

# **Certificate of Conformity**

## **Isothermal Tower Aluminium Fixed Point Cell**

**MODEL: 493  
SERIAL NUMBER:**

**ISSUED BY: ISOTHERMAL TECHNOLOGY LIMITED.**

**DATE OF ISSUE: 12<sup>th</sup> October 2009**

**Congratulations you are now the custodian of one of the best ITS-90 Fixed Point  
Cells ever produced.**

**The Cells we make are not just an ingot of pure metal.**

**We go to extreme lengths to ensure all elements that go into the fabrication of  
the cells are the best available world wide.**

**CUSTOMER:****CUSTOMER ORDER:****ITL REFERENCE:**

**DESCRIPTION:** Isotech Model 493 Isothermal Tower Aluminium Fixed Point Cell.

**ASSIGNED ITS 90 TEMPERATURE:** Freezing Point of Aluminium, 660.323 °C.

**IDENTIFICATION:****CONSTRUCTION:**

The fixed point cell within the Isothermal Tower comprises an ingot of 99.9999 (6N) pure metal in a very high purity graphite crucible, all sealed in metal.

**PERFORMANCE:**

There is a temperature variation with depth below the metal surface where the ITS 90 defined temperature applies.

The distance from the metal surface to the bottom of the re entrant well is 180 mm ± 5 mm.

The hydrostatic temperature variation of this cell is 0.0016 mK per mm.

The correction should be calculated using the distance between the metal surface and the mean sensing position of the thermometer in the re entrant well.

Approved By

Name:

Signature:

## **THE METAL**

The metal we use in our fixed point cells is certified by the manufacturer to be 6N pure.

The manufacturer will typically analyse 20 elements from any one sample, however, their minimum detection levels to which they are operating may be relatively high, up to 5 ppm.

An assumption is made that if an impurity is less than the minimum detection level then it is classified as zero!

Clearly a manufacturer's analysis is of limited value.

The National Research Council of Canada (NRCC) has probably the best analysis facility publicly available.

At your request we can send a sample of the metal used in your cell to NRCC for analysis.

There the sample will be analysed for up to 60 elements in a system with minimum detection levels down in the parts per billion (ppb).

This analysis will give a higher confidence level to you, the user.

There is an additional cost for this service, consult Isotech for a sample NRCC certificate of analysis and an up to date cost.

**Certificate of Analysis**  
**For**  
**Isothermal Tower Aluminium**  
**Serial No:**

Date: 8/9/2005

Material: Aluminium

Lot No.: M9904

Based on information supplied with the material Lot No. as above, the significant detected metallic impurities are those listed:-

Mg	=	0.16 ppm
Si	=	0.42 ppm
Fe	=	0.22 ppm
Cu	=	0.23 ppm

Signed by;



.....  
John P. Tavener, Managing Director  
& Head of Laboratories.

## **THE GRAPHITE CRUCIBLE**

The graphite crucible that surrounds the metal in the fixed point cell must be the densest available with the smallest particle size, whilst also having the highest purity.

Our research identified graphite with average grain size of 7 $\mu$ m and a purified grade containing less than 5 ppm of impurities.

But this is only the first stage of the process.

The finished machined parts then go through a post machine purification process to further reduce the impurities.

Finally followed by a time versus temperature versus vacuum process prior to the metal being introduced.

The resulting graphite contains no measurable impurities.

# Certificate of Isotropic Graphite Analysis For Cell Crucible. Serial No.

Date: January 2008

Material: Isotropic Graphite

Grade: SS

Based on information supplied with the material Grade as above, the significant detected metallic impurities are those listed:-

Fe	=	<1 ppm
Mg	=	<1 ppm
Si	=	<1 ppm
Ti	=	<1 ppm

Signed by;



.....  
John P. Tavener, Managing Director  
& Head of Laboratories.

## **THE GAS**

Compared to say 1 Kg of 6N pure metal, only a few milligrams of Argon are used to surround the cell.

Even so the Argon that we use is certified as 5N5 pure, ensuring that the effects of its impurities are un-measurable.

