CI/SfB
(5-) Xn7 (M2)
Third Issue May 2005

The Kingspan KoolDuct® zero ODP System

FABRICATION MANUAL

zero O.D.P

Manufactured to BS EN ISO 9001: 2000
Certificate No. 388/2

Kingspan®
Ducting Solutions

Contents

The Kingspan KoolDuct® zero ODP System

Overview

The Heating, Ventilation, and Air Conditioning (HVAC) industry is in the midst of a dynamic era. However, air ducting, a critical component of HVAC systems, has remained virtually unchanged since the early 1900's. Several factors and recent innovations have introduced the need to revolutionise air ducting. Building materials and insulating products have dramatically improved. Requirements for clean air are becoming increasingly stringent. Energy use has continued to escalate. Speed of construction has become a valuable asset. Floor space and headroom are under constant pressure.

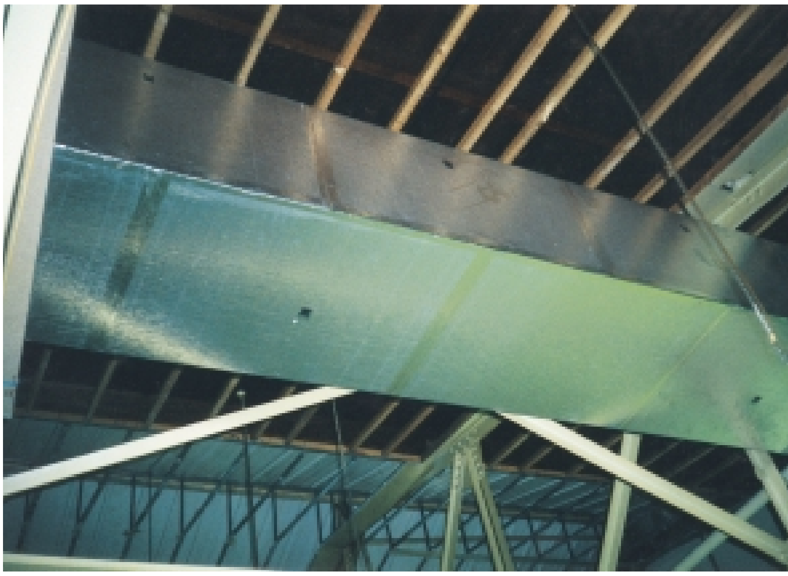
Kingspan Insulation is pleased to present a revolutionary approach to insulated ductwork. The *Kingspan* **Kool**Duct® zero ODP System is like no other insulated ducting system. It is the most advanced and innovative System of pre–insulated air distribution ductwork available in the UK and Ireland. The *Kingspan* **Kool**Duct® zero ODP System of pre–insulated ducting is a proven, easy, innovative product providing a new perspective in the field of air distribution.

This fourth generation System virtually eliminates all the problems of traditional metal ductwork while at the same time offering extra advantages to both the consulting engineer and the registered fabricator/installer. The System is the clear leader in the new generation of insulated prefabricated ducting and has already proved itself in the highly competitive global marketplace.

What's different about the *Kingspan* **Kool**Duct® zero ODP System?

Traditionally, ducting is made of sheet metal which is installed first and then lagged with insulation as a second operation. The *Kingspan* **Kool**Duct® zero ODP System comprises pre–insulated ducting with aluminium surfaces in a single fix.

The *Kingspan* **Kool**Duct® zero ODP System comprises 3 m long duct sections fabricated from zero ODP rigid phenolic insulation panels which are joined together with a patented jointing system.



This manual provides an overview of the fabrication process for the *Kingspan* **Kool**Duct® zero ODP System.

Information relating to the design of the System can be found in the 'The *Kingspan* **Kool**Duct® zero ODP System Specification Manual'.

1 Fabrication of Ductwork

1.1 General

All personnel responsible for the fabrication and construction of ductwork systems shall, prior to being engaged in the work, have successfully completed the specialised *Kingspan* **Kool**Duct® zero ODP System training course and shall be familiar with all aspects of the techniques necessary for the fabrication of the complete system. All trainees who successfully complete the training course are awarded a *Kingspan* **Kool**Duct® zero ODP System certificate of competency.

The *Kingspan* **Kool**Duct® zero ODP System offers a complete product line providing all tools, accessories and components necessary to fabricate ductwork. Each item has been rigorously tested in the laboratory and 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 *Kingspan* **Kool**Duct® zero ODP System products.

1.2 Procedure

The construction of a duct is accomplished by following a standardised procedure. The process is the same regardless of the shape of the duct element: tracing, cutting, gluing, folding, taping, flanging & reinforcement; and sealing.

Although each of the above operations is described in general below, this fabrication manual is by no means intended to serve as an instruction manual to replace the training course. Note that when properly fabricated, the finished duct will have no exposed rigid phenolic insulation – internally or externally.

1.3 Tracing

The tracing of the duct outline onto the rigid phenolic insulation panel is the first step of the process. This is accomplished by utilising the Teflon “pencils” supplied in each tool box which scribe a line as opposed to marking a 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 registered fabricator adopt the convention of internal measurements during plotting. Accordingly, all tracing and plotting will take place on the internal side of the duct.

1.4 Cutting

This operation involves cutting 45° mitre cuts along each edge of the duct. The ‘V’ grooves made by the 45° Jack Plane enable the rigid phenolic insulation panel to be folded into shape. The ‘V’ groove is also optimal for the subsequent gluing operation as it provides maximum bonded 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 Planes available including the 22.5°, and the Adjustable.

1.5 Gluing

The glue must be well shaken prior to use in order to assure uniform consistency. Glue is applied evenly to mitred surfaces utilising a Pneumatic Glue Spreader, and should cover all exposed phenolic material. Note that the ‘V’ groove 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 COSHH datasheet sheet should be observed. The curing period is complete when the glue is dry to the touch.

Ducts can be manufactured using method 1 without the use of glue.

In some fabrication formats, tiger closures as shown in Figure 1.1 may be used instead of glue. These have been designed as mechanical closures to hold the open mitred joints together whilst the tape is applied (Figure 1.2). This method makes the fabrication process much quicker as there is no drying time needed. The limitations on their use is given below.

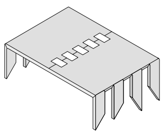


Figure 1.1 Tiger Closure

Straight air ducts with sides up to 500 mm:

- Maximum air pressure 500 Pascals.
- The maximum distance between each tiger closure is 900 mm.
- Tiger closures must be installed at the beginning and end of the duct, about 50 mm from the edge.

Straight air ducts with sides from 500 to 750 mm:

- Maximum air pressure 300 Pascals.
- The maximum distance between each tiger closure is 600 mm.
- Tiger closures must be installed at the beginning and end of the duct, about 50 mm from the edge.

Elbows, Tees, Take-offs, Reducers:

- Internal radiuses: place the tiger closure every 100 mm between creases.
- External radiuses: place the tiger closure every 300 mm.
- Tiger closure must be installed at the beginning and end of the duct, about 50 mm from the edge.
- Use care and common sense.

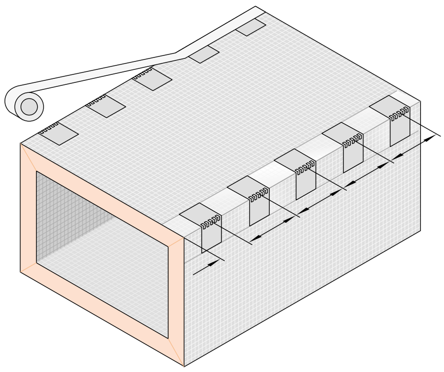


Figure 1.2 Maximum spacings of tiger closures as per limits

1.6 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 aluminium foil edge of the mitre 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 required at the opposite end only. 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.

1.7 Taping

Special reinforced aluminium self adhesive tape is provided. The tape has been double cured for increased pliability, and contains 2.5 times as much glue as standard tapes to ensure maximum adhesion. The taping of the duct serves four purposes:

- it re–establishes the vapour barrier within the mitred cuts;
- external seams are taped to improve the duct's aesthetic appearance;
- tape is used to repair and cover any damage to the rigid phenolic insulation panel, both externally and internally; and
- 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, silicone, and grease. If the surface can not 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 1.5 on page 4). The tape should ideally be applied in temperatures above 10°C in order to assure a satisfactory bond. The tape should not be applied to the duct's surface when the temperature is below 0°C due to the potential entrapment of ice crystals.

Tape is only applied to seams where the external surface of the aluminium foil has been cut. On sides where the rigid phenolic insulation panel has been simply folded, as opposed to joined, no tape is required. The tape–marker is used to scribe a line on the zero ODP rigid phenolic insulation 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 trapped underneath. When taping reducers or elbows, the tape must always be applied to the curved or creased surface (not the flat surface), and the supplemental directions within the respective sections should be observed.

1.8 Aluminium Profile & Reinforcement

There are a variety of aluminium profiles available to suit various installation requirements. A full discussion of each, complete with instruction, is provided in section 10. Depending on both the system pressure and the duct's dimensions, the installation of reinforcement bar may be necessary. Section 7 provides a complete guide to its usage.

1.9 Sealing

Following assembly of the duct section, all internal joints must be sealed with silicone. In addition to imparting greater strength and rigidity, the primary function of the silicone is to seal the internal surface of the duct and prevent any phenolic particles from entering the air stream. It is recommended that after the silicone bead has been applied, a radiused tool (or alternatively a wet finger) is gently run along the entire length of the bead to further spread the sealant along the sides of the duct wall. Proper application is crucial in order to achieve "clean air" performance and minimise leakage.

2 Rectangular Ducts

2.1 General

For purposes of clarity, the following convention will be adopted, where w refers to internal duct width, h refers to internal duct height, and l refers to duct length:

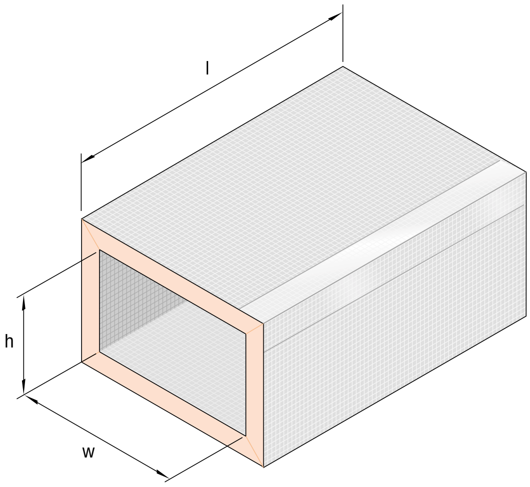


Figure 2.1

Kingspan **Kool**Duct® zero ODP rigid phenolic insulation panels are supplied in one size only: 2.95 m x 1.2 m x 22 mm. Ducts may be fabricated by cutting 'V' grooves along the length or the width of the zero ODP rigid phenolic insulation panel. The methods for cutting rectangular ducts are divided into four general classes and the selection of the appropriate technique is governed by the dimensions of the duct. The correct choice will minimise both material usage and fabrication time. Table 2.1 specifies the limiting dimensions of a duct for each method, and sections 2.2–2.5 describe the procedure. Dual Duct design is presented separately in section 8.

