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Report on evaluation of
Insultec Insulating Membrane

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Thermal Conductivity.

Thermal conductivity (k) is the calculation of the rate at which heat flows through a material by conduction. The property is defined as the rate at which heat flows through the material by conduction per unit of cross sectional area taken normal to the direction of the heat flow and the unit temperature gradient measured in the direction of heat flow.

For low conductance materials such as the Insultec membrane the method specified in Plastics Institute of Australia code of Practice for PVC wall cladding, Appendix E is appropriate and was used. The principle of the method is to measure the rate of heat penetration into an enclosure by determining the rate at which solid carbon dioxide contained in the enclosure is volatalised by the heat. The method provides a measurement of thermal resistance 'R' of the specimen, from which thermal conductance 'C' may be derived directly and by knowledge of specimen thickness the thermal conductivity 'K' can be derived. Accuracy of the method is estimated to be plus or minus 15%. Nevertheless the 'K' factor is significantly below those of solid vinyl, acrylic or olefine polymers, which are in the order of 0.5 to 0.30 W m^{-1} K^{-1}.

The conductivity is however, higher than that of low density insulants such as cork, polystyrene foam and the like, which range from 0.03 down to 0.015 W m^{-1} K^{-1}.

Values of various common insulating materials are shown below.

Cork	0.0381
Polystyrene foam	0.036
Glass fibre	0.033 – 0.044
Rigid Polyether Urethane foam	
Trichlorfluoromethane blown	0.016-0.026
Carbon Dioxide Blown	0.036

The relationship of thermal resistance (R) the thermal conductance (C) and the thermal conductivity (K) is shown below.

$$R = \frac{1}{C}$$

$m^2\ K\ w^{-1} = m^{-2}\ K^{-1}\ W$

$C = K \times m$

$m^{-2}\ K^{-1}\ W = m^{-2}\ K^{-1}\ W$

Thermal resistance of sample, 'R' = 0.12 m^2 K W^{-1}
Thermal conductance of sample, 'C' = 8.6 W m^{-2} K^{-1}
Thermal conductivity 'K' (based on thickness of 1.0 mms for the specimen submitted)
'K' = 0.090 W m^{-1} K^{-1}

The density of the specimen provided is 1290 kg m indicating a filled material.

Exposure Testing (Townsville, Queensland, Australia, Tropic of Capricorn).

A particular advantage of the Insultec membrane is its suitability for exterior exposure. Testing was conducted at the Allunga Exposure Laboratory for six months at an inclination of 20 0C facing north, the samples were evaluated in accordance with the procedures of Australian Standard 1580, Method 481.1.3 and at the conclusion of the testing the samples were in excellent condition and indicative of the product possessing a long life in normal service situations.

The expose of many synthetic foam insulating materials such as polystyrene polyurethane is unsatisfactory due to rapped yellowing, hardening and deterioration. Some polyurethane foam insulating materials have been coated after application with compatible coating material to seal and protect the foam from the elements. The success of such systems has been limited.

Summary

Performance testing of the Insultec membrane on small steel buildings has shown that a considerable reduction in the interior temperature is achieved. In Sydney over a three month period a reduction of 9.6 0C was achieved while in Townsville similar testing showed an average reduction of 11.5 0C, while on some occasions reductions of 15-20 0C were achieved. No attempts were made to fill in the gaps in the buildings and such action could be expected to further increase the reductions.

Thermal conductivity measurements showed that the insulating filling material present in the membrane reduced the thermal conductivity from 0.15 – 0.30 W m^{-1} K^{-1} to a value of 0.50 W m^{-1} K^{-1}.

A particular advantage of the Insultec membrane product is its formation as a continuous membrane and its suitability to withstand exterior exposure. Most available insulting material, batts and foam, are not continuous or suitable for exterior use.

If we can be of further assistance in this matter please contact the writer.

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