

Comparative Test Using Various Advanced Heat Flow Meter Systems on Vacuum Insulation Panels

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Fast and reliable assessment of the thermal conductivity is becoming increasingly important for insulating materials used in the construction of buildings. The Guarded Hot Plate technique (GHP) has established as a standard method for the characterization of insulations. The technique offers a high accuracy and a broad scope of applications regarding measurement and temperature ranges. Measurements under different atmospheres or under vacuum are possible. However, one major drawback of this technique is the long measurement time, making it less useful for the field of quality control. The Heat Flow Meter (HFM) technique is another method generally used to measure the thermal conductivity of insulations. It is limited to temperatures around room temperature. Furthermore, it is not an absolute technique. However, it is easier to use and much faster compared to the Guarded Hot Plate method. Therefore, it has established to be the standard instrument for research and quality control for conventional applications. Even though the Heat Flow Meter technique is generally used for conventional insulating materials, there is always the question about the performance of those instruments for materials with higher or lower thermal conductivities. Vacuum insulation panels get more and more important for special insulation applications in the construction field or for special insulation needs such as wall insulations for refrigerators or transport boxes in the medical field. Such boxes can keep vaccines or other drugs cold for days without the need for active cooling. The question is, if conventional Heat Flow Meters can measure highly insulating structures such as vacuum insulation panels with reasonable accuracy and reliability. With effective thermal conductivities below $5 \text{ mW}/(\text{m}^*\text{K})$, those panels are close to the measurement limit of conventional Heat Flow Meters. Within this work, an internal intercomparative test was carried out, using 5 vacuum insulation panels with two different sizes (3 samples 300 mm by 300 mm and 2 samples 600 mm by 600 mm). The panels were manufactured by va-Q-tec AG, Wuerzburg, and show a thermal conductivity of $<4,2 \text{ mW}/(\text{m}^*\text{K})$ according to the specification sheet. The panels were tested in different HFMs and one GHP at $10 \pm 0.3^\circ\text{C}$. Further tests were carried out to analyze the temperature dependence of the thermal conductivity and the $\square T$ behavior. The results show that heat flow meters can be used to characterize such materials. The measurements on the different sizes show that the bond line has some impact on the measurement results.