

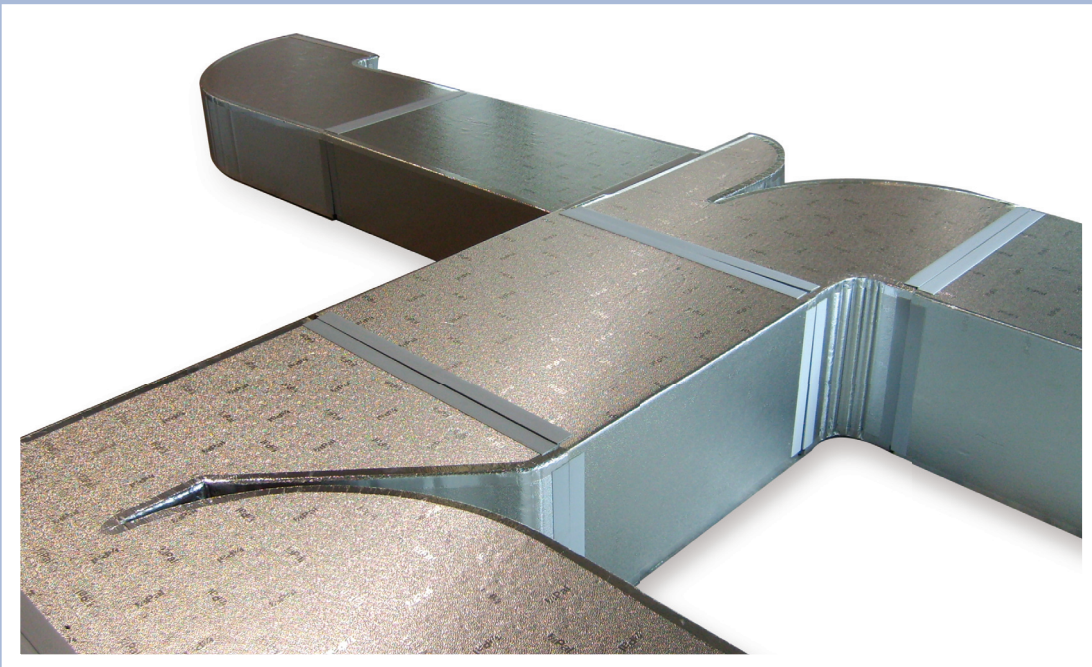


CONSTRUCTION GUIDELINES

INTRODUCTION

PAL Pre-insulated Ducting System is an innovative technology for manufacturing of revolutionary foam based pre-insulated ductwork for Heating Ventilation and Air Conditioning systems as alternative to sheet metal ductwork.

PAL Pre-insulated Ducting System provides a wide range of accessories and consumption materials which allow the assembly of any shape and dimensions of ducts, using few and simple tools. All production phases are carried out at quality conditions, from the choices of raw materials, to the production process and final product evaluation. To guarantee the perfect product use, training courses are conducted to ensure proper procedures are done accordingly to provide high quality final product to meet every needs in HVAC installations.



METHOD STATEMENT

FABRICATION OF DUCTWORK

All personnel responsible for the fabrication and construction of ductwork systems shall, prior to being engaged in the work, have successfully completed the specialized PAL Pre-insulated Ducting System training course and shall be familiar with all aspects of the fabrication techniques necessary for the manufacture of the complete system. All trainees who successfully complete the training course are awarded a PAL certificate of competency. PAL Pre-insulated Ducting System offers a complete product line providing all tools, accessories and components necessary to fabricate ductwork. Each item has been rigorously tested in the field to the highest of standards in a variety of applications. Under no circumstance are any substitute components to be used in place of approved PAL products.

PROCEDURES

The construction of a duct is accomplished by following a standardized procedure. The process is the same regardless of the shape of the duct element:

- Tracing
- Cutting
- Gluing
- Folding
- Taping
- Sealing
- Flanging and reinforcement

Although each of the above operations is described in general below, this specification is by no means intended to serve as an instruction manual to replace the training course. Note that when properly constructed, the finished duct segment will have no exposed foam – neither internally nor externally.

1. Tracing

The tracing of the duct outline onto the panel is the first step of the process. This is accomplished by utilizing the teflon “pencils” supplied in each tool box which scribe a line as opposed to marking an ink line. Note that all measurements specified on drawings of duct systems refer to a duct’s internal dimension. This corresponds to the cross-sectional area of the air passage necessary to satisfy design requirements.



It is therefore recommended that the fabricator adopt the convention of internal measurements during plotting. Accordingly, all tracing and plotting will take place on the internal side of the duct.

2. Cutting

The operation involves cutting 45° miter cuts along each edge of the duct. The V-grooves made by the 45° Double Blade Jack Planes enable the panel to be folded into shape. The V-grooves is also ideal for the subsequent gluing operation as it provides maximum surface area. The material that is discarded as a result of this operation must have been accounted for during the previous tracing. There are also several other special purpose Jack Plane available including the 22.5° and the Adjustable.



3. Gluing

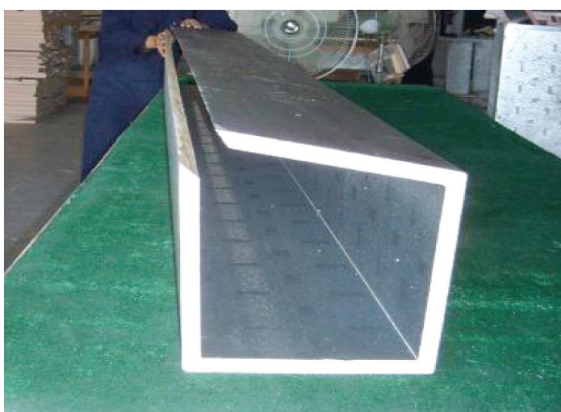
The glue is a contact adhesive in containers that must be well shaken prior to use in order to assure uniform consistency. The glue can either be applied with a pneumatic glue spreader, or sprayed on with a pneumatic glue gun. Glue is applied evenly to mitered surfaces covering all exposed phenolic material. Note that the V-grooves should first be swept clean of any remaining phenolic dust. Depending on the temperature and relative humidity, the adhesive requires approximately 10 to 20 minutes to cure during which time the solvents evaporate.



This operation should be performed in a well ventilated area and the precautions recommended on the COSH (Certificate of Safety and Handling) sheet should be observed. The curing period is complete when the glue is dry to the touch.

4. Folding

Following the curing phase, the sides are folded at right angles to each other (90°) and the duct shape is formed. Note that when two open sides of a duct are joined together, the aluminum foil edge of the miter cut on the internal surface should be used for aligning purposes. When a duct is comprised of several individual pieces, the joining process should always be initiated from the same end so that the subsequent trimming operation of any excess length is only required at the opposite end. The black hard spatulas should then be used to firmly crease along the edges of the duct to ensure maximum adhesion in the V-grooves.



5. Taping

Aluminum self adhesive tape is provided. The tape has been double cured for increased pliability, and contains two and one-half times as much glue as standard tapes; also, it is a special glue with high technical characteristics to ensure maximum adhesion. The taping of the duct serves four purposes:

1. It re-establishes the vapor barrier within the mitered cuts.
2. External seams are taped to improve the duct's aesthetic appearance.
3. Tape is used to repair and cover any damage to the panel, both externally and internally, and
4. It seals and isolates the phenolic material from the surroundings.



Prior to applying the tape, ensure that all surfaces are dry and free of dirt, oil, silicon, and grease. If the surface cannot be thoroughly cleaned, then a simple solution is to apply a light coat of glue on the surface where the tape is to be placed (note that the glue must be allowed to cure first, as discussed within Section 3 above). The tape should ideally be applied in temperatures above 10°C (50°F) in order to assure a good bond. The tape should not be applied to the duct's surface when the temperature is below 0°C (32°F) due to the potential entrapment of ice crystals.

Tape is only applied to seams where the external surface of the aluminum foil has been cut. On sides where the panel has been simply folded, as opposed to joined, no tape is required. The tape-marker is used to scribe a line on the panel which serves as reference during application of the tape. The soft spatula is brushed firmly along the surface of the tape during application to ensure maximum adhesion and to expel any air bubbles trapped underneath. When taping reducers or elbows, the tape must always be applied to the curved or creased side (not the straight side), and the supplemental directions within the respective sections should be observed.

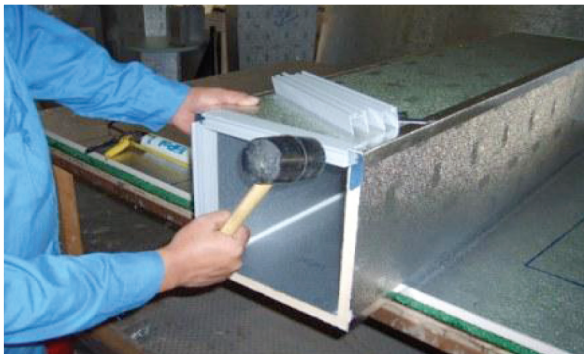
6. Sealing

Following assembly of the duct segment, all internal joints must be sealed with silicon. In addition to imparting greater strength and rigidity, the primary function of the silicon is to hermetically seal the internal surface of the duct and prevent any phenolic particles from entering the air stream. It is recommended that after the silicon bead has been applied, a radiused tool (or alternatively a wet finger) is gently run along the entire length of the bead to duct wall. Proper application is imperative in order to ensure “clean air” and minimal leakage.



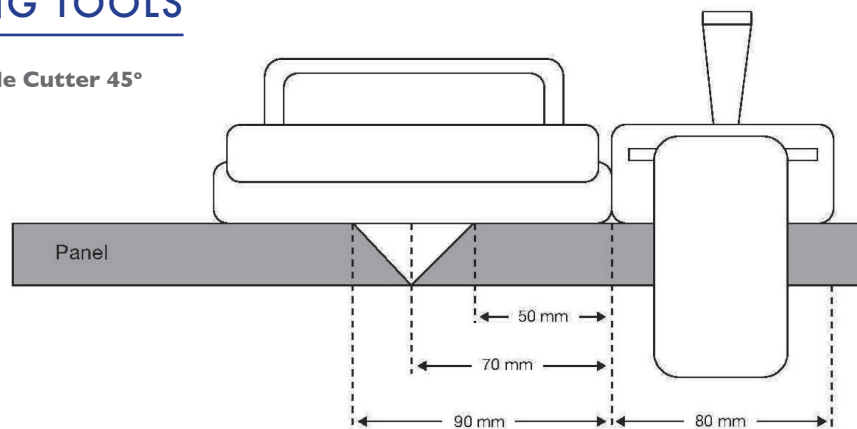
7. Aluminum Profile and Reinforcement

There are a variety of aluminum profiles available to suit various installation requirements. Depending on both the system pressure and the duct’s dimensions, the installation of a reinforcing bar may be necessary.

