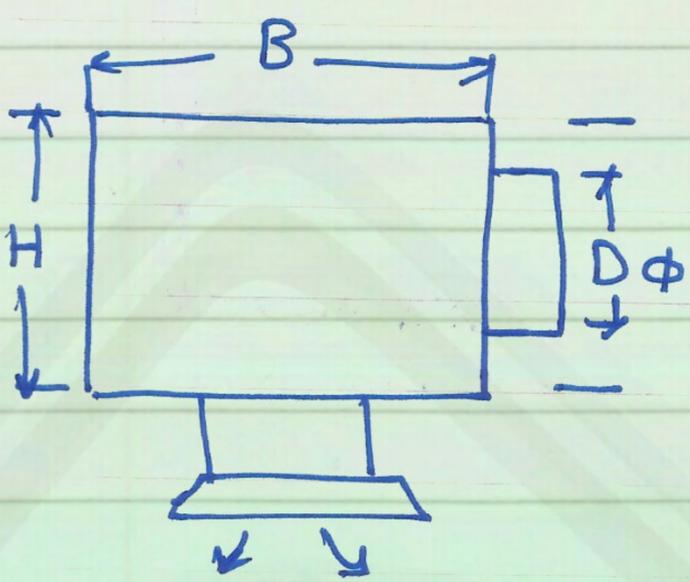


planum box لقيہ کير ابعاد

- ابعاد P.B تعدي الاساس على ابعاد (neck diffuser)

- بالنسبة Slot diff. تعدي على عدد Slots والارتفاع بين

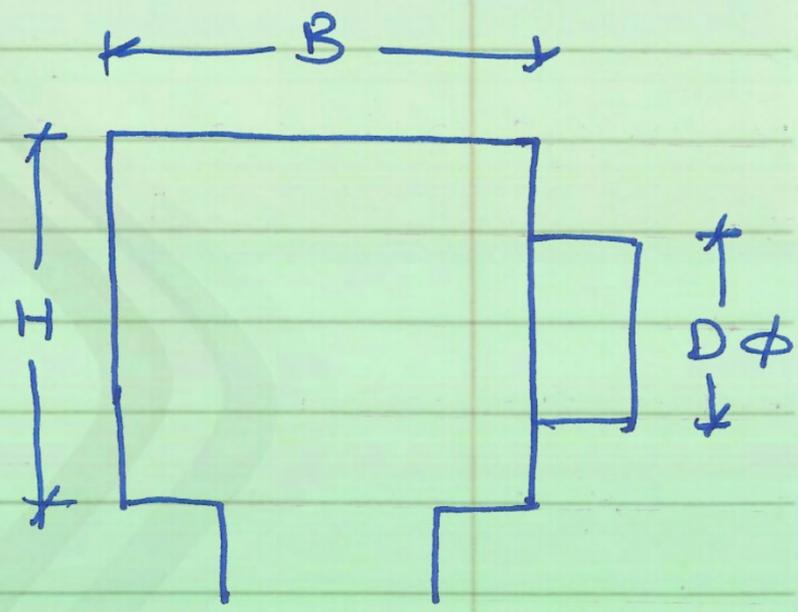
For diffuser



Dim	H	B	D φ
150*150	200	250	150
225*225	300	330	250
300*300	350	400	300
370*370	400	500	350
450*450	450	550	400

For Slot diffuser

No. of slot	H	B	D φ
1	240	155	127
2	240	190	150
3	290	225	200
4	290	265	200
5	330	300	250
6	370	335	300

