NETZSCH
TAURUS INSTRUMENTS

HotBox Test Chambers TDW 4040, TDW 4140 and TDW 4240

With Heat Flow Meter, Guarded Hotbox or a Combination

Analyzing & Testing

TDW 4040, 4140 and 4240

HotBox Test Chambers

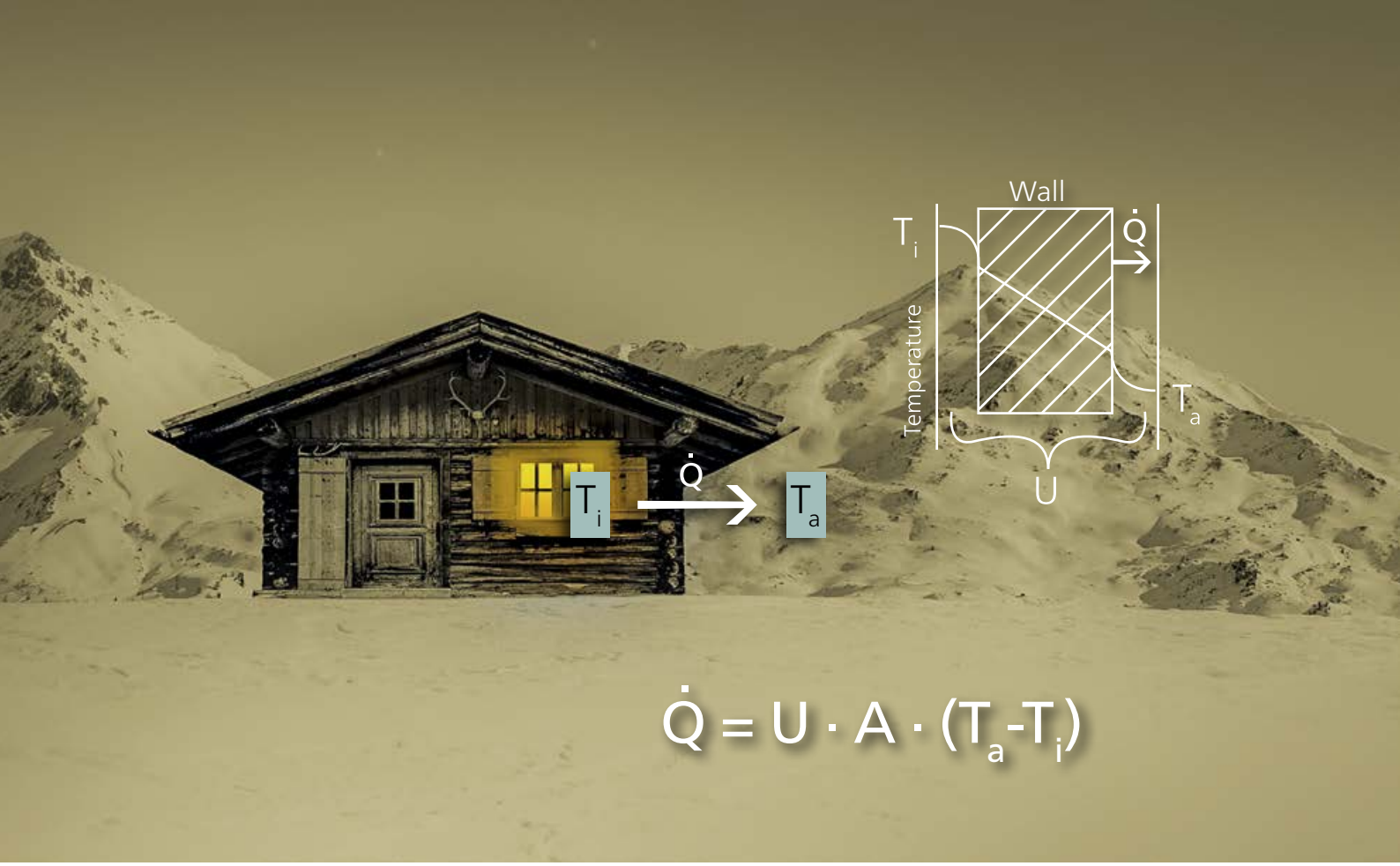
For determining the stationary heat transfer properties of complex components and finished products used in construction such as doors, windows and bricks.
Our HotBox devices are in accordance with DIN EN 1934, DIN EN ISO 8990, DIN EN 1946-4, DIN EN ISO 12567, DIN EN 12412-2, and ASTM C1363.

