BEAMA Guide

Use of aluminium diffuser plates in underfloor heating systems

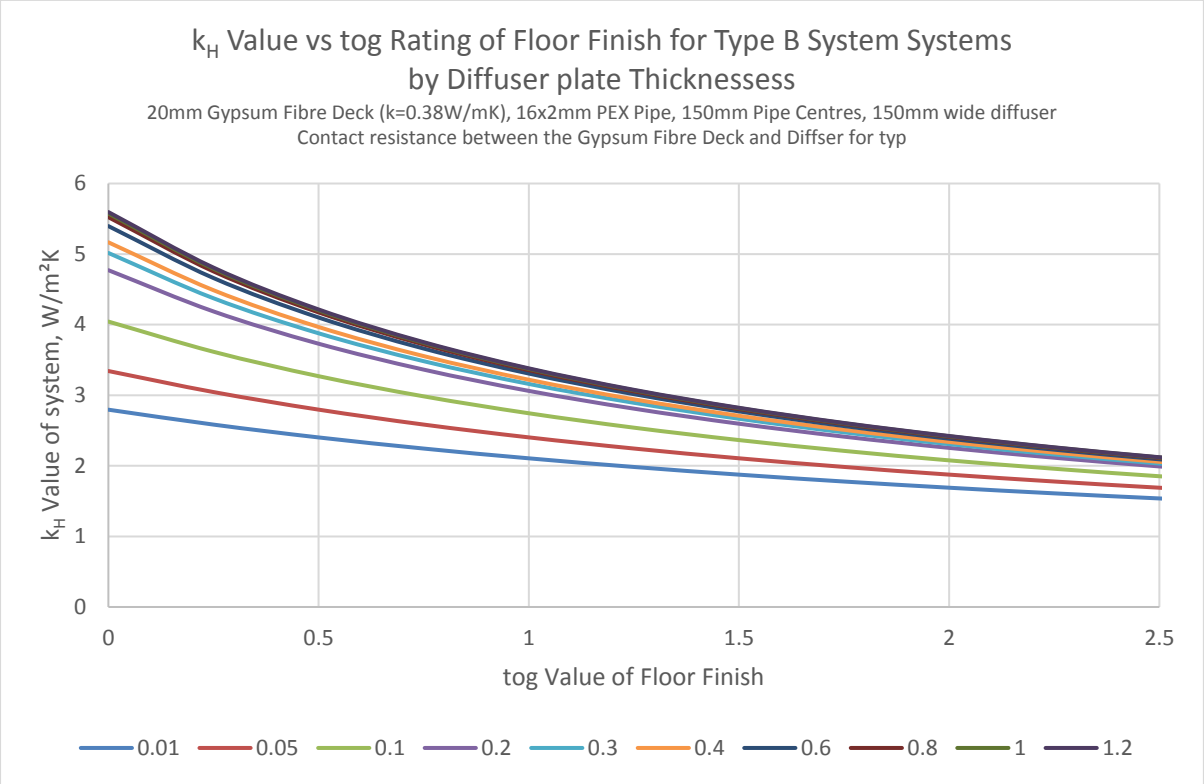
Introduction

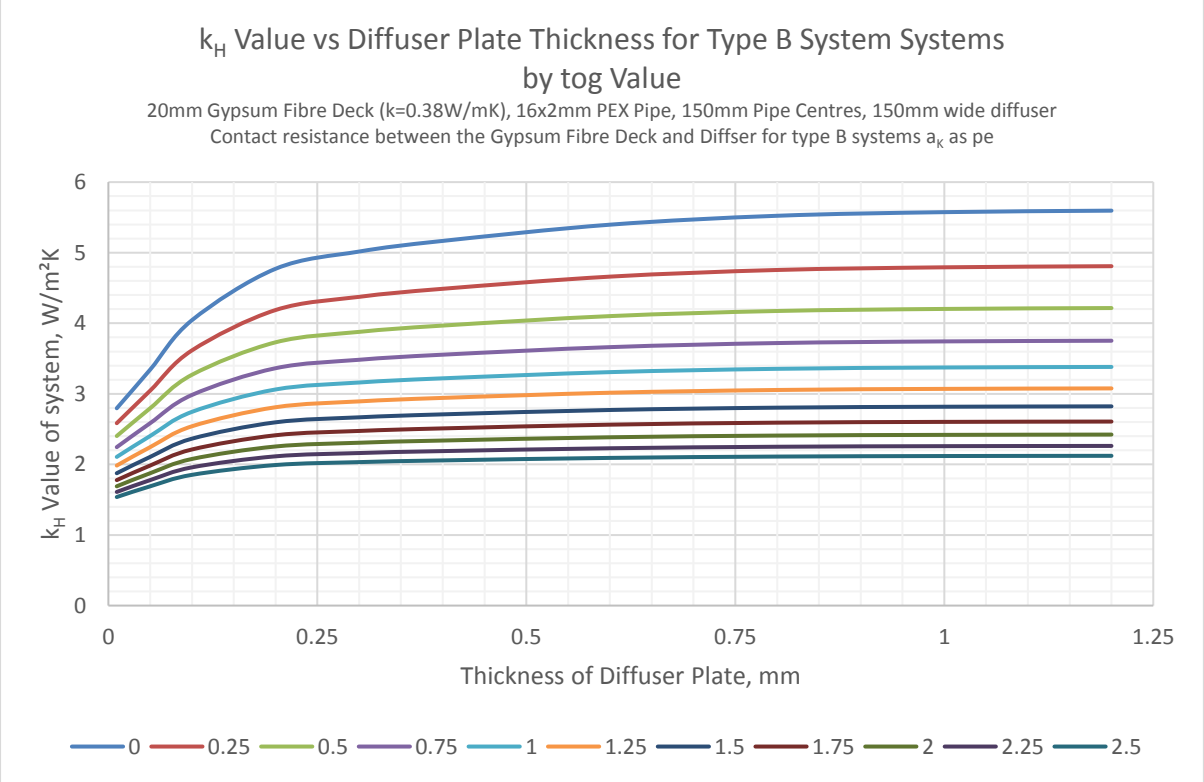
Hydronic Underfloor Heating has traditionally been split into two categories the first being a "wet" system where the heating pipework is installed into a 75mm deep screed or concrete floor, and the second being a "dry" system where the pipework is installed in a timber joisted floor, or low profile system. In the wet system, heat from the UFH pipe is easily conducted laterally by the screed/concrete to give a fairly uniform mean surface temperature. In the "dry" system as defined by BS EN 12364 as Type B, the usual means of lateral heat conduction is by means of an aluminium plate which is in contact with the UFH pipe. Here we investigate the relationship between the thickness of the aluminium plate, its ability to conduct this heat, and the resulting floor surface