## **THE CELL GAS PRESSURE**

ITS-90 specifies that at the transition temperature where the cell melts and freezes the pressure inside the cell shall be within 1 % of one standard atmosphere. (101, 325 Pa or 1.013 bar) (excepting Triple Points). \*\*

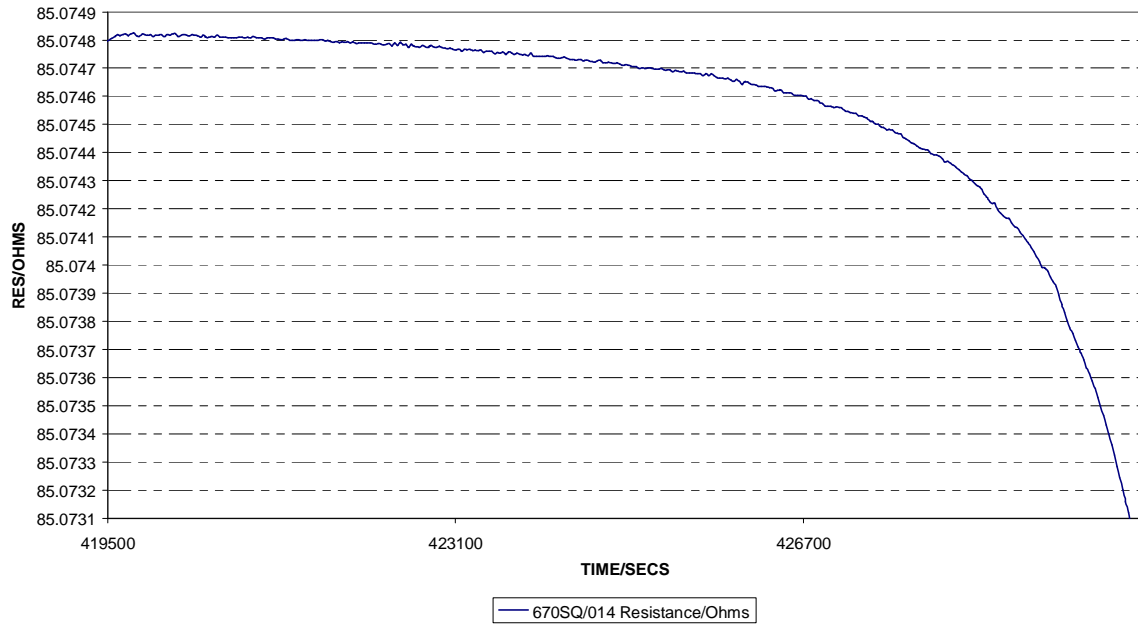
Each sealed cell produced by Isotech is set to one standard atmosphere +/- 5 mb, using a UKAS certified Druck vacuum gauge.

A cell whose pressure is not that of one standard atmosphere does not fully conform to ITS-90.

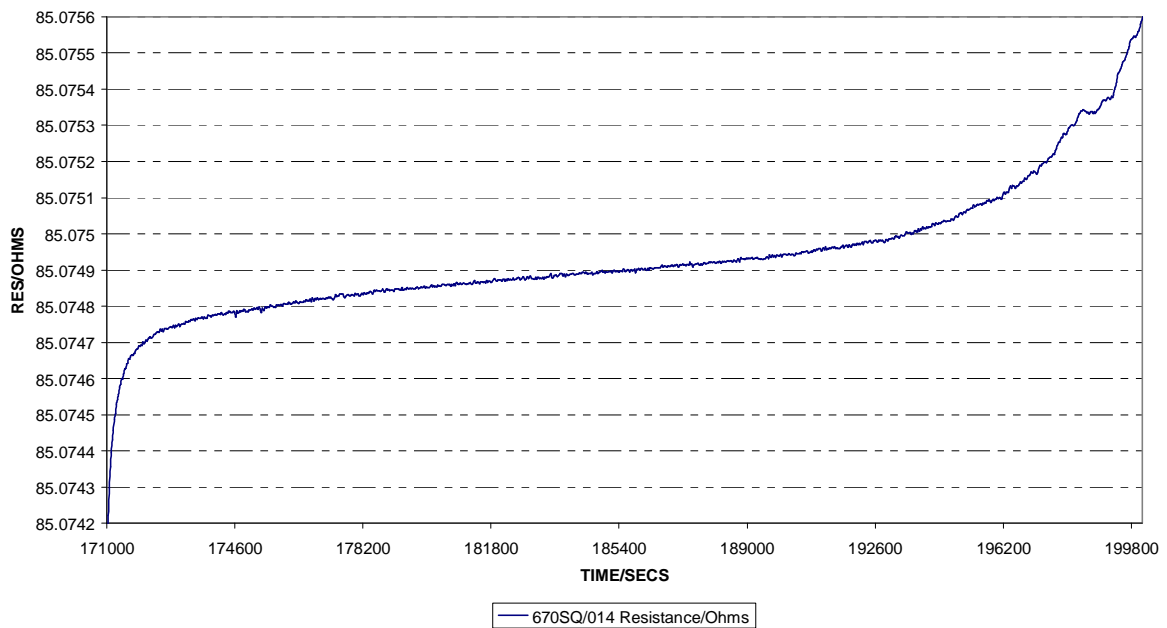
\*\* Ref. Metrologia 27, 3-10 (1990).

