



Kooltherm™ FM

Project Specification

HVAC & Building Services Pipe Insulation



Project Specification

CONTENTS

Project Specification

1	General	4
2	Standard References	4
3	Fire Rating of Insulation Materials	5
4	Scope of Works	6
5	Materials	6
6	Insulation Finishes	8
7	Standards & Workmanship	9
8	Identification of Services	9
9	Appendix 1	10
10	Appendix 2	12
11	Appendix 3	13
12	Appendix A	15
13	Appendix B	17
14	Appendix C	19
15	Appendix D	21



Kooltherm™ FM Pipe Insulation

Kooltherm™ FM Pipe Insulation comprises one metre long sections of Kooltherm™ FM Insulation faced with a factory-applied aluminium foil vapour barrier jacket autohesively bonded to the insulation core during manufacture.

Kooltherm™ FM Pipe Insulation is available in a range of thicknesses to suit different performance specifications and is compatible with both standard and non-standard pipe diameters.

Project Specification

1 General

- 1.1 The subcontractor shall include for the supply, delivery and installation of materials necessary for the thermal insulation of systems described in this specification.
- 1.2 The insulation work shall be carried out by a Member of the Thermal Insulation Contractors Association. The thermal insulation specialist shall make themselves fully acquainted with all the site conditions and programme of works and shall execute their works within such confines and programme. Reference should be made to BS 5970 as appropriate.
- 1.3 The thermal insulation shall not be applied until the pipework installation has been tested.
- 1.4 Insulation materials and finishes shall be inherently proof against rotting, mould and fungal growth and attack by vermin, be non-hygroscopic and in all respects be suitable for continuous use throughout the range of operating temperatures and within the environment indicated.
- 1.5 Any work not of acceptable standard shall be removed and replaced at no cost to the contract.
- 1.6 All insulation materials and finishes shall be installed in accordance with the manufacturers recommendations.
- 1.7 No insulation material containing CFC or HCFC components shall be accepted.

2 Standard References

2.1 British Standards

BS 476-6: 1989

Fire tests on building materials and structures. Method of test for fire propagation for products

BS 476-7: 1997

Fire tests on building materials and structures. Method of test to determine the classification of the surface spread of flame of products

BS 1387: 1985 (1990)

Specification for screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads

BS 1710: 1984 (1991)

Specification for identification of pipelines and services

BS 4735: 1974

Laboratory method of test for assessment of the horizontal burning characteristics of specimens no larger than 150 mm x 50 mm x 13 mm (nominal) of cellular plastics and cellular rubber materials when subjected to a small flame

BS 5422: 2009

Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°C to $+700^{\circ}\text{C}$

BS 6700: 1997

Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages

BS EN ISO 2286-2: 1998

Rubber or plastics-coated fabrics. Determination of roll characteristics. Methods for determination of total mass per unit area, mass per unit area of coating and mass per unit area of substrate

BS EN ISO 9001: 2000

Quality management systems. Requirements

2.2 European Standards

EN ISO 9001: 2000

Quality management systems. Requirements

2.3 American Standards

ASTM D 1621

Standard Test Method for Compressive Properties of Rigid Cellular Plastics

ASTM D 1622

Standard Test Method for Apparent Density of Rigid Cellular Plastics

ASTM D 2856 Method B

Standard Test Method for Open-Cell Content of Rigid Cellular Plastics by the Air Pycnometer

ASTM C 518

Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

2.4 German Standards

DIN 53122

Determination of the water vapour transmission rate of plastic film, rubber sheeting, paper, board and other sheet materials by gravimetry

2.5 Other References

TIMSA Guide

TIMSA Domestic & Non-Domestic Heating, Cooling and Ventilation Guide

NES Specification Expert

Y50 Thermal Insulation

Defence Estate Organisation Ministry of Defence Specification 036: 1997

Heating, hot and cold water, steam and gas installations for buildings

2.6 Building Regulations / Standards

England & Wales

The Building Regulations 2000.

Approved Document B 2002 Edition. Appendix A12

Scotland

The Building Standards (Scotland) Regulations.

Section 2 (Non-Domestic) 2006. 2 E Table

Northern Ireland

The Building Regulations (Northern Ireland) 2005.

Technical Booklet E. Paragraph 2.4

Irish Republic

The Building Regulations 2006. Technical Guidance

Document B. Appendix A. Paragraphs A11 and A12

3 Fire Rating of Insulation Materials

3.1 All insulation materials and facings installed within buildings shall achieve the following standards when tested to:

BS 476-6: 1989 – of low contribution to fire growth with fire propagation index of performance (I) not exceeding 12 and sub index (i1) not exceeding 6.

BS 476-7: 1997 – of very low surface spread of flame (Class 1).

3.2 Insulation systems which meet the required combined standards as detailed above are rated Class 0 / Low Risk to the Building Regulations / Standards.

3.3 Insulation materials, adhesives, sealants and facings installed on pipework and equipment external to buildings shall be rated as Class 1 when tested to BS 476-7: 1997.

Project Specification

4 Scope of Works

4.1 Pipework Systems

Unless otherwise indicated, the following services shall be thermally insulated and also vapour sealed where noted:

- a. chilled water and refrigeration pipework insulated and vapour sealed;
- b. low and medium temperature hot water insulated to suit temperatures;
- c. hot water services (non-domestic) insulated to suit temperatures;
- d. cold water services (non-domestic) insulated and vapour sealed;
- e. steam, condensate and high temperature hot water insulated to suit temperature; and
- f. pipework exposed on roof or other external locations, unless otherwise indicated, insulation will be as above with weatherproof finish, and in the case of services a and d with electric trace heating.

4.2 Heat Exchangers, Cylinders and Buffer Tanks

Unless otherwise indicated, the following vessels shall be thermally insulated and also vapour sealed where noted:

- a. heat exchangers, hot water cylinders and calorifiers insulated to suit temperature; and
- b. chilled water and cold water buffer tanks insulated and vapour sealed.

4.3 Internal and External Water Storage Tanks

All tanks shall be provided pre-insulated and vapour sealed.

4.4 Valves, Flanges and Unions

Unless otherwise indicated, all fittings shall be insulated to the same thickness and type as insulation on adjacent pipework and also vapour sealed on services operating below ambient temperatures.

5 Materials

5.1 Pipework Systems up to 110°C

- 5.1.1 Insulation shall comprise 37 kg/m³ minimum density CFC/HCFC-free rigid phenolic insulation sections with zero Ozone Depletion Potential (ODP), one metre in length with a factory applied fully bonded reinforced aluminium foil vapour barrier jacket.
- 5.1.2 The aged thermal conductivity of the insulant shall not exceed 0.021 W/m·K at 10°C mean.
- 5.1.3 The insulation shall be Class 0 / Low Risk rated to the Building Regulations / Standards. The bore face of sections shall be de-dusted and coated with a non-odorous passivating solution after manufacture.
- 5.1.4 The insulation shall be rigid phenolic insulation, Kooltherm™ FM Pipe Insulation, as manufactured by Kingspan Industrial Insulation Limited.
App. A1 & A4
App. E: Figure E1 & E3
- 5.1.5 Insulation thickness is to be determined in accordance with the TIMSA Guide / BS 5422: 2009 (delete as applicable), from the tables given in App. B of this specification.
- 5.1.6 All pipe support inserts on pipework operating up to 120°C shall be rigid phenolic insulation, Kooltherm™ Insulated Pipe Support Inserts designed in accordance with the tables given in App. D.
App. A3 & A4
App. E: Figure E4–E5

5.2 Pipework Systems above 110°C

- 5.2.1 Insulation shall comprise 130 kg/m³ minimum density mineral fibre pipe sections with factory applied fully bonded reinforced aluminium foil facing. The thermal conductivity of the insulant shall not exceed 0.033 W/m·K at 10°C mean.
App. A12
- 5.2.2 In kitchens, food preparation areas, food storage areas or other areas where the use of fibrous materials is restricted, calcium silicate insulation shall be used in place of mineral fibre.
App. A14
- 5.2.3 Insulation thickness is to be determined in accordance with the TIMSA Guide / BS 5422: 2009 (delete as applicable).

