Thermal Insulation

The requirements of the indoor climate and comfort have become more stringent during the recent years. The insulation constitutes an important factor of this, as it ensures that the correct temperature is obtained.

The most common way of expressing thermal properties is by using the following nomenclature:

- **Coefficient of the Thermal Transmission (U-value)**

- **Thermal Resistance (R)**

- **Thermal Conductivity (λ)**

It is important to note that the λ-value for any given material varies with temperature.

Specification of the λ-value should therefore be referred to as "mean" temperature and, if possible, to a standardised method for measurement and calculation.

Solutions for Thermal Insulation

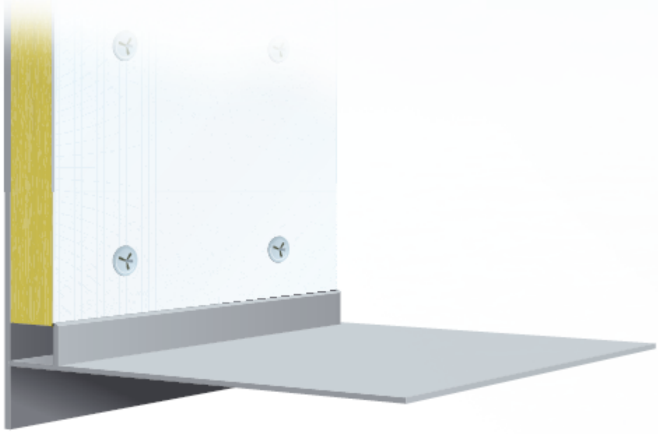
1: Thermal insulation can be used alone where there is no other demand for the deck and bulkhead.

2: Thermal insulation can also be used together with fire insulation or sound insulation.

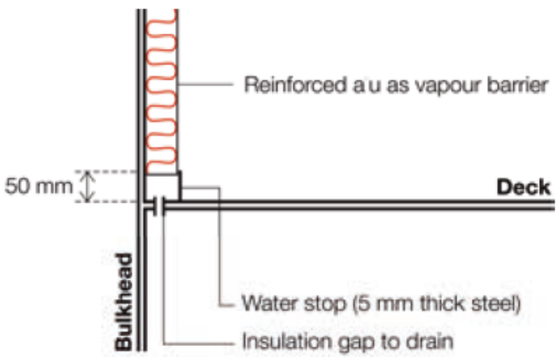
When the minimum insulation thickness has been found for protecting against sound or fire, the thermal transmission (U-value) of this material can be calculated from the λ-value. If a higher insulation level is requested the construction can be improved by adding an extra layer of a lower density product.

In all cases of insulating towards cold temperatures the wool must always be covered by a vapour tight surface. This surface can be aluminium foil or another kind of vapour barrier. The gaps should be tightly sealed with alu tape.

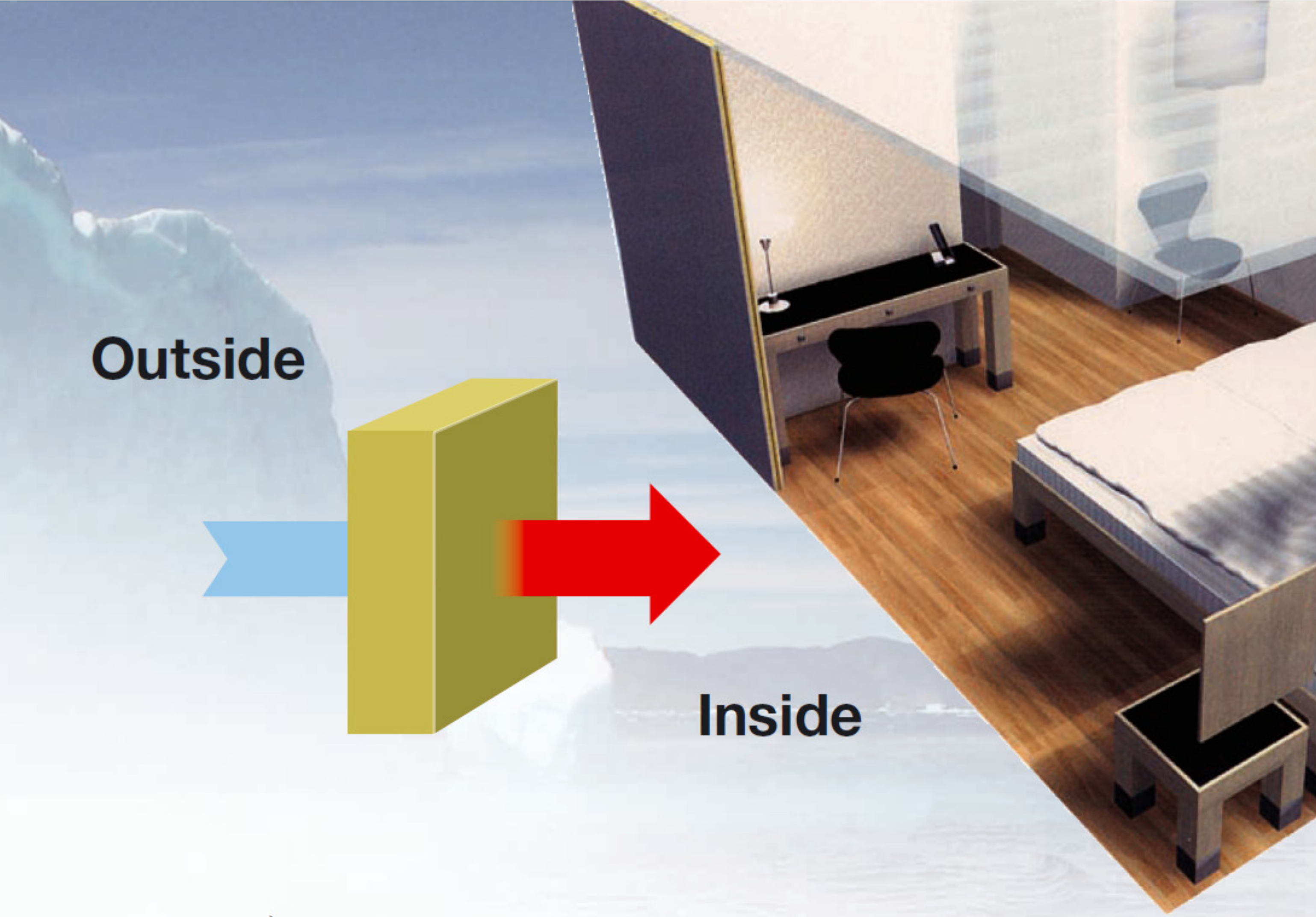
When adding additional insulation to a fire construction it should be documented and approved by the local surveyor.