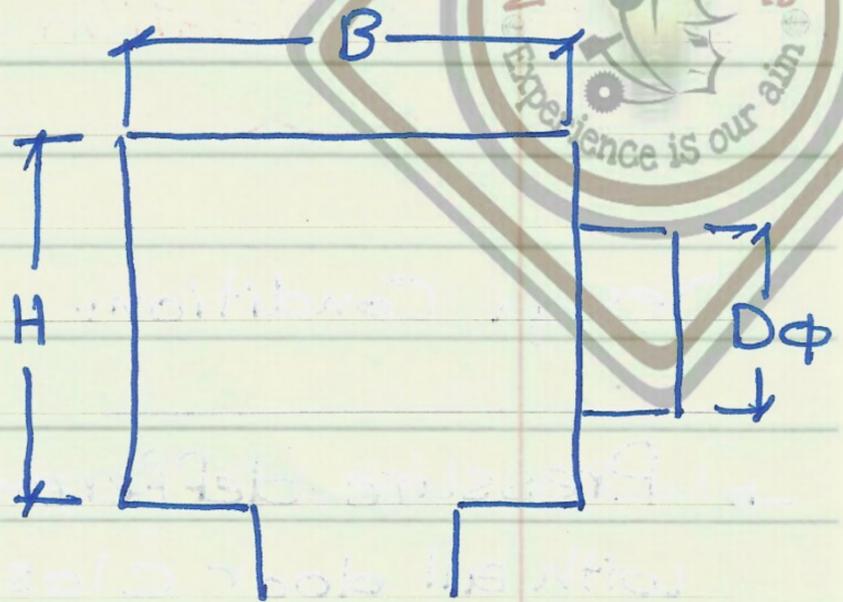


* with inside sound insulation



* Slot diffuser

No. of slot	H	B	D ϕ
1	220	120	
2	220	160	
3	250	190	
4	250	200 220	
5	300	250	
6	300		
	350	290	



⊗ Non insulation.



Dampers



④ Dampers

4-1) Volume dampers

- To Control the Air Flow quantity in each branch
- Equalizing to Friction or pressure drop.

* Types of Volume dampers

① Parallel blade



② Opposed blade



③ Round single blade



④ Rectangular Single b.



- * Located in Supply and return duct
- * There is manual type and motorized type
- * Should have access door for balancing.



4-2) Fire damper

- To prevent the spread of Fire inside the building by HVAC equipments
- Should install on the Fire rated wall
- It is a box assembled in GI sleeve, with a Curtain or blade inside the box and connected with spring with Fusible link
- IF the smoke pass through the duct, the Link will fused and close the Curtain or the blade.

⊗ Types of Fire damper



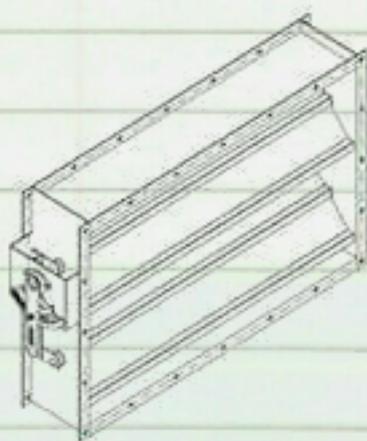
- ⊗ Located in supply and return duct
- ⊗ There is a manual and motorized Fire damper