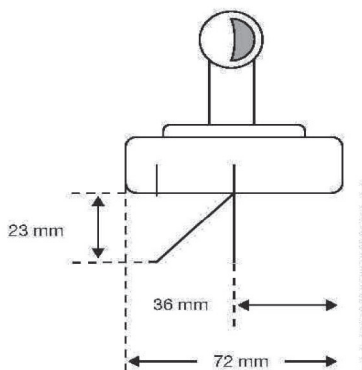


CUTTING TOOLS

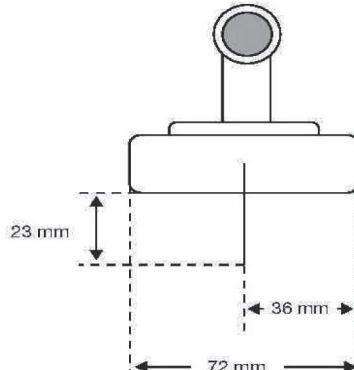
Double Blade Cutter 45°



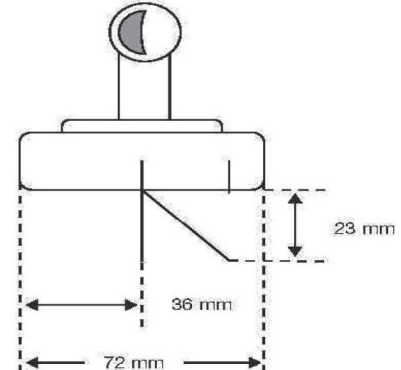
Single Blade Cutter – 45° Left



Single Blade Cutter – 90°

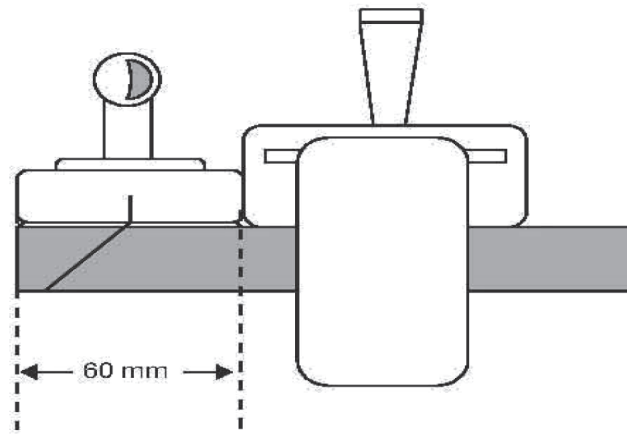


Single Blade Cutter – 45° Right

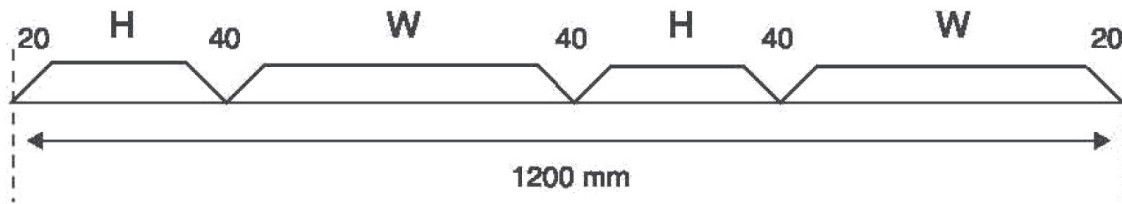


CUTTING TOOLS

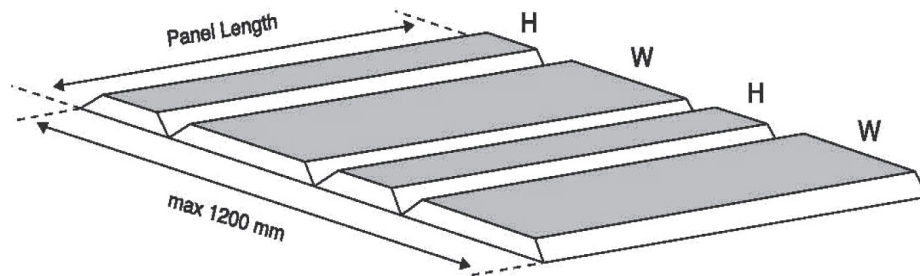
Single Blade Cutter



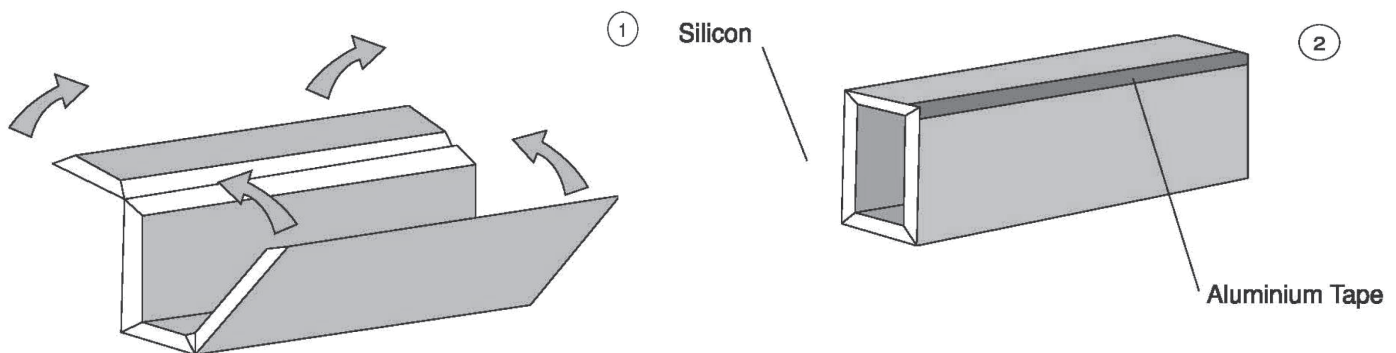
STRAIGHT DUCT METHOD: Method 1



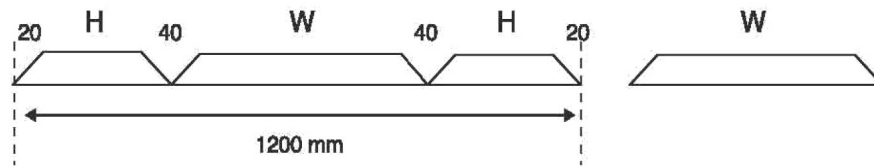
- Cutting along the panel length
- The sum of 4 sides less than 1040mm ($2H + 2W$)



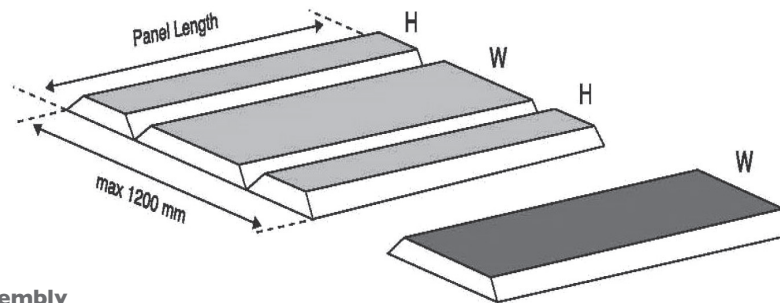
Sequence of Assembly



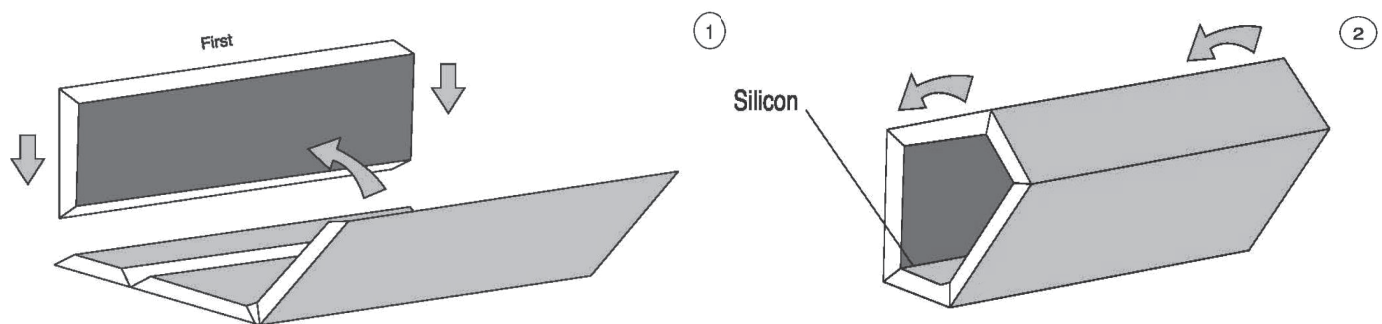
STRAIGHT DUCT METHOD: Method 2A



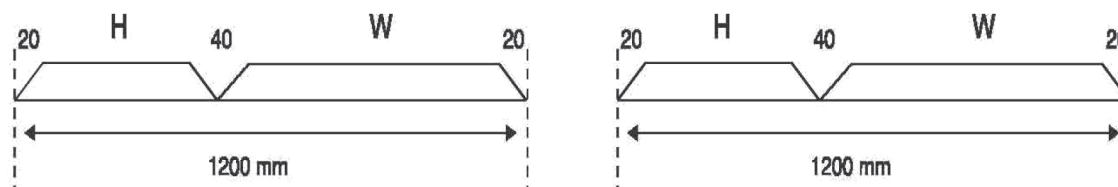
- Cutting along the panel length
- The sum of 3 sides less than 1080mm ($2H + W$ or $2W + H$)



Sequence of Assembly

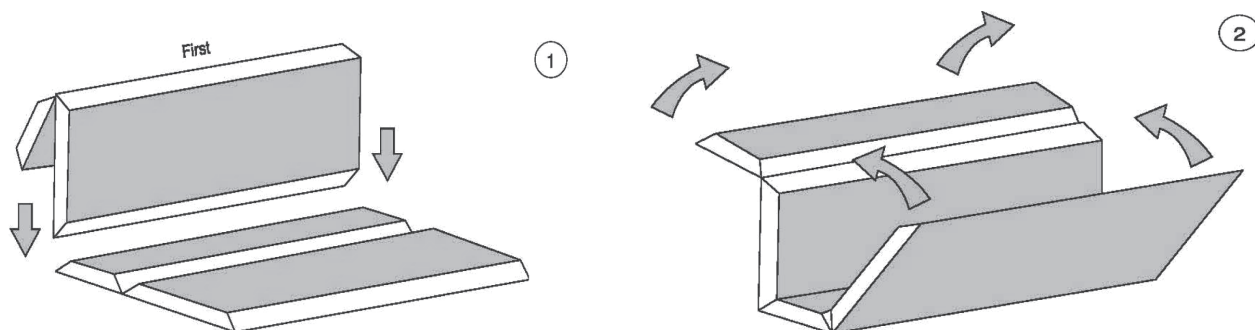


STRAIGHT DUCT METHOD: Method 2B

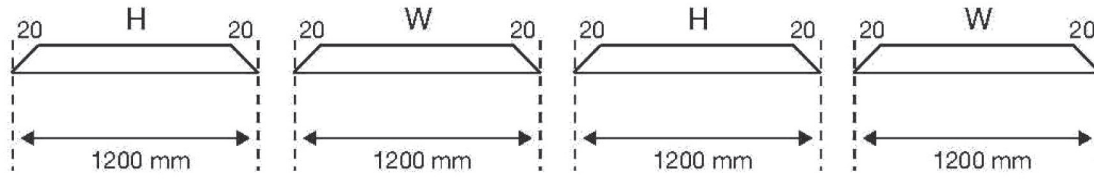


- Cutting along the panel length
- The sum of 2 sides less than 1120mm ($W + H$)

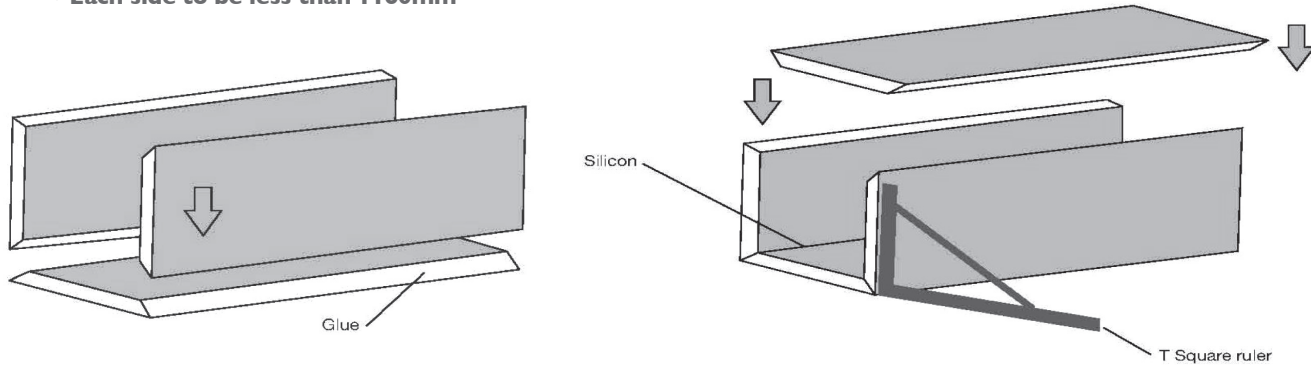
Sequence of Assembly



STRAIGHT DUCT METHOD: Method 2C



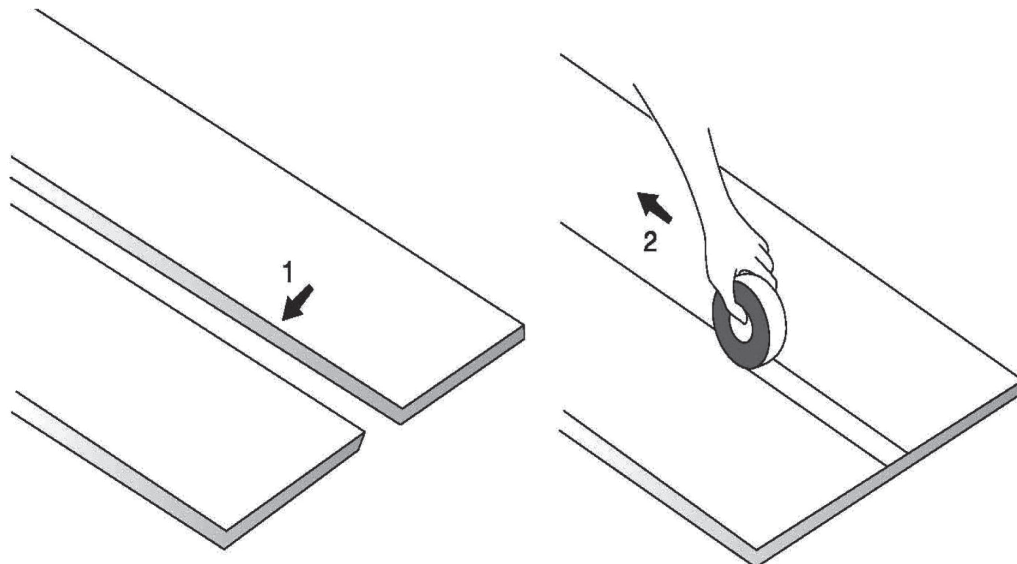
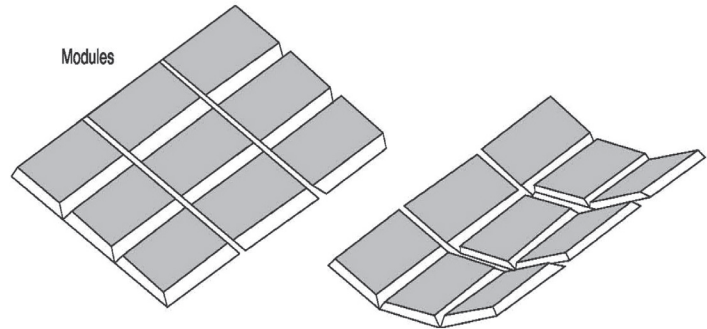
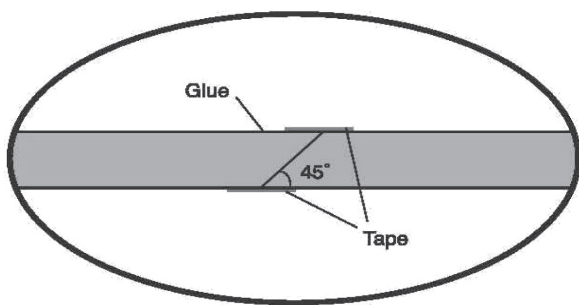
- Cutting along the panel length
- Each side to be less than 1160mm



NOTE

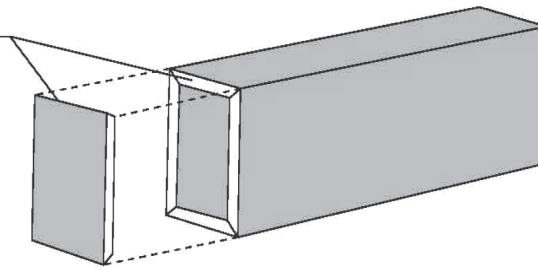
- Extra Silicon (bigger tip cut)
- When assembling the four sides, the sides should be checked (with T Square Ruler) and held in position

