



# AEC-NASA TECH BRIEF



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## Low Temperature Scale For a 1- To 20- Degree Kelvin Region

A new and more accurate temperature scale has been developed for use in the region of one to twenty Kelvin. It is based on the National Bureau of Standards 1955 platinum resistance thermometer scale and is believed to be accurate to better than  $\pm 0.001$  Kelvin over the low temperature region.

The new scale is based on precise susceptibility measurements on two paramagnetic salts, chromic methyl-ammonium alum and manganous ammonium sulfate. Temperatures below 18 K were obtained by calibrating the paramagnetic salt thermometer from 20 to 30 K against the NBS 1955 platinum resistance thermometer and then extrapolating this calibration into the liquid helium region. The procedure, which is completely independent of the systematic errors which enter into gas thermometer or acoustic measurements, has a precision which varies from 0.001 K above approximately 5 K to 0.0005 K at lower temperatures.

These data confirm that while the accepted temperature scales in the liquid helium region are internally consistent below 3.5 K, they are not consistent with the platinum resistance thermometer scales. If the NBS scale is correct, for instance, the accepted boiling point for  $\text{He}^4$  is too low by 0.007 K and all of the vapor pressure temperatures below 3.5 K are too low by 0.18 per cent.

Many experiments are referenced to an NBS scale between 2 and 20 K which is based on acoustic thermometry. This acoustic scale lies systematically 0.03 per cent higher than the paramagnetic scale at all temperatures from 2 to 19 K. If the two scales are "normalized" by this amount, the maximum deviation of any of the

19 acoustic calibration points from the new scale is 0.005 K.

### Reference:

Cetas, T. C. and Swenson, C. A.: Deviation of  $T_{58}$  from Thermodynamic Temperatures, Phys. Rev. Letters 25, 337 (1970).

### Note:

Requests for further information may be directed to:

W. E. Dreeszen  
Manager, Information and Security  
Ames Laboratory  
Ames, Iowa 50010  
Reference: B72-10146

### Patent status:

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Mr. G. H. Lee, Chief  
Chicago Patent Group  
U. S. Atomic Energy Commission  
Chicago Operations Office  
9800 South Cass Avenue  
Argonne, Illinois 60439

Source: T. C. Cetas and C. A. Swenson  
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