

Model K18C

Mercury Triple Point Cell

Operators Manual

Serial Number _____

by

Pond Engineering Laboratories, Inc.

2401 South Larimer County Road 21

Berthoud, Colorado 80513

(303)651-1678

www.pondegnineering.com

REV. Oct 2004

1. Background	3
2. General Information and Operating Procedures	3
3. Temperature Correction for Hydrostatic Head	3
4. Cell Geometry and Construction	3
4.1. Mercury Cell Specifications.....	4
5. Handling and Maintenance	4

Mercury Triple Point Cell

1. Background

This report documents the fabrication and initial testing, as well as the operating and maintenance procedures for Mercury Triple Point Cell, Model Number K18C.

Information contained in this manual is considered by Pond Engineering Laboratories to be proprietary and is provided for use exclusively by the purchaser for instructional and maintenance purposes relative to the hardware delivered. Any other use is prohibited.

2. General Information and Operating Procedures

On the ITS-90, the triple point (equilibrium state of solid, liquid, and vapor phases) of mercury is assigned the value 234.3156 K or -38.8344 degrees C. With high purity mercury (99.99999%), both freezing and melting techniques realize triple point temperatures that agree within +/- 0.1mK over most of the plateau region.

Since the triple point of mercury is considerably below normal laboratory ambient room temperatures, it is recommended that the cell be used in melting mode. Maintaining an inner melt adjacent to the thermometer well is much easier when using the melting mode.

Following initial preparation of the cell by completely freezing the metal sample and allowing the cell to come into equilibrium at a temperature slightly below the Triple Point, it is recommended that a warm (room temperature) thermometer or glass rod be inserted into the central well and the cell surroundings be maintained slightly (a few tenths degree C) warmer than the Triple Point. This procedure will maintain a thin layer of metal adjacent to the thermometer well as well as around the periphery of the metal sample, thus obtaining the most consistent temperature measurements.

For subsequent calibration of thermometers, it is recommended that a precooled thermometer be inserted into the central well. It should be noted that when a thermometer is removed from the precool well, its temperature increases dramatically. When inserted into the cell's center well, the warmer thermometer causes minimal melting of the metal sample adjacent to the central well, prolonging the life of the plateau.

3. Temperature Correction for Hydrostatic Head

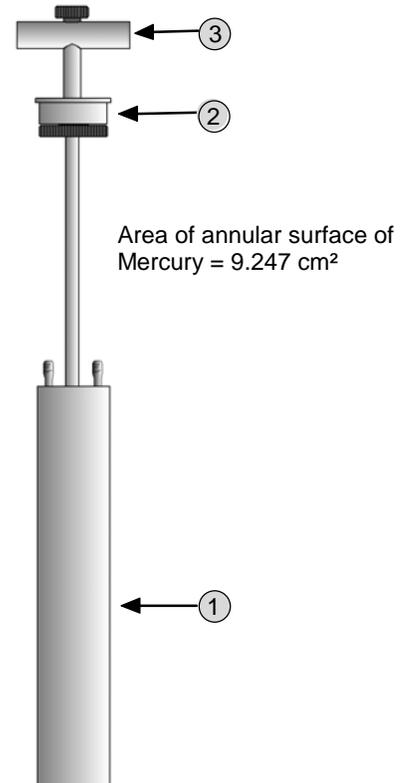
Triple point conditions are maintained inside the cell at the vapor /liquid /solid interface which occurs only at the upper surface of the mercury. Since there is considerable hydrostatic head imposed by mercury at the depth of immersion of these cells, a correction must be applied to the theoretical triple point temperature to account for the static head pressure present at the sensing point. For all practical purposes, this correction results in an increase of 0.0011 degrees C and variability between cells is negligible. This results in a temperature, at the center of the sensing element of a SPRT inserted in the central well, of -38.8333 degrees C (ITS-90). The following data concerning cell construction is provided for reference and to allow independent verification of corrections applied.

4. Cell Geometry and Construction

These cells consist of machined and welded type 304 stainless steel vessels as shown in the diagram on the next page. Cell envelope outside dimensions are consistent with those shown in NIST Technical Note 1265 Figure 10, page 43. During fabrication, each cell envelope is leak checked with a Helium Mass Spectrometer leak detector to verify leak rates less than 1×10^{-9} standard cc/second air equivalent. During the cleaning and filling processes, the two small tubes

adjoining the central well are crimped and welded providing a rugged, completely sealed cell envelope.

REF. #	NAME	MAKE	MODEL
1	Mercury Triple Point Cell	Pond Engineering Laboratories	K18C
2	Mercury Cell Top	Pond Engineering Laboratories	K18C-TOP
3	Cell Handle	Pond Engineering Laboratories	K18C-HND



4.1. Mercury Cell Specifications

The cell was filled with approximately 2.5 kilograms of high purity mercury and had a fully charged weight of approximately 2.8 kilograms. Based on the internal dimensions of the cell and the mass of mercury contained, the calculated height of liquid mercury is 18.0 cm above the bottom of the center well.

5. Handling and Maintenance

As previously mentioned, the triple point cells are completely sealed and require no periodic maintenance. Handling precautions should be observed to generally store the cells in a vertical orientation to minimize contact of the liquid mercury with the welded closures on the cell filling tubes. Contact has not been known to cause contamination of the cell, and vertical storage is only a precaution.

Any moisture which may condense on the outer cell envelope during or after use should be removed from the surface prior to storage to prevent any corrosion which may otherwise occur.

As the cells are handled, a fairly sharp “click” or hydrostatic hammer should be observed as the slug of mercury moves into contact with the inside surface of the cell. The presence of this hydrostatic hammer is a good indication that the envelope integrity is in tact and that triple point conditions are being maintained inside the cell when cooled and prepared by the cryostat.