Method	Duct Side Dimensions (mm)	Maximum Length of Duct Segment (metres)
1	2 x (w+h) <1,040 the sum of 4 sides	2.95
2a	(h+w+h) <1,080 the sum of any 3 sides	2.95
2b	(w+h) <1,120 the sum of 2 sides	2.95
2c	w and h <1,160 any single side	2.95
3a, 3b	(h+w+h) <2,830 the sum of any 3 sides	3.56
4	w and h <2,910 any single side	1.2
Dual Ducts	unlimited see section 3.8	2.95

Table 2.1 Rectangular Straight Duct Fabrication.

2.2 Rectangular Ducts – Method 1

This method is utilised when the perimeter of a duct is less than or equal to 1,040 mm. The advantages are simplicity and strength in that the entire duct can be fabricated from a single *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel. The figure of 1,040 mm is derived from subtracting the combined length of the off–cuts of the mitre grooves (equivalent to 20+40+40+40+20 = 160 mm) from the *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel width: 1,200 mm–160 mm = 1,040 mm. The 'V' grooves are cut in the lengthways direction, and the duct is constructed as shown below in Figure 2.2. Aluminium flanges should be fitted on both ends of the duct section

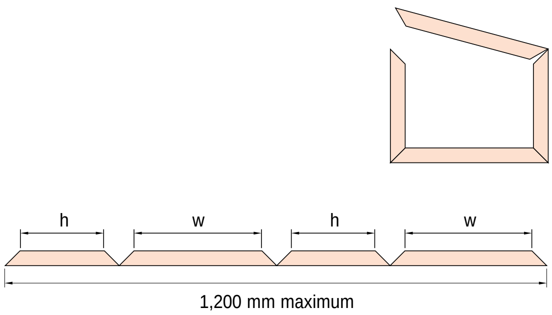


Figure 2.2 Method 1: w+h+w+h<1,040 mm

The use of glue is not necessary with this method, alternative holding methods may be used.

2.3 Rectangular Ducts – Method 2

This method is utilised for larger ducts that are still 3 metres in length, but fabricated using separate *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panels that are subsequently joined. The dimensions of the duct dictate whether or not the individual pieces are symmetrical (method 2b), or asymmetrical (method 2a).

When the duct cannot be fabricated according to Figure 2.2, and the sum of three of the sides is less than or equal to 1,080 mm, then method 2a applies. The duct is constructed as illustrated in Figure 2.3 by using a U shaped piece and a cover. The 'V' grooves are still cut in the lengthways direction.

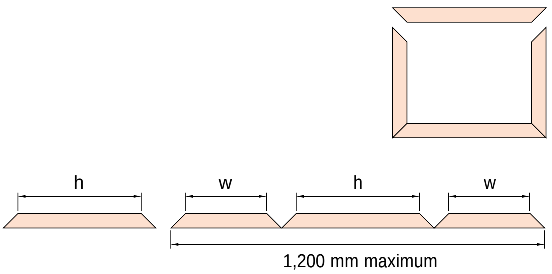


Figure 2.3 Method 2a: w+h+w<1,080 mm

If the duct is larger still, and the sum of two sides is less than or equal to 1,120 mm, then method 2b applies. In this case, the duct will be fabricated using two symmetrical pieces, each consisting of two full sides. The 'V' grooves are again cut in the lengthways direction, and is illustrated in Figure 2.4.

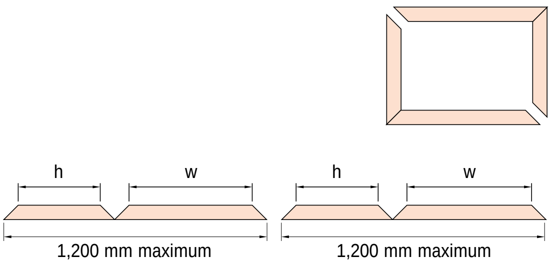


Figure 2.4 Method 2b: w+h<1,120 mm

A larger duct can also be fabricated utilising an individual zero ODP rigid phenolic insulation panel for each side of the duct section, as prescribed by method 2c, illustrated in Figure 2.5. The side dimension of such a duct section would be limited to the size of the *Kingspan* **Kool**Duct® zero ODP System rigid phenolic insulation panel corrected for the mitre cuts, 1,160 mm (1,200 – 20 – 20). The length of the duct section is again limited to the length of the panel, 3 m.

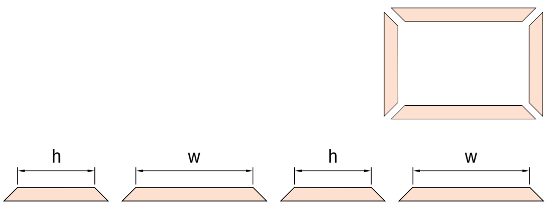


Figure 2.5 Method 2c: w and h<1,160 mm

Aluminium flanges should be fitted on both ends of the duct section, for each of the methods covered in Class 2 ducts.

2.4 Rectangular Ducts – Method 3

This method is employed for larger ducts still. The 'V' grooves are now cut along the widthways direction of the *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel which means that each individual module is limited to 1,180 mm in length (computed as the 1,200 mm *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel width less the 20 mm mitre cut).

When fabricating rectangular ducts utilising the third family of techniques, it is permissible to join up to three individual modules together with male–female jointing alone, provided that the following precautions are observed. First, the cover must be carefully positioned such that the joints are staggered, thus adding an additional degree of strength and stability. The edge of the cover must never, under any circumstance, be allowed to coincide with the male–female joints of the three duct modules.

In addition, the direction of the male–female joints must be consistent with the direction of the air flow. Figure 2.6 below demonstrates the proper application. All male–female joints must be glued and then taped on both sides. Finally, aluminium flanges shall not exceed 3.6 metres in distance apart (three duct modules) when using this method of construction.

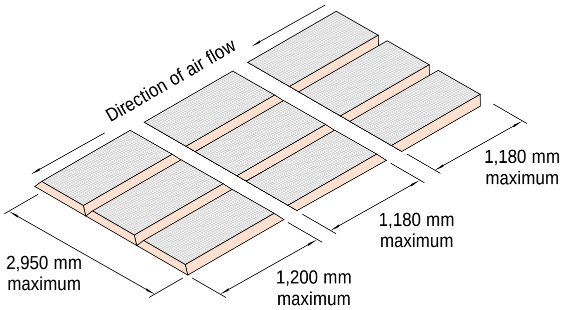


Figure 2.6

When the dimensions of the duct exceed the limits set forth in the previous two classes, and the sum of three sides is less than or equal to 2,830 mm, then both methods 3a and 3b can be utilised. The determining factor for selecting the proper technique is the width of the cover. If the cover width is less than or equal to 1,160 mm, then method 3a applies, as shown in Figure 2.7. Note that the orientation of the cover is lengthways (2,950 mm) which would mean that a supplementary piece of roughly 630 mm in length would be necessary to complete the cover for a duct that is composed of three modules (3.6 metres long) as is the case in Figure 2.7.

- 3 U–shaped sections joined together using male/female
- maximum combined length of 3.56 m (3 modules)
- the sum of three sides equal to or less than 2,830 mm (internally)
- cover width equal to or less than 1,160 mm (internally)

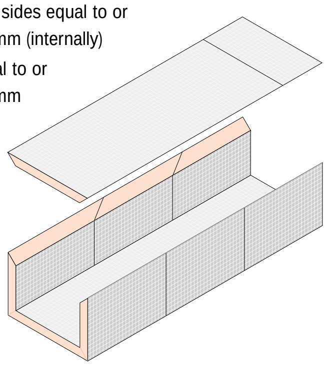


Figure 2.7 Method 3a: w+h+w<2,830 mm

This method should only be used for low pressure systems only (less than 500 Pascals). For pressures above this, method 4 should be used.

If the cover width exceeds 1,160 mm, then method 3b would be applicable. The difference is that the orientation of the *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel strips used for the cover is in the widthways direction. Accordingly, each are 1,200 mm long. Again, care should be taken to ensure that the seams of the cover do not coincide with the male–female joints of the duct body. Figure 2.8 provides an example.

- 3 U–shaped sections joined together using male/female
- maximum combined length of 3.56 m (3 modules)
- the sum of three sides equal to or less than 2,830 mm (internally)
- cover width greater than 1,160 mm (internally)

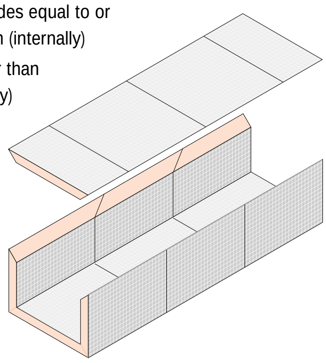


Figure 2.8 Method 3b: w+h+w<2,830 mm

2.5 Rectangular Ducts – Method 4

This method is reserved for the largest of duct sizes. The 'V' grooves are cut along the widthways direction of the *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel, and duct sections are fabricated in lengths of 1.2 metres, flanged at each end. An entire *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel can be used for a single side, which enables a maximum side width or height of 2.91 m. Reinforcement of method 4 ducts is almost a certainty, and the schedules in section 7 should be referenced.

Depending on the air pressure and velocity, it might be advisable, and more economical, to fabricate according to the Dual Duct methodology outlined in section 8. Beyond resulting in a more rigid duct, less stiffening bars would be required, and the ducts could also be fabricated in 3 m lengths.

2.6 End Caps

Sometimes it may be necessary to cap the end of a duct. The end of the duct should then be cut in a 45° female mitre utilising the Small Jack Plane. The cap is cut male, and then checked for a good fit. It is recommended that both the cap and duct are marked while held in place in order to assure the proper orientation is attained. All mitred cuts should then be glued, allowed to cure, the cap fitted, and the external seams taped. The internal seams should be sealed with silicone, either through an access door or prior to installation of the end cap. Figure 2.9 below illustrates the fitting.

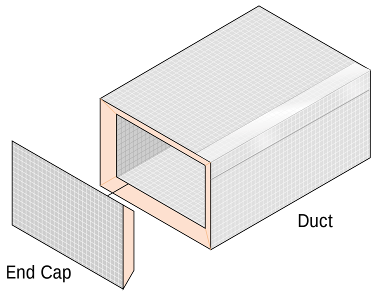


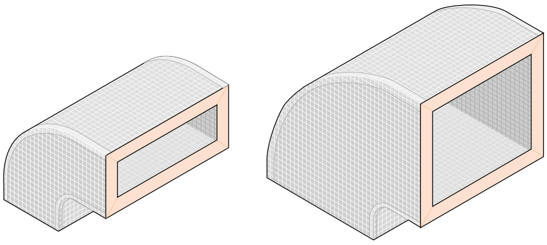
Figure 2.9 End–Cap Fabrication

3 Elbows

3.1 General

Elbows are the most common fitting in the ducting system. Prior to discussing fabrication techniques, it is necessary to define some basic terminology.

