CEAST 50 years 1953 - 2003

HEAT FLOW METER

CEAST

DESIGN AND PRODUCTION OF INSTRUMENTS AND APPARATUS FOR QUALITY CONTROL ON MATERIALS

These instruments are made in compliance with CE health and safety requirements

CE

Heat Flow Meter - code 6891000

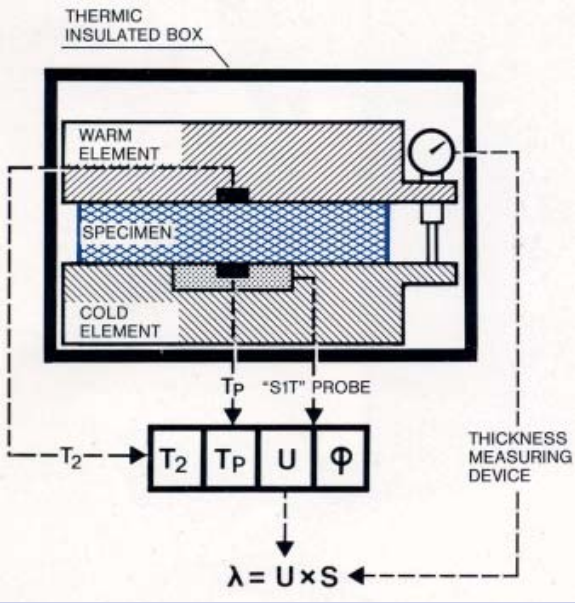
Introduction

Thermic transmittance, defined by U factor (U = K), is one of the basic parameters to evaluate thermic insulation property of a material. It is known how two separate bodies coupled each other and having different initial temperatures (T_1, T_2) exchange energies under form of heat aiming to reach the same temperature (T_x). This heat-exchange occurs as a result of three different factors, that is, conductance, radiation and convention.

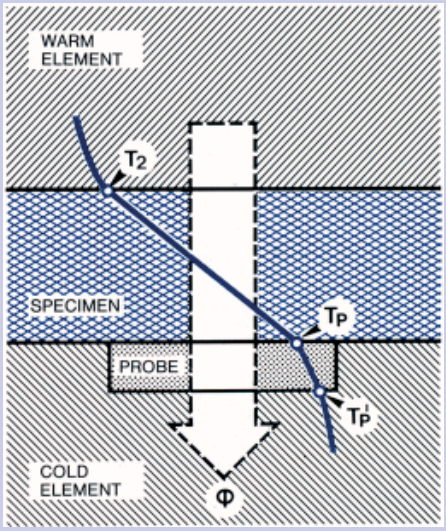
Through CEAST Heat Flow Meter, code 6891/000, it is possible to know the sum of these three factors which is just represented by the U value (U = K).

Operation Principle

CEAST Heat Flow Meter, code 6891/000, has been designed and manufactured to meet ISO standard 2581-75, AS Method.
It consists of a module, thermically insulated, inside which two radiant elements are housed, both suitable to reach different pre-set temperature values.
The lower one is kept at a lower temperature as regards the upper one through an outside thermostatic unit. On same the thermic flow measurement probe is housed. Inside the probe there is also a sensor of superficial Tp, temperature of the lower side of the specimen.
The upper one, kept at a higher temperature than the lower one by a separate outside thermostatic unit, houses the sensor of superficial temperature Tg of the upper side of the specimen.
This second radiant element is moreover adjustable heightwise to allow insertion of specimens of different thickness and is connected to a position sensor capable to visualize on a separate display the specimen thickness when in testing conditions with a 0.1 mm accuracy.



The "S1T" probe, in contact with the specimen, can be considered as a supplementary element of the specimen itself.
The figure illustrates the measurement principle of the heat flow by means of the probe.



Probe conductance is known being

$U = \lambda_s / d_s$ where

λ_s = thermic conductivity of the probe material [W/mK]

d_s = probe thickness [m]

Should there be a heat flow through the specimen (and therefore through the probe), there is also a temperature'' difference between the two sides of the probe:

$$T_p - T_p' = \Delta T_s = \lambda / U$$

Being value U known and constant and being the superficial temperatures of the probe read by numerous sensors, the cp flux crossing the probe, and therefore the specimen under test results determined.
Signals coming from the probe and temperature sensors T_2 and T_p are sent to a separate data acquisition module which is able to visualize the values T_2, T_p, U, λ.
Dividing then the U value by the thickness read on a second display we obtain the λ value, specific of the material under test.

