



Kingspan **Kooltherm**[®] Duct and Kingspan **Therma**[™] Duct Insulation

Rigid Insulation for HVAC Ductwork Installation Guide



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Introduction

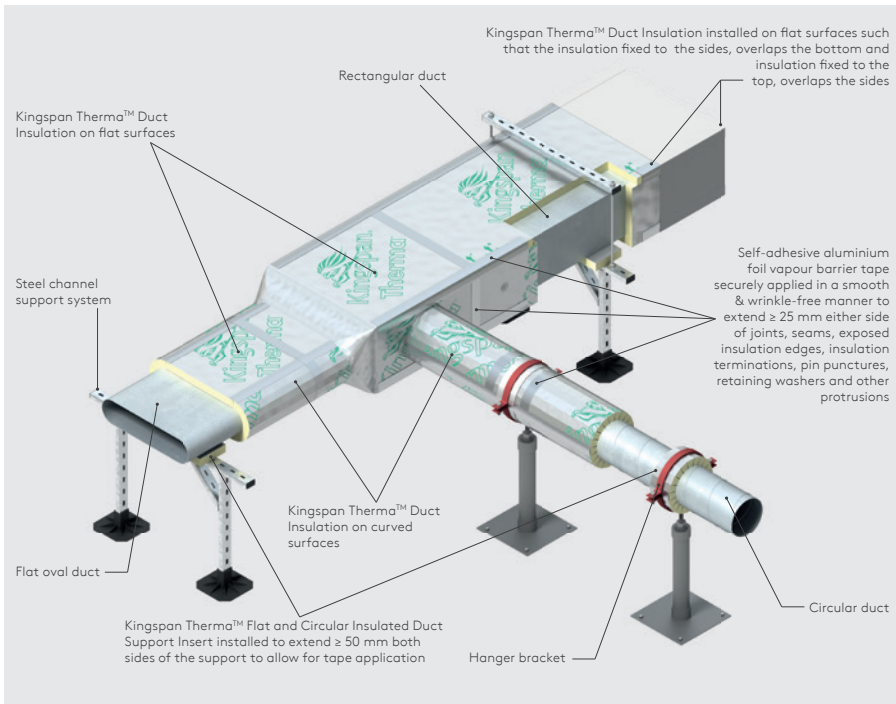
Kingspan Kooltherm® Duct Insulation and Kingspan Therma™ Duct Insulation

Rigid insulation for HVAC ductwork, associated equipment and other industrial installations shall be applied in accordance to BS 5970: 2012 (Thermal insulation of pipework, ductwork, associated equipment and other industrial installations in the temperature range of -100°C to $+870^{\circ}\text{C}$. Code of practice).

The following guide provides details for the application of rigid insulation for HVAC ductwork in the temperature range -20°C to $+80^{\circ}\text{C}$.

This guide should be used in conjunction with an appropriate product Specification (such as a specification for Kingspan Kooltherm® Duct Insulation or Kingspan Therma™ Duct Insulation).

All thermal insulation and cladding shall be carried out by fully trained Thermal Insulation Operatives who hold valid TICA Skillcards and are employed by companies who are registered with The Thermal Insulation Contractors Association (TICA).



Introduction

Kingspan Insulation offer specific solutions for the insulation of HVAC ductwork.

Kingspan Kooltherm® Duct Insulation or Kingspan Therma™ Duct Insulation are supplied as rigid boards and are CE marked to the relevant British and European Standard for thermal insulation products for building equipment and industrial installations.

Kingspan Kooltherm® Duct Insulation

Rigid phenolic insulation for sheet metal HVAC ductwork - rectangular, circular and flat oval. Installed both indoors and outdoors (with additional weatherproof finish).

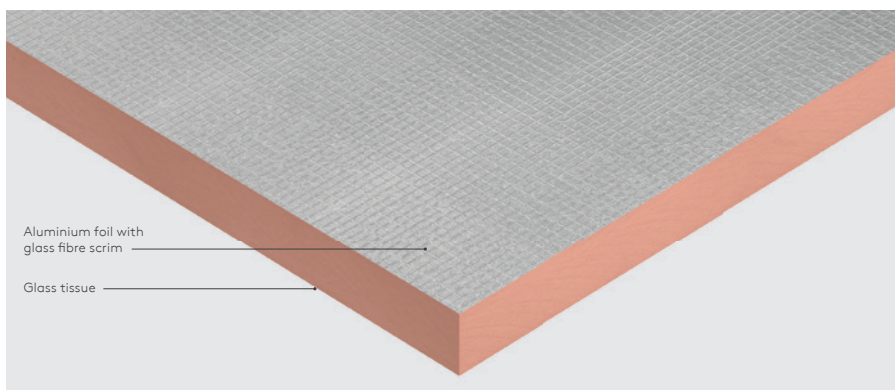


Figure 1: Rigid phenolic insulation

Main features:

- Premium performance insulation board with external aluminium facing and internal glass tissue as shown above in Figure 1.
- Flat or slotted boards, dimension 1200 x 600 mm or 1200 x 2400 mm. Other dimensions are available for shipment by container.
- 20, 25, 30, 40, 50 mm thicknesses available.
- Non fibrous phenolic insulation core.

CE marking

Kingspan Kooltherm® Duct Insulation is CE marked in conformance with BS EN 14314: 2009 +A1: 2013 (Thermal insulation products for building equipment and industrial installations. Factory made phenolic foam (PF) products. Specification). A Declaration of Performance is available to download from www.kingspanductwork.co.uk.

Introduction

Kingspan Therma™ Duct Insulation

Rigid PIR insulation for sheet metal HVAC ductwork - rectangular, circular and flat oval. Installed outdoors only (with additional weatherproof finish).