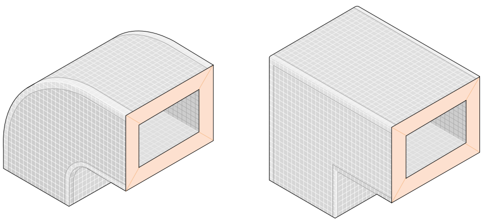
First, bends are classified as “hard” or “easy.” A hard bend signifies that rotation occurs in the plane of the longer side of the duct’s cross section. That is, w is less than h. An easy bend signifies that rotation occurs in the plane of the shorter side of the duct’s cross section. That is, w is greater than h. An example is illustrated in Figure 3.1 below.



Easy Elbow Hard Elbow

Figure 3.1

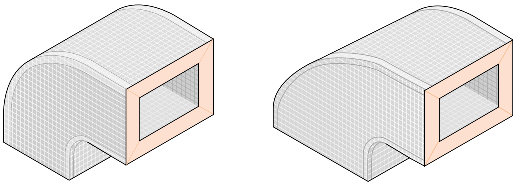
Bends are also classified as “radiused” or “square.” A radiused bend is a smooth elbow where the air changes direction along a radiused path. This type of design assures the continuance of laminar flow and therefore minimises both noise and drag. A square bend has no radius and the abrupt change in air direction requires the use of turning vanes. Examples of each are shown in Figure 3.2 below.



Radiused Elbow Square Elbow

Figure 3.2

Finally, bends are also classified as symmetric, or asymmetric. A symmetric elbow has an inlet and an outlet of identical dimensions. Accordingly, the outlet on an asymmetric elbow is not the same size as the inlet. Figure 3.3 demonstrates the difference.



Symmetric Elbow Asymmetric Elbow

Figure 3.3

Figure 3.4 details the components of the elbow which will be repeatedly cited in the following instruction on fabrication of elbows.

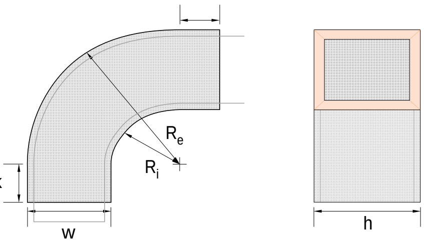


Figure 3.4

3.2 Elbow Fabrication

As illustrated in Figure 3.5, elbows are generally fabricated from four separate pieces: the two sides, and the inner and outer strips.

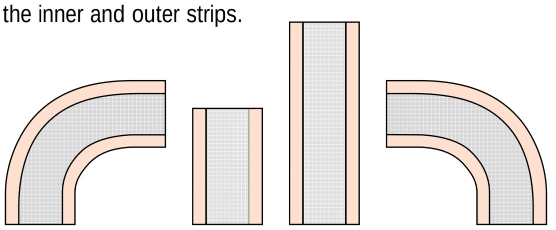


Figure 3.5 Components of an Elbow

In order to properly fabricate an elbow, the following information should ideally be supplied:

- dimensions of inlet;
- dimensions of outlet;
- internal radius (or external radius);
- lengths of inlet and outlet neck.

When designing an elbow to be made of *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panels, it is essential to observe the following recommendations:

- the minimum length of any neck shall be 200 mm;
- the internal radius shall not be less than 200 mm;
- the distances between the creases on the internal and external strips shall not be less than 50 mm apart.

As with rectangular ducts, all measuring should be performed on the internal side of the duct. The sides of the elbow are cut using the Small Jack Plane with a 45° cutter. The second side of the elbow can be traced by simply turning the previously cut first side upside down onto a new *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel and scribing a line along the internal edge. The lengths of the strips are obtained by bending the flexible ruler along the curved perimeter of the sides. A nominal amount should be added to compensate for the subsequent creasing process. The excess length can be trimmed following complete assembly.

Parallel scribe lines should be marked on both strips in preparation for the bending machine. Note that the bending of the internal strip is performed on the outer surface, and the bending of the external strip is performed on the inner surface. The gluing process is as described in section 1.5.

The fitting process begins by placing the external strip onto the table. Both sides are joined to the external strip simultaneously starting at the end of the neck, taking care to ensure that the inner edges of the aluminium foil are properly aligned. The process continues along the external radius until the three pieces are joined together. The fourth side is then fitted, starting at the same end of the duct as previously. The black, stiff spatulas are then used to gently crease along the edges to ensure maximum adhesion in the 'V' grooves. The procedure is illustrated in Figure 3.6 below.

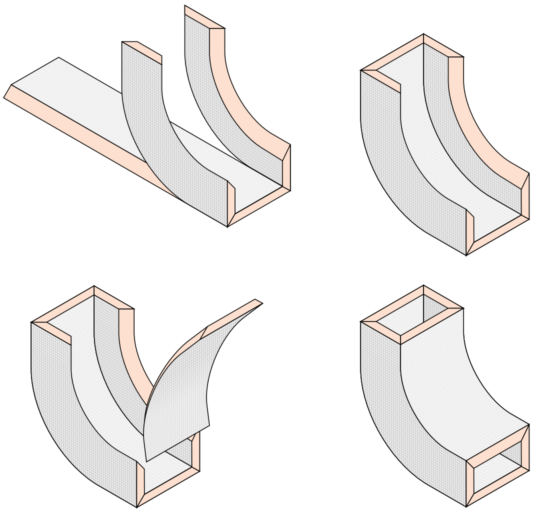


Figure 3.6 Elbow Fitting Procedure

The taping and sealing process is as described in sections 1.7 and 1.9. Note that the tape is always first applied to the strips (the side with the creases), not the elbow's sides. In addition, because the surface to be taped is curved, the edge of the tape to be folded over should be slit intermittently in order to prevent wrinkling, the entrapment of air, and a poor application as a result. Again, the soft spatula should always be used.
Finally, both ends of all elbows shall be fitted with aluminium profiles.

3.3 Splitters

Splitters are inserted in radiused elbows in order to reduce turbulence in the air stream and the associated pressure drop. No splitters are required in elbows that have a turning radius of at least 200 mm with a width, w, of less than 600 mm. Elbows of widths greater than 600 mm but less than 900 mm will require a single splitter positioned one third of the width dimension away from the internal curvature. Elbows over 900 mm but less than 1,200 mm will require two splitters placed equally between the internal and external curvature. Elbows over 1,200 mm will require three splitters placed equally apart. Splitters can be fabricated using *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panels and should be glued and sealed in position.

When using *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panels as splitters, they run parallel to the inner and outer strips of the elbow with a neck on either end. The front end of the splitter on the inlet side is cut in a 'V' shaped manner to ensure minimal disruption to the air stream and taped to seal all insulation surfaces. Note that splitters are not a substitute for positive pressure reinforcement.

3.4 Turning Vanes

Square elbows are employed when space is limited or when explicitly specified. All square elbows shall be fitted with turning vanes secured at both ends. Aerodynamically designed aluminium turning vanes, also known as double skin, are recommended. Turning vanes should be fitted as illustrated in Figure 3.7, and fastened to externally mounted bayonet strips with 35 mm aluminium rivets. A bead of silicone sealant spread along the turning vane track can be used to further secure the vane assembly to the duct. Note that turning vanes are not a substitute for proper reinforcement.

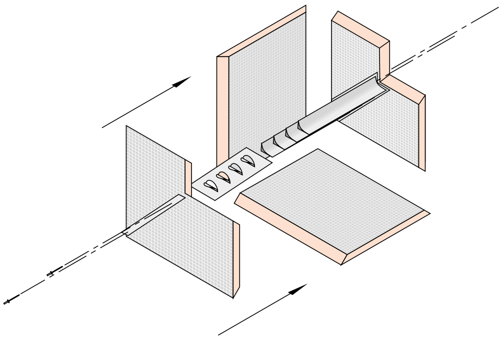


Figure 3.7 Square Elbow and Turning Vane Assembly

4 Reducers

4.1 General

Reducers are classified as concentric or eccentric. As illustrated in Figure 4.1, eccentric reducers have a taper (or reduction) on one side of the duct only. Concentric reducers have a taper on both sides of the duct, thus maintaining the centre line in both cross sections.

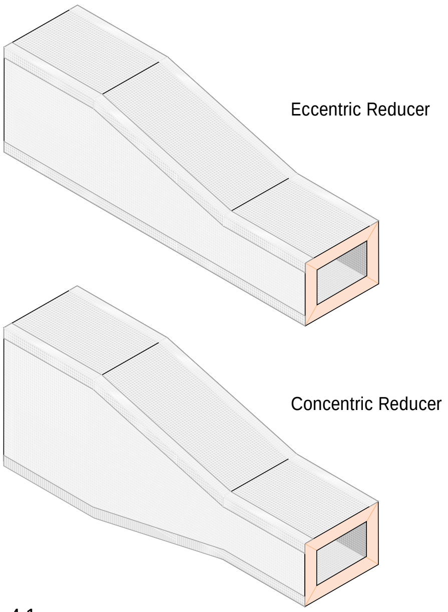


Figure 4.1

Abrupt changes in cross sectional area within a duct can induce turbulence thereby increasing drag and noise. A well designed reducer shall have a diagonal equivalent to three to four times the length of the difference of the inlet and outlet:

3 x (Inlet–Outlet) < Diagonal Length < 4 x (Inlet–Outlet)

The above rule of thumb translates to a taper angle of no greater than 20°. In addition, a minimum neck length of 200 mm before and after the taper shall always be included.

4.2 Reducer Construction

As with elbows, reducers are generally fabricated using four separate pieces of *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel as shown in Figure 4.2. Note that after the first side of the reducer has been designed and cut, it can be turned upside down and used as a template to trace the second.

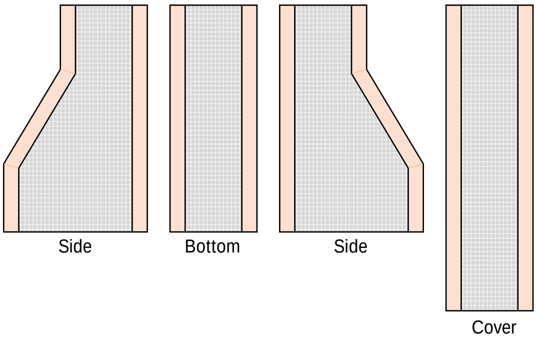


Figure 4.2 Components of a Reducer

When fabricating a reducer comprised of four separate pieces, it is recommended that assembly is commenced with the base first. The sides are sequentially attached, and the creased cover installed last. As with all other fittings, priority should be focused on ensuring that the internal aluminium facing of sides that are joined is carefully aligned. All joining should start from the same end of the reducer, and the excess length of the cover can be trimmed off after it is fully assembled.

However, for smaller ducts, the reducer can be constructed from as few as two pieces, resulting in improved structural rigidity and reduced materials usage. This is generally accomplished by forming the two sides and the base from a single piece. The same procedure as described in the preceding paragraph applies.

The cover of the reducer shall have a minimum of three creases per bend performed with the bending machine. One crease is always performed on the centreline of the bend, and then at least one more on each side of the centre. The minimum spacing between creases is again 50 mm. Figure 4.3 provides an example.

