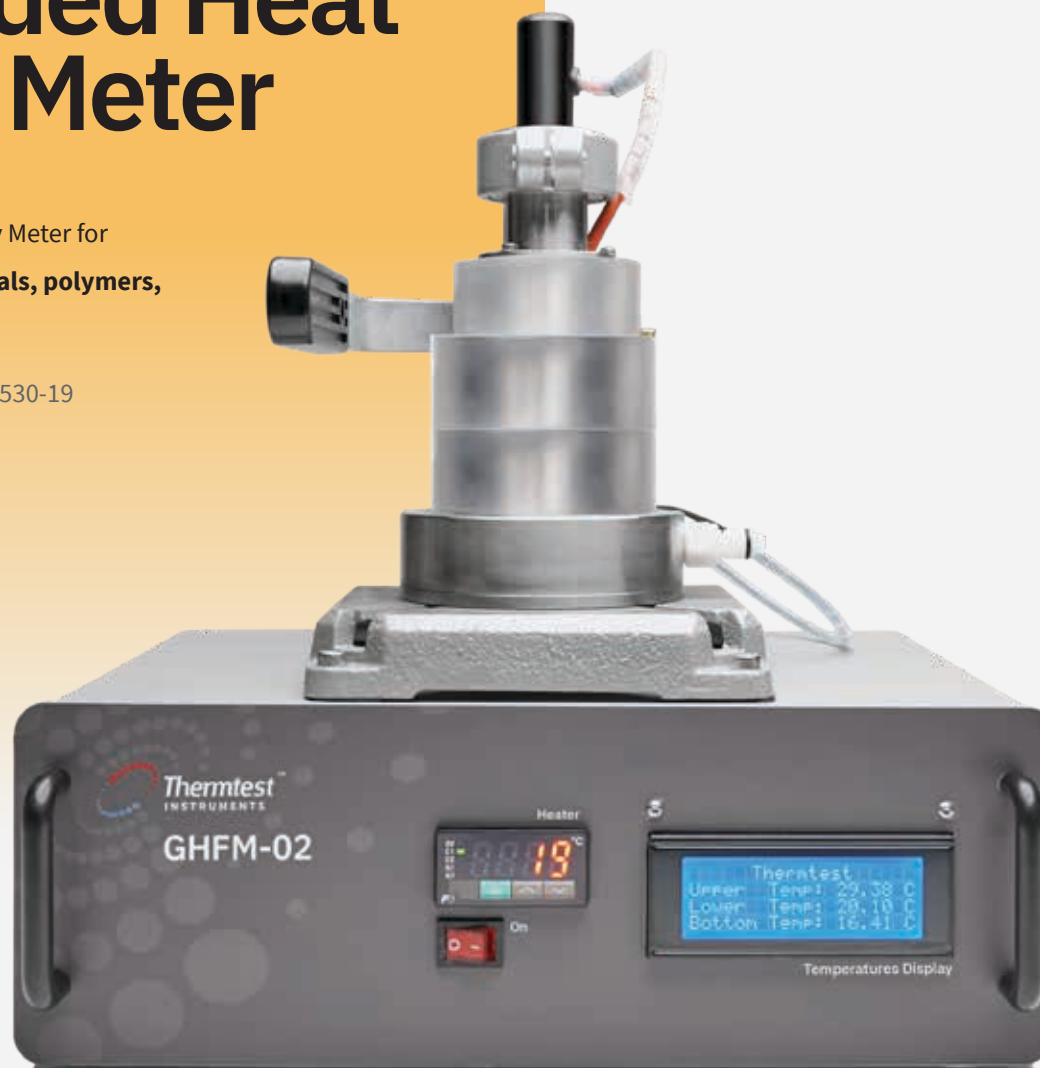


# GHFM-02 Guarded Heat Flow Meter

Thermal Conductivity Meter for  
measurement of **metals, polymers,  
and composites**