The U-value measures the heat transmission through a building part, e.g., wall or window

Our HotBox is a constructively complex test apparatus for determining the heat transfer properties of wall elements, walls, windows and doors. In the HotBox, it is possible to simulate real-world conditions as they would exist for a building wall, by simulating conditions both inside the building and on the outside of the wall. To do so, temperature, humidity, air speed and radiation properties on both sides of the test wall must be detectable and precisely adjustable.

In contrast with conventional analysis methods for determining the thermal conductivity (e.g., laser flash, plate method or transient source), the HotBox takes into consideration not only the heat conduction through the test specimen (pure material dependence), but also the heat transfer conditions (material properties and ambient conditions). Thus, for example, the surface structures of walls (e.g., from fluid to solid) or the transmission properties of window panes have a direct influence on the effective heat transfer.

Trolley with brick wall.



$$\lambda = \frac{\dot{Q}}{A}\frac{L}{\Delta T}$$

λ in SI unit: [W/(m·K)] or British Thermal Units: [Btu in/(h·ft²·°F)]

$$R = \frac{L}{\lambda}$$

R in SI unit [(m²·K/W)] or British Thermal Units: [(h·ft²·°F)/Btu]

$$U = \frac{1}{R}$$

U in SI unit [W/(m²·K)]

The heat flow through a brick wall or a window part is defined by the U-value in [W/(m²K)]. The lower the U-value, the better the insulation property of the respective part of the building and therefore the greater the energy efficiency of the building as a whole.

This illustrates the need to determine the U-value for all parts of the building envelope, such as brick walls, facades, windows and doors.
Stationary methods are usually preferred for larger inhomogeneous samples.

Just as with the heat flow meter or the guarded hot plate, the HotBox technique is an established method. At NETZSCH, we offer systems with heat flux sensors, HotBox systems and combinations of the two.

Expert knowledge

A small but subtle difference in terminology: The U-value and the heat transmission coefficient are represented by the same unit, but the U-value is mostly based on the temperature difference within the air whereas the heat transmission coefficient is based on the temperature difference within the material.

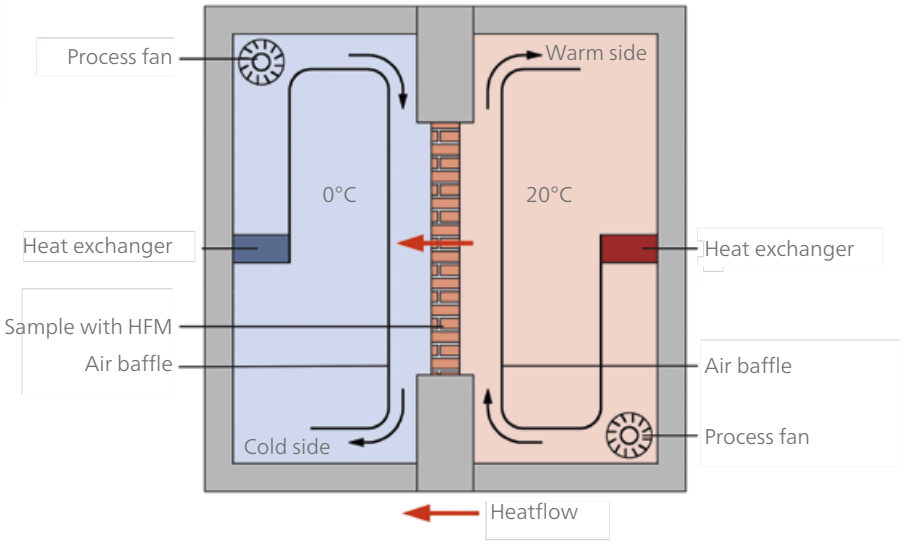
TDW 4040

Test Chamber for Determining the Stationary Heat Transfer Properties with a Heat Flow Meter in Accordance with DIN EN 1934