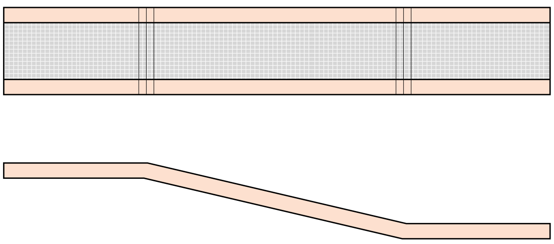


Figure 4.3 Reducer Cover

4 Reducers

As with all other duct fittings, internal seams must be glued and sealed, and external seams taped (sections 1.5, 1.9, and 1.7 respectively). When taping the reducer, it should always be applied to the curved side first (the side that has the creases). Prior to bending the tape over the edge, the tape should first be slit at the site of each crease on the cover to prevent wrinkling and the entrapment of air. Aluminium flanges should be fitted on to each end of a reducer section.

4.3 Splitters in Reducers

In the event that splitters or reinforcement bars are required due to duct size, placement should always be spaced proportionally between the two sides, as shown in Figure 4.4. Splitters should be glued and sealed in position, and are not a substitute for positive pressure reinforcement.

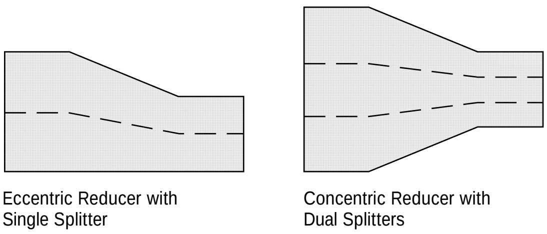


Figure 4.4 Positioning of Splitters in Reducers

4.4 Expansions, Contractions & Restrictions

If and when required, the same principles described within the section on reducers should be observed. Whenever possible, avoid locating any pipe, electrical conduit, structural members, or any other obstructions within the duct. Inside a straight duct, any pipe or other obstruction greater than an equivalent diameter of 100 mm shall be encased in an easement in order to provide minimum disruption to the air stream. Examples are demonstrated in Figure 4.5.

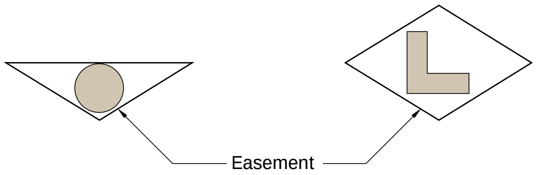


Figure 4.5 Easement of Obstruction within Ductwork

When the sectional area of an easement reduces the duct cross sectional area by more than 20%, then the duct shape must be modified accordingly in order to maintain the original cross sectional area. Refer to Figure 4.6 for examples.

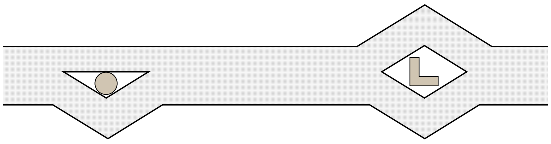


Figure 4.6 Easements within Ductwork

When a duct's shape is transformed in order to accommodate an obstruction, the same rules governing maximum angles of taper for a reducer are still applicable.

5 Offsets

5.1 General

Offsets are frequently required in order to duct around fixed obstructions or to connect with a differently aligned duct. Offsets are classified as mitred or radiused, as shown in Figure 5.1. The 'V' groves of mitred offsets can be cut with a number of speciality Jack Planes available (22.5°, 45°, and Adjustable). Radiused offsets are easier to fabricate and more commonly used. The curvature is achieved by creasing the curved sides as previously discussed in section 4 on reducers. All the same rules apply: creases shall be spaced a minimum of 50 mm apart, necks shall be a minimum of 200 mm in length, etc. Splitters and reinforcement bar can be installed as required. The maximum recommended inclination of an offset is 30° due to aerodynamic considerations.

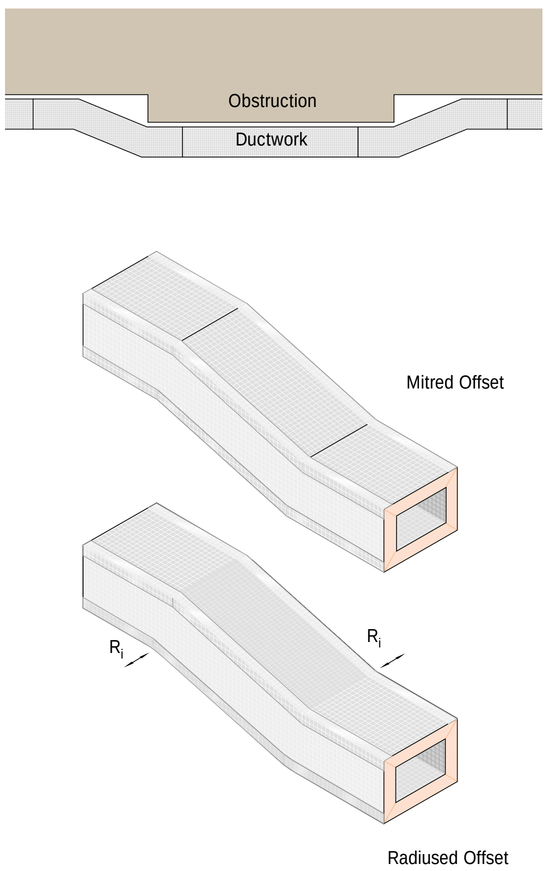


Figure 5.1

5.2 Offset Construction

Whether mitred or radiused, offsets are generally constructed of four separate pieces. The pieces are joined together following the same rules as described for elbows in section 3. After all the 'V' grooves have been glued and allowed to cure, the two sides are simultaneously attached to the base. The cover is subsequently fitted to close the piece (both the cover and base are creased pieces). The stiff spatulas are then creased along the sides of duct section in order to ensure good adhesion within the mitre joint. The taping and sealing process is as described within Sections 1.7 and 1.9 with the same precautions taken for elbows. Each offset should be fitted with aluminium flanges at both ends of the duct section.

6 Take-Offs

6.1 General

Take–offs are classified as dynamic or static. A dynamic branch will actually divert a portion of the air stream to the branch. The air flow through a static take–off is a direct result of the static pressure in the duct. There are three types of static take–offs typically manufactured:

- straight branch (90°);
- angle branch; and
- boot branch.

Figure 6.1 illustrates the differences between each of the various take–offs.

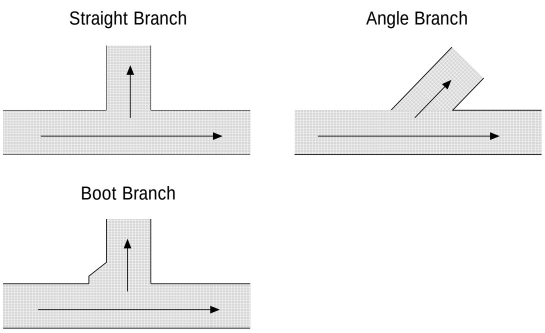


Figure 6.1 Static Branches

6.2 Static Branch Attachment to Supply Duct

There are three methods of connecting a branch to the supply duct:

Male Female Connections: for short, light weight branches, the take–off can be attached by cutting the end with a male 45° Small Jack Plane, and the supply duct with a female 45° Small Jack Plane. Both surfaces should be glued, allowed to cure, and joined together. A silicone bead should then be applied all along the outer seam, and tape on the inner seam. Support should be positioned accordingly. An example is illustrated in Figure 6.2. Note that if heavy diffusers, grilles or dampers are to be installed in the take–off, then the joints should be flanged as described below.

Flanged Connections: when the take–off is both large and long, it is recommended that the connections be flanged together for greater support. Two different types of aluminium profiles are used to form the connection. The branch duct is fitted with 'U' Profile, and the supply duct is fitted with 'F' Profile. The assembly is fitted with self adhesive gasket, and then rivetted together. An example is illustrated in Figure 6.2.

All in one Connections: in situations where excessive movement is possible a third option with increased strength is suggested. In this method the top and bottom of the attachment is part of the *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel. A example of this, for a boot branch, is illustrated in Figure 6.2.

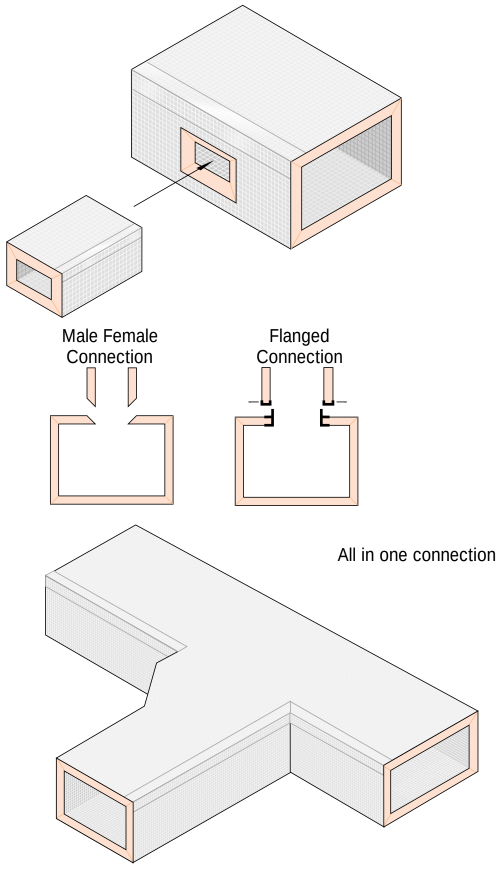


Figure 6.2 Branch Attachment to Main Duct

6.3 Static Boot Branch

Boot branches are preferable to straight take–offs because of the improved aerodynamic flow they offer. Static take–offs in general can induce turbulence which contributes to increased drag and noise. The inherent design of a boot branch does a much better job of maintaining laminar flow than a straight branch.

Boot branches are basically constructed in the same manner as a reducer, the procedure for which is detailed in section 4. The only difference is that the cover is mitred instead of creased. As shown in Figure 6.3, the cover tapers at an angle of 45° which necessitates the use of the 22.5° Jack Plane. Note that the first mitre is cut on the outside of the cover, and the second is cut on the inside. As before, the neck on either side of the taper must be a minimum of 200 mm.

