

Specification for

Miniature lever-operated manual switches

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Foreword

This British Standard has been prepared as a result of enquiries within the aircraft industry which showed a need for a switch of smaller size and rating than those in BS G 194 yet larger than the miniature switches complying with the American specification MIL-S-8834.

The specification has been based on BS G 194, *“Lever-operated manual switches for aircraft”*, and, in addition to specifying performance requirements, defines preferred dimensions and fixing holes. Switches are classified according to the environmental conditions for which they are suitable.

The tests, which are grouped as type tests, production tests and quality tests, include a test of the force required to operate the switch, and recommendations as to suitable tests for verifying the serviceability of the switches after storage or use.

This standard makes reference to the following British Standards:

BS 2G 100, *General requirements for electrical equipment and indicating instruments for aircraft.*

BS G 177, *Nyvin type electrical cables for aircraft.*

BS G 178, *Crimped joints for general purpose electrical cables for aircraft.*

BS SP 20, *Panel type air filter elements for use with internal combustion engines and compressors on aircraft.*

BS 410, *Test sieves.*

BS 580, *Trichloroethylene.*

NOTE Where metric equivalents are given, the figures in British units are to be regarded as the standard. The metric equivalents are approximate. More accurate conversions should be based on the tables in BS 350, *“Conversion factors and tables”*.

Obsolescent (by Amendment No. 1)

The need for the equipment covered by this British Standard has been reviewed and it has been decided that, in the interests of rationalization, it should be regarded as obsolescent and not therefore used for new designs. The standard will be withdrawn in due course.

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 12 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.

Amendments issued since publication

Amd. No.	Date of issue	Comments
4303	July 1983	Indicated by a sideline in the margin

This British Standard, having been approved by the Aerospace Industry Standards Committee and endorsed by the Chairman of the Engineering Divisional Council, was published under the authority of the General Council of the Institution on 21 August 1967

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The following BSI references relate to the work on this standard:
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1 General requirements

1.1 Scope

This British Standard specifies the requirements for two classes of single-hole fixing, miniature lever-operated manual switches for use in nominal 28 V d.c. and 115/200 V three-phase, 400 cycle a.c. systems in aircraft.

Class 1 switches are sealed and are suitable for higher altitude and wider temperature conditions than Class 2, which are sealed only at the lever entry.

1.2 General

1.2.1 The switch shall comply with the requirements of this British Standard, those of BS 2G 100 and those of the relevant switch drawings.

1.2.2 The switch shall be suitable for either of the following temperature and altitude classifications:

Class 1. Suitable for use at altitudes up to 70 000 ft (21 400 m) and for temperatures within the range -40°C to $+70^{\circ}\text{C}$; they should not suffer damage or deterioration when subjected to -65°C .

Class 2. Suitable for use at altitudes up to 20 000 ft (6 100 m) and for occasional use at 60 000 ft (18 300 m), and for temperatures within the range -20°C to $+55^{\circ}\text{C}$; they should not suffer damage or deterioration when subjected to -40°C .

1.2.3 The switch shall be suitable for mounting through the panel from the rear and shall operate satisfactorily when mounted in any attitude.

1.2.4 The switch may be the two- or three-position type, with one or more poles: it may be self-retaining and/or spring return. It should preferably be designed to allow the incorporation of integral locking of the lever in any or all positions.

1.2.5 The method of operation of the switch shall be by means of a single lever, moving in a plane at right angles to the mounting panel. The relationship of the lever positions to the keyway shall be as shown in Figure 1, and the relationship of the terminal numbers to the lever positions shall be as stated in the individual specification¹⁾.

1.2.6 The switch terminals shall be identified by number in the sequence shown in the individual specification¹⁾.

1.3 Rating

1.3.1 Voltage. The switch shall operate in nominal 28 V d.c. and 115/200 V three-phase, 400 cycle a.c. systems having the characteristics specified in BS 2G 100-3. In addition, the switch shall be suitable for use at voltages down to 4 V d.c. or a.c.

1.3.2 Current. The switches shall be suitable for all of the following normal current ratings:

- 1) 5 A resistive load
- 2) 3 A inductive load
- 3) 2.5 A tungsten filament lamp load (28 V d.c.)
- 4) 1.5 A tungsten filament lamp load (200 V a.c.)

In addition, unless otherwise declared, the switch shall be suitable for operation at 100 mA resistive load at voltages down to 4 V.

The inductive loads shall be as follows:

- 28 V d.c. — 3 A 40 mH
115/200 V a.c. — 3 A 0.70 power factor lagging.

