

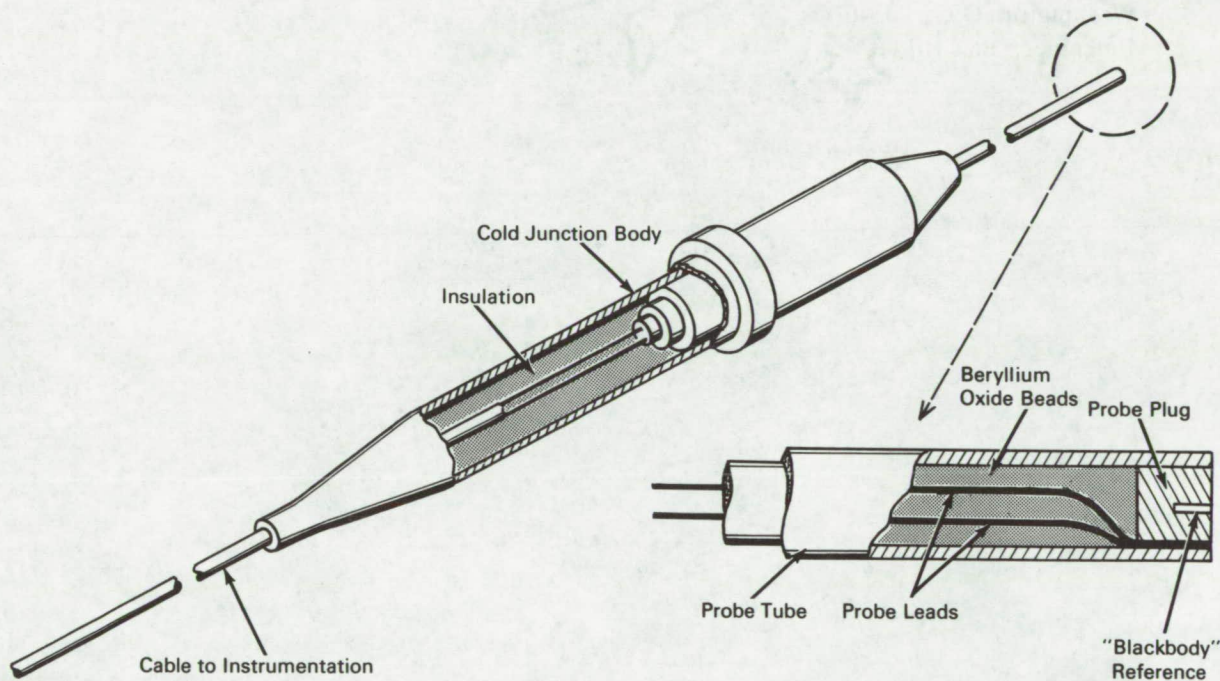
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# NASA TECH BRIEF



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## High Temperature Thermocouple Operates in Reduction Atmosphere



### The problem:

To design an instrument for the continuous measurement of a flowing gas up to 4500°F in a hazardous radiation environment.

### The solution:

A thermocouple that combines tungsten and rhenium in the probe, housing, and swaged extension lead.

### How it's done:

The probe is made of tungsten-5%-rhenium and tungsten-26%-rhenium wire insulated by beryllium

oxide beads inside a tungsten-26%-rhenium tube. The sensor junction is formed near the probe tip by a tungsten-26%-rhenium plug that forces the two wires against the side of the tube and electrically shorts them together. The outer end of the plug is fused to form a gastight metallurgical seal as well as a mechanical force-fit hold of the plug. A small hole drilled part way through the plug serves as a blackbody reference for use with an optical pyrometer during furnace calibration.

(continued overleaf)

**Notes:**

1. The thermocouple wires extend continuously without splice or foreign material from the cold junction to the probe tip, thus eliminating errors from secondary thermocouple effects.
2. This thermocouple operates over a range of 500° to 4500° F with an accuracy of  $\pm 1\%$  at the high end and better than  $\pm 1\%$  at the low end.
3. The probe may be used to measure high temperature gases in a non-oxidizing atmosphere with some development, and may be modified for use in an oxidizing atmosphere.
4. Inquiries concerning this invention may be directed to:

Technology Utilization Officer  
AEC-NASA Space Nuclear Propulsion  
Office  
U.S. Atomic Energy Commission  
Washington, D.C., 20546  
Reference: B66-10134

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C., 20546.

Source: R. G. Hoff, et al  
of Aerojet-General Corporation  
under contract to  
Space Nuclear Propulsion Office  
(NU-0046)