

# **CERTIFICATE OF ANALYSIS**

International Temperature Scale of 1990

Zinc Freezing-Point Cell  
Pond Engineering Model K23C  
Serial Number Zn 98356

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 Zn FP cell (s/n Zn 98356)  
Purchase Order No.: 7230-127/1.998  
Test No.: 836/261097-99

Dear Dr. Benyon:

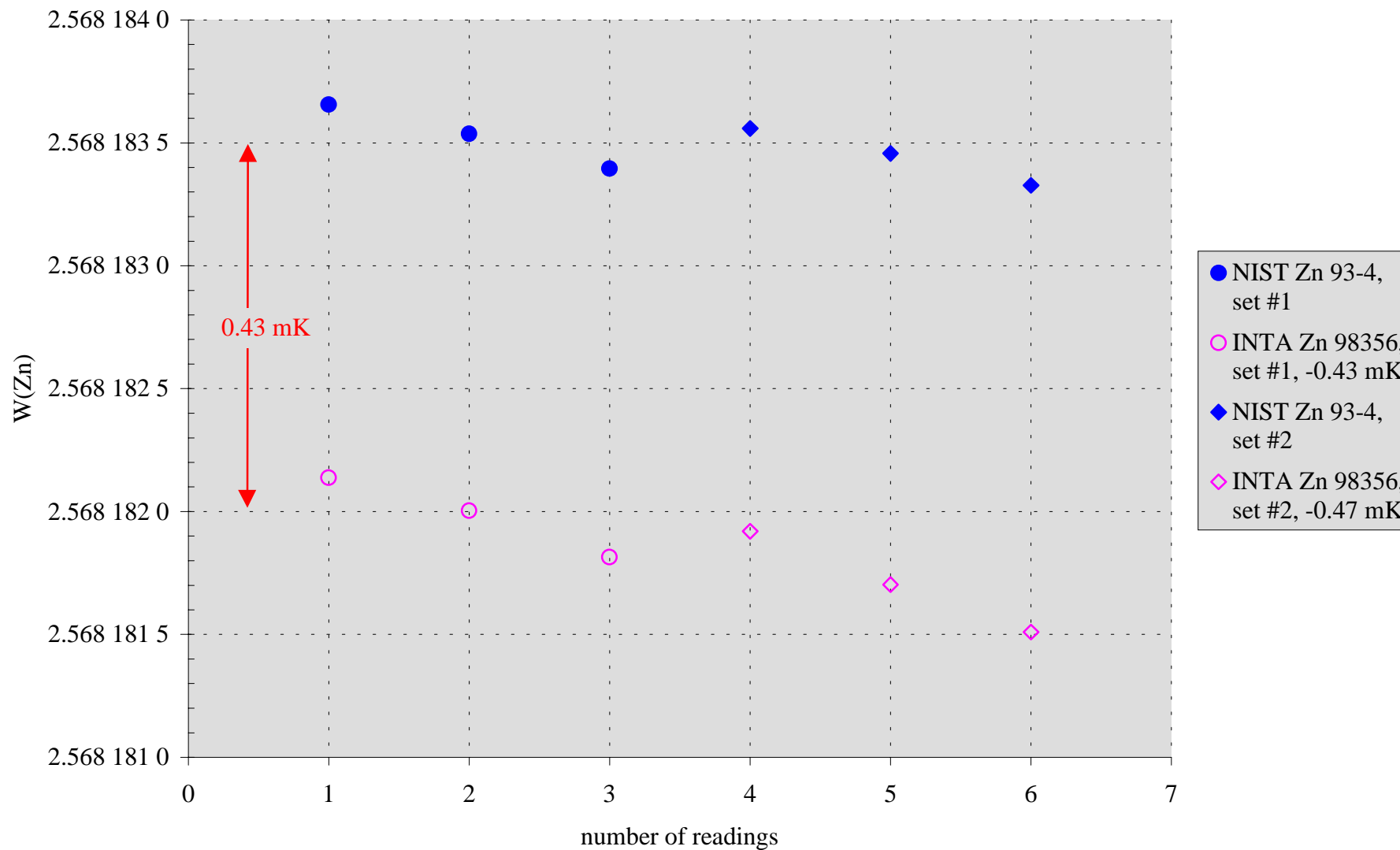
A direct comparison of your zinc freezing-point cell (Pond Engineering Model K23C, s/n Zn 98356) was made against our laboratory standard zinc freezing-point cell (Zn 93-4). The measurement system included an ASL Model F18 operating at a frequency of 30 Hz with a 100  $\Omega$  Tinsley Model 5685 reference resistor, temperature controlled to within  $\pm 8$  mK, and a 25.5  $\Omega$  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 0.45 mK lower than that of the NIST reference cell Zn 93-4 cell. We assign an expanded uncertainty ( $k=2$ ) of 0.41 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 zinc. 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.