The compact test chamber TDW 4040 was designed for testing brickwork (such as brick, lime sand brick, concrete, or aerated concrete) and basically simulates the temperature and the natural convection inside and outside a building. Optionally, the humidity level in the two sections of the chamber can be set as needed. The HotBox software at the measurement and control units is used to set all parameters, as well as for complete data logging, detailed analysis and printing of test reports. There are also other devices, accessories and materials that allow for sample preparation and conditioning to optimize the testing procedure.

HOTBOX TEST CHAMBERS

with Heat Flow Meter



Principle illustration of HotBox test chamber with heat flow meter

HotBox Test Chambers with Heat Flow Meter are Used to Determine the Stationary Heat Transfer Properties of Brickwork

The test chamber consists of a cold and a warm section as well as a test frame that is positioned between the two sections of the chamber. Both sections contain heat exchangers for temperature control and air deflectors with radial fans to generate the necessary convection.

In the cold section (see left side of the diagram) the ambient conditions outside a building are simulated. The conditions on the inside of a building are simulated in the warm section (right hand side in the diagram above). The temperature ranges and the convection fulfill the requirements are set forth in the standard but can be adjusted to specific individual applications as needed. The heat flow meter with guarded zone is installed at the surface of the brickwork specimen to be tested in the warm section and completely covers the component to be tested. Numerous sensors at the air deflectors, inside the sections and on the brickwork specimen are used to capture the data pertaining to temperatures, convection and humidity.

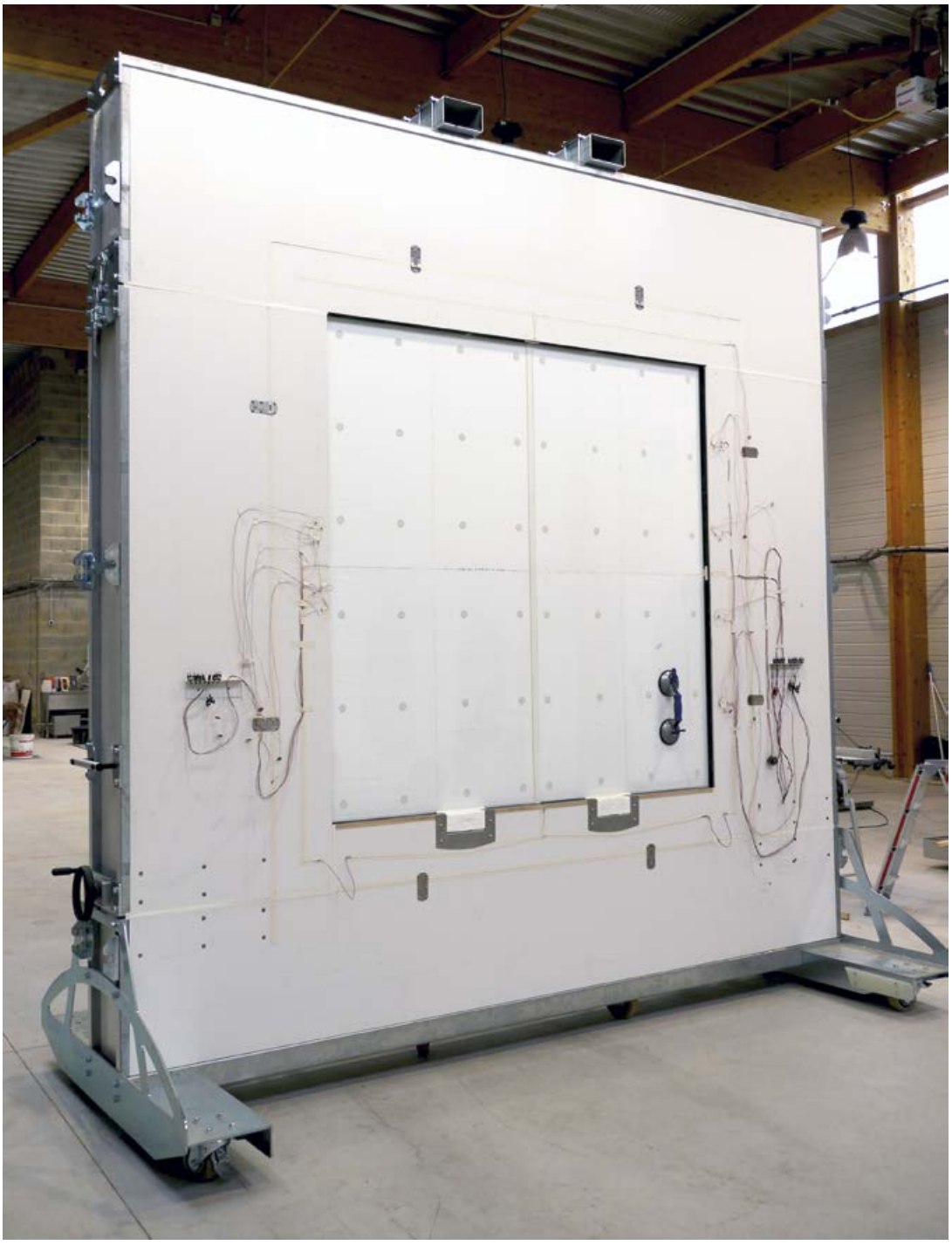
The test frame positioned between the cold and the warm sections holds the brickwork specimen and minimizes lateral thermal influences. The test frame is locked airtight with both sections of the chamber for the duration of the test.

