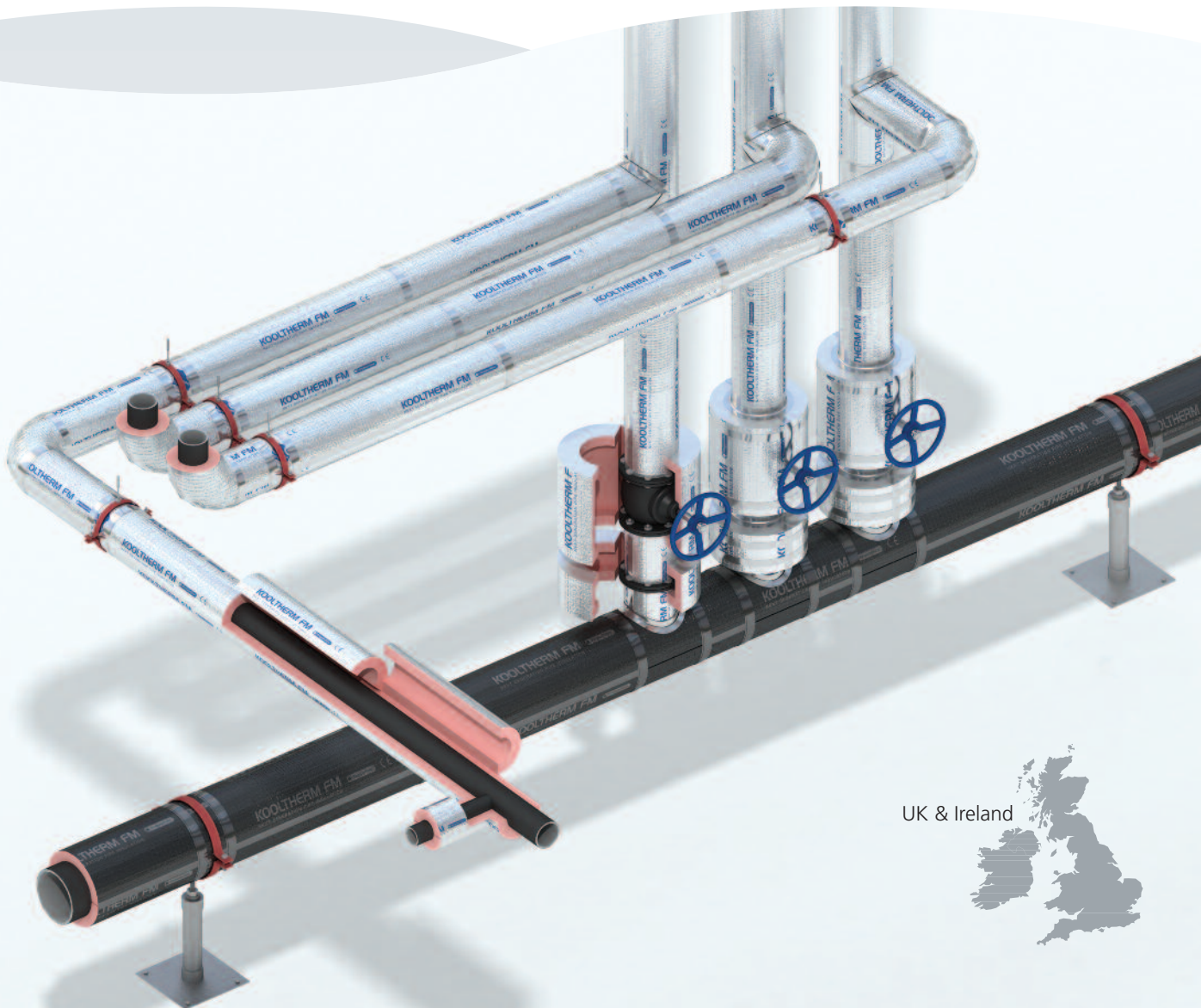


Kooltherm[®] FM

Quick Guide

HVAC & Building Services Pipe Insulation



UK & Ireland



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Kingspan Tarec® Industrial Insulation

Kingspan Tarec® Industrial Insulation are market leading manufacturers of premium performance pipe insulation products and systems.

Kingspan Tarec® premium performance insulation products are the thinnest and most efficient products commonly available for the insulation of pipework in building services / HVAC, process and petrochemical applications and refrigeration services. With over 35 years' experience in these sectors, Kingspan Tarec® provides its customers with manufacturing excellence, technical expertise and state of the art technologies.