Table 1 "Melting point, Freezing Point (temperature at a pressure of 101, 325 Pa, at which the solid and liquid phases are in equilibrium)".

**Isothermal Tower Aluminium Fixed Point Cell FREEZE PLATEAU 5**  
**5th October 2009 (S.P. 660.0 Deg C, Zone 12.0)**



**Isothermal Tower Aluminium Fixed Point Cell MELT PLATEAU 5**  
**2nd October 2009 (S.P. 661.4 Deg C, Zone 12.0)**



# **Certificate of Conformity**

## **Isothermal Tower Tin Fixed Point Cell**

**MODEL: 491  
SERIAL NUMBER:**

**ISSUED BY: ISOTHERMAL TECHNOLOGY LIMITED.**

**DATE OF ISSUE: 1<sup>st</sup> October 2009**

**Congratulations you are now the custodian of one of the best ITS-90 Fixed Point Cells ever produced.**

**The Cells we make are not just an ingot of pure metal.**

**We go to extreme lengths to ensure all elements that go into the fabrication of the cells are the best available world wide.**

**CUSTOMER:****CUSTOMER ORDER:****ITL REFERENCE:**

**DESCRIPTION:** Isotech Model 491 Isothermal Tower Tin Fixed Point Cell.

**ASSIGNED ITS 90 TEMPERATURE:** Freezing Point of Tin, 231.928 °C.

**IDENTIFICATION:****CONSTRUCTION:**

The fixed point cell within the Isothermal Tower comprises an ingot of 99.9999 (6N) pure metal in a very high purity graphite crucible, all sealed in metal.

**PERFORMANCE:**

There is a temperature variation with depth below the metal surface where the ITS 90 defined temperature applies.

The distance from the metal surface to the bottom of the re entrant well is 180 mm  $\pm$  5 mm.

The hydrostatic temperature variation of this cell is 0.0022 mK per mm.

The correction should be calculated using the distance between the metal surface and the mean sensing position of the thermometer in the re entrant well.

Approved By  
Name:  
Signature:

## **THE METAL**

The metal we use in our fixed point cells is certified by the manufacturer to be 6N pure.

The manufacturer will typically analyse 20 elements from any one sample, however, their minimum detection levels to which they are operating may be relatively high, up to 5 ppm.

An assumption is made that if an impurity is less than the minimum detection level then it is classified as zero!

Clearly a manufacturer's analysis is of limited value.

The National Research Council of Canada (NRCC) has probably the best analysis facility publicly available.

At your request we can send a sample of the metal used in your cell to NRCC for analysis.

There the sample will be analysed for up to 60 elements in a system with minimum detection levels down in the parts per billion (ppb).

This analysis will give a higher confidence level to you, the user.

There is an additional cost for this service, consult Isotech for a sample NRCC certificate of analysis and an up to date cost.

**Certificate of Analysis  
For  
Isothermal Tower Tin  
Serial No:**

Date: 01/04/1998

Material: Tin

Lot No.: M8967

Based on information supplied with the material Lot No. as above, the significant detected metallic impurities are those listed:-

B	=	0.1 ppm
Cs	=	0.2 ppm
Mg	=	0.1 ppm
Si	=	0.2 ppm

Signed by;



.....  
John P. Tavener, Managing Director  
& Head of Laboratories.

## **THE GRAPHITE CRUCIBLE**

The graphite crucible that surrounds the metal in the fixed point cell must be the densest available with the smallest particle size, whilst also having the highest purity.

Our research identified graphite with average grain size of 7 $\mu$ m and a purified grade containing less than 5 ppm of impurities.

But this is only the first stage of the process.

The finished machined parts then go through a post machine purification process to further reduce the impurities.

Finally followed by a time versus temperature versus vacuum process prior to the metal being introduced.

The resulting graphite contains no measurable impurities.

