



# Apparatus Mercury Triple Point

- Purpose Designed for Isotech Mercury Cell
- Outstanding Convenience and Safety
- Liquid Free

The Isotech Model ITL -M-17725 Cryostat is a self-contained, mechanically-refrigerated, system with a main well to house one cell and two auxiliary wells for pre-chilling of thermometers. The cryostat temperature is steplessly adjustable from  $-36^{\circ}\text{C}$  to  $-42^{\circ}\text{C}$  with scale-divisions of  $0.1^{\circ}\text{C}$  (interpolation possible) and 24 hour stability better than  $\pm 0.05^{\circ}\text{C}$  measured by an SPRT in the well of a Mercury Cell inside the Cryostat.

The cryostat has several unique features providing outstanding convenience and safety. The refrigeration system has sufficient capacity to bring a cell to operating temperature in about one hour. At operating temperature, the cooling rate is about 1 Kelvin/minute and the heating rate is about 2 Kelvin/minute.

This permits rapid changes to be imposed on the temperature of the cell environment to a void excessive demands on the (low) heat-of-fusion energy of the mercury within the cell.

In addition, all temperature control is accomplished through control of refrigerant flow, providing inherently fail-safe operation. Indicators provided for the cryostat are "POWER ON" and "COOLING".

The cryostat provides convenient conditions for operating mercury fixed point cells both in heating and in cooling mode.



Model	ITL-M-17725 Apparatus
Temperature Range	$-36^{\circ}\text{C}$ to $-42^{\circ}\text{C}$
Uncertainty	0.22mK (with cell)
Ambient Limits	$18^{\circ}\text{C}$ to $28^{\circ}\text{C}$
Plateau Duration	8-12 hour Plateau
Power	750W typical. 208-240 VAC, 50/60Hz
Dimensions	Height 960mm Width 600mm Depth 560mm Weight 96kg

**How to order**  
ITL-M-17725 Mercury Triple Point Apparatus

# The Best Primary Standards for your Laboratory

The key factor is that of purity. ITS-90 specifies that the purity of the ITS-90 fixed points should be 99.9999% (6N).

The performance of an optimal 6N pure cell has been best described in CCT/2000-13 "Optimal Realization of the Defining Points of the ITS-90..."

All Isotech's cells for primary laboratories conform to the ideals set out in this document. To prove to ourselves, and you, our customer, that this is so we compared some 160 UKAS certificates over 10 years using a variety of metal samples to CCT/2000-13. The results tabulated below show that we equal or exceed the values given in that document.

## CCT/2000-13 Optimal Realizations of ITS-90

Comparison of 160 Isotech UKAS Certified Cells to CCT/2000-13		
	CCT/2000-13	Large (Optimal) Cells mK
Hg	0.2mK	0.12
Ga	0.1mK	0.05
In	0.5mK	0.17
Sn	0.3mK	0.18
Zn	0.5mK	0.21
Al	0.7mK	0.66
		0.3*
Ag	1.1mK	1.1

\*6N5 pure

With each delivery of metal the supplier furnishes us with a certificate detailing the impurities detected in PPM.

At Isotech we go one step further, samples of the metal are sent to NRCC in Canada who analyse the sample to parts per billion and look for 60 elements rather than the 20 that the supplier analyses. This independent analysis increases confidence in the metal of the cell.

The metal of the cell is contained in a graphite crucible. Our graphite is the densest available having an average grain size of just 7 µm.

No metal has ever penetrated this graphite. It is supplied with a purity better than 99.9995% and at Isotech temperature and vacuum processing further reduced the impurities.

Whether you choose a sealed, or resealable cell we need pure argon to surround the cell, our argon is 99.9999% pure.

Before we make cells commercially with a new delivery of metal we make a cell for evaluation. It goes through the same 5 step process as is used by National Laboratories for international intercomparisons.

The cell is melted and frozen three times and the coincidence between melt and freeze point measured. The impurities are used to calculate the expected depression of the metal from ITS-90 and the cell is intercompared on 2 separate occasions with a reference cell directly traceable to NIST's realization. This process takes 15 working days.

ITS-90 specifies that the melting or freezing should take place at 101,325 Pa.

An Isotech sealed cell is filled with 6N pure argon to 101,325 Pa ±0.04% as certified by a UKAS certificate of the vacuum gauge.