Standard

Designed and built to meet the following standards:

ISO 2581

and others equivalent.

Technical Features

The heat-flow meter, code 6891/000, includes:

Test Module

The module incorporates the chamber which consists of:

- a lower radiant element kept at even temperature through forced circulation of ethanol cooled down by a separate thermostatic unit till obtaining on specimen surface the desired temperature.

Furthermore housing for the measuring probe of the thermic flow is foreseen. The same will be described later.

An upper radiant element kept at even temperature through forced circulation of water heated up by a separate thermostatic unit till obtaining on specimen surface the desired temperature.

Moreover, housing for control sensor of superficial temperature of specimen (Pt 1000) is foreseen;

- a manual adjustment system to allow introduction amongst the radiant elements of the specimen;
- a read-out system of specimen thickness in test conditions, with measurements visualization in [mm] on display.

The test module, housing what described above, is provided with a front door to insert and take out the specimen.

- Dimension of specimens on which tests are performed
  max: 300 x 300 x 50 mm
  min : 200 x 200 x 1 mm
- Dimensions of radiant element (L x D)
  300 x 300 mm
- Thermic range of upper radiant element from room temperature to +60°C
- Thermic range of the lower radiant element room room temperature to -40°C
- Test module dimensions (LxDxH)
  540 x 550 x 510 mm
- Weight 70 kg.

Thermic flow measurement probe

It is of electronic type with integrated circuits, thickness, non-insulating, having very low capacity and time constant and incorporating the sensor for the superficial temperature of the specimen

- U Value (U=K) 57 W/m^{2}K
- Time constant 140 s
- Thermic resistance 1.7 K/W
- Thermic capacity 83 J/K
- Emissivity 0.8 (grey bodies)
- Temperature sensor Pt 1000
- Operative temperature -40°C to+90°C
- At max 100°C
- Probe dimensions 120 x 100 x 4 mm

Data acquisition and visualization module

This module processes the signals coming from measurement probe and temperature sensors in contact with the two opposite faces of the specimen and displays the instantaneous values of T_2, T_p, U, ◘ (U=K).

- Display LCD, 19999 digits
- Measurement range: cp = ± 1999.9 W/m^2 ±3%
  U = 19.999 W/m^{2}K ±4%
  T = -40°C to + 90°C ±1%
- Displayed values through push-buttons:
  T_2 = upper temp.
  T_p = lower temp.
  U = thermic conductor
  ◘ = thermic flow
- Dimensions (LxDxH) 210 x 182 x 70 mm
- Weight 1.6 kg.

OPTIONS

Code 1331.000.1

Cryostat P1 C75P
with following characteristics:

- Temperature range:
  -75°C to +100°C
- Temperature constant:
  0.02 K
- Temperature regulation:
  Fuzzystar refrigerating element power at:
  20°C/0°C = 280/220°C
  -20°C/-40°C = 180/130°C
  -60°C = 50 W
- Pump max pressure:
  560 MBar
- Pump max flow:
  24 l/min
- Pump max suction:
  380 MBar
- Pump max suction flow:
  22 l/min
- Bath capacity:
  6 l
- Opening/Depth:
  130 x 100/200 mm
- Grafic interactive display with resolution:
  0.01°C
- 10 segments temperature program protection low level
- Protection cooling circuit
- External dimensions (L x l x H):
  400 x 510 x 770 mm
- Weight:
  68 kg
- Power supply:
  230 V - 50 Hz - Singlephase
- Max power absorbed:
  3600 VA

Code 6705.050

Set consisting of 4 connection hoses, siliconic material made, I.D. ◘ =9 mm; L = 2 m each; complete with thermic insulation coating.

Code 0500/473

Sample of standard material, certified by the COMMUNITY BUREAU OF REFERENCE - BRUSSELS

- Sample dimension
  3000 x 300 mm
- Thermic conductivity
  0 001456 + 0.00010285 T W/mK
  for 88 kgs/m^3 density
- Tolerance
  ±2.5% (confidence limit 95%)

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