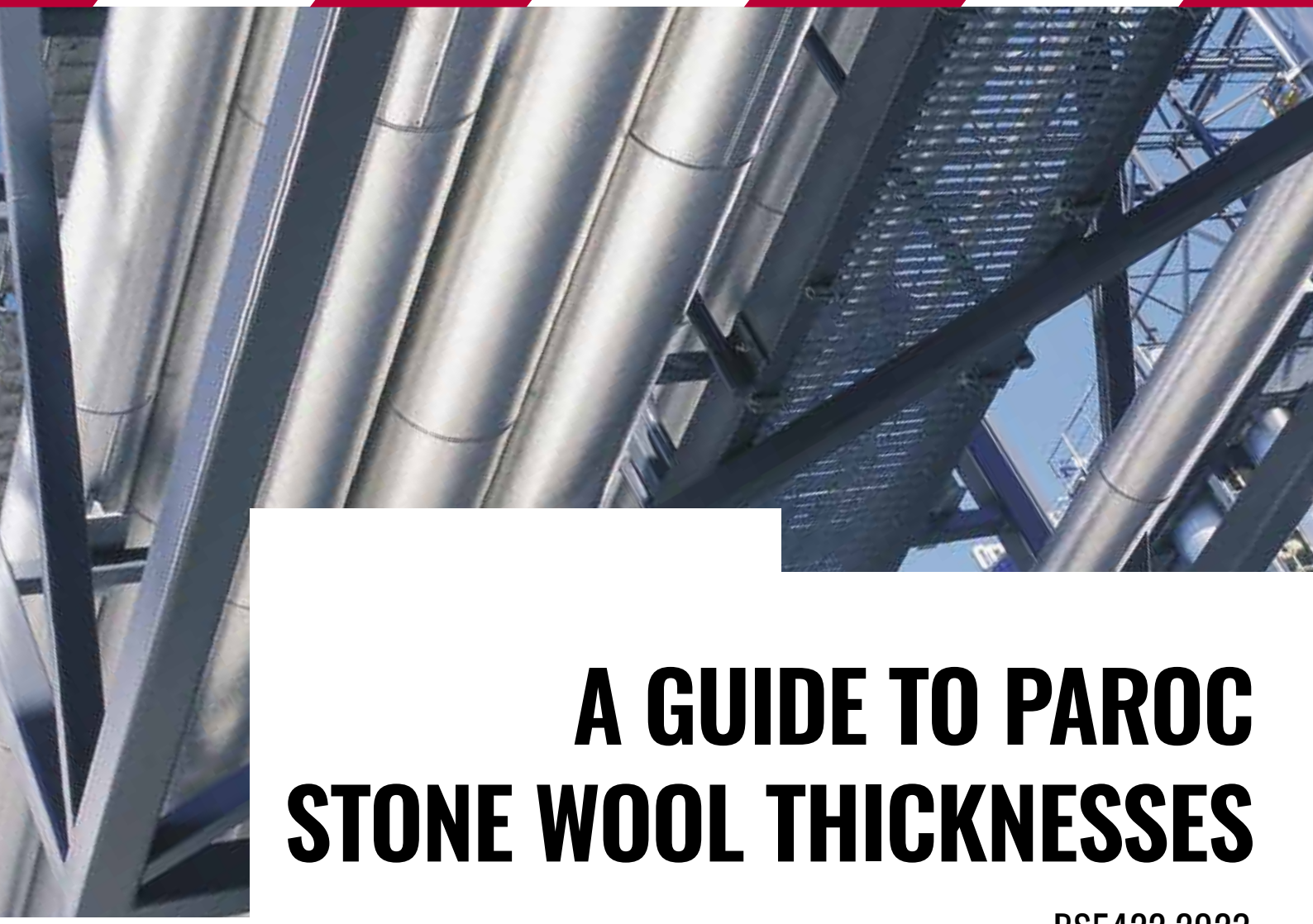

A GUIDE TO PAROC STONE WOOL THICKNESSES

BS5422:2023

OWENS CORNING® PAROC®

CONTENTS

BS5422:2023

”Thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range –40 °C to +700 °C – Method for specifying.”

BS5422:2023 was issued in 2023 to replace the previous version of the national standard issued in 2009. The latest version shows some changes to the previous. For example, tables have been revised with simplification in mind where possible. All pipe sizes are indicated on a “less than or equal to” basis, which reduces the need for interpolation, and tends to increase the overall thermal efficiency of the targeted systems. Meanwhile, some new tables have been introduced.

After a long interpretation and adoption time, the international calculation standard ISO 12241:2022 became available to use – that is to say, programmed in recognized tools such as Paroc Calculus – some time afterwards. The main change in this standard is a fundamentally different and much more complex approach to determining convection effects. This particular booklet shows the prescribed thicknesses of Paroc Stone Wool Insulation that should be used to conform to both these standards.