STRAIGHT DUCT METHOD: Method 3

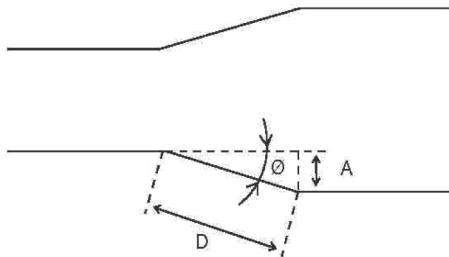


END CAPS

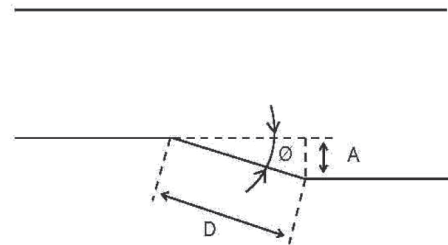
Cut 45°, Glue, Tape



TRANSITIONS

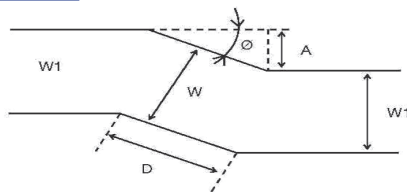


Concentric Transition
 θ max. 20° (D = 3 x A)
 θ suggested 15° (D = 4 x A)

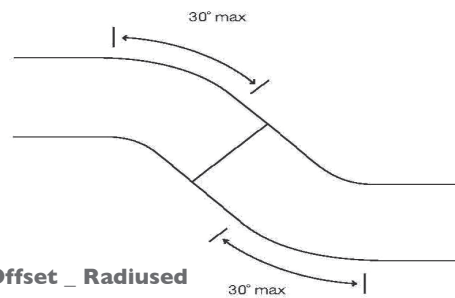


Eccentric Transition
 θ max. 20° (D = 3 x A)
 θ suggested 15° (D = 4 x A)

OFFSETS



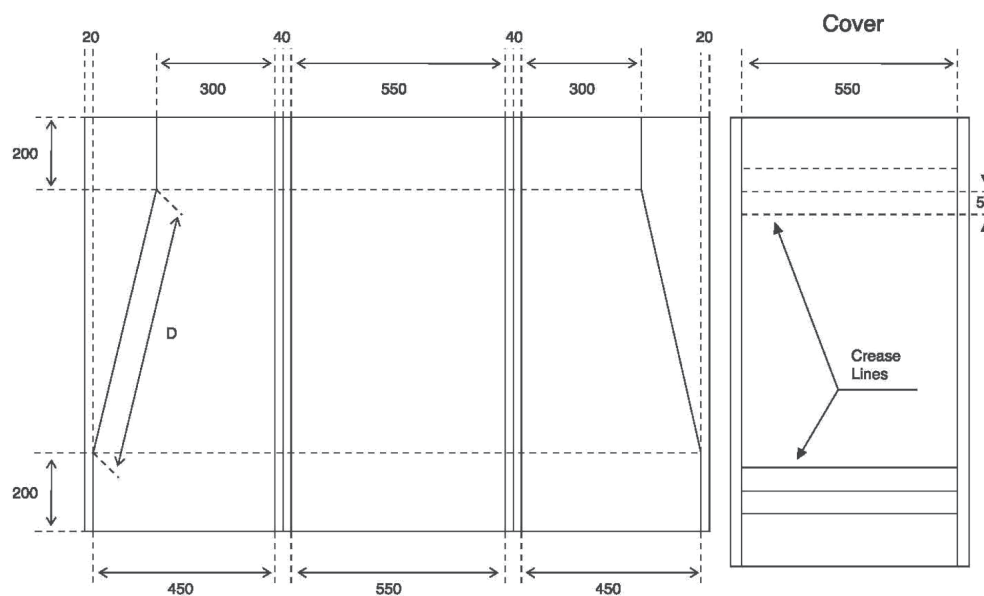
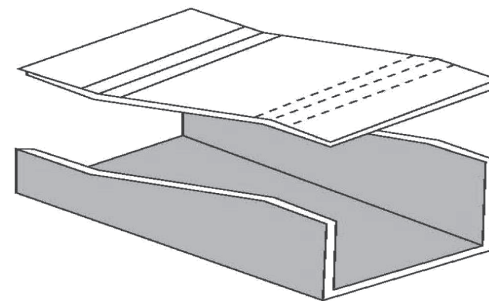
Offset - Angled
 θ max. 30° (D = 2 x A)



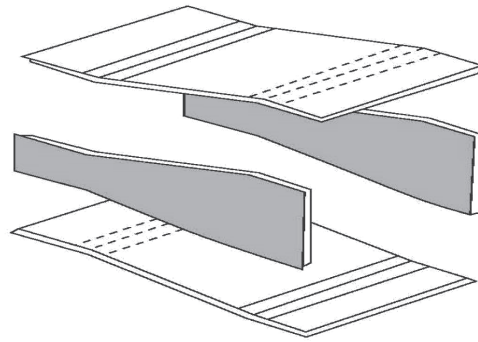
Offset _ Radiused
 30° max

ECCENTRIC REDUCER

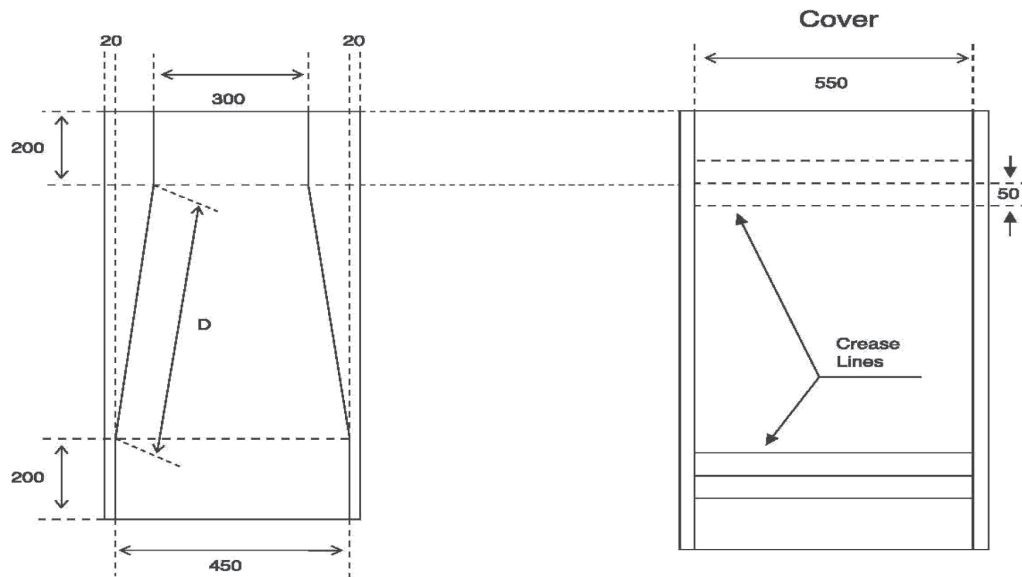
- Dimension in "mm"
- D suggested = 4 x (450-300)
 = 600:D minimum = (450-300) = 150



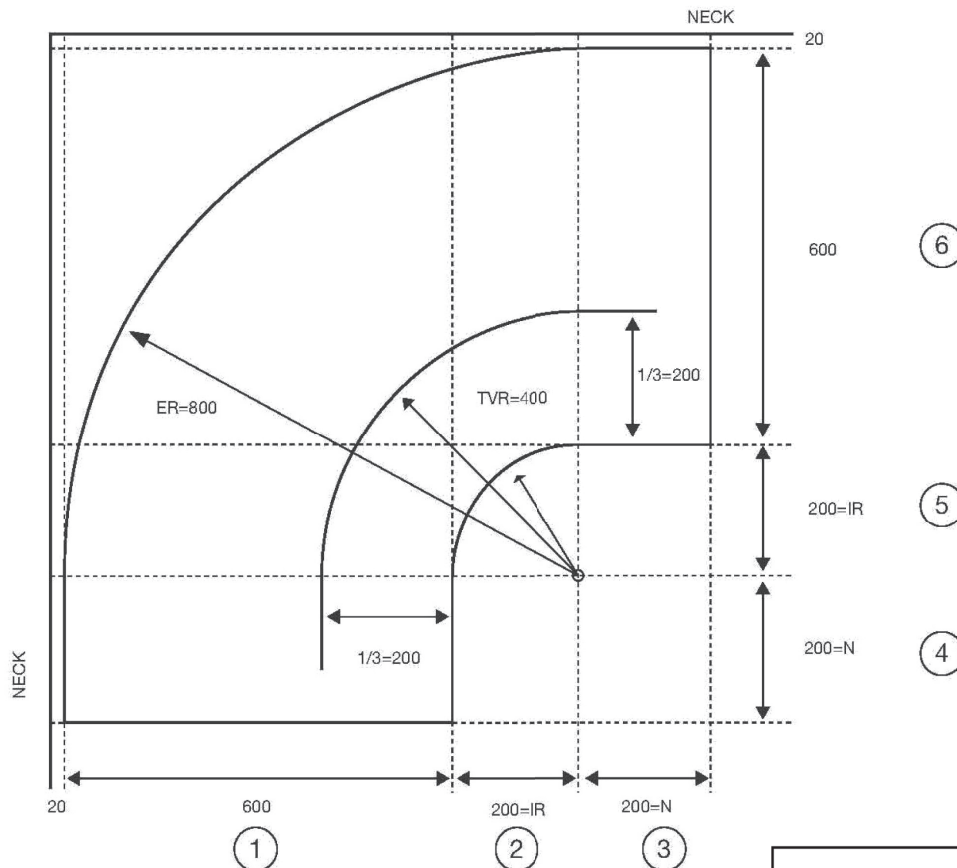
CONCENTRIC REDUCER



- Dimension in "mm"
- D suggested = $2 \times (450-300) = 300$; D minimum = $1.5 (450-300) = 225$



ELBOW

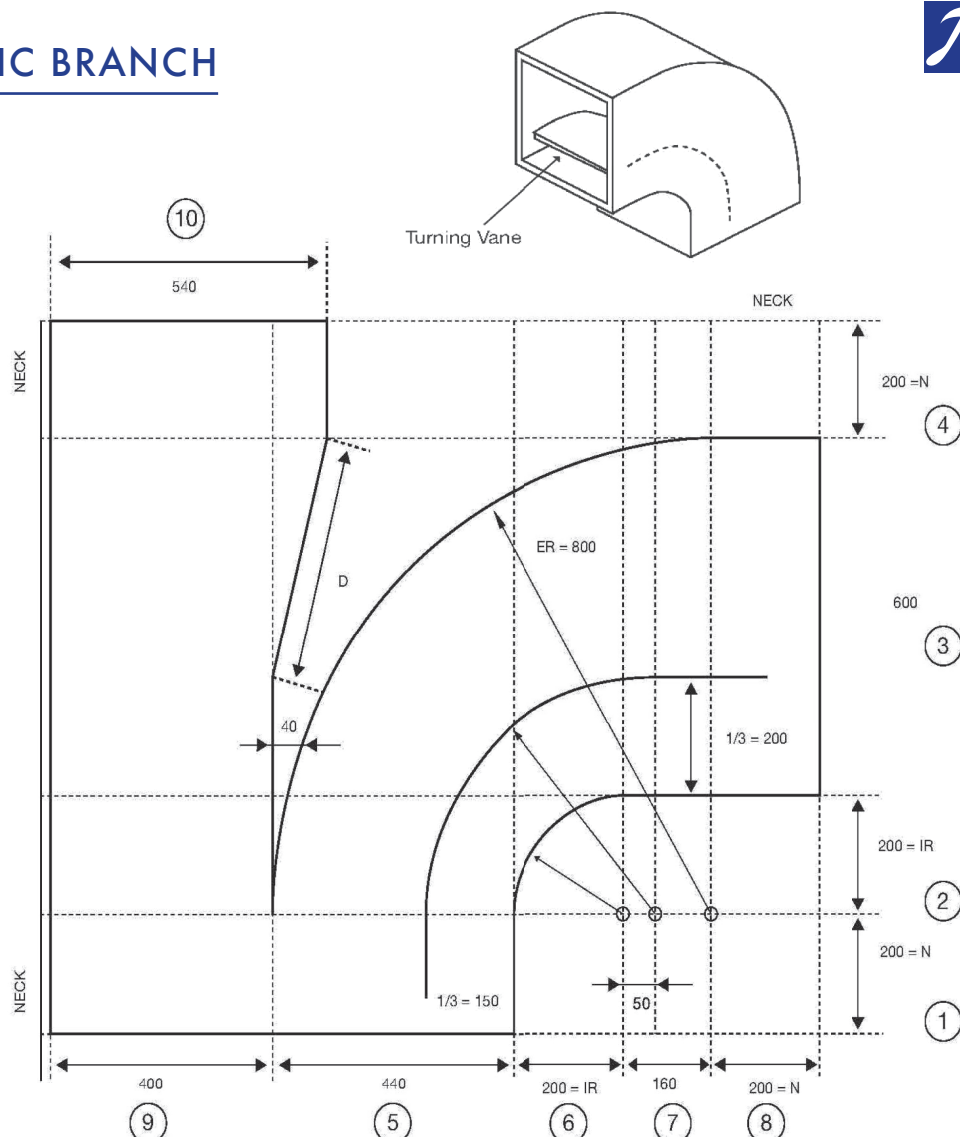


LEGEND:
 N = Neck
 ER = External Radius
 IR = Internal Radius
 TVR = Turning Vane Radius