temperature. After all it is the temperature difference between the warm floor and ambient air that defines the heat output of an Underfloor Heating System.

Aluminium Thickness vs Lateral Heat Conduction

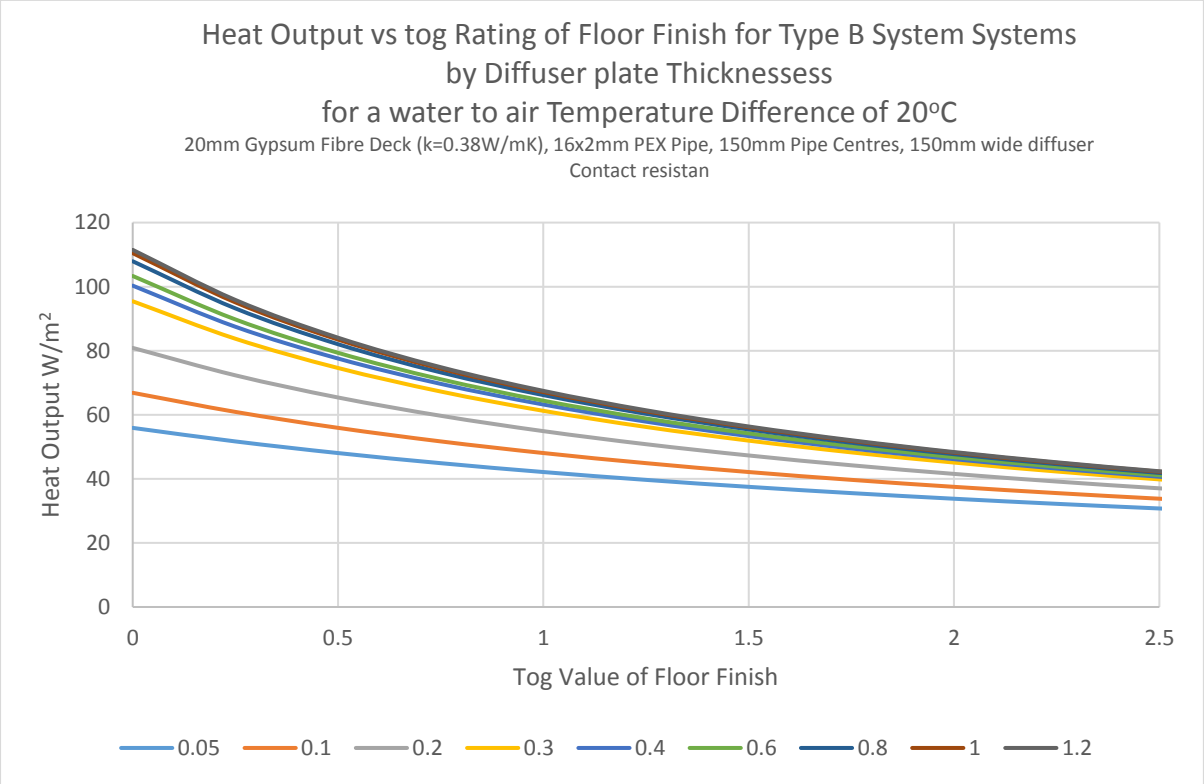
Tests carried out by BEAMA Underfloor members analysing heat transfer have shown that there is a significant correlation between the thickness of an aluminium diffuser plate and its ability to transfer heat. Below are the results of our analysis in accordance with EN 1264-2, using aluminium diffuser plates ranging in thickness from 0.05mm to 1.2mm, each with a Gypsum Fibre Deck covering. We have also shown the effect of different final floor coverings with tog ratings of 0 tog to 4 tog. The results shown are in K_h values where K_h is the amount of heat in Watts emitted per square metre of heated floor, for every degree difference between the floor surface temperature and ambient air temperature.