In this edition of BS5422, noteworthy additions are that enhanced insulation thicknesses have been captured from the legacy Energy Technology List / Capital Allowances levels. These can be found in Tables 15B, 16B, 17B, 18B, 19B and 20B.

Also, district heating tables for secondary and tertiary systems has been added in Tables 19C and 20C.

It should be recognized that BS5422 is not a prescriptive document and there may be several reasons why insulation of such equipment as described above is required. The criteria involved in any particular case may not conform exactly to those shown in the tables and specifiers should take care to interpret the information accordingly. Please refer to our “Dimensioning” guide for more information when fitting more than a single layer of pipe section insulation.

Emissivity of a Surface (ε)

The surface in question is that of the material which is used to cover the insulation at the time of installation. Some insulation products may require no additional covering in which case the surface emissivity is that of the insulation or its ”as supplied” covering (eg; aluminium foil).

Emissivity is a dimension-less number & is defined as the ratio of energy radiated from a material’s surface to that radiated from a ”black body” (a perfect emitter with ε value = 1) under the same conditions. The emissivity depends not only on the material itself but the nature of the surface (smooth or rough, clean or oxidized, if a metal – for example). It is also somewhat temperature dependent. It is necessary to have some information about surface emissivity when doing heat transfer calculations.

In general terms, typically clean metallic surfaces have low emissivity (ε) values and are lower the more polished the surface. Other surface materials – eg; cloths and plastics will typically have higher ε values.

For any particular combination of pipe size, operating temperature & ambient conditions, a low emissivity surface will result in a higher surface temperature than if a high emissivity covering was used. This difference in surface temperature can be significant. On the other hand the difference in the actual heat loss is not so dependent on the surface emissivity. It can be slightly reduced when a low emissivity surface is used but the heat loss itself is much more dependent on the thermal resistance of the insulating layer.

Surface emissivity (ε) table

Aluminium, bright	0 .05
Aluminium, oxidized	0.13
Aluminium foil, bright reinforced	0 .05
Aluminium foil, polyester faced reinforced	0 .40
Alu-zinc	0.18
Austenitic steel	0.15
Cast iron (and iron)	0 .35
Cast iron, rusted or oxidized	0 .65
Chrome, polished	0.10
Cloth	0 .90
Copper, commercial scoured to a shine	0 .07
Copper, oxidized	0 .70
Copper, polished	0 .02
Fire brick	0 .75
Galvanized steel, blank	0 .26
Galvanized steel, dusty	0 .44
Paint	0 .90
Paint, aluminium weathered	0 .55
Paint, aluminium new	0 .30
Rubber	0 .90
Steel	0 .35
Steel, black painted	0 .90
Steel, oxidized	0.80

Note 1: The above values provide a useful guide to surface emissivity. However as noted, the emissivity of a material varies with temperature and surface finish. Therefore, use the most accurate emissivity estimation available, especially when a high degree of accuracy is required.

TABLE 6
ACC. BS5422:2023

Minimum insulation thickness for chilled and cold water pipes to control condensation on a high emissivity outer surface (~0.9) with an ambient temperature of +25 °C and a relative humidity of 80%

PAROC Hvac Section AluCoat T + high emissivity cladding
PAROC Pro Section WR 100 AluCoat + high emissivity cladding

Outside diameter of pipe on which insulation has been based (mm)	Temperature of the content (°C)		
	10	5	0
	Thickness of insulation (mm)		
≤17.2	20	20	20
≤21.3	20	20	20
≤26.9	20	20	20
≤33.7	20	20	20
≤42.4	20	20	20
≤48.3	20	20	20
≤60.3	20	20	20
≤76.1	20	20	20
≤88.9	20	20	25
≤114.3	25	25	25
≤139.7	25	25	25
≤168.3	25	25	25
≤219.1	30	30	30
≤273.0	30	30	30
≤323.9	30	30	30
≤355.6	30	30	30
≤406.4	30	30	30
≤457.0	30	30	30
≤508.0	30	30	30
≤610.0	40	40	40

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at t °C in still air at 25 °C, emissivity of outer surface of insulated system as specified.

NOTE 2: Thicknesses given are calculated specifically against the criteria noted in the table. These thicknesses may not satisfy other design requirements. In situations where the ambient air temperature is greater than 25 °C and/or the relative humidity exceeds 80%, these thicknesses will not be sufficient to control condensation.