- Dimension in "mm"
- Numbers in the hoop show suggested tracing procedure

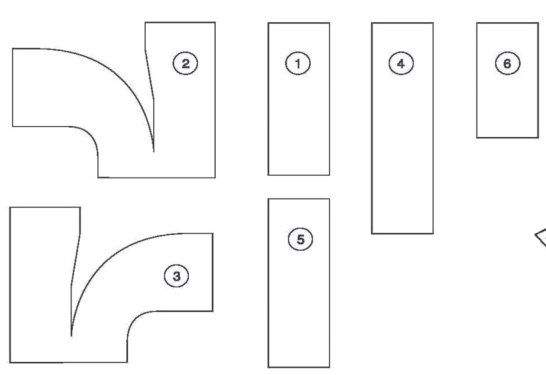
TURNING VANE	
Elbow Side (mm)	Vane
0 - 550	0
600 - 800	1
900 - 1200	3
Over 1200	3

DYNAMIC BRANCH

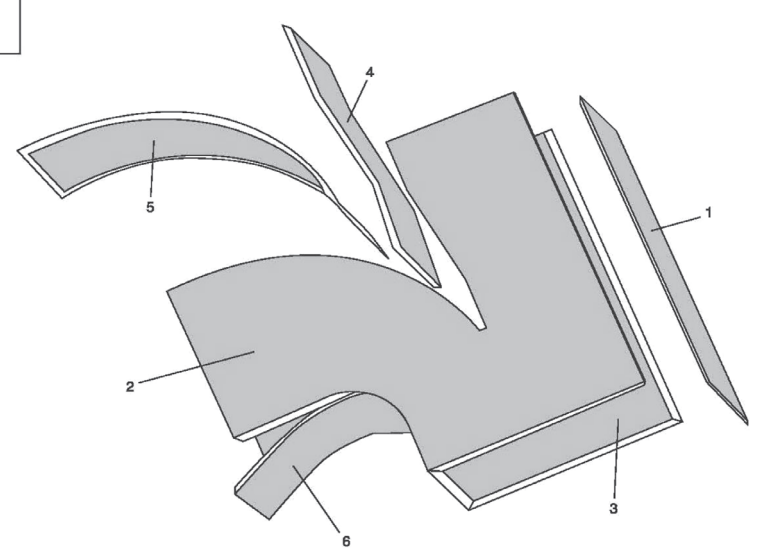


Dimension in "mm"
Numbers in the hoop show suggested tracing procedure
D suggested = 4 x (540 - 400) = 560; D minimum = 3 x (540-400) = 420

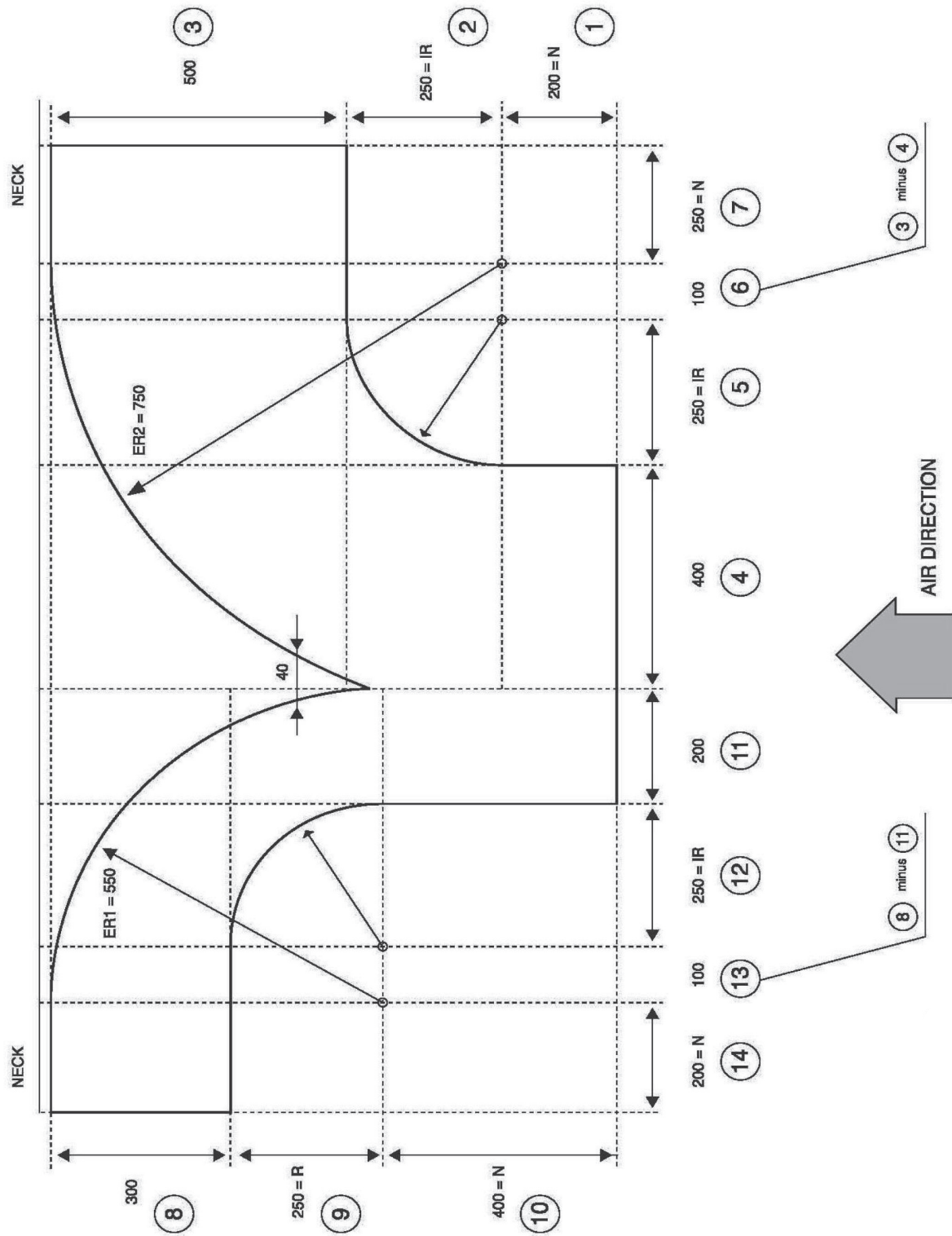
ASSEMBLY PROCEDURE



- Place 1 on the table
- Join section 2 and Section 3 to 1
- Install Section 4
- Install Section 5
- Install Section 6



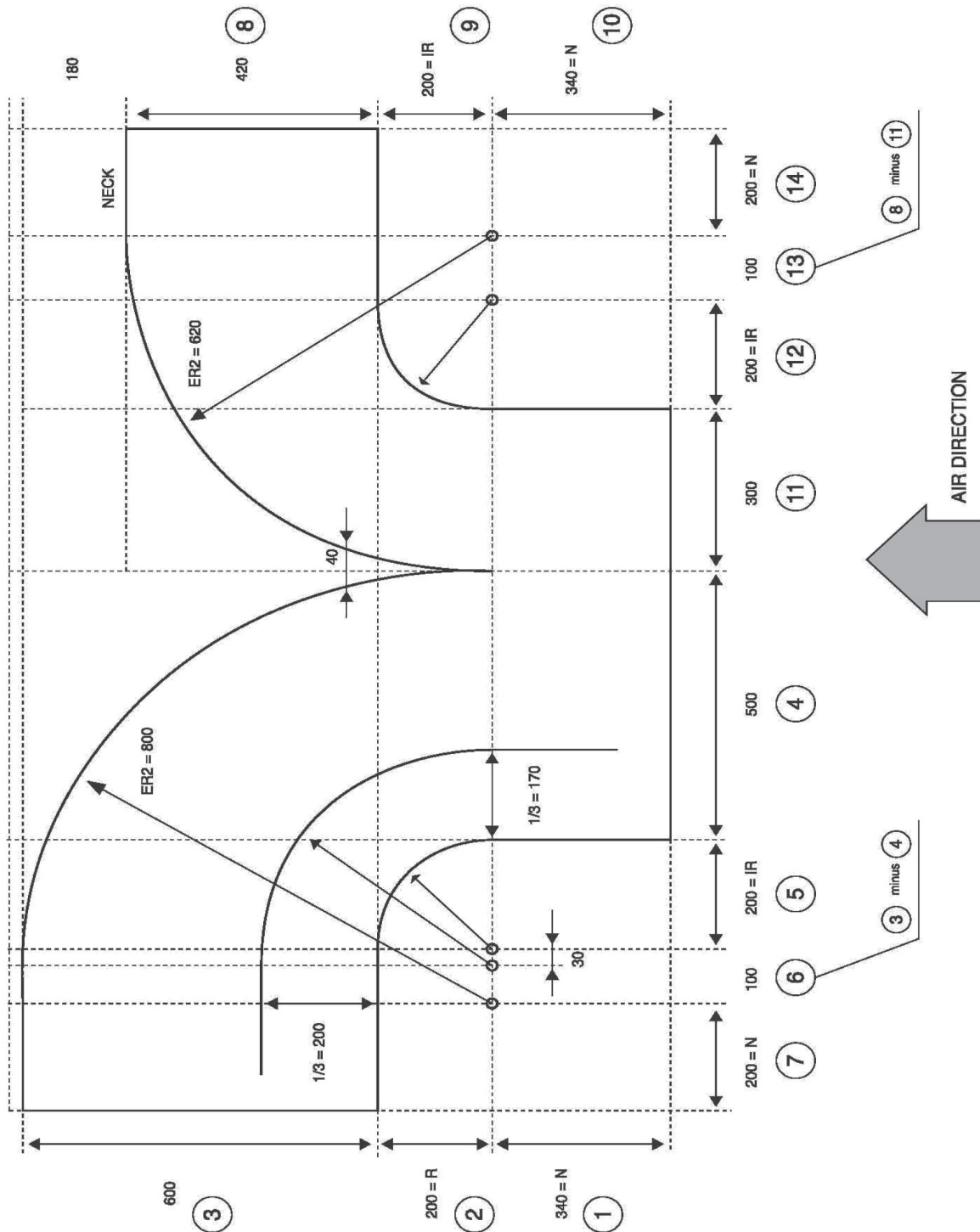
TEE BRANCH (External Side Flushed)



- Dimension in "mm"
- Numbers in the hoop show suggested tracing procedure

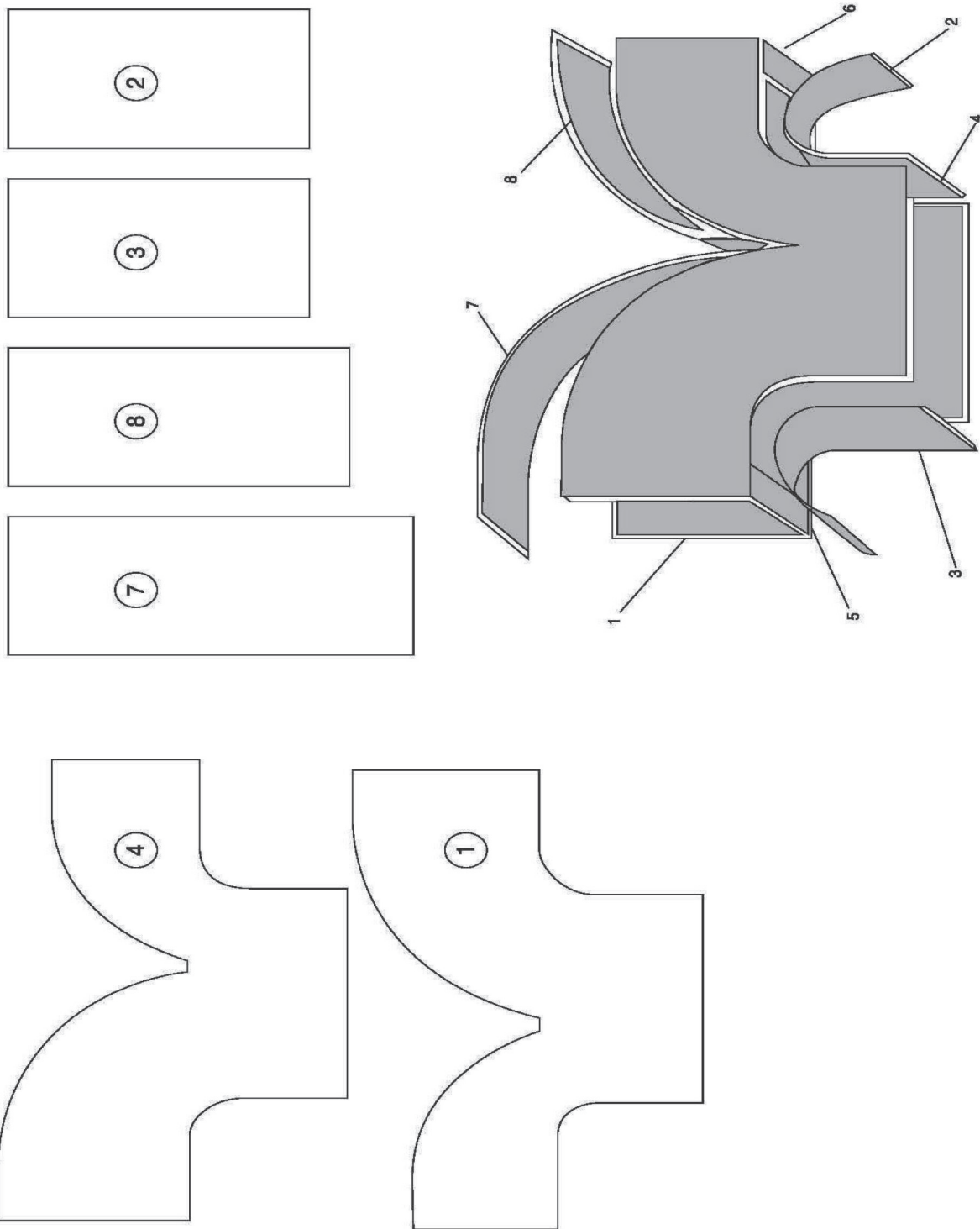
||

TEE BRANCH (Internal Side Flushed)