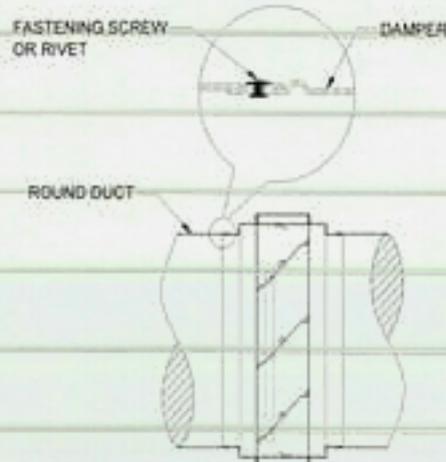


*** Volume damper installation**

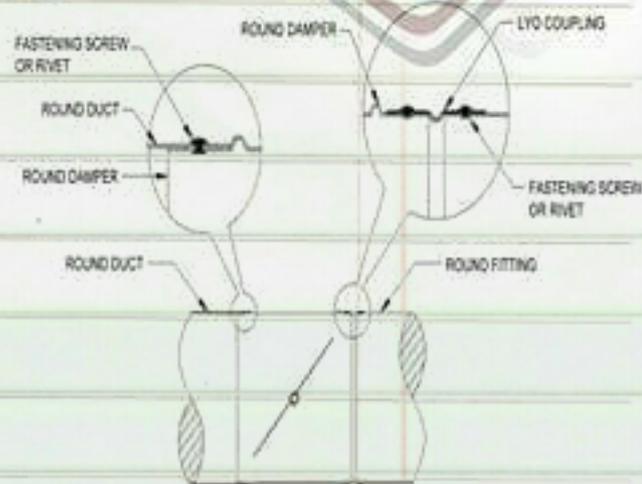
Flange Drilling



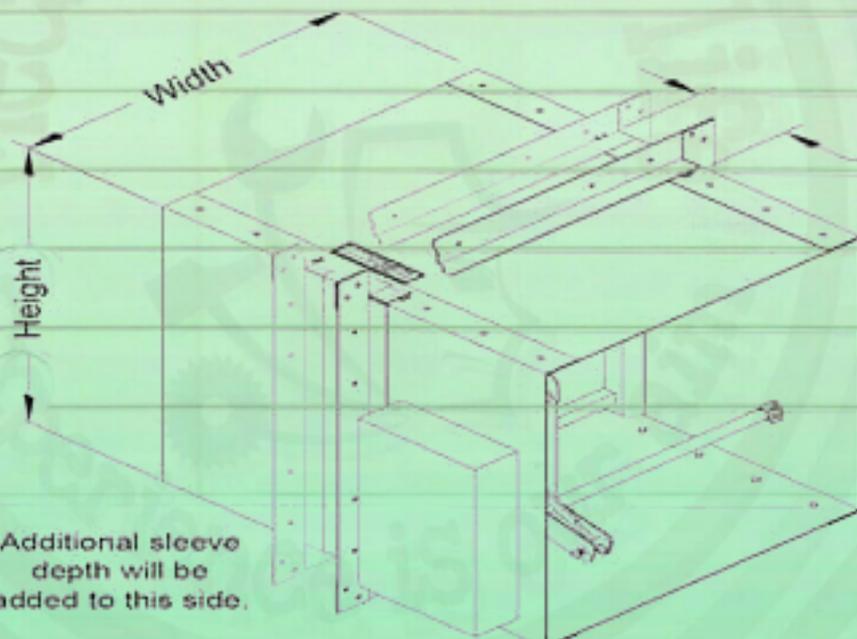
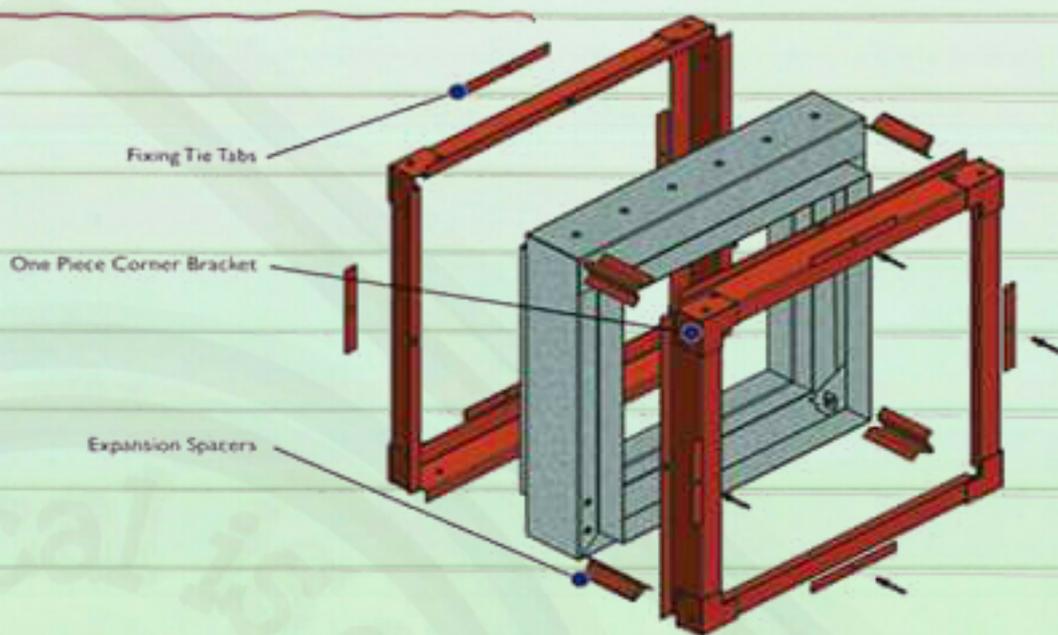
Circular and Oval