NOTE 3: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 8
ACC. BS5422:2023

Minimum insulation thickness for chilled and cold water pipes to control condensation on a low emissivity outer surface (~0.05) with an ambient temperature of +25 °C and a relative humidity of 80%

PAROC Hvac Section AluCoat T
PAROC Pro Section WR 100 AluCoat

Outside diameter of pipe on which insulation has been based (mm)	Temperature of the content (°C)		
	10	5	0
	Thickness of insulation (mm)		
≤17.2	20	25	40
≤21.3	20	30	40
≤26.9	25	30	40
≤33.7	25	30	40
≤42.4	25	40	40
≤48.3	25	40	50
≤60.3	30	40	50
≤76.1	30	40	50
≤88.9	30	40	50
≤114.3	30	50	60
≤139.7	40	50	60
≤168.3	40	50	60
≤219.1	40	50	60
≤273.0	40	50	70
≤323.9	40	60	70
≤355.6	40	60	70
≤406.4	40	60	80
≤457.0	50	60	80
≤508.0	50	60	80
≤610.0	50	60	80

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at t °C in still air at 25 °C, emissivity of outer surface of insulated system as specified.

NOTE 2: Thicknesses given are calculated specifically against the criteria noted in the table. These thicknesses may not satisfy other design requirements. In situations where the ambient air temperature is greater than 25 °C and/or the relative humidity exceeds 80%, these thicknesses will not be sufficient to control condensation.

NOTE 3: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 10
ACC. BS5422:2023

Indicative thickness of insulation for cooled and chilled water systems to control heat gain – low emissivity outer surfaces ε ~ 0.05

PAROC Hvac Section AluCoat T

Outside diameter of pipe on which insulation thickness has been based (mm)	Temperature of the content (°C)					
	10		5		0	
	Thickness of insulation (mm)	Maximum permissible heat gain (W/m)	Thickness of insulation (mm)	Maximum permissible heat gain (W/m)	Thickness of insulation (mm)	Maximum permissible heat gain (W/m)
≤17.2	20	2.48	20	2.97	25	3.47
≤21.3	20	2.72	20	3.27	25	3.81
≤26.9	20	3.05	25	3.58	25	4.18
≤33.7	20	3.41	25	4.01	30	4.60
≤42.4	20	3.86	25	4.53	30	5.11
≤48.3	20	4.11	25	4.82	30	5.45
≤60.3	20	4.78	25	5.48	30	6.17
≤76.1	20	5.51	25	6.30	40	6.70
≤88.9	20	6.17	30	6.90	40	7.77
≤114.3	25	7.28	30	8.31	40	9.15
≤139.7	25	8.52	30	9.49	40	10.45
≤168.3	25	9.89	30	10.97	40	11.86
≤219.1	30	12.27	30	13.57	40	14.61
≤273.0	30	14.74	30	16.28	40	17.48
>273.0	30	-	30	-	40	-

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at t °C in still air at 25 °C, emissivity of outer surface of insulated system as specified.

NOTE 2: Thicknesses derived solely against the criteria noted in this table may not necessarily satisfy other design requirements such as control of condensation.

NOTE 3: Heat gain relates to the specified thickness and temperature.

NOTE 4: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 11
ACC. BS5422:2023

Indicative thickness of insulation for cooled and chilled water systems to control heat gain – high emissivity outer surfaces ε ~ 0.9

PAROC Hvac Section AluCoat T + high emissivity cladding

Outside diameter of pipe on which insulation thickness has been based (mm)	Temperature of the content (°C)					
	10		5		0	
	Thickness of insulation (mm)	Heat Gain (W/m)	Thickness of insulation (mm)	Heat Gain (W/m)	Thickness of insulation (mm)	Heat Gain (W/m)
≤17.2	20	2.48	25	2.97	25	3.47
≤21.3	20	2.72	25	3.27	30	3.81
≤26.9	25	3.05	30	3.58	30	4.18
≤33.7	25	3.41	30	4.01	40	4.60
≤42.4	25	3.86	30	4.53	40	5.11
≤48.3	25	4.11	30	4.82	40	5.45
≤60.3	25	4.78	40	5.48	40	6.17
≤76.1	25	5.51	40	6.30	40	6.70
≤88.9	30	6.17	40	6.90	40	7.77
≤114.3	30	7.28	40	8.31	50	9.15
≤139.7	30	8.52	40	9.49	50	10.45
≤168.3	30	9.89	40	10.97	50	11.86
≤219.1	30	12.27	40	13.57	50	14.61
≤273.0	30	14.74	40	16.28	50	17.48
>273.0	30	-	40	-	50	-

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at t °C in still air at 25 °C, emissivity of outer surface of insulated system as specified.
NOTE 2: Thicknesses derived solely against the criteria noted in this table may not necessarily satisfy other design requirements such as control of condensation.
NOTE 3: Heat gain relates to the specified thickness and temperature.
NOTE 4: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 12
ACC. BS5422:2023

Minimum insulation thickness for condensation control on ductwork carrying chilled air in ambient conditions: indoor still air temperature +25 °C, relative humidity 80%, dew point temperature 21.3 °C

Icerock Ductwrap
Icerock Ductslab

Minimum air temperature inside the duct (°C)	Emissivity of outer surface		
	~0.05	~0.44	~0.90
	Thickness of insulation (mm)		
15	25	25	25
10	50	25	25
5	65	40	25
0	90	50	25