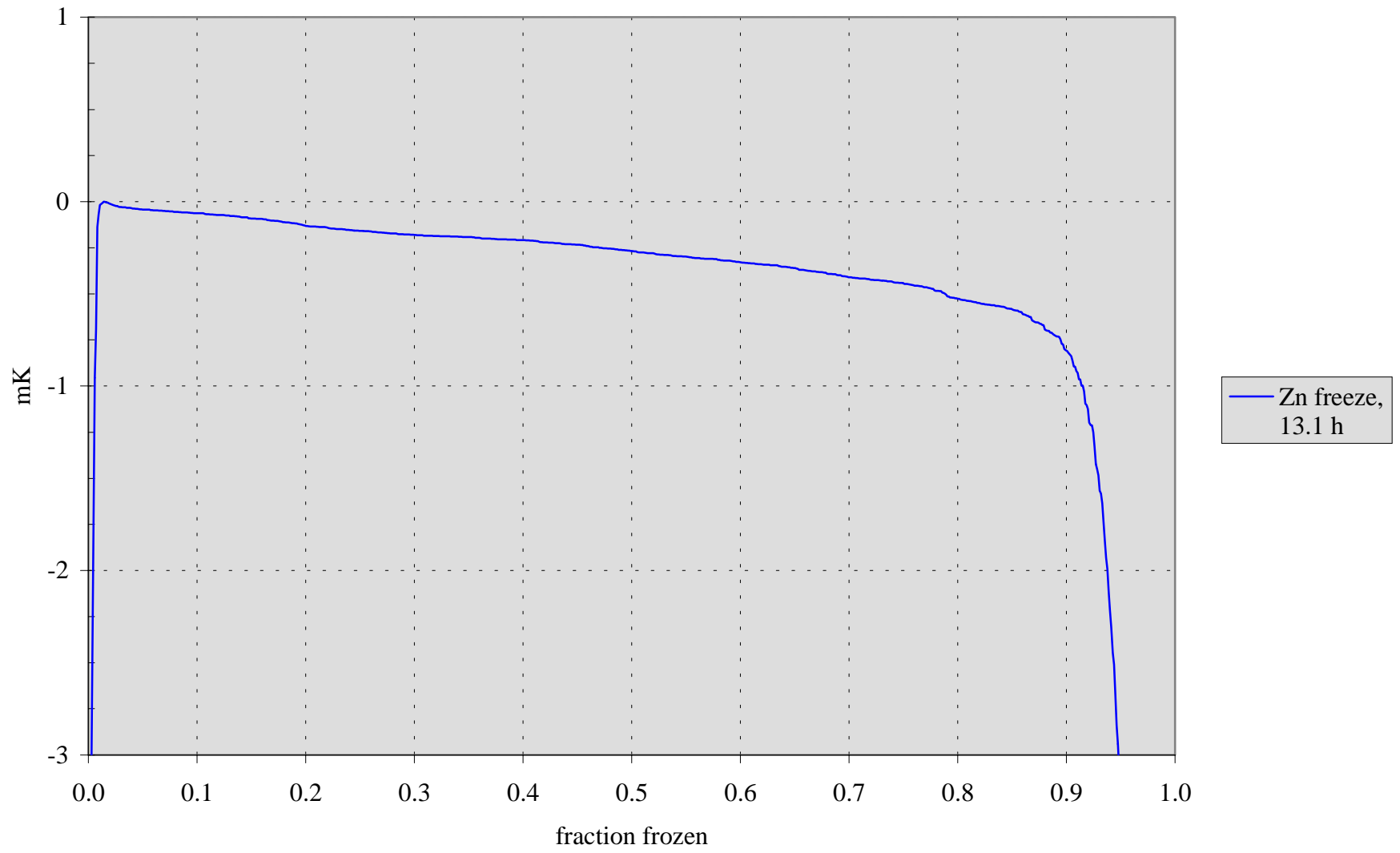
Sincerely,

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

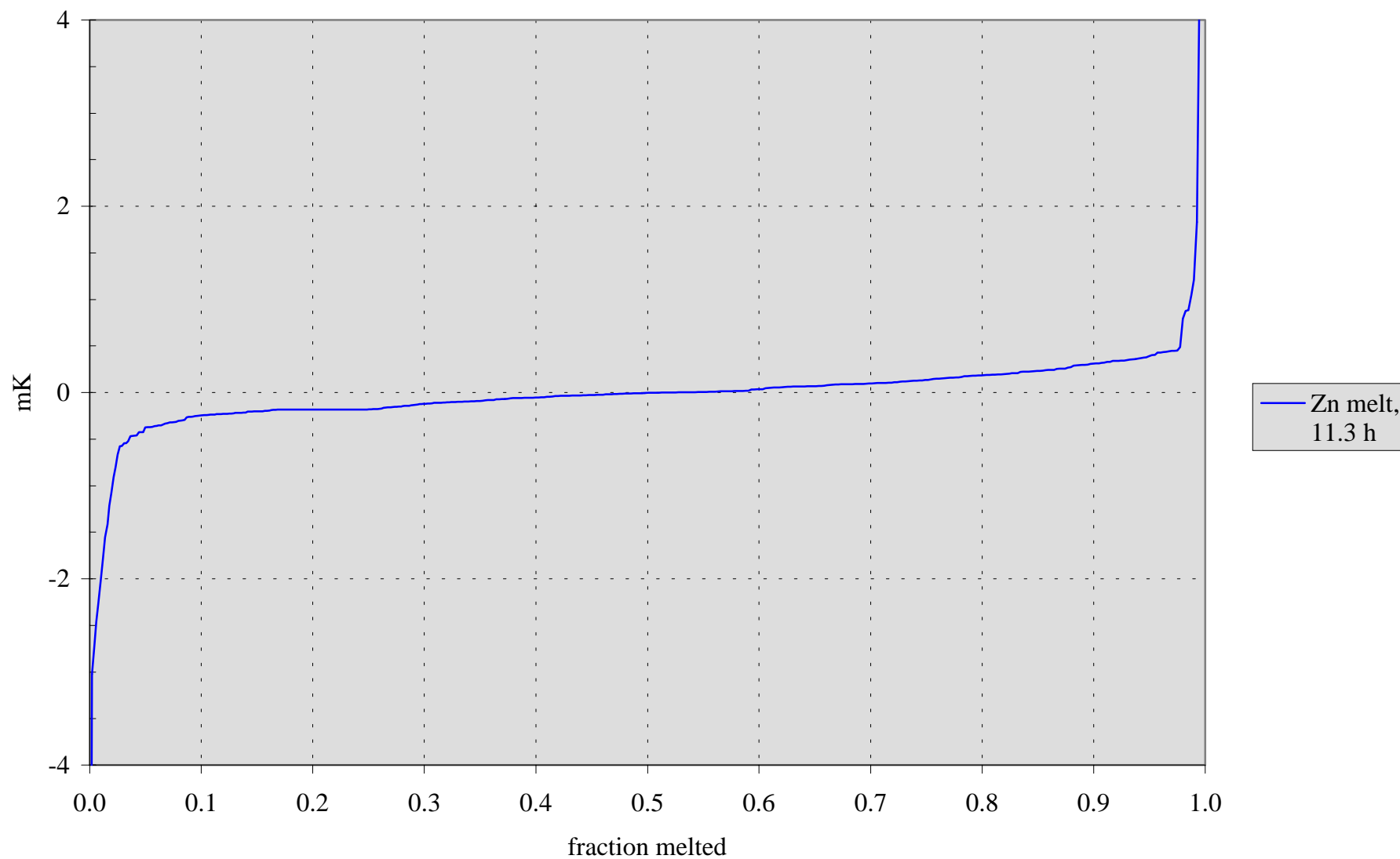
**Figure 1: Direct comparison of the INTA Zn cell (s/n Zn 98356) with the NIST reference Zn cell (Zn 93-4), ASL F18, 30 Hz, 0 mA**



**Figure 2: Freezing curve of the INTA Zn fixed-point cell (s/n Zn 98356)**  
**ASL F18, 30 Hz, 1 mA**



**Figure 3: Melting curve of the INTA Zn fixed-point cell (s/n Zn 98356)  
ASL F18, 30 Hz, 1 mA**



**Figure 4: Immersion profile of the INTA Zn fixed-point cell (s/n Zn 98356)  
during a freezing-point realization using SPRT 0051 (L&N 8167)  
ASL F18, 30 Hz, 0 mA**

