

Specification for

General requirements for equipment for use in aircraft —

Part 2: All equipment —

Section 3: Environmental conditions —

Subsection 3.13: Resistance to fire in
designated fire zones

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Foreword

This British Standard is part of a composite standard in the Aerospace series of British Standards specifying general requirements for equipment in aircraft. An introduction to the complete British Standard is given in BS 3G 100-0.

This subsection of BS 3G 100 supersedes **223** and **224** in BS 2G 100-2:1962. It relates to three grades of resistance to fire applicable to aircraft components and equipment contained within designated fire zones. It also includes appendices giving details of three sizes of burner.

The physical quantities and dimensions stated in this standard are expressed in metric (SI) units, but are based upon experience of tests conducted, and also test equipment designed, in imperial units. Appendix G is included to relate a number of the physical quantities to other units in current use.

The standard does not relate to the resistance to fire outside designated fire zones, or to flammability requirements which will be the subject of a further subsection to BS 3G 100.

This standard makes reference to the following British Standards:

- *3G 100: General requirements for equipment in aircraft;*
- *Part 0: Introduction;*
- *Part 1: Identification, declaration and construction;*
- *Part 2: Subsection 3.0 Standard test conditions.*

BS 350, *Conversion factors and tables.*

BS 1646, *Graphical symbols for process measurement and control functions.*

BS 3939, *Graphical symbols for electrical power, telecommunications and electronics diagrams.*

NOTE Information concerning metric (SI) units is given in BS 350, “*Conversion factors and tables*”, BS 3763, “*The International System of units (SI)*”, and PD 5686, “*The use of SI units*”.

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 15 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.

1 Scope

This British Standard specifies requirements for all components and equipment (contained in designated fire zones) designed and constructed to provide a level of fire resistance not less than a specified minimum. *It does not relate to flammability requirements.*

The standard should also be read in conjunction with BS 3G 100-0.

2 Definitions

For the purposes of this standard, the following definitions apply:

2.1

designated fire zone

a region of an aircraft designated as such by the aircraft designer in accordance with appropriate civil or military requirements e.g. BCAR's, AvP 970, FAR's, etc

2.2

standard flame

a flame having a nominal temperature of 1 100 °C and the characteristics specified in Table 1

2.3

torching flame

a flame, intended to simulate a combustion chamber burn through, having characteristics appropriate to the type of engine under consideration (see Table 1)

2.4

resistance to fire

the ability to withstand satisfactorily a given flame for a given time

3 Grades of resistance to fire

Components and equipment installed in designated fire zones shall, where necessary, conform to the requirements selected from the following grades of resistance to fire. The relevant specification shall state the required grade.

3.1 Fire resistant. Components and equipment to this grade shall be capable of withstanding for a period of at least 5 minutes the application of heat by a standard flame without any malfunction that would jeopardize the safety of the aircraft, or failure that would aggravate an existing hazard.

3.2 Fireproof. Components and equipment to this grade shall be capable of withstanding for a period of at least 15 minutes the application of heat by a standard flame without any malfunction that would jeopardize the safety of the aircraft, or failure that would aggravate an existing hazard.

NOTE It is appreciated that the term "fireproof" could be ambiguous; discussion is currently in progress with the aim of agreeing a number of grades of fire-resistance. At the first revision of this standard, account will be taken of these agreements.

3.3 Torching flame resistant. Components and equipment to this grade shall be capable of withstanding for a period of at least 2 minutes, the application of heat by a torching flame without any malfunction that would jeopardize the safety of the aircraft, or failure that would aggravate an existing hazard.

4 Test equipment

4.1 Standard flame burners. The Type A standard flame shall be produced by one of the following burners.

- 1) 19 mm (0.75 in) nominal diameter nozzle propane¹⁾ gas burner, similar to that described in Appendix A and having the characteristics specified in Table 1.
- 2) 180 mm (7 in) nominal diameter propane gas burner, similar to that described in Appendix B and having the characteristics specified in Table 1.

Type B standard flame shall be produced by a 150 mm (6 in) nominal diameter propane gas burner, similar to that described in Appendix C and having the characteristics specified in Table 1. This burner produces a flame more severe than that produced by the Type A standard burners.

NOTE Other burners demonstrated to have the same characteristics may be permitted by agreement with the Approving Authority²⁾.