Designed for testing brickwork

Features at a Glance

- Insulated warm and cold sections with heat exchangers and air deflectors, radial fans, roll chassis on guiding rails and 12-point locking system
- Insulated test frame with roll chassis and openings for sample insertion via forklift
- Recirculation cooler with water cooling for temperature control of warm and cold sections
- 2 isothermal blocks with 60 measuring points each, 1 set ot thermocouples, flow sensors, 2 heat flow meters with guard plates
- Control rack unit with measuring and control modules, PC printer and 23" monitor
- Interfaces: 1x RS232, 2x USB, 1x Gigabite Ethernet
- Single license for HotBox software
- 2x calibration panel with factory calibration certificate
- 1 set stainless steel guide rails for warm and cold sections

	TDW 4040
Measuring range	R: 0.10 to 8.00 m^2·K/W
Specimen size (L x W)	▪ Variant A: 1500 mm x 1500 mm (brick wall) ▪ Variant B: 2000 mm x 2000 mm
Specimen thickness (H)	▪ Variant A: up to 360 mm ▪ Variant B: up to 560 mm
Temperature range	▪ Cold section: -10°C to 40°C ▪ Warm section: +10°C to 40°C
Interface	1x RS 232,1x Gigabit Ethernet
Dimensions (H x W x D)	300 cm x 500 cm x 360 cm
Power supply	230 V / 400 V / 50 Hz
Weight	3890 kg



