NETZSCH

Proven Excellence.



Guarded Hot Plate GHP 721 Series

Thermal Conductivity Testing

Analyzing & Testing





Thermal Conductivity Measuring Devices

Protecting the environment, preserving our natural resources and conserving energy have become more and more important. The use of insulation and building materials with a low thermal conductivity value substantially contributes to achieving these goals. These materials help prevent the inside temperature of buildings from approaching the temperature on the outside, thereby minimizing the loss of energy in buildings. As a result, the amount of energy needed to heat or cool the inside of buildings is considerably reduced.

The thermal conductivity (lambda, λ) is the property of conveying a material's ability to conduct heat and is expressed in W/(m·K). **The lower the thermal conductivity of a material, the better its insulating properties.**

NETZSCH primarily focuses on devices for measuring the thermal conductivity of building, construction and insulating materials.

- Devices with guarded hot plate in accordance with ISO 8302
- Devices with guarded hot pipe in accordance with DIN EN ISO 8497 (see TLR 1000 brochure)

Guarded Hot Plate

THE ABSOLUTE METHOD FOR DETERMINATION OF THE THERMAL CONDUCTIVITY

- Direct measuring method
- For low-conductive and building materials
- Specimens with high thickness up to 380 mm
- Customized heating plates
- Tilting measuring chamber up to 90°
- Guarded test chamber

Definition of Thermal Conductivity

Thermal conductivity (λ with the unit W/(m·K)) describes the transport of energy – in the form of heat – through a body of mass as the result of a temperature gradient.

According to the second law of thermodynamics, heat always flows in the direction of the lower temperature.

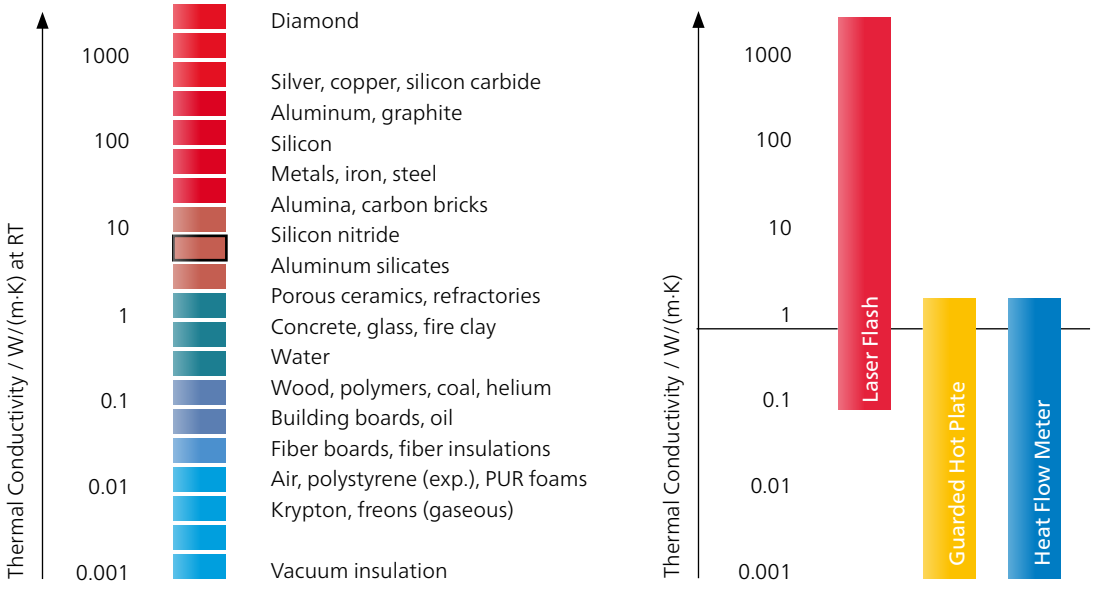
The relationship between transported heat per unit of time (dQ/dt or heat flow $\dot{Q}$) and the temperature gradient ($\Delta T/\Delta x$) through Area A (the area through which the heat is flowing perpendicularly at a steady rate) is described by the thermal conductivity equation.

Thermal conductivity is thus a material-specific property used for characterizing steady heat transport. It can be calculated using the following equation:

$$\lambda(T) = \rho(T) \cdot c_p \cdot a(T)$$

where:
a = thermal diffusivity
c_p = specific heat capacity
ρ = density

An overview of the thermal conductivity for various materials is shown in the figure below:



GHP 721-500 mm – Thermal Conductivity Tester

Guarded Hot Plate with touch display – especially for thick specimens!