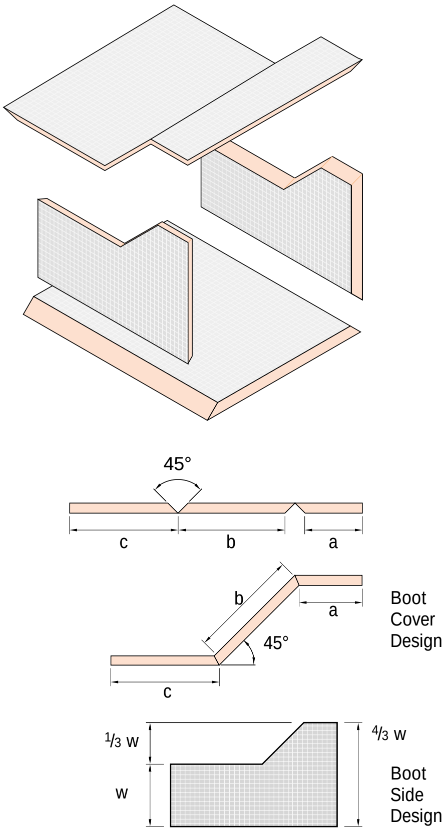


Figure 6.3 Boot Branch Design and Assembly

6.4 Connection of Spiral Ductwork to the *Kingspan* **Kool**Duct® zero ODP System

The connection of spiral ductwork is easily accommodated with the *Kingspan* **Kool**Duct® zero ODP System. The connection is made by means of a shoe branch fitting as illustrated in Figure 6.4. In order to attach the fitting, a hole matching in size to the fitting must be cut in the main duct. This is most easily accomplished by holding the fitting in the desired position on the duct, scribing a line around the perimeter, and then using the standard knife provided in the tool box to cut the hole. The fitting should then be inserted in the hole so that the knurl is flush to the outer surface, and the tabs then bent back against the inner surface. Finally, a bead of silicone should be applied along the groove between the knurl and the supply duct's outer surface. In addition to sealing the joint, it also securely bonds the fitting to the duct.

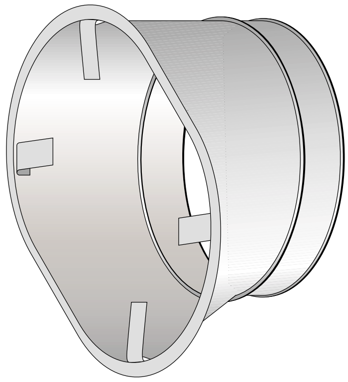


Figure 6.4 Shoe Branch Fitting

6.5 Dynamic Branches

Dynamic branches are named such because the air directed to the branches is due to the dynamic motion of the air stream, also known as velocity pressure. They can be constructed as either two way or three way. Figure 6.5 provides examples of a dynamic branch and tee. The following general rules apply to all dynamic branch type duct sections:

- minimum neck length is always 200 mm;
- minimum internal radius is 200 mm;
- creases on curved strips shall not be less than 50 mm apart;
- aluminium profile must be installed at all ends of the duct section; and
- reinforcement bar and/or splitters must still be used on the larger duct sizes specified within section 7.

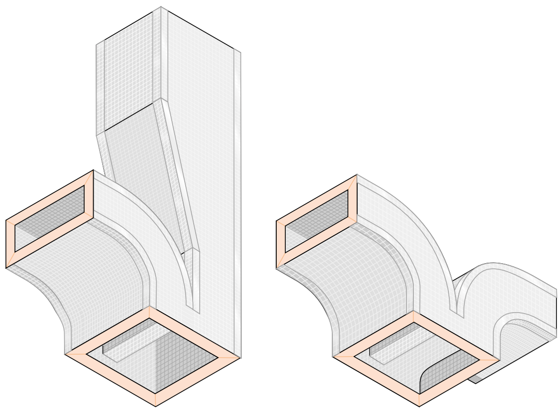


Figure 6.5 Dynamic Branch and Tee

6.6 Construction of Dynamic Branches

Dynamic branches and tees are the most complex pieces to construct. The procedure, however, is the same as that described for elbows and reducers. The very same steps must be followed for tracing, cutting, gluing, fitting, taping, flanging, and sealing, in that order. Figure 6.6 below illustrates all the component pieces that make up a dynamic branch. Dynamic tees and three way branches are constructed in the same manner.

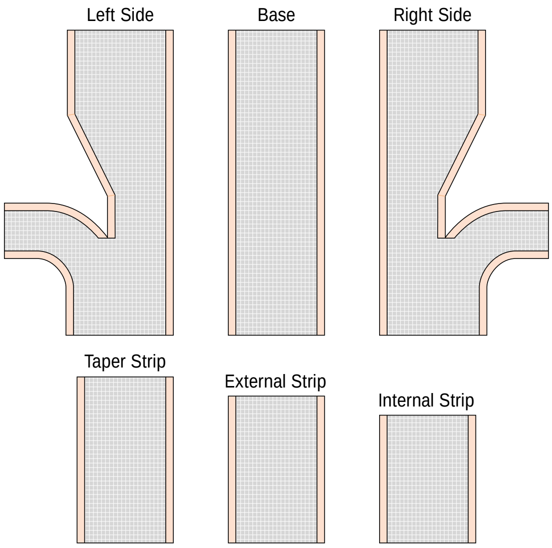


Figure 6.6 Component Pieces of a Dynamic Branch

Sequence of assembly for two–way branch: set base on table and attach left side. Attach right side next. The taper strip, external strip, and finally the internal strip are then sequentially fitted.

Sequence of assembly for two way tee: set a side of the tee on table. Attach both creased internal strips sequentially to the side. Fit the other side piece to the two inner strips. Finally attach both external creased strips, sequentially, to both of the sides to complete the tee.

7 Duct Reinforcement

7.1 General

Duct reinforcement is required to ensure that the true rectangular cross section of the duct is maintained during system operation. It can be applied to protect against negative pressure, positive pressure, or both. Surface deformation as a result of internal air pressure is a concern with respect to both the materials modulus of elasticity and the bending moment at the duct corners. It is therefore imperative to carefully observe and apply the recommendations for reinforcement as detailed within this section.

7.2 Duct Reinforcement Application

The *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panels are self supporting and do not require any external bracing. In fact, the duct may not require any internal reinforcement either. The determination is made based on two parameters:

- duct size (evaluate both width and height); and
- total system pressure (static plus dynamic*).

**In A/C systems, generally only static pressures are known, and that would be satisfactory for low velocity systems.*

Note that the method of duct fabrication employed is irrelevant.

Figure 7.1 is used in conjunction with the information above to determine whether or not, and what kind, of reinforcement is necessary. Specifically, the chart identifies the spacing between bars, and whether or not one is sufficient, or pairs of bars are required. For example, 'TWO BARS @ 600' means the bars should be installed as pairs (distributed evenly across the width), and subsequent pairs are installed every 600 mm.
If reinforcement is necessary, proceed on to section 7.3.

Negative pressures need to be treated slightly different in determining the degree of reinforcement required. For pressures below 450 Pascals negative, 200 Pascals should be added for determining the reinforcement requirements. For example, a duct at 600 Pascals negative would be reinforced as if it were 800 Pascals negative. (See Figure 7.1)

Bends should be included in the reinforcement schedule. Please contact Kingspan Insulation Technical Services on 01457 890534.

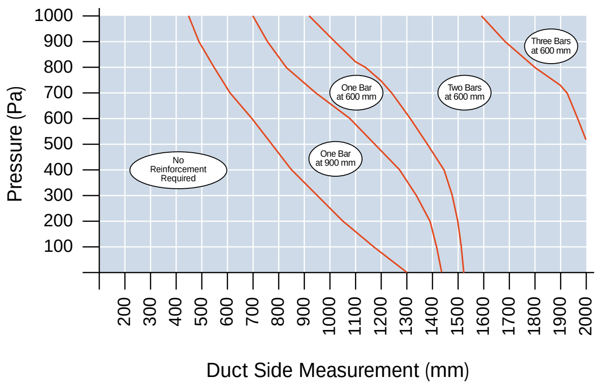


Figure 7.1 Schedule of Duct Reinforcement

7.3 Installation of Duct Reinforcement

Duct reinforcement is only installed after the duct section is completely finished (section 1). Duct reinforcement can be accomplished with one of two techniques:

- the use of *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel as reinforcement for protection against negative pressure only; or
- the application of aluminium reinforcement for protection against both positive and negative pressure.

The former method is performed exactly as a splitter is inserted into a radiused elbow (section 3.3).
Note that the reinforcement zero ODP rigid phenolic insulation panel must be glued and sealed in position with exposed edges taped. Again, a splitter does not provide protection against positive air pressure.

7 Duct Reinforcement

The three components of the aluminium reinforcement system are discs, speed clips, and bar (2 types).
The proper installation technique is illustrated in Figure 7.2. As can be seen in the diagram, the inner bar in combination with the reinforcement discs on the outside surface of the duct protect against side deformation resulting from positive air pressure. The outer bar, which sleeves over the inner bar, in combination with the discs on the inside of the duct protect against side deformation resulting from negative air pressure.

The first bar on a long duct section requiring multiple reinforcements is installed 50% of the step distance (specified from Figure 7.1) from the duct end, and at full step intervals thereafter, until the last bar is less than or equal to 50% of the step length from the end. Figure 7.2 illustrates this procedure. Also note that when a duct section has both vertical and horizontal reinforcement bars, the bars should ideally be tied together at their point of intersection within the duct with wire.

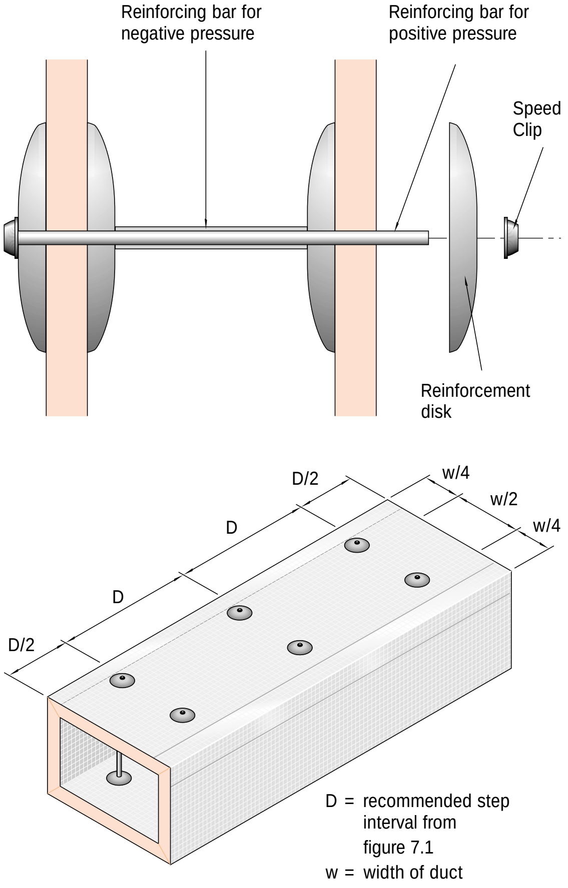


Figure 7.2 Duct Reinforcement

8 Dual Duct Design

8.1 General

The dual duct method should always be considered as an alternative fabrication technique for a large duct, preferably when the system pressure exceeds 500 Pascals, and duct side lengths exceed 1.4 metres. As the name implies, dual ducts literally means two ducts fastened together. The ducts are preferably similar in dimension, and not necessarily limited to two.

Because a dual duct is comprised of multiple smaller ducts, it is comparably very rigid and generally requires less reinforcement, if any at all. Furthermore, the ducts can be fabricated in 2.95 metre lengths (as opposed to 1.2m for Class 4 ducts), thereby reducing both labour and aluminium flange requirements.