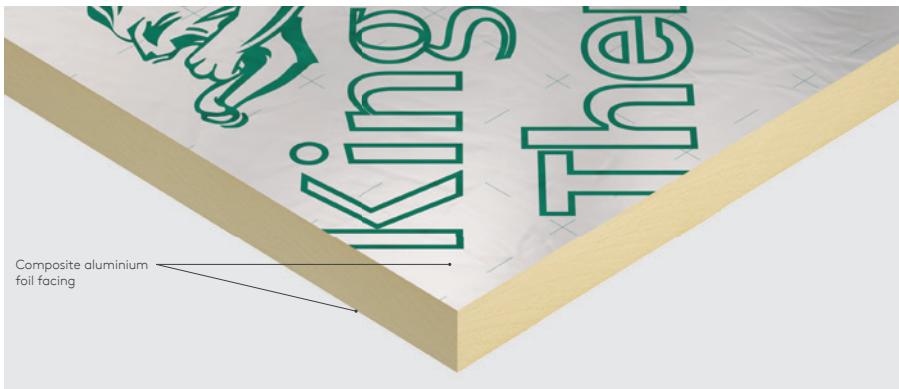


Figure 2: Rigid polyisocyanurate (PIR) insulation

Main features:

- High performance insulation board with aluminium laminate facings on both sides as shown above in Figure 2.
- Flat or slotted boards, dimension 1200 x 600 mm, or 1200 x 2400 mm.
- 25, 30, 40, 50 mm thicknesses available.
- Non fibrous PIR insulation core.

CE marking

Kingspan Therma™ Duct Insulation is CE marked in conformance with BS EN 14308: 2009 +A1: 2013 (Thermal insulation products for building equipment and industrial installations. Factory made rigid polyurethane foam (PUR) and polyisocyanurate foam (PIR) products. Specification). A Declaration of Performance is available to download from www.kingspanductwork.co.uk.

Introduction

Insulated Duct Support Inserts

During the installation of galvanised steel ductwork, the contractor should place insulated support inserts between ducts and supports, to extend no less than 50 mm both sides of the support to allow for tape application. Insulated duct support inserts should be of suitable compressive strength to carry the loads transmitted to the supports and should be of the same thickness as that of the adjacent duct insulation.

Figures 3 - 8 show various insulated duct support applications.

Kingspan Insulation recommend the use of (as applicable) Kingspan Kooltherm® Insulated Duct Support Inserts (indoors and outdoors), or Kingspan Therma™ Insulated Duct Support Inserts (outdoors only).

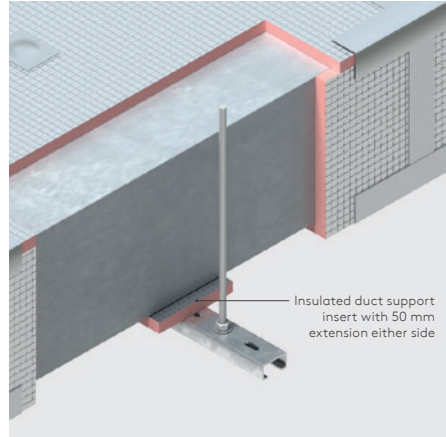


Figure 3: Kingspan Kooltherm® Insulated Duct Support Inserts for rectangular ductwork

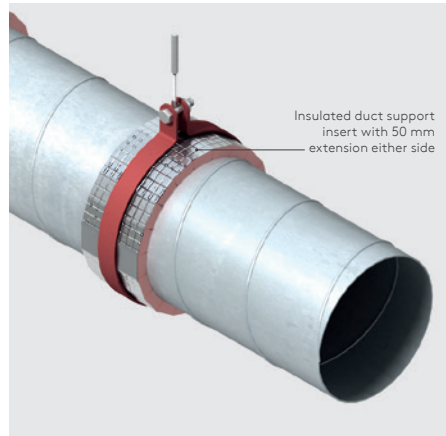


Figure 4: Kingspan Kooltherm® Insulated Duct Support Inserts for circular ductwork

Introduction

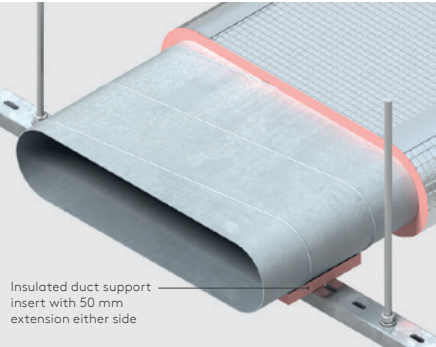


Figure 5: Kingspan Kooltherm® Insulated Duct Support Inserts for flat oval ductwork

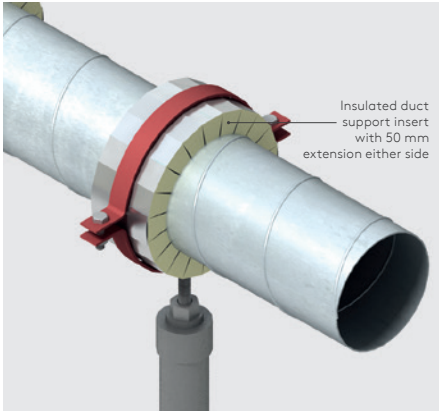


Figure 7: Kingspan Therma™ Insulated Duct Support Inserts for circular ductwork

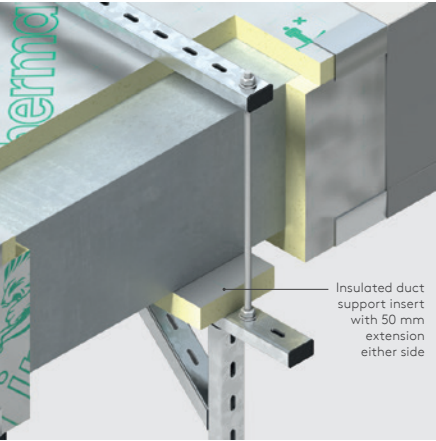


Figure 6: Kingspan Therma™ Insulated Duct Support Inserts for rectangular ductwork

