

Carpets & Underfloor Heating

SUMMARY:

Modern heating systems can cope with carpeting of almost any thickness or density provided the (approximate) thermal resistance value is known in advance by the heating system installer. Even with older, already established systems a wide choice of carpeting is possible. In all cases, the main requirements are that the carpet assembly's durability and appearance retention is not significantly affected and, the assembly has no odour when heated.

Underfloor Heating (UFH)

Heat can be supplied by electrical cables in or on top of the floor or it can be radiated from hot water circulated in a closed loop network of pipes under the floor. The water is usually heated by solar, gas, electricity or by heat pumps.

Carpet and UFH systems

Choosing the right carpet is very important when installed over a UFH system. Carpet with high insulating properties will restrict the heat from rising up through the carpet resulting in reduced efficiency of UFH and increased energy costs by having to run at a higher temperature.

The thermal insulation property – Thermal Resistance – is referred to as an R-value. The R-value is used to measure a material's resistance to heat transfer or thermal resistance – the higher the R-value the greater the insulating effect.

For more information about Thermal Insulation of Carpet, refer to CIAL Fact sheet: *Thermal Insulation Performance of Carpet*.

R-Value and TOG

Similar to R-value, TOG is a measure of thermal resistance of a unit area, also known as thermal insulance. It is commonly used in the textile industry and often seen quoted on fibre-filled bedding such as quilts and duvets, and carpet underlay. While engineers use R-values for their heating and cooling energy calculations, TOG is often used when referring to carpet and carpet underlay. TOG is the R-value x 10.

For example: TOG 1.5 = R 0.15 x 10



Choosing Carpet for UFH systems

The thermal resistance of carpet is influenced by a number of factors. The pile height has a significant influence as does the pile weight. Tuft density, fibre, backing type, and total carpet construction are all contributing factors.

While the carpet and underlay to be used with a combined value up to a maximum of TOG 2.5 is considered acceptable, a much higher TOG value will affect the efficiency of the heating.

For example: Combined TOG value: A carpet of TOG 1.60 and underlay of TOG 0.75 has a 2.35 TOG value.

Determining a Carpet's R-value

The standard test method is ASTM-C518-2010 – "Test Method for Steady-State Thermal Transmission Properties" using the Heat Flow Meter Apparatus.

Carpet manufacturers generally do not test every style of carpet they make but they may be able to give an estimate of the TOG value or provide advice on a particular carpet's suitability for UFH.

Carpet Pile Fibre Types

In carpets, the amount of air trapped in the pile plays a more important role in governing heat flow through the carpet than do the pile fibres, since still air is a poor conductor of heat. As a consequence, with a reduced volume of air or an increased pile density, the thermal resistance of carpets is correspondingly reduced. Carpets with moderate pile height and high pile density fulfil the requirement for low thermal resistance.

Wool carpet is known to have very good insulating properties but similar weight synthetic carpet with higher pile heights can have almost the same TOG rating. *Refer Table 1**.

In comparison, felted pure wool carpets have higher TOG ratings than similar non felted ones. *Refer Table 1***.

Choosing Underlay for UHF systems

There is a balance needed when making the choice of underlay. The underlay used should allow adequate heat to pass through the floor covering into the room area above as well as giving the carpet structure adequate support during its performance lifetime.

The thermal resistance of underlay is dependent on a number of factors, the most important being what it is made of and its thickness. Rubber underlays are preferred by UFH system suppliers as they generally have lower TOG values than foam or felt underlays. *Refer Table 2.*

Underlays specifically developed for underfloor heating purposes are available with TOG values as low as 0.5.

It is important to consider the underlay TOG value as this must be added to the carpet TOG value to get the total value for the installation.

Felt (Textile) underlays are not suitable due to their high TOG values. Some having TOG values as high as 4.0. *Refer Table 2**.

Examples of Test Results – Carpets – Table 1

Fibre Type	Construction	Weight (oz/yd ²)	Weight (gm/m ²)	Pile Height (mm)	TOG value	R-value
SDN	Cut-pile	20	678	3.5	0.9	0.09
SDN	Cut-pile	32	1085	5	1.0	0.1
SDN	Cut-pile	40	1357	8	1.5	0.15
SDN	Cut-pile	45	1526	9.6	1.6	0.16
SDN	Cut-pile*	48	1628	10.5	1.5	0.15
100% Wool	Loop-pile	40	1356	6.6	1.5	0.15
100% Wool	Cut-pile *	40	1356	3.7	1.8	0.18
100% Wool	Loop-pile	45	1526	5.9	2.0	0.20
100% Wool	Cut-pile	48	1628	7.0	1.9	0.19
100% Wool	Cut-pile	52	1763	9.5	2.2	0.22
100% Wool	Loop-pile (not felted)**	60	2035	11.0	1.9	0.19
100% Wool	Loop-pile (felted)**	60	2035	9.8	3.1	0.31
100% Wool	Cut-pile (felted)	75	2543	13.9	2.8	0.28