5.3 Heat Exchangers, Cylinders and Buffer Tanks up to 80°C

5.3.1 Insulation shall comprise 40 kg/m³ nominal density, CFC/HCFC-free with zero Ozone Depletion Potential (ODP) rigid phenolic insulation boards with an aluminium foil vapour barrier jacket autohesively bonded to the exposed face and glass fibre autohesively bonded to the inner face during manufacture e.g. Kingspan Kooltherm™ FM Duct Insulation or equivalent. All corner and straight butt joints shall be sealed with 100 mm wide self-adhesive aluminium foil tape.

App. A5

5.3.2 Insulation thickness is to be determined in accordance with the TIMSA Guide / BS 5422: 2009 (delete as applicable), from the tables given in App. B of this specification.

5.4 Heat Exchangers, Cylinders and Buffer Tanks above 80°C

Insulation shall comprise 75 mm thick, 33 kg/m³ density lamella mineral fibre slabs with a factory applied reinforced foil facing. All corner and straight butt joints shall be sealed with 100 mm wide self-adhesive aluminium foil tape.

App. A13

5.5 Internal and External Water Storage Tanks

When supplied to site uninsulated, insulation shall comprise 40 mm thick, 40 kg/m³ nominal density CFC/HCFC-free with zero Ozone Depletion Potential (ODP), rigid phenolic insulation boards reinforced with an aluminium foil vapour barrier jacket autohesively bonded to the exposed face and glass fibre autohesively bonded to the inner face during manufacture e.g. Kingspan Kooltherm™ FM Duct Insulation or equivalent. All corner and straight butt joints shall be sealed with 100 mm wide self-adhesive aluminium foil tape.

App. A5

Project Specification

6 Insulation Finishes

6.1 Service Ducts, Ceiling Voids and Floor Voids

Pipe insulation shall be supplied with a factory applied reinforced aluminium foil facing, rated as Class 0 / Low Risk to the Building Regulations / Standards.
App. A4

Longitudinal and circumferential butt joints are to be sealed with 50 mm wide self-adhesive aluminium foil tape. Support to the sections shall comprise two circumferential bands of self-adhesive aluminium foil tape per section or alternatively 12 mm wide aluminium strappings with matching seals applied as two circumferential bands per section.
App. E: Figure E1

6.2 Internal and Exposed to View

Specification for pipe insulation will be as detailed in section 6.1, plus the following finish:

The pipe insulation shall be wrapped with a 170 g/m² canvas membrane with a water based protective coating, e.g. Idenden ET-10 or equivalent (App. A6). When fully dried the outer surface of the canvas shall be treated with a second coat in accordance with the manufacturers instructions. It is essential that the finish is applied to a high standard. An additional acrylic emulsion paint finish shall be provided to an approved BS colour if necessary.
App. E: Figure E2

6.3 Internal in Plant Rooms or Boiler Houses

6.3.1 Specification for pipe insulation will be as detailed in section 6.1 plus the following mechanical protection:

- insulation to be overcoated with two full applications of Idenden ET-150 coating (App. A7) with open weave No. 10 Glass Cloth between coats (App. A8); or alternatively
- insulation to be finished with fabricated sheet aluminium casings 0.6 mm thick on pipework up to and including 150 mm diameter and 0.8 mm thick on pipework over 150 mm diameter. Cladding to pipework operating at temperatures below ambient, to be secured with aluminium bands and matching seals at 450 mm centres and at circumferential joints which shall be overlapped by a minimum of 40 mm.
App. E: Figure E2

6.3.2 Cladding to hot pipework to be secured with self tapping screws or 'pop' rivets.

6.3.3 All flanges and valves in plant rooms shall be fitted with removable boxes, constructed with 0.7 mm thick aluminium sheeting lined with equivalent bonded insulation to the same thickness as adjacent pipe insulation. Boxes shall be secured with 'quick release' clips. On below ambient pipework the vapour barrier shall be maintained by dressing joints with moisture resistant sealant e.g. Foster 95-44 or equivalent.
(App. A9).

6.4 External (Weather Protection)

Specification for pipe insulation will be as detailed in section 6.1 plus the following weather protection:

- insulation to be overcoated with two full applications of Idenden 30-150 vapour barrier coating (App. A10), with No. 10 Glass Cloth between coats (App. A8). A solvent based weatherproof mastic e.g. Foster 60-75 (App. A11) or equivalent shall be used in damp and low temperature conditions; or alternatively
- insulation shall have a weatherproof coating of minimum 0.8 mm thickness polyisobutylene sheeting bonded to the insulation with, minimum 30 mm wide circumferential and longitudinal lap joints, which shall be fully solvent welded in accordance with the manufacturers instructions.
App. E: Figure E2

7 Standards and Workmanship

- 7.1 Adhesives, sealants and coatings shall be utilised in strict accordance with current recommendations of the supplier, particularly in respect of coverage, drying time, service temperature limits and methods of application.
- 7.2 All pipework shall be insulated with preformed pipe insulation sections with factory applied reinforced aluminium foil finish, rated as Class 0 / Low Risk to the Building Regulations / Standards (App. A4). All joints in the foil jacket shall be sealed with 50 mm wide self-adhesive aluminium foil tape.
- 7.3 All pipe insulation sections shall be concentric and matched for thickness. No sections having damaged ends or edges shall be used.
- 7.4 Insulation for bends and fittings shall be formed from mitred and trimmed pipe insulation sections, cut to ensure that a good contact with the surface to be insulated is made.
- 7.5 The insulation shall be neatly trimmed with purpose made end caps at pump casings, flange joints, valves and strainers.
- 7.6 The aluminium foil facing shall be continuous at junctions with insulated pipe support inserts with joints sealed.
- 7.7 Under no circumstances shall pipes be married together with the insulating materials.
- 7.8 Care must be taken to ensure the integrity of the vapour barrier is maintained on cold water, chilled water and refrigeration pipework.
- 7.9 Pipework conveying liquids below 10°C shall be additionally fitted with electrical trace heating for frost protection.

8 Identification of Services

- 8.1 The contractor shall include for the identification of those services both insulated and uninsulated.
- 8.2 Identification on insulated pipelines shall be by means of BS 1710: 1984 painted non-ferrous colour bands, fastened around the insulation. Directional arrows or other labels denoting flow and return (F & R) where specified, shall be either PVC adhesive tape or painted symbols as agreed with the engineer.
- 8.3 Colour band identification, and when specified directional arrows and labels, shall be made at:
 - a. 3 metre centres on exposed pipework;
 - b. 6 metre centres on concealed pipework; and
 - c. adjacent all valves, changes of direction, inlets and exits to ducts and buildings and at either side of walls and floors.
- 8.4 All arrows used to indicate direction of flow shall be either black or white to contrast with the colour of the insulation finish.

