STANDARD TEMPERATURE SENSORS

PERFORMANCE SPECIFICATION
CHINO

■STANDARD PLATINUM RESISTANCE THERMOMETERS
■STANDARD PLATINUM-COBALT RESISTANCE THERMOMETER FOR CRYOGENIC TEMPERATURE

These are standard temperature sensors conforming to the International Temperature Scale of 1990.
The temperature range from 4 K to 962ºC is measured by these sensors which are classified into a standard platinum-cobalt resistance thermometer for cryogenic temperature, standard platinum resistance thermometers for low temperature, medium temperature and high temperature.
The R800 series standard platinum resistance thermometers, which have been commercialized under the guidance of the National Metrology Institute of Japan (NMIJ), have been adopted by national metrology institute in overseas countries with reputation on their performance and reliability.

MODEL R800-0

MODEL R800-2

■FEATURES

●These sensors are manufactured with selected quality materials by highly skilled manufacturing techniques under the guidance of NMIJ.

●The standard platinum resistance thermometer for low temperature is the first international product in Japan as the standard thermometer applicable to 13 K.

●The standard platinum resistance thermometers for medium temperature and for high temperature have been delivered to national measurement institute in overseas countries in large quantities. Its performance has been highly reputed in Comite Consultatif de Thermometrie (CCT).

●The standard platinum-cobalt resistance thermometer for cryogenic temperature features excellent reproducibility and stability in a cryogenic temperature range below to 4 K.

■LIST OF STANDARD TEMPERATURE SENSORS

- STANDARD TEMPERATURE SENSORS
  - STANDARD PLATINUM RESISTANCE THERMOMETERS R800 series
    - STANDARD PLATINUM-COBALT RESISTANCE THERMOMETER FOR CRYOGENIC TEMPERATURE — MODEL R800-4
    - STANDARD PLATINUM RESISTANCE THERMOMETER FOR LOW TEMPERATURE — MODEL R800-0
    - STANDARD PLATINUM RESISTANCE THERMOMETER FOR MEDIUM TEMPERATURE — MODEL R800-2
    - STANDARD PLATINUM RESISTANCE THERMOMETER FOR HIGH TEMPERATURE — MODEL R800-3
    - LOW RESISTANCE TYPE STANDARD PLATINUM RESISTANCE THERMOMETER FOR HIGH TEMPERATURE — MODEL R800-3T

STANDARD PLATINUM RESISTANCE THERMOMETER FOR LOW TEMPERATURE (CAPSULE TYPE)

MODEL R800-0

MODEL R800-0

This thermometer is designed as a capsule type standard temperature sensor covering the temperature range from 13.8033 K (-259.3467 ºC triple point of equilibrium hydrogen) to 30 ºC.

■FEATURES

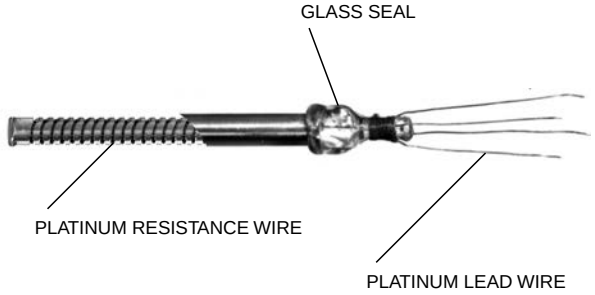
- ●Conforms to the specifications of ITS-90 (International Temperature Scale of 1990)
- ●The adoption of the strain-free double coil system structure in a sensing part and CHINO's unique manufacturing techniques have realized excellent reproducibility and stability of the thermometer for a long time.

■GENERAL SPECIFICATIONS

MEASURING TEMPERATURE RANGE
: 13 K to 30 ºC
RESISTANCE VALUE
: 25.5 ± 1 Ω (at 0 ºC)
SPECIFIED CURRENT
: 1 mA
TEMPERATURE CHARACTERISTIC
: *R* (-38.8344 ºC) / *R* (0.01 ºC) ≦ 0.844235
SENSITIVITY : 0.1 Ω / K
SELF-HEATING : Approx. 1 mK / 1 mA
SEALED GAS : Helium gas
CONNECTING LEAD WIRE
: 4-conductor type platinum wire Ø 0.3 mm X 40 mm
FRAME : Cross quartz
PROTECTING TUBE
: Capsule type platinum sheath Ø 5 mm X 43 mm

■CONSTRUCTION

An element made by winding a platinum resistance wire onto a cross quartz frame by the double coil system is accommodated a platinum-sheathed capsule, and connecting lead wires are led through the metal glass sealing.