PAROC Hvac Mat AluCoat, PAROC Hvac Slab AluCoat

Minimum air temperature inside the duct (°C)	Emissivity of outer surface		
	~0.05	~0.44	~0.90
	Thickness of insulation (mm)		
15	30	30	30
10	50	30	30
5	80	40	30
0	100	50	30

PAROC Pro Lamella Mat AluCoat

Minimum air temperature inside the duct (°C)	Emissivity of outer surface		
	~0.05	~0.44	~0.90
	Thickness of insulation (mm)		
15	30	20	20
10	60	25	20
5	80	40	25
0	120	50	30

NOTE 1: Thicknesses given are calculated in accordance with BS EN ISO 12241:2022 based on a reasonable worst case 0.6 m high x 0.8m wide horizontal rectangular duct, with typical internal flow rate range and ductwork lengths. For critical cases, it is suggested to evaluate the top of a rectangular duct separately as a flat surface calculation.

NOTE 2: Thicknesses given are calculated specifically against the criteria noted above. These thicknesses may not satisfy other design requirements.

NOTE 3: Refer to page 3 for surface emissivities of common finishing materials. In situations where the ambient air temperature is greater than 25 °C and/or the relative humidity exceeds 80%, these thicknesses will not be sufficient to control condensation.

TABLE 13 - ACC. BS5422:2023

Indicative thickness of insulation for ductwork carrying warm air to control heat loss

Icerock Ductwrap, Icerock Ductslab

Emissivity of outer surface		
~0.05	~0.44	~0.90
Max Heat Loss 16.34 W/m²		
Thickness of insulation (mm)		
40	**40**	**50**

Paroc Hvac Mat, Paroc Hvac Slab, Paroc Pro Lamella Mat

Emissivity of outer surface		
~0.05	~0.44	~0.90
Max Heat Loss 16.34 W/m²		
Thickness of insulation (mm)		
40	**50**	**50**

NOTE 1: Heat loss relates to the specified thickness and temperature.
NOTE 2: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal duct at 35 °C in still air at 15 °C, emissivity of outer surface of insulated system as specified. Based on a 0.6 m high horizontal rectangular duct, with typical internal flow rate range and ductwork dimensions & lengths.

TABLE 14 - ACC. BS5422:2023

Indicative thickness of insulation for chilled and dual-purpose ducting to control heat transfer

Icerock Ductwrap, Icerock Ductslab

Emissivity of outer surface		
~0.05	~0.44	~0.90
Max Heat Transfer 6.45 W/m²		
Thickness of insulation (mm)		
60	**65**	**65**

Paroc Hvac Mat, Paroc Hvac Slab

Emissivity of outer surface		
~0.05	~0.44	~0.90
Max Heat Transfer 6.45 W/m²		
Thickness of insulation (mm)		
60	**70**	**80**

Paroc Pro Lamella Mat

Emissivity of outer surface		
~0.05	~0.44	~0.90
Max Heat Gain 6.45 W/m²		
Thickness of insulation (mm)		
70	**80**	**80**

NOTE 1: Heat loss relates to the specified thickness and temperature.
NOTE 2: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal duct at 13 °C in still air at 25 °C, emissivity of outer surface of insulated system as specified. Based on a 0.6 m high horizontal rectangular duct, with typical internal flow rate range and ductwork dimensions & lengths.
NOTE 3: Thicknesses derived solely against the criteria noted in this table may not necessarily satisfy other design requirements such as control of condensation.

TABLE 15A & 15B ACC. BS5422:2023

Thickness of insulation for non-domestic heating services to control heat loss – low emissivity outer surfaces ε ~ 0.05

PAROC Hvac Section AluCoat T

Outside diameter of pipe on which insulation thickness has been based (mm)	Base level (A)		Outside diameter of pipe on which insulation thickness has been based (mm)	Enhanced Level (B)	
	Thickness of insulation (mm)	Max heat loss (W/m)		Thickness of insulation (mm)	Max heat loss (W/m)
≤17.2	25	8.90	**≤17.2**	40	7.78
≤21.3	30	9.28	**≤21.3**	40	8.42
≤26.9	40	10.06	**≤26.9**	40	9.05
≤33.7	40	11.07	**≤33.7**	50	9.86
≤42.4	40	12.30	**≤42.4**	50	10.83
≤48.3	40	12.94	**≤48.3**	50	11.42
≤60.3	40	14.45	**≤60.3**	50	12.61
≤76.1	50	16.35	**≤76.1**	60	14.12
≤88.9	50	17.91	**≤88.9**	60	15.28
≤114.3	50	20.77	**≤114.3**	60	17.51
≤139.7	50	23.71	**≤139.7**	70	19.72
≤168.3	50	26.89	**≤168.3**	70	22.34
≤219.1	50	32.54	**≤219.1**	70	26.61
≤273.0	50	38.83	**≤273.0**	70	30.91
>273.0	50	-	**>273.0**	70	-