# Certificate of Isotropic Graphite Analysis For Cell Crucible. Serial No.

Date: January 2008

Material: Isotropic Graphite

Grade: SS

Based on information supplied with the material Grade as above, the significant detected metallic impurities are those listed:-

Fe	=	<1 ppm
Mg	=	<1 ppm
Si	=	<1 ppm
Ti	=	<1 ppm

Signed by;



.....  
John P. Tavener, Managing Director  
& Head of Laboratories.

### **THE GAS**

Compared to say 1 Kg of 6N pure metal, only a few milligrams of Argon are used to surround the cell.

Even so the Argon that we use is certified as 5N5 pure, ensuring that the effects of its impurities are un-measurable.

### **THE CELL GAS PRESSURE**

ITS-90 specifies that at the transition temperature where the cell melts and freezes the pressure inside the cell shall be within 1 % of one standard atmosphere. (101, 325 Pa or 1.013 bar) (excepting Triple Points). \*\*

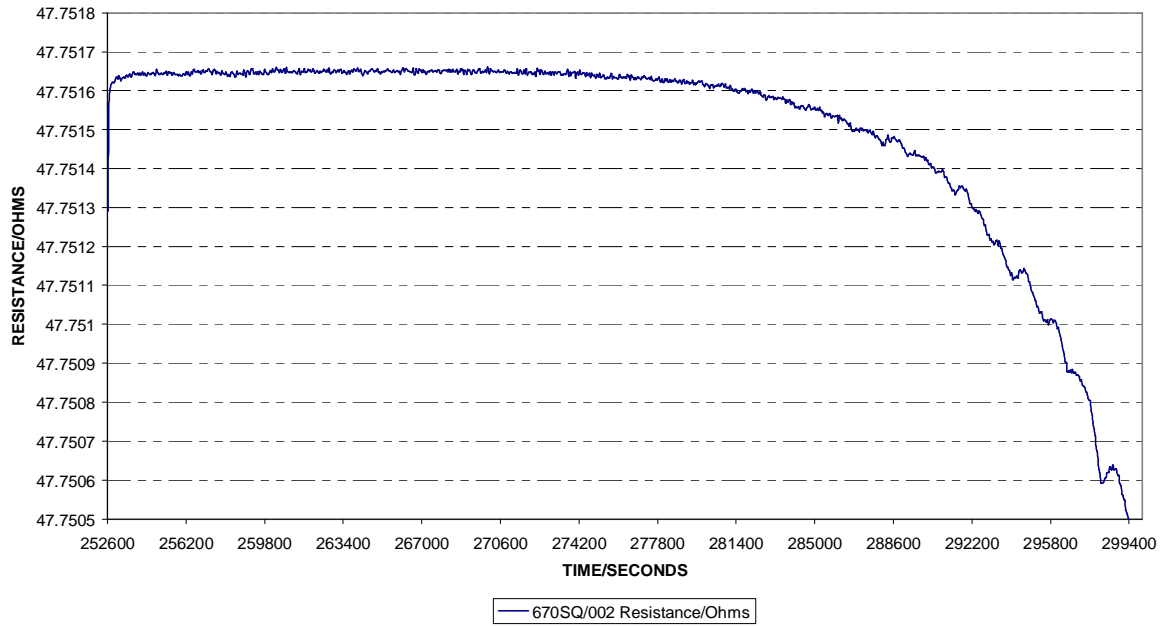
Each sealed cell produced by Isotech is set to one standard atmosphere +/- 5 mb, using a UKAS certified Druck vacuum gauge.

A cell whose pressure is not that of one standard atmosphere does not fully conform to ITS-90.