Conforms to ASTM E1530-19



Metals

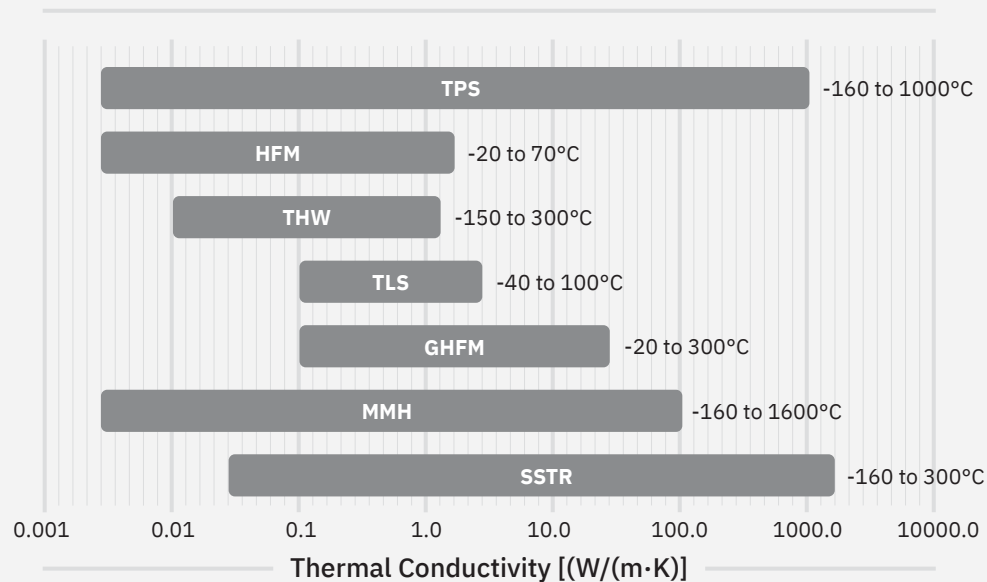


Polymers



Composites





**THERMAL CONDUCTIVITY:**

**HFM-100** (Heat Flow Meter)

**THW-L1** (Transient Hot Wire)

**GHFM-01** (Guarded Heat Flow Meter)

**MMH-1600** (Monotonic Heating)

**SSTR-F** (Steady State Thermoreflectance)



**TLS-100** (Transient Line Source)

**THW-L2** (Transient Hot Wire)

**TPS-EFF** (Transient Plane Source)

**GHFM-02** (Guarded Heat Flow Meter)

**MP-2** (Measurement Platform)

**HFM-25** (Heat Flow Meter)

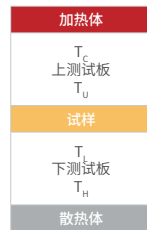
Thermtest has been advancing the measurement of thermal conductivity, thermal diffusivity, and specific heat since 2005. With more than 2000 satisfied customers worldwide, our unique combination of advanced thermal conductivity instrumentation for the laboratory, portable meters for the field, and accessories enables us to provide ideal solutions to fit any material testing application and budget.

# Featured Guarded Heat Flow Meter Capabilities

The Guarded Heat Flow Meter (GHFM-02) follows ASTM E1530-19 for testing thermal resistance and thermal conductivity of solids, such as metals, polymers and composites. The easy to operate GHFM-02 follows the trusted steady-state approach, with the addition of a guard to limit the effects of lateral heat loss. This design, allows testing of a wide range of materials with low to medium thermal conductivity.

According to the method, the sample is subjected to a steady-state through-thickness temperature gradient. The thermal conductivity of the sample is obtained by measuring the temperature difference across it, and one additional temperature.

The testing stack is made up of a heater – upper plate, with integrated temperature sensor and heat sink – lower plate with integrated temperature sensor on each side of the sample. Additional temperature sensors are placed near the top and bottom surface of the sample.



