

# The Jarrett-Isotech Water Triple Point Cells

- Uncertainty to  $<0.0001^{\circ}\text{C}$
- Fifty Years of Proven Use
- Quartz Glass and Isotopic Analysis Available

The Water Triple Point is the most important fixed point, the only point common to the ITS-90 and the Thermodynamic Temperature Scale. It is an essential reference point for every temperature laboratory.

The Jarrett-Isotech cells are the best standard, all cells are not the same, accept no inferior device.

## Total Confidence – The Internationally Proven Cells

The Jarrett-Isotech cells have been in production since 1958. A independent comparison\* in 1981 showed the first cell to be within  $0.000006^{\circ}\text{C}$  of the reference cell. The most recent international study organized by BIPM\*\* consistently shows labs using both recent and older Jarrett-Isotech cells tightly grouped, tens of  $\mu\text{K}$  around the BIPM reference value.

International comparisons prove the quality of the Jarrett-Isotech Cells and are unique in the number, and history of comprehensive evaluations.

\* *Reproducibility of Some Triple Point of Water Cells* By George T. Furukawa and William R. Bigge. *Temperature - Its Measurement & Control in Science & Industry* Vol. 5 1982.

\*\* *Final Report on CCT-K7: Key comparison of water triple point cells.* M Stock et al 2006 *Metrologia* 43 03001

## Quality

The capability of a triple point of water cell to provide an accurate, stable and reproducible temperature depends upon the purity of the water in the cell. Jarrett-Isotech cells are carefully cleaned and aged by a special procedure. They are then filled with water that has been purified by an elaborate 12 step process designed to eliminate the possibility of contamination while avoiding change in isotope proportions.

## Isotopic Content

Jarrett-Isotech Cells use water with an isotopic content essentially similar to Standard Mean Ocean Water. Following research by the international science community into the make up of Standard Mean Ocean Water, and V-SMOW the BIPM recommended in 2005\* that

The triple point of water is now defined as the equilibrium temperature of vapour, liquid and solid water, with the liquid water having the isotopic composition defined by the following amount of substance ratios:



0.00015576	mol $^2\text{H}$ per mol $^1\text{H}$
0.0003799	mol $^{17}\text{O}$ per mol $^{16}\text{O}$
0.0020052	mol $^{18}\text{O}$ per mol $^{16}\text{O}$

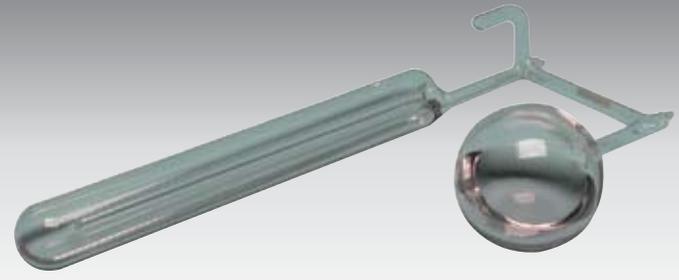
\* *Technical annex for the International Temperature Scale of 1990 (ITS-90)* Adopted by the CCT on 10 June 2005

Since early in 2000 Jarrett-Isotech Cells have been made to this definition and our cells have been within  $+10$  and  $-40\mu\text{K}$  of it.

During 2005, subsequent to the CCT definition, the water in our triple point cells has been further enriched and our latest cells meet  $\pm 20\mu\text{K}$  of the above definition.

We can provide Isotopic Analysis of the water in our triple point cells; recommended for NMIs. Samples of the actual water used in a particular cell can be supplied for purity analysis.

Isotech's unique KT Water Triple Point Cell



**Quartz vs Borosilicate Glass**

The special cleaning and ageing of the usual borosilicate glass ensure, and the evaluations demonstrate, the long life of the cells. Selected cell types are available in quartz construction which are expected to last ten times longer.

**Performance**

The cells include a certificate of conformance.

A UKAS calibration service is available for all of our water triple point cells. The larger cells can be UKAS certified to  $< \pm 0.1\text{mK}$ , 2 Sigma. This will benefit the most demanding of NMIs and users.