Round

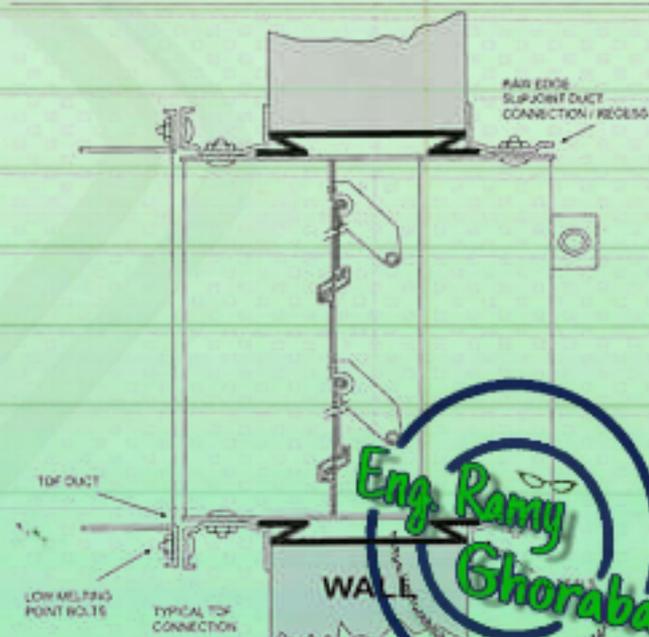


*** Fire damper installation**



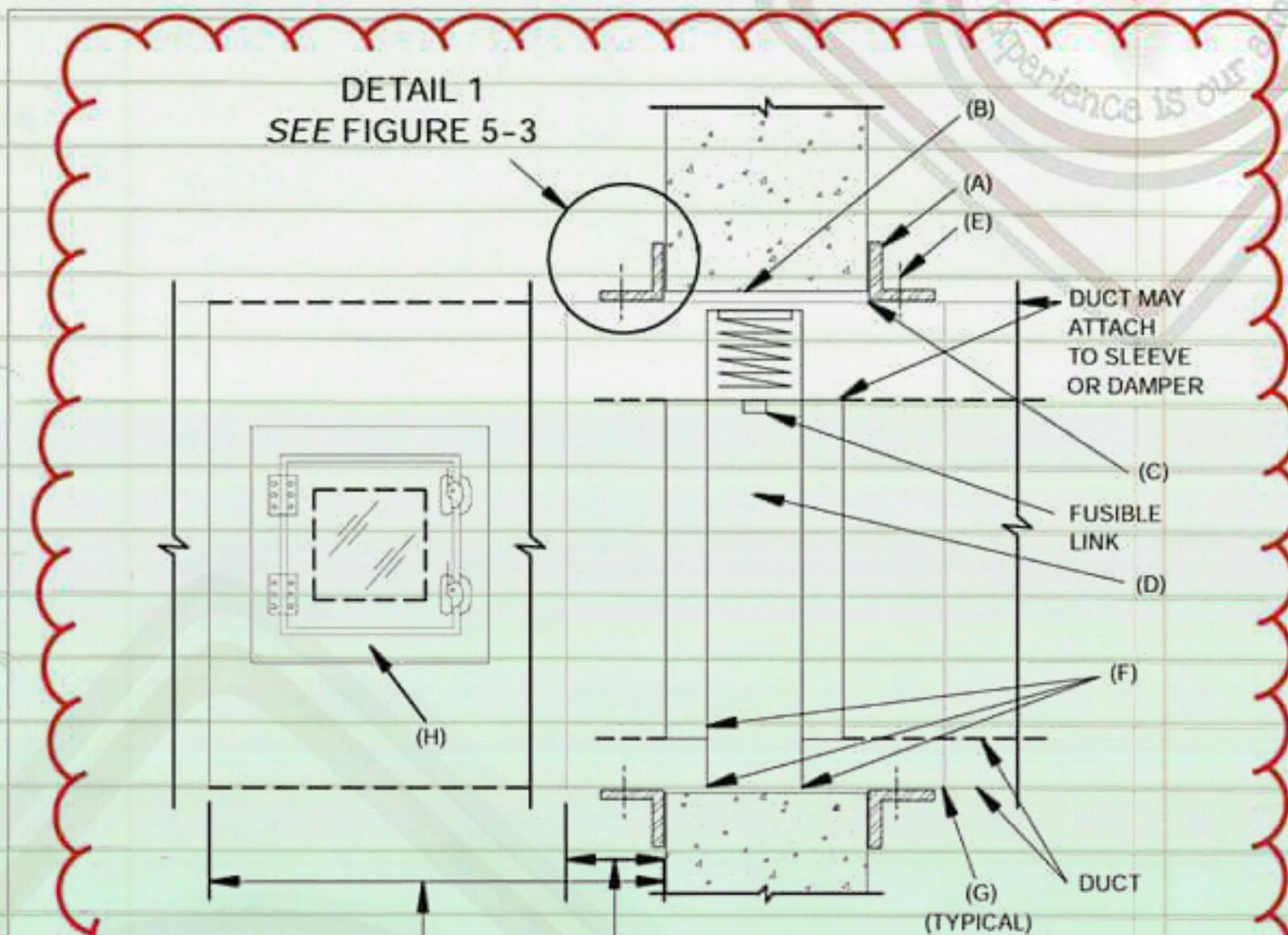
Adjustable Retaining Angle (varies for 4" or 6" wall openings)

Additional sleeve depth will be added to this side.