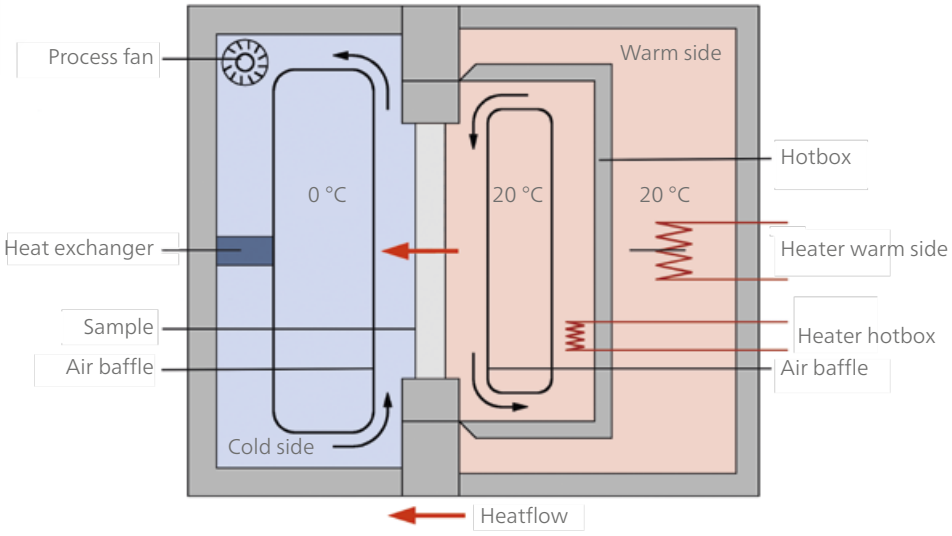
Test wall with calibration panel (special version).

TDW 4140 and TDW 4240

Test Chamber for Determining the Stationary Heat Transfer Properties with a Controlled Hotbox in Accordance with DIN EN ISO 8990, DIN EN 1946-4, DIN EN ISO 12567, DIN EN 12412-2, and ASTM C1363; and Combined in Accordance with DIN EN 1934

The compact test chambers TDW 4140 and TDW 4240 were designed for testing elements and components used in construction, such as windows, profiles, doors and domes (and in the case of TDW 4240, also brick walls). They basically simulate the temperature and the natural convection inside and outside a building. Optionally, the humidity level in the two sections of the chamber can be set as needed. The HotBox software at the measurement and control unit is used to set all parameters as well as for complete data logging, detailed analysis and printing of test reports. There are also other devices, accessories and materials available that allow for sample preparation and conditioning to optimize the testing procedure.

HOTBOX TEST CHAMBERS
with Guarded Hotbox



Principle illustration of HotBox test chamber with guarded hotbox

HotBox Test Chambers with Guarded Hotbox According to DIN EN ISO 8990, DIN EN 12412, DIN EN ISO 12567, ASTM C1363 (Measurement Principle)

HotBox test chambers with guarded hotbox are primarily used for determining the stationary heat transfer properties of elements and components used for construction, such as windows, profiles, doors and domes.

The test chamber consists of a cold and a warm section, the hotbox and a test frame with test mask that is positioned between the two sections of the chamber. Both sections contain heat exchangers for temperature control and air deflectors with radial fans to generate the necessary convection.

In the cold section (see left side of the diagram) the ambient conditions outside a building are simulated. The conditions on the inside of a building are simulated in the warm section (see right side of the scheme). The temperature ranges and the convection fulfill the requirements set forth in the standard but can be adjusted to specific individual applications as needed. The guarded hotbox is installed in the warm section and completely encloses the component to be tested with the respective test mask. Numerous sensors at the air deflectors, inside the sections and the hotbox and on the specimen are used to capture the data pertaining to temperatures, convection and humidity.

The test frame positioned between the cold and the warm sections holds the specimen and the test mask and minimizes lateral thermal influences. The test frame is locked airtight with both sections of the chamber for the duration of the test.

Designed for testing elements and components used in construction

Features at a Glance

- Insulated warm and cold sections with heat exchangers and air deflectors, radial fans, roll chassis on guiding rails and 12-point locking system
- Hotbox with axial fan, air deflectors, roll chassis and hydraulic cylinders
- Insulated test frame with roll chassis and openings for sample insertion via forklift
- Recirculation cooler with water cooling for temperature control of warm and cold sections
- Control rack unit with measuring and control modules, PC, printer and 23" monitor
- Interfaces: 1 x RS232, 2 x USB, 1x Gigabit Ethernet
- 2 isothermal blocks with 60 measuring points each, 1 set of thermocouples, flow sensors, TDW 4240: 2 heat flow meters with guard plates
- Single license for HotBox software
- 4 (TDW 4240: 6) calibration panels with factory calibration certificate
- 1 set stainless steel guide rails for warm and cold sections

