ISOCALT®:
Report on metrological tests.

GDF-DATA BANKS (Bucharest) has asked our cooperation in testing its product the Isothermally Controlled Dry Bath ISOCALT® 21/70/3* devoted for calibration of thermometers of different types. In the period of June-July 2001 the prototype** of this product has been tested in our Temperature Calibration Laboratory. The following aspects and characteristics were mainly analyzed:

- The reliability,
- The temperature stability on the operating range (room temperature:+500^{0}C),
- Temperature gradients in the immersion block.

Short description of the installation:
ISOCALT 21/70/3 tested in our Laboratory is composed by a control electronic unit and the proper thermostat. Electronic unit is designed on modular principle made from power supply (FPS-3), temperature controller (PTC-J) and the microvoltmeter (MV-3).***
The thermostat contains the immersion block and has a robust construction thermally protected from environment in view to ensure minimum temperature gradients in the immersion block, temperature stability and minimum thermal dissipation (it has no dangerous hot areas even for long operation at +500^{0}C). The cylindrical immersion block is made from Inconel and has 2x3 orifices with three different diameters of 5, 6.5 and 10 mm, respectively, corresponding to the dimensions of the most used temperature sensitive elements.
The immersion depth is 70 mm.
The immersion block of the tested model had mounted one differential temperature sensor measuring the maximum radial temperature gradient at the half height.

The separate construction of the two units allows to immediately replace and/or to adapt the thermostat with immersion block of the same or different geometry specific to other dimensions of thermometers. The modular construction of the electronic unit also allows to immediately replace in economic manner of any fault module and/or to realize the desired configuration of the unit for different applications (for instance the simultaneous operation of many thermostats).

Reliability

The tested installation has been maintained in continuous operation and observation for 2 weeks at different temperatures on the operating range of ambient:+500^{0}C. In all testing period in our Laboratory (over 2 months), this installation was under function for minimum 8 hours/ 24 hours (excepting for weekends) and its operation has no technical fault or deviation from the operating characteristics mentioned below.

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* see for the introductory description GDF DATABANKS BULLETIN VOL.5, No.2, 2001.
** In fact, it was tested an experimental model incompletely equipped comparative to the commercial model.
*** The latest model has a temperature reference module (RT-70).