Nothing is left to chance with an Isotech Primary Standard.

Because we supply most of the worlds primary laboratories we need to be able to certify what we have made. Working with UKAS and NIST we have reduced our uncertainties of measurement to the smallest outside NIST. They are tabulated below for your information.

UKAS k=2	Isotech ±mK Quartz & Metal Clad (*)
Hg	0.22
H <sub>2</sub> O	0.07
Ga	0.07
In	0.65
Sn	0.60
Zn	0.90
Al	1.10
Ag	2.00

(\*As November 2008 - The latest UKAS Schedule can be found from our website or at [www.ukas.org](http://www.ukas.org))

The above contains no fancy claims or unsubstantiated numbers, only independently verifiable facts.

Some 500 metrologists visit Isotech each year for discussions and training, you will be welcome.

The immersion of the cells from metal surface to the bottom of the re-entrant tube is 200mm ±5mm.

Each primary cell is accompanied by a conformity certificate which includes a copy of the impurities analysis, a copy of the metal of the cell evaluation freeze and melt curves.

At an extra cost we can issue a UKAS certificate to the uncertainty above. This takes 15 working days.

## Cell Containment

### ■ Resealable cells

Traditionally our optimal cells have been assembled into resealable quartz tubes or crucibles whereby the cell can be vacuumed and refilled with pure argon to 1 atmosphere.

More recently Isotech have pioneered metal clad cells replacing the more fragile quartz with a pre-aged metallic alternative. These cells have a small metal tube which can be used for vacuuming and refilling the cell and because of less conduction from the cell; the cell is closer thermally to its ITS-90 value.

### ■ Sealed Cells

It maybe more convenient to have sealed cells - cells with a cladding whose internal pressure is preset to 1 atmosphere at the freeze temperature and then sealed. Isotech offers both quartz and metal clad sealed cells.

# UKAS Calibration Service for SPRTs

## SPRT Calibration with ITS-90 Fixed Points: Premium Service ISOTECH UKAS Calibration Uncertainties ( $k=2$ )

Suitable only for Isotech 670SQ Models or other Primary Standard SPRTS of similar stability

Fixed Point	°C	Range 1	Range 2	Range 3	Range 4	Range 5	Range 6 <sup>1</sup>
Typical Uncertainties ±							
TP Argon <sup>2</sup>	-189.3442		1mK	1mK	2mK	2mK	
TP Mercury	-38.8344	0.6mK	1mK	1mK	1mK	2mK	
TP Water	0.01	0.5mK	1mK	1mK	1mK	2mK	4mK
MP Gallium	29.7646	0.6mK					
FP Indium	156.5985		1mK	1mK			
FP Tin	231.928			1mK	1mK	2mK	4mK
FP Zinc	419.527				1.2mK	2mK	4mK
FP Aluminium	660.323					2mK	4mK
FP Silver	961.78						7mK

## SPRT Calibration with ITS-90 Fixed Points: Standard Service ISOTECH UKAS Calibration Uncertainties ( $k=2$ )

Suitable for Primary and Working SPRTS - Isotech 670 & 909 families and other SPRTS of similar stability

FIXED POINT Fixed Point	°C	Range 1	Range 2	Range 3	Range 4	Range 5	Range 6 <sup>1</sup>
Typical Uncertainties ±							
BP Nitrogen	-195.798		10mK	10mK	10mK	10mK	
TP Mercury	-38.8344	2mK	2mK	2mK	2mK	5mK	
TP Water	0.01	1mK	1mK	1mK	2mK	5mK	10mK
MP Gallium	29.7646	2mK					
FP Indium	156.5985		3mK	3mK			
FP Tin	231.928			3.5mK	3.5mK	5mK	10mK
FP Zinc	419.527				3.5mK	5mK	10mK
FP Aluminium	660.323					10mK	25mK
FP Silver	961.78						40mK

- Note 1:** Model 96178 or other HTSPRTS of similar stability
- Note 2:** Alternatively in place of TP Argon the BP Nitrogen point can be used, the uncertainty increases to 5mK for Ranges 2 to 4 and 6mK for Range 5.
- Note:** TP = Triple Point      MP = Melting Point  
 FP = Freezing Point      BP = Boiling Point

The latest schedule can be found on the Isotech website or at [www.ukas.org](http://www.ukas.org).



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