	TDW 4140	TDW 4240
Measuring range	▪ R: 0.10 to 8.00 m^2·K/W ▪ U: 0.12 to 3.70 W/(m^2·K)	▪ R: 0.10 to 8.00 m^2·K/W ▪ U: 0.12 to 3.70 W/(m^2·K)
Sample dimensions – window (H x W)	▪ Variant A: 1480 mm x 1230 mm ▪ Variant B: 2180 mm x 1480 mm	▪ Variant A: 1480 mm x 1230 mm ▪ Variant B: 2180 mm x 1480 mm
Sample dimensions – door (H x W)	▪ Variant A: 2180 mm x 1230 mm ▪ Variant B: 2180 mm x 2000 mm	▪ Variant A: 2180 mm x 1230 mm ▪ Variant B: 2180 mm x 2000 mm
Specimen thickness (D)	up to 340 mm	up to 560 mm
Temperature range	▪ Cold section: -10°C to 40°C ▪ Warm section: +10°C to 40°C	▪ Cold section: -15°C to 40°C ▪ Warm section: +10°C to 60°C
Interface	1x RS 232,1x Gigabit Ethernet	1x RS 232,1x Gigabit Ethernet
Dimensions (H x W x D)	▪ Closed: 400 cm x 400 cm x 405 cm ▪ Open: 400 cm x 610 cm x 405 cm	▪ Closed: 400 cm x 400 cm x 405 cm ▪ Open: 400 cm x 610 cm x 405 cm
Power supply	230 V/400 V/50 Hz	230 V/400 V/50 Hz
Weight	4260 kg	4680 kg

TDW 4240 (open) with test mask for windows.

HOTBOX SOFTWARE

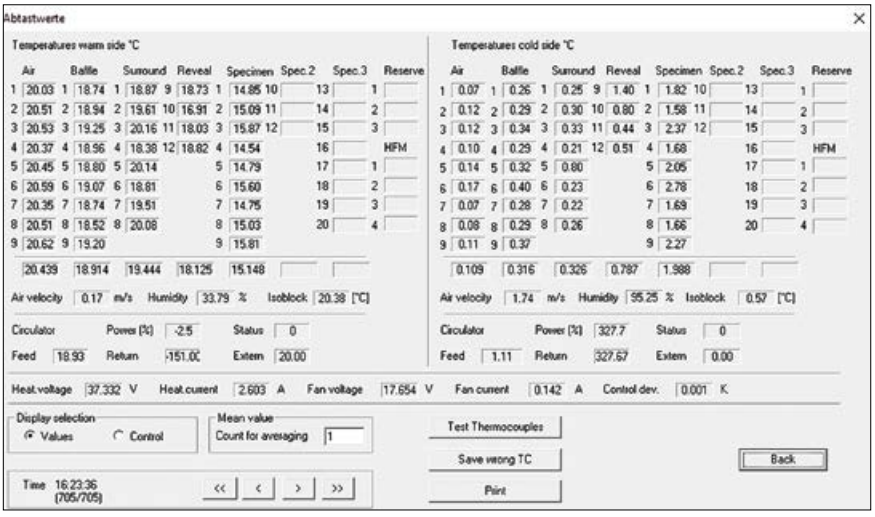
Universal program for control, data logging and analysis for test chambers for determining stationary heat transfer properties