Kooltherm® FM Pipe Insulation

Kooltherm® FM

HVAC & Building Services Pipe Insulation

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

Kooltherm® FM Pipe Insulation is CE Marked in accordance with BS EN 14314.

Kooltherm® FM Pipe Insulation is available in a range of thicknesses to suit different performance specifications and may be used on mild steel, stainless steel, carbon steel, copper and plastic pipework in standard and non-standard pipe diameters.

Kooltherm® FM Pipe Insulation is manufactured using state of the art continuous and slotted board technologies. Both methods feature the use of a unique bore coated liner and minimise production wastage.

Kooltherm® FM Pipe Insulation manufactured on the continuous process is supplied in 1 metre lengths and pipe insulation manufactured from slotted board is supplied in 1.165 metre lengths.

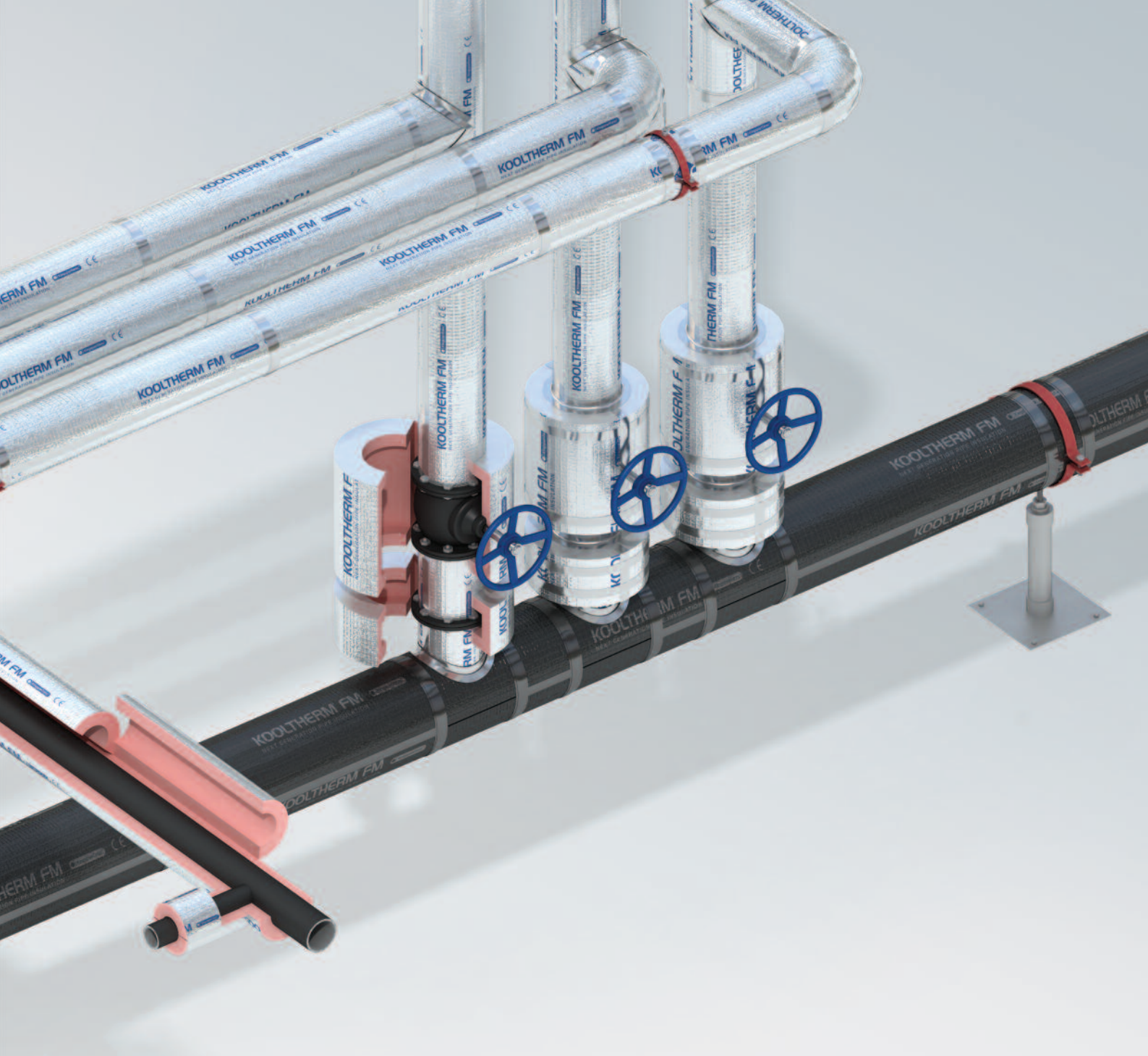
Kooltherm® FM Pipe insulation is available in a standard density of 37 kg/m³.