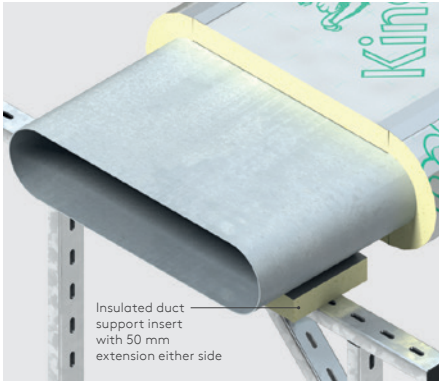


Figure 8: Kingspan Therma™ Insulated Duct Support Inserts for flat oval ductwork

Introduction

Load-bearing insulation inserts can be fabricated from standard Kingspan Kooltherm® Duct Insulation boards and Kingspan Therma™ Duct Insulation boards to suit the whole range of duct dimensions and insulation thicknesses. They can withstand the loads imposed by HVAC / building services ductwork at locations where ductwork supports and hangers are installed.

Load-bearing calculations for the standard range of Kingspan Kooltherm® Insulated Duct Support Inserts and Kingspan Therma™ Insulated Duct Support Inserts are based upon the compressive strength of the products and include a safety factor as described below. They are designed to support the maximum static compressive loads imposed by horizontal ductwork with hanger supports spaced at the maximum centres¹.

Galvanised Steel Ductwork	Duct Size (mm)	Support Width (mm)	Maximum Compressive Load ² (Kg/m ²)	Maximum Load, On Insert (kg/m ²)	Minimum Safety Factor
Rectangular	w and h < 1000	40	13130	≤ 2595	5.1
Rectangular	w and h < 2000	40	13130	≤ 2966	4.4
Rectangular	w and h ≤ 3000	40	13130	≤ 3555	3.7
Circular	diameter ≤ 2000	40	13130	≤ 2305	5.7
Flat Oval	A x B up to 1885 x 508	40	13130	≤ 2523	5.2

Table 1 - Maximum load and Minimum safety factor of load-bearing Kingspan Kooltherm® Insulated Duct Support Inserts and Kingspan Therma™ Insulated Duct Support Inserts.

¹ Maximum support spacing per DW 144 Specification for Sheet Metal Ductwork, Table 16-17-18.

² The Maximum Compressive Load (kg/m²) is the value at which the insulation reaches its compressive strength of 130 kPa.

Installation

Getting Started

Preparation

- The insulation should only be installed after all testing of the ductwork system has been completed.
- Insulation must not be installed at locations where the ductwork penetrates fire resistance rated walls, partitions, floors and ceiling-floor assemblies. Consideration should be given to current Buildings Regulations / Standards with regard to the requirements for and the provision of, fire stops.
- Before being insulated, duct surfaces must be made clean, dry and free from grease, dust, dirt, loose rust, scale and all other foreign matter.
- The insulation should be installed to achieve a close fit between insulation joints.

Health & Safety

Kingspan Kooltherm® Duct Insulation and Kingspan Therma™ Duct Insulation are chemically inert and safe to use. No unusual hazards are expected under conditions of normal use. It is recommended that gloves be worn when handling the product.

For further information, product safety information sheets for Kingspan Therma™ Duct Insulation and Kingspan Kooltherm® Duct Insulation are available from our website: www.kingspanductwork.co.uk.

Installation

Rigid insulation for Rectangular Ductwork

Rectangular straight ductwork

- Rigid insulation boards are cut to size using a fine tooth insulation saw or knife.



- For precision cutting, a trimming knife blade or a sharpened straight edge knife is commonly used.
- To produce a straight cut it is common practice to also mark the size required on the board, score the surface with a blade and then score through the full thickness of the insulation in stages.
- Insulation is applied to the ductwork with aluminium tape, usually starting from the bottom and finishing on the top as shown in the installation sequence in Figures 9 and 10.

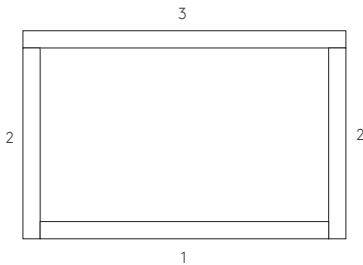


Figure 9: Numbered installation sequence

- To maintain the specified thickness of insulation at all four corners of the duct, on horizontally orientated ducts, the insulation fixed to the top / bottom and the insulation that is fixed to the sides should overlap as shown in Figures 9 and 10.

- For the use of adhesive / mechanical fixing and the vapour barrier, see pages 15 and 20.

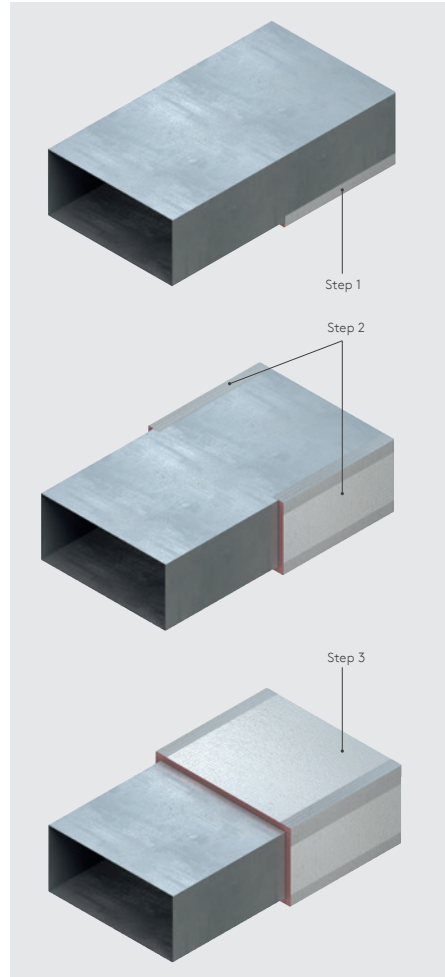


Figure 10: Installation sequence

Installation

Rectangular radius duct components (e.g. radius bends, radius Tee)

- For flat parts of the duct component, rigid insulation boards are cut to size and are applied with aluminium tape.

