

CERTIFICATE OF ANALYSIS

International Temperature Scale of 1990

Indium Freezing-Point Cell
Pond Engineering Model K23C
Serial Number In 98353

Tested for
Instituto Nacional de Tecnica Aeroespacial
Madrid, Spain

6 December 1999

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Instituto Nacional de Tecnica Aeroespacial
Attn.: Dr. Robert Benyon
Temperature and Humidity Laboratory
CTRA Ajalvir
22850 Torrejón de Ardoz
Madrid, Spain

Subject: Quality evaluation of In FP cell (s/n In 98353)
Purchase Order No.: 7230-127/1.998
Test No.: 836/261097-99

Dear Dr. Benyon:

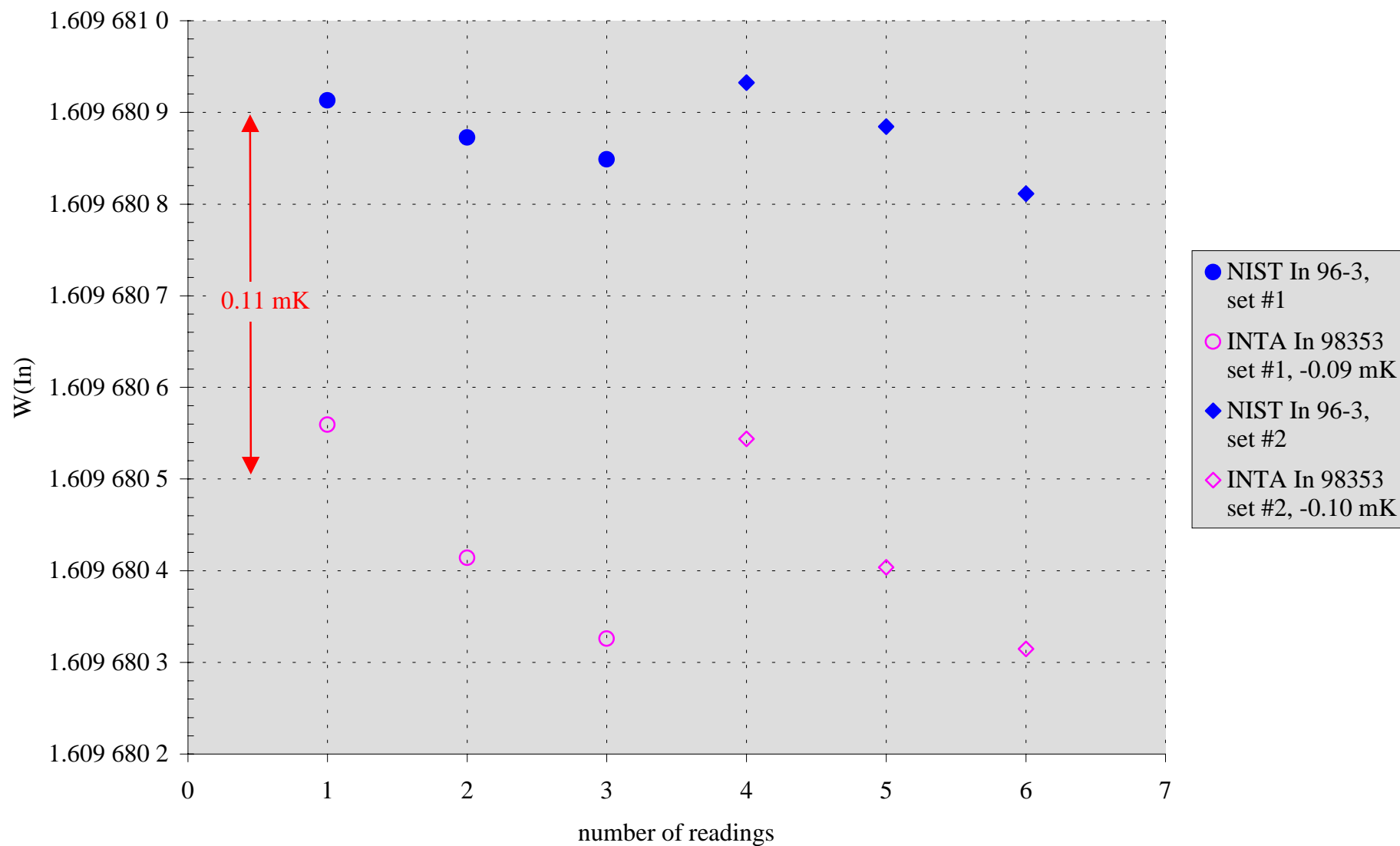
A direct comparison of your indium freezing-point cell (Pond Engineering Model K23C, s/n In 98353) was made against our laboratory standard indium freezing-point cell (In 93-6). The measurement system included an ASL Model F18 operating at a frequency of 30 Hz with a 100 Ω Tinsley Model 5685 reference resistor, temperature controlled to within ± 8 mK, and a 25.5 Ω SPRT. The depth from the mid-point of the SPRT sensor to the liquid surface of your fixed-point cell is stated to be 16.5 cm; the depth of our cell is 18 cm. The pressure in your fixed-point cell and our cell was set to 101.3 kPa. Corrections were made to account for the difference in immersion depth. As shown in figure 1, the freezing-point temperature of your cell is 0.10 mK lower than that of the NIST reference cell In 93-6 cell. We assign an expanded uncertainty ($k=2$) of 0.10 mK on the realized value of our cell to account for impurities and measurement errors.

