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APPENDIX 2

INSTRUCTIONS FOR USING THE TRANSFER ZINC FIXED-POINT FURNACE

EURAMET 658 EXTENSION PROJECT TO EXAMINE UNDERLYING PARAMETERS IN RADIANCE TEMPERATURE SCALE REALISATION FROM 156 °C TO 1000 °C

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Instructions for using the transfer Zinc fixed-point furnace

EURAMET 658 Extension Project to Examine Underlying Parameters in Radiance Temperature Scale Realisation from 156 °C to 1000 °C

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Operational guidelines for the check at the Zn point

Check at the Zn point

Check at the Zn point must be done at arrival at each institute using for this purpose the transfer blackbody furnace. The results of these checks must be transmitted to NPL **immediately** (Helen.Mcevoy@npl.co.uk). In case of dubious results NPL will contact thermometer's supplier, i.e., IKE or INRiM.

Note: For detailed information about the Zn-point furnace, refer to the paper*:*
F. Girard, T. Ricolfi, "A transportable blackbody furnace for the accurate realization of the fixed points of indium, tin and zinc", Meas. Sci. Technol. 9, 1215-1218 (1998)

Experimental set up

- The thermometers must be positioned at the following distances from the Zn-point furnace:
  INRiM thermometer: **330 mm** between the end of the objective lens holder and the front stainless steel flange of the furnace.
  IKE thermometer: **610 mm** between the front of the radiation thermometer housing and the front stainless steel flange of the furnace.

- The alignment of the thermometers can be made visually by illuminating the interior of the furnace with a suitable illuminator (eg, fiber optic). If thermometer and furnace are properly aligned, observing through the thermometer eyepiece one will see several concentric circles located in different focal planes.

- The following gain must be set:
  INRiM thermometer: $\mathbf{10^7}$ V/A.
  IKE thermometer:

Running the furnace

The parameters on the temperature controller of the furnace have been set to run automatically 2 cycles each of them being comprised of one melt and one freeze. In this way it is possible to check both thermometers in succession utilizing the two freezing plateaus. The operations to start the automatic cycles after switching on the furnace are as follows:

- Press button "**PAR**" two times in quick succession and release it immediately: the display will indicate "**prog**" on the top and "**idle**" below.
- Press the button with vertical arrow (Δ) and release it immediately: the display will indicate "**prog**" on the top and "**run**" below.

The controller now starts running the set program. No further intervention of the operator is needed.

Notes:
- The execution of the whole program including two melts and two freezes will take approximately 5 and half hours.

-The temperature regulator will indicate 424 °C during the melting phase and 417.5 °C during the freezing phase. Do not switch off the furnace before terminating the program. The program will be terminated when the set point display indicates 0 °C after completing the second freeze.

Warning: in case of mistake in the above operations, simply wait a few seconds for the regulator to restore the stand-by condition then repeat the procedure. Do not change the parameters that have been set. Should any problem arise, contact INRiM immediately (f.girard@inrim.it).

Check of positioning

The quality of the melting plateaus is not optimum because of the fast temperature change in the furnace. However a melting plateau may be used to check the alignment of the thermometer. To this purpose, the furnace should be slightly rotated or displaced laterally and vertically during the plateau to ensure that the cone of sight of the thermometer is not partially obstructed.

Measurements during freeze

At the beginnining of the freezing plateau, the following parameters should be measured:
- Ambient temperature t_{amb}
- Relative humidity RH
- Zero signal S_0 by masking the lens with the objective cap.

During the freezing plateau, the following quantities must be measured:
Signals output S in millivolts and resistance R_{int} of the internal PRT (for INRiM thermometer) and temperature t_{int} of IKE thermometer.

(The INRiM thermometer is provided with a 100 Ω PRT for measuring its internal temperature. A four-wire cable is supplied for this purpose. The internal temperature t_{int} can be obtained from the PRT resistance R_{int} according to the relationship

$$t_{int}\ (°C) = -274.8501 + 2.857835\ R_{int} - 1.151867 \bullet 10^{-3}\ R_{int}^{2} \qquad (1)$$

The range of applicability of Eq. (1) is from t_{int} = 20 °C to t_{int} = 30 °C).

As representative of the Zn-point signal S_{Zn}, the **average of at least 25 readings taken during a time interval of 10 minutes around the maximum of the plateau** should be considered.

After completing the freezing plateau, the temperature of the furnace will be increased automatically to repeat a melt-freeze cycle. Replace the first thermometer with the other one and repeat the operations above including the check of positioning during the melting plateau.

Note: the Zn point is to be intended for performance and stability checks of the thermometers and not for calibration, because of its low quality. Any possible comparison with other Zn points would provide not significant results