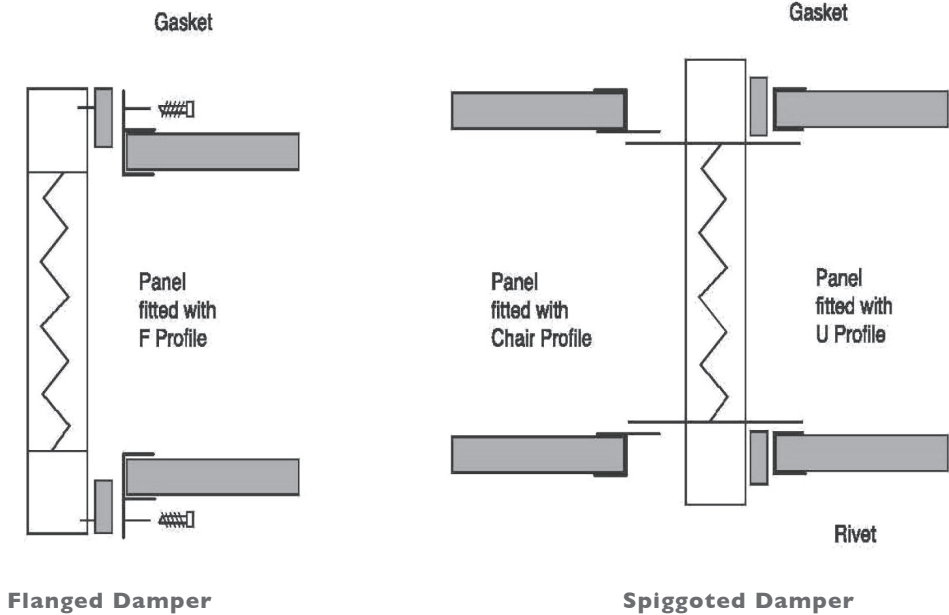
- Dimension in “mm”
- Numbers in the hoop show suggested tracing procedure

ASSEMBLY PROCEDURE

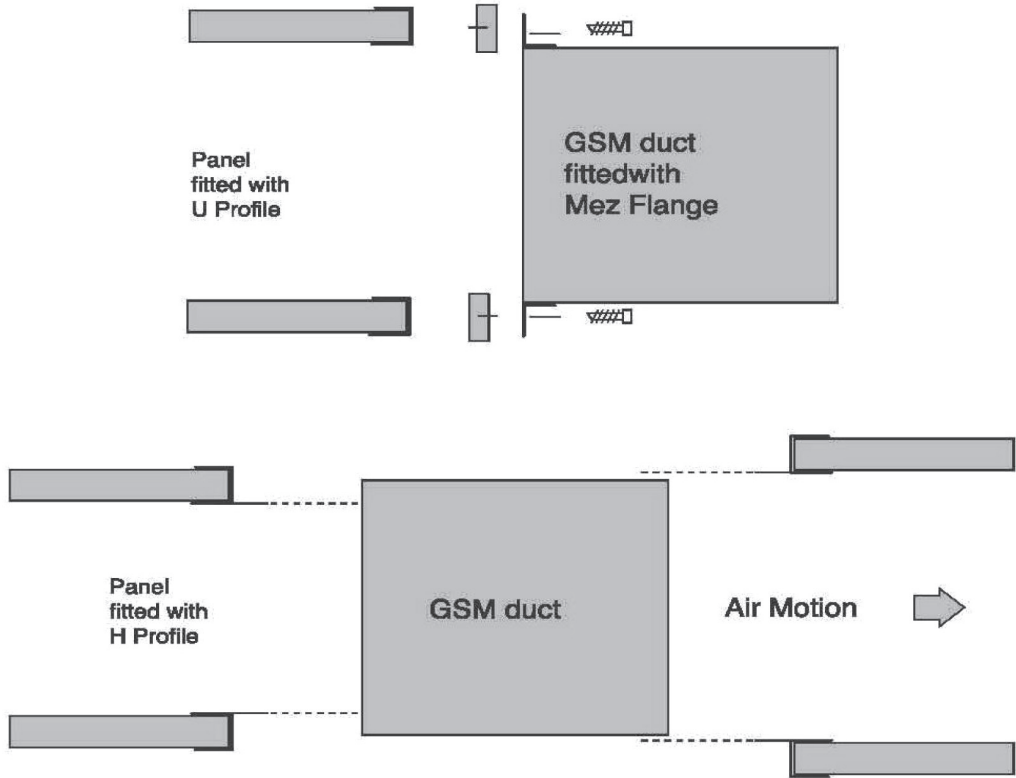


- Place 1 on the table
- Join section 2 and 3 only the Neck Section
- Add pieces (scraps) 5 and 6 with just Tape and on Glue
- Install bigger Circumference Section with cover 7
- Install Section 8
- Remove section 5 and glue section 3
- Remove section 6 and glue section 2

CONNECTION TO ACCESSORIES

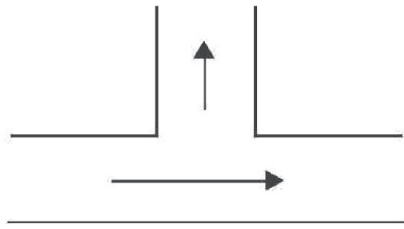


CONNECTION TO SHEET METAL

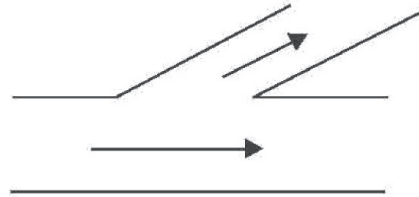


TAKE OFF

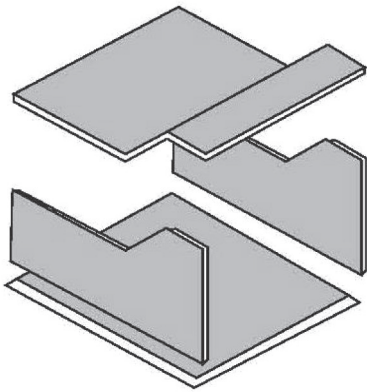
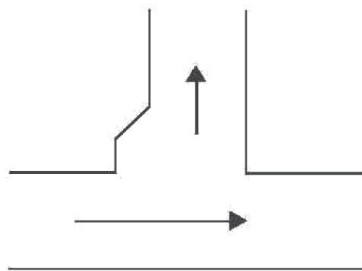
Straight Branch



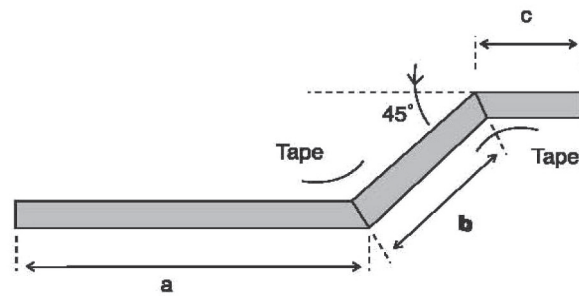
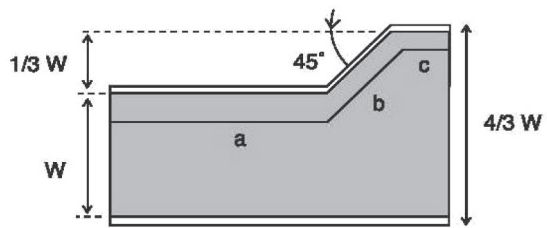
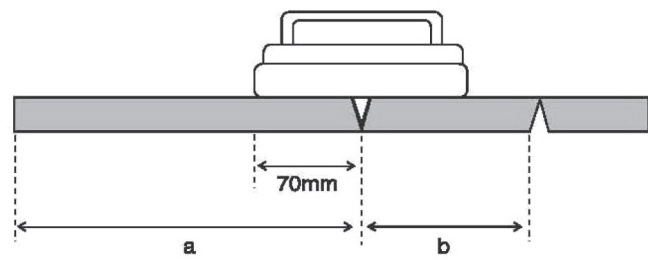
Angle Branch



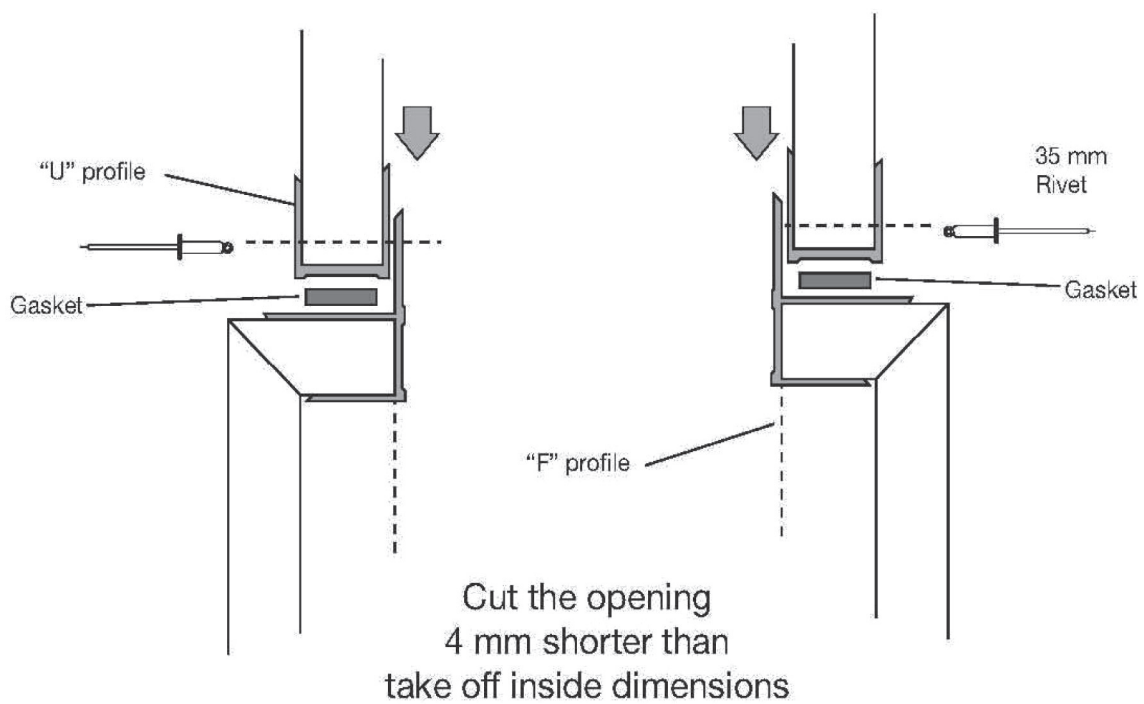
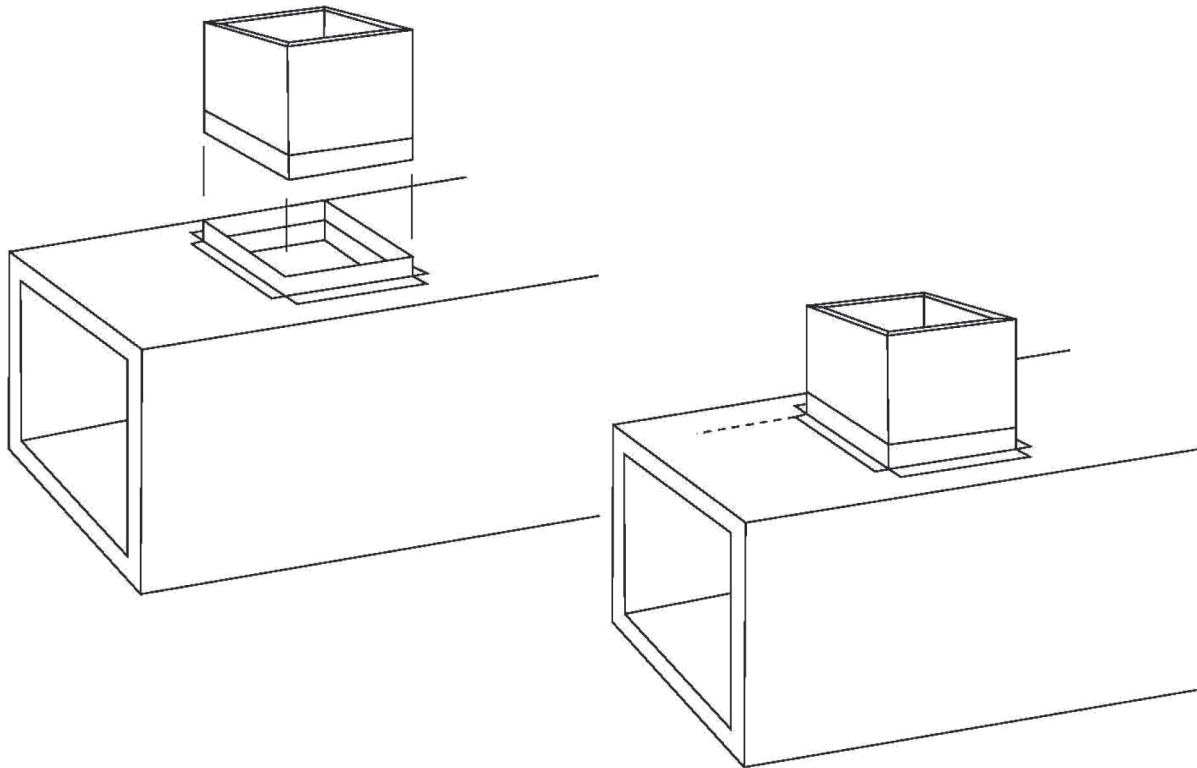
Boot Branch



