

Specification for

**Electric cables for
general airframe
or equipment
interconnect
use (135 °C), wrapped
insulation**

UDC 629.7.064.5:621.315.33-408.4

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Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Aerospace Standards Committee (ACE/-) to Technical Committee ACE/6, upon which the following bodies were represented:

- BEAMA Ltd.
- British Airways
- British Rubber Manufacturers' Association
- Civil Aviation Authority
- Electric Cable Makers' Confederation
- Electronic Components Industry Federation
- Ministry of Defence
- National Supervising Inspectorate
- Society of British Aerospace Companies Limited

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 30 September 1987

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The following BSI references relate to the work on this standard:
Committee reference ACE/6
Draft for comment 85/71991 DC

ISBN 0 580 15920 5

Amendments issued since publication

Amd. No.	Date of issue	Comments

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Foreword

This revision of this British Standard, having been prepared under the direction of the Aerospace Standards Committee, specifies requirements for a range of lightweight thin-wall insulated cables that are individually suitable for general airframe or equipment interconnect use. It supersedes BS G 232:1984, which is withdrawn. It updates the 1984 edition and incorporates additional tests for type 05 and type 06 cables.

The dielectric insulation material is spirally lapped with an overall coating to provide the necessary colour coding and to provide a base for printed identification legends. The standard requires the application of the dielectric material so as to provide the minimum penalties of weight and space whilst offering reliable performance over a full airframe life of not less than 50 000 h.

Cables manufactured to this standard are not required to meet the fire resistance requirements of BS 3G 100-3.13, but they are required to satisfy the flammability requirements of BS G 230.

NOTE This cable may not be suitable for termination by certain soldering techniques. The user should ascertain that the cable and terminations are completely compatible.

Attention is drawn to BS G 230 which specifies the general requirements for aircraft electric cables (second series).

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 16, an inside back cover 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 construction and performance requirements for a range of lightweight cables with wrapped insulation suitable for general airframe use in the size range 26 to 0000, and for equipment interconnect in the size range 26 to 18.

The following types of cable are specified.

Type 01	interconnect	}	Single-core or twisted multi-cores only
Type 02	airframe		
Type 03	interconnect	}	Two or more cores, with an outer jacket
Type 04	airframe		
Type 05	interconnect	}	Single- or multi-core, with a screen and outer jacket
Type 06	airframe		

The cables are suitable for continuous use where the maximum stabilized conductor temperature does not exceed 135 °C. They are suitable for applications involving flexing at temperatures down to – 65 °C.

The cables are suitable for use where the potential between conductors or between a conductor and screen, or the aircraft structure, does not exceed 600 V r.m.s. and the frequency does not exceed 2 000 Hz.

Interconnect cables are suitable for use in areas with some physical protection, such as behind panels or bulkheads. They also have an application for the internal wiring of equipment.

Airframe cables are of sufficiently robust construction to be used for open aircraft wiring.

The short-term and long-term current ratings for the cables are specified in this standard.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Classification

Cables are classified according to the number of cores as follows:

- class 1: single core
- class 2: two core
- class 3: three core
- class 4: four core

3 Construction

3.1 General

The materials and method of construction used for the formation of the cables shall be defined and controlled to the satisfaction of the Approving Authority¹⁾. No change shall be made to such materials or processes unless it can be shown to the satisfaction of the Approving Authority that the performance and handling properties of the cable have not been degraded. The cable shall be made of materials such that the performance requirements of this standard are satisfied.

3.2 Conductors

3.2.1 Conductors shall comply with BS G 231 before fabricating into completed cable.

3.2.2 Copper strands shall be tin plated and high strength copper alloy strands shall be silver plated.

3.3 Insulation

The insulation for interconnect cables shall consist of one or more overlapped tapes of insulating material and, for airframe cables, two or more overlapped tapes. An overall coating may also be provided which, for the purposes of this standard, shall be regarded as part of the cable. The insulating material shall be such that the performance requirements of this standard are satisfied. Only 100 % new materials that have been through only those processes essential to their manufacture and application shall be used.

3.4 Screen

The screen shall be constructed of a braid having a coverage of 85 % minimum, and a lay factor less than 3 when calculated in accordance with Appendix A of BS G 230. There shall be no joints in the complete screen. Where breaks in individual strands occur, the ends shall be brazed or tucked into the weave ensuring that the cut end is on the outside of the screen. There shall be not more than one such break in any 300 mm length of cable or in any 10 m length of individual strand. Strands from which the braid is constructed shall be tin plated and comply with BS G 231 before braiding.

3.5 Jacket

The jacket shall be made of an insulating material, and shall be constructed, such that the performance requirements of this standard are satisfied.

¹⁾ The Approving Authority is either:

a) for UK Civil Aviation products, the Civil Aviation Authority (or their accredited representatives); or
b) for UK military products, information is available from the Procurement Executive, Ministry of Defence, Directorate General of Defence Quality Assurance, Directorate of Standardization, Kentigern House, 65 Brown Street, Glasgow G2 8EX.