8.2 Dual Duct Construction

As shown in Figure 8.1, the ducts can be fastened together using strips of bayonet and pop rivets (or any other comparable method). In order to assure equivalent and balanced pressure in both of the ducts, openings should be cut between the ducts. This is an absolute requirement when the dual ducts feed branch ducting. The openings can be any shape, as long as their dimensions and relative spacing are suitable for the duct size. For example, a duct with a side of one metre could have circular openings of 200–300 mm in diameter, with centres spaced every two metres. Note that the cut *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel for the openings should have a strip of tape applied to prevent phenolic particles from entering the air stream.

Dual ducts are flanged similarly to ordinary ducts. Note that only the perimeter of the composite dual duct is fitted with flange. Furthermore, if grip flange is used, care should be taken to position the ends of the profile that wrap together away from the seam where the component ducts are joined. The internal sides of dual ducts that are adjacent to each other do not get flanged, and should be taped in order to isolate the phenolic material. Figure 8.1 illustrates an example.

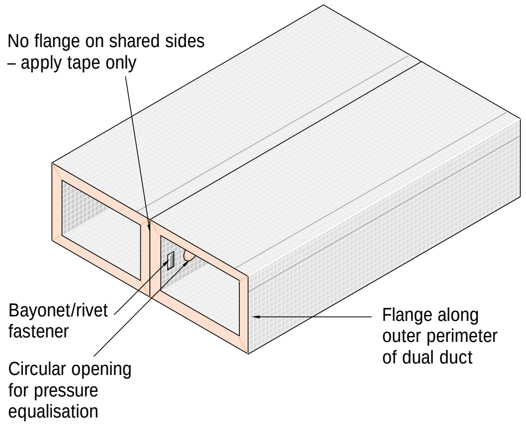
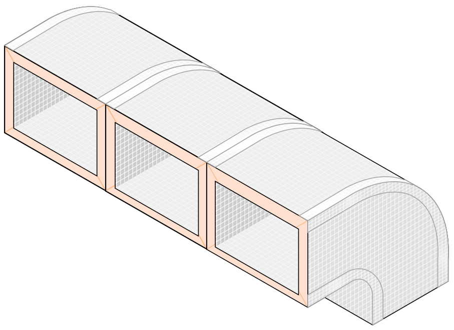


Figure 8.1 Dual Ducts

It is important to note that the same rules for duct reinforcement as detailed within section 7 are still applicable. For extremely large ducts, triple ducts and quadruple ducts can be constructed using these same guidelines, as shown in Figure 8.2. It should be mentioned that the required openings for pressure equalisation are not visible in the illustration below.



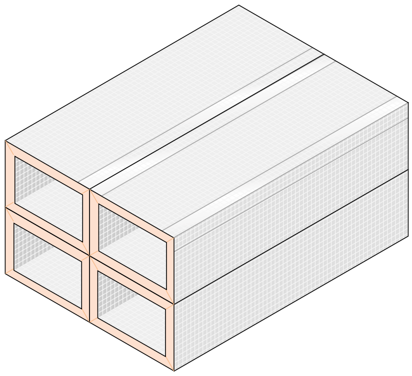


Figure 8.2 Dual Duct Configurations

9 Access Openings

Access openings, access doors, inspection covers, etc. are required in an air duct system for visual control or maintenance inside the duct. It is recommended that the access doors be 300 mm x 300 mm or larger. They can be built by using actual *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel or a bought out pre–fabricated door. The *Kingspan* **Kool**Duct® zero ODP System offers the flexibility of installing access doors before or after the duct is suspended. In either case, the preparatory work to the duct is the same. The outline of the access door should be scribed onto the duct's surface, and cut out using a 90° Small Jack Plane. The entire perimeter of the door opening on the duct should then be fitted with aluminium U profile which adds durability and acts as a door frame. If a *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel is to be used as the door, then the piece that was cut out of the duct should be trimmed and fitted with chair profile ('h') around its perimeter. An example is shown below in Figure 9.1. A layer of self adhesive gasket should be applied to the back of the door, and the door can then be screwed into the door frame for easy access.

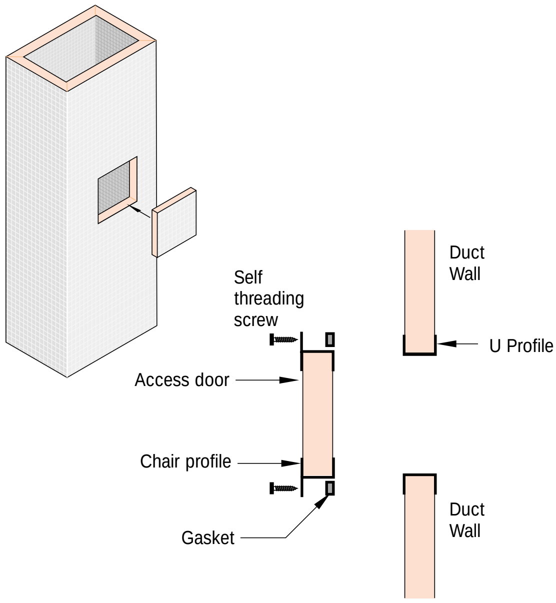


Figure 9.1 Access Doors

A 'bought–out' pre–fabricated access door can be installed to *Kingspan* **Kool**Duct® zero ODP System ducting by fitting the supply duct with either F profile or chair profile, depending on the style of the door.

10 Aluminium Flange Usage

10.1 General

The *Kingspan* **Kool**Duct® zero ODP System offers four different types of flanging systems used to join individual duct sections together:

- grip flange;
- one piece flange;
- invisible flange; and
- tiger connector.

The selection of the appropriate flange system is dependent upon the application. The grip flange was specifically designed for use with the *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel and compliments its unique characteristics. It provides a permanent air tight joint without the use of fasteners or adhesive, adds structural rigidity, and is recommended as the flange of choice for the *Kingspan* **Kool**Duct® zero ODP System. The grip flange, to a large extent, has replaced the one piece flange (see section 10.3) as it is more versatile. The invisible flange is also generally used (although not restricted to) in place of the one piece flange when the ducting is installed in limited access areas, or when the ducting itself is visibly mounted, and aesthetics are a prime consideration. Finally, the tiger connector is an economical alternative designed solely for small ductwork as defined in section 10.6.

Both the one piece and the grip flanges incorporate a unique bayonet cleat fastening system, whilst the invisible flange uses rivets. A self adhesive gasket is required for use with the first three types of flanges when joining two duct sections together, while the tiger connector utilises silicone to achieve air leakage standards.

10.2 Installation of Grip Flange

The grip flange is designed for use on *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel without a need for adhesives, fastening hardware, or corner reinforcements. The system comprises a two piece assembly complete with the integral male–female locking feature. The installation procedure is described below and illustrated in Figure 10.1.

The external profile is differentiated from the internal profile by the additional fitting for the bayonet cleat. On the internal side of the duct, four pieces should be cut, each equivalent to the sides internal dimension less 3 mm. The external profile is installed as a single piece, wrapping around the entire outer perimeter of the duct. As shown in Figure 10.1, four 'V' shaped 90° notches must be cut out of the external piece. The bayonet cleat lip on the back side of the external grip should also be sawed through at the centre of the 'V'. This enables the profile to be bent into the desired shape, and accordingly, the centre of the notches should be positioned at the exact location of the duct corners.

The external piece should then be bent around the outer perimeter of the duct, positioned in place, and checked for fit at the duct corners. Internal flange is then pressed and lightly hammered into position commencing with the back of the duct, the two sides, and finally the front (the front is designated as the side where both ends of the external flange meet). As with all other flanges the self adhesive gasket is applied to only one of the two sections being joined. Duct sections are joined together with bayonet cleats in exactly the same way as illustrated in Figure 10.2 for one piece flanges, and as described in section 10.5.

Where there is a possibility of cold bridging that may cause condensation to form on the external flange, a plastic tropical flange is available that greatly reduce the possibility of condensation. The tropical flange is used as a replacement for the internal profile.

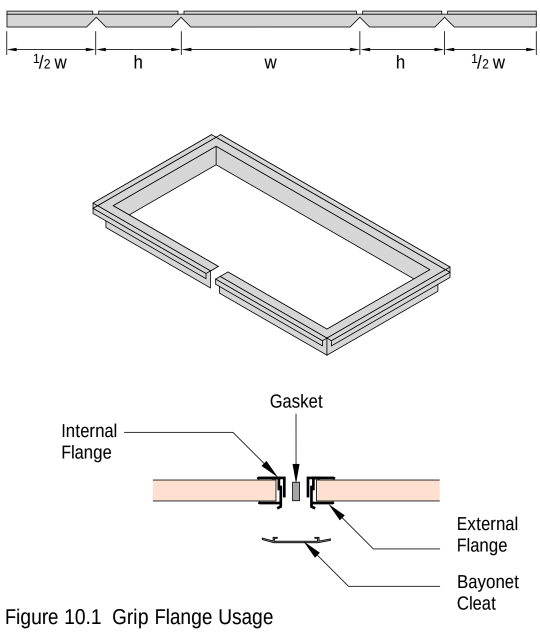


Figure 10.1 Grip Flange Usage

10 Aluminum Flange Usage

10.3 Installation of One Piece Flange

As shown in Figure 10.2, the one piece flange incorporates a ‘U’ shaped profile and simply slips over the rigid phenolic insulation panel ends. Each end of the duct section will require four pieces of flange, each of which is cut to the internal dimension of the corresponding side of the duct less 3 mm. The flange width is slightly less than the rigid phenolic insulation panel thickness providing an interference fit. Prior to insertion of the flange, the ends of the duct section (both inner and outer surfaces) should be gently creased with the black spatulas in order to ease installation.

A thin layer of glue should also be brushed along the inside of the flange, although no curing time is necessary. The flange should be installed with the longer lip on the inner surface. The rubber mallet can be used to assist in the insertion of the flange onto the duct section end.

Nylon angles should always be used in conjunction with the one piece flange. They are simply placed in each corner of the duct section, and their tabs are tucked in–between the duct section end and the flange.
In addition to contributing aesthetically to the outer surface of the flange and duct, it also provides additional strength and rigidity to the duct to counteract the outward forces of air pressure inside. Figure 10.2 demonstrates their usage.

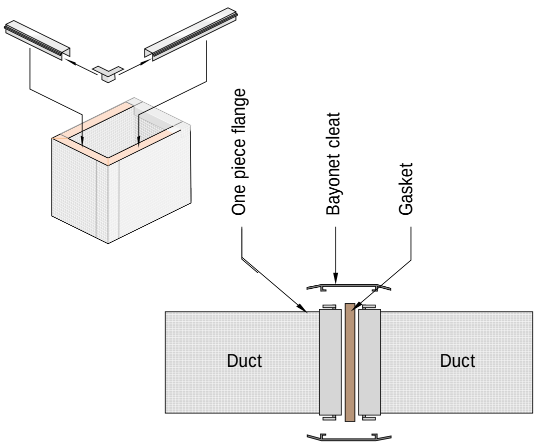


Figure 10.2 One Piece Flange Usage

After the flange has been fully installed, a strip of self adhesive gasket should be applied. Note that it is only applied on one of the two duct sections being joined together. Bayonet cleats are used to join the two duct sections together and is described in section 10.5. Figure 10.2 provides an example.