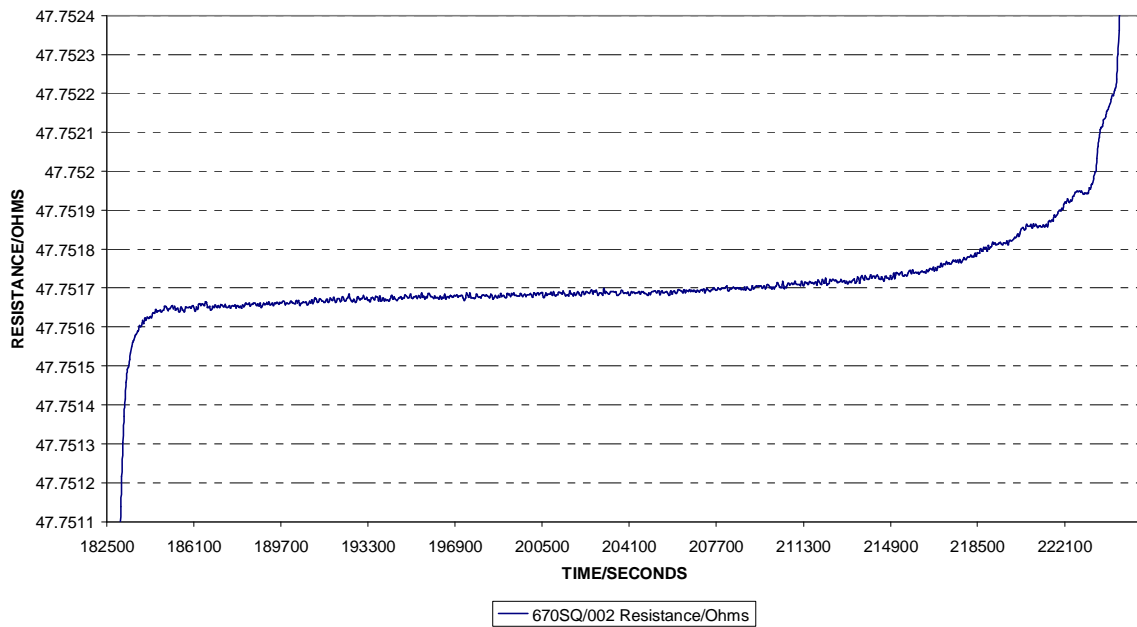
\*\* Ref. Metrologia 27, 3-10 (1990).

Table 1 “ Melting point, Freezing Point (temperature at a pressure of 101, 325 Pa, at which the solid and liquid phases are in equilibrium)”.

**Isothermal Tower Tin Fixed Point Cell FREEZE PLATEAU 2**  
**(S.P. 231.0 Deg C, Zone 4.0) 15th August 2009**



**Isothermal Tower Tin FixedPoint Cell MELT PLATEAU 2**  
**(S.P. 231.6 Deg C, Zone 4.0) 14th August 2009**



# **Certificate of Conformity**

## **Isothermal Tower Zinc Fixed Point Cell**

**MODEL: 492  
SERIAL NUMBER:**

**ISSUED BY: ISOTHERMAL TECHNOLOGY LIMITED.**

**DATE OF ISSUE: 20<sup>th</sup> October 2009**

**Congratulations you are now the custodian of one of the best ITS-90 Fixed Point Cells ever produced.**

**The Cells we make are not just an ingot of pure metal.**

**We go to extreme lengths to ensure all elements that go into the fabrication of the cells are the best available world wide.**

**CUSTOMER:****CUSTOMER ORDER:****ITL REFERENCE:**

**DESCRIPTION:** Isotech Model 492 Isothermal Tower Zinc Fixed Point Cell.

**ASSIGNED ITS 90 TEMPERATURE:** Freezing Point of Zinc, 419.527 °C.

**IDENTIFICATION:****CONSTRUCTION:**

The fixed point cell within the Isothermal Tower comprises an ingot of 99.9999 (6N) pure metal in a very high purity graphite crucible, all sealed in metal.

**PERFORMANCE:**

There is a temperature variation with depth below the metal surface where the ITS 90 defined temperature applies.

The distance from the metal surface to the bottom of the re entrant well is 180 mm  $\pm$  5 mm.

The hydrostatic temperature variation of this cell is 0.0027 mK per mm.

The correction should be calculated using the distance between the metal surface and the mean sensing position of the thermometer in the re entrant well.

Approved By  
Name:  
Signature:

## **THE METAL**

The metal we use in our fixed point cells is certified by the manufacturer to be 6N pure.

The manufacturer will typically analyse 20 elements from any one sample, however, their minimum detection levels to which they are operating may be relatively high, up to 5 ppm.

An assumption is made that if an impurity is less than the minimum detection level then it is classified as zero!

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At your request we can send a sample of the metal used in your cell to NRCC for analysis.

There the sample will be analysed for up to 60 elements in a system with minimum detection levels down in the parts per billion (ppb).

This analysis will give a higher confidence level to you, the user.

There is an additional cost for this service, consult Isotech for a sample NRCC certificate of analysis and an up to date cost.