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe in still air at 15 °C at 75 °C, emissivity of outer surface of insulated system as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: The thicknesses in this table are applicable to pipes serving commercial solar hot water panels.
NOTE 4: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 16A & 16B ACC. BS5422:2023

Thickness of insulation for non-domestic heating services to control heat loss – high emissivity outer surfaces ε ~ 0.9

PAROC Hvac Section AluCoat T + high emissivity cladding

Outside diameter of pipe on which insulation thickness has been based (mm)	Base level (A)		Outside diameter of pipe on which insulation thickness has been based (mm)	Enhanced Level (B)	
	Thickness of insulation (mm)	Max heat loss (W/m)		Thickness of insulation (mm)	Max heat loss (W/m)
≤17.2	30	8.90	**≤17.2**	40	7.78
≤21.3	40	9.28	**≤21.3**	40	8.42
≤26.9	40	10.06	**≤26.9**	50	9.05
≤33.7	40	11.07	**≤33.7**	50	9.86
≤42.4	40	12.30	**≤42.4**	50	10.83
≤48.3	50	12.94	**≤48.3**	60	11.42
≤60.3	50	14.45	**≤60.3**	60	12.61
≤76.1	50	16.35	**≤76.1**	60	14.12
≤88.9	50	17.91	**≤88.9**	70	15.28
≤114.3	50	20.77	**≤114.3**	70	17.51
≤139.7	60	23.71	**≤139.7**	70	19.72
≤168.3	60	26.89	**≤168.3**	70	22.34
≤219.1	60	32.54	**≤219.1**	70	26.61
≤273.0	60	38.83	**≤273.0**	80	30.91
>273.0	60	-	**>273.0**	80	-

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe in still air at 15 °C at 75 °C, emissivity of outer surface of insulated system as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: The thicknesses in this table are applicable to pipes serving commercial solar hot water panels.
NOTE 4: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 17A
ACC. BS5422:2023

Base level thickness of insulation for non-domestic hot water service areas to control heat loss – low emissivity outer surfaces ε ~ 0.05

PAROC Hvac Section AluCoat T

Outside diameter of pipe on which insulation thickness has been based (mm)	Thickness of insulation (mm)	Maximum Permissible Heat loss (W/m)
≤17.2	25	6.60
≤21.3	25	7.13
≤26.9	30	7.83
≤33.7	30	8.62
≤42.4	30	9.72
≤48.3	40	10.21
≤60.3	40	11.57
≤76.1	40	13.09
≤88.9	40	14.58
≤114.3	40	17.20
≤139.7	40	19.65
≤168.3	40	22.31
≤219.1	40	27.52
≤273.0	40	32.40
>273.0	40	-

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at 60 °C in still air at 15 °C, emissivity of outer surface of insulated system as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 17B
ACC. BS5422:2023

Enhanced level thickness of insulation for non-domestic hot water service areas to control heat loss – low emissivity outer surfaces ε ~ 0.05

PAROC Hvac Section AluCoat T

Outside diameter of pipe on which insulation thickness has been based (mm)	Thickness of insulation (mm)	Maximum Permissible Heat loss (W/m)
≤17.2	30	6.04
≤21.3	30	6.45
≤26.9	40	7.00
≤33.7	40	7.71
≤42.4	40	8.46
≤48.3	40	9.01
≤60.3	50	9.94
≤76.1	50	11.25
≤88.9	50	12.17
≤114.3	50	14.29
≤139.7	60	16.09
≤168.3	60	18.24
≤219.1	60	22.06
≤273.0	60	25.95
>273.0	60	-

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at 60 °C in still air at 15 °C, emissivity of outer surface of insulated system as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 18A ACC. BS5422:2023

Base level thickness of insulation for non-domestic hot water service areas to control heat loss – high emissivity outer surfaces ε ~ 0.9

PAROC Hvac Section AluCoat T + high emissivity cladding

Outside diameter of pipe on which insulation thickness has been based (mm)	Thickness of insulation (mm)	Maximum Permissible Heat loss (W/m)
≤17.2	30	6.60
≤21.3	30	7.13
≤26.9	40	7.83
≤33.7	40	8.62
≤42.4	40	9.72
≤48.3	40	10.21
≤60.3	40	11.57
≤76.1	40	13.09
≤88.9	40	14.58
≤114.3	50	17.20
≤139.7	50	19.65
≤168.3	50	22.31
≤219.1	50	27.52
≤273.0	50	32.40
>273.0	50	-

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at 60 °C in still air at 15 °C, emissivity of outer surface of insulated system as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 18B
ACC. BS5422:2023

Enhanced level thickness of insulation for non-domestic hot water service areas to control heat loss – high emissivity outer surfaces ε ~ 0.9

