

-185 to -196°C

# Boiling Point Apparatus Nitrogen

- Boiling Point of Liquid Nitrogen
- Gas Manifold for Thermometers
- Self Contained - Bench Mounted

Isotech Nitrogen Boiling Point Apparatus is designed specifically to realize and maintain the liquid/vapour equilibrium (boiling point) of nitrogen or argon, for the calibration of thermometers on the International Temperature Scale of 1990.

The Boiling Point Apparatus is self-contained and refrigerated by liquid nitrogen or liquid argon, which must be supplied by the user. Either liquid is suitable for the purpose. Liquid nitrogen is generally less costly and more readily available than liquid argon. The Apparatus does not require electrical power for its operation.

The Boiling Point Apparatus will maintain the liquid-vapour equilibrium of nitrogen (-195.798°C) or of argon (-185.8468°C) indefinitely, provided boiled-off gas is replenished.

ITS-90 specifies the triple point of argon (-189.3442°C) as the low end of the long-stem Standard Platinum Resistance Thermometer range. As a practical matter, realization of this triple point is a costly (in equipment and time) and complicated process.

Most laboratories will choose to calibrate this end of the platinum range by comparison of the thermometer under test with a thermometer of known calibration. National Laboratories themselves will invariably calibrate thermometers submitted to them by comparison, realising the actual argon triple point only infrequently for calibration of their own reference thermometers. The National Physical Laboratory of England makes this statement:

*"Most thermometers (submitted for calibration) will involve measurements (by) ... comparison with NPL standards in a bath of liquid nitrogen (about -196°C)"*

Model 18205 Comparator is designed for precisely such comparison calibration. It comprises a stainless steel dewar, an inner equalizing block having wells for 3 thermometers, top connections for filling and monitoring the level of liquid coolant, a pressure safety blow-off and a manifold which may be used to thermally tie the thermometers under test to the equalizing block with helium gas (optional).

Since the slopes (dR/dT) of Standard Platinum Resistance Thermometers are very similar at any temperature, calibration uncertainties not larger than 0.002K can be obtained at a small fraction of the cost of an absolute calibration.



*Boiling point of  
Liquid Nitrogen, -195.798°C  
High Accuracy  $\pm 0.002K$ ,  
Handbook/Tutorial supplied  
Self-contained, Bench mounted*

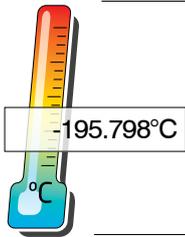
Model	ITL-M-18205
Temperature Range	-185°C or -196°C nominal
Uncertainty	$\pm 0.002^\circ\text{C}$
Power	NA
Dimensions	Below flange 430mm Diameter below flange 127mm Flange diameter 165mm Weight 14kgs

The temperature distribution across the copper block is less than 2mK. To this must be added the uncertainty issued with the calibration certificate from the National Laboratory.

Extra uncertainties will also exist if dissimilar probes are compared.

**How to order**  
ITL-M-18205 Nitrogen Boiling Point Apparatus

**Note**  
The Nitrogen Point Apparatus may be adapted for use with liquid argon. Please contact the factory for details



# Simple Liquid N<sub>2</sub> Apparatus

## Model 461

- Safe to use
- Economical

This model is a lower cost alternative to the ITL M 18205. This model is a simple apparatus open to the atmosphere comprising a stainless steel dewar flask filled with liquid Nitrogen, an insulating layer which houses a metallic equalising block and thermometer holder. Lastly a split insulated lid reduces evaporation and permits easy addition of liquid Nitrogen.

From time to time extra liquid Nitrogen must be added, approximately every 30 minutes, to keep the dewar flask full.

The dewar flask is 100mm inside diameter and 280mm deep. The standard equalizing block houses four SPRTs or industrial thermometers up to 8mm in diameter, giving  $\pm 0.002^{\circ}\text{C}$  temperature uniformity.

### Method of Operation

A standard calibrated SPRT is placed in the equalizing block together with the sensors to be calibrated. The whole is allowed equilibrate.

The level is checked and Nitrogen added as necessary and readings taken 10 minutes afterwards.

The Isotech Simple Liquid Nitrogen Apparatus is safe to use, having no glass dewar flask internally to explode.