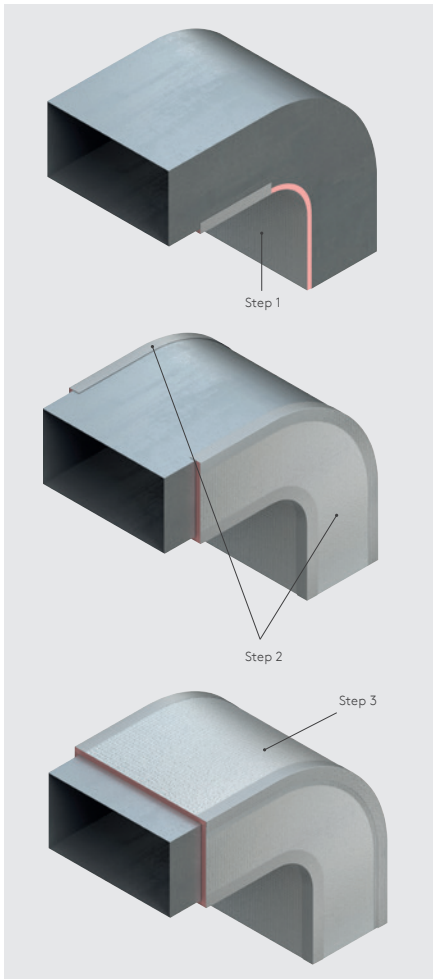


Figure 11: Installation to radius duct components

- For radius parts, before its application rigid insulation is grooved in parallel lines on one facing so that it can adapt to the shape of the duct section.
- Insulation is applied to the ductwork with aluminium tape, usually starting from the bottom and finishing on the top as shown in Figure 11.
- The use of pre-slotted or V-grooved insulation is preferred because it allows the required thickness of insulation to be maintained all across the curve as shown in Figure 12.
- The use of rigid insulation scored, slotted or grooved on site is acceptable as shown in Figure 13.

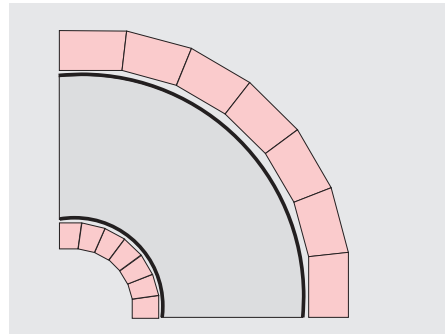


Figure 12: Preferred (insulation v-grooved)

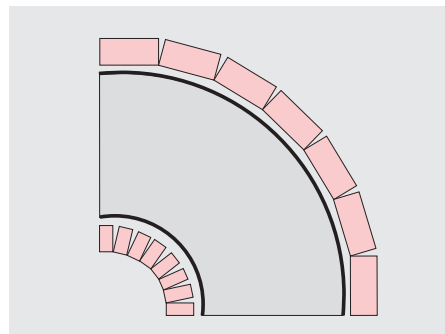


Figure 13: Acceptable (insulation scored)

- Grooved / scored insulation is fitted as closely as possible to outside and inside radius.
- For the use of adhesive / mechanical fixing and the vapour barrier, see pages 15 and 20.

Installation

Rectangular angled duct components (e.g. transitions, offsets)

- For flat parts of these duct components, rigid insulation boards are cut to size and applied with aluminium tape. (Figure 14).
- For angled parts, before application rigid insulation is grooved / scored on one facing in correspondence with the angle, so that it can adapt to the shape of the duct section.

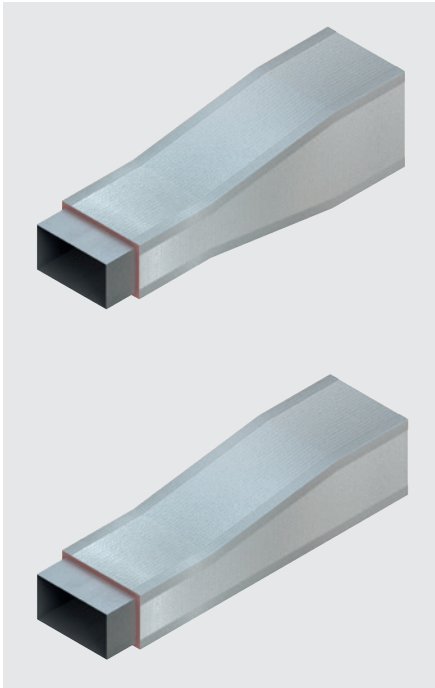


Figure 14: Rectangular angled duct components

- For the use of adhesive / mechanical fixing and the vapour barrier, see pages 15 and 20.

Rigid insulation for Circular Ductwork

Circular straight ductwork

- The rigid insulation shall be slotted or V-grooved through its internal face to accommodate the surface curvature of circular ductwork, alternatively pre-formed curved sections can be used (e.g. Kingspan Kooltherm® Pipe Insulation sections).
- Rigid insulation is cut to size to suit the diameter of the ductwork and wrapped around the ductwork as shown in Figure 15.
- Insulation is applied with aluminium tape as shown in Figures 16-17.

