Material Properties Used in NatHERS Software Tools

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This document lists the material properties used in NatHERS software tools. It is documented in accordance with AccuRate Sustainability help file. The properties for the following material groups are listed in this document:

Normal materials
Insulation (bulk) materials
Air gaps, vertical, unventilated
Air gaps, vertical, ventilated
Air gaps, horizontal, unventilated
Air gaps, horizontal, ventilated
Air gaps inclined 45°, unventilated
Air gaps inclined 45°, ventilated
Air gaps inclined 22.5°, unventilated
Air gaps inclined 22.5°, ventilated
Air gaps, other

Important Disclaimer

Material properties

Overview

In what follows, 'materials' includes air gaps.

All materials used in AccuRate are fully described by a thermal resistance (or resistances for non-vertical air gaps - see below) and a thermal capacitance. The values used are listed in various tables according to the material type.

The units of thermal resistance are $m^2.K/W$.

The thermal capacitance is the product of the density and specific heat, and its units in the material tables are $kJ/m^3.K$ (note the use of kJ, not J).

Except for non-vertical air gaps, the thermal resistance and capacitance do not change during the simulation.

Non-vertical air gaps (i.e. Horizontal, Inclined 45°, and Inclined 22.5°) are characterised by ***two*** thermal resistances: one for heat flow up and one for heat flow down. At each time step in the simulation, the heat flow direction in these air gaps is determined and the appropriate value of the thermal resistance is used. The up and down values are fixed (i.e. they do not change according to the temperature difference or other factors).

Air gap properties are given for fixed ranges of thicknesses, emissivities and inclinations. Choose the closest match to the air gap required (e.g. choose the thickness closest to one of the available thicknesses). With respect to emissivities, the key parameter is the effective emissivity, E, rather than the individual surface emissivities, and emissivity matching should be based on E. If the two surfaces have emissivities e1 and e2, then the effective emissivity is calculated as:

E = (e1*e2)/(e1 + e2 - e1*e2)

Air gaps with thicknesses below 13 mm

For an air gap with a thickness of less than 13 mm, a single thermal resistance that does not depend on heat flow direction may be estimated as follows. Let

L = thickness of air gap (mm)
t_m = mean temperature of air gap (°C)
R = resistance of air gap ($m^2.K/W$)

Then

$R = 1/(0.227*E*(2.73 + t_m/100)^3 + 21.8*(1 + 0.00274*t_m)/L)$.

For example, if L = 5 mm, t_m = 20°C and E = 0.82, then R = 0.108 $m^2.K/W$.

This air gap can then be used in a construction as follows.

1. Calculate R as above.
2. Calculate an *effective* thickness (mm) as $L_{eff} = 100*R$.
3. To represent this air gap, select the material Generic resistance (k = 0.1) from the materials list.
4. Enter the thickness for this material as L_{eff} .

Properties of the following material groups are listed in this document:

Normal materials
Insulation (bulk) materials
Air gaps, vertical, unventilated
Air gaps, vertical, ventilated
Air gaps, horizontal, unventilated
Air gaps, horizontal, ventilated
Air gaps inclined 45°, unventilated
Air gaps inclined 45°, ventilated
Air gaps inclined 22.5°, unventilated
Air gaps inclined 22.5°, ventilated
Air gaps, other

Normal materials

The following table lists the material properties of all the 'normal' materials (i.e. materials other than bulk insulation and air gaps) available from the Material Selector, which is accessed via the ... button in the Constructions page, details section.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the 'Resistance (heat flow down)' column indicates that the resistance for heat flow down is the same as for heat flow up.