9 Frost Protection

- 9.1 Where pipework services are located at roof level or within unheated areas of a building, insulation thickness is to be determined in accordance with BS 5422: 2001, from the tables given in App. B: Table B4 of this specification.
- 9.2 Insulation alone will not give adequate protection from frost on static lines subjected to long periods of low temperatures and should be used in conjunction with electrical tracing.

Project Specification

Appendix A1 – Materials, Technical Data and Information

- A1 Kooltherm™ FM 37 kg/m³ rigid phenolic insulation (CFC/HCFC-free rigid phenolic insulation with zero Ozone Depletion Potential (ODP) for pipe sections and radiused and bevelled segments)
- A2 Kooltherm™ FM 60 kg/m³ rigid phenolic insulation (CFC/HCFC-free rigid phenolic insulation with zero Ozone Depletion Potential (ODP) for pipe sections, radiused and bevelled segments and insulated pipe support inserts)
- A3 Kooltherm™ FM High-Density 80 & 120 kg/m³ rigid phenolic insulation (CFC/HCFC-free high density rigid phenolic insulation with zero Ozone Depletion Potential (ODP) for insulated pipe support inserts)
- A4 Aluminium Foil Vapour Barrier Jacket (Glass fibre reinforced aluminium foil)
- A5 Kingspan Kooltherm™ FM Duct Insulation (CFC/HCFC-free rigid phenolic insulation boards with zero Ozone Depletion Potential (ODP) for the insulation of heat exchangers, cylinders and buffer tanks up to 80°C and internal and external water storage tanks)
- A6 Idenden ET-10 (Protective coating)
- A7 Idenden ET-150 (Coating)
- A8 No.10 Glass cloth (Open weave glass fibre reinforcing membrane for mastics coating and vapour sealants)
- A9 Fosters 95-44 (Moisture resistant sealant)
- A10 Idenden 30-150 (Vapour barrier coating)
- A11 Fosters 60-75 (Solvent based weatherproof mastic)
- A12 130 kg/m³ minimum density mineral fibre pipe sections
- A13 33 kg/m³ lamella mineral fibre slabs
- A14 Calcium silicate pipe sections

Appendix A1 – Kooltherm™ FM 37 kg/m³ Rigid Phenolic Insulation (Pipe sections and radiused and bevelled segments)

Description

Kooltherm™ FM 37 kg/m³ rigid phenolic insulation is CFC/HCFC-free with zero Ozone Depletion Potential (ODP). Its closed cell structure gives the product excellent thermal properties as well as making it highly resistant to moisture penetration and wicking.

Kooltherm™ FM 37 kg/m³ rigid phenolic insulation can withstand temperatures from -50°C to +110°C. It also has a far superior resistance to burning and spread of flame than that of any other cellular plastic insulation. The composition of Kooltherm™ FM 37 kg/m³ is such that when subjected to fire, the outer surface forms a strong carbonaceous layer which retards further flame spread and penetration.

Kooltherm™ FM 37 kg/m³ rigid phenolic insulation satisfies the requirements of the TIMSA Guide and BS 5422: 2001 in addition to other major national specifications, including NHS CO₂, NES Specification Expert Y50, DEO Specification 036 and BS 6700: 1997. Kooltherm™ FM 37 kg/m³ rigid phenolic insulation is manufactured under a quality control system approved to BS EN ISO 9001: 2000 (Quality management systems. Requirements).

Application

Kooltherm™ FM 37 kg/m³ rigid phenolic insulation has diverse applications especially within the building services industry. While it is primarily used for pipe insulation, Kooltherm™ FM 37 kg/m³ rigid phenolic insulation can also be used for insulating complex shapes such as vessels.

Availability

- pipe sections and bends;
- radiused and bevelled segments;
- slabs: standard slab 2400 x 1000 mm;
- standard and non standard pipe sizes; and
- single layer, multi layer or rebated joints.

General Physical Properties

Property	Test Method	Typical Value
Minimum Density	(ASTM D 1622)	37 kg/m ³
Thermal Conductivity at +10°C Mean Temp	(ASTM C 518)	0.025 W/m·K
Colour		Pink
Closed Cell Content	(ASTM D 2856 Method B)	≥ 90
Compressive Strength at +23°C	(ASTM D 1621)	Minimum 150 kPa
Operating Temperature Limits	Upper Limit Lower Limit	+110°C - 50°C

Fire Test Classifications

Kooltherm™ FM rigid phenolic insulation will achieve the results given below which enables it to be classified by the Building Regulations as being Class 0 and Low Risk by the Building Standards in Scotland.

Property	Test Method	Typical Result
Reaction to Fire	EN 13501-1	B _L - s1, d0
Surface Burning Characteristics	ASTM E 84	Class A/1
Fire Propagation	BS 476-6	Index of performance (I) not exceeding 12 and sub index (i ₁) not exceeding 6
Flame Spread	BS 476-7	Class 1*

* These test results combined enable a Class 0 classification to the Building Regulations in England & Wales, Northern Ireland and the Republic of Ireland, and a Low Risk classification to the Building Standards in Scotland.

Thermal Conductivity Design Values

	Mean Temperature	Typical Value
Thermal Conductivity	+80°C	0.027 W/m·K
	+50°C	0.025 W/m·K
	+10°C	0.025 W/m·K
	0°C	0.021 W/m·K
	-10°C	0.021 W/m·K
	-20°C	0.021 W/m·K

Project Specification

Appendix A2 – Kooltherm™ FM 60 kg/m³ Rigid Phenolic Insulation (Pipe sections, radiused and bevelled segments and insulated pipe support inserts)

Design

Kooltherm™ FM 60 kg/m³ rigid phenolic insulation is CFC/HCFC-free with zero Ozone Depletion Potential (ODP). Its closed cell structure gives the product excellent thermal properties as well as making it highly resistant to moisture penetration and wicking.

Kooltherm™ FM 60 kg/m³ rigid phenolic insulation can withstand temperatures from -50°C to +110°C. It also has a far superior resistance to burning and spread of flame than that of any other cellular plastic insulation.

The composition of Kooltherm™ FM 60 kg/m³ rigid phenolic insulation is such that when subjected to fire, the outer surface forms a strong carbonaceous layer which retards further flame spread and penetration.

Kooltherm™ FM 60 kg/m³ rigid phenolic insulation satisfies the requirements of the TIMSA Guide and BS 5422: 2001 in addition to other major national specifications, including NHS CO₂, NES Specification Expert Y50, DEO Specification 036 and BS 6700: 1997. Kooltherm™ FM 60 kg/m³ rigid phenolic insulation is manufactured under a quality control system approved to BS EN ISO 9001: 2000 (Quality management systems. Requirements).

Application

Kooltherm™ FM 60 kg/m³ rigid phenolic insulation has diverse applications, especially within the building services industry. While it is primarily used for pipe insulation, Kooltherm™ FM 60 kg/m³ rigid phenolic insulation is also ideal for the manufacture of panels.

Availability

- pipe sections and bends;
- insulated pipe support inserts;
- radiused and bevelled segments;
- slabs: standard slab 2400 x 1000 mm;
- standard and non standard pipe sizes; and
- single layer, multi layer or rebated joints.

General Physical Properties

Property	Test Method	Typical Value
Nominal Density	(ASTM D 1622)	60 kg/m ³
Thermal Conductivity at +10°C Mean Temp	(ASTM C 518)	0.031 W/m·K
Colour		Grey
Closed Cell Content	(ASTM D 2856 Method B)	≥ 90%
Compressive Strength at +23°C	(ASTM D 1621)	Minimum 170 kPa
Operating Temperature Limits	Upper Limit Lower Limit	+110°C - 50°C

Fire Test Classifications

Kooltherm™ FM rigid phenolic insulation will achieve the results given below which enables it to be classified by the Building Regulations as being Class 0 and Low Risk by the Building Standards in Scotland.