Temperature stability

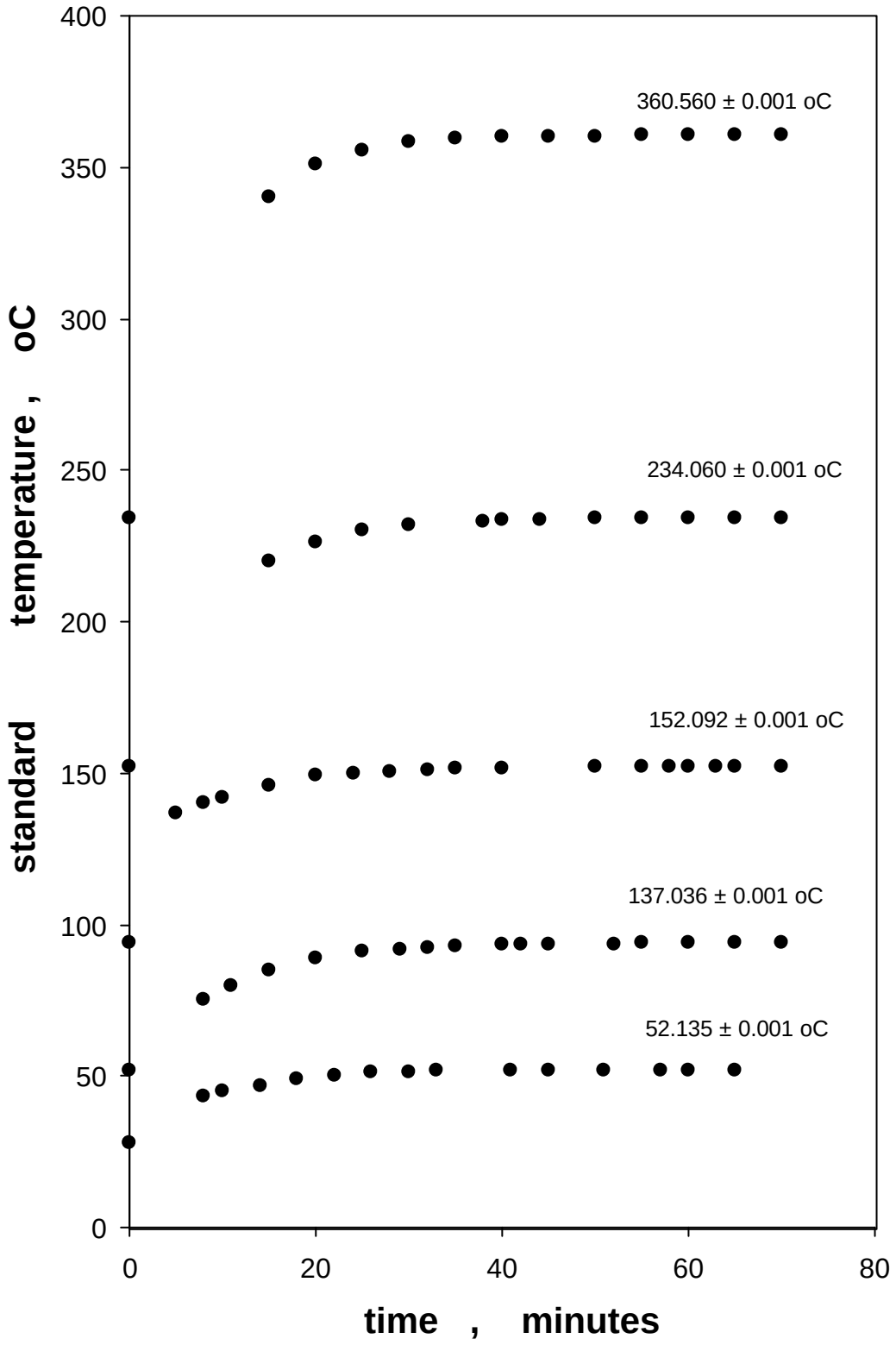
A standard digital thermometer, type DPT 100 (with Pt-100 sensor, 0.001^0C resolution, Calibration Certificate issued by INM-Bucharest by using ITS-90 fixed points) in view to establish the temperature kinetics and stability in the immersion block. The sensor shield has the diameter of 6 mm and was immersed in the one of orifices of 6.5 mm diameter (both were tested).
Different temperature steps were applied commended from temperature controller PTC-J and were noted the time (hour:minutes) from the start and the readings of standard thermometer at time interval of 4-8 minutes. The annexed diagram shows the obtained kinetics curves for a series of successively temperature steps. It has been established that the equilibrium temperature is reached after approximately 60 minutes from the start no matter the commended temperature step and is stable for 15 minutes with deviations of 0.001^0C.

Temperature gradients

The prototype of ISOCALT 21/70/3 tested in our Laboratory has mounted only one sensor of differential temperature between the center and a marginal point between two immersion orifices, both of them placed at the half height of the immersion block. This temperature difference has been measured on different sensitivities with the Microvoltmeter MV-3 used as null indicator on a digital scale made from 2x10 LEDs.
This indicator has proved as very useful in evidencing the kinetics and stability of temperature during repeated calibrations when the temperature distribution in the immersion block is perturbed by temperature steps and/or by replacing of thermometers.

Separately, the value of temperature gradients in the immersion block at equilibrium temperature has been estimated by using mercury glass thermometers with resolution of 0.1^0C and recently calibrated on water standard baths. The temperature gradients on the range of ambient:$+100^0$C were under 0.01^0C as it has been established by careful observing the Hg meniscus with an optical magnifier.
As we know from recent offers of temperature calibrators produced by famous companies in the world, no model has the option of measuring the temperature gradients during calibration. On the other hand, these gradients as measured separately, not during calibration, belong in the range of $0.1\text{-}0.5^0$C.

Viorel Zambreanu, Executive Manager,
THERMODENSIROM-SA, B-d Basarabiei 171, sector 3 Bucharest, Romania
Bucharest, 2 June, 2002



Kinetic curves obtained on the experimental model of ISOCALT 21/70/3 for successive temperature steps.
Calibration Laboratory, TERMODENSIROM-SA, 10 July 2001; standard thermometer DPT 100, Pt-100, #0.001oC.