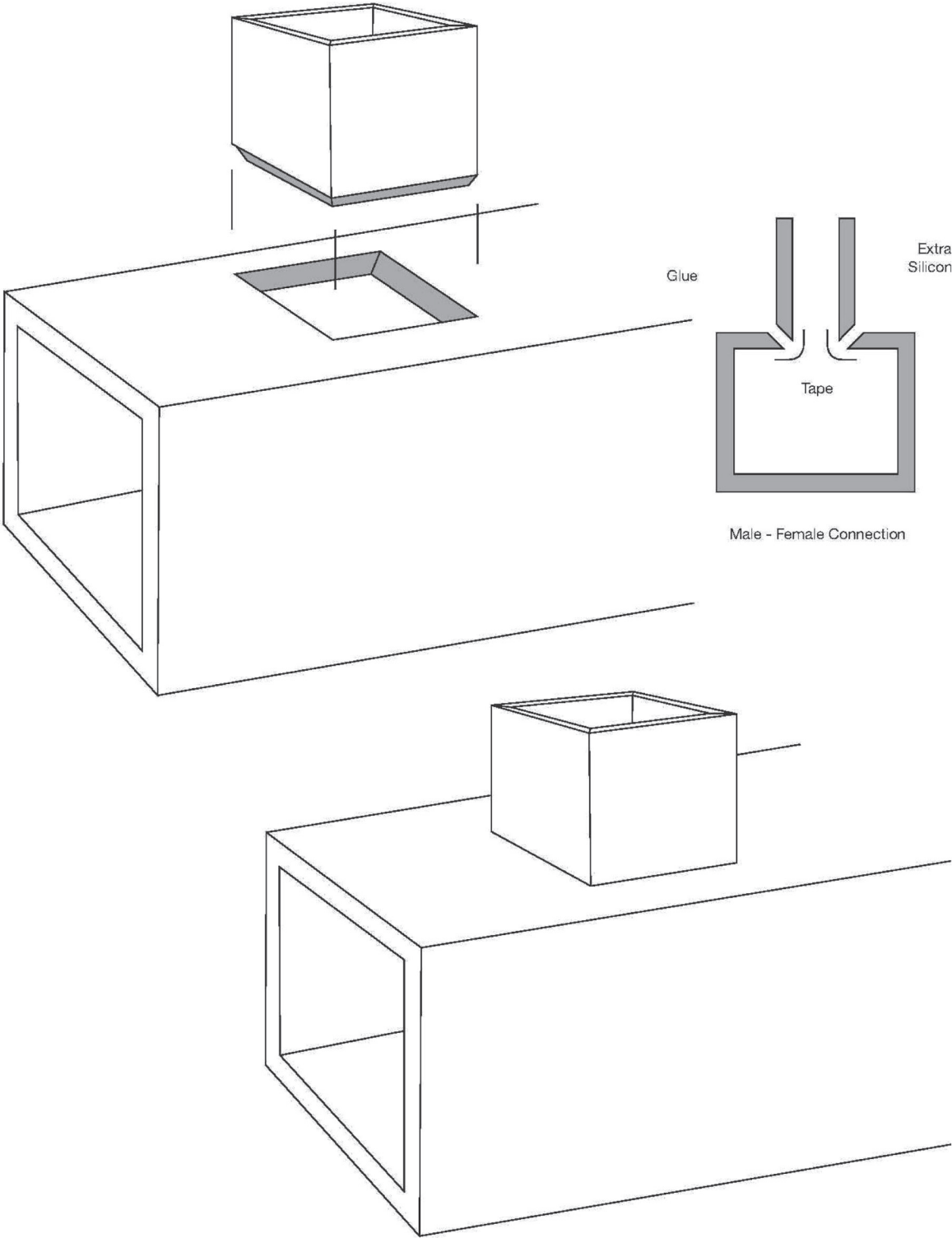
Jack Plane 22.5 degrees



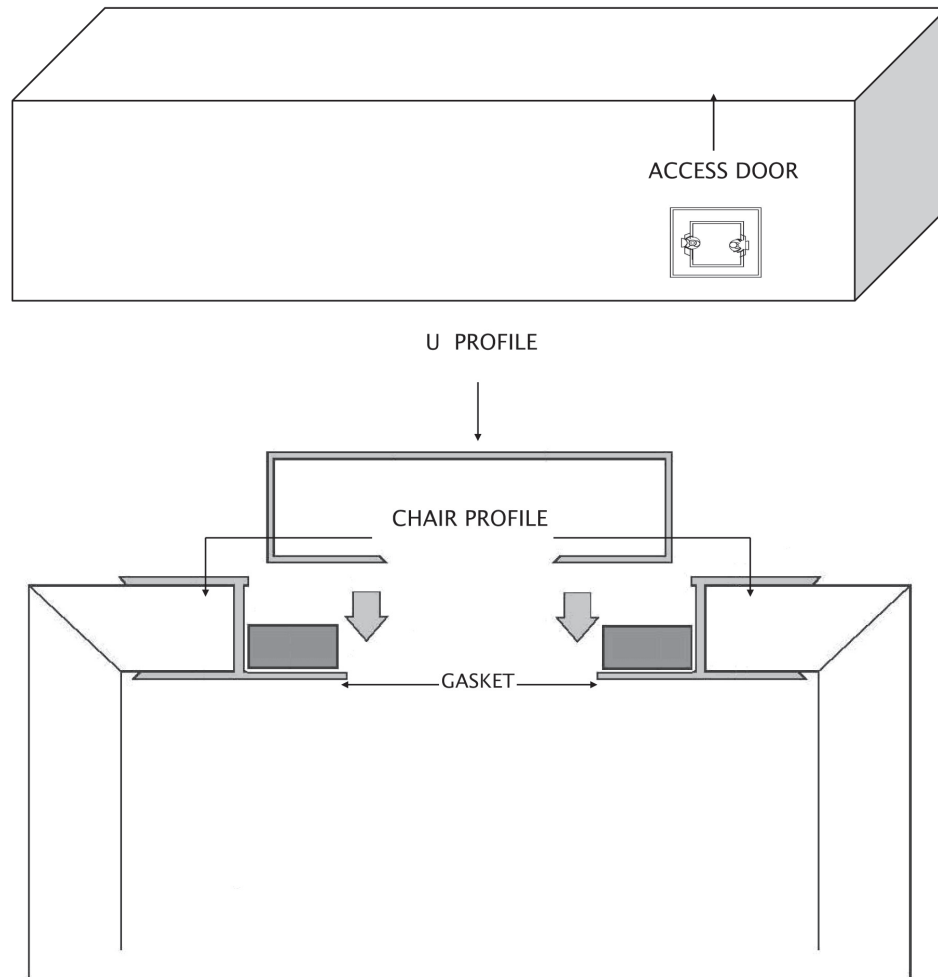
TAKE OFF (above 1000 x 1000mm)



TAKE OFF (up to 1000 x 1000mm)

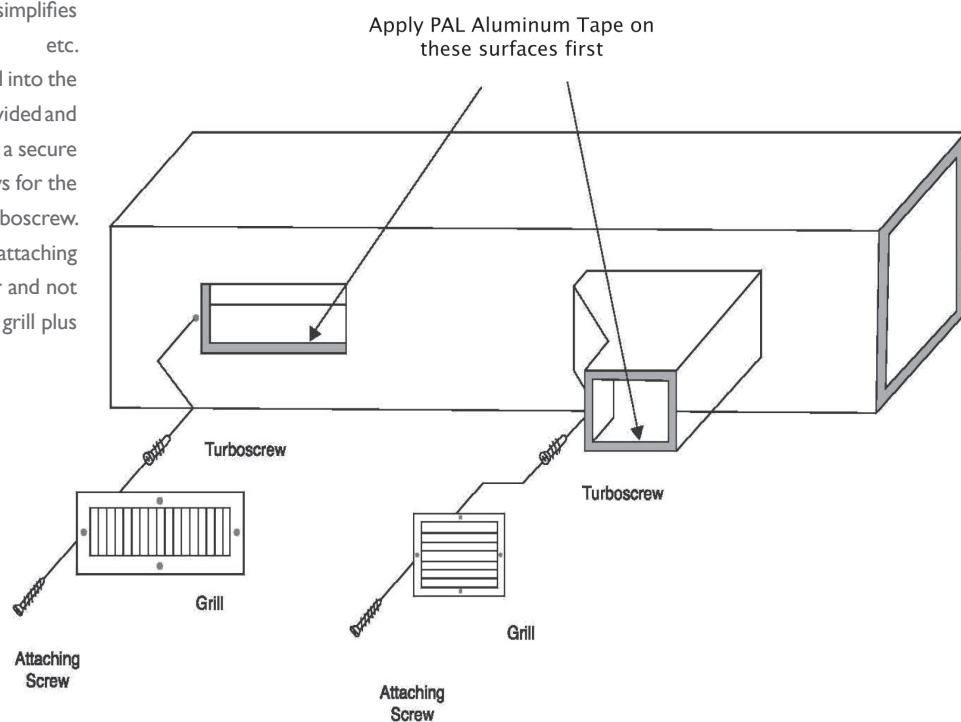


PROFILES FOR ACCESS DOORS

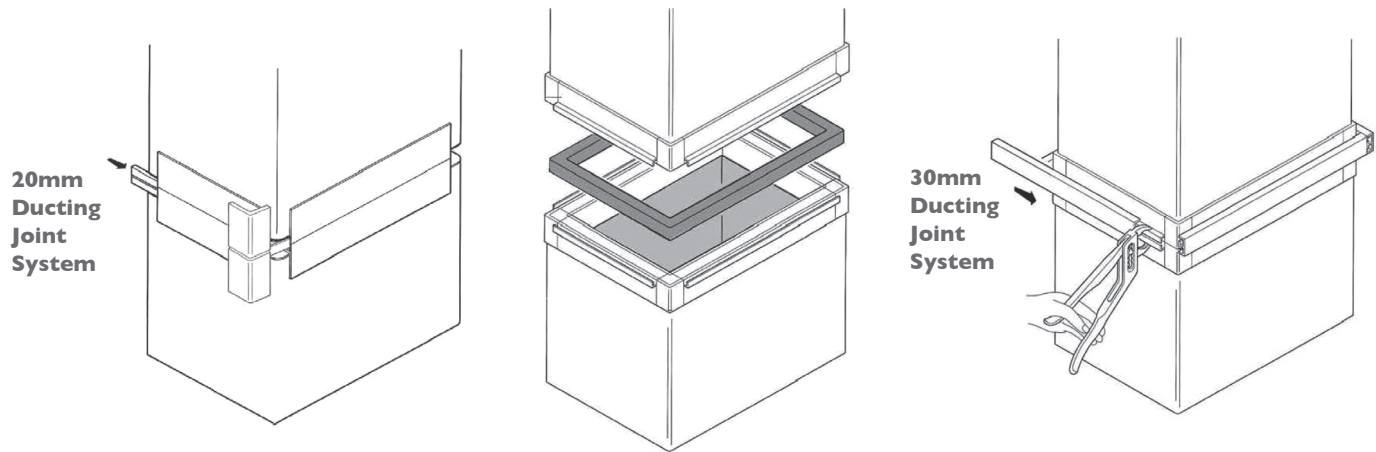


GRILL INSTALLATION (with Turboscrews)

The Turboscrew greatly simplifies the installation doors, etc. The turboscrew is easily screwed into the panel utilizing the simple tool provided and has a large thread which ensures a secure fit. The standard attaching screws for the grill are then screwed into the Turboscrew. The only constraint is the attaching screws are 4 – 5mm in diameter and not longer than the thickness of the grill plus 22mm.

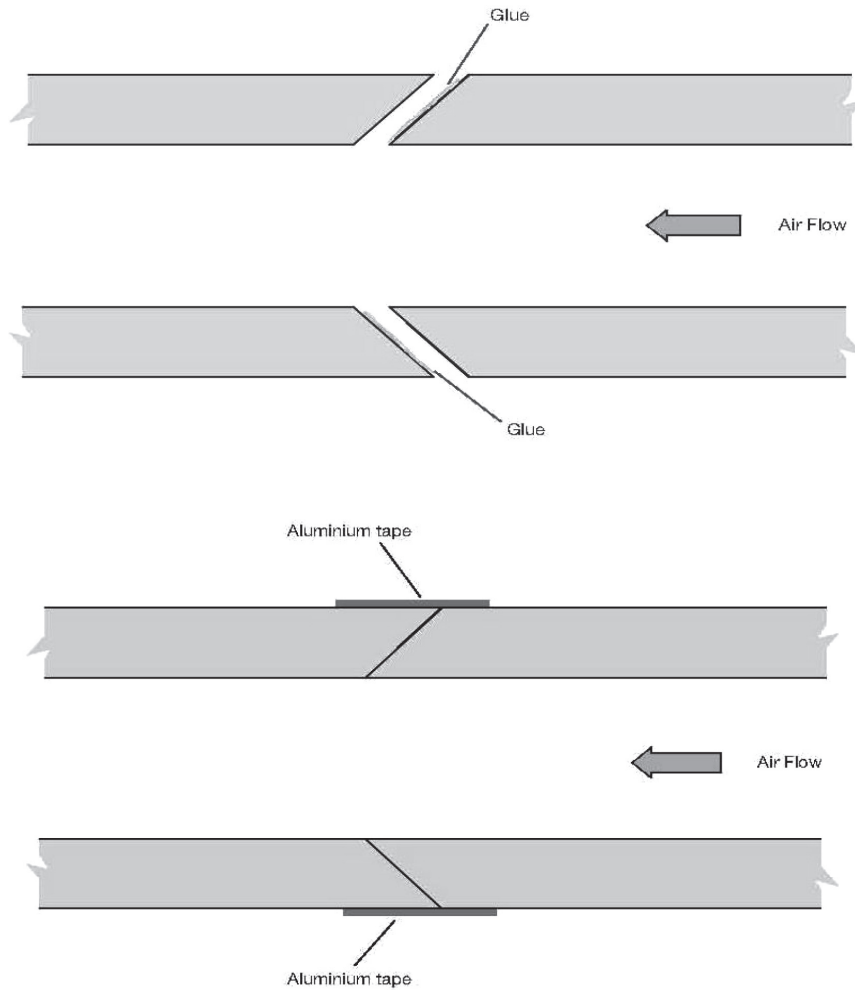


OPTION 1 - Duct Joining System



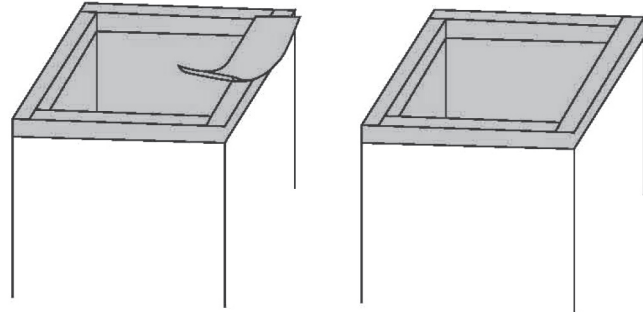
OPTION 2 - For Internal Duct (20mm thick) Less than 500 x 500mm Section