Property	Test Method	Typical Result
Reaction to Fire	EN 13501-1	B _L - s1, d0
Surface Burning Characteristics	ASTM E 84	Class A/1
Fire Propagation	BS 476-6	Index of performance (I) not exceeding 12 and sub index (i _f) not exceeding 6
Flame Spread	BS 476-7	Class 1*

* These test results combined enable a Class 0 classification to the Building Regulations in England & Wales, Northern Ireland and the Republic of Ireland, and a Low Risk classification to the Building Standards in Scotland.

Thermal Conductivity Design Values

	Mean Temperature	Typical Value
Thermal Conductivity	+10°C	0.025 W/m·K

Appendix A3 – Kooltherm™ FM High Density 80 kg/m³ Rigid Phenolic Insulation (Insulated pipe support inserts)

Design

Kooltherm™ FM 80 kg/m³ High-Density is CFC/HCFC-free rigid phenolic insulation with zero Ozone Depletion Potential (ODP). It has an open cell structure but, because of its high density, it is resistant to moisture penetration and is non-wicking. It has been developed to provide optimum performance with regards to insulation efficiency, fire resistance, low smoke emission, compressive strength, environment, health, safety and cost.

Kooltherm™ FM High-Density 80 kg/m³ rigid phenolic insulation is easily fabricated on site when required.

Application

Kooltherm™ FM High-Density 80 kg/m³ rigid phenolic insulation is recommended for insulated pipe support inserts and may be used to support mild steel, stainless steel, copper and plastic pipework operating within the temperature range of -50°C to +110°C.

Kooltherm™ FM High-Density 80 kg/m³ rigid phenolic insulation designed to be used in pipe hanger brackets and will support the maximum static compressive loads imposed by horizontal water filled mild steel pipework. It is not however, designed to accommodate pipe anchor loads and stresses.

The availability of Kooltherm™ FM High-Density 80 kg/m³ rigid phenolic insulation in sizes and thicknesses that are compatible with standard pipe sizes and insulation thicknesses means that the specified thickness of insulation can be maintained at the pipe support inserts. This facilitates the installation of a continuous and fully sealed vapour barrier, which is particularly important on cold and chilled pipework. Kooltherm™ FM High-Density 80 kg/m³ rigid phenolic insulation is manufactured under a quality control system approved to BS EN ISO 9001: 2000 (Quality management systems. Requirements).

Availability

Kooltherm™ FM High-Density 80 kg/m³ rigid phenolic insulation is available in the following form as standard: insulated pipe support inserts.

General Physical Properties

Property	Test Method	Typical Value
Nominal Density	(ASTM D 1622)	80 kg/m ³
Thermal Conductivity at +10°C Mean Temp	(ASTM C 518)	0.036 W/m·K
Colour		Grey
Compressive Strength at +23°C	(ASTM D 1621)	Minimum 340 kPa
Operating Temperature Limits	Upper Limit Lower Limit	+110°C - 50°C

Fire Test Classifications

Kooltherm™ FM rigid phenolic insulation will achieve the results given below which enables it to be classified by the Building Regulations as being Class 0 and Low Risk by the Building Standards in Scotland.

Property	Test Method	Typical Result
Reaction to Fire	EN 13501-1	B _L – s1, d0
Surface Burning Characteristics	ASTM E 84	Class A/1
Fire Propagation	BS 476-6	Index of performance (I) not exceeding 12 and sub index (i _t) not exceeding 6
Flame Spread	BS 476-7	Class 1*

* These test results combined enable a Class 0 classification to the Building Regulations in England & Wales, Northern Ireland and the Republic of Ireland, and a Low Risk classification to the Building Standards in Scotland.

Project Specification

Appendix A3 – Kooltherm™ FM High Density 120 kg/m³ Rigid Phenolic Insulation (Insulated pipe support inserts)

Description

Kooltherm™ FM High-Density 120 kg/m³ is CFC/HCFC-free rigid phenolic insulation with zero Ozone Depletion Potential (ODP). It has an open cell structure but, because of its high density, it is resistant to moisture penetration and is non-wicking. It has been developed to provide optimum performance with regards to insulation efficiency, fire resistance, low smoke emission, compressive strength, environment, health, safety and cost. Kooltherm™ FM High-Density 120 kg/m³ rigid phenolic insulation is easily fabricated on site when required.

Application

Kooltherm™ FM High-Density 120 kg/m³ rigid phenolic insulation is recommended for insulated pipe support inserts and may be used to support mild steel, stainless steel, copper and plastic pipework operating within the temperature range of -50°C to +110°C.

Kooltherm™ FM High-Density 120 kg/m³ rigid phenolic insulation rigid phenolic insulation is designed to be used in pipe hanger brackets and will support the maximum static compressive loads imposed by horizontal water filled mild steel pipework. It is not however, designed to accommodate pipe anchor loads and stresses.

The availability of Kooltherm™ FM High-Density 120 kg/m³ rigid phenolic insulation in sizes and thicknesses that are compatible with standard pipe sizes and insulation thicknesses means that the specified thickness of insulation can be maintained at the pipe support inserts. This facilitates the installation of a continuous and fully sealed vapour barrier, which is particularly important on cold and chilled pipework. Kooltherm™ FM High-Density 120 kg/m³ rigid phenolic insulation is manufactured under a quality control system approved to BS EN ISO 9001: 2000 (Quality management systems. Requirements).

Availability

Kooltherm™ FM High-Density 120 kg/m³ rigid phenolic insulation is available in the following form as standard:

- insulated pipe support inserts.

General Physical Properties

Property	Test Method	Typical Value
Nominal Density	(ASTM D 1622)	120 kg/m ³
Thermal Conductivity at +10°C Mean Temp	(ASTM C 518)	0.045 W/m·K
Colour		Grey
Compressive Strength at +23°C	(ASTM D 1621)	Minimum 800 kPa
Operating Temperature Limits	Upper Limit Lower Limit	+110°C - 50°C

Fire Test Classifications

Kooltherm™ FM rigid phenolic insulation will achieve the results given below which enables it to be classified by the Building Regulations as being Class 0 and Low Risk by the Building Standards in Scotland.

Property	Test Method	Typical Result
Reaction to Fire	EN 13501-1	B _L - s1, d0
Surface Burning Characteristics	ASTM E 84	Class A/1
Fire Propagation	BS 476-6	Index of performance (I) not exceeding 12 and sub index (i _f) not exceeding 6
Flame Spread	BS 476-7	Class 1*

* These test results combined enable a Class 0 classification to the Building Regulations in England & Wales, Northern Ireland and the Republic of Ireland, and a Low Risk classification to the Building Standards in Scotland.

Appendix A4 – Aluminium Foil Vapour Barrier Jacket (Glass fibre reinforced aluminium foil)

Description

An extremely durable and puncture resistant aluminium foil laminate with a 5 mm x 5 mm glass scrim and a LDPE surface coating. It is used as a factory applied, fully adhered vapour barrier jacket on Kooltherm™ FM Pipe Insulation and Kooltherm™ Insulated Pipe Support Inserts. Aluminium Foil Vapour Barrier Jacket is manufactured under a quality control system approved to BS EN ISO 9001: 2000 (Quality management systems. Requirements).

Application

Aluminium Foil Vapour Barrier Jacket is used as a covering to prevent the ingress of moisture, dust and dirt into the insulation that it covers.

