ISIS
EVALUATION REPORT

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An Evaluation Report of the ISIS Metal Block Bath
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Introduction

The ISIS is part of the Isotech family of products. It can be used as a dry-block or ITS-90 fixed point device calibrator.

At Isotech it is our earnest desire to present for our customer's consideration as much useful information as possible and to this end we have spent a substantial amount of time evaluating our products.

The results of the evaluation of a bath can be presented in many formats some of which will give an optimistic or indeed a pessimistic view of how the product operates.

The evaluation is based on almost the worse case error that may occur within the bath.

With some care and proper procedures it is possible to improve considerably upon these results.

Summary of Performance

Metal Block Mode.

TEMPERATURE °C	STABILITY ±°C	RADIAL HOMOGENEITY	AXIAL HOMOGENEITY
-100.0	0.010	0.009	0.137
0.00	0.010	0.010	0.038
40.00	0.010	0.008	0.006

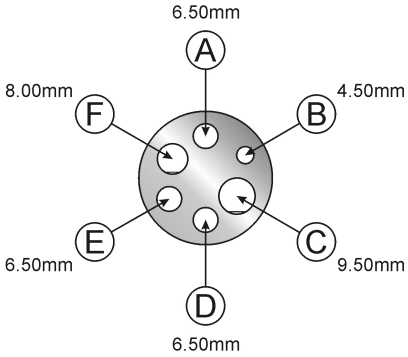
* Uncertainty is calculated, for the spread $k = 2$, which is the combined uncertainty x 2 and equivalent to a confidence level of approximately 95% (2 Sigma)

ITS-90 Fixed Point Mode.

FIXED POINT	UNCERTAINTY
Gallium, 29.7646°C	0.001°C
Water 0.01°C	0.001°C

Evaluation with Metal Insert
Axial Temperature Homogeneity

Axial Temperature Homogeneity: The axial temperature distribution is measured at three different temperatures representative of the field of application and covering the extreme temperatures that may occur. A suitable thermometer is used, the sensor length not exceeding 5mm. At least six different measurements per bore are carried out in the calibration zone and adjoining parts of the bore, the distance between measurement points being 1cm.



Test Method

A 935-14-12 probe (designed for small stem conduction) was placed in each of the 4.5mm holes. One probe was raised in 1cm steps (Pocket B) and the temperature difference between it and the static probe at the bottom of pocket D was recorded.

Axial Temperature Homogeneity: -100°C

DISTANCE FROM BOTTOM OF INSERT POCKET, CM	TEMPERATURE DIFFERENCE Δ T=TD-TB °C
0	0.000
1	0.023
2	0.041
3	0.080
4	0.137
5	0.179
6	0.198
(0 Repeat)	0.001

At -100°C the Maximum Variation over 40mm Zone was 0.137°C

Axial Temperature Homogeneity: 0°C

DISTANCE FROM BOTTOM OF INSERT POCKET, CM POCKET D	TEMPERATURE DIFFERENCE Δ T=TD-TB °C
0	0.000
1	0.011
2	0.020
3	0.026
4	0.038
5	0.047
6	0.066
(0 Repeat)	0.001

At 0°C the Maximum Variation over 40mm Zone was 0.038°C

Axial Temperature Homogeneity: 40°C

DISTANCE FROM BOTTOM OF INSERT POCKET, CM POCKET D	TEMPERATURE DIFFERENCE Δ T=TD-TB °C
0	0.000
1	0.002
2	0.002
3	0.004
4	0.006
5	0.015
6	0.028
(0 Repeat)	0.000

At 40°C the Maximum Variation over 40mm Zone was 0.006°C

Evaluation with Metal Insert
Radial Temperature Homogeneity

Radial Temperature Homogeneity: The temperature differences between the zones in the individual bores provided for the measurements are measured with a suitable thermometer at three different temperatures representative of the field of application and covering the extreme temperatures which may occur.

Test Method:

A 935-14-12 thermometer (designed for small stem conduction) was placed in each of the 4.5mm holes. Measurements were recorded and then the probes were moved between the two pockets and repeat measurements made. The temperature, Δt, was calculated to remove the small offsets between the two probes.

$$\Delta t = 2 [(t_{AAB} - t_{AAD}) + (t_{ZZB} - t_{ZZD})]$$

TEMPERATURE °C	Δ t
-100	0.009°C
0	0.010°C
40	0.008°C

Stability with Time

Stability with time: The variation of temperature with time in the zones in the individual bores provided for measurements must be sufficiently small. The temperature variations are considered to be sufficiently small when the greatest temperature difference occurring within 30 minutes is smaller than or, equal to, half the uncertainty of the measurement stated.

Stability at –100°C, 30 minute period, ±0.010°C
Stability at 0°C, 30 minute period, ±0.010°C
Stability at 40°C, 30 minute period, ±0.010°C

Test Method:

A 935-14-12 thermometer was placed into one of the 4.5mm holes. The probe was connected to a TTI 2 precision temperature indicator and the variation in temperature was recorded for a 30-minute period. The ambient temperature was within 21°C ±2°C.

Heat up time – Insert -100°C to 0°C - 72 minutes.

Cool down time – Insert 20°C to -100°C - 87 minutes.

Use with Fixed Points

Slim Fixed Point Cells

Fixed Point Cells provide fixed point calibration. The International Temperature Scale, ITS-90, specifies for the range -38 to 962°C values for the melting, freezing or triple points of a metal (or water for the water triple point, 0.01°C). The freezing point of a metal can be defined with great accuracy. The accuracy comes not from the precision of electronic or other artificial means but from the purity of a metal and the physics of latent heat.

Using a fixed point cell with the Isis is simple. The cell is placed into the well and thermometers to be calibrated are then placed in turn into the cell.

As the cell changes state, from a solid to a liquid, the temperature remains constant and known - a fundamental constant of nature.

Slim Fixed Point Cells are built with the same materials and techniques as the larger cells that Isotech manufactures for Primary Standard Laboratories but the smaller size of the cells makes them more affordable and practical for the industrial laboratory.

For the industrial laboratory Slim Fixed Point Cells provide fixed point reference standards, useful for checking the labs reference thermometers.