Once steady-state temperature across sample is achieved, the Fourier law equation can be applied. It can readily be shown that for any solid sample, the ratio  $R_s$  ( $m^2 K/W$ ), equal to the thickness of the sample,  $d(m)$ , to its thermal conductivity,  $\lambda$  ( $W/mK$ ), can be obtained from the temperatures measured:

$$R_s = F \left[ \frac{T_u - T_L}{T_L - T_H} \right] - R_{int} \Rightarrow R_s = F \left[ \frac{\Delta T_s}{\Delta T_B} \right] - R_{int}$$

The above equation is linear in form, and is the working equation of the instrument. Constants  $F(m^2 K/W)$  and  $R_{int}$  ( $m^2 K/W$ ), can be obtained by calibration of the instrument. To this effect, calibration samples of known thermal conductivity and hence, thermal resistance, are employed. Calibrated results for thermal resistance and thermal conductivity are reported.

- **Follows international standard ASTM E1530-19**
- **Economical and Accurate**
- **Easy to use**
- **Variable Thickness**

## GHFM-02 Specifications

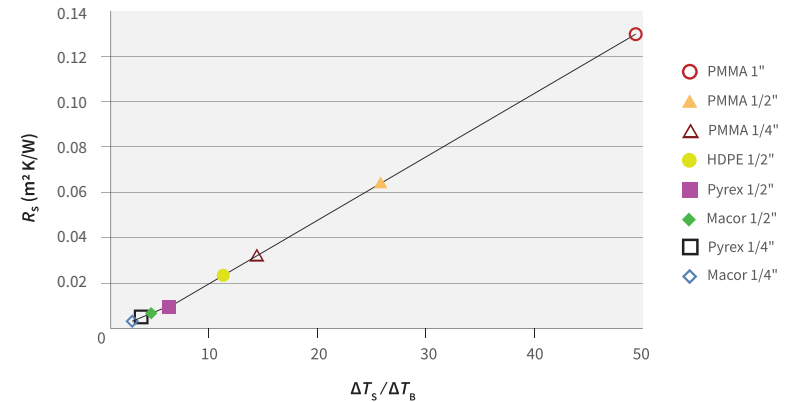
|                          |                                 |
|--------------------------|---------------------------------|
| Materials                | Metals, Polymers and Composites |
| Measurement Capabilities | Through-Thickness               |
| Thermal Resistance       | 0.00007 to 0.25 $m^2 K/ W$      |
| Thermal Conductivity     | 0.1 to 15 $W/m \cdot K$         |
| Measurement Time         | Typically 30-60 minutes         |
| Reproducibility          | 2%                              |
| Accuracy                 | 5%                              |
| Temperature              | 20 °C – 30 °C                   |
| Sample Diameter          | 50.8 mm / 2 in.                 |
| Maximum Thickness        | 25.4 mm / 1 in.                 |
| Standard                 | ASTM E1530 -19                  |

# Economical. Accurate.



## Standard GHFM-02 Testing Stack

The GHFM-02 comes with a standard 50.8 mm (2 inches) diameter sample opening to allow testing of metals, polymers and composite materials. Sample thickness can vary up to 25.4 mm (1 inch). Typically a 20°C temperature delta from top to bottom of the sample is set to a mean temperature of 20°C to 30°C. Temperature points  $T_u$ ,  $T_L$  and  $T_H$  are then entered into the included GHFM software for auto calculation of thermal resistance and calibrated thermal conductivity results.



## Calibration

The basic GHFM-02 comes calibrated to calculate thermal conductivity from thermal resistance range of 0.0032 to 0.1270 m² K/W. Additional available calibration ranges allow testing from 0.00007 to 0.25 m² K/W.

# Sample Measurement



## Step 1

GHFM-02 samples should be 50.8 mm or 2 inches in diameter. The bottom surface should be flat and parallel.



< 1 min.



## Step 2

A thin layer of the included contact paste should be added to the top and bottom of the sample surface.



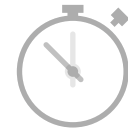
< 2 min.