Higher density pipe insulation sections and insulated pipe supports fabricated from 60 kg/m³, 80 kg/m³ and 120 Kg/m³ densities are also available.

Kooltherm® Insulated Pipe Support System

Kooltherm® Insulated Pipe Support Inserts provide optimal load bearing capacity whilst offering protection against insulation compression. Designed for use in pipe supports, hanger brackets and clamps, they will support the compressive loads imposed by horizontal pipework carrying water or other liquids.





Vapour Barrier Jacket

All Kooldtherm® FM Pipe insulation products and systems are faced, as standard, with an extremely durable and protective low vapour permeability aluminium foil or theatre black vapour barrier jacket reinforced with a glass scrim.

The vapour barrier jacket is factory-applied to avoid onsite application, which carries the risk of vapour barrier damage and with it, a risk to the integrity of the system. This also reduces the labour cost for installation of the Kooldtherm® FM Pipe Insulation System.

A matching self-adhesive tape is available to complete the vapour barrier at joints and breaks.

Features & Benefits

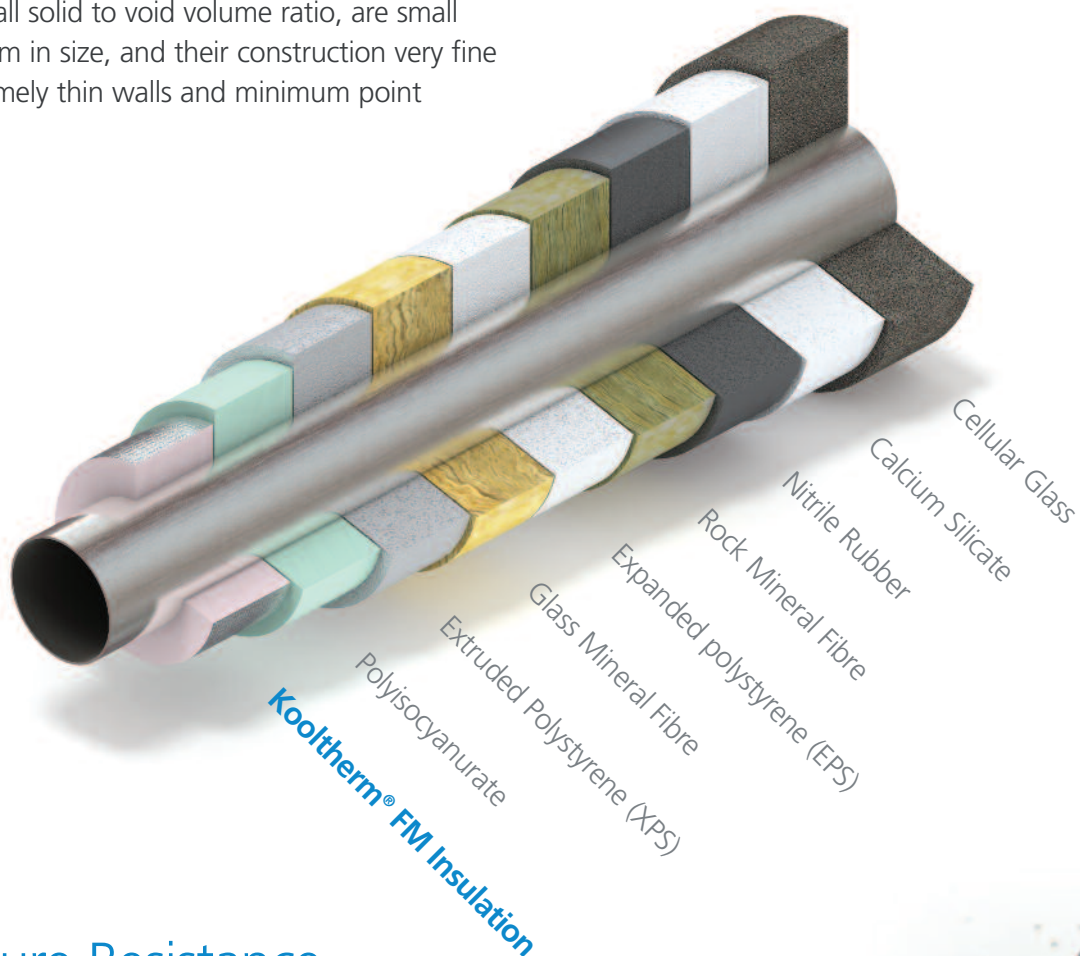
Thermal Performance

With a thermal conductivity as low as 0.025 W/m·K (at 10°C mean), Kooltherm® FM Insulation is the most thermally efficient insulation material commonly used. A low thermal conductivity allows specified thermal performance standards to be achieved with thinner insulation.

The superior thermal performance of Kooltherm® FM Insulation derives mainly from its closed cell properties. Its closed cell structure has been optimised to resist heat transfer. The closed cells have a small solid to void volume ratio, are small and uniform in size, and their construction very fine with extremely thin walls and minimum point

contacts (struts). They are filled with a thermally efficient CFC/HCFC-free blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

As a result of its closed cell structure, Kooltherm® FM Insulation is unaffected by air infiltration – problems that can be experienced with mineral fibre and which can reduce thermal performance.



Moisture Resistance

Kooltherm® FM Insulation has a 90% (or greater) closed cell structure, which makes it non-wicking and highly resistant to moisture penetration. The risk of moisture absorption into the insulation is effectively eliminated as the factory-applied facing to Kooltherm® FM Pipe Insulation products and systems provides a high performance vapour barrier jacket.



Fire

Kooltherm® FM Pipe Insulation products and systems have a densely cross-linked structure that makes them difficult to ignite and when subjected to fire, the outer surface forms a strong carbonaceous layer that limits heat generation and retards further flame spread.

The excellent fire and smoke performance characteristics of Kooltherm® FM Pipe Insulation products and systems clearly demonstrates their suitability for the designated application, with best in class European Reaction to Fire performance of BL,s1,d0.