General Physical Properties (Vapour Barrier Jacket)

Property	Test Method	Unit	Typical Value
Weight	(EN ISO 536)	g/m ²	75 – 100
Thickness	(EDANA)	µm	310+ / –100
Tensile Strength MD/CD	*EN 12311–2)	N/15 mm	> 30 / > 50
Water Vapour Transmission	(ASTM F 1249)	g/m ² .24 h (ASTM E 96)	< 0.1 g/m ² .24 h 0.01

Fire Test Classifications

The Aluminium Foil Vapour Barrier Jacket bonded to Kooltherm™ FM Pipe Insulation and Kooltherm™ Insulated Pipe Support Inserts, will achieve the results given above which enables it to be classified by the Building Regulations as being Class 0 and Low Risk by the Building Standards in Scotland.

Fire Test	Test Method	Result
Fire Propagation	BS 476-6: 1989	Index of performance (I) not exceeding 12 and sub index (i _r) not exceeding 6
Surface Spread of Flame	BS 476-7: 1997	Class 1

Project Specification

Appendix A5

Kingspan Kooltherm™ FM Duct Insulation

CFC/HCFC -free rigid phenolic insulation boards with zero Ozone Depletion Potential (ODP) for the insulation of heat exchangers, cylinders and buffer tanks up to 80°C and internal and external water storage tanks

Refer to:

Kingspan Insulation Ltd

Pembridge, Leominster, Herefordshire HR6 9LA

Tel: +44 (0) 1544 388 601

www.kingspaninsulation.co.uk

Appendix A6

Idenden ET-10

Protective coating

Refer to:

Bostik Ltd

Common Road, Stafford, Staffs ST16 3EH

Tel: +44 (0) 1785 272 727

www.evode.co.uk

Appendix A7

Idenden ET-150

Coating

Refer to:

Bostik Ltd

Common Road, Stafford, Staffs ST16 3EH

Tel: +44 (0) 1785 272 727

www.evode.co.uk

Appendix A8

No.10 Glass Cloth

Open weave glass fibre reinforcing membrane for mastics, coatings and vapour sealants

Refer to:

Local insulation distributor

Appendix A9

Fosters 95-44

Moisture resistant sealant

Refer to:

Temati (UK) Ltd

Lowmoor Road, Kirkby in Ashfield, Nottingham NG17 7BE

Tel: +44 (0) 1623 636 169

www.fostereurope.com

Appendix A10

Idenden 30-150

Vapour barrier coating

Refer to:

Bostik Ltd

Common Road, Stafford, Staffs ST16 3EH

Tel: +44 (0) 1785 272 727

www.evode.co.uk

Appendix A11

Fosters 95-44

Solvent based weatherproof mastic

Refer to:

Temati (UK) Ltd

Lowmoor Road, Kirkby in Ashfield, Nottingham NG17 7BE

Tel: +44 (0) 1623 636 169

www.fostereurope.com

Appendix A12

130 kg/m³ minimum density mineral fibre pipe sections

Refer to:

Local mineral fibre manufacturer

Appendix A13

75 mm, 33 kg/m³ lamella mineral fibre slabs

Refer to:

Local mineral fibre manufacturer

Appendix A14

Calcium silicate pipe sections

Refer to:

Local calcium silicate manufacturer

Appendix B - Thickness Tables to the TIMSA Guide & BS 5422: 2009

Steel Pipe Size			Water at 60°C			Water at 75°C		
NB (inches)	NB (mm)	OD (mm)	Kooltherm™ FM max. heat loss			Kooltherm™ FM max. heat loss		
			ε=0.05 silver	ε=0.9 black	(W/m)	ε=0.05 silver	ε=0.9 black	(W/m)
3/8	10	17.2	15	15	6.60	15	15	8.90
1/2	15	21.3	15	20	7.13	15	20	9.28
3/4	20	26.9	15	20	7.83	20	20	10.06
1	25	33.7	20	20	8.62	20	20	11.07
1 1/4	32	42.4	20	20	9.72	20	25	12.30
1 1/2	40	48.3	20	25	10.21	25	25	12.94
2	50	60.3	20	25	11.57	25	25	14.45
2 1/2	65	76.1	25	25	13.09	25	30	16.35
3	80	88.9	25	25	14.58	25	30	17.91
4	100	114.3	25	30	17.20	30	30	20.77
5	125	139.7	25	30	19.65	30	35	23.71
6	150	168.3	25	30	22.31	30	35	26.89
8	200	219.1	30	30	27.52	30	35	32.54
10	250	273.0	30	30	32.40	35	35	38.83

Estimated Mean Temperature of Insulation: +50°C
Ambient Air Temperature: +15°C
Surface Emissivity ε (Outer Surface): 0.05 / 0.9
Assumed Thermal Conductivity (k-value) of Kooltherm™ FM 37kg/m³ Insulation: 0.025 W/m·K

Table 1: Indicative Thickness (mm) of Insulation for Non-Domestic Hot Water (60°C) and Low Temperature Heating Service Areas (75°C) to Control Heat Loss

(Based on Non-domestic Building Services Compliance Guide: 2013 Edition, Section 11; TIMSA HVAC Guide Sections 6.2.1 & 6.2.2; and BS 5422:2009 Tables 15 & 18)

Project Specification

Appendix B - Insulation Thickness Table to Control Heat Loss: ECA & Y50 Enhanced

Steel Pipe Size			Water at 60°C			Water at 75°C		
NB (inches)	NB (mm)	OD (mm)	Kooltherm™ FM max. heat loss			Kooltherm™ FM max. heat loss		
			ε=0.05 silver	ε=0.9 black	(W/m)	ε=0.05 silver	ε=0.9 black	(W/m)
3/8	10	17.2	15	20	6.04	20	20	7.78
1/2	15	21.3	20	20	6.45	20	20	8.42
3/4	20	26.9	20	25	7.00	20	25	9.05
1	25	33.7	25	25	7.71	25	25	9.86
1 1/4	32	42.4	25	25	8.46	25	30	10.83
1 1/2	40	48.3	25	30	9.01	30	30	11.42
2	50	60.3	30	30	9.94	30	35	12.61
2 1/2	65	76.1	30	30	11.25	35	35	14.12
3	80	88.9	30	35	12.17	35	35	15.28
4	100	114.3	35	35	14.29	35	40	17.51
5	125	139.7	35	40	16.09	40	40	19.72
6	150	168.3	35	40	18.24	40	45	22.34
8	200	219.1	35	40	22.06	40	45	26.61
10	250	273.0	40	40	25.95	45	50	30.91

Estimated Mean Temperature of Insulation:	+50°C
Ambient Air Temperature:	+15°C
Surface Emissivity ε (Outer Surface):	0.05 / 0.9
Assumed Thermal Conductivity (k-value) of Kooltherm™ FM 37kg/m³ Insulation:	0.025 W/m·K

Table 2: Indicative Thickness (mm) of Insulation for Non-Domestic Hot Water (60°C) and Low Temperature Heating Service Areas (75°C) to Control Heat Loss

(Based on NES Y50 Enhanced and Enhanced Capital Allowance thickness tables)