System:	BS EN 1264 Type B
UIFH Pipe Spacing	150 mm
Pipe Material:	PEX 16x2 mm
Thermal Conductivity of UFH Pipe:	0.35 W/mK
Thickness of Gypsum Fibre Board Deck thickness:	20 mm
Gypsum Fibre Board Deck Thermal Conductivity:	0.38 W/mK
Diffuser Plate Material:	Aluminium
Thermal Conductivity of Diffuser Plate:	200 W/mK
Width of Diffuser Plate:	150 mm





Whilst the above graphs are interesting let's put this data into a typical UFH heating system where we have an average heating water temperature of 40°C and an air temperature of 20°C, giving a temperature difference of 20°C .



It can be seen that the thinnest aluminium diffuser plate of 0.05mm (typically a foil based product) will have a heat output of around 40W/m^2 when used with a typical 1 tog floor covering. Increasing the thickness of the foil to 0.6mm increases the heat output by 62.5% to 64 W/ m^2 A further increase to 1.2mm results in a heat output of 67W/ m^2.

If the tog rating of the floor covering is increased to the 2.5, the performance benefit is reduced, with the 0.05mm, 0.6mm and 1.2mm diffusion systems have heat outputs of 31 W/m^2, 41 W/m^2 and 42 Wm^2 respectfully. However there is still a 33% increase in performance when moving from a 0.05mm foil to a 0.6mm plate.

Conversely, if the tog rating of the floor covering is reduced to 0, which is similar to that of a tiled floor at 0.1 tog, that for a ceramic floor, the 0.05mm, 0.6mm and 1.2mm diffusion systems have heat outputs of 56 W/m^2, 103 W/m^2 and 111 Wm^2 respectfully.

Thicknes of Aluminium Diffuser Plate, mm	Tog Value of Floor Finish		
	0	1	2.5
0.05	55.90912	42.12615	30.7538
0.1	66.86034	48.05704	33.79898
0.2	80.87693	54.89522	37.04444
0.3	95.43846	61.23694	39.82779
0.4	100.3195	63.21031	40.65324
0.6	103.3355	64.39452	41.13981
0.8	107.9302	66.14936	41.84908
1	110.4601	67.09112	42.22405
1.2	111.482	67.46674	42.37252

To summarize, it is important to correctly assess the heating requirements of a particular room prior to selecting a UFH system. Consideration should be given to increasing the aluminium thickness, which may increase the system cost, but will allow for a broader choice of floor finishes and cooler water temperatures to be used, providing the option to choose improved comfort or increased heating system efficiency.

*Data provided by Antony White of Warmup Plc.