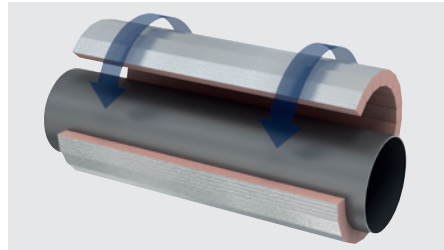


Figure 15: Insulation is wrapped around the ductwork

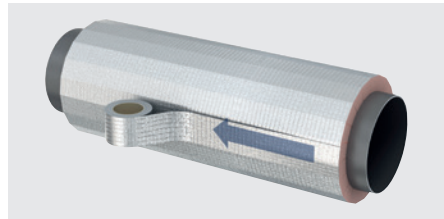


Figure 16: Aluminium tape is applied

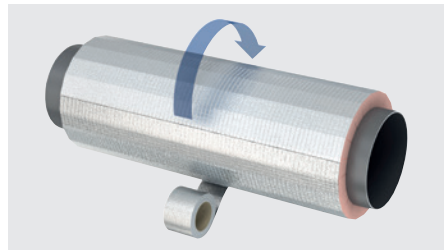


Figure 17: Aluminium tape is applied

- For the use of adhesive / mechanical fixing and the vapour barrier, see pages 15 and 20.

Installation

Notes on slotted insulation

- Kingspan Insulation can offer rigid insulation boards slotted on the internal face (See Figure 18 below). This slotted insulation can be applied to duct diameters of 350 mm and larger.

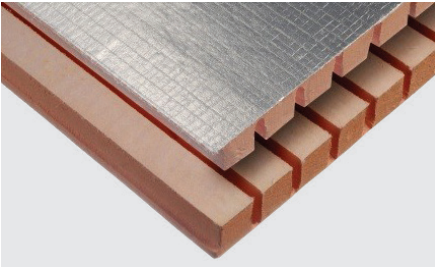


Figure 18: Slotted insulation boards

- For smaller curved surfaces Kingspan Kooltherm® Pipe Insulation or Kingspan Tarecpir™ Pipe Insulation is recommended.

Circular bends

- A straight section of circular rigid insulation shall be cut into mitred segments as shown in Figure 19.
- The width of the mitres shall be determined in order to ensure a good contact with the duct surface. The first and last mitre should have one straight side to match the adjoining straight duct covers and should have a width of at least 50 mm.

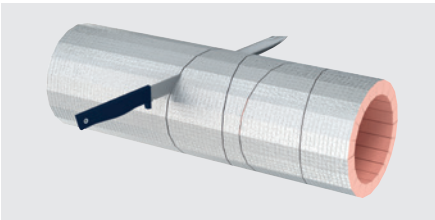


Figure 19: Mitred segments

- Each mitred segment is applied with longitudinal joints vapour sealed with an appropriate self adhesive aluminium foil vapour barrier tape (Figure 20).
- When positioning the next tapered insulation element, ensure that a proper fit is made and no gaps arise in the joints (Figure 21).

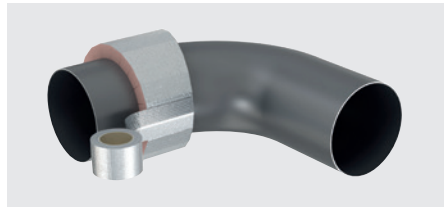


Figure 20: Joints sealed with foil vapour barrier tape

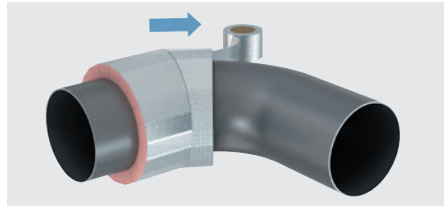


Figure 21: Ensure no gaps arise in the joints

- The procedure shall be repeated until the full angle of the elbow is achieved and all longitudinal joints are taped (Figure 22).
- All circumferential joints shall be vapour sealed with tape securely applied in a smooth and wrinkle-free manner to ensure a proper, vapour tight and lasting adhesion as shown in Figure 23.

Installation

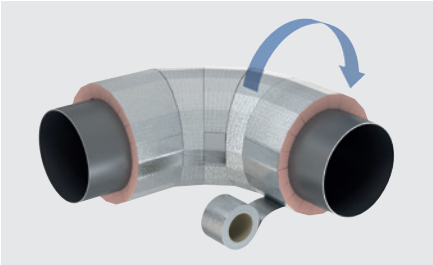


Figure 22: Repeat until full angle of the elbow is completed

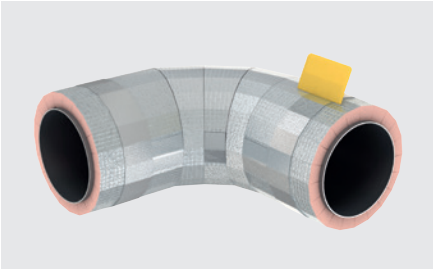


Figure 23: Smooth out any wrinkles

- For the use of adhesive / mechanical fixing and the vapour barrier, see pages 15 and 20.

Circular angled duct components (e.g. transitions, offsets)

The rigid insulation is applied similarly as described above for circular straight ducts and bends.

Rigid insulation for Flat Oval Ductwork

Flat oval straight and non-straight ductwork

- For flat parts, rigid insulation boards are applied as per rectangular ductwork, cut to size and applied with aluminium tape (see previous sections for details).
- For curved parts, circular duct components cut from slotted rigid insulation boards or pipe insulation should be used.
- Figure 24 shows that flat oval ducts are available in standard sizes A x B, for e.g. 361 x 76 mm
- For duct diameters below 350 mm, it is recommended that Kingspan Kooltherm® Pipe Insulation or Kingspan Tarecpir™ Pipe Insulation is used.
- For duct diameters of 350 mm and larger, slotted insulation boards can be applied.
- For the use of adhesive / mechanical fixing and the vapour barrier, see pages 15 and 20.