Male - Female Joining System

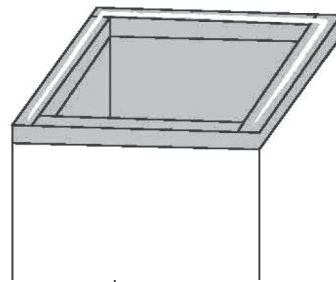


OPTION 2 – For Internal Duct (20mm thick) Less than 500 x 500mm Section

STEP 1
Application of Aluminum Tape on
both ends of the duct segments

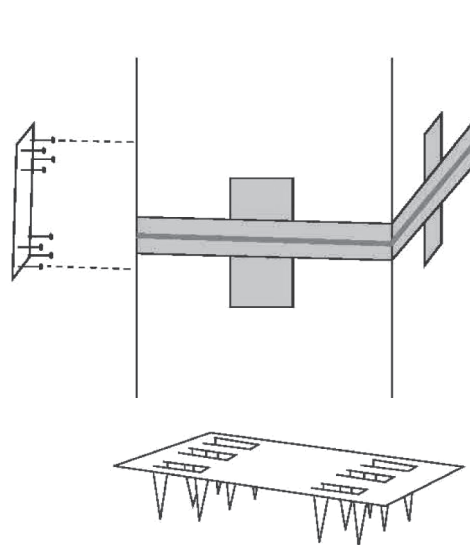


STEP 2
Silicon is placed on one side of one duct, then
the two duct segments are joined together

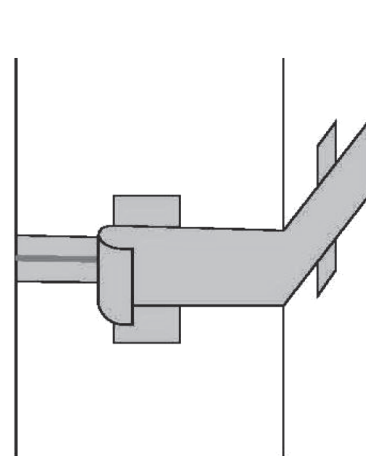


STEP 3
Tiger Connectors are placed on all
four sides of the duct.
For small ducts up to 300mm, use **ONE** Tiger
Connector on each side of the duct.

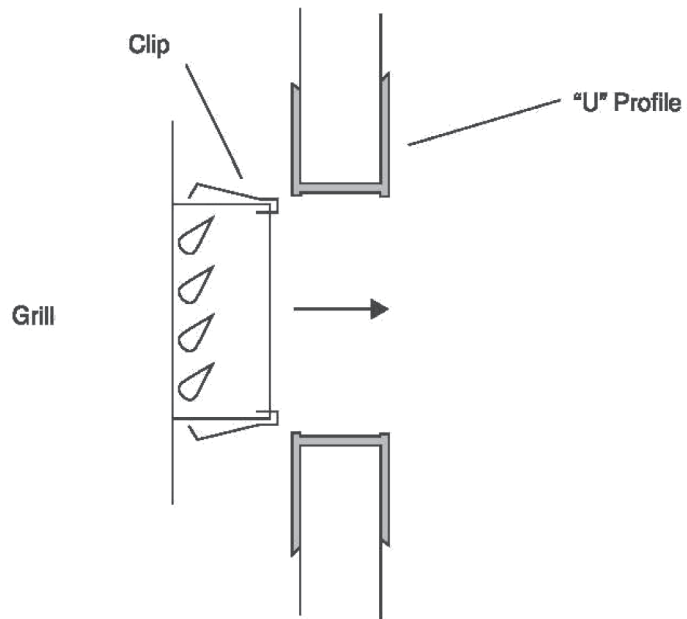
For ducts with one side 350 to 500mm,
use **TWO** Tiger Connectors on each side.



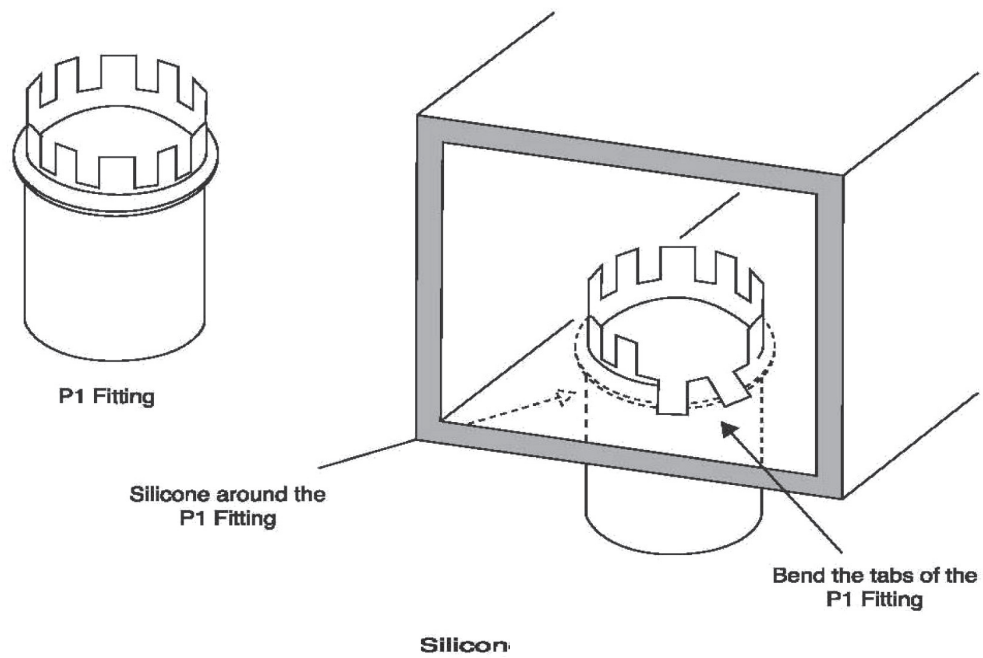
STEP 4
Aluminum Tape covers the connection of the
two duct segments.



GRILL INSTALLATION with Aluminum Profiles



"P1" FITTINGS INSTALLATION for Round Diffusers & Flexible Ducts

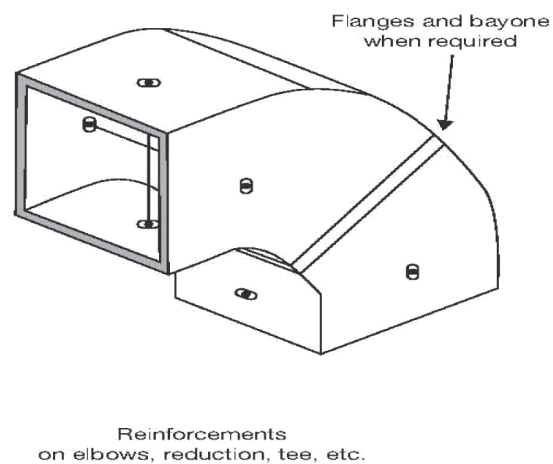
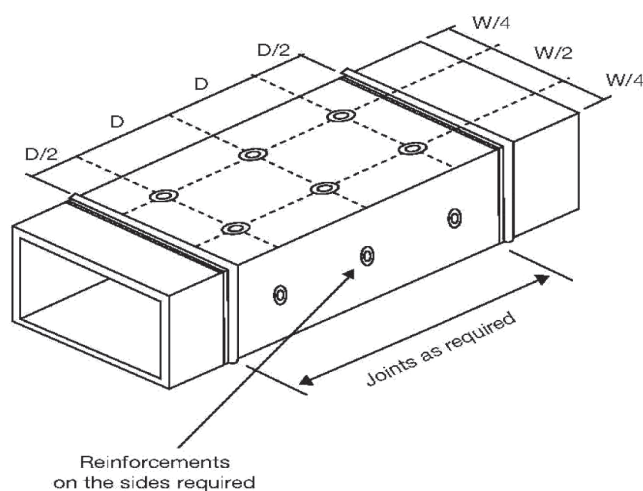


DUCT REINFORCEMENT



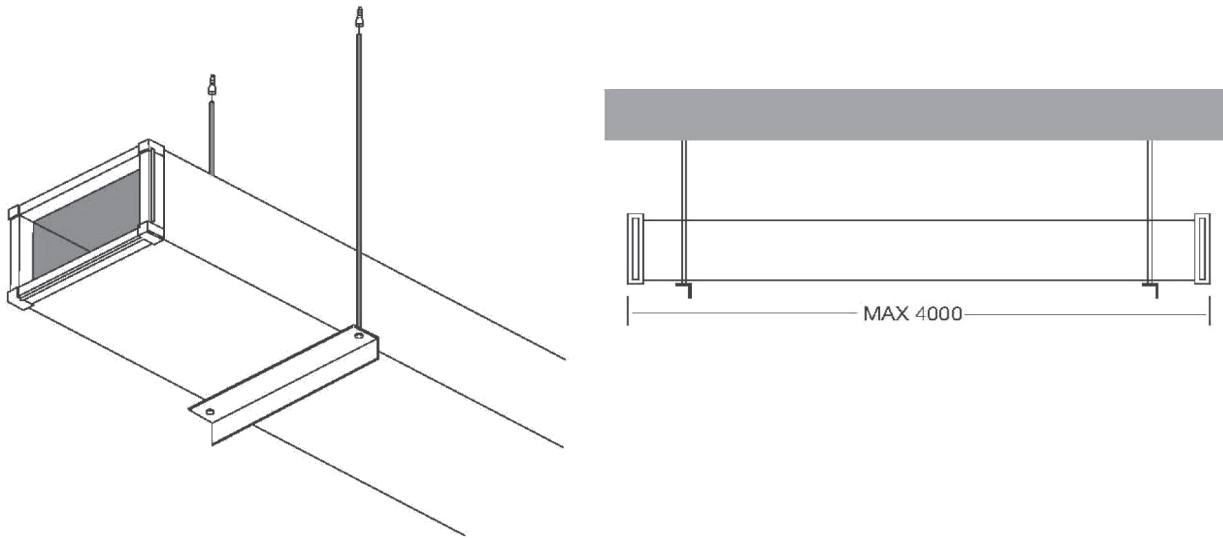
Table for the Calculation of Stiffening

DUCT SIDE mm	PRESSURE											
	PA 0-150	PA 160-300	PA 310-450	PA 460-600	PA 610-750	PA 760-950	PA 960-1000	PA 1010-1250	PA 1260-1500	PA 1510-1750	PA 1760-2000	
510-600									1	1	2	
610-700								1	1	1	2	
710-800							1	1	2	2	2	
810-900					1	1	1	2	2	2	2	
910-1000	1	1	1	1	1	1	2	2	2	2	2	
1010-1100	1	1	1	1	2	2	2	2	2	2	2	
1110-1200	1	1	1	2	2	2	2	2	2	2	2	
1210-1300	1	1	1	2	2	2	2	2	2	2	2	
1310-1400	1	1	1	2	2	2	2	2	2	2	2	
1410-1500	2	2	2	2	2	2	2	2	2	2	2	
1510-1600	2	2	2	2	2	2	2	2	2	2	2	
1610-1700	2	2	2	2	2	2	2	2	2	2	2	
1710-1800	2	2	2	2	2	2	2	2	2	2	2	
1810-1900	2	2	2	2	2	2	2	2	2	2	2	
1910-2000	2	2	2	2	2	2	2	2	2	2	2	