■CALIBRATION

For applying this thermometer as a standard temperature sensor, the temperature-resistance value table must be prepared by calibrating it. CHINO will prepare a temperature-resistance value table if requested. (Calibration charge is separately asked.)

●CALIBRATION TEST

CALIBRATION POINT

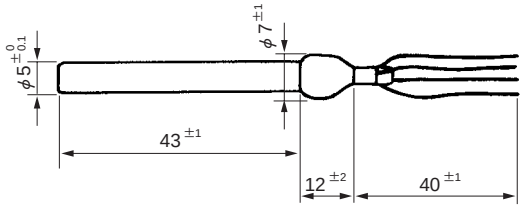
: Triple point of water	(273.16 K)
Equivalent to triple point of mercury	(234.3156 K)
* Equivalent to triple point of argon	(83.8058 K)
* Equivalent to triple point of oxygen	(54.3584 K)
* Equivalent to triple point of neon	(24.5561 K)
* Equivalent to boiling point of equilibrium hydrogen	(20.2711 K)
* Equivalent to 17.035 K point of equilibrium hydrogen	(17.035 K)
* Equivalent to triple point of equilibrium hydrogen	(13.8033 K)

CALIBRATION UNCERTAINTY : 0.1 K
* By comparison calibration

●TEMPERATURE-RESISTANCE VALUE TABLE

The temperature-resistance value table will be prepared by interpolating scales at intervals of 1 K between 13 K and 0 ºC according to the calibrated values in the calibration test.

■EXTERNAL DIMENSIONS



Unit : mm

*The lead wire section size may change more or less.

STANDARD PLATINUM RESISTANCE THERMOMETER FOR MEDIUM TEMPERATURE (LONG STEM TYPE)

MODEL R800-2

MODEL R800-2

This thermometer is designed as a long stem type standard temperature sensor with a quartz protecting tube covering the temperature range from 73 K (-200.15 ºC) to 933.473 K (660.323 ºC, freezing point of aluminum).

■FEATURES

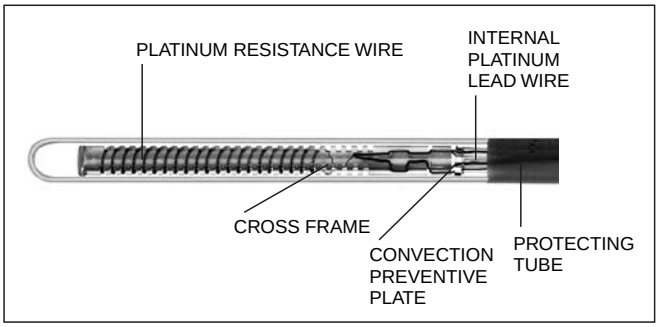
- ●Conforms to the specifications of ITS-90 (International Temperature Scale of 1990).
- ●The adoption of the strain-free double coil system structure in a sensing part and CHINO's unique manufacturing techniques have realized excellent reproducibility and stability of the thermometer for a long time.
- ●The unique structure including a convection preventive plate and a delustered surface finish protecting tube have reduced an error caused by thermal radiation, thermal conduction, and others.

■GENERAL SPECIFICATIONS

MEASURING TEMPERATURE RANGE
: 73 K to 661 ºC
RESISTANCE VALUE
: 25.5 Ω ± 1 Ω (at 0 ºC)
SPECIFIED CURRENT
: 1 mA
TEMPERATURE CHARACTERISTIC
: *R* (29.7646 ºC) / *R* (0.01 ºC) ≧1.11807
SENSITIVITY : 0.1 Ω / K
SELF-HEATING : Approx. 2 mK / 1 mA
SEALED GAS : Mixture gas (argon and oxygen)
CONNECTING INTERNAL LEAD WIRE
: Platinum wire
CONNECTING EXTERNAL LEAD WIRE
: 4-conductor cabtyre cord 2 m with gold-plated terminals
FRAME : Cross quartz
PROTECTING TUBE
: Delustered quartz tube (Ø7.0 ± 0.5) mm X 600 mm

■CONSTRUCTION

An element made by winding a platinum resistance standard onto a cross quartz frame by the double coil system is accommodated into a quartz tube. The interior of the protecting tube is composed of the element, convection preventive plate, spacer, internal lead wire, etc., and 4-conductor external leads have gold-plated terminals.