Measuring device with guarded hot plate in accordance with ISO 8302, ASTM C177, EN 1946-2, EN 12664, EN 12667 and EN 12939

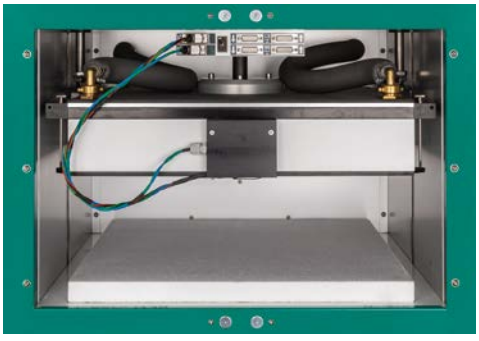
Measuring devices of the GHP 500 series are robust cabinet devices which are especially suited for testing thicker specimens. Thanks to the integrated single board computer (SBC) with Windows operating system, the Lambda software and the high-resolution color touch display, the devices are very user-friendly.

Numerous interfaces such as RS232, USB and Gigabit Ethernet enable connectivity to peripheral devices and allow for fast and convenient data transfer. Connection to an external PC allows for the extensive evaluation of test results and the printing of test reports.

Features at a Glance

- Large thermal conductivity measuring range up to 2.0 W/(m·K) – depending on material and thickness
- Fully insulated guarded test chamber, designed for specimens with a thickness up to 200 mm
- Available as 1- or 2-specimen measurement method according to ISO 8302 (chapter 1.6.2)
- **Easy specimen change from the front**
- Integrated digital measurement of specimen thickness and sample pressure
- Motorized lifting of the upper plate
- **Operator guidance via touch display with intuitive guidance through software**
- Network capability
- Control, data acquisition and data processing via external PC and Lambda software (optional)
- Variable dimensions of heating plates; heating area from 100 mm x 100 mm up to 300 mm x 300 mm
- **Square-shaped or rectangular measuring areas**
- Cold plates and guarded chamber are controlled by chiller systems

GHP 721-500 mm	
Measuring range	0.005 to 2.0 W/(m·K), depending on material and thickness
Specimen size (L x W)	500 mm x 500 mm, variable, according to the dimension of the hot plate: 200 mm x 200 mm up to 300 mm x 300 mm
Specimen thickness (H)	▪ 1x 15 mm to 200 mm (1-specimen measurement method) ▪ 2x 15 mm to 100 mm (2-specimen measurement method)
Temperature range	▪ Cooling plate: -15°C to 60°C ▪ Heating plate: -5°C to 70°C
Interface	1x RS 232,1x Gigabit Ethernet
Dimensions (H x W x D)	186 cm x 75 cm x 75 cm
Power supply	110 V to 230 V, 50/60 Hz
Weight	192 kg



Open test chamber
with specimen



GHP 721-600 mm – Thermal Conductivity Tester

For specimen dimensions up to 600 mm x 600 mm



Measuring device with guarded hot plate in accordance with ISO 8302, ASTM C177, EN 1946-2, EN 12664, EN 12667 and EN 12939

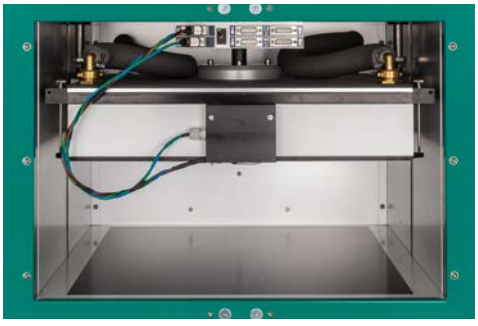
Measuring devices of the GHP 721-600 mm series are robust cabinet devices which are especially suited for testing thicker specimens. Thanks to the integrated single board computer (SBC) with Windows operating system, the Lambda software and the high-resolution color touch display, the devices are very user-friendly.

Numerous interfaces such as RS232, USB and Gigabit Ethernet enable connectivity to peripheral devices and allow for fast and convenient data transfer. Connection to an external PC allows for the extensive evaluation of test results and the printing of test reports.