PAROC Hvac Section AluCoat T + high emissivity cladding

Outside diameter of pipe on which insulation thickness has been based (mm)	Thickness of insulation (mm)	Maximum Permissible Heat loss (W/m)
≤17.2	40	6.04
≤21.3	40	6.45
≤26.9	50	7.00
≤33.7	50	7.71
≤42.4	50	8.46
≤48.3	50	9.01
≤60.3	50	9.94
≤76.1	60	11.25
≤88.9	60	12.17
≤114.3	60	14.29
≤139.7	60	16.09
≤168.3	60	18.24
≤219.1	60	22.06
≤273.0	70	25.95
>273.0	70	-

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at 60 °C in still air at 15 °C, emissivity of outer surface of insulated system as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLES 19A, 19B & 19C ACC. BS5422:2023

Thickness of insulation for domestic heating and hot water systems, having low emissivity outer surfaces ε ~ 0.05

PAROC Hvac Section AluCoat T

TABLE 19A, Base level	Domestic heating & hot water		TABLE 19B, Enhanced level	Domestic heating & hot water	
Outside diameter of pipe (mm)	Thickness of insulation (mm)	Maximum permissible heat loss (W/m)	Outside diameter of pipe (mm)	Thickness of insulation (mm)	Maximum permissible heat loss (W/m)
≤12.0	20	7.35	**≤12.0**	20	6.52
≤15.0	20	7.89	**≤15.0**	20	7.03
≤22.0	20	9.12	**≤22.0**	20	8.02
≤28.0	20	10.07	**≤28.0**	25	8.87
≤35.0	20	11.08	**≤35.0**	25	9.63
≤42.0	20	12.19	**≤42.0**	25	10.58
≤54.0	20	14.12	**≤54.0**	30	11.83
>54.0	20	-	**>54.0**	30	-

NOTE 1: Insulation thicknesses according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at 60 °C in still air at 15 °C, emissivity as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: This table is applicable to pipes serving solar hot water panels.
NOTE 4: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size

Thickness of insulation for district heating (secondary system) having low emissivity outer surfaces ε ~ 0.05.

PAROC Hvac Section AluCoat T

TABLE 19C	Secondary district heating	
Outside diameter of pipe (mm)	Thickness of insulation (mm)	Maximum permissible heat loss (W/m)
≤21.3	40	4.40
≤26.9	50	4.70
≤33.7	60	4.70
≤42.4	70	5.10
≤48.3	80	5.10
≤60.3	90	5.40
≤76.1	100	5.80
≤88.9	110	6.10
>88.9	110	-

NOTE 1: Insulation thicknesses according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at 55 °C in still air at 20 °C, emissivity as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: Maximum permissible heat losses derived from BS EN 12828:2012+A1:2014 for district heating, linear U-values Class 7 (found in Branschstandard Teknisk Isolering).
NOTE 4: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLES 20A, 20B & 20C ACC. BS5422:2023

Thickness of insulation for domestic heating and hot water systems having high emissivity outer surfaces ε ~ 0.9

PAROC Hvac Section AluCoat T + high emissivity cladding

TABLE 20A, Base level	Domestic heating & hot water		TABLE 20B, Enhanced level	Domestic heating & hot water	
Outside diameter of pipe (mm)	Thickness of insulation (mm)	Maximum permissible heat loss (W/m)	Outside diameter of pipe (mm)	Thickness of insulation (mm)	Maximum permissible heat loss (W/m)
≤12.0	20	7.35	**≤12.0**	20	6.52
≤15.0	20	7.89	**≤15.0**	20	7.03
≤22.0	20	9.12	**≤22.0**	25	8.02
≤28.0	20	10.07	**≤28.0**	30	8.87
≤35.0	25	11.08	**≤35.0**	30	9.63
≤42.0	25	12.19	**≤42.0**	30	10.58
≤54.0	25	14.12	**≤54.0**	40	11.83
>54.0	25	-	**>54.0**	40	-

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at 60 °C in still air at 15 °C, emissivity of outer surface of insulated system as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: This table is applicable to pipes serving solar hot water panels.
NOTE 4: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

Thickness of insulation for district heating (secondary system) having high emissivity outer surfaces ε ~ 0.9

PAROC Hvac Section AluCoat T + high emissivity cladding

TABLE 20C	Secondary district heating	
Outside diameter of pipe (mm)	Thickness of insulation (mm)	Maximum permissible heat loss (W/m)
≤21.3	50	4.40
≤26.9	60	4.70
≤33.7	70	4.70
≤42.4	80	5.10
≤48.3	90	5.10
≤60.3	100	5.40
≤76.1	110	5.80
≤88.9	110	6.10
>88.9	110	-

NOTE 1: Insulation thicknesses according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at 55 °C in still air at 20 °C, emissivity as specified.
NOTE 2: Heat loss relates to the specified thickness and temperature.
NOTE 3: Maximum permissible heat losses derived from BS EN 12828:2012+A1:2014 for district heating, linear U-values Class 7 (found in Branschstandard Teknisk Isolering).
NOTE 4: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 21
ACC. BS5422:2023