Kooltherm® FM Pipe Insulation is FM Approved per Approval Standard Class 4924.



Fire Test Classifications (Kooltherm® FM Insulation)

Property	Test Method	Typical Result
Reaction to fire	EN 13501-1	Bl - 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.

Environmental

Kooltherm® FM Pipe Insulation products and systems are based on award winning patented technology. They are CFC/HCFC-free non-fibrous, premium performance rigid thermoset modified resin insulants manufactured with a blowing agent that has zero Ozone Depletion Potential (ODP) and low Global Warming Potential (GWP).

Details of compliance with BREEAM can be found at: www.kingspanTarec.com/environmental.htm



Manufactured to
BS EN ISO 9001: 2008
Certificate No. 935626/1



Manufactured to
BS EN ISO 9001: 2008
Certificate No. 388-2QMS
BS EN ISO 14001: 2004
Certificate No. 388-2EMS
BS OHSAS 18001:2007
Certificate No. 388-2HS



Recommended Thickness

Insulation Thickness Table to Control Heat Loss: BS 5422:2009

Steel Pipe Size			Water at 60°C			Water at 75°C		
			Kooltherm® FM max. heat loss			Kooltherm® FM max. heat loss		
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)
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/m ³ 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)

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

Steel Pipe Size			Water at 60°C			Water at 75°C		
			Kooltherm [®] FM max. heat loss			Kooltherm [®] FM max. heat loss		
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)
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	25	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

<i>Estimated Mean Temperature of Insulation:</i>	+50°C
<i>Ambient Air Temperature:</i>	+15°C
<i>Surface Emissivity ε (Outer Surface):</i>	0.05 / 0.9
<i>Assumed Thermal Conductivity (k-value) of Kooltherm[®] FM 37kg/m³ Insulation:</i>	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)

Recommended Thickness

Insulation Thickness Table to Control Heat Gain & Control Condensation

Steel Pipe Size			Water at 0°C			Water at 5°C			Water at 10°C		
			max		Kooltherm® FM heat gain (W/m)	max		Kooltherm® FM heat gain (W/m)	max		Kooltherm® FM heat gain (W/m)
NB (inches)	NB (mm)	OD (mm)	ε=0.05 silver	ε=0.9 black		ε=0.05 silver	ε=0.9 black		ε=0.05 silver	ε=0.9 black	
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)

Insulation Thickness Table to Protect Against Freezing

Steel Pipe Size				Pipe Location	
NB (inches)	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

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

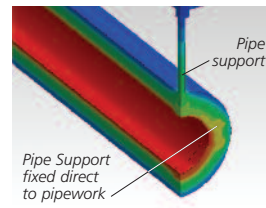
Table 4: Minimum Thickness (mm) of Insulation required to give protection against freezing under specified commercial and institutional conditions
(based on BS 5422:2009 Table 29)

Kooltherm® Insulated Pipe Support Inserts

Kooltherm® Insulated Pipe Support Inserts 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.

