



AEROSPACE INFORMATION REPORT	AIR46™	REV. C
	Issued	1956-03
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Superseding AIR46B		
The Preparation and Use of Thermocouples for Aircraft Gas Turbine Engines		

RATIONALE

AIR46C has been revised to incorporate the contents of AIR46B with three other documents to create a single comprehensive report covering thermocouples. The details of the other three documents are as follows:

- AIR65: Thermoelectric Circuits and the Performance of Several Aircraft
- ARP690: Standard Exposed Junction Thermocouple for Controlled Conduction Errors in the Measurement of Air or Exhaust Gas Temperature
- ARP691: Recommended Ice Bath for Reference Junctions

Due to the availability of similar and more up-to-date information in the public domain, together with the extensive effort required, the original material has not been brought up to date.

Upon publication of AIR46C, the three superseded documents—AIR65, ARP690, and ARP691—will be cancelled. This strategy was agreed by the SAE E-32 committee in accordance with the Committee Master Plan.

FOREWORD

This document, originally prepared in 1956, was reviewed by industry and committee members between 1983 and 1988. Those who reviewed it generally agreed that the document, with minor changes, would continue to be a useful industry reference. Changes were limited to updating the list of references, as well as to exhibit temperatures in both °F and °C.

Changes made in 1996 were format/editorial only.

Changes made in 2021 to incorporate the content of AIR65, ARP690, and ARP691, thus rendering these three documents obsolete. These changes combine the detail relating to the use of thermocouples for aircraft gas turbine engines with the detail on the thermo-electric circuits of thermocouple systems used in gas turbines and the associated errors of such circuits.

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1. SCOPE

This SAE Aerospace Information Report (AIR) reviews the precautions that must be taken and the corrections which must be evaluated and applied if the experimental error in measuring the temperature of a hot gas stream with a thermocouple is to be kept to a practicable minimum. Discussions will focus on Type K thermocouples, as defined in National Institute of Standards and Technology (NIST) Monograph 175 as Type K, nickel-chromium (Kp) alloy versus nickel-aluminum (Kn) alloy (or nickel-silicon alloy) thermocouples. However, the majority of the content is relevant to any thermocouple type used in gas turbine applications.

1.1 Purpose

The purpose of this document is to assist those concerned with measuring gas temperatures in turbines and those who wish to utilize gas temperature for actuating engine controls. In these applications, the problem of temperature measurement may be considered to consist of two distinct parts: namely, a determination of the actual temperature of the measuring junction or junctions and a reliable estimation of the difference in temperature between this junction/s and the gas. The former requires that numerous precautions be observed in the construction, installation, and use of the thermocouple or thermocouples in a circuit; the latter requires proper application of appropriate corrections for such effects as impact and heat exchange by conduction, convection, and radiation.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 NIST Publications

Available from NIST, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070, Tel: 301-975-6478, www.nist.gov.

International Practical Temperature Scale of 1968

AF Technical Report No. 5738 National Bureau of Standards Reports on Test of Chromel-Alumel Thermocouples Supplied by General Electric Company

AF Technical Report No. 5739 National Bureau of Standards Report on Test of Thermocouples, Type K.L.G. 64/1675

AF Technical Report No. 6455 Test of Commercial Chromel-Alumel Thermocouples for Jet Engines

NIST Monograph 175 Temperature-Electromotive Force Reference Functions and Tables for the Letter-Designated Thermocouple Types Based on the ITS-90

WADC TR 53-251 Tests of Four Total Temperature Probes

WADC TR 53-311 Performance Tests of Firewall Thermocouple-Connector Assemblies

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM 470B Special Technical Publication 470B: Manual on the Use of Thermocouples in Temperature Measurement