Minimum insulation thickness for process pipework and equipment to control heat loss

PAROC Pro Section WR 100 + low emissivity cladding
PAROC Pro Section WR 140 + low emissivity cladding

Outside diameter of pipe on which insulation has been based (mm)	Hot face temperature (°C)													
	100		200		300		400		500		600		700	
	Thickness of insulation (mm)	Max. Heat loss (W/m)	Thickness of insulation (mm)	Max. Heat loss (W/m)	Thickness of insulation (mm)	Max. Heat loss (W/m)	Thickness of insulation (mm)	Max. Heat loss (W/m)	Thickness of insulation (mm)	Max. Heat loss (W/m)	Thickness of insulation (mm)	Max. Heat loss (W/m)	Thickness of insulation (mm)	Max. Heat loss (W/m)
≤17.2	25	12.79	40	28.67	60	47.12	80	69.08	90	96.08	110	126.93	130	163.60
≤21.3	25	14.04	50	30.72	70	50.54	80	74.10	90	103.00	120	135.40	140	174.50
≤26.9	30	15.42	50	33.73	70	54.97	90	80.06	100	110.72	120	145.58	150	186.90
≤33.7	30	17.25	50	37.11	70	59.90	90	87.16	110	119.80	130	156.77	150	201.20
≤42.4	40	19.15	50	40.76	80	65.79	90	95.05	110	130.57	130	170.00	150	217.30
≤48.3	40	20.42	60	43.24	80	69.42	100	99.66	110	136.95	130	178.30	160	227.80
≤60.3	40	23.17	60	48.44	80	76.66	100	109.91	120	149.28	140	194.30	160	247.20
≤76.1	40	26.21	60	54.20	90	85.08	100	121.21	120	164.62	150	213.22	170	270.20
≤88.9	40	28.73	60	58.66	90	92.02	110	130.15	130	176.67	150	227.69	180	288.40
≤114.3	40	33.89	70	67.25	90	104.55	110	146.83	130	198.17	160	254.18	180	320.70
≤139.7	40	38.74	70	75.74	100	116.62	120	163.60	140	218.23	160	279.81	190	351.40
≤168.3	40	43.99	70	84.85	100	129.46	120	180.38	140	240.54	170	305.53	190	383.80
≤219.1	50	53.38	70	101.24	100	152.70	120	209.59	150	277.77	180	350.96	200	437.20
≤273.0	50	62.87	80	117.64	110	175.73	130	239.40	150	315.35	190	386.92	210	495.10
>273.0	50	-	80	-	110	-	130	-	150	-	190	-	210	-

Please refer to our "Dimensioning" guide for more information when fitting more than a single layer of pipe section insulation (available on www.paroc.co.uk).

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe in still air at 20 °C.
NOTE 2: This table refers to industrial heat loss. Emissivity is calculated at 0.05.
NOTE 3: Maximum heat loss values for intermediate operating temperatures may be deduced by interpolation.
NOTE 4: Heat loss measured in watts per metre (W/m) relates to the specified thickness and temperature.
NOTE 5: The thermal conductivity of insulation materials increases with mean temperature and for any given material. The use of a different thermal conductivity might be required for each operating temperature.
NOTE 6: These thicknesses may not satisfy other design requirements, in particular those for control of surface temperature (see Table 22, Table 23 and Table 24).
NOTE 7: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

TABLE 22
ACC. BS5422:2023

Minimum insulation thickness to control the surface temperature of a non-metallic surface with a surface emissivity of ~0.9 and design cold face temperature of 59 °C

PAROC Pro Section WR 100 + high emissivity cladding
PAROC Pro Section WR 140 + high emissivity cladding

Outside diameter of pipe (mm)	Temperature of the content (°C)						
	100	200	300	400	500	600	700
	Thickness of insulation (mm)						
≤17.2	20	20	20	30	40	60	70
≤21.3	20	20	20	30	50	60	70
≤26.9	20	20	25	40	50	60	80
≤33.7	20	20	25	40	50	70	80
≤42.4	20	20	25	40	50	70	90
≤48.3	20	20	25	40	50	70	90
≤60.3	20	20	25	40	60	70	90
≤76.1	20	20	30	40	60	80	100
≤88.9	20	20	30	50	60	80	100
≤101.6	20	20	30	50	60	80	100
≤114.3	25	25	30	50	70	90	110
≤139.7	25	25	30	50	70	90	110
≤168.3	25	25	30	50	70	90	120
≤219.1	30	30	40	50	70	100	120
≤244.5	30	30	40	50	70	100	120
≤273.0	30	30	40	60	80	110	130
≤323.9	30	30	40	60	80	110	130
≤355.6	30	30	40	60	80	110	140
≤406.4	30	30	40	60	80	110	140
≤457.0	30	30	40	60	80	110	140
≤508.0	30	30	40	60	80	110	140
≤610.0	40	40	40	60	90	110	150
Flat surfaces	NOTE 1						

Please refer to our "Dimensioning" guide for more information when fitting more than a single layer of pipe section insulation (available on www.paroc.co.uk).