1.4 Declarations

In addition to the declarations required by BS 2G 100-1, the manufacturer shall declare:

- 1) The classification.
- 2) The limits of the forces necessary to operate the switch to any position.
- 3) The system of batching used for quality test sampling.
- 4) The switch operation relative to the lever position and the terminal numbering.

1.5 Marking

1.5.1 In addition to the terminal numbering, the following minimum information shall be clearly and indelibly marked on each switch:

- 1) BS G 200 and classification.
- 2) The manufacturer's name or identification.
- 3) The manufacturer's type number.
- 4) "5 A res." (i.e. res. = resistive).
- 5) "28 V d.c./200 V a.c."

1.5.2 The application of some identifying mark to indicate the date of manufacture is recommended.

¹⁾ Attention is drawn to the fact that it has not been found practicable to standardize these features.

2 Particular requirements

2.1 Operation

2.1.1 The switch lever action shall be positive and it shall not be possible during normal usage for the lever to stay in any position other than a fully-operated position. The operation of the switch shall not be affected adversely by the speed of movement of the lever.

2.1.2 It shall not be possible to rotate the lever about its longitudinal axis.

2.1.3 The angular movement of the lever should preferably be $20 \pm 2^\circ$ from the central position, but angular movements up to $23 \pm 2^\circ$ are acceptable.

2.1.4 There shall be at least a 10° movement of the lever before switching occurs.

2.1.5 The lever shall be capable of withstanding without damage or distortion a force of 20 lbf (9 kgf) applied steadily in the directions specified in **3.2.2**.

2.2 Construction

2.2.1 The lever, including any metal inserts, shall be insulated from all live parts.

2.2.2 The force required to operate the switch shall be not less than 1 lbf (0.45 kgf) and not more than 10 lbf (4.5 kgf). For each operation, of a particular type of switch, the maximum force shall not exceed the minimum force by more than 100 %. The manufacturer shall declare the maximum and minimum values of the force for each operation appropriate to each type of switch.

2.2.3 Where locking of the lever is provided, it shall be positive and automatic, and the lock shall be released by raising the lever against a spring force of 1.5 lbf to 5 lbf (0.7 kgf to 2.3 kgf).

2.2.4 The exposed portion of the switch shall have a non-glaring finish.

2.2.5 The switch shall be sealed at the point of entry of the lever to prevent the ingress of liquids or foreign matter. In addition, the bodies of Class 1 switches shall be sealed to the standard required by the test in **3.15**.

2.2.6 Terminations shall be by screws, each capable of accepting two crimped tag-type terminations of approved design. The terminal threads shall be 4–40 UNC. Terminals shall have a mechanical strength adequate to satisfy the requirements of **3.2.1**.

2.2.7 The terminal arrangement shall be such that wiring access is still provided when the switches are mounted in rows at minimum spacing. Means shall be provided to avoid accidental contact or short-circuiting between adjacent terminals. The switches shall be suitable for close mounting and shall not constitute an electrical hazard if the side faces of adjacent switches touch one another.

2.2.8 The switch shall be mounted by means of a $15/32$ -28UNS threaded bush with a locating keyway in the plane of movement of the lever. Two hexagon mounting nuts, one locating washer and one internal shakeproof washer shall be provided with each switch.

2.2.9 The switch shall be so constructed that it is suitable for performing at least 50 000 operations at maximum rated current and voltage.

2.2.10 The switch contacts, including common internal connections, should be self-wiping on all switched contact positions.

2.2.11 The lever mechanism should incorporate a positive contact opening action in order to assist in breaking a tack weld.

2.2.12 The appropriate contacts only shall operate when the lever is suddenly released from a spring-loaded position.

2.2.13 Springs should be of the compression type.

2.3 Dimensions

The envelope dimensions (including terminals) and the fixing arrangements for the switches shall be as shown in Figure 1 and Figure 2.

2.4 Environmental requirements

2.4.1 The switch shall comply with the relevant requirements of BS 2G 100-2 in respect of mechanical and physical environmental conditions. Its grading for vibration, climatic and acceleration performance shall be:

Vibration:	Grade B
Acceleration:	Grade C, Class 1A (i) and crash Grade E, Class 11.
Climatic:	Class 1 or Class 2 as declared by the manufacturer.

2.4.2 Class 1 switches shall also comply with the requirements of **3.17**, **3.18** and **3.19** of this British Standard in respect of resistance to salt corrosion, dust and sand, and fluid contamination.

2.4.3 Class 2 switches shall comply with the requirements of BS 2G 100-2 for explosion-proof equipment.