Figures 2 and 3 give an example of a freezing and melting curve for your cell, respectively. Figure 4 gives an example of the immersion characteristics of an L&N 8167 SPRT in your cell relative to the ITS-90 assigned hydrostatic-head effect for indium. A thermometer must track the hydrostatic-head effect over the bottommost 3 cm of the reentrant well to exhibit proper immersion in a fixed-point cell.

Sincerely,

Dr. B. W. Mangum
Leader, Thermometry Group
Process Measurements Division

**Figure 1: Direct comparison of the INTA In cell (s/n In 98353)
with the NIST reference In cell (In 96-3), ASL F18, 30 Hz, 0 mA**



**Figure 2: Freezing curve of the INTA In fixed-point cell (s/n In 98353)
ASL F18, 30 Hz, 1 mA**

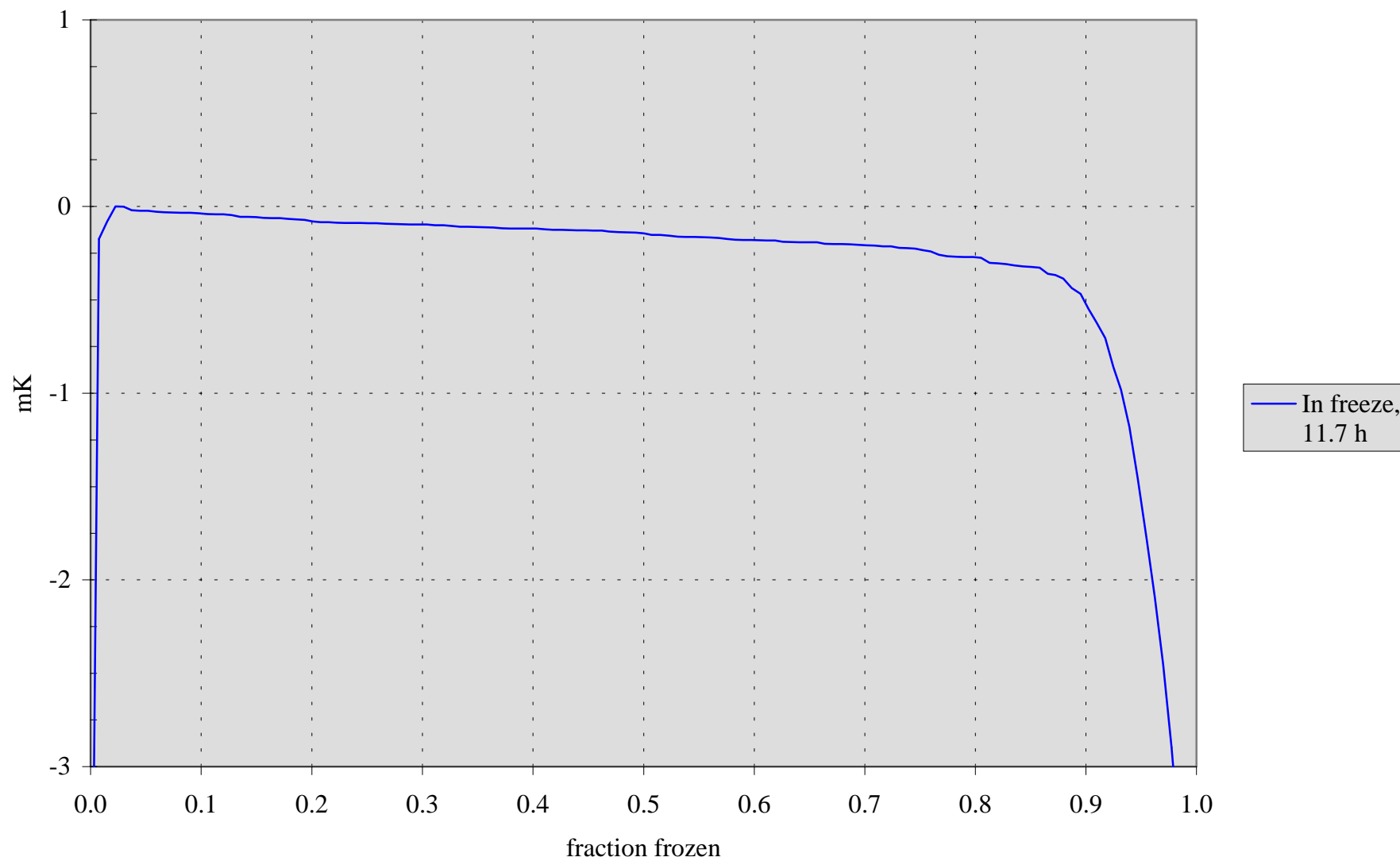
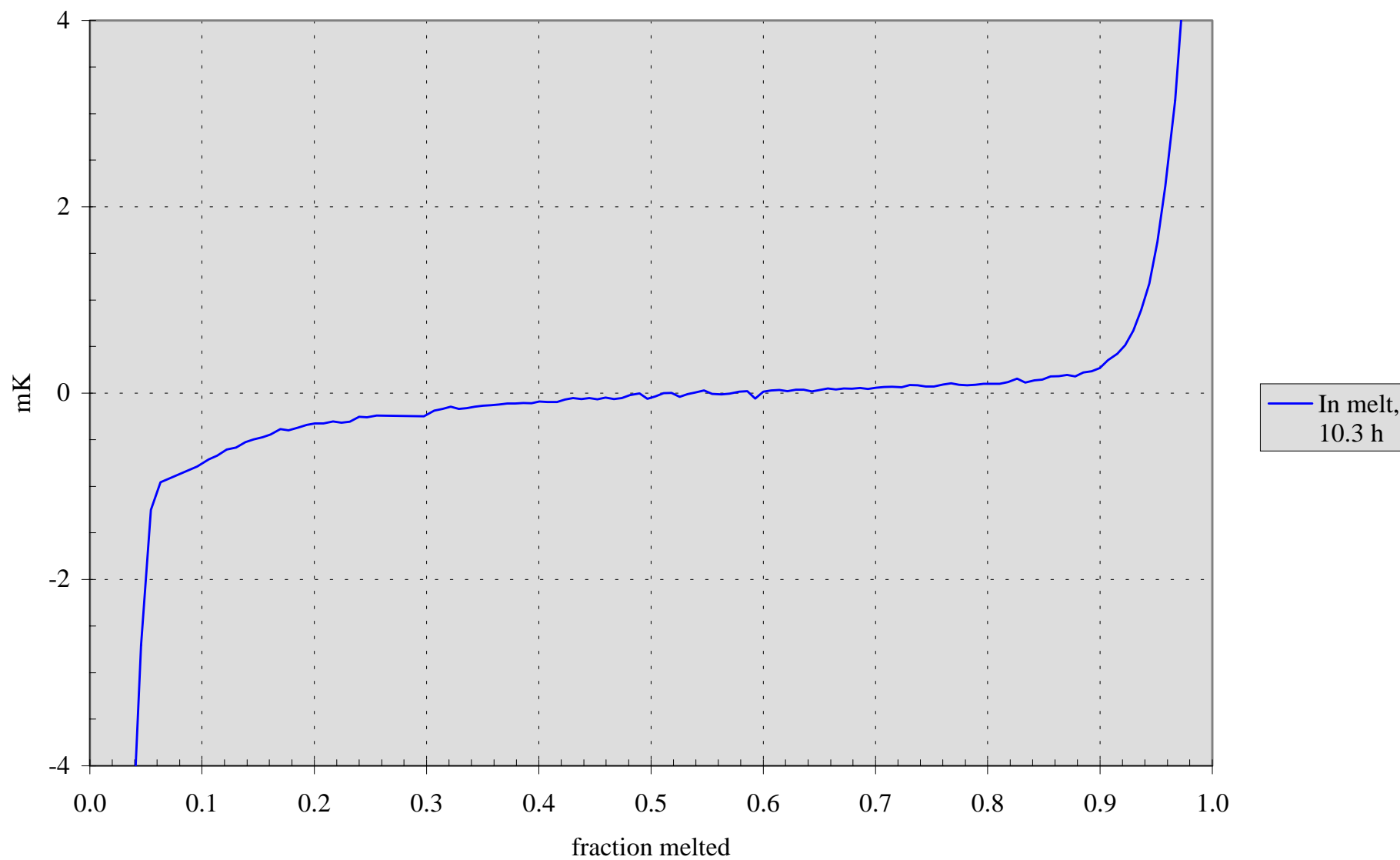


Figure 3: Melting curve of the INTA In fixed-point cell (s/n In 98353)
ASL F18, 30 Hz, 1 mA



**Figure 4: Immersion profile of the INTA In fixed-point cell (s/n In 98353)
during a freezing-point realization using SPRT 0041 (L&N 8167)
ASL F18, 30 Hz, 0 mA**