4.2 Torching flame burner. The torching flame shall be produced by a burner possessing characteristics consistent with a typical combustion chamber burn through in an engine of the type under consideration with the engine operating under its most critical conditions.

The details of the burner to be employed for a series of tests shall be acceptable to the Approving Authority. Guidance for the design of suitable burner equipment is given in Table 1 and Appendix D.

¹⁾ Butane gas may be used in this burner provided that suitable adjustments are made to the air adjusting nut setting as described in Appendix A.

²⁾ The Approving Authorities are the Civil Aviation Authority, Airworthiness Division, for civil aircraft and the Ministry of Defence, Procurement Executive, for military aircraft.

Table 1 — Burner characteristics

Burner		Burner dia. nominal		Nominal flame temperature	Flame intensity ^a	
	Type	mm	in	°C	kW/m ²	CHU/ft ² /s
Standard flame (see 5.1.4)	A	19.0	0.75	1 100 ± 50	470 ± 20	23 ± 1
		180	7	1 100 ± 50	530 ± 20	26 ± 1
	B	150	6	1 100 minimum	630 minimum	31 minimum
Torching flame		18.0	0.70	1 725 max. ^b	^b	^b

^a The values stated here have been determined by using the calorimeter described in Appendix F.

^b The precise characteristics for the torching flame burner relate to fuel flow, nozzle pressure ratio etc. (See Appendix D.)

^a The values stated here have been determined by using the calorimeter described in Appendix F.

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4.3 Calibration of standard flame burner. The standard flame burner shall be calibrated before the start of individual flame tests. To confirm that the burner complies with the characteristics required by 4.1, it shall be calibrated as described in Appendix E.

5 Tests

5.1 Test conditions. The following conditions shall apply to all fire resistance and fireproof tests.

5.1.1 Laboratory conditions. The test shall be conducted in substantially still air conditions.

5.1.2 Vibration. Unless otherwise stated in the relevant specification, all units shall be vibrated at an amplitude of ± 0.4 mm (0.015 in) at the nearest non-resonant frequency to 50 Hz. Flexible hose assemblies shall be vibrated at an amplitude of ± 1.25 mm (0.05 in) at a nominal frequency of 50 Hz.

5.1.3 Mounting. The component or equipment shall be mounted on a test rig in a manner that is no less critical than in the aircraft installation, e.g. in the simulation of heat sink characteristics, etc.

5.1.4 Use of the standard flame burners. During the fire tests the critical portions of the component shall be enveloped in the test flame from the appropriate direction.

5.1.4.1 Type A standard flame burners. This type of burner will be the standard to be normally employed using the following arrangements of burner or burners.

Components which present a small area to the test flame, e.g. small groups of electrical cables or pipes up to 25 mm (1.0 in) diameter would require the use of the 19 mm torch as described in 4.1 1). On some components a number of 19 mm torches (up to a maximum of 3) can be used and arranged in a pattern to suit the shape of the component. Components or equipment presenting a large surface area to the flame would require the use of one 180 mm burner as described in 4.1 2).

The nominal axial distance between the burner nozzle and the face of the item under test shall be as follows:

19 mm burner:	50 mm
180 mm burner: vertical axis	100 mm
horizontal axis	50 mm

5.1.4.2 Type B standard flame burner. This burner may be used as an alternative to the Type A burners, but it should be noted that its use imposes more severe test conditions.

The airflow conditions within the fire zone of a particular installation may require tests using a Type B standard flame burner only; this requirement shall be stated in the relevant equipment specification.

The nominal axial distance between the burner nozzle and the face of the item under test shall be 100 mm.

5.2 Test method. Tests to determine resistance of equipment to fire shall be conducted as follows:

5.2.1 Standard flame tests. To demonstrate compliance with the requirements for fire resistant and fireproof components and equipment, the item shall, unless otherwise agreed by the Approving Authority, be subjected to the heating effects of a standard flame under the following conditions:

- 1) for an initial period of one minute whilst being subject to the most critical operating conditions that are appropriate, e.g. pressure, temperature, fluid flow, voltage etc.
- 2) and for the remaining period of time (i.e. 4 minutes for fire resistant, and 14 minutes for fireproof) the critical conditions prevailing in 1) shall be changed to take account of conditions that would exist on completion of engine fire drill, e.g. engine windmilling.

The relevant specification shall state the appropriate operating conditions.