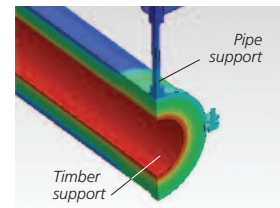
In addition to allowing a continuous vapour barrier on below ambient systems, thermal analysis of a +75°C LTHW system to EN ISO 10211:2007 has shown that Kooltherm® Insulated Pipe Support System can limit heat loss by up to 4x more than rubber lined pipe clips, 5x more than metal pipe clips and 10x more than hardwood pipe support inserts.

Conventional Pipe Support Methods



Rubber lined pipe support

Thermal analysis* illustrates heat loss of up to **4 x greater** than through the Kooltherm® Insulated Pipe Support System.



Timber support insert

Thermal analysis* illustrates significant heat loss of up to **10 x greater** than through the Kooltherm® Insulated Pipe Support System.

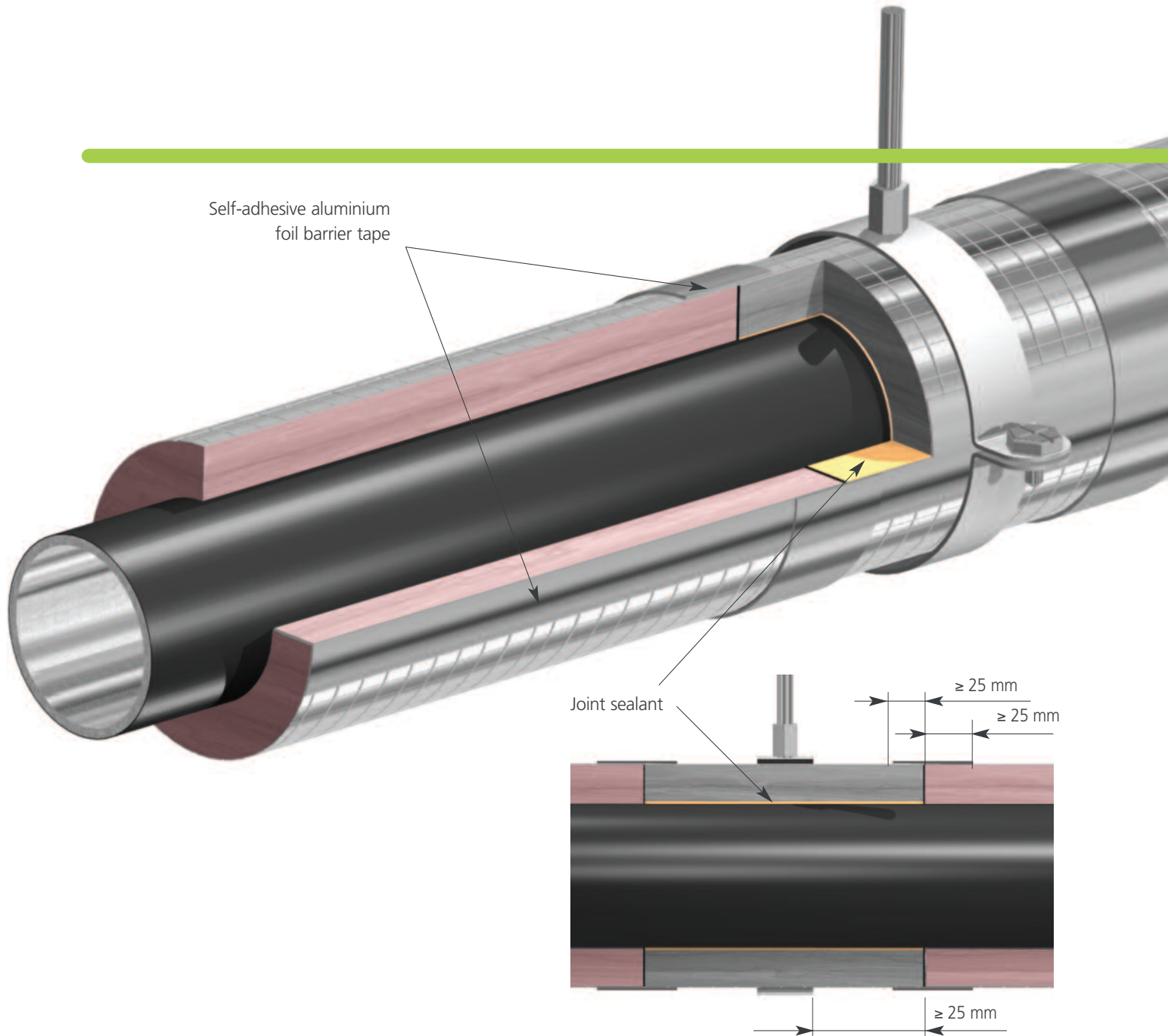
**When analysed in accordance with BS EN ISO 10211: 2007*

