Finding the R Value of Insulation using the KD2 Pro

The R value of a material is a measure of its resistance to heat flow. The higher the R value, the lower the heat flow for a given temperature difference. In winter, a house with an average R value of 10 will lose heat twice as fast as a house with an average R value of 20. The R value is therefore critical for determining energy requirements associated with heating and cooling of homes and other buildings.

The KD2 Pro can't measure the average R value of a building, but it can measure the thermal resistivity of the materials that make up the building. The most important and most variable of these is the insulating material. This note describes how to measure the resistivity of the material and how to compute the R value from that measurement.

We'll start by defining some terms. Thermal conductivity, *K* is the amount of heat (Watts or BTU) that flows across a plane of unit area (1 m^2 or 1 ft^2) in unit time (1 s or 1 hr) when there is unit temperature gradient (1 C/m or 1 F/in). Units are W/(m C) or BTU in/(ft^2 hr F). Thermal resistivity is the reciprocal of thermal conductivity (1/*K*), so units are m C/W or ft^2 hr F/(BTU in). Thermal resistivity is the resistance per unit thickness of the material (per meter or inch). Thermal *resistance* is the product of the resistivity and the thickness of the material, so its value is specific not only to the material but also to its physical configuration. The R value, as used in U. S. building trades, is the thermal resistance in units of ft^2 hr F/BTU.

Determining an R value with the KD2 Pro consists of measuring the thermal resistivity of the material, converting it to English units (the KD2 Pro shows m C/W), and multiplying by the insulation thickness in inches. The multiplier is 0.144.

Taking a measurement with the KD2 Pro is simple. Just insert the needle into a representative sample of the material to test, wait 90 seconds for the measurement to complete and record the reading.

As an example, assume we made a measurement with the KD2 Pro and found that the thermal resistivity of an insulating material was 20 m C/W. Converting this to English units gives

$$20\frac{m\ C}{W} \text{ x } 0.144 = 2.88\frac{ft^2hr\ F}{BTU\ in}$$

If the thickness of this insulation were 6 inches, the thermal resistance would be

$$2.88\frac{ft^2hr\ F}{BTU\ in} \text{ x } 6 = 17.28\frac{ft^2hr\ F}{BTU}$$

The R value of this insulation would therefore be approximately 17. Doubling the thickness would, of course, double the R value.

Printed in USA

13391-01