Normal materials

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Aerated autoclaved concrete block	Y	7.700		525.0
Aluminium	Y	0.005		2358.4
Bituminous roof membrane	Y	6.250		1646.4
Bottom Ash	Y	3.360		964.0
Brickwork: extruded brick (generic)	Y	1.630		1484.9
Brickwork: pressed brick (generic)	Y	1.110		1929.2
BST lightweight concrete	Y	3.333		1128.0
Carpet	Y	17.600		147.7
Carpet underlay (felt)	Y	25.000		147.7
Carpet underlay (rubber)	Y	12.500		470.9
Carpet 10 + felt underlay 10	Y	21.300		147.7
Carpet 10 + rubber underlay 8	Y	15.330		279.2
Ceramic tile	Y	0.880		1600.0
'Concrete block 190 denseweight (not core-filled)'	Y	0.963		968.9
'Concrete block 190 denseweight (core-filled at 1500 centres)'	Y	0.942		1052.5
'Concrete block 190 denseweight (fully core-filled)'	Y	0.795		1970.3
'Concrete block 190 lightweight (not core-filled)'	Y	1.211		799.9
'Concrete block 190 lightweight (core-filled at 1500 centres)'	Y	1.226		883.5
'Concrete block 190 lightweight (fully core-filled)'	Y	1.002		1802.2
'Concrete block 140 denseweight (not core-filled)'	Y	1.150		1096.5
'Concrete block 140 denseweight (core-filled at 1500 centres)'	Y	1.093		1167.8
'Concrete block 140 denseweight (fully core-filled)'	Y	0.799		1963.3
'Concrete block 140 lightweight (not core-filled)'	Y	1.493		905.5
'Concrete block 140 lightweight (core-filled at 1500 centres)'	Y	1.471		976.8
'Concrete block 140 lightweight (fully core-filled)'	Y	1.024		1772.3
'Concrete block 110 denseweight (not core-filled)'	Y	1.273		1449.4
'Concrete block 110 denseweight (solid)'	Y	0.843		1918.4
'Concrete block 110 lightweight (not core-filled)'	Y	1.727		1196.8
'Concrete block 110 lightweight (solid)'	Y	1.340		1584.0
'Concrete block 90 denseweight (not core-filled)'	Y	1.311		1449.4
'Concrete block 90 denseweight (solid)'	Y	0.843		1918.4
'Concrete block 90 lightweight (not core-filled)'	Y	1.867		1196.8
'Concrete block 90 lightweight (solid)'	Y	1.340		1584.0
Concrete: standard (2400 kg/m^3)	Y	0.690		2112.0
Conpolcrete	Y	12.800		329.0
Copper	Y	0.003		3516.0
Cork tile	Y	12.500		900.0
Felt (undercarpet)	Y	21.700		165.6
Fibre-cement sheet	Y	3.125		1251.6
Fibre-cement sheet (compressed)	Y	2.000		1680.0
Generic resistance (k = 0.1)	Y	10.000		8.8
Generic resistance (k = 0.3)	Y	3.333		8.8

Normal materials (continued)

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Glass	Y	0.950		2108.4
Granite	Y	0.345		2385.0
Hollowcore precast concrete panel 200	Y	0.850		1478.4
Hollowcore precast concrete panel 150	Y	0.893		1478.4
Lead	Y	0.029		1436.4
Limestone	Y	1.075		2184.0
Linoleum	Y	4.545		1092.0
Marble	Y	0.667		2393.6
Masonite	Y	4.550		1716.9
Mud brick	Y	1.300		1500.0
Particleboard	Y	8.300		1280.0
Plaster (cement:sand 1:4)	Y	0.909		1590.0
Plasterboard	Y	5.900		924.0
Plywood	Y	7.140		795.0
Polycarbonate	Y	4.400		1380.0
Rammed earth	Y	0.800		1940.0
Reflective blind	N	0.001		0.0
Roof tiles (clay)	Y	1.190		1770.2
Roof tiles (concrete)	Y	0.690		2112.0
Sand (building)	Y	3.333		1200.0
Sandstone	Y	0.769		1840.0
Scoria	Y	2.950		1459.0
Slate	Y	0.667		1987.5
Softboard	Y	16.700		400.0
Soil (average)	Y	0.830		1613.0
Steel	Y	0.020		3900.0
Straw board	Y	12.350		336.0
Straw bale rendered	Y	10.100		125.0
Styrocon	Y	4.270		500.0
'Timbercrete (solid low-density: 900 kg/m^3)'	Y	4.274		663.3
'Timbercrete (solid mid-density: 1000 kg/m^3)'	Y	3.185		850.0
'Timbercrete (solid high-density: 1100 kg/m^3)'	Y	2.415		834.9
'Timbercrete (hollow low-density: 900 kg/m^3)'	Y	3.760		544.0
'Timbercrete (hollow mid-density: 1000 kg/m^3)'	Y	2.920		692.0
'Timbercrete (hollow high-density: 1100 kg/m^3)'	Y	2.320		684.0
Timber (softwood)	Y	10.000		1057.5
Timber (hardwood)	Y	6.250		1414.9
Timber (Jarrah)	Y	5.000		1801.6
Timber (Mountain ash)	Y	6.250		1414.9
Timber (Radiata pine)	Y	10.000		1057.5
Vinyl (floor tiles)	Y	1.270		1722.0
Water	Y	1.667		4192.0
Window film	N	0.001		0.0

Insulation (bulk)

The following tables list the material properties of all the bulk insulation materials available from the Material Selector, which is accessed via the button in the Constructions page, details section.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Two types of bulk insulation are provided:

- Specified resistance (as indicated in the name, e.g. R1.5)
  Use this if the resistance required corresponds to one of the resistances provided. The thickness cell in the Construction details table will show the thickness used, but will be disabled.

- Specified thermal conductivity (*k*) and (sometimes) density (as indicated in the name, e.g. k = 0.057, density = 7 kg/m^3).
  Use this if the required insulation resistance does not correspond to one of the resistances provided. The thickness cell in the Construction details table will be enabled. The required thickness is calculated as follows. If the required resistance is *R* (m^2.K/W) and the specified conductivity is *k* (W/m.K), then the required thickness, in mm, is 1000**k***R*.