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at t °C in still air at 20 °C, emissivity of outer surface of insulated system as specified. Flat surfaces and larger objects should be calculated case-by-case.

NOTE 2: Thicknesses given are calculated specifically against the criteria noted in the table. These thicknesses may not satisfy other design requirements.

NOTE 3: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

NOTE 4: Slabs & mats are available for flat surfaces.

TABLE 23
ACC. BS5422:2023

Minimum insulation thickness to control the surface temperature of a metallic surface with a surface emissivity of ~0.05 and design cold face temperature of 50 °C

PAROC Pro Section WR 100 + low emissivity cladding
PAROC Pro Section WR 140 + low emissivity cladding

Outside diameter of pipe (mm)	Temperature of the content (°C)						
	100	200	300	400	500	600	700
	Thickness of insulation (mm)						
≤17.2	20	25	50	70	100	130	170
≤21.3	20	30	50	70	100	140	170
≤26.9	20	30	50	80	110	140	180
≤33.7	20	30	60	80	110	150	190
≤42.4	20	40	60	90	120	160	200
≤48.3	20	40	60	90	120	160	210
≤60.3	20	40	70	100	130	170	220
≤76.1	20	40	70	100	140	180	240
≤88.9	20	40	70	110	140	190	250
≤101.6	20	40	70	110	150	200	250
≤114.3	25	40	80	110	150	200	260
≤139.7	25	50	80	120	160	210	270
≤168.3	25	50	80	120	170	220	280
≤219.1	30	50	90	130	180	240	300
≤244.5	30	50	90	130	180	240	310
≤273.0	30	50	90	130	190	250	320
≤323.9	30	50	90	140	190	260	330
≤355.6	30	50	100	140	200	260	340
≤406.4	30	50	100	150	200	270	350
≤457.0	30	50	100	150	210	280	360
≤508.0	30	50	100	150	210	290	370
≤610.0	40	60	100	160	220	300	380
Flat surfaces	NOTE 1						

Please refer to our "Dimensioning" guide for more information when fitting more than a single layer of pipe section insulation (available on www.paroc.co.uk).

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at t °C in still air at 20 °C, emissivity of outer surface of insulated system as specified. Flat surfaces and larger objects should be calculated case-by-case.

NOTE 2: Thicknesses given are calculated specifically against the criteria noted in the table. These thicknesses may not satisfy other design requirements.

NOTE 3: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

NOTE 4: Slabs & mats are available for flat surfaces.

TABLE 24
ACC. BS5422:2023

Minimum insulation thickness to control the surface temperature of a non-metallic surface with a surface emissivity of ~0.90 and design cold face temperature of 50 °C

PAROC Pro Section WR 100 + high emissivity cladding
PAROC Pro Section WR 140 + high emissivity cladding

Outside diameter of pipe (mm)	Temperature of the content (°C)						
	100	200	300	400	500	600	700
	Thickness of insulation (mm)						
≤17.2	20	20	25	40	60	70	90
≤21.3	20	20	30	40	60	80	100
≤26.9	20	20	30	50	60	80	100
≤33.7	20	20	30	50	60	80	110
≤42.4	20	20	40	50	70	90	110
≤48.3	20	20	40	50	70	90	120
≤60.3	20	20	40	50	70	100	120
≤76.1	20	20	40	60	80	100	130
≤88.9	20	20	40	60	80	100	130
≤101.6	20	20	40	60	80	110	140
≤114.3	25	25	40	60	80	110	140
≤139.7	25	25	40	60	90	110	150
≤168.3	25	25	40	70	90	120	150
≤219.1	30	30	50	70	90	130	160
≤244.5	30	30	50	70	100	130	170
≤273.0	30	30	50	70	100	130	170
≤323.9	30	30	50	70	100	130	170
≤355.6	30	30	50	70	100	140	180
≤406.4	30	30	50	70	100	140	180
≤457.0	30	30	50	80	110	140	190
≤508.0	40	40	50	80	110	150	190
≤610.0	40	40	50	80	110	150	200
Flat surfaces	NOTE 1						

Please refer to our "Dimensioning" guide for more information when fitting more than a single layer of pipe section insulation (available on www.paroc.co.uk).

NOTE 1: Insulation thicknesses in this table have been calculated according to BS EN ISO 12241:2022 using standardized assumptions: horizontal pipe at t °C in still air at 20 °C, emissivity of outer surface of insulated system as specified. Flat surfaces and larger objects should be calculated case-by-case.

NOTE 2: Thicknesses given are calculated specifically against the criteria noted in the table. These thicknesses may not satisfy other design requirements.

NOTE 3: Actual thickness required may be lower than shown in table, however the thickness shown is the nearest available thickness for that pipe size.

NOTE 4: Slabs & mats are available for flat surfaces.

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