10.4 Installation of Invisible Flange

The installation of invisible flange is identical to the procedure for installing one piece flange previously described in section 10.3. The only differences are in the type of corners used, and the way that the duct sections are joined together.

The invisible flange uses a nylon dual angle corner. The corners are installed the same way as the nylon single angle corners of the one piece flange, but only one duct section of the two being joined together is fitted with the nylon angles.

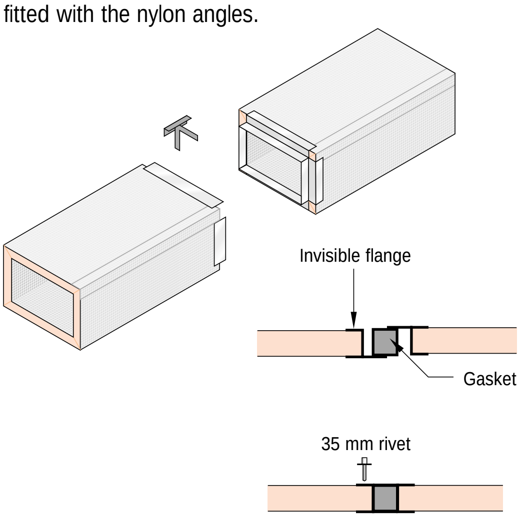


Figure 10.3 Invisible Flange Usage

Both duct sections being joined together use exactly the same profile. However, the flange on the opposing section is installed as the inverse of the other.
As shown in Figure 10.3 above, this enables the two sections to be joined. Self adhesive gasket is applied to one duct section only. Two sections are then permanently fastened with 35 mm rivets.

10.5 Installation of Bayonet Cleats

Bayonet cleats are used to join duct sections that are fitted with both the grip flange and the one piece flange. If the duct sections being joined have been accurately fabricated, the bayonet cleat should simply slide into position, although the rubber mallet can be used to gently assist. In order to ensure that the bayonet cleats do not loosen over time, it is important to observe the following recommendations:

- the bayonet cleats for the vertical sides of the duct should be cut in length equivalent to the sides; and
- the bayonet cleats for the horizontal sides of the duct should be cut in length equivalent to the side plus 10 mm.

This simple safeguard ensures that the vertical bayonet cleats are locked into position. It is also recommended that silicone be applied at the ends of each of the bayonet cleats in order to achieve leakage compliance.

Plastic end caps can be fitted to enhance the appearance of the duct and cover any sharp edges that may be present. Figure 10.4 provides an example.

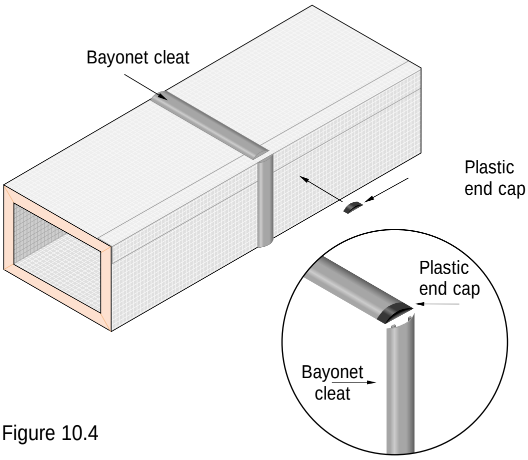


Figure 10.4

10.6 Flange Installation in Limited Access Areas

There are several instances where a particular installation might not afford the required clearance necessary to install bayonet cleats. An example would be technical duct risers inside a shaft, or even ducting installed flush in a recessed channel, as shown in Figure 10.5. A simple solution is to install flange with bayonet cleats on the duct sides where the clearance is sufficient, and to use Invisible flange on the remaining sides. In Figure 10.5, one piece flange and bayonet cleats are utilised on the vertical sides of the duct, and invisible flange is utilised on the horizontal sides. In this scenario, it is permissible to rivet the invisible flange on the lower side only, and to leave the upper side unfastened if inaccessible. Extra care should be exercised in the hanging and support of the ductwork.

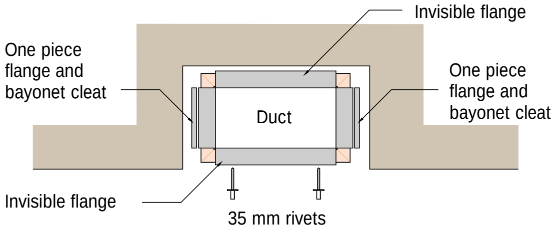


Figure 10.5

10.7 Installation of Tiger Connector

The tiger connector is an alternative flanging system specifically designed for low pressure small ductwork, i.e., maximum size of any duct side: 500 mm. As shown in Figure 10.6, it is basically an aluminium plate with punched in prone points to join two duct sections together. It is a highly cost effective solution for small ductwork, both in terms of material and labour.

The installation of the tiger connector is fairly straight–forward, but the procedure, as shown in Figure 10.6, must be strictly followed in order to ensure proper function. First, aluminium tape is applied to the ends of both ducts to be joined, such that all phenolic insulation is fully sealed. A continuous bead of silicone is then applied to only one of the ends of the duct sections. The two sections are then brought together, and a single tiger connector is pressed in the centre of each side, directly over the seam. Finally, aluminium tape is wrapped around the joint of the connected duct sections.

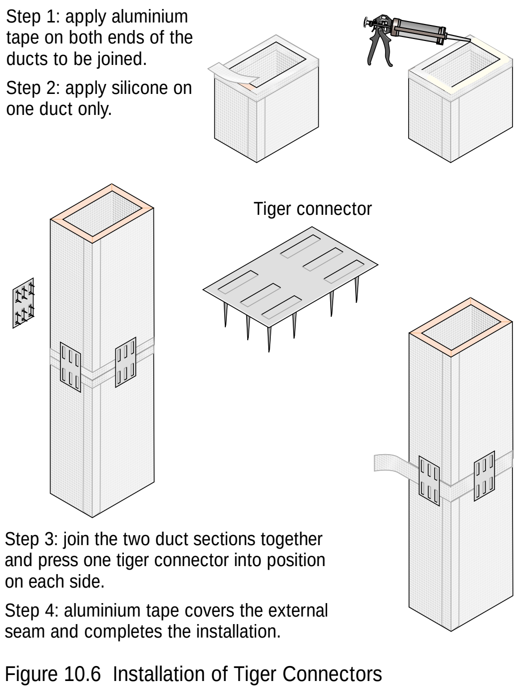


Figure 10.6 Installation of Tiger Connectors

11 Plant & Component Connection

The *Kingspan* **Kool**Duct® zero ODP System of pre–insulated ducting is completely compatible with all standard duct system components including fans, air handling units, volume control dampers, fire dampers, bought–out access doors, flex duct, and even galvanised sheet metal ductwork. A full range of aluminium profiles is offered which enables connection to virtually any type of surface.

NB. the connection of the *Kingspan* **Kool**Duct® zero ODP System to fire dampers should be carried out in accordance with BS 5589 : Part 9 : 1999 (Code of practice for ventilation and air conditioning ductwork).

All components typically either have a flanged connection or a spigotted connection. The examples in Figure 11.1 illustrate the proper use of aluminium profile for both varieties of connections. Note that gasket is always used in the joint. Finally, flexible joints are easily accommodated and should always be used for connection to fans.

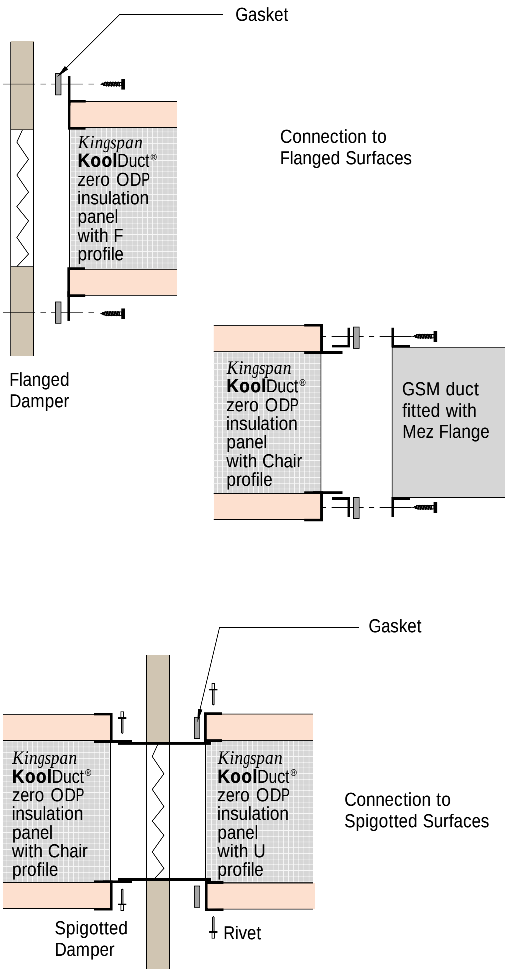


Figure 11.1

12 Duct Support and Hangers

12.1 General

Duct supports are an essential component of the ductwork system. Due to the light weight of *Kingspan* **Kool**Duct® zero ODP System ducting (approximately 2.0 kg/m² fully flanged) duct support and hangers do not have to be as robust nor as numerous as its sheet metal counterpart. Because of the large number of support systems that can be used on any one project and also the wide range of materials used to fix the systems to structures, the registered fabricator normally assumes responsibility for supporting and hanging the *Kingspan* **Kool**Duct® zero ODP System. As a result, this document will only address the attachment of the *Kingspan* **Kool**Duct® zero ODP System to structures where *Kingspan* **Kool**Duct® zero ODP ancillaries are used.

12.2 Fixing to Building Structures

Fixing strength and durability in structures should be sufficient to support twice the weight of the ductwork system. Fixing to concrete and brickwork should be performed with particular care to prevent loosening over time. Expansion anchors and channel section are recommended in such applications. Attachment to the building frame may be made as seen fit, generally by means of beam clamps, spring clips, wall clamps, and screw anchors.

12.3 Hangers and Duct Support

The most common types of hangers used are aluminium or galvanised steel channel. The *Kingspan* **Kool**Duct® zero ODP System offers the following hanger:

- the *Kingspan* **Kool**Duct® zero ODP System tiger duct support (Figure 12.1) in aluminium which can be fitted into the ductwork (maximum size of any duct side: 700 mm).

Suspension can be with 8 mm threaded galvanised bar, steel cable, galvanised chain, etc.

In addition the *Kingspan* **Kool**Duct® zero ODP System can be supported by the use of traditional unistrut and drop rods.

12.4 Spacing Between the Supports

While this specification will make general recommendations as to the maximum spacing between supports, it is the responsibility of the registered fabricator to determine both spacing and placement of supports.

Supports on straight runs of ductwork shall be positioned at centres not exceeding 3 m. Additionally, ductwork shall be supported at branch connections and tee fittings. Special consideration shall be given to ductwork support at changes of direction as necessary.

For vertically oriented ductwork, supports should be positioned to coincide with individual floor slabs which should be no more than 4 m apart.