Bulk insulation

Name	Thickness required	Resistance (heat flow up) ($m^2.K/W$)	Resistance (heat flow down) ($m^2.K/W$)	Capacitance (kJ/m^3)
175 mm waffle pod insulation	Y	25.641		5.4
225 mm waffle pod insulation	Y	25.641		5.4
300 mm waffle pod insulation	Y	25.641		5.4
375 mm waffle pod insulation	Y	25.641		5.4
Cellular insulation (not including air gaps): R0.14	N	0.140		0.0
Cellulose fibre: loose fill (k = 0.04)	Y	25.000		0.0
Cellulose fibre (loose fill): R1.0	Y	25.000		50.2
Cellulose fibre (loose fill): R1.5	Y	25.000		50.2
Cellulose fibre (loose fill): R2.0	Y	25.000		50.2
Cellulose fibre (loose fill): R2.5	Y	25.000		50.2
Cellulose fibre (loose fill): R3.0	Y	25.000		50.2
Cellulose fibre (loose fill): R3.5	Y	25.000		50.2
Cellulose fibre (loose fill): R4.0	Y	25.000		50.2
Cellulose fibre (loose fill): R4.5	Y	25.000		50.2
Cellulose fibre (loose fill): R5.0	Y	25.000		50.2
Cellulose fibre (loose fill): R5.5	Y	25.000		50.2
Cellulose fibre (loose fill): R6.0	Y	25.000		50.2
Cellulose fibre (loose fill): R6.5	Y	25.000		50.2
Cellulose fibre (loose fill): R7.0	Y	25.000		50.2
Glass fibre batt (k = 0.057 density = 7 kg/m3)	Y	17.544		6.2
Glass fibre batt (k = 0.044 density = 12 kg/m3)	Y	22.727		10.6
Glass fibre batt: R1.0	Y	22.727		10.6
Glass fibre batt: R1.5	Y	22.727		10.6
Glass fibre batt: R2.0	Y	22.727		10.6
Glass fibre batt: R2.5	Y	22.727		10.6
Glass fibre batt: R3.0	Y	22.727		10.6
Glass fibre batt: R3.5	Y	22.727		10.6
Glass fibre batt: R4.0	Y	22.727		10.6
Glass fibre batt: R4.5	Y	22.727		10.6
Glass fibre batt: R5.0	Y	22.727		10.6
Glass fibre batt: R5.5	Y	22.727		10.6
Glass fibre batt: R6.0	Y	22.727		10.6
Glass fibre batt: R6.5	Y	22.727		10.6
Glass fibre batt: R7.0	Y	22.727		10.6
Polyethylene foam (k = 0.04)	Y	25.000		10.8
Polyester or polyester/wool blanket (k = 0.063 density = 8 kg/m3)	Y	15.873		8.0
Polyester or polyester/wool blanket (k = 0.045 density = 16 kg/m3)	Y	22.222		16.0
Polyester or polyester/wool blanket: R1.0)	Y	22.222		16.0
Polyester or polyester/wool blanket: R1.5)	Y	22.222		16.0
Polyester or polyester/wool blanket: R2.0)	Y	22.222		16.0
Polyester or polyester/wool blanket: R2.5)	Y	22.222		16.0
Polyester or polyester/wool blanket: R3.0)	Y	22.222		16.0
Polyester or polyester/wool blanket: R3.5)	Y	22.222		16.0
Polyester or polyester/wool blanket: R4.0)	Y	22.222		16.0
Polyester or polyester/wool blanket: R4.5)	Y	22.222		16.0
Polyester or polyester/wool blanket: R5.0)	Y	22.222		16.0
Polyester or polyester/wool blanket: R5.5)	Y	22.222		16.0
Polyester or polyester/wool blanket: R6.0)	Y	22.222		16.0
Polyester or polyester/wool blanket: R6.5)	Y	22.222		16.0
Polyester or polyester/wool blanket: R7.0)	Y	22.222		16.0

Bulk insulation (continued)

