TP1668/DU01/01

Thermal Resistance of three Insulation Samples

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IANZ Approved Signatory

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Senior Technician
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All tests reported herein have been undertaken at the BRANZ Ltd laboratories located in Judgeford, Porirua, New Zealand, unless stated otherwise.

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All tests reported herein have been performed in accordance with the laboratory’s scope of accreditation.
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i. BRANZ undertakes to exercise due care and skill in the performance of the Services and accepts liability to the Client only in cases of proven negligence.
   
   ii. Nothing in this Agreement shall exclude or limit BRANZ's liability to a Client for death or personal injury or for fraud or any other matter resulting from BRANZ's negligence for which it would be illegal to exclude or limit its liability.
   
   iii. BRANZ is neither an insurer nor a guarantor and disclaims all liability in such capacity. Clients seeking a guarantee against loss or damage should obtain appropriate insurance.
   
   iv. Neither BRANZ nor any of its officers, employees, agents or subcontractors shall be liable to the Client nor any third party for any actions taken or not taken on the basis of any Output nor for any incorrect results arising from unclear, erroneous, incomplete, misleading or false information provided to BRANZ.
   
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   vi. The liability of BRANZ in respect of any claim for loss, damage or expense of any nature and howsoever arising shall in no circumstances exceed a total aggregate sum equal to 10 times the amount of the fee paid in respect of the specific service which gives rise to such claim or NZD$50,000 (or its equivalent in local currency), whichever is the lesser.
   
   vii. BRANZ shall have no liability for any indirect or consequential loss (including loss of profits).
   
   viii. In the event of any claim the Client must give written notice to BRANZ within 30 days of discovery of the facts alleged to justify such claim and, in any case, BRANZ shall be discharged from all liability for all claims for loss, damage or expense unless legal proceedings are commenced in respect of the claim within one year from:
   
   - The date of performance by BRANZ of the service which gives rise to the claim;
   - or
   
   - The date when the service should have been completed in the event of any alleged non-performance.

b. Indemnification: The Client shall guarantee, hold harmless and indemnify BRANZ and its officers, employees, agents or subcontractors against all claims (actual or threatened) by any third party for loss, damage or expense of whatsoever nature including all legal expenses and related costs and howsoever arising relating to the performance, purported performance or non-performance, of any Services.

c. Without limiting clause b above, the Client shall guarantee, hold harmless and indemnify BRANZ and its officers, employees, agents or subcontractors against all claims (actual or threatened) by any party for loss, damage or expense of whatsoever nature including all legal expenses and related costs arising out of:
   
   i. any failure by the Client to provide accurate and sufficient information to BRANZ to perform the Services;
   
   ii. any misstatement or misrepresentation of the Outputs, including Public Outputs;
   
   iii. any defects in the Products the subject of the Services; or
   
   iv. any changes, modifications or alterations to the Products the subject of the Services.
Thermal Resistance of three Insulation Samples

1. **CLIENT**

Expol Insulation, 105 Captain Springs Rd., Onehunga, Auckland, New Zealand

2. **DESCRIPTION OF TEST EQUIPMENT**

The test equipment used was a LaserComp Fox 600 heat flow meter. The specimen for testing is placed horizontally in the apparatus, with upwards heat flow. The hot and cold plates each have a 250 mm x 250 mm heat flux transducer embedded in their surface. The edges of the specimen are insulated from the room ambient temperature.

3. **PROCEDURE**

The specimens were supplied by the client and consisted of three pieces of polystyrene insulation segments. The dimensions of the samples were 600 x 560 mm. They were tested at their actual thicknesses, to the requirements of ASTM C518-04.

4. **RESULTS**

<table>
<thead>
<tr>
<th>Nominal Upper Plate Temperature</th>
<th>13 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Lower Plate Temperature</td>
<td>33 °C</td>
</tr>
<tr>
<td>Nominal Difference in Temperature</td>
<td>20 K</td>
</tr>
<tr>
<td>Nominal Mean Temperature</td>
<td>23 °C</td>
</tr>
</tbody>
</table>

**Measured results**

<table>
<thead>
<tr>
<th>Calibration check</th>
<th>17-Nov-08, EPS 01</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRANZ reference</td>
<td>D4306A D4306B D4306C</td>
</tr>
<tr>
<td>‘grams per sq. metre’</td>
<td>753 741 759</td>
</tr>
<tr>
<td>Sample weight</td>
<td>gram 253 249 255</td>
</tr>
<tr>
<td>Test date</td>
<td>13-Nov 21-Nov 21-Nov</td>
</tr>
<tr>
<td>Test thickness</td>
<td>mm 60.5 60.3 60.1</td>
</tr>
<tr>
<td>Density</td>
<td>kg/m³ 12.45 12.29 12.63</td>
</tr>
<tr>
<td>Temperature difference</td>
<td>K 20.0 20.0 20.0</td>
</tr>
<tr>
<td>Mean temperature</td>
<td>°C 23.0 23.0 23.0</td>
</tr>
<tr>
<td>Heat-flux</td>
<td>W/m² 13.88 14.12 13.88</td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>m²K/W 1.442 1.417 1.441</td>
</tr>
<tr>
<td>Thermal conductivity</td>
<td>W/mK 0.0420 0.0426 0.0417</td>
</tr>
<tr>
<td>Difference between heat flux transducers</td>
<td>% 3.1 1.7 2.5</td>
</tr>
</tbody>
</table>
Results adjusted from a mean temperature of 23°C to a mean temperature of 15°C

See AS/NZS 4859.1 Section 2.3.3.3 Figure 2.1 Effect of mean temperature on R-value

assuming thermal conductivity sensitivity of 0.4%/K

thermal conductivity @ 15°C = \frac{\text{thermal conductivity @ 23°C}}{1.032}

thermal resistance @ 15°C = 1.032 \times (\text{thermal resistance @ 23°C})

<table>
<thead>
<tr>
<th>BRANZ reference</th>
<th>D4306A</th>
<th>D4306B</th>
<th>D4306C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated thermal conductivity of test sample</td>
<td>0.041</td>
<td>0.041</td>
<td>0.040</td>
</tr>
<tr>
<td>Estimated thermal resistance of test sample</td>
<td>1.49</td>
<td>1.46</td>
<td>1.49</td>
</tr>
</tbody>
</table>

These measurements comply with the requirements of ASTM C518. The uncertainty in the measurements of thermal conductivity and thermal resistance are estimated to be ± 3%.

5. REFERENCES

American Society for Testing and Materials, Philadelphia, PA, 2004