(SDN means Solution Dyed Nylon)

Examples of Test Results – Underlays – Table 2

Underlay Type	Thickness (mm)	TOG value	R-value
Rubber	7.6	0.5	0.05
Rubber	7.5	0.6	0.06
Rubber	8.5	0.9	0.09
Rubber	9.5	1.1	0.11
Rubber	9.5	1.4	0.14
Foam	7.0	1.9	0.19
Foam	8.0	2.2	0.22
Foam	9.0	2.3	0.23
Foam	10.0	2.5	0.25
Textile*	9.0	2.6	0.26
Textile*	14.5	4.0	0.40





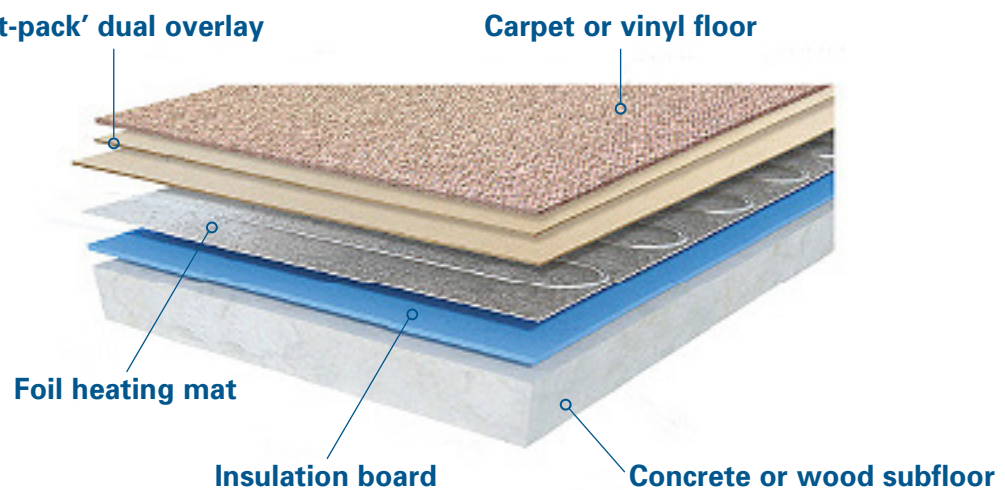
Types of UFH systems

There are a variety of underfloor systems available and their manufacturers tend to recommend different maximum TOG values and that a layer of insulation should always be included to minimise downward heat loss and maximise the efficiency of the underfloor heating system.

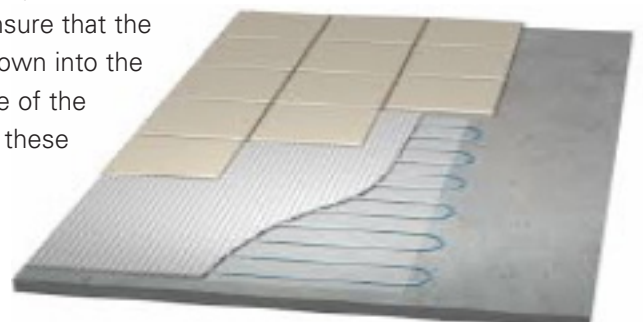
It is recommended that you consult the heating system manufacturer, their representative or a qualified heating systems engineer to ensure that the carpet/underlay combined TOG value is suitable for their system.

Under Carpet Heating Mats – Fits between the carpet and underlay and are available in different sizes to fit most rooms. They consist of a flexible heating cable sandwiched between foil sheets giving an even spread of heat. These are easy to retro-fit into existing properties.

'Heat-pack' dual overlay



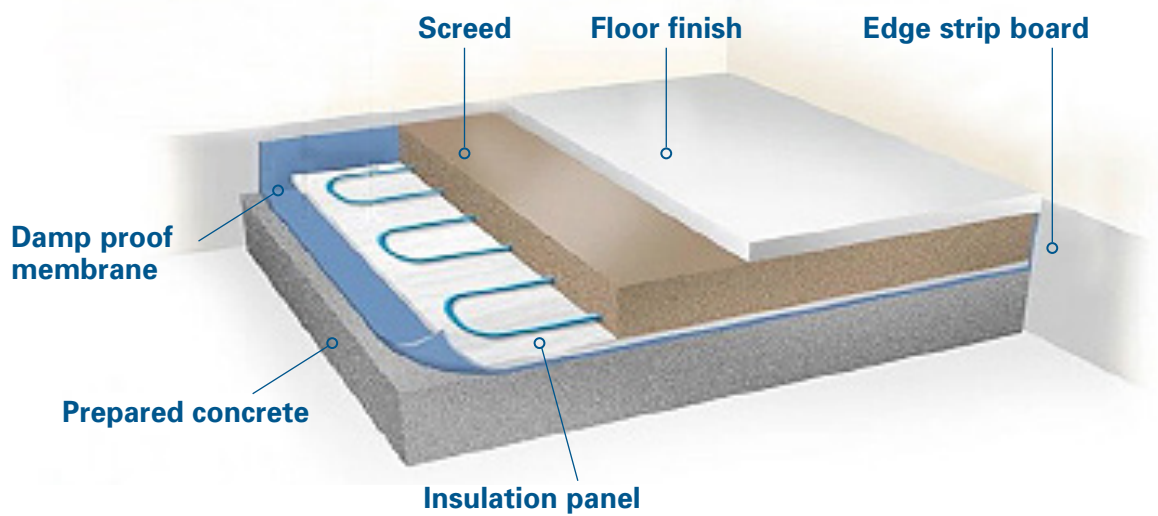
Electric heating mats on tiled or other hard floors – generally only recommended for use under tiled or other hard floors but if carpet/underlay is to be installed over heating mats, suppliers of these types of mats generally recommend that they should be covered by a layer of flexible self levelling compound before any floor coverings are installed. This is to ensure that the underlay and then the carpet does not bed down into the contours of the different levels and the shape of the cables within the matting. Should this occur, these contours will more than likely be seen in the carpet appearance.