■CALIBRATION

For applying this thermometer as a standard temperature sensor, the temperature-resistance value table must be prepared by calibrating it. CHINO will prepare the temperature-resistance value table if requested. (Calibration charge is separately asked.)

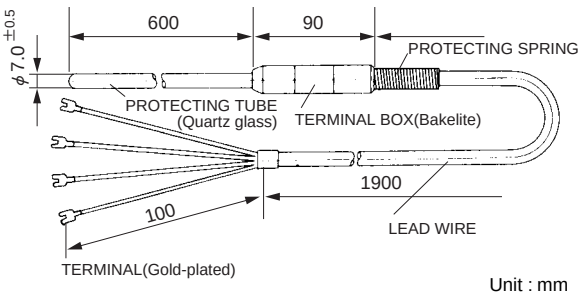
●CALIBRATION TEST

CALIBRATION POINT
: Freezing point of aluminum (660.323 ºC)
Freezing point of zinc (419.527 ºC)
Freezing point of tin (231.928 ºC)
Triple point of water (0.0 l ºC)
CALIBRATION UNCERTAINTY : 0.01 K

●TEMPERATURE-RESISTANCE VALUE TABLE

The temperature-resistance value table will be prepared by interpolating the *R (t)* values between 0 ºC and 661 ºC at intervals of 1 K according to the calibrated values in the calibration test.

■EXTERNAL DIMENSIONS



Unit : mm

STANDARD PLATINUM RESISTANCE THERMOMETER FOR HIGH TEMPERATURE (LONG STEM TYPE)

MODEL R800-3

MODEL R800-3

This thermometer using a high purity platinum wire with a large diameter as a temperature sensing wire is designed as a stem type standard temperature sensor covering the temperature from 273.15 K (0 ºC) to 1234.93K (961.78 ºC, freezing point of silver).

■FEATURES

- ●Conforms to the specifications of ITS-90 (International Temperature Scale of 1990).
- ●The adoption of the strain-free double coil system structure in a sensing part and CHINO's unique manufacturing processing techniques have realized excellent reproducibility and stability of the thermometer for a long time.
- ●A long quartz protecting tube is suitable for high-temperature measurement.

■GENERAL SPECIFICATIONS

MEASURING TEMPERATURE RANGE
: 0 ºC to 962 ºC
RESISTANCE VALUE
: 2.55 Ω ± 0.1 Ω (at 0 ºC)
SPECIFIED CURRENT
: 1 mA
TEMPERATURE CHARACTERISTIC
: *R* (29.7646 ºC) / *R* (0.01 ºC) ≧ 1.11807 and
R (961.78 ºC) / *R* (0.01 ºC) ≧ 4.2844
SENSITIVITY : 0.01 Ω / K
SELF-HEATING : Approx. 0.2 mK / 1 mA
SEALED GAS : Mixture gas (argon and oxygen)
CONNECTING INTERNAL LEAD WIRE
: Platinum lead wire
CONNECTING EXTERNAL LEAD WIRE
: 4-conductor cabtyre cord 2 m with gold-plated
FRAME : Cross quartz
PROTECTING TUBE
: Delustered quartz tube
(Ø7.0 ± 0.5) mm X 700 mm

■CALIBRATION

For applying this sensor as a standard thermometer, the temperature-resistance value table must be prepared by calibrating it. CHINO will prepare the temperature-resistance value table at CHINO's standard laboratory if requested. (Calibration charge is separately asked.)