Floor connection
When making a surface towards the exterior it is necessary to end the insulation 50 mm above the floor. This to make sure that condensate from the bulkhead can be drained away.



In front of the gab, a piece of flat iron can be fit to guide the condensate to a drain.

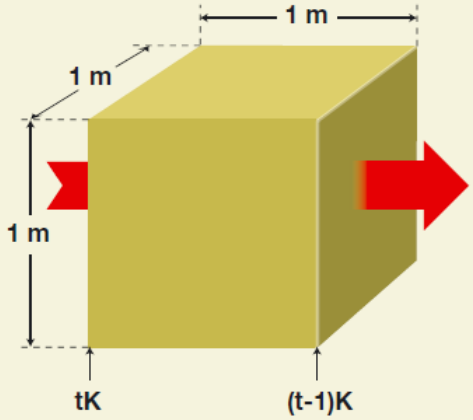


Lambda value (λ) measurements on Rockwool products (EN12667):

Product λ [W/mK]	λ10
Marine Batts 32	0.036
Marine Batts 45	0.034
Marine Slab 60	0.034
Marine Slab 80	0.034
Marine Slab 140	0.035
Marine Slab 150	0.035
Marine Slab 200	0.037
Marine Firebatts 100	0.035
Marine Firebatts 110	0.035
Marine Firebatts 130	0.035
Marine Lamella Mat 32	0.039
Marine Wired Mat 80	0.033
Marine Wired Mat 90	0.034
Marine Wired Mat 105	0.034
HC Firebatts 150	0.035
Pipe Section 850/864	0.035
Universal Pipe Section	0.036

All Rockwool Marine & Offshore products fulfil the IMO rules of "noncombustibility" and "low flame spread". Besides this the products have excellent water repellent properties which are also important as thermal insulation is often placed directly up against the outer construction with changing temperatures.

Thermal Calculations



$$\lambda = W/mK$$

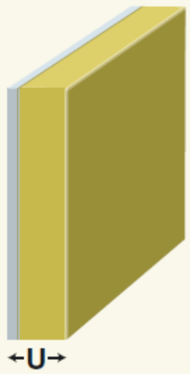
Lambda value/ thermal conductivity (λ)

The lambda(λ) value, also referred to as thermal conductivity, is a value indicating how well a material conducts heat. It indicates the quantity of heat (W), which is conducted through 1 m^2 wall, in a thickness of 1 m, when the difference in temperature between the opposite surfaces of this wall equals 1 K (or 1°C). In practice λ is a numerical value expressed in terms of W/(mK). The lower the λ value, the better the insulation property of the material.

Examples at 10°C

Steel:	λ = 50 W/mK
Concrete:	λ = 1.6 W/mK
Glass:	λ = 1.1 W/mK
Wood:	λ = 0.12 W/mK
Rockwool:	λ = 0.033W/mK

Most materials will increase in λ at rising temperatures.



$$U = W/m^2K$$

U value

The transport of thermal energy through a structure is expressed by a coefficient, U (Thermal transmittance coefficient). It represents the flow of heat (in W) through 1 m^2 of a structure, when the difference between the two surrounding temperatures is 1 K (or 1°C). The thermal transmittance coefficient is expressed in W/(m^2K). The lower the coefficient, the better the structure insulates.

$$R = \frac{1}{U} \quad \text{or} \quad R = \frac{\text{Thickness(m)}}{\lambda\ (W/mK)}$$

R value

Thermal resistance, R, is a measure used in a construction. The R value is the reciprocal value U-value. Increasing the thickness of an insulating layer increases the R value.

Examples

The steel plate is not taken into consideration due to the low added value.

Marine Batts 45, 50 mm (λ10 = 0.034 W/mK)
R = 0.05/0.034 = 1.47[m^2K/W] U = 0.68[W/m^2K]

Marine Batts 45, 100 mm (λ10 = 0.034 W/mK)
R = 0.1/0.034 = 2.94[m^2K/W] U= 0.34[W/m^2K]

Marine Firebatts 100, 60 mm (λ10 = 0.035 W/mK)
R = 0.06/0.035 = 1.714[m^2K/W] U = 0.57[W/m^2K]

Marine Firebatts 100, 60 mm + Marine Batts 45, 50 mm (λ10 = 0.035 W/mK λ10 = 0.034 W/mK)
R = (0.06/0.035) + (0.05/0.034) = 3.18[m^2K/W] U = 0.31[W/m^2K]

Marine Firebatts 100, 60mm + Marine Batts 45, 100mm (λ10 = 0.035 W/mK λ10 = 0.034 W/mK)
R = (0.06/0.035) + (0.1/0.034) = 4.65[m^2K/W] U = 0.21[W/m^2K]