Fire damper installation

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SIX INCHES (152 mm) ON EACH SIDE FOR DAMPERS INTENDED FOR USE WITHOUT AN ACTUATOR OR A FACTORY INSTALLED ACCESS DOOR IN THE SLEEVE.

SIX INCHES (152 mm) ON ONE SIDE AND SIXTEEN INCHES (406 mm) ON THE OPPOSITE SIDE FOR DAMPERS INTENDED FOR USE WITH AN ACTUATOR AND/OR A FACTORY INSTALLED ACCESS DOOR ON THE LONGER SIDE.

SIXTEEN INCHES (406 mm) ON EACH SIDE FOR DAMPERS INTENDED FOR USE WITH AN ACTUATOR ON ONE SIDE AND A FACTORY INSTALLED ACCESS DOOR ON THE OTHER SIDE.

- A - RETAINING ANGLES
- B - EXPANSION SPACE
- C - DAMPER SLEEVE
- D - FIRE DAMPER/ COMBINATION FIRE/SMOKE DAMPER
- E - RETAINING ANGLES FASTENED TO SLEEVE
- F - DAMPER ATTACHMENT TO SLEEVE
- G - CONNECTION TO DUCT
- H - ACCESS DOOR OR PANEL

* Back Draft damper



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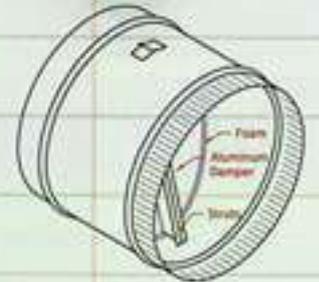
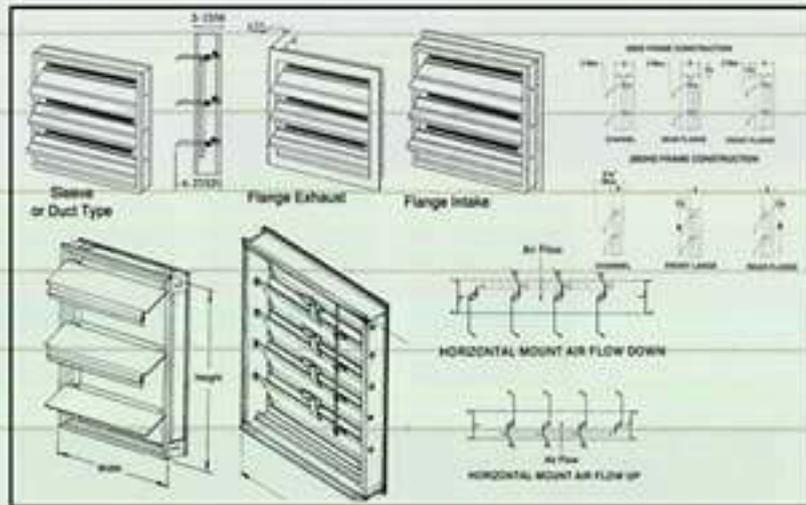
Function - To let the air moving in one direction only

Location - Install before exhaust fan to prevent the Air to come back again

- Install in case that you have 2 unit (1 duty and 1 stand by) Connected to the same duct line



Square BDD

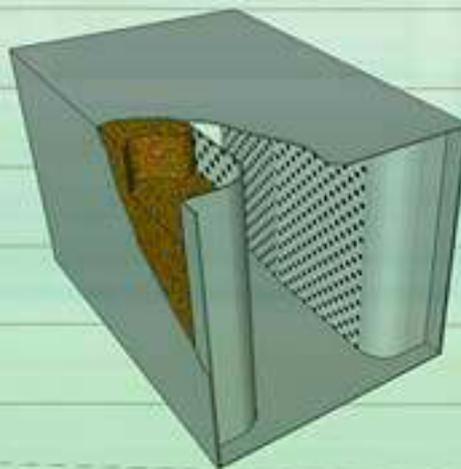


Round BDD

* Sound Attenuator

Function -> To reduce the Sound in the duct

Location -> Install in the supply duct nearest from the unit.



Round Sound Attenuator



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