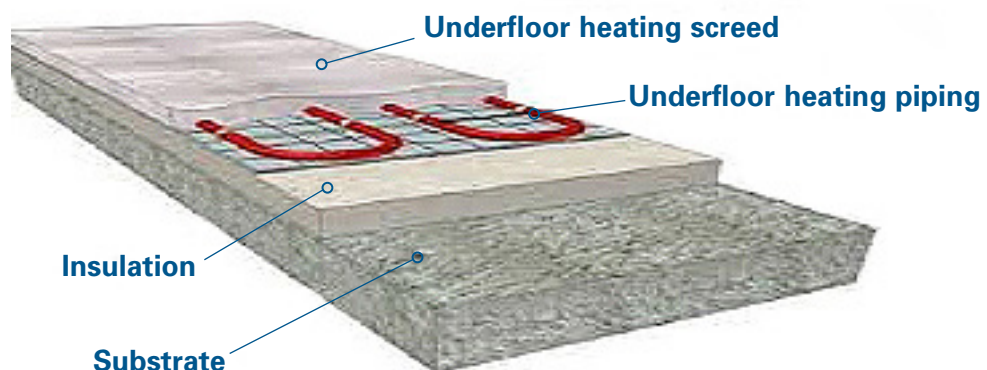


Electric heating cables buried in screed or within a suspended timber floor – as thicker floor coverings may cause overheating, these systems generally have a recommended maximum value of 1.5 TOG.

Underfloor Heating – screed construction



Water pipes buried in screed – an underfloor system which uses water pipes buried in screed, the maximum recommended combined value of the carpet and underlay is often stated as 2.5 TOG.





Installation of Carpet and Underlay over the UFH system

UFH that is buried in a concrete floor or covered with a screed can have the carpet installed using the Conventional method, Dual Bond method or Direct Stick.

Conventional is where the underlay is loose laid and the carpet is stretched and attached to perimeter gripper strips.

Dual Bond is where the underlay is glued to the floor, then the carpet is glued to the underlay.

Direct Stick has the carpet glued directly to the floor and is common in commercial installations.

Whichever installation system is used, the aim is to provide close contact between the floor, underlay and carpet allowing better heat transfer and to avoid uneven heating.

For Dual Bond or Direct Stick installations, the heating can be operated before the carpet is laid to ensure the subfloor moisture has been lowered to the recommended level for the adhesive.

The UFH system should be turned off prior to Dual Bond or Direct Stick installations and not operated for 2 days to allow the adhesives to cure naturally. Once turned on the UFH system should not be operated at maximum temperature for a further week.

It is advisable to check with the adhesive manufacturer to ensure suitability for use at the maximum working temperature of the heating system.

For performance of flooring products including adhesives, underlays and floorcoverings, the generally recommended maximum subfloor temperature is 29°C. It should be noted that a temperature of 29°C set on the thermostat may result in a higher subfloor temperature based on the R values of the installed floorcovering assembly.

Disclaimer

While the information in this document is believed to be accurate and reliable, there are no guarantees given regarding the veracity of any and all information, nor shall Carpet Institute of Australia Ltd be held responsible for any and all instances of injury or damage resulting or incidental to the use of this document and its contents.

About the Carpet Institute of Australia

The Carpet Institute of Australia Limited (CIAL) is the lead industry association for Australia's \$1.6 billion carpet industry. CIAL represents carpet manufacturers, carpet retailers and other suppliers of goods and services to the industry.

Carpet Institute of Australia Limited ABN 11 006 829 303

PO Box 7172, St Kilda Road, Melbourne 3004 Tel: (03) 9804 5559 | Fax: (03) 9804 5560
 info@carpetoz.com.au | www.carpetinstitute.com.au



The "Carpet It Just Feels Better" campaign is an initiative of the Carpet Institute of Australia, a non-profit association sponsored by carpet manufacturers, their suppliers and other companies that provide goods and services to the broader carpet industry.