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Polyisocyanurate (PIR) aged foam (K = 0.022)	Y	45.455		53.7
Polystyrene expanded (k = 0.039)	Y	25.641		5.4
Polystyrene expanded: R1.0	Y	25.641		5.4
Polystyrene expanded: R1.5	Y	25.641		5.4
Polystyrene expanded: R2.0	Y	25.641		5.4
Polystyrene expanded: R2.5	Y	25.641		5.4
Polystyrene expanded: R3.0	Y	25.641		5.4
Polystyrene expanded: R3.5	Y	25.641		5.4
Polystyrene expanded: R4.0	Y	25.641		5.4
Polystyrene expanded: R4.5	Y	25.641		5.4
Polystyrene expanded: R5.0	Y	25.641		5.4
Polystyrene expanded: R5.5	Y	25.641		5.4
Polystyrene expanded: R6.0	Y	25.641		5.4
Polystyrene expanded: R6.5	Y	25.641		5.4
Polystyrene expanded: R7.0	Y	25.641		5.4
Polystyrene extruded (k = 0.028)	Y	35.714		10.9
Polystyrene extruded: R1.0	Y	35.714		10.9
Polystyrene extruded: R1.5	Y	35.714		10.9
Polystyrene extruded: R2.0	Y	35.714		10.9
Polystyrene extruded: R2.5	Y	35.714		10.9
Polystyrene extruded: R3.0	Y	35.714		10.9
Polystyrene extruded: R3.5	Y	35.714		10.9
Polystyrene extruded: R4.0	Y	35.714		10.9
Polystyrene extruded: R4.5	Y	35.714		10.9
Polystyrene extruded: R5.0	Y	35.714		10.9
Polystyrene extruded: R5.5	Y	35.714		10.9
Polystyrene extruded: R6.0	Y	35.714		10.9
Polystyrene extruded: R6.5	Y	35.714		10.9
Polystyrene extruded: R7.0	Y	35.714		10.9
Polyurethane rigid foamed aged (k = 0.028)	Y	35.714		10.8
Polyurethane rigid foamed aged: R1.0	Y	35.714		10.8
Polyurethane rigid foamed aged: R1.5	Y	35.714		10.8
Polyurethane rigid foamed aged: R2.0	Y	35.714		10.8
Polyurethane rigid foamed aged: R2.5	Y	35.714		10.8
Polyurethane rigid foamed aged: R3.0	Y	35.714		10.8
Polyurethane rigid foamed aged: R3.5	Y	35.714		10.8
Polyurethane rigid foamed aged: R4.0	Y	35.714		10.8
Polyurethane rigid foamed aged: R4.5	Y	35.714		10.8
Polyurethane rigid foamed aged: R5.0	Y	35.714		10.8
Polyurethane rigid foamed aged: R5.5	Y	35.714		10.8
Polyurethane rigid foamed aged: R6.0	Y	35.714		10.8
Polyurethane rigid foamed aged: R6.5	Y	35.714		10.8
Polyurethane rigid foamed aged: R7.0	Y	35.714		10.8

Bulk insulation (continued)

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Rockwool loose fill (k = 0.04)	Y	25.000		58.9
Rockwool batt (k = 0.033)	Y	30.303		29.4
Rockwool batt: R1.0	Y	30.303		29.4
Rockwool batt: R1.5	Y	30.303		29.4
Rockwool batt: R2.0	Y	30.303		29.4
Rockwool batt: R2.5	Y	30.303		29.4
Rockwool batt: R3.0	Y	30.303		29.4
Rockwool batt: R3.5	Y	30.303		29.4
Rockwool batt: R4.0	Y	30.303		29.4
Rockwool batt: R4.5	Y	30.303		29.4
Rockwool batt: R5.0	Y	30.303		29.4
Rockwool batt: R5.5	Y	30.303		29.4
Rockwool batt: R6.0	Y	30.303		29.4
Rockwool batt: R6.5	Y	30.303		29.4
Rockwool batt: R7.0	Y	30.303		29.4
Silica aerogel (k = 0.014)	Y	71.400		142.5
Wool loose fill (k = 0.08)	Y	12.500		14.4
Wool/polyester batt 80/20 (k = 0.059 density = 8 kg/m3)	Y	16.949		9.6
Wool/polyester batt 80/20 (k = 0.045 density = 16 kg/m3)	Y	22.222		19.2
Wool/polyester batt 80/20: R1.0	Y	22.222		19.2
Wool/polyester batt 80/20: R1.5	Y	22.222		19.2
Wool/polyester batt 80/20: R2.0	Y	22.222		19.2
Wool/polyester batt 80/20: R2.5	Y	22.222		19.2
Wool/polyester batt 80/20: R3.0	Y	22.222		19.2
Wool/polyester batt 80/20: R3.5	Y	22.222		19.2
Wool/polyester batt 80/20: R4.0	Y	22.222		19.2
Wool/polyester batt 80/20: R4.5	Y	22.222		19.2
Wool/polyester batt 80/20: R5.0	Y	22.222		19.2
Wool/polyester batt 80/20: R5.5	Y	22.222		19.2
Wool/polyester batt 80/20: R6.0	Y	22.222		19.2
Wool/polyester batt 80/20: R6.5	Y	22.222		19.2
Wool/polyester batt 80/20: R7.0	Y	22.222		19.2

Air gaps vertical, unventilated

The following table lists the material properties of all the vertical unventilated air gaps available from the Material Selector, which is accessed via the ... button in the Constructions page, details section. See Overview for air gaps below 13 mm thickness.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Air gap names include the emissivities of the two surfaces and the effective emissivity.
For example, (0.4/0.9, E = 0.38) indicates that the emissivities of the two surfaces are 0.4 and 0.9 respectively, and that the effective emissivity is 0.38.

