

Heatpipe measuring station

Characterization and testing of heat pipes

At the measuring station, heat pipes can be tested under precisely defined conditions.

Heat pipes are a central component in many cooling and heat dissipation systems. For heat pipes to function efficiently and reliably, they must be optimally adapted to the respective operating conditions. Fraunhofer IPM develops its own measuring stations to test and characterize heat pipes of different geometries based on their dimensions, heat loads and spatial orientation.

Reliable data instead of standard values

Generally, manufacturers of heat pipes provide information on heat transfer capacity, maximum heat load and so on. However, this information is often unreliable, insufficient, or only valid for specific standard cases. In practical applications, technical parameters usually deviate from the standard:

To achieve optimal cooling, heat pipes must often be bent, operated under specific spatial orientations, or the length of the evaporator and condenser areas must be adjusted.

However, data sheets typically do not provide useful information for these adjustments. Therefore, it is necessary to test the heat transfer capacity of heat pipes under these specific conditions.

Verifying the specifications and performance parameters provided by the manufacturer is especially important where cooling and heat dissipation systems depend on the high heat transfer capacity of heat pipes.

Flexible measuring conditions

At our measuring station, specially developed for characterizing heat pipes, we test tubular heat pipes of various diameters and lengths. The tilt angle and spatial orientation are adjustable. Bent heat pipes can also be examined.

The heat output is fed into the evaporator area (the hot side) via a heated copper block. The heat pipe can be inserted into this block at different depths to adjust the size of the evaporator area. The integrated power supply allows different heating outputs to be set for the evaporator area.

»Real performance data on our heat pipes is essential for our products. Now, we can finally test these components individually and precisely.«

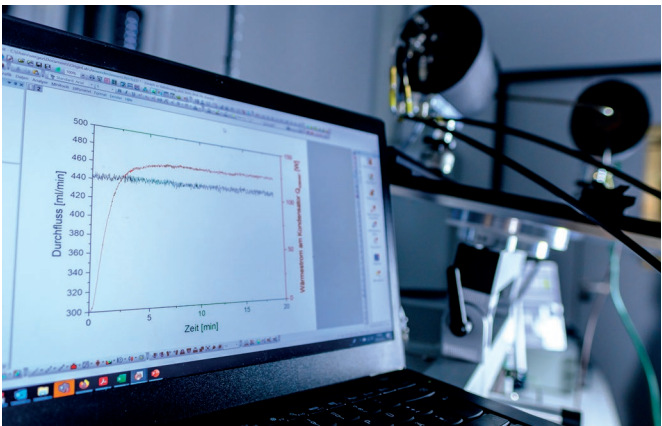
Nils Katenbrink, Quick-Ohm
Küpper & Co. GmbH



The heat pipe measuring station is specially designed to characterize tubular heat pipes. We examine heat pipes with different diameters, lengths, and bends, as well as adjustable tilt angles and spatial orientations.

The condenser area is created using a copper block, into which the heat pipe can be inserted at varying depths. This allows the size of the condenser area to be adjusted. Water flows through the copper block, which allows the temperature of the condenser area to be individually adjusted over a wide range by using a thermoregulator. The difference between the water's inlet and outlet temperatures at the condenser can be used to determine the heat flow that has actually passed through the heat pipe from the evaporator to the condenser area. Together with the temperature gradients measured along the heat pipe, it enables the precise determination of the heat pipe's thermal resistance.

To minimize parasitic heat flows, the measuring station is equipped with customized thermal insulation. The remaining parasitic heat flows are estimated through model calculations.



The measurement data recorded at the heat pipe measuring station can easily be retrieved and evaluated on any computer.

A data logger with 20 data inputs records all measurement data on a time-dependent basis. This data can be easily retrieved and evaluated on any computer. Customers can install additional temperature sensors (thermocouples of various types, PT100/PT1000, etc.) according to individual requirements. This allows for flexible temperature determination at various positions on the heat pipe.

Our offer

We manufacture customized heat pipe measuring stations for our customers. When designing these stations, we consider individual specifications regarding the dimensions of the heat pipes, evaporator and condenser area size, heating capacity, and other characteristics.

Technical data (example)

Heat pipe length of heat pipe	100 – 350 mm
Heatpipe diameter	3 – 8 mm
Length evaporator and condenser area	20 – 100 mm
Max. heating capacity evaporator area	150 W
Adjustable condenser temperature range	10 – 80 °C

Technical data can be customized according to customer requirements. For example, longer heat pipes can also be tested and characterized.

Contact

Dr. Markus Winkler
Project Manager
Phone +49 761 8857-611
markus.winkler@ipm.fraunhofer.de

Fraunhofer Institute for
Physical Measurement Techniques IPM
Georges-Köhler-Allee 301
79110 Freiburg, Germany
www.ipm.fraunhofer.de/en