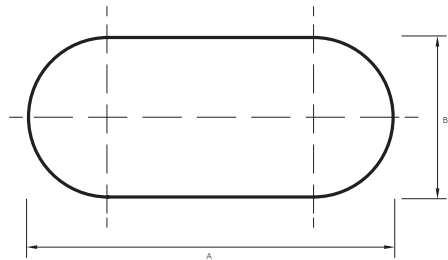


Figure 24: Flat oval ducts size

Installation

Adhesives and Mechanical Fixings

Application

- When necessary, insulation shall be permanently secured directly to the duct by means of adhesives, by mechanical means, or by a combination of both. This is required when the tape is not sufficient to guarantee a secure and long lasting installation, for example:
 - vertical oriented ductwork
 - load bearing areas such as:
 - underside and sides of horizontal rectangular ductwork
 - underside and sides of horizontal flat oval ductwork, or the bottom part of circular ductwork with larger diameters
 - Sides typically larger than 300 mm
- Adhesives and / or mechanical means are applied in accordance with the manufacturer's recommendations.

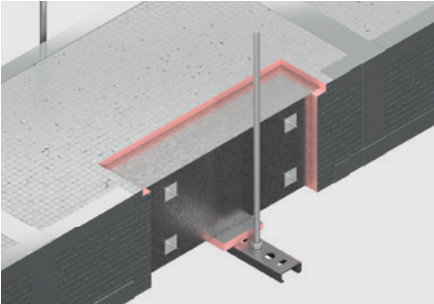


Figure 25: Insulation pin fixings attached to ductwork

- A suitable adhesive can be a contact adhesive or spray adhesive.
- When required, insulation pins / insulation hangers such as those shown in Figure 26, are used as mechanical means of fixing. Caution is advised when proposing the use of self-adhesive insulation hangers in place of perforated plate pins that utilise a separate adhesive; the latter allow a higher bond to the duct surface.
- The selection of compatible adhesive / mechanical fixings will be dependent upon: the substrate material; operating temperatures, size and orientation of the duct and the duct wall; and the degree of vibration to which the duct is subjected during operation.

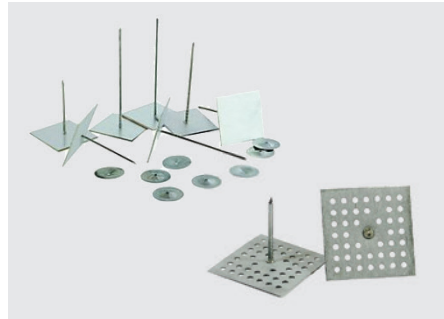


Figure 26: Various insulation pins / hangers for mechanical fixing

Installation

- For large surfaces, average spacing of mechanical fixings should be:
 - vertical surfaces: 450 mm square spacing;
 - upward-facing surfaces: 600 mm square spacing; and
 - over-hanging and downward-facing surfaces: 300 mm (maximum) square spacing.
- When they are used, mechanical fixing pins should be positioned so that they are neatly and evenly distributed under each piece of insulation as shown in Figure 25. They should be located no less than 75 mm, and no greater than 150 mm, from insulation edges and corners.
- When insulation board is fixed to another insulation board, use a suitable contact or spray adhesive.
- Bands (preferably aluminium) and matching seals are used as additional mechanical means on circular ductwork.
- The banding must be no less than 15 mm wide and should be applied circumferentially at least three per section of insulation or at maximum 400 mm centres as shown in Figure 27.

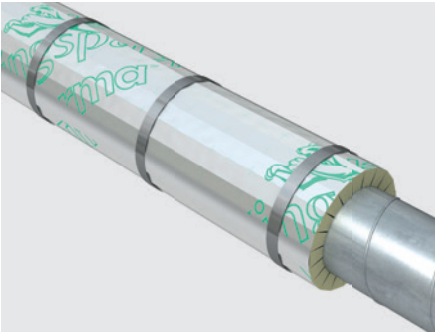


Figure 27: Banding can be used as additional fixings

Notes on Adhesive and Mechanical fixings

Kingspan Technical Insulation does not supply ancillary items such as tape, adhesive and mechanical means of fixing insulation.

A list of adhesives suitable for Kingspan Kooltherm® Duct Insulation and Kingspan Therma™ Duct Insulation is available, please contact us for details.

Insulation of Flanges, Stiffeners and Connections

Application

- In addition to the surfaces of ductwork - flanged joints, stiffeners and connections must also be effectively insulated in order to reduce heat loss, heat gain and / or to control condensation.
- There are two methods most commonly used in the industry for the insulation of flanges, stiffeners and connections, see below.

a) Method 1

- The preferred method is that the insulation should be installed to achieve a close fit between the insulation and substrate (duct walls).
- Once the surfaces of ductwork have been insulated, further insulation may need to be applied on flanges³ according to the following guidelines:

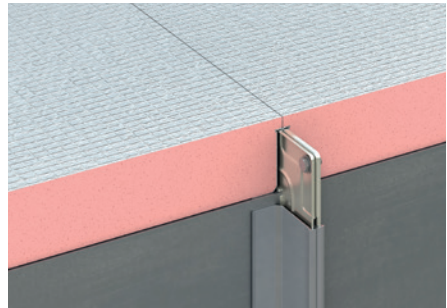


Figure 28: Flange is covered by minimum 5 mm insulation

- When the thickness of insulation is at least 5 mm more⁴ than the size of the flanges, sheets of insulation material should be pushed tight against the flange on both sides to give at least 5 mm cover⁴, as shown in Figure 28 above.