Appendix B - Thickness Table to Control Heat Gain & Control Condensation

Steel Pipe Size			Water at 0°C			Water at 5°C			Water at 10°C		
			Kooltherm™ FM		max heat gain	Kooltherm™ FM		max heat gain	Kooltherm™ FM		max heat gain
NB (inches)	NB (mm)	OD (mm)	ε=0.05 silver	ε=0.9 black	(W/m)	ε=0.05 silver	ε=0.9 black	(W/m)	ε=0.05 silver	ε=0.9 black	(W/m)
3/8	10	17.2	25	20	3.45	20	15	2.97	15	15	2.48
1/2	15	21.3	25	20	3.81	20	15	3.27	15	15	2.72
3/4	20	26.9	25	20	4.18	20	20	3.58	15	15	3.05
1	25	33.7	30	20	4.60	25	20	4.01	20	15	3.41
1 1/4	32	42.4	30	25	5.11	25	20	4.53	20	15	3.86
1 1/2	40	48.3	30	25	5.45	25	20	4.82	20	20	4.11
2	50	60.3	35	25	6.17	25	25	5.48	20	20	4.78
2 1/2	65	76.1	35	30	6.70	30	25	6.30	20	20	5.51
3	80	88.9	40	30	7.77	30	25	6.90	20	20	6.17
4	100	114.3	40	30	9.15	35	25	8.31	25	20	7.28
5	125	139.7	45	30	10.45	35	25	9.49	25	20	8.52
6	150	168.3	45	30	11.86	35	25	10.97	25	20	9.89
8	200	219.1	50	35	14.61	40	30	13.57	30	20	12.27
10	250	273.0	50	35	17.48	40	30	16.28	30	25	14.74
12	300	323.9	55	35	17.48*	40	30	16.28*	30	25	14.74*
14	350	355.6	55	35	17.48*	45	30	16.28*	30	25	14.74*
16	400	406.4	55	35	17.48*	45	30	16.28*	30	25	14.74*
18	450	457.0	60	35	17.48*	45	30	16.28*	35	25	14.74*
20	500	508.0	60	35	17.48*	45	30	16.28*	35	25	14.74*
24	600	610.0	65	35	17.48*	50	30	16.28*	35	25	14.74*

Ambient Air Temperature: +25°C
Relative Humidity: 80%
Surface Emissivity ε (Outer Surface): 0.05 / 0.9
Assumed Thermal Conductivity (k-value) of Kooltherm™ FM 37kg/m³ Insulation: 0.025 W/m·K

Table 3: Indicative Thickness (mm) of Insulation required for cold and chilled water supplies to control heat gain and control condensation

*For pipes and vessels of diameter greater than 273mm, the items shall be assumed to be 273mm for calculation purposes

(Based on Non-domestic Building Services Compliance Guide: 2013 Edition, Section 11; TIMSA HVAC Guide Sections 6.2.3 & 7.2; and BS 5422:2009, Tables 6, 8, 10 & 11)

Project Specification

Appendix B - Insulation Thickness Table to Protect Against Freezing

NB (inches)	Steel Pipe Size			Pipe Location	
	NB (mm)	OD (mm)	ID (mm)	Indoor	Outdoor
½	15	21.3	16.0	30	75
¾	20	26.9	21.6	15	30
1	25	33.7	27.2	15	20
1¼	32	42.4	35.9	15	15
1½	40	48.3	41.8	15	15
2	50	60.3	53.0	15	15
2½	65	76.1	68.8	15	15
3	80	88.9	80.8	15	15

NB (mm)	Copper Pipe Size		Pipe Location	
	NB (mm)	ID (mm)	Indoor	Outdoor
15		13.6	35	130
22		20.2	15	20
28		26.2	15	20
35		32.6	15	15
42		39.6	15	15
54		51.6	15	15
76.1		73.1	15	15
108		105.0	15	15

<i>Ambient Air Temperature – Indoor:</i>	-6°C
<i>Ambient Air Temperature – Outdoor:</i>	-10°C
<i>Initial Water Temperature:</i>	+2°C
<i>Evaluation Period:</i>	12 hours
<i>Permitted Ice Formation:</i>	50%
<i>Assumed Thermal Conductivity (k-value) of Insulation:</i> <i>Kooltherm™ FM</i>	0.025 W/m·K

Table 4: Minimum Thickness (mm) of Insulation required to give protection against freezing under specified commercial and institutional conditions
(based on BS 5422:2009 Table 29)

Appendix C – Kooltherm™ Insulated Pipe Support Inserts – Design Data

Kooltherm™ FM Insulated Pipe Support Inserts (App. E: Figure E4) are available to suit a full range of pipe diameters and in a full range of insulation thicknesses as shown in the following table, however, special sizes are available on request. Load bearing calculations for the standard range of Kooltherm™ Insulated Pipe Support Inserts are based on the minimum compressive strength of the relevant density of rigid phenolic insulation (i.e. perpendicular to rise) and include a safety factor of

five. They are designed to support the maximum static compressive loads imposed by horizontal water filled mild steel (BS 1387: 1985 (1990) - heavy grade) and copper pipework with hanger supports spaced at the maximum centres shown below.

Kooltherm™ Insulated Pipe Support Inserts are not designed to accommodate pipe anchor loads and stresses. For pipework supported on roller supports the modified design, which is shown in App. E: Figure E5, should be used.

Steel Pipe

Steel Pipe Size			Kooltherm™ Insulated Pipe Support Inserts				
DN (in)	DN (mm)	OD (mm)	Length (mm)	Max. Load (kg)	Spreader Plate (mm)	Support Distance (m)	Density (kg/m ³)
1/2	15	21.3	99	12	none	3	60
3/4	20	26.9	99	15	none	3	60
1	25	33.7	99	19	none	3	60
1 1/4	32	42.4	99	23	none	3	60
1 1/2	40	48.3	99	27	1.0	4	60
2	50	60.3	99	33	1.0	4	60
2 1/2	65	76.1	99	62	1.0	4	80
3	80	88.9	99	73	1.0	4	80
4	100	114.3	99	94	1.0	4	80
5	125	139.7	99	115	1.0	6	80
6	150	168.3	124	410	1.5	6	120
8	200	219.1	124	534	1.5	6	120
10	250	273.0	124	666	1.5	6	120
12	300	323.9	200	1265	2.0	4	120
14	350	355.6	200	1389	2.0	4	120
16	400	406.4	200	1585	2.0	4	120
18	450	457.0	200	1784	2.0	4	120

Values given are based upon Kooltherm™ insulated pipe support inserts with an integral metal spreader plate.

Copper Pipe

Steel Pipe Size			Kooltherm™ Insulated Pipe Support Inserts				
DN (in)	DN (mm)	OD (mm)	Length (mm)	Max. Load (kg)	Spreader Plate (mm)	Support Distance (m)	Density (kg/m ³)
–	–	15	99	9	none	3	60
–	–	22	99	12	none	3	60
–	–	28	99	15	none	3	60
–	–	35	99	19	none	3	60
–	–	42	99	23	none	3	60
–	–	54	99	30	1.0	4	60
–	–	67	99	45	1.0	4	60
–	–	76	99	62	1.0	4	80

Values given are based upon Kooltherm™ insulated pipe support inserts with an integral metal spreader plate.