Load bearing calculations for the standard range of Kooltherm® Insulated Pipe Support Inserts are based upon the minimum compressive strength of the relevant density and include a safety factor of five. They are designed to support the maximum static compressive loads imposed by horizontal water filled mild steel 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.

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)
½	15	21.3	99	12	none	3	60
¾	20	26.9	99	15	none	3	60
1	25	33.7	99	19	none	3	60
1¼	32	42.4	99	23	none	3	60
1½	40	48.3	99	27	1.0	4	60
2	50	60.3	99	33	1.0	4	60
2½	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	2.0	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.

Technical Data

General Physical Properties (Kooltherm® FM Insulation System)

Property	Test Method	Unit	Typical Value			
Nominal Density	(EN ISO 845) / (ASTM D 1622)	kg/m ³	37	60	80	120
Thermal Conductivity at +10°C	(EN 12667) / (ASTM C 518)	W/m·K	0.025	0.031	0.036	0.045
Colour			Pink	Grey	Grey	Grey
Closed Cell Content	(EN ISO 4590) Method 1 / (ASTM D 2856) Method B	%	≥ 90	–	–	–
Operating Temperature: Pipe Section	Upper Limit	°C	+110	+110	+110	+110
	Lower Limit	°C	–50	–50	–50	–50
Slotted Board Pipe Section	Upper Limit	°C	+100	+100	+100	+100
	Lower Limit	°C	0	0	0	0
Minimum Compressive Strength at +23°C	(EN 826) / (ASTM D 1621)					
	Parallel	kPa	150	320	470	1000
	Perpendicular	kPa	100	170	340	800

General Physical Properties (Vapour Barrier Jacket)

Property	Test Method	Unit	Typical Value
Weight	(EN ISO 536)	g/m ²	75 – 100
Thickness	(EDANA)	µm	150 – 250
Tensile Strength MD/CD	(EN 12311–2)	N/15 mm	> 30 / > 50
Water Vapour Transmission	(ASTM F 1249)	g/m ² .24 hr	< 0.1
	(ASTM E 96)	g/m ² .24 hr	0.01

Fire Test Classifications (Kooltherm® FM Insulation)

Property	Test Method	Typical Result
Reaction to fire	EN 13501-1	B _{s1} – 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.

All KingspanTarec® cardboard packaging uses 100% recycled content and is 100% recyclable.



Kooltherm® FM Pipe Insulation is CE Marked in accordance with BS EN 14314.

Case Studies



Case Studies



Silverstone UTC



Charles de Gaulle Airport



Market Sectors





Apartments

Infrastructure

Commercial

Healthcare

Education



HIGH PERFORMANCE INSULATION

KingspanTarec® Industrial Insulation Ltd

Glossop Brook Road, Glossop, Derbyshire SK13 8GP
United Kingdom
Tel: +44 (0) 1457 890400 Fax: +44 (0) 1457 852319
E-mail: info.uk@kingspantarec.co.uk

www.KingspanTarec.com

KingspanTarec® Industrial Insulation NV

Visbeekstraat 24
B - 2300 Turnhout, Belgium
Tel: +32 14 44 25 25 Fax: +32 14 42 72 21
E-mail: info.be@kingspantarec.com

www.KingspanTarec.com

Kingspan Tarec Industrial Insulation 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 Tarec Industrial Insulation offers a free Technical Advisory Service the advice of which should be sought for uses of Kingspan Tarec Industrial Insulation products that are not specifically described herein. Please check that your copy of the literature is current by contacting the Marketing Department.