●CALIBRATION TEST

CALIBRATION POINT

: Freezing point of silver	(961.78 ºC)
Freezing point of aluminum	(660.323 ºC)
Freezing point of zinc	(419.527 ºC)
Freezing point of tin	(231.928 ºC)
Triple point of water	(0.01 ºC)

CALIBRATION UNCERTAINTY
: Triple point of water, tin point, zinc point: 0.01 ºC
Aluminum point: 0.02 ºC, silver point: 0.03 ºC

●TEMPERATURE-RESISTANCE VALUE TABLE

The temperature-resistance value table will be prepared by interpolating the *R (t)* values between 660 ºC and 962 ºC at intervals of 1 K according to the calibrated values in the

LOW RESISTANCE TYPE STANDARD PLATINUM RESISTANCE THERMOMETER FOR HIGH TEMPERATURE (LONG STEM TYPE)

MODEL R800-3T

MODEL R800-3T

This thermometer using a high purity platinum wire with a large diameter as a temperature sensing wire is designed as a stem type standard temperature sensor covering the temperature range from 273.15 K (0 ºC) to 1234.93 K (961.78 ºC, freezing point of silver).

■FEATURES

- ●Conforms to the specifications of ITS-90 (International Temperature Scale of 1990).
- ●Improved the sensing part of former R800-3L and the stability and repeatability becomes even better. (Evaluation tested at NMIJ).
- ●As a low resistance type platinum wire being suitable for high temperature measurement is used, the influence of insulation resistance is very low.

■GENERAL SPECIFICATIONS

MEASURING TEMPERATURE RANGE
: 0 ºC to 962 ºC
RESISTANCE VALUE
: 0.25 Ω (at 0 ºC)
SPECIFIED CURRENT
: 10 mA
TEMPERATURE CHARACTERISTIC
: *R* (29.7646 ºC) / *R* (0.01 ºC) ≧ 1.11807 and
R (961.78 ºC) / *R* (0.01 ºC) ≧ 4.2844
SENSITIVITY : 1 mΩ / K
SELF-HEATING : Approx. 0.02 mK / 1 mA
SEALED GAS : Mixture gas (argon and oxygen)
CONNECTING INTERNAL LEAD WIRE
: Platinum lead wire
CONNECTING EXTERNAL LEAD WIRE
: 4-conductor cabtyre cord 2 m with gold-plated
FRAME : Cross quartz
PROTECTING TUBE
: Delustered quartz tube
(Ø7.0 ± 0.5) mm X 700 mm

■CALIBRATION

For applying this thermometer as a standard temperature sensor, the temperature-resistance value table must be prepared by calibrating it. CHINO will prepare the temperature-resistance value table if requested. (Calibration charge is separately asked.)

●CALIBRATION TEST

CALIBRATION POINT

: Freezing point of silver	(961.78 ºC)
Freezing point of aluminum	(660.323 ºC)
Freezing point of zinc	(419.527 ºC)
Freezing point of tin	(231.928 ºC)
Triple point of water	(0.01 ºC)

CALIBRATION UNCERTAINTY
: Triple point of water, tin point, zinc point: 0.01 ºC
Aluminum point: 0.02 ºC, silver point: 0.03 ºC

●SILVER POINT CALIBRATION TEST

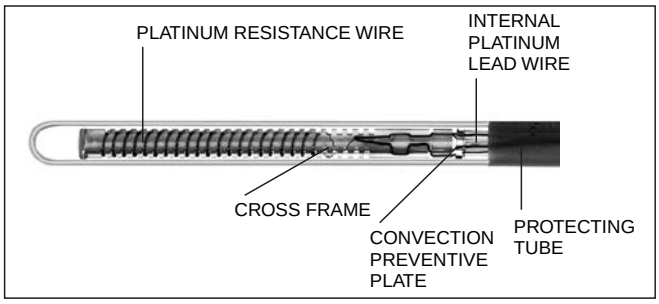
2 points calibration of freezing point of silver and triple point of water is also provided.

●TEMPERATURE-RESISTANCE VALUE TABLE

The temperature-resistance value table will be prepared by interpolating the *R (t)* values between 0 ºC and 962 ºC at intervals of 1 K according to the calibrated values in the calibration test.

■CONSTRUCTION (R800-3)

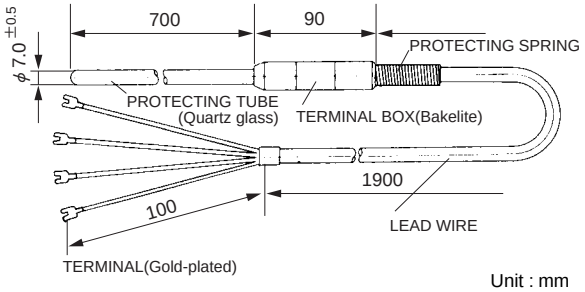
An element made by winding a platinum resistance standard onto a cross quartz frame by the double coil system is accommodated into a quartz tube. The interior of the protecting tube is composed of the element, convection preventive plate, spacer, internal lead wire, etc., and 4-conductor external leads have gold-plated terminals.



