

U-Values, building regulation changes and insulation

A rough guide to understanding

Insulation is required below all underfloor heating systems to stop downward heat transmission. As well as this purpose it is also necessary under the building regulations to provide the better-insulated buildings and reduce building heating requirements. These requirements have recently changed.

U-Values and building regulations

Recent changes to the building regulations have reduced the stipulated U-Value for floors from 0.45 to 0.25 W/m²K.

The formula for calculation of a ground floor U-Value is given in CIBSE Guide A3 and is very complicated. A simplified method of calculating the U-Value of an uninsulated floor has been described in BRE Information Paper IP 3/90.

This simplified formula can be used for all types of ground floor including; ground bearing, suspended concrete and suspended timber. It can also be used with relative ease for irregularly shaped floor plans, not just simple rectangular shapes.

The IP 3/90 formula is:

$$U = 0.05 + 1.65(P/A) - 0.6(P/A)^2$$

Where:

U = U-Value of the uninsulated floor (W/m²K).

P = Length of the exposed perimeter (m).

A = Area of the floor (m²)

Note

The measurement of the perimeter and area should be to the inside surface of the perimeter walls that enclose the heated space. Unheated spaces such as garages and porches etc. should be excluded. The perimeter should not include walls between adjacent heated areas such as semi-detached or terraced properties.

U-Values of uninsulated ground floor

The formula yields the following values for different perimeter to area ratios.

Perimeter/Area Ratio P/A = 0.10 0.1253 0.20 0.30 0.40 0.50 0.60 0.70

Uninsulated U-Value U = 0.21 0.25 0.36 0.50 0.62 0.73 0.83 0.92

The above formula shows that only floor plans with P/A ratios less than 0.1253 will meet the new building regulations without additional insulation. Using the figures above we can calculate the effective thermal resistance of the uninsulated floor (m²K/W) (this is the reciprocal of the U-Value). In order to meet the new building regulations for a U-Value no greater than 0.25 we must therefore increase the thermal resistance to at least 4.0 by the addition of insulation.

Knowing the additional component thermal resistance that the insulation must provide we can then calculate the required thickness of insulation from the thermal conductivity of the material.

The table can then be expanded to give guidelines as to what thickness of each type of insulation is required to bring the floor U-Value under 0.25. On a cautionary note it must be stressed that the following table is based on approximate calculations as detailed above and is for guidance only. It is intended to help give some 'feel' for insulation requirements and cannot replace full U-Value calculations.

The attached table provides a guide to the required floor insulation thickness with the different types of floor insulation available.

Uninsulated U-Value

Perimeter / Area Ratio	P/A =	0.10	0.1253	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.30	0.40	0.50	0.60	0.70
Uninsulated U-Value	U _o =	0.21	0.25	0.26	0.27	0.29	0.3	0.32	0.35	0.36	0.36	0.50	0.62	0.73	0.83	0.92
Thermal Res Unins	R =	4.76	4.00	3.84	3.7	3.44	3.33	3.12	3.03	2.85	2.77	2.00	1.61	1.36	1.20	1.08
Additional Res Required	R +	n/a	0.00	0.16	0.3	0.56	0.67	0.88	0.97	1.15	1.23	2.00	2.39	2.64	2.80	2.92

EXPANDED POLYSTYRENE (SDN) (Jablite etc) Thickness Required Assuming K=0.037 W/mk

Insulation reqd (mm)	ITR =	n/a	0	6	12	21	25	33	36	43	46	74	89	98	104	109
----------------------	-------	-----	---	---	----	----	----	----	----	----	----	----	----	----	-----	-----

EXPANDED POLYSTYRENE (HDN) (Jablite etc) Thickness Required Assuming K=0.035 W/mk

Insulation reqd (mm)	ITR =	n/a	0	6	11	20	24	31	34	41	44	70	84	93	98	103
----------------------	-------	-----	---	---	----	----	----	----	----	----	----	----	----	----	----	-----

EXPANDED POLYSTYRENE (EHDN) (Jablite etc) Thickness Required Assuming K=0.033 W/mk

Insulation reqd (mm)	ITR =	n/a	0	6	10	19	23	30	33	38	41	66	79	88	93	97
----------------------	-------	-----	---	---	----	----	----	----	----	----	----	----	----	----	----	----

EXTRUDED POLYSTYRENE (POLYFOAM etc) Thickness Required Assuming K=0.028 W/mk

Insulation reqd (mm)	ITR =	n/a	0	5	9	16	19	25	28	33	35	56	67	74	79	82
----------------------	-------	-----	---	---	---	----	----	----	----	----	----	----	----	----	----	----

EXTRUDED POLYSTYRENE Thickness Required Assuming K=0.026 W/mk

Insulation reqd (mm)	ITR =	n/a	0	5	8	15	18	23	26	30	32	52	63	69	73	76
----------------------	-------	-----	---	---	---	----	----	----	----	----	----	----	----	----	----	----

Polyurethane Thickness Required Assuming K=0.022 W/mk (Kingspan)

Insulation reqd (mm)	ITR =	n/a	0	4	7	13	15	20	22	26	28	44	53	59	62	65
----------------------	-------	-----	---	---	---	----	----	----	----	----	----	----	----	----	----	----

Polyurethane Thickness Required Assuming K=0.019 W/mk (Celotex RR, Ecotherm, Floortherm etc)

Insulation reqd (mm)	ITR =	n/a	0	4	6	11	13	17	19	22	24	38	46	51	54	56
----------------------	-------	-----	---	---	---	----	----	----	----	----	----	----	----	----	----	----