Installation

- When the thickness of insulation is not sufficient to give at least 5 mm cover 4, flanges should be covered with additional pre-formed sheets of insulation material as shown in Figure 29 below.

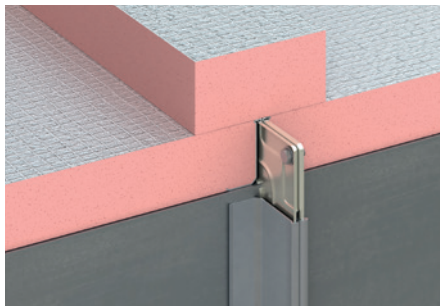


Figure 29: Flange is smaller than the thickness of insulation

³ The term "Flanges" refers to all flanged joints, stiffeners and connections.

⁴ For the actual thickness required, see tables of minimum thickness in BS 5422: 2009 (Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C).

- When the size of the flanges is greater than the thickness of insulation, so that they project over the insulation, they should be covered with either pre-formed sheets of insulating material or by increasing the general thickness of insulation to give sufficient cover as shown in Figure 30 below, (for thicknesses see BS 5422: 2009 (Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to +700°C). This can be achieved as follows:

- Cut two strips of duct Insulation board and install them at the two sides of the flange, on top of the duct insulation previously applied. The size of these strips shall be such that they are as much as possible in line with the top of the protruding flange.
- Cut a third oversize strip of duct Insulation board and install it over the two strips previously cut.
- For the use of adhesive / mechanical fixing and the vapour barrier, see pages 15 and 20.

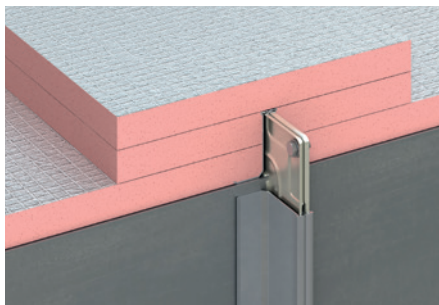
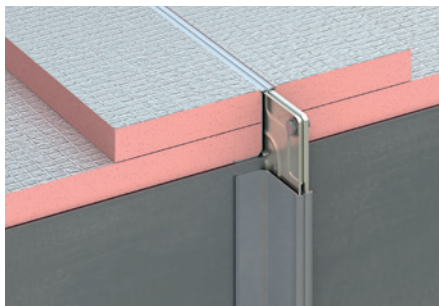
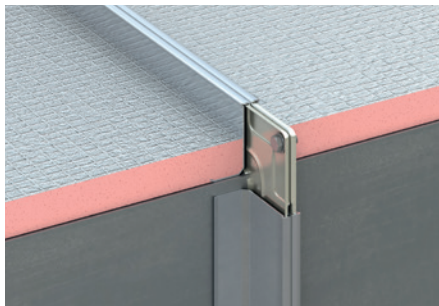


Figure 30: Flange is larger than the thickness of insulation

Installation

b) Method 2

- An alternative method shown in Figure 31, which is used in the industry is that the insulation is installed by levelling all insulation with the flanges, in order to achieve a uniform appearance; this can be obtained as follows:
 - Strips of insulation or “noggins” having depth equivalent to that of the flanges are fitted on duct walls at intervals of approx. 300 mm centres.
 - These strips of insulation are secured to the duct wall with adhesive & foil tape
 - Insulation board are placed over the “noggins” and over the flanges.
 - Insulation is secured to the “noggins” with suitable adhesive
 - Then all insulation boards are further secured in place along all joints with foil tape to produce a vapour seal.
- This method is compatible with rigid insulation material, when the insulation is installed carefully.
- If using this method, it should be noted that:
 - Air gaps are present between the ductwork walls and the insulation;
 - Insulation is less prone to receive any external load; if insulation receives an external load, it may crack / break in correspondence with the gaps between noggins.

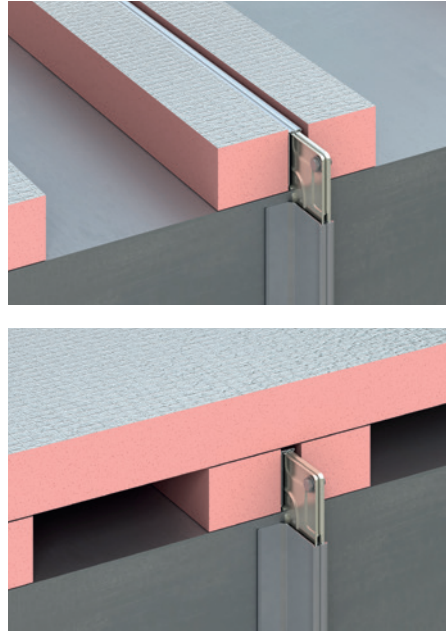


Figure 31: Insulation on top of the “noggins”