■CONSTRUCTION (R800-3T)

An element made by winding a platinum resistance strarnd onto a cross quartz frame by the single coil system is accommodated into a quartz tube.
The interior of the protecting tube is composed of the element, convection protective plate, spacer, internal lead wire, etc. and 4-conductor external leads have gold-plated terminals.

■EXTERNAL DIMENSIONS

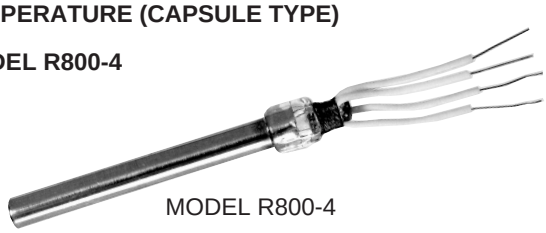


Unit : mm

MODEL R800-4

STANDARD PLATINUM-COBALT RESISTANCE THERMOMETER FOR CRYOGENIC TEMPERATURE (CAPSULE TYPE)

MODEL R800-4



MODEL R800-4

This thermometer is designed as a standard temperature sensor covering from 4 K to 13 K. It adopts platinum-cobalt rarefied alloy as a temperature sensing wire.
The platinum-cobalt rarefied alloy is made by alloying precious metal platinum with infinitesimal magnetic element cobalt, and it features a considerably high resistance and sensitivity in a cryogenic temperature range, as compared with pure metals. A platinum-cobalt resistance thermometer (Model R800-7) for industrial use is prepared, too.

■FEATURES

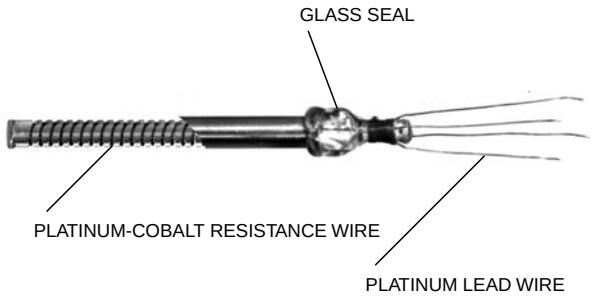
- ●A single sensor covers temperature range from 4 K to 0 ºC
- ●Stable sensitivity (resistance change ratio).
- ●Double coil type temperature sensing structure features very excellent reproducibility of the thermometer.
- ●Excellent responsibility owing to sealed helium gas.

■GENERAL SPECIFICATIONS

MEASURING TEMPERATURE RANGE
4 K to 0 ºC
TEMPERATURE SENSING ELEMENT
: Platinum-cobalt rarefied alloy (Pt-0.5 mol%Co)
RESISTANCE VALUE
: 100 Ω ± 4 Ω (at 0 ºC)
MEASURING CURRENT
: 1 mA
SENSITIVITY : Min. 0.09 Ω / K (at 12 K)
Max. 0.4 Ω / K
SELF-HEATING : Approx. 2 mK / 1 mA in LN_2
SEALED GAS : Helium gas
LEAD WIRE : 4-conductor platinum wire Ø 0.3 mm X 40 mm
FRAME : Cross quartz
PROTECTING TUBE
: Capsule type platinum sheath Ø 5 mm X 43 mm

■CONSTRUCTION

An element made by winding a platinum-cobalt resistance wire onto a cross quartz frame by the double coil system is accommodated into a platinum-sheathed capsule, and connecting lead wires are led through the metal glass sealing.

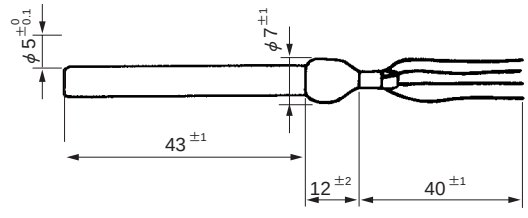


■CALIBRATION

For applying this sensor as a standard thermometer, the temperature-resistance value table must be prepared by calibrating it. CHINO will prepare the temperature-resistance value table if requested. (Calibration charge is separately asked.)