More cost effective calibration options to uncertainties of  $\pm 0.1$  and  $\pm 0.5\text{mK}$  are also available. Regardless of calibration the Jarrett-Isotech cells are reproducible to  $\pm 0.000020^\circ\text{C}$  and after equilibrium has been reached the inner melt of the ice mantle will give stability of  $\pm 0.00001^\circ\text{C}$

Reverting to the very first designs of water triple point cells, Isotech produce a cell with Isotopic analysis, a McLeod gauge to assess any trapped air and an attached flask where the cell's water can be transferred and redistilled. By accounting for these sources of uncertainty we claim that this cell represents the ultimate reference for those requiring cells as close to ITS-90 as possible. Please ask for a copy of a comprehensive report describing the cell, its operation and performance.

**Model Types**

**Premium Water Triple Point Cells - Borosilicate Glass**

These Premium Cells can be calibrated to an uncertainty of  $< +/- 0.0001^\circ\text{C}$  (0.1mK)

- A11-50-270\*
- A13-50-270\*
- B11-50-270\*
- B11-65-270\*
- B13-65-270
- B16-65-270

*\*Also available in Quartz Glass*

**Further Laboratory Water Triple Point Cells**

These cells have shorter immersion depth and can be calibrated to an uncertainty of  $\pm 0.0001^\circ\text{C}$  (0.1mK)

- B12-40-210
- B12-46-210

**Slim Water Triple Point Cell**

- B8-30-130

This small cell fits into portable Dry Block Calibrators for use outside of the calibration laboratory. It can be calibrated to  $\pm 0.0005^\circ\text{C}$  (0.5mK)

**Performance**

**Accuracy**

The equilibrium temperature of the Jarrett-Isotech Triple Point of Water Cell is within  $\pm 20\mu\text{K}$  of the 2005 definition as described in CCT/05-07/rev(2). We can provide Isotopic Analysis of the water in our triple point cells; recommended for NMIs.

**Reproducibility**

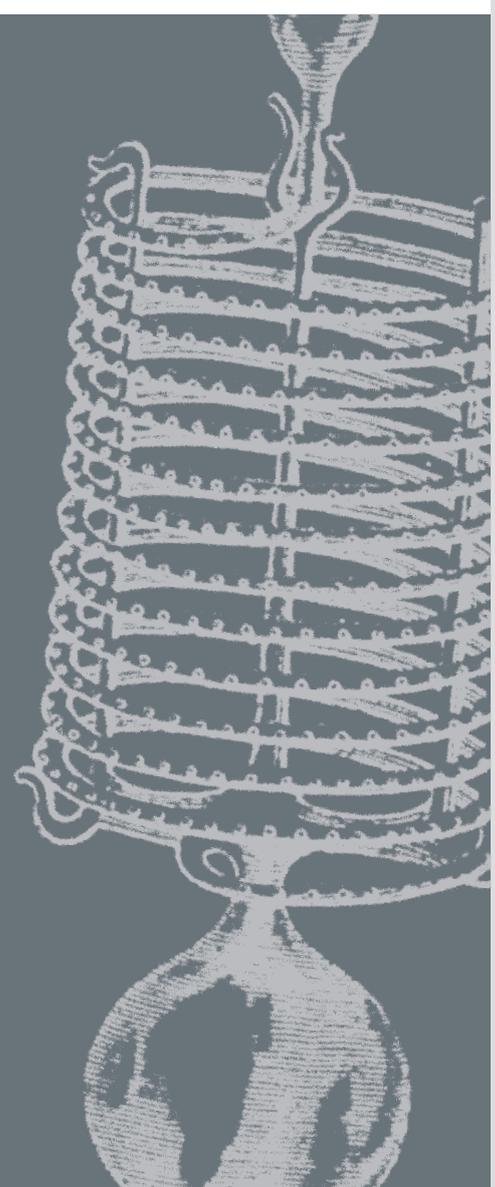
The equilibrium temperature of a cell will repeat to within  $\pm 0.000,02^\circ\text{C}$  of the mean equilibrium temperature.

**Stability**

After equilibrium is reached, the temperature of the inner melt of an ice mantle will remain constant to within  $\pm 0.000,01^\circ\text{C}$  for as long as the mantle can be preserved (up to 90 days in some instances).