Supported Testing Methods

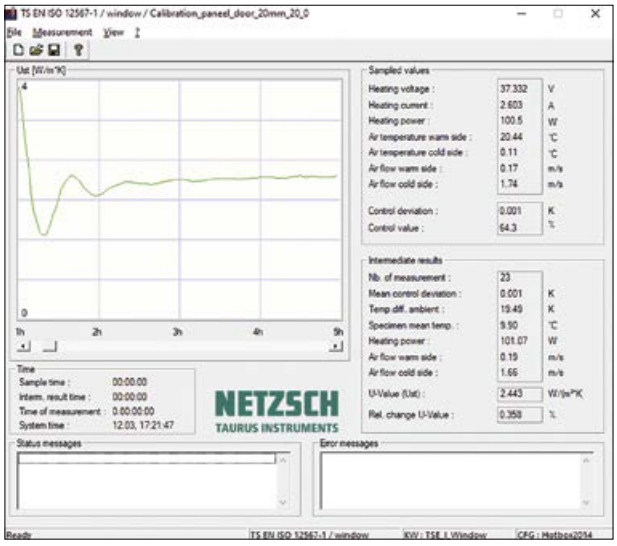
- **Method with heat flow meter**
  in accordance with DIN EN 1934 for brickwork
- **Method with controlled hotbox**
  according to DIN EN ISO 8990, DIN EN 1946-4, DIN EN ISO 12567, DIN EN 12412, ASTM C-1363 for standard windows, profiles, standard doors and surface shells

Functions

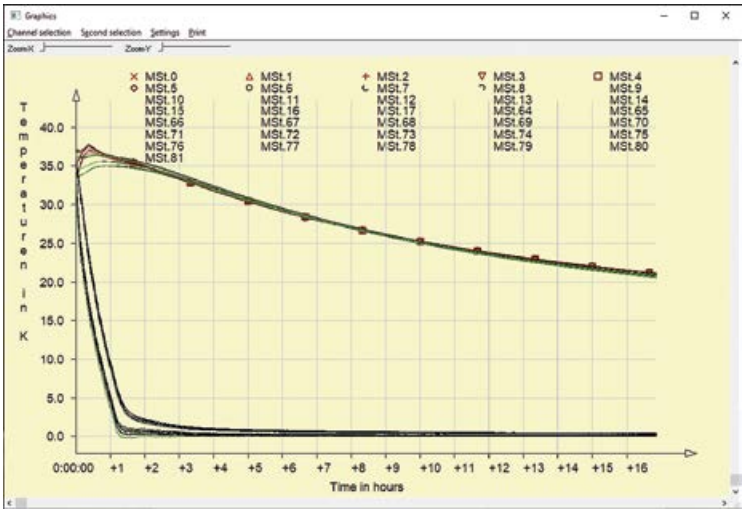
- Choice of manual or automatic measuring procedure with up to 16 definable measuring points per measurement
- Integrated calibration routines
- Display of all relevant data, measuring results, intermediate and final results as graphs and tables
- Measuring point function test and monitoring with defined limit values
- Monitoring of the test chamber with display of relevant messages and automatic shutdown when exceeding critical limits
- Extensive mathematical functions
- Numerical and graphical report generation in accordance with current standards
- Security concept with user and administrator levels



Presentation of current single values.



Main window with overview of main values and graphical presentation of U-value over time (optional temperature difference or temperature deviation).



Graphical presentation of individual sensor values.

ACCESSORIES

Accessories and options for test chambers with heat flow meter and controlled hotbox to expand upon their functions and allow them to be adapted to individual applications

To adapt the test chambers for use for measuring various materials such as brickwork, windows, doors, profiles, domes and surface shells, additional equipment and consumables are needed. Furthermore, the chambers should be checked regularly and calibrated using appropriate reference materials.

Suitable for test chamber type	Description
All models	Air humidifier / dryer TAP 3440
All models	Cold water generator KWB 4310 for recooling of the recirculation coolers
TDW 4040	Drying chamber TTS 440 for sample preparation of brickwork
TDW 4040	Platform scale for sample preparation of brickwork
All models	Thermal imaging camera
TDW 4040	Transport trolley for brickwork specimens
All models	Individual test frames depending on sample size
TDW 4140 / TDW 4240	Individual test masks depending on sample size
All models	Reference sample depending on sample size
TDW 4140 / TDW 4240	Spotlight assembly TKP 3240 for testing the longitudinal warping of door leaves in accordance with EN 1121

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