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Air gap vertical 90 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.161		0.0
Air gap vertical 90 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.213		0.0
Air gap vertical 90 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.275		0.0
Air gap vertical 90 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.396		0.0
Air gap vertical 90 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.511		0.0
Air gap vertical 90 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.601		0.0
Air gap vertical 90 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.657		0.0
Air gap vertical 90 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.685		0.0
Air gap vertical 40 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.163		0.0
Air gap vertical 40 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.216		0.0
Air gap vertical 40 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.280		0.0
Air gap vertical 40 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.406		0.0
Air gap vertical 40 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.529		0.0
Air gap vertical 40 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.625		0.0
Air gap vertical 40 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.686		0.0
Air gap vertical 40 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.716		0.0
Air gap vertical 20 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.161		0.0
Air gap vertical 20 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.212		0.0
Air gap vertical 20 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.274		0.0
Air gap vertical 20 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.394		0.0
Air gap vertical 20 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.508		0.0
Air gap vertical 20 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.596		0.0
Air gap vertical 20 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.652		0.0
Air gap vertical 20 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.679		0.0
Air gap vertical 13 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.147		0.0
Air gap vertical 13 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.189		0.0
Air gap vertical 13 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.237		0.0
Air gap vertical 13 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.321		0.0
Air gap vertical 13 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.393		0.0
Air gap vertical 13 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.444		0.0
Air gap vertical 13 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.474		0.0
Air gap vertical 13 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.488		0.0

Air gaps vertical, ventilated

The following table lists the material properties of all the vertical ventilated air gaps available from the Material Selector, which is accessed via the button in the Constructions page, details section. See Overview for air gaps below 13 mm thickness.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Air gap names include the emissivities of the two surfaces and the effective emissivity.
For example, (0.4/0.9, E = 0.38) indicates that the emissivities of the two surfaces are 0.4 and 0.9 respectively, and that the effective emissivity is 0.38.

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Air gap vertical 90 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.131		0.0
Air gap vertical 90 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.180		0.0
Air gap vertical 90 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.237		0.0
Air gap vertical 90 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.350		0.0
Air gap vertical 90 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.457		0.0
Air gap vertical 90 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.541		0.0
Air gap vertical 90 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.592		0.0
Air gap vertical 90 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.619		0.0
Air gap vertical 40 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.133		0.0
Air gap vertical 40 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.182		0.0
Air gap vertical 40 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.242		0.0
Air gap vertical 40 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.358		0.0
Air gap vertical 40 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.473		0.0
Air gap vertical 40 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.562		0.0
Air gap vertical 40 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.619		0.0
Air gap vertical 40 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.647		0.0
Air gap vertical 20 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.131		0.0
Air gap vertical 20 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.179		0.0
Air gap vertical 20 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.236		0.0
Air gap vertical 20 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.348		0.0
Air gap vertical 20 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.454		0.0
Air gap vertical 20 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.536		0.0
Air gap vertical 20 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.588		0.0
Air gap vertical 20 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.613		0.0
Air gap vertical 13 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.120		0.0
Air gap vertical 13 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.159		0.0
Air gap vertical 13 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.204		0.0
Air gap vertical 13 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.283		0.0
Air gap vertical 13 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.351		0.0
Air gap vertical 13 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.399		0.0
Air gap vertical 13 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.427		0.0
Air gap vertical 13 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.441		0.0

Air gaps horizontal, unventilated

The following table lists the material properties of all the horizontal unventilated air gaps available from the Material Selector, which is accessed via the ... button in the Constructions page, details section. See Overview for air gaps below 13 mm thickness.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Air gap names include the emissivities of the two surfaces and the effective emissivity.
For example, (0.4/0.9, E = 0.38) indicates that the emissivities of the two surfaces are 0.4 and 0.9 respectively, and that the effective emissivity is 0.38.

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Air gap horizontal 90 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.149	0.192	0.0
Air gap horizontal 90 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.192	0.271	0.0
Air gap horizontal 90 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.242	0.380	0.0
Air gap horizontal 90 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.330	0.656	0.0
Air gap horizontal 90 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.407	1.051	0.0
Air gap horizontal 90 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.461	1.514	0.0
Air gap horizontal 90 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.494	1.930	0.0
Air gap horizontal 90 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.509	2.190	0.0
Air gap horizontal 40 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.145	0.180	0.0
Air gap horizontal 40 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.185	0.248	0.0
Air gap horizontal 40 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.230	0.337	0.0
Air gap horizontal 40 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.309	0.537	0.0
Air gap horizontal 40 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.376	0.775	0.0
Air gap horizontal 40 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.422	1.000	0.0
Air gap horizontal 40 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.449	1.166	0.0
Air gap horizontal 40 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.461	1.257	0.0
Air gap horizontal 20 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.140	0.163	0.0
Air gap horizontal 20 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.178	0.215	0.0
Air gap horizontal 20 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.220	0.279	0.0
Air gap horizontal 20 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.291	0.404	0.0
Air gap horizontal 20 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.349	0.526	0.0
Air gap horizontal 20 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.388	0.621	0.0
Air gap horizontal 20 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.411	0.682	0.0
Air gap horizontal 20 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.523	0.711	0.0
Air gap horizontal 13 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.137	0.146	0.0
Air gap horizontal 13 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.174	0.188	0.0
Air gap horizontal 13 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.213	0.235	0.0
Air gap horizontal 13 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.278	0.318	0.0
Air gap horizontal 13 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.331	0.389	0.0
Air gap horizontal 13 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.366	0.438	0.0
Air gap horizontal 13 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.387	0.467	0.0
Air gap horizontal 13 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.396	0.481	0.0