Installation

Vapour Barrier

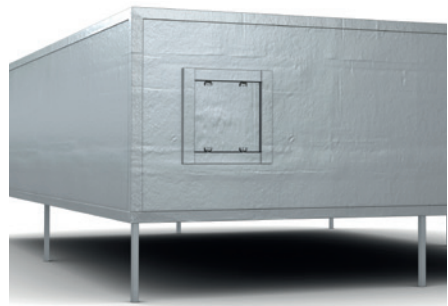
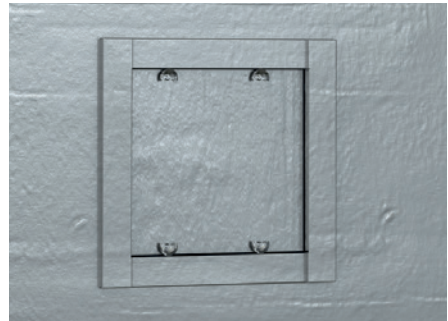
- Kingspan Kooltherm® Duct Insulation and Kingspan Therma™ Duct Insulation are supplied with a factory applied vapour barrier foil.
- The vapour barrier over the insulation should be continuous all over the ductwork and fully sealed.
- A high strength self-adhesive aluminium foil vapour barrier tape should be applied to all discontinuities in the vapour barrier. This includes those between insulated duct support inserts and abutting duct insulation, joints, seams, exposed insulation edges, insulation terminations, pin punctures, retaining washers and other protrusions.
- The self-adhesive vapour barrier tape should be applied in a smooth and wrinkle-free manner. It should extend no less than 25 mm either side of joints, seams insulation edges and terminations, as well as in all directions of pin punctures, retaining washers and other protrusions.
- To ensure successful adhesion, all surfaces should be made clean, dry and free from grease, dust, dirt and all other foreign matter prior to application. If required, surfaces may be primed with a thin coat of compatible high strength contact adhesive. A gentle pressure may also be exerted using a soft spatula tool, whilst applying the tape.



Other Details

Insulation of access opening

- To facilitate inspection, testing, adjustment, balancing, maintenance and cleaning, removable and fully vapour sealed piece of insulation, of sufficient size, must be provided at access door locations.
- If the door is already pre-insulated it does not need to be further insulated; the insulation and finish should terminate clear of access openings and hinged or removable doors.



Installation

Packaging & Storage

- The polyethylene packaging of insulation products should not be considered adequate for outdoor protection. Note that the packaging used by Kingspan Insulation is recyclable.
- Insulation products should be maintained in good condition throughout the duration of the works and should not be unpacked onsite until required for immediate use. They should be returned to protected storage at the end of each workday.
- Insulation materials should be adequately protected from the weather, humidity, abrasive matter, contaminants and all other foreign matter.
- Ideally, products should be stored inside a building. If, however, outside storage cannot be avoided, they should be stored in a dry atmosphere, clear of the ground, out of direct sunlight and covered with an opaque and weatherproof material. Products that have been allowed to get wet should not be used.

Protection and Finishes

- The factory-applied aluminium foil barrier facing is the standard finish for rigid insulation in concealed indoor areas, e.g. ceiling voids, floor voids, modules and risers.
- An additional cosmetic finish, e.g. paint may be added. Consideration should, however, be given to any effect that it might have on the thermal and fire performance of the finished ductwork.
- When ductwork is located indoors up to 2 m from the floor, or at risk of being subjected to mechanical or physical abuse, e.g. in plant rooms, boiler houses, service areas or publicly accessible areas, an additional protective finish should be applied over the insulation (see below).

Suitable protective finishes

Suitable finishes include:

- aluminium or stainless steel sheet;
- aluminium-zinc alloy coated steel sheet;
- heavy-duty, self-adhesive laminate;
- synthetic elastomeric jacketing, systems;
- reinforcing glass / synthetic cloth embedded between two coats of appropriate coating; or
- glass reinforced polyester / epoxy (GRP / GRE) cladding systems.

All applied in accordance with the manufacturer's recommendations and the project's specification requirements.

Ductwork insulation located outdoors

- If located outdoors, the insulation must be adequately protected with an additional weatherproof and water / vapour tight finish that shields against the effects of wind and sunlight. The finish must also be capable of providing suitable protection if at risk of being subjected to mechanical or physical abuse. Suitable protective finishes are listed opposite.
- On circular ductwork, the weatherproof metal cladding should be retained by banding.
- Where exposure to high wind is probable, the metal cladding of any shape of ductwork should be retained by banding with all overlaps mechanically secured.
- On rectangular and flat oval ductwork located outdoors, to prevent the accumulation of water on top of the finished insulation, the HVAC engineer may require the ductwork top cover to be sloped. For example as shown in Figure 32, 2 percent slope may be suggested, i.e. the slope shall be of 2 cm vertical per 100 cm horizontal ratio: 1 in 50).



Figure 32: 2 percent slope (ratio 1 in 50)

- Sloped insulation as shown in Figure 33 can be applied as follows:
 - Insulation is applied to the ductwork at the bottom and sides
 - Strips of insulation are fitted on one side or in the centre of the ductwork top
 - These strips of insulation are secured to the duct wall with adhesive & foil tape
 - Insulation boards are placed over the ductwork and the strips
 - Insulation is secured to the ductwork
 - Then all insulation boards are further secured in place along all joints with foil tape to produce a vapour seal
 - A suitable weatherproof finish is applied

Installation

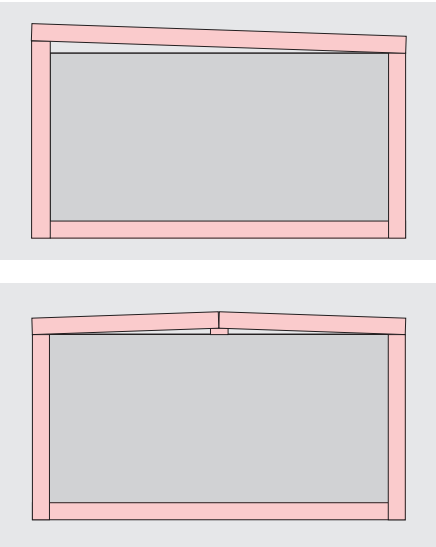


Figure 33: Sloped insulation fixing details

Installation

Thermal Insulation Contractors Association (TICA) and the TICA Skillcard

Details of the TICA Skillcard and competence criteria can be found at: www.tica-acad.co.uk/tica-skillcard

Details regarding TICA membership can be found at: www.tica-acad.co.uk/membership

and to search for a TICA member, visit: www.tica-acad.co.uk/member-search.



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