# Efficiency with Ease

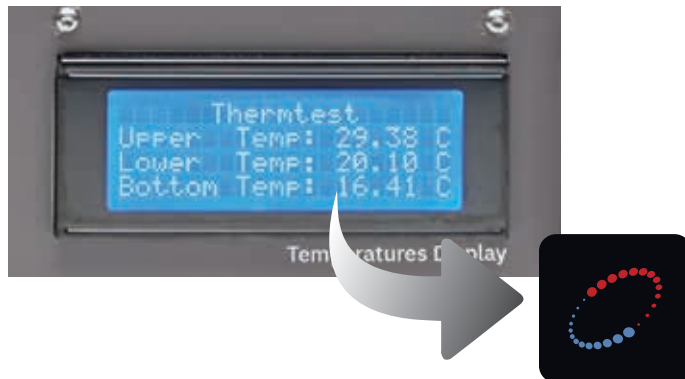


## Step

For a sample mean temperature of 25°C, the top heater should be set to 35°C, while the bottom heat sink chiller – circulator set to 15°C to achieve a delta temperature of 20°C.



< 2 min.



## Step

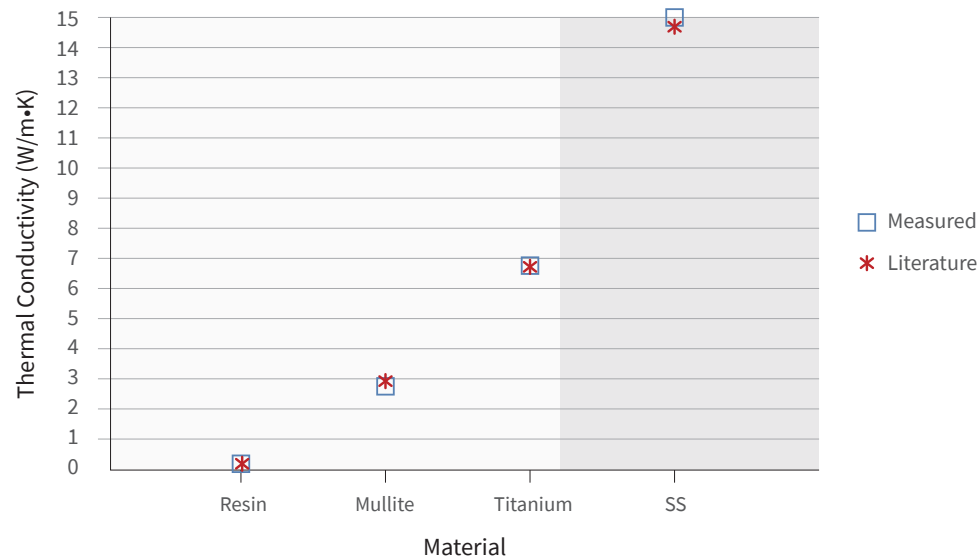
Once stable, temperatures from upper temperature ( $T_u$ ), lower temperature ( $T_L$ ) and heat sink temperature ( $T_H$ ) are then entered into the GHFM-02 software for auto calculation of thermal resistance, and calibrated thermal conductivity results.



< 60 min.

# Thermal Conductivity of Solids

Four unknown samples were measured by the GHFM-02 and compared to literature values. Each sample was tested using the corresponding calibrations range. All results were compared to literature values better then 5%.