Air gaps horizontal, ventilated

The following table lists the material properties of all the horizontal ventilated air gaps available from the Material Selector, which is accessed via the ... button in the Constructions page, details section. See Overview for air gaps below 13 mm thickness.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Air gap names include the emissivities of the two surfaces and the effective emissivity.
For example, (0.4/0.9, E = 0.38) indicates that the emissivities of the two surfaces are 0.4 and 0.9 respectively, and that the effective emissivity is 0.38.

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Air gap horizontal 90 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.121	0.156	0.0
Air gap horizontal 90 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.162	0.228	0.0
Air gap horizontal 90 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.209	0.328	0.0
Air gap horizontal 90 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.291	0.579	0.0
Air gap horizontal 90 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.364	0.939	0.0
Air gap horizontal 90 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.415	1.362	0.0
Air gap horizontal 90 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.445	1.741	0.0
Air gap horizontal 90 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.460	1.978	0.0
Air gap horizontal 40 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.118	0.146	0.0
Air gap horizontal 40 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.156	0.209	0.0
Air gap horizontal 40 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.198	0.291	0.0
Air gap horizontal 40 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.273	0.474	0.0
Air gap horizontal 40 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.336	0.693	0.0
Air gap horizontal 40 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.380	0.899	0.0
Air gap horizontal 40 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.405	1.052	0.0
Air gap horizontal 40 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.416	1.135	0.0
Air gap horizontal 20 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.114	0.133	0.0
Air gap horizontal 20 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.150	0.181	0.0
Air gap horizontal 20 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.190	0.241	0.0
Air gap horizontal 20 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.257	0.357	0.0
Air gap horizontal 20 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.312	0.470	0.0
Air gap horizontal 20 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.349	0.559	0.0
Air gap horizontal 20 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.371	0.615	0.0
Air gap horizontal 20 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.472	0.642	0.0
Air gap horizontal 13 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.111	0.119	0.0
Air gap horizontal 13 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.147	0.158	0.0
Air gap horizontal 13 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.184	0.203	0.0
Air gap horizontal 13 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.245	0.281	0.0
Air gap horizontal 13 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.296	0.348	0.0
Air gap horizontal 13 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.329	0.394	0.0
Air gap horizontal 13 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.349	0.421	0.0
Air gap horizontal 13 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.358	0.435	0.0

Air gaps inclined 45°, unventilated

The following table lists the material properties of all the unventilated air gaps inclined at 45 degrees available from the Material Selector, which is accessed via the button in the Constructions page, details section. See Overview for air gaps below 13 mm thickness.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Air gap names include the emissivities of the two surfaces and the effective emissivity.
For example, (0.4/0.9, E = 0.38) indicates that the emissivities of the two surfaces are 0.4 and 0.9 respectively, and that the effective emissivity is 0.38.

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Air gap 45° 90 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.154	0.171	0.0
Air gap 45° 90 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.200	0.230	0.0
Air gap 45° 90 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.254	0.305	0.0
Air gap 45° 90 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.354	0.461	0.0
Air gap 45° 90 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.443	0.626	0.0
Air gap 45° 90 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.509	0.766	0.0
Air gap 45° 90 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.549	0.860	0.0
Air gap 45° 90 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.568	0.908	0.0
Air gap 45° 40 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.151	0.173	0.0
Air gap 45° 40 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.195	0.235	0.0
Air gap 45° 40 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.247	0.313	0.0
Air gap 45° 40 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.339	0.479	0.0
Air gap 45° 40 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.421	0.660	0.0
Air gap 45° 40 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.480	0.816	0.0
Air gap 45° 40 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.515	0.923	0.0
Air gap 45° 40 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.532	0.979	0.0
Air gap 45° 20 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.150	0.162	0.0
Air gap 45° 20 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.194	0.215	0.0
Air gap 45° 20 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.245	0.278	0.0
Air gap 45° 20 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.336	0.403	0.0
Air gap 45° 20 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.416	0.523	0.0
Air gap 45° 20 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.473	0.617	0.0
Air gap 45° 20 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.507	0.677	0.0
Air gap 45° 20 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.523	0.706	0.0
Air gap 45° 13 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.144	0.146	0.0
Air gap 45° 13 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.185	0.188	0.0
Air gap 45° 13 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.230	0.234	0.0
Air gap 45° 13 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.309	0.317	0.0
Air gap 45° 13 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.375	0.387	0.0
Air gap 45° 13 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.421	0.436	0.0
Air gap 45° 13 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.448	0.465	0.0
Air gap 45° 13 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.461	0.479	0.0