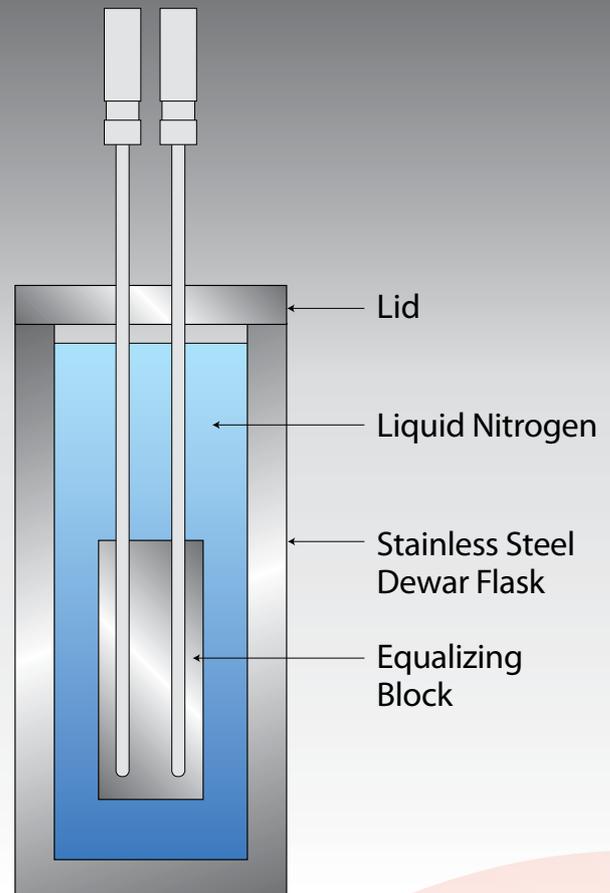
A comprehensive handbook accompanies the apparatus which includes an article by Henry E. Sostmann on the corrections required to convert the calibration to the ITS-90 value of the Argon Triple Point.

### Technical Note:

The Simple Liquid Nitrogen Apparatus, because there is air access will slowly condense oxygen from the atmosphere increasing the temperature of the Boiling Point.

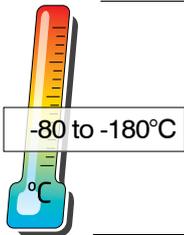
This is of small importance provided a calibrated SPRT is being used as the reference and simultaneous ratios of SPRT and unknown thermometers are being recorded, with a bridge such as the Isotech microK.

Liquid Nitrogen is not supplied with the apparatus.



Model	461 Simple Liquid Nitrogen Apparatus
Temperature Range	$-196^{\circ}\text{C}$ Nominal
Uncertainty	$\pm 0.002^{\circ}\text{C}$ The temperature distribution across the block is typically 2mK. To this must be added the uncertainty issued with the calibration certificate from the National Laboratory. Extra uncertainties will also exist if dissimilar probes are compared.
Power	NA
Dewar Dimensions	Inside diameter 100mm Depth 280mm Volume 3 litres
Thermometer wells	Four 8mm as standard, others to special orders

**How to order**  
461 Simple Liquid N<sub>2</sub> Apparatus



# Cryostat Model 459

- Extreme Low Temperature Calibration
- High Stability

When we considered low temperature comparison calibration, we had to take into account Health and Safety considerations, both of the liquids used in compressors to generate low temperatures and also the liquids used in the calibration volume itself. The cost of chillers increases considerably for very low temperatures. We concluded that using chillers for very low temperatures was expensive, unsafe and unreliable.

Our solution is a simple heated metal block design using a single, safe surrounding liquid, liquid nitrogen.

An apparatus immersed in liquid nitrogen will cool to approximately -195°C. Our design, using a controller and heater, permits the cryostat to be set at any temperature above liquid nitrogen temperature.

The Cryostat comprises an insulated machined copper equalizing block inside an 80mm diameter tube 480mm long, attached via a flange to a lid giving access for three thermometers, a vacuum port and a Lemo connector for the temperature sensor and heater. A cable runs to a controller which sets the temperature. An RS422 connector permits the calibration to be automated using one of our Software programs.

### Evaluation

The most used range for the Isotech Cryostat is between -80°C to -180°C. This temperature range is selected because Oxygen condenses at -186°C and if this is then accidentally boiled off it can cause a health and safety issue. The performance of the Cryostat actually improves as the temperature is lowered because the temperature difference between Cryostat and it's surrounding liquid nitrogen is smaller. The measurements were made with two model 670 thermometers.

### Method

The Cryostat is connected to a vacuum pump. It is pumped for five minutes and then sealed. The Cryostat is connected to the controller, switched on to check the connections. The Cryostat is then lowered into the container of liquid nitrogen, which should come between 25mm and 75mm below the flange. Three thermometer tubes exit the Cryostat and have nylon compression fittings. The standard PRT and unknown thermometers to be calibrated are lowered into the wells and the nylon fittings are hand tightened until the nylon grips the thermometer without damage. The controller is set to the required temperature and the Cryostat left to stabilize before comparison readings are made.



Optional Container for Cryostat

Model	459
Cryostat Temperature:	-80°C to -180°C
Absolute Stability (over 30 minutes)	±0.005°C at -80°C ±0.0015°C at -150°C
<i>(as measured by one of the 670 thermometers in the bottom of one of the pockets of the cryostat)</i>	
Homogeneity pocket to pocket	±0.005°C
Vertical Profile (over bottom 50mm)	±0.005°C at -80°C ±0.01°C at -150°C
Immersion Depth	560mm
Neck Diameter	120mm
Compatibility	Liquid Nitrogen Containers
Nitrogen Capacity	35 litres
<b>How to Order</b>	
459 Cryostat	
<b>Accessories</b>	
459-01-01 Hand Vacuum Pump	
459-01-02 Electric Vacuum Pump	
459-01-03 35 Litre Cryostat Container	
459-01-04 25 Litre Container for topping up	