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## 1. Scope

- 1) This document defines the characteristics of temperature sensors to be used for temperature measurement in applications like
  - magnet cryostats
  - cryogenic supply systems
  - cryogenic transport systems
  - cryogenic current lead boxes
  - auxiliary cryogenic systems
 within FAIR accelerators.
- 2) This document is NOT related to bakeable temperature sensors.
- 3) This document is NOT related to any other purpose as aforementioned.

## 2. Temperature Sensors for applications down to 30 K

- 1) For temperature measurement down to 30 K temperature sensors of the type Vishay® CLTS-2B or equivalent in construction AND performance shall be applied.
- 2) For Installation instructions see [1].

### 2.1. Calibration and documentation

- 1) A CLTS shall be delivered with a calibration data sheet showing the values of
  - Lot Number
  - Sensor Number (in lot)
  - R(Ni) in  $\Omega$  at 297 K
  - R(Mn) in  $\Omega$  at 297 K
  - R(Composite) in  $\Omega$  at 297 K
  - R(Composite) in  $\Omega$  at 77.4 K (LN<sub>2</sub> temperature)
  - $\Delta R$ (Composite) in  $\Omega$  from 297 K down to 77.4 K
- 2) All calibration data shall show the correlated calibration errors.



## Technical Guideline

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## Temperature Sensors for Cryogenic Purposes

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### 3. Temperature Sensors for applications down to 3.5 K

- 1) For temperature measurement below 30 K temperature sensors of the CERNOX types
  - CX 1050
  - CX 1070 (down to 4 K only)or equivalent in construction AND performance shall be applied.
- 2) The sensor choice and packaging is dependent of the temperature range respectively required sensitivity, mechanical and thermal application requirements.
- 3) The dedicated choice shall be agreed with GSI.
- 4) For Installation instructions see [1].

#### 3.1. Calibration and Documentation

- 1) Such sensors shall be delivered calibrated, with documentation of at least the following properties as long as not defined different in a correlated detailed specification
  - Temperature dependent resistivity  $R(T)$  in  $\Omega$
  - Temperature dependent sensitivity  $\partial R/\partial T$  in  $\Omega/K$
  - Temperature dependent error measurement  $\Delta T/T$  in %
  - Thermal response time in ms
  - Heat dissipation at applied excitation voltage
- 2) The calibration range shall reach from 300K down to the operation temperature as specified in the correlated detailed specification of the relevant application.
- 3) All calibration data shall show the correlated calibration errors.

### 4. References

- [1] Technical Guideline No. 13.5e: Temperature Sensor Installation for Cryogenic Purposes

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