**Certificate of Analysis  
For  
Isothermal Tower Zinc  
Serial No:**

Date: 18/12/2006
Material: Zinc
Lot No.: M27615

Based on information supplied with the material Lot No. as above, the significant detected metallic impurities are those listed:-

No Impurities Detected

Signed by;



.....  
John P. Tavener, Managing Director  
& Head of Laboratories.

## **THE GRAPHITE CRUCIBLE**

The graphite crucible that surrounds the metal in the fixed point cell must be the densest available with the smallest particle size, whilst also having the highest purity.

Our research identified graphite with average grain size of 7 $\mu$ m and a purified grade containing less than 5 ppm of impurities.

But this is only the first stage of the process.

The finished machined parts then go through a post machine purification process to further reduce the impurities.

Finally followed by a time versus temperature versus vacuum process prior to the metal being introduced.

The resulting graphite contains no measurable impurities.

# Certificate of Isotropic Graphite Analysis For Cell Crucible. Serial No.

Date: January 2008

Material: Isotropic Graphite

Grade: SS

Based on information supplied with the material Grade as above, the significant detected metallic impurities are those listed:-

Fe	=	<1 ppm
Mg	=	<1 ppm
Si	=	<1 ppm
Ti	=	<1 ppm

Signed by;



.....  
John P. Tavener, Managing Director  
& Head of Laboratories.

### **THE GAS**

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Even so the Argon that we use is certified as 5N5 pure, ensuring that the effects of its impurities are un-measurable.

### **THE CELL GAS PRESSURE**

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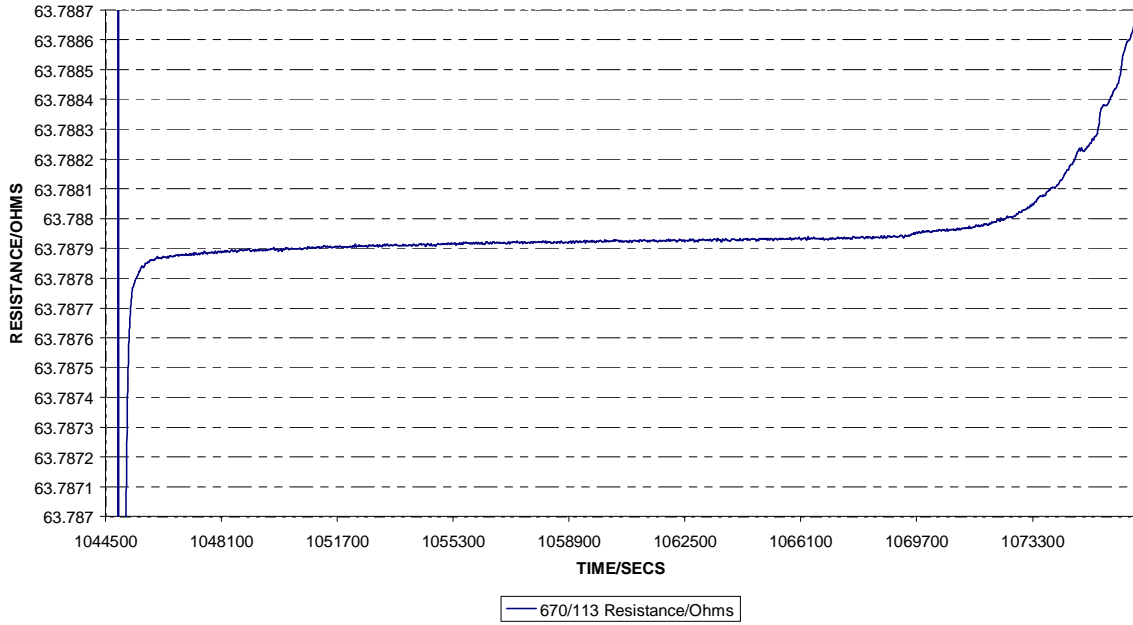
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A cell whose pressure is not that of one standard atmosphere does not fully conform to ITS-90.

\*\* Ref. Metrologia 27, 3-10 (1990).

Table 1 "Melting point, Freezing Point (temperature at a pressure of 101, 325 Pa, at which the solid and liquid phases are in equilibrium)".

**Isothermal Tower Zinc Fixed Point Cell MELT PLATEAU**  
12th October 2009 (S.P. 420.0 Deg C, Zone 13.0)



**Isothermal Tower Zinc Fixed Point Cell FREEZE PLATEAU**  
13th October 2009 (S.P. 419.0 Deg C, Zone 13.0)