Air gaps inclined 45°, ventilated

The following table lists the material properties of all the ventilated air gaps inclined at 45 degrees available from the Material Selector, which is accessed via the button in the Constructions page, details section. See Overview for air gaps below 13 mm thickness.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Air gap names include the emissivities of the two surfaces and the effective emissivity.
For example, (0.4/0.9, E = 0.38) indicates that the emissivities of the two surfaces are 0.4 and 0.9 respectively, and that the effective emissivity is 0.38.

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Air gap 45° 90 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.125	0.139	0.0
Air gap 45° 90 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.169	0.194	0.0
Air gap 45° 90 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.219	0.263	0.0
Air gap 45° 90 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.312	0.407	0.0
Air gap 45° 90 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.396	0.560	0.0
Air gap 45° 90 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.458	0.689	0.0
Air gap 45° 90 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.495	0.776	0.0
Air gap 45° 90 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.513	0.820	0.0
Air gap 45° 40 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.123	0.141	0.0
Air gap 45° 40 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.164	0.198	0.0
Air gap 45° 40 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.213	0.270	0.0
Air gap 45° 40 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.299	0.423	0.0
Air gap 45° 40 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.376	0.590	0.0
Air gap 45° 40 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.432	0.734	0.0
Air gap 45° 40 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.464	0.833	0.0
Air gap 45° 40 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.481	0.884	0.0
Air gap 45° 20 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.122	0.132	0.0
Air gap 45° 20 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.163	0.181	0.0
Air gap 45° 20 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.211	0.240	0.0
Air gap 45° 20 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.297	0.356	0.0
Air gap 45° 20 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.372	0.467	0.0
Air gap 45° 20 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.425	0.555	0.0
Air gap 45° 20 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.457	0.611	0.0
Air gap 45° 20 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.472	0.638	0.0
Air gap 45° 13 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.117	0.119	0.0
Air gap 45° 13 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.156	0.158	0.0
Air gap 45° 13 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.198	0.202	0.0
Air gap 45° 13 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.273	0.280	0.0
Air gap 45° 13 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.335	0.346	0.0
Air gap 45° 13 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.379	0.392	0.0
Air gap 45° 13 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.404	0.419	0.0
Air gap 45° 13 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.416	0.433	0.0

Air gaps inclined 22.5°, unventilated

The following table lists the material properties of all the unventilated air gaps inclined at 22.5 degrees available from the Material Selector, which is accessed via the button in the Constructions page, details section. See Overview for air gaps below 13 mm thickness.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Air gap names include the emissivities of the two surfaces and the effective emissivity.
For example, (0.4/0.9, E = 0.38) indicates that the emissivities of the two surfaces are 0.4 and 0.9 respectively, and that the effective emissivity is 0.38.

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Air gap 22.5° 90 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.152	0.182	0.0
Air gap 22.5° 90 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.196	0.251	0.0
Air gap 22.5° 90 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.248	0.343	0.0
Air gap 22.5° 90 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.342	0.559	0.0
Air gap 22.5° 90 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.425	0.839	0.0
Air gap 22.5° 90 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.485	1.140	0.0
Air gap 22.5° 90 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.522	1.395	0.0
Air gap 22.5° 90 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.539	1.549	0.0
Air gap 22.5° 40 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.148	0.177	0.0
Air gap 22.5° 40 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.190	0.242	0.0
Air gap 22.5° 40 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.239	0.325	0.0
Air gap 22.5° 40 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.324	0.508	0.0
Air gap 22.5° 40 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.399	0.718	0.0
Air gap 22.5° 40 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.451	0.908	0.0
Air gap 22.5° 40 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.482	1.045	0.0
Air gap 22.5° 40 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.497	1.118	0.0
Air gap 22.5° 20 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.145	0.163	0.0
Air gap 22.5° 20 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.186	0.215	0.0
Air gap 22.5° 20 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.233	0.279	0.0
Air gap 22.5° 20 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.314	0.404	0.0
Air gap 22.5° 20 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.383	0.525	0.0
Air gap 22.5° 20 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.431	0.619	0.0
Air gap 22.5° 20 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.459	0.680	0.0
Air gap 22.5° 20 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.523	0.709	0.0
Air gap 22.5° 13 mm unventilated non-reflective (0.9/0.9; E = 0.82)	N	0.141	0.146	0.0
Air gap 22.5° 13 mm unventilated reflective (0.6/0.9; E = 0.56)	N	0.180	0.188	0.0
Air gap 22.5° 13 mm unventilated reflective (0.4/0.9; E = 0.38)	N	0.222	0.235	0.0
Air gap 22.5° 13 mm unventilated reflective (0.2/0.9; E = 0.20)	N	0.294	0.318	0.0
Air gap 22.5° 13 mm unventilated reflective (0.1/0.9; E = 0.10)	N	0.353	0.388	0.0
Air gap 22.5° 13 mm unventilated reflective (0.05/0.9; E = 0.05)	N	0.394	0.437	0.0
Air gap 22.5° 13 mm unventilated reflective (0.05/0.05; E = 0.03)	N	0.418	0.466	0.0
Air gap 22.5° 13 mm unventilated reflective (0.03/0.03; E = 0.015)	N	0.429	0.480	0.0

