

Specification for

General purpose platinum temperature sensors for aircraft

UDC 629.7.054:536.531

Confirmed
January 2009

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Foreword

This British Standard, which is a revision of BS 2G 148:1963, is applicable to general purpose platinum resistance temperature sensors for use in aircraft. Sensors suitable for the measurement of outside air temperatures will be the subject of another British Standard in the “G” series. Although the sensors are intended for use on d.c. electrical supplies, they may, if non-inductively wound, be suitable for use in a.c. systems up to 400 Hz.

The revised standard differs from the 1963 edition in the following respects.

- a) The introduction of a resistance of 100 Ω at 0 °C in line with other International Standards.
- b) The sensor characteristics and tolerances are now in agreement with EEC standards.
- c) The deletion of the connector and the introduction of high temperature capability cable (200 °C).
- d) The deletion of the loose olive and replacement with a fixed olive of metric dimensions.
- e) The dimensions of the sensor olive, nut and boss are compatible with those specified in SBAC¹⁾ standards AS 43021, AS 43022, and AS 43023.
- f) The addition of specific test requirements relating to the performance of the sensors.
- g) The introduction of a clause stating the characteristics to be declared by the manufacturer relating to immersion error.

This British Standard supersedes BS 2G 148:1963, which is therefore withdrawn.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

This British Standard, having been prepared under the direction of the Aerospace Standards Committee, was published under the authority of the Board of BSI and comes into effect on 31 December 1981

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The following BSI references relate to the work on this standard:
Committee reference ACE/30
Draft for comment 80/76254 DC

ISBN 0 580 12482 7

¹⁾ Society of British Aerospace Companies Ltd.

Amendments issued since publication

Amd. No.	Date of issue	Comments

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1 Scope

This British Standard specifies the general design and performance requirements for platinum resistance temperature sensors designed for the measurement of the temperature of gases or fluids in small diameter ducts. The sensors are designed for satisfactory operation for the measurement of fluid temperature whilst under high pressure. The temperature-resistance relationship is based on a sensor having a resistance of 100 Ω at 0 °C.

2 References

This standard makes reference to the following standards publications.

BS G 210, *PTFE insulated equipment wires (with silver plated copper conductors)*.

BS 3G 100, *General requirements for equipment for use in aircraft*.

3 General constructional requirements

3.1 The design and construction of the platinum resistance temperature sensors shall conform to the outlines given in Figure 1 or Figure 2 and shall be such as to comply with the relevant environmental requirements of BS 3G 100.

3.2 The sensors shall be constructed from corrosion-resistant materials and no materials which are fungi nutrients shall be used.

The user shall exercise care in selecting materials for the overall assembly to minimize electrolytic action between dissimilar metals.

4 Design and performance requirements

4.1 Temperature range. The temperature range shall be – 70 °C to + 450 °C, subject to the connecting cable being kept to a temperature not exceeding + 200 °C.

4.2 Temperature-resistance relationship and tolerances. The sensor shall have a nominal resistance of 100 Ω at 0 °C.

The temperature-resistance relationship shall be as shown in Table 1. The limits of intrinsic error shall not exceed those given in Table 2. The values given in Table 1 have been calculated from the following temperature-resistance relationships.

Characteristics

For the range – 70 °C to 0 °C:

$$R_t = R_0 [1 + At + Bt^2 + C(t - 100\text{ °C})t^3]$$

For the range of 0 °C to 450 °C:

$$R_t = R_0 (1 + At + Bt^2)$$

The values of the constants in these equations are as follows:

$$A = 3.908\,02 \times 10^{-3} \text{ °C}^{-1}$$

$$B = -5.802 \times 10^{-7} \text{ °C}^{-2}$$

$$C = -4.273\,50 \times 10^{-12} \text{ °C}^{-4}$$

R_0 is the resistance at 0 °C and R_t the resistance at t °C. These equations are listed as the basis for the temperature-resistance tables of this standard and are not intended to be used for the calibration of individual thermometers. Values of temperature in this standard are in the International Practical Temperature Scale (IPTS) of 1968.

4.3 Self-heating. With the sensor immersed in water at 20 °C flowing at 1 m/s transverse to the axis of the sensor, the I^2R power dissipated in it shall not cause an indicated temperature rise of greater than + 0.01 °C/mW. In still air the error shall not be greater than 0.25 °C/mW.

4.4 Time constant (response time). When quickly plunged into water at approximately 80 °C moving at 1 m/s with flow transverse to the axis of the sensor, 63 % of the response to the step of temperature shall take place in less than 1.5 s.

4.5 Stability. The sensor shall withstand 10 consecutive temperature shocks from – 70 °C to + 20 °C or 10 shocks from + 450 °C to + 20 °C at a rate of not less than 25 °C/min, after which the resistance at 0 °C shall not change by more than ± 0.05 %.

4.6 Insulation resistance. When measured with a 500 V d.c. insulation tester the insulation resistance between the electrical conductors and the sheath of the sensor shall be not less than 20 M Ω at 20 $\pm$ 5 °C, and 1 M Ω at the working temperature.

4.7 Maximum current. The sensor shall withstand a continuous current of 20 mA without de-regiment.

4.8 Pressure. The sensor sheath shall withstand a working pressure of 27.6 MPa (276 bar). Whilst at this pressure there shall be no change in measured resistance compared with the unpressurized state.

4.9 Vibration. The sensor when correctly mounted in the standard boss shall withstand without failure the vibration environment as specified in BS 3G 100-2.3.1, for region D, for use on any part of the airframe, excluding direct contact with the power unit. The cable shall be adequately supported. The supplier shall declare the maximum sensor length up to which this requirement can be met.