Project Specification

Appendix D – Installation / Finishing Details

- E1 Application of Kooltherm™ FM Pipe Insulation
- E2 Additional Finishes Available for Protection of Kooltherm™ FM Pipe Insulation
- E3 Kooltherm™ FM Preformed Bends are Available as an Alternative to Mitred Sections
- E4 Kooltherm™ Insulated Pipe Support Inserts
- E5 Kooltherm™ Insulated Pipe Support Inserts – Special Design for Point Loads

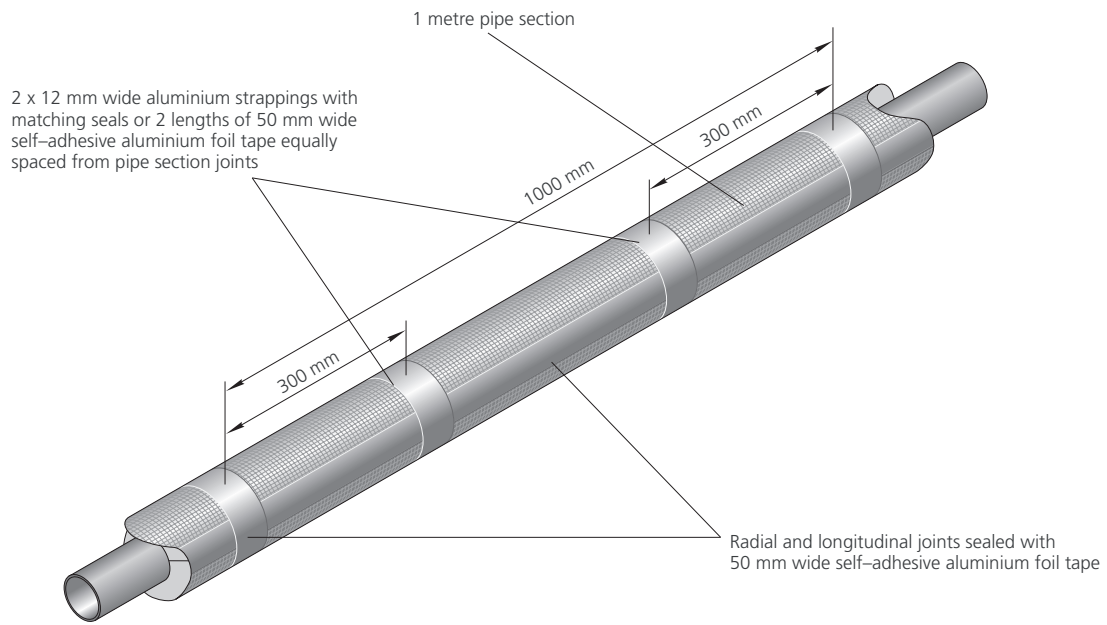
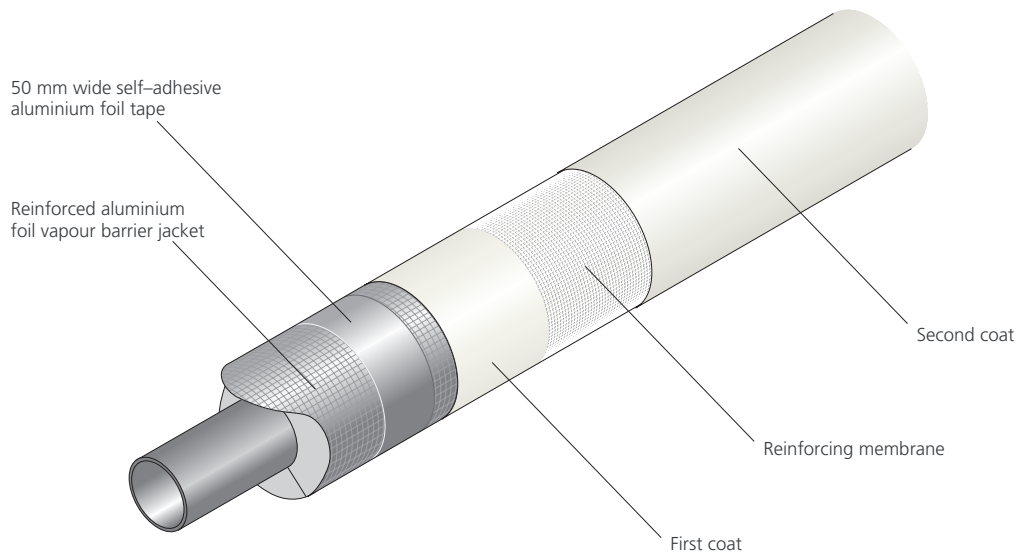


Figure E1: Application of Kooltherm™ FM Pipe Insulation



	First Coat	Membrane	Second Coat
Internal & Exposed to View see Specification section 6.2	No coat under canvas	Canvas	Two coats of Idenden ET-10
Internal in Plant Rooms or Boiler Houses see Specification section 6.3	Idenden ET-150 Coating or fabricated sheet aluminium casings 0.6 mm thick on pipework up to and including 150 mm and 0.8 mm thick on pipework over 150 mm diameter	No.10 Glass Cloth	Idenden ET-150 Coating
External (Weather Protection) see Specification section 6.4	Idenden 30-150 Coating or 0.8 mm (min) polyisobutylene sheeting with minimum 30 mm wide circumferential and longitudinal lap joints fully solvent welded	No.10 Glass Cloth	Idenden 30-150 Coating or Foster 60-75*

**in damp or low temperature conditions*

Figure E2: Additional Finishes Available for Protection of Kooltherm™ FM Pipe Insulation

Project Specification

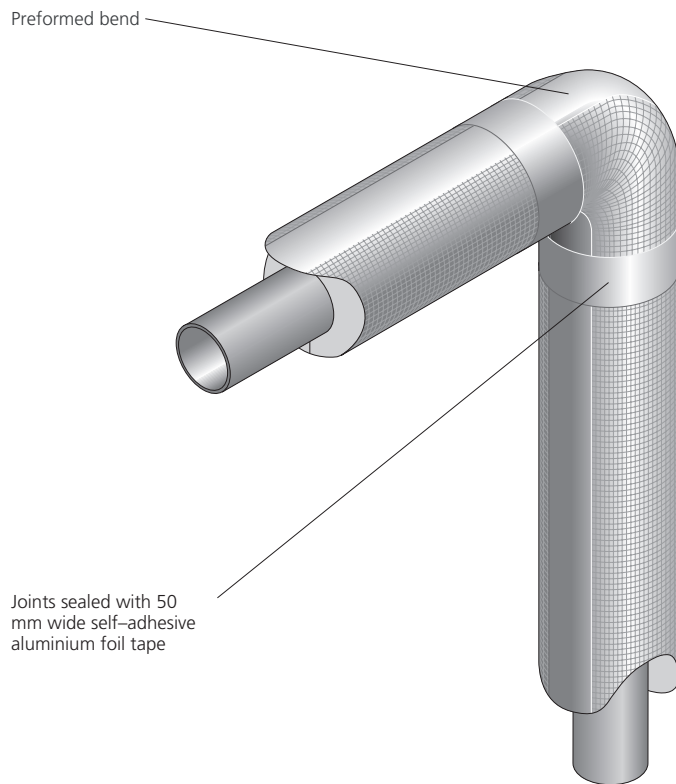


Figure E3: Kooltherm™ FM Preformed Bends are available as an Alternative to Mitred Sections