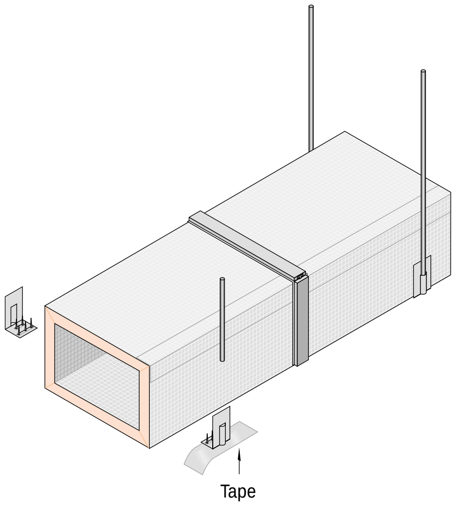
For supporting the *Kingspan* **Kool**Duct® zero ODP System in vertical applications e.g. riser shafts, the method shown in Figure 12.1 can be used. This method is suitable for spacing up to 3 m apart or a 40 kg total weight.

For larger ductwork sizes, and that constructed utilising the dual duct system, the spacing between supports would be reduced. In any case, distance between supports must not exceed 2.95 m. It is furthermore recommended that all larger duct system supports be of the unistrut or steel channel variety.

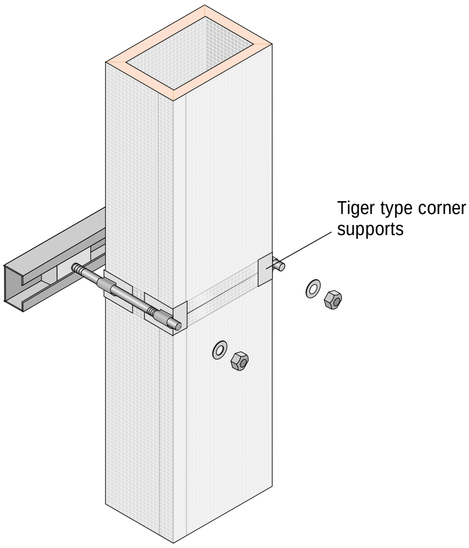
All accessories such as fire dampers, volume control dampers, mixing boxes, coils, humidifiers, etc., shall be independently supported from the duct. The load of such accessories to the ductwork shall be neutralised by the accessory support.

Finally, it is recommended that ductwork be isolated from the support structure to dampen vibration and noise, and to prevent damage to the aluminium facing. Depending on the application, *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panel off–cut strips, cut to measure, with all exposed insulation fully taped are recommended.

12 Duct Support and Hangers



Kingspan **Kool**Duct® zero ODP System Tiger Support



Kingspan **Kool**Duct® zero ODP System Vertical Support

Figure 12.1

13 Protective Treatment & Painting

13.1 General

The *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panels incorporate a reinforced 25 micron aluminium foil facing and therefore duct sections do not require any special coating or treatment for conventional indoor installations. However, for ductwork that is installed outdoors, or in an aggressive atmosphere (i.e. swimming pools etc.) Kingspan Insulation Limited should always be consulted. Recommendations for use should be verified as to suitability and compliance with actual requirements, specifications, and any applicable laws and regulations.

13.2 Weather Proofing Ductwork

A number of systems are available that can be applied to the *Kingspan* **Kool**Duct® zero ODP System to give a protective and weather proof finish. For such applications please contact Kingspan Insulation Technical Services on 01457 890534.

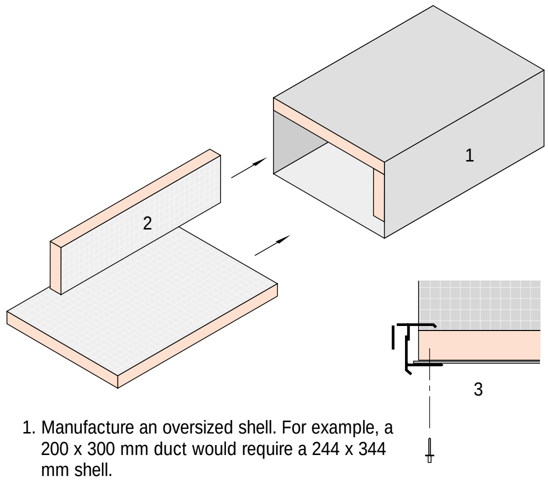
13.3 Painting of Ductwork

Kingspan **Kool**Duct® zero ODP System ducting can be easily painted for decorative purposes. The only requirement in the selection of paint is that it is compatible with aluminium. Although a primer coat is generally recommended, certain polyurethane base paints may not require it.

Note that paint is not an acceptable weatherproof solution for external installations.

13.4 Cladding of Ductwork

The *Kingspan* **Kool**Duct® zero ODP System can be installed in a fully clad form for decorative and/or protective purposes. Depending on the application, the thickness of the cladding is recommended to be a minimum of 0.7 mm, and can be selected from a range of materials including polished aluminium, stucco, and aluminium zinc alloy coated steel sheet. While it is recognised that there are a variety of methods to fabricate a clad duct segment, the illustration in Figure 13.1 is presented as a preferred method. Beyond producing a robust, fully integrated, highly aesthetic product, it is still a single–fix installation. Note that the clad form of the *Kingspan* **Kool**Duct® zero ODP System is acceptable weatherproof solutions for external installations, provided that all external seams and flanged joints are fully sealed.



1. Manufacture an oversized shell. For example, a 200 x 300 mm duct would require a 244 x 344 mm shell.
2. *Kingspan* **Kool**Duct® zero ODP rigid phenolic insulation panels are utilised to internally line the shell and glued in position. Mitred edges are not necessary.
3. The grip flange is applied to the composite product. Aluminium rivets shall be positioned every 150 mm along the flange perimeter, with no less than two per side.
4. All internal seams shall be fully sealed with a continuous and radiused bead of silicone.
5. For outdoor installations only, seal all external seams – particularly the flanged joints.

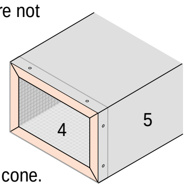


Figure 13.1 Aluminium Clad **Kool**Duct® zero ODP

14 Damage Repair

14.1 General

The *Kingspan* **Kool**Duct® zero ODP System, like any other material and equipment on site, may be subjected to physical damage. The System offers the flexibility to repair localised damage in–situ as opposed to replacing the entire duct section. Repairs can be made in an economical and efficient manner.

14.2 Repair Procedure

Whether the damage is on the face of the duct, or along a seam, the procedure to repair it is identical. First a border is scribed onto the duct wall which completely encompasses the damaged area. The 45° Small Jack Plane is then used to cut out the damaged piece. Note that this operation will result in the actual duct having a female mitre, and the damaged piece with a male mitre. Once removed, the damaged piece should be used as the template to trace the outline of an identical replacement piece. The replacement piece is cut with the same Jack Plane so that male–female jointing system is consistent. Glue should first be applied to the mitre cuts, and allowed to cure. After the replacement piece is installed, both the exterior and interior seams should be taped (use soft spatulas as described within section 1.7). An example is illustrated in Figure 14.1.

1. remove damaged pieces A and B.
2. replace with new pieces C and D.
3. remember to use glue and tape

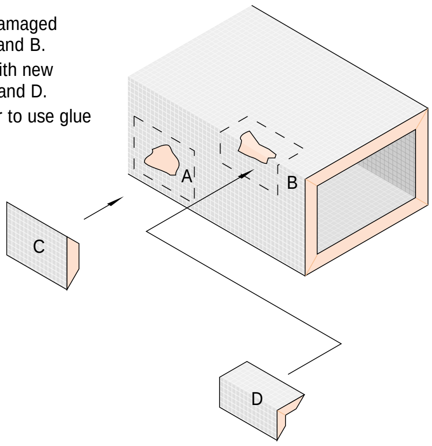


Figure 14.1

15 Cleaning

The *Kingspan* **Kool**Duct® zero ODP System can be cleaned utilising many of the dry cleaning methods outlined in TR/17 published by the HVCA. Hand scraping should not be used and if using a brushing method, a soft brush should be used.

Contact Details

Customer Service

For quotations, order placement and details of despatches please contact our Customer Services Department on the numbers below:

UK – Telephone: +44 (0) 870 850 8555
– Fax: +44 (0) 870 850 8666
– email: commercial.uk@koolduct.kingspan.com

Ireland – Telephone: +353 (0) 42 97 95000
– Fax: +353 (0) 42 97 46129
– email: commercial.ie@koolduct.kingspan.com

Technical Advice/Design

Kingspan Insulation Ltd support all of their products with a comprehensive Technical Advisory Service for specifiers, stockists and contractors.

This includes a free computer-aided service designed to give fast, accurate technical advice. Simply phone our TECHLINE with your project specification and we can run calculations to provide heat losses/gains, condensation/dew point risk, required insulation thicknesses etc.... Thereafter we can run any number of permutations to help you achieve your desired targets.

We can also give general application advice and advice on design detailing and fixing etc... Site surveys are also undertaken as appropriate.

Please contact our Building Services and Industrial Insulation Technical Services Department on the TECHLINE numbers below:

TECHLINE

UK and Ireland
– Telephone: +44 (0) 1457 890 534
– Fax: +44 (0) 870 850 8444
– email: techline.uk@koolduct.kingspan.com

Literature & Samples

Kingspan Insulation produces a comprehensive range of technical literature for specifiers, contractors, stockists and end users. The literature contains clear 'user friendly' advice on typical design; design considerations; thermal properties; sitework and product data.

Available as a complete Design Manual or as individual product brochures, Kingspan Insulation technical literature is an essential specification tool. For copies please contact our Marketing Department on the numbers below:

UK – Telephone: +44 (0) 870 833 7333
– Fax: +44 (0) 1544 387 299
– email: literature.uk@koolduct.kingspan.com

Ireland – Telephone: +353 (0) 42 97 95038
– Fax: +353 (0) 42 97 46129
– email: literature.ie@koolduct.kingspan.com

General Enquiries

For all other enquiries contact Kingspan Insulation on the numbers below:

UK – Telephone: +44 (0) 870 850 8555
– Fax: +44 (0) 870 850 8666
– email: info.uk@koolduct.kingspan.com

Ireland – Telephone: +353 (0) 42 97 95000
– Fax: +353 (0) 42 97 46129
– email: info.ie@koolduct.kingspan.com

Kingspan Insulation Ltd. reserve the right to amend product specifications without prior notice. The information, technical details and fixing instructions etc. included in this literature are given in good faith and apply to uses described. Recommendations for use should be verified as to the suitability and compliance with actual requirements, specifications and any applicable laws and regulations. For other applications or conditions of use, Kingspan Insulation offers a free Technical Advisory Service (see left) whose advice should be sought for uses of Kingspan Insulation products that are not specifically described herein. Please check that your copy of the literature is current by contacting our Marketing Department (see above).

Kingspan Insulation

Pembridge, Leominster, Herefordshire HR6 9LA, UK
Castleblayney, County Monaghan, Ireland

www.koolduct.kingspan.com