Features at a Glance

- Large thermal conductivity measurement range up to 2.0 W/(m·K) – depending on material and thickness
- Fully insulated guarded test chamber, designed for specimens with a thickness up to 200 mm
- Available as 1- or 2-specimen measurement method according to ISO 8302 (chapter 1.6.2)
- **Easy specimen change from the front**
- Integrated digital measurement of specimen thickness and sample pressure
- Motorized lifting of the upper plate
- **Operator guidance via touch display with intuitive guidance through software**
- Network capability
- Control, data acquisition and data processing via external PC and Lambda software (optional)
- **Square-shaped or rectangular measuring areas**
- Cold plates and guarded chamber are controlled by chiller systems

GHP 721-600 mm	
Measuring range	0.005 to 2.0 W/(m·K), depending on material and thickness
Specimen size (L x W)	600 mm x 600 mm dimension of the hot plate: 300 mm x 300 mm
Specimen thickness (H)	▪ 1x 15 mm to 200 mm (1-specimen measurement method) ▪ 2x 15 mm to 100 mm (2-specimen measurement method)
Temperature range	▪ Cooling plate: -15°C to 60°C ▪ Heating plate: -5°C to 70°C
Interface	1x RS 232,1x Gigabit Ethernet
Dimensions (H x W x D)	186 cm x 85 cm x 85 cm
Power supply	110 V to 230 V, 50/60 Hz
Weight	214 kg



Open test chamber; 1-specimen measurement method

GHP 721S-900 mm – Thermal Conductivity Tester

Thermal conductivity measuring device with guarded hot plate in accordance with ISO 8302, ASTM C177, EN 1946-2, EN 12664, EN 12667, EN 12939 and EN 674

Measuring devices of the GHP 721S-900 mm series are cabinet devices with a tiltable test chamber that are well suited for a wide range of applications, those involving especially thicker specimens and insulating glass. The design of the device is such that specimens are inserted into the test chamber from the top. This allows for the insertion of heavy and complex samples without damaging the measuring plates. Data logging and control of the device are handled by the external Lambda Control desktop device alongside a PC with Windows operating system and Lambda software.

GHP with a Tiltable Test Chamber

Cabinet devices with a tiltable test chamber are especially well suited for determining the thermal conductivity and U-value of windows and skylights. The U-value of an insulation glass window depends on the mounting angle (vertical, horizontal or in between) due to different heat transfer conditions within the gas phase. The GHP 721S-900 mm is able to measure the thermal conductivity of such insulation glass windows as a function of temperature and mounting angle.





Features at a Glance

- Large thermal conductivity measuring range up to 2.0 W/(m·K)
- Fully insulated guarded test chamber, designed for specimens with a thickness up to 380 mm
- Available as 1- or 2-speciment measurement method according to ISO 8302 (chapter 1.6.2)
- **Easy specimen change from the top**
- Fixation of specimens onto the measurement positioning surface
- Electrically operated tilting mechanism for the test chamber
- **Tiltable – especially important for skylights**
- **Tilting angle indicator (0 to 90°) on LCD display**
- Control, data acquisition and data processing via external PC and Lambda software
- Variable dimensions of heating plates – especially for bricks with different dimensions; heating area from 200 mm x 200 mm up to 500 mm x 500 mm
- Square-shaped or rectangular measuring areas
- Cold plates and guarded chamber are controlled by chiller systems

GHP 721S-900 mm	
Measuring range	0.005 to 2.0 W/(m·K), depending on material and thickness
Specimen size (L x W)	900 mm x 900 mm variable, according to the dimension of the hot plate: 200 mm x 200 mm up to 500 mm x 500 mm
Specimen thickness (H)	▪ 1-plate method: 1x 15 mm to 380 mm ▪ 2-plate method: 2x 15 mm to 180 mm
Temperature range	▪ Cooling plate: -10°C to 60°C ▪ Heating plate: 0°C to 70°C
Interface	1x RS 232,1x Gigabit Ethernet
Dimensions (H x W x D)	235 cm x 130 cm x 120 cm
Power supply	110 V to 230 V, 50/60 Hz
Weight	256 kg



Lambda Software

Universal Software Program for Control, Data Acquisition and Evaluation in the Use of Thermal Conductivity Measuring Devices