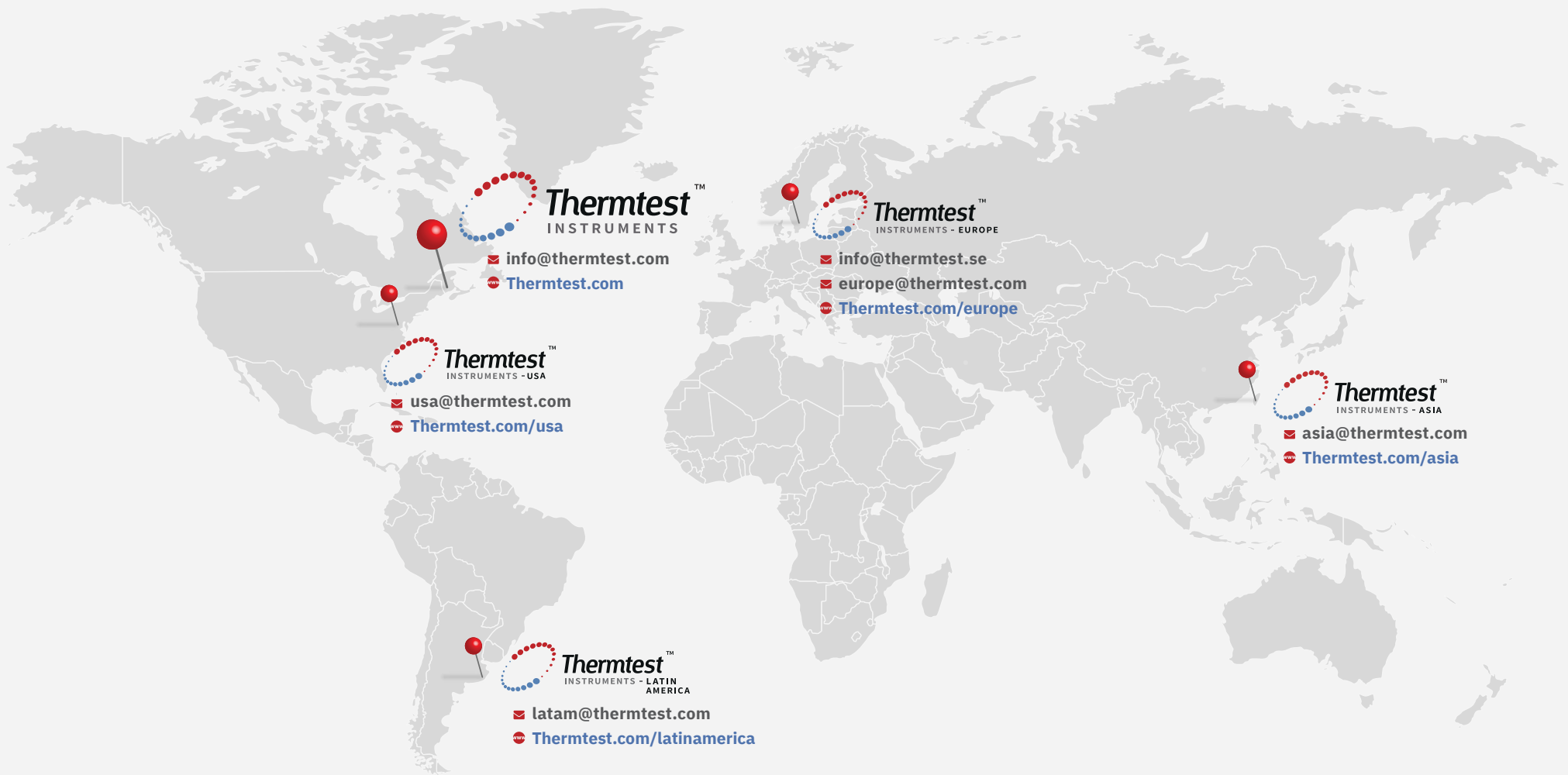


| Calibrations |         |
|--------------|---------|
| Basic 2      | Basic 3 |

## Calibration Ranges

In addition to the basic low conductivity range, additional ranges are available.

| Ranges  | Low Thermal Resistance (m²K/W) | High Thermal Resistance (m²K/W) |
|---------|--------------------------------|---------------------------------|
| Basic 1 | 0.1270                         | 0.25                            |
| Basic 2 | 0.0032                         | 0.1270                          |
| Basic 3 | 0.00007                        | 0.0032                          |



## HEADQUARTERS

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