Air gaps inclined 22.5°, ventilated

The following table lists the material properties of all the ventilated air gaps inclined at 22.5 degrees available from the Material Selector, which is accessed via the button in the Constructions page, details section. See Overview for air gaps below 13 mm thickness.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Air gap names include the emissivities of the two surfaces and the effective emissivity.
For example, (0.4/0.9, E = 0.38) indicates that the emissivities of the two surfaces are 0.4 and 0.9 respectively, and that the effective emissivity is 0.38.

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Air gap 22.5° 90 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.123	0.148	0.0
Air gap 22.5° 90 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.165	0.211	0.0
Air gap 22.5° 90 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.214	0.295	0.0
Air gap 22.5° 90 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.302	0.493	0.0
Air gap 22.5° 90 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.380	0.750	0.0
Air gap 22.5° 90 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.436	1.025	0.0
Air gap 22.5° 90 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.470	1.258	0.0
Air gap 22.5° 90 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.486	1.399	0.0
Air gap 22.5° 40 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.120	0.144	0.0
Air gap 22.5° 40 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.160	0.204	0.0
Air gap 22.5° 40 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.206	0.280	0.0
Air gap 22.5° 40 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.286	0.448	0.0
Air gap 22.5° 40 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.356	0.641	0.0
Air gap 22.5° 40 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.406	0.817	0.0
Air gap 22.5° 40 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.435	0.942	0.0
Air gap 22.5° 40 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.449	1.010	0.0
Air gap 22.5° 20 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.118	0.132	0.0
Air gap 22.5° 20 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.157	0.181	0.0
Air gap 22.5° 20 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.201	0.240	0.0
Air gap 22.5° 20 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.277	0.356	0.0
Air gap 22.5° 20 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.342	0.469	0.0
Air gap 22.5° 20 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.387	0.557	0.0
Air gap 22.5° 20 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.414	0.613	0.0
Air gap 22.5° 20 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.472	0.640	0.0
Air gap 22.5° 13 mm ventilated non-reflective (0.9/0.9; E = 0.82)	N	0.114	0.119	0.0
Air gap 22.5° 13 mm ventilated reflective (0.6/0.9; E = 0.56)	N	0.151	0.158	0.0
Air gap 22.5° 13 mm ventilated reflective (0.4/0.9; E = 0.38)	N	0.191	0.202	0.0
Air gap 22.5° 13 mm ventilated reflective (0.2/0.9; E = 0.20)	N	0.259	0.280	0.0
Air gap 22.5° 13 mm ventilated reflective (0.1/0.9; E = 0.10)	N	0.316	0.347	0.0
Air gap 22.5° 13 mm ventilated reflective (0.05/0.9; E = 0.05)	N	0.354	0.393	0.0
Air gap 22.5° 13 mm ventilated reflective (0.05/0.05; E = 0.03)	N	0.376	0.420	0.0
Air gap 22.5° 13 mm ventilated reflective (0.03/0.03; E = 0.015)	N	0.387	0.434	0.0

Air gaps, other

The following table lists the material properties of other types of air gaps available from the Material Selector, which is accessed via the  button in the Constructions page, details section.

A 'Y' in the 'Thickness required' column indicates that the resistances and capacitances listed are for a material thickness of 1.0 m. The actual resistance and capacitance of the material used in a construction is the product of its thickness and the value in the table.

'N' indicates that the resistance and capacitance in the table are used directly without reference to any indicated thickness.

A blank entry in the Resistance (heat flow down) column indicates that the resistance for heat flow down is the same as for heat flow up.

Name	Thickness required	Resistance (heat flow up) (m^2.K/W)	Resistance (heat flow down) (m^2.K/W)	Capacitance (kJ/m^3)
Double cell horizontal 25 mm + 25 mm unventilated E = 0.026	N	0.844	1.638	0.0
Double cell vertical 25 mm + 25 mm unventilated E = 0.026	N	1.418		0.0
Double cell 45° 25 mm + 25 mm unventilated E = 0.026	N	1.030	1.570	0.0
Double cell 22.5° 25 mm + 25 mm unventilated E = 0.026	N	0.937	1.604	0.0
Glazing air gap (generic)	N	0.110		0.0