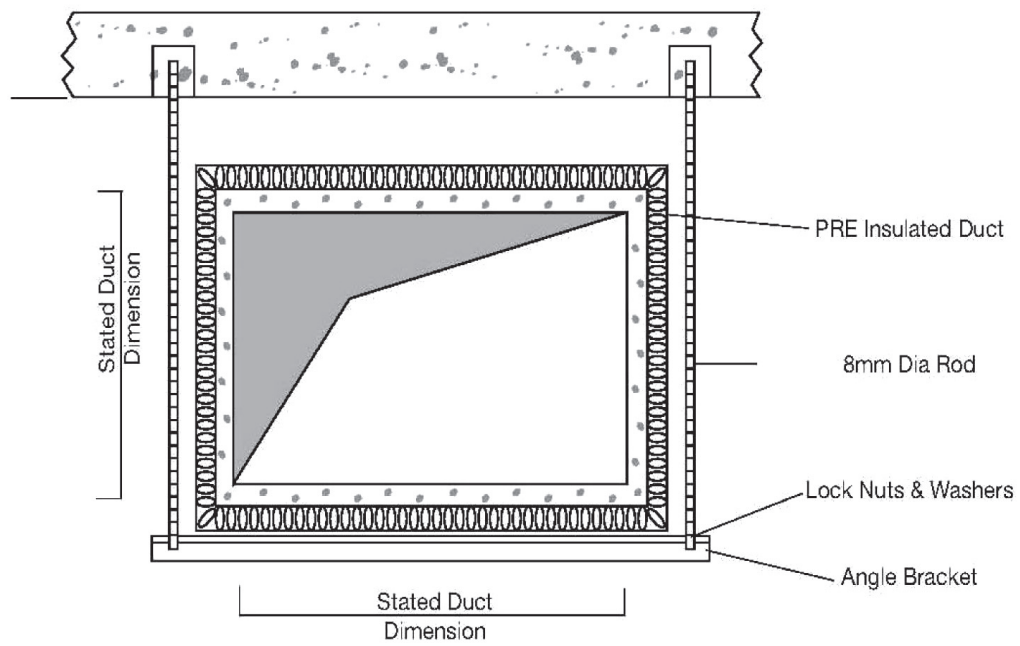


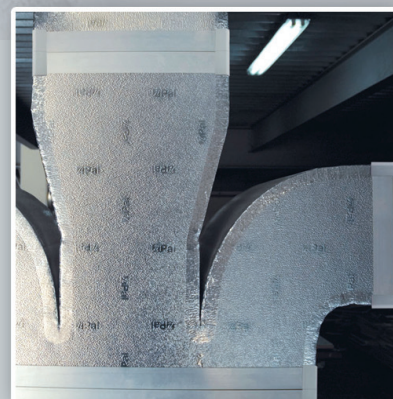
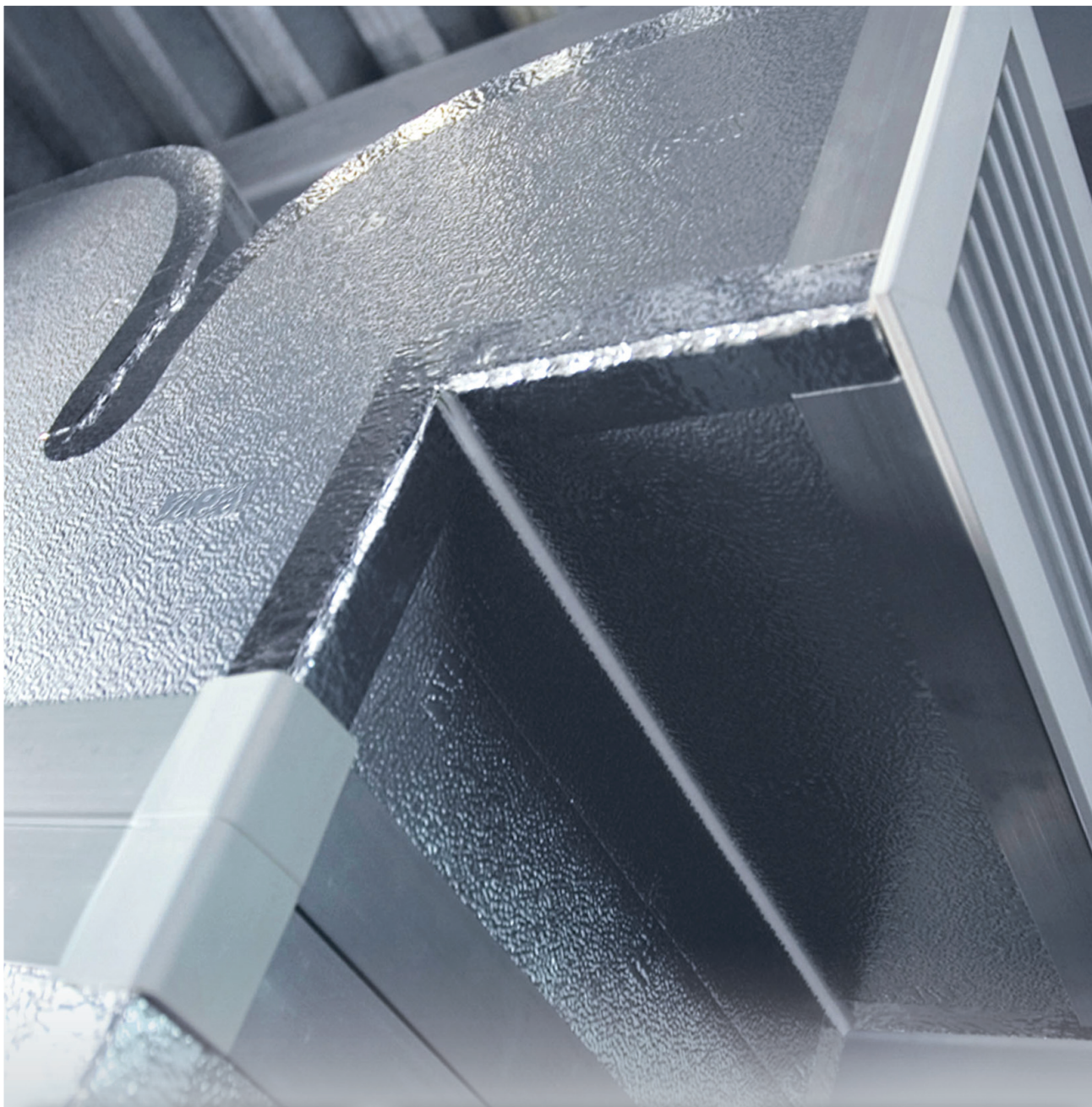
D = Recommended Step Interval (see schedule of Duct Reinforcement)
W = Width of Duct

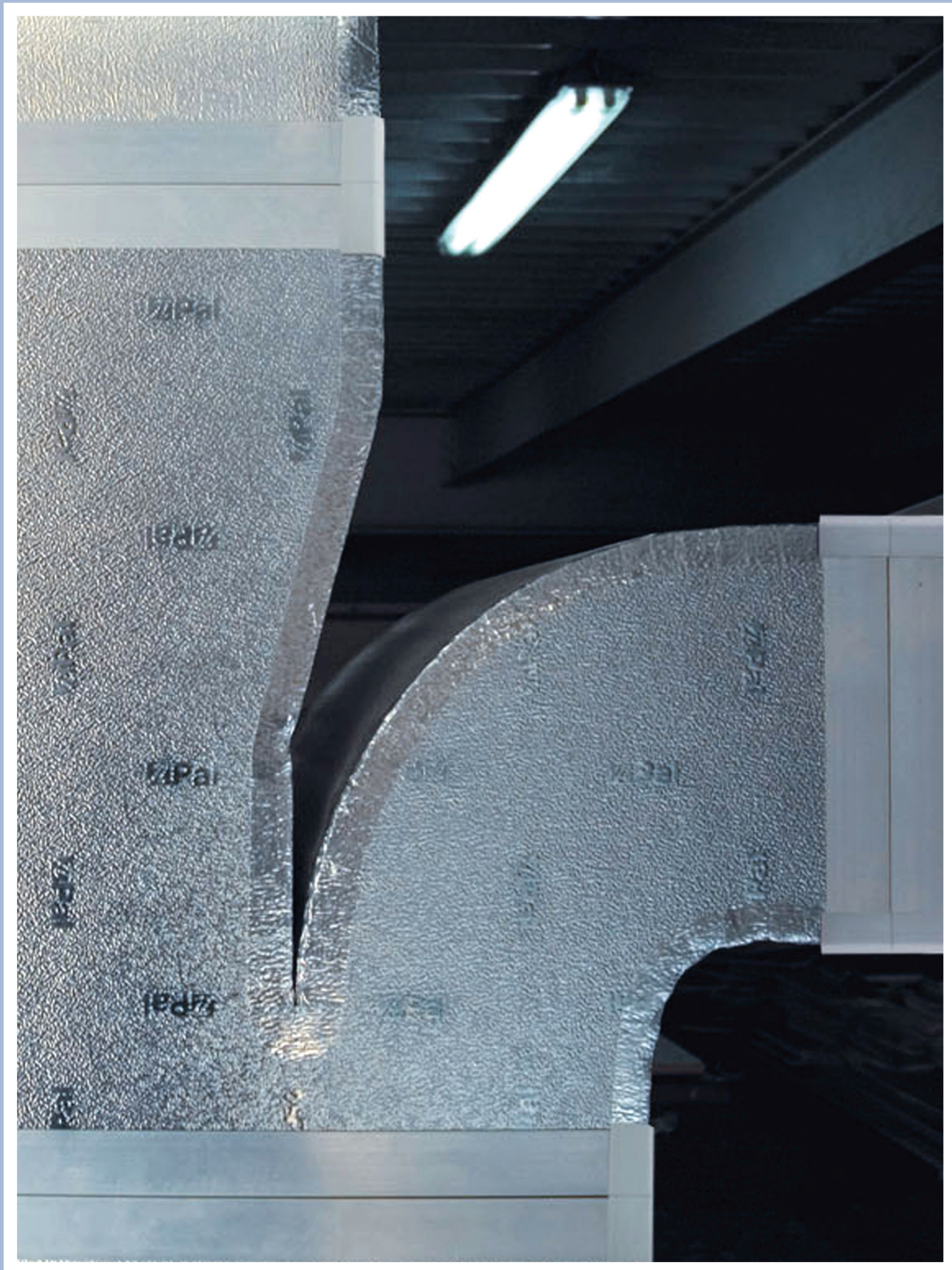
HANGER SYSTEM



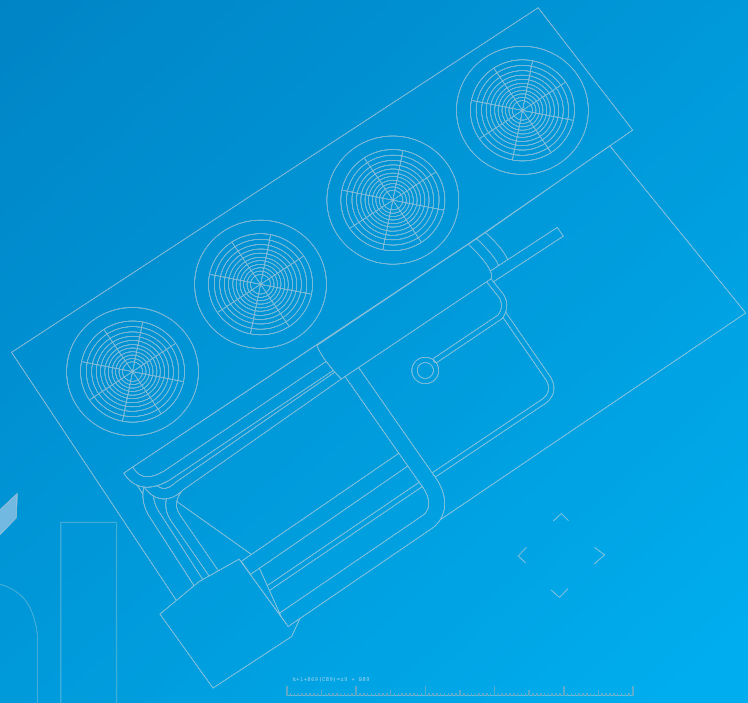
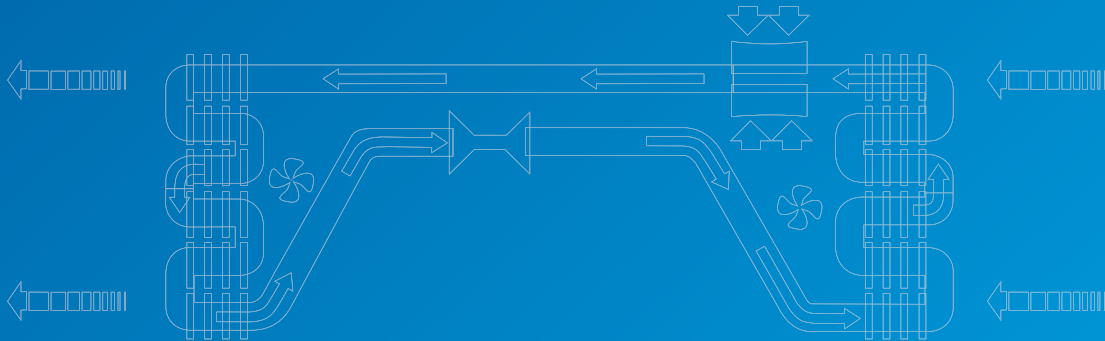
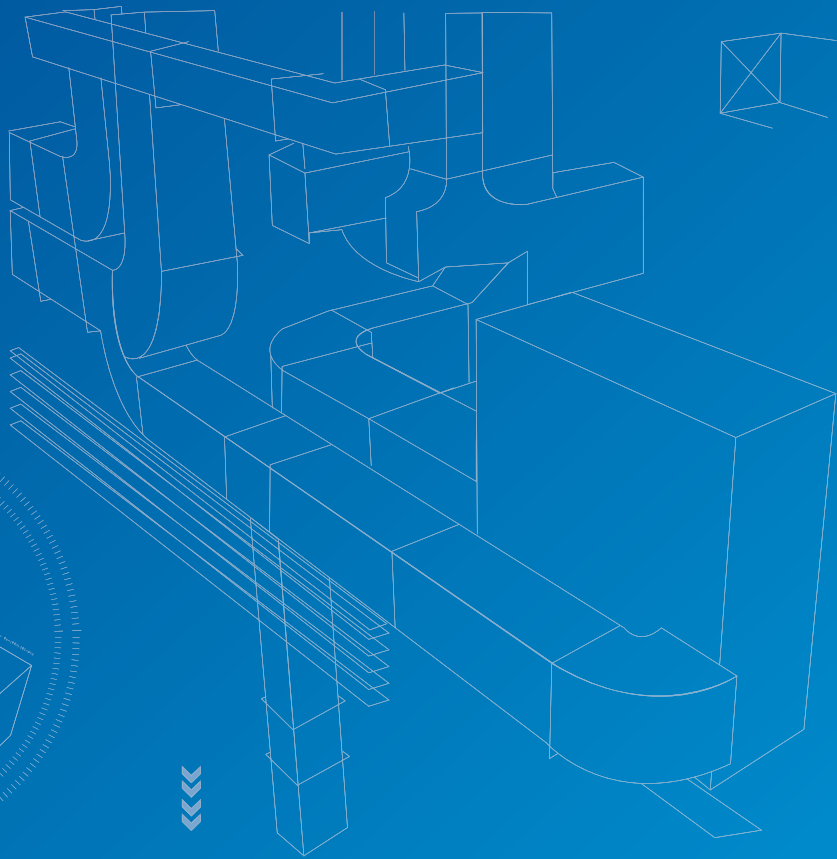
DUCTWORK SUPPORT DETAIL







0
1
2
3
4
5





P.O. Box 113826 Dubai, United Arab Emirates
T +971 4 258 2640 F +971 4 258 2641 Email palme@emirates.net.ae
Visit www.pal-me.net