CALIBRATION TEMPERATURE: 4 K to 0 ºC or 14 K to 0 ºC

■EXTERNAL DIMENSIONS

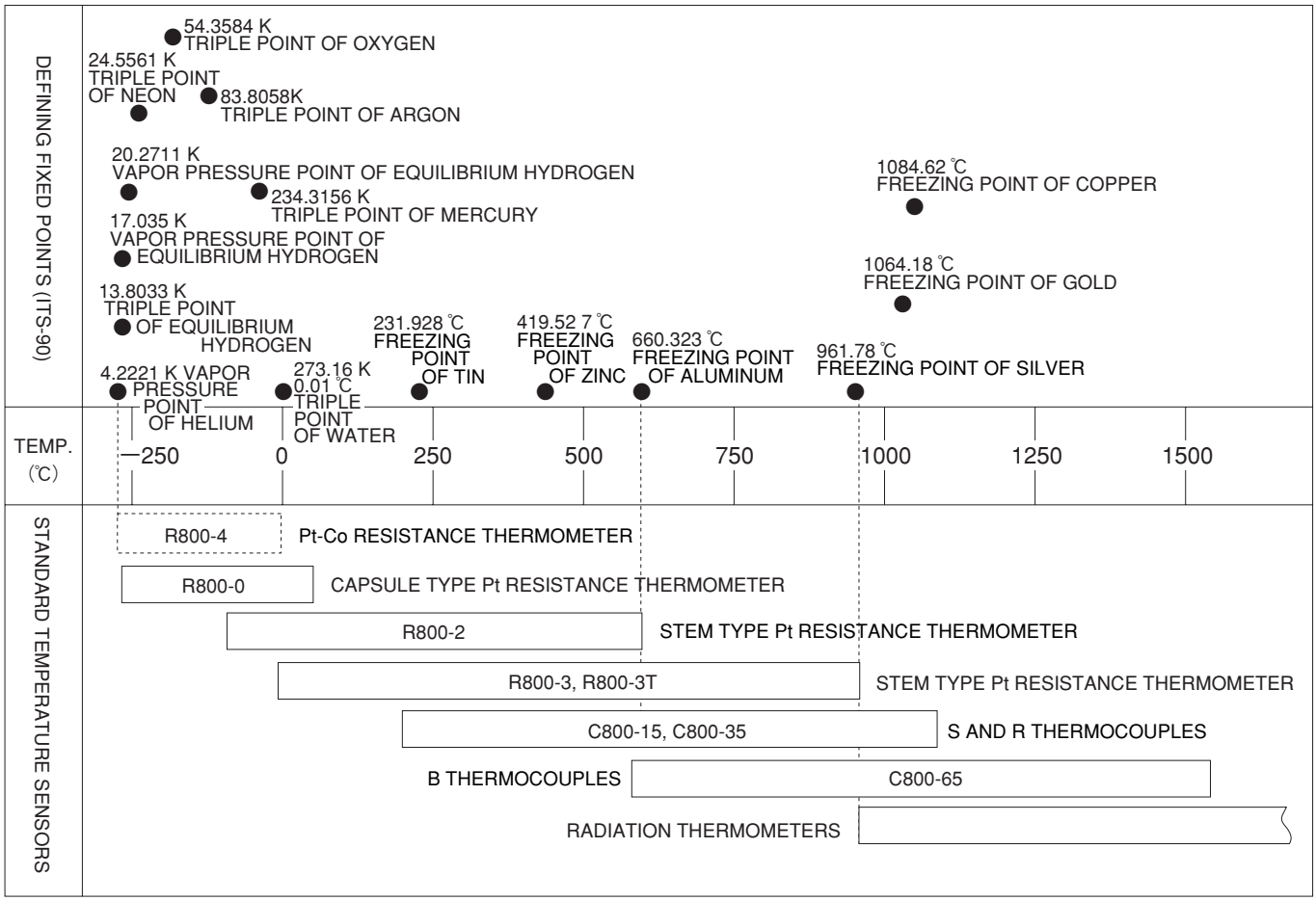


Unit : mm

*The lead wire section size may change more or less.

REFERENCES

■STANDARD TEMPERATURE SENSORS



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