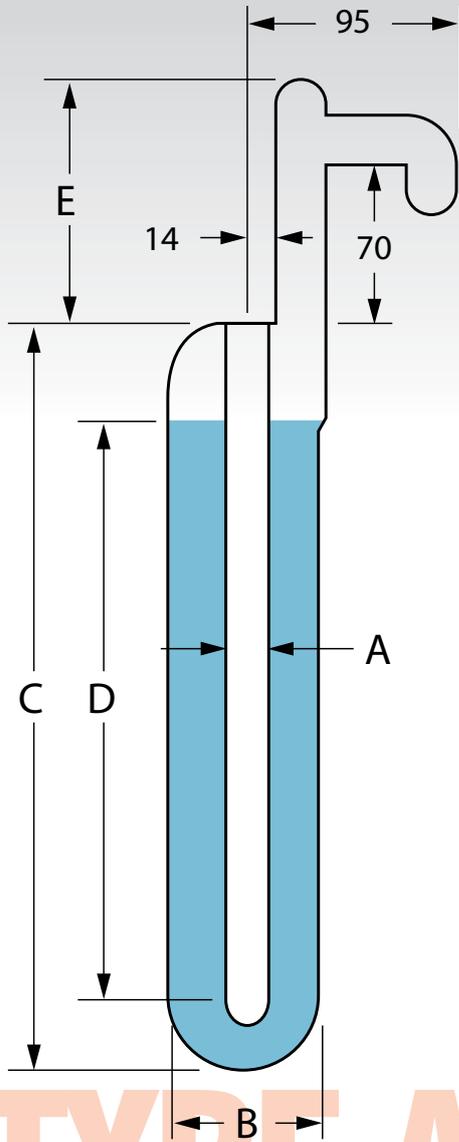
**Life**

Cells made from Borosilicate Glass may drift lower in temperature by up to 0.1mK after 10 to 20 years. Cells made from Quartz are expected to last 10 times longer.



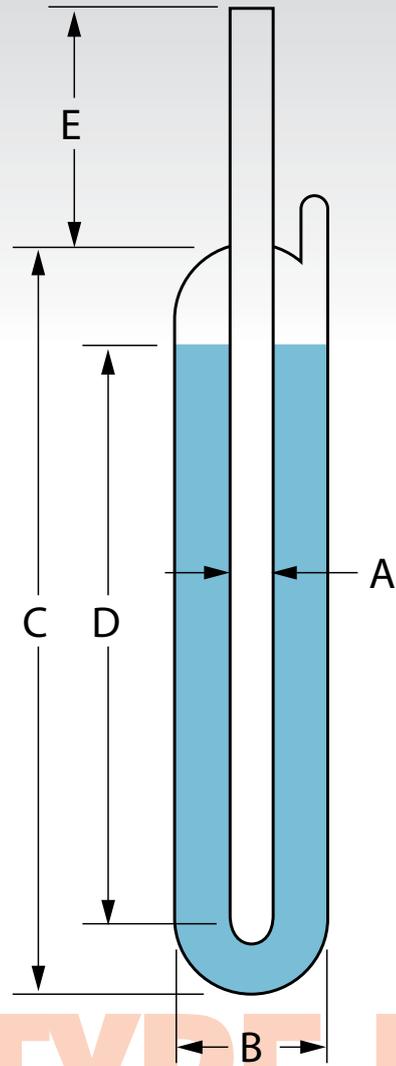
### Physical Features

**Type A cells** were designed by Dr. H. F. Stimson at NBS. A tubular glass extension at the top of the cell serves as a convenient handle for lifting and carrying the cell, as a hook for supporting it in an ice bath, and as an indicator of partial pressure of air in the cell.



# TYPE A

**Type B cells** were designed at NRC of Canada. The thermometer well extends 100mm above the top of the cell. Heat transfer to the ice mantle may be essentially eliminated by keeping these cells packed in ice to the top of the well extension, or by immersing them sufficiently in a Water Triple Point Maintenance Bath.



# TYPE B

Nominal Dimensions in mm

Model	A	B	C	D	E	Comments
A11-50-270	11	50	350	270	100	Highly recommended (1) (2)
A13-50-270	13	50	350	270	100	Large re-entrant tube (1)
B8-30-130	8	30	160	130	0	Slim Cell - Fits Isotech Dry Blocks
B12-40-210	12	40	290	210	75	Replacement for NPL, UK Type 32 Cells
B12-46-210	12	46	290	210	75	Recommended for Isotech Oceanus
B11-50-270	11	50	350	270	100	Highly recommended (1) (2)
B11-65-270	11	65	350	270	100	NRCC's favourite Cell (1) (2)
B13-65-270	13	65	350	270	100	Large re-entrant tube (1)
B16-65-270	16	65	350	270	100	Larger re-entrant tube (1)

(1) Isotopic Analysis is available.  
 (2) Available in Quartz Glass.