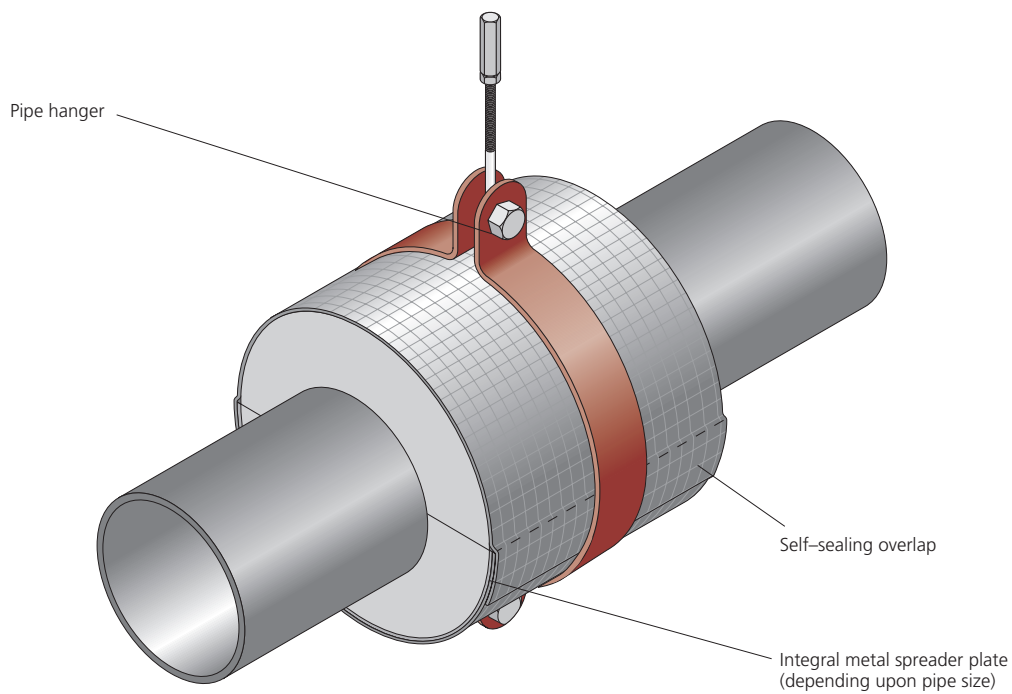
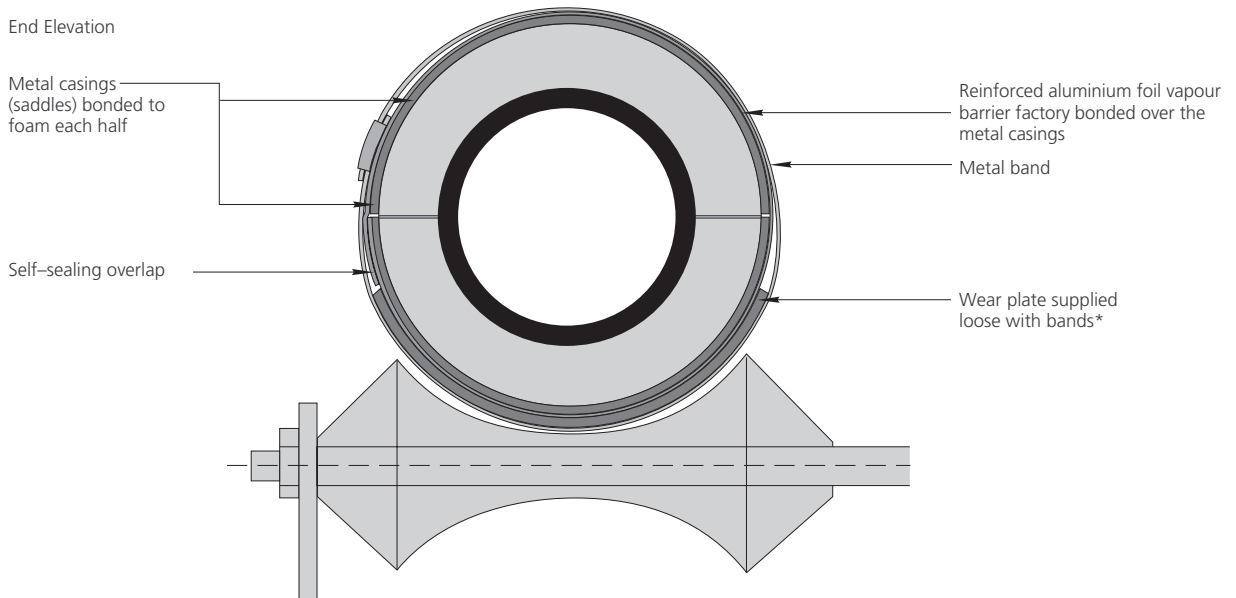
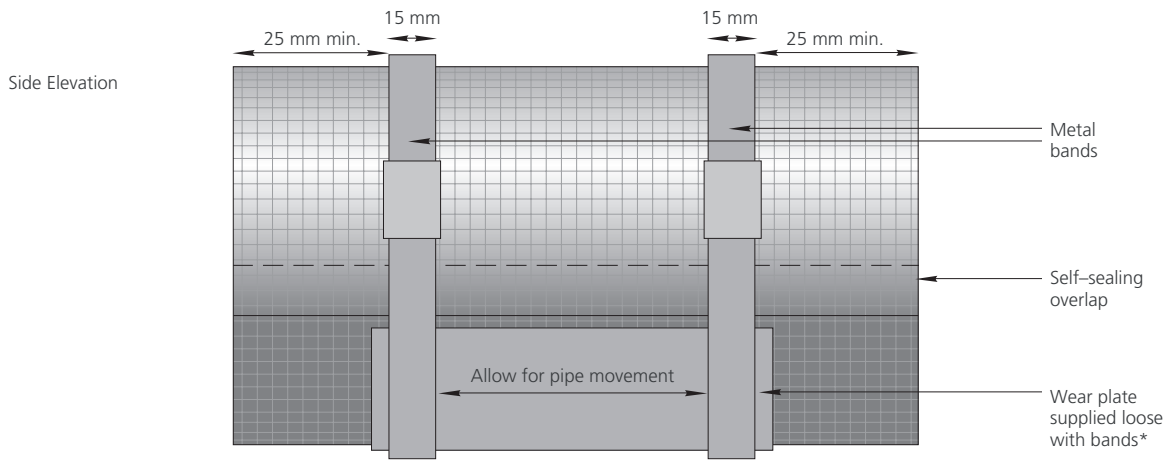


Figure E4: Kooltherm™ Insulated Pipe Support Inserts



**not supplied by Kingspan Tarec Industrial Insulation Ltd.*

Figure E5: Kooltherm™ Insulated Pipe Support Inserts – Special Design for Point Loads



UK, Ireland & Gibraltar

Kingspan Industrial Insulation Ltd

Pembridge, Leominster, Herefordshire, HR6 9LA, United Kingdom
General Enquiries Tel: +44 (0) 1544 388 601
Technical Advice Tel: 0808 168 7363 or +44 (0) 1457 890534

Australasia, Oceania and SE Asia as far west and north as,
and including, Myanmar, China, Mongolia, Japan

Kingspan Insulation Pty Ltd

266 Beringarra Ave, Malaga, WA 6090, Australia
Tel: 1300 247 235 (for calls within Australia only)
Tel: +61 8 6240 6200 (for calls outside of Australia)

The rest of Europe (excluding Turkey, Malta & Cyprus)
and Russia

Kingspan Insulation N.V.

Visbeekstraat 24
B - 2300 Turnhout, Belgium
Tel: +32 14 44 25 25

Everywhere else excluding Canada, USA, Mexico, Bermuda,
the Cayman Islands, Puerto Rico & St Pierre and Miquelon

PAL Middle East PIR LLC

P.O. Box 113826, Dubai Investment Park 2, Dubai, U.A.E.
Tel: +971 4 889 1000



www.kingspaninsulation.com



™ Kingspan, Kooltherm and the Lion Device are Trademarks of the Kingspan Group plc.

Kingspan reserves the right to amend product specifications without prior notice. All 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 offers a free Technical Advisory Service the advice of which should be sought for uses of Kingspan products that are not specifically described herein. Please check that your copy of the literature is current by contacting the Marketing Department.

Published May 2015