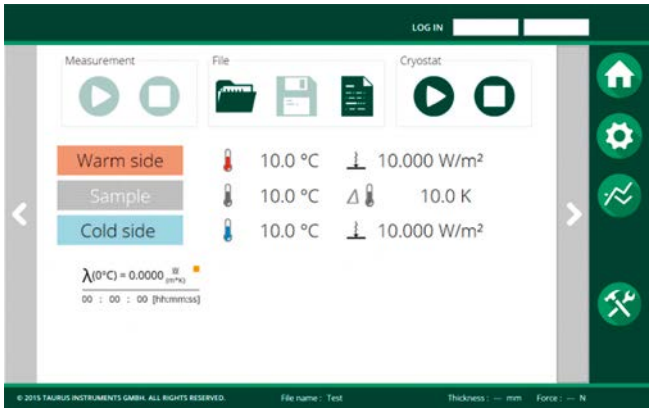
Supported Measuring Methods

- Method with heat flow meter in accordance with ISO 8301, ASTM C518, DIN EN 1946-3, EN 12664, EN 12667 and EN 12939
- One- or two-specimen measurement method with guarded hot plate in accordance with ISO 8302, ASTM C177, DIN EN 1946-2, EN 12664, EN 12667, EN 12939, EN 674 and ISO 10291
- Thermal conductivity measuring device with guarded hot pipe in accordanc with DIN EN ISO 8497, DIN EN 1946-5, DIN 52613, ASTM C 534 and ASTM C 335

Intuitive Software!

Functions

- Choice of manual or automatic measuring procedure with up to 16 definable mean temperatures per measurement
- Creation of favorites for fast access to frequently used measurement tasks
- Display of all relevant data, measuring results, intermediate and final results as graphs and tables
- Monitoring of relevant messages and information
- Safety function via error messages
- Calculation of nominal λ value from ascertained $\lambda_{90/90}$
- Customized test report
- Intuitive icons for menu functions
- User and administrator level



Measurement screen



Graph of 7-point measurement

Accessories and options for expanding upon the functions of the devices are available. The operator can adapt the different measuring tasks as needed with regard to determining the thermal conductivity using heat flow meters, guarded hot plates and guarded hot pipes.

Auxiliary equipment is required for certain measurements, especially those involving materials such as insulating glass or other insulating materials, natural stone, concrete, plastics, composite materials or loose materials like granulates or flakes. In addition, suitable reference materials should be used for routinely checking and validating the devices.

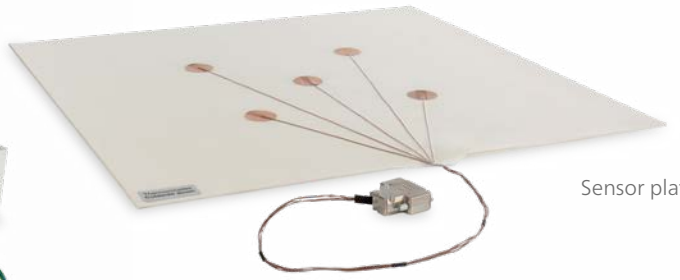
Accessories

Instrument Type	Description
GHP*	Customized heating plates
GHP*/HFM	▪ Test masks in various dimensions for different specimens ▪ Measuring frame in various dimensions for loose fill materials ▪ Silicone sponge sheet ▪ Thermal grease ▪ Thermocouple foils in various dimensions with 5 thermocouples each
HFM 300	Reference sample IRMM 440 A (European Commission – Joint Research Centre) 300 mm x 300 mm x 35 mm
GHP*	IRMM 440 B (European Commission – Joint Research Centre) 500 mm x 500 mm x 35 mm
TLR**	▪ Customer-specific heating pipes Ø 18 mm to 89 mm ▪ Reference test pipe made of mineral wool including works calibration certificate ▪ Hot pipes with extended temperature range

* for instruments of the 500, 600 and 900 or 900 S series
** see separate TLR flyer



Specimen adapter plate for 1-specimen mode



Sensor plate

The owner-managed NETZSCH Group is a leading global technology company specializing in mechanical, plant and instrument engineering.

Under the management of Erich NETZSCH B.V. & Co. Holding KG, the company consists of the three business units Analyzing & Testing, Grinding & Dispersing and Pumps & Systems, which are geared towards specific industries and products. A worldwide sales and service network has guaranteed customer proximity and competent service since 1873.

When it comes to Thermal Analysis, Calorimetry (adiabatic & reaction), the determination of Thermophysical Properties, Rheology and Fire Testing, NETZSCH has it covered. Our 60 years of applications experience, broad state-of-the-art product line and comprehensive service offerings ensure that our solutions will not only meet your every requirement but also exceed your every expectation.

Proven Excellence.

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