3.6 Single-core cables

The mass and dimensions of single-core cables shall be as given in Table 1 and Table 2 as appropriate.

3.7 Multi-core cables

The mass and dimensions of multi-core cables shall be as given in Table 3 to Table 8 as appropriate. The cables shall consist of two or more single cores complying with 3.6, twisted together with a lay of approximately 12 times the pitch circle diameter for sizes 26 to 4 and approximately 16 times the pitch circle diameter for sizes 2 to 0000. Types 01 and 02 shall consist of twisted assemblies of single-core cable, types 03 and 04 of twisted assemblies with an outer jacket, and types 05 and 06 of twisted assemblies with a screen and outer jacket.

3.8 Colour

The colour of the insulation for class 1 cables, the core insulation for multi-core cables and the jackets shall comply with BS G 230.

4 Designation and marking

4.1 Manufacturer's marking and designation

The designation and marking of the cables shall be in accordance with BS G 230.

4.2 User applied marking

4.2.1 The surface of the insulation or coating of type 02 (airframe) cable shall be suitable for the acceptance of user applied identification marks by at least one of the following methods:

- a) hot stamp marking;
- b) laser marking;
- c) ink jet.

The cable manufacturer shall declare which method is suitable and the tests given in clause 6 shall be performed using cables that have been so marked.

4.2.2 Appropriate methods of marking the outer jacket of cable types 03, 04, 05 and 06 shall be declared by the manufacturer who may specifically prohibit the use of hot stamp or laser marking.

4.2.3 Type 01 (interconnect) cable shall not be required to accept hot stamp or laser marking or any other method that may degrade the insulation material.

5 Packaging and labelling

The cables shall be packaged and labelled in accordance with BS G 230.

6 Tests

The following tests shall be carried out in accordance with BS G 230. Specific requirements of this standard are given against the appropriate test. The application of each test for qualification approval, production quality testing, inspection lot testing and production routine testing shall be as given in Table 9. All qualification approval test specimens shall be marked in accordance with clause 4 before commencement of testing.

NOTE For qualification approval testing, specimens selected from a particular size within the following groups may be considered as proving the requirements for all sizes within that group of a given type (see clause 1). Qualification of type 05 cable may be considered as proving the requirements of type 03, classes 2 to 4, and type 06 as proving type 04, classes 2 to 4.

- Group 1. Sizes 26 to 24, type 02, classes 1 to 4
- Group 2. Sizes 22 to 16, type 02, classes 1 to 4
- Group 3. Sizes 14 to 10, type 02, class 1
- Group 4. Sizes 8 to 2, type 02, class 1
- Group 5. Sizes 1 to 0000, type 02, class 1
- Group 6. Sizes 26 to 24, type 01, classes 1 to 4
- Group 7. Sizes 22 to 18, type 01, classes 1 to 4
- Group 8. Sizes 26 to 16, type 06, classes 1 to 4
- Group 9. Sizes 26 to 18, type 05, classes 1 to 4

BS G 230 test no.	Test applicable to cable types 01 and 02	Specific requirements of this standard																							
1.	Appearance and identification of finished cable	Maximum values shall be as given in Table 1 to Table 6 Minimum values shall be as given in Table 1 and Table 2 Minimum and maximum values shall be as given in Table 1 to Table 6 Values shall be as follows: <table><tr><th rowspan="2">Strand diameter</th><th colspan="2">Tensile strength</th><th>Elongation</th></tr><tr><th>Min.</th><th>Max.</th><th>Min.</th></tr><tr><td>mm</td><td>N/mm²</td><td>N/mm²</td><td>%</td></tr><tr><td>Copper alloy: 0.08 to 0.12</td><td>350 (for 7 strands)</td><td>—</td><td>6</td></tr><tr><td>Copper: 0.08 to 0.12</td><td>220</td><td>300</td><td>9</td></tr><tr><td>0.15 to 0.45</td><td>220</td><td>300</td><td>10</td></tr></table>	Strand diameter	Tensile strength		Elongation	Min.	Max.	Min.	mm	N/mm ²	N/mm ²	%	Copper alloy: 0.08 to 0.12	350 (for 7 strands)	—	6	Copper: 0.08 to 0.12	220	300	9	0.15 to 0.45	220	300	10
Strand diameter	Tensile strength			Elongation																					
	Min.		Max.	Min.																					
mm	N/mm ²		N/mm ²	%																					
Copper alloy: 0.08 to 0.12	350 (for 7 strands)		—	6																					
Copper: 0.08 to 0.12	220		300	9																					
0.15 to 0.45	220		300	10																					
2.	Mass per unit length of finished cable																								
3.	Conductor composition																								
4.	Visual examination of strands																								
5.	Insulation thickness and concentricity																								
6.	Core and cable outer diameters																								
7.	Tensile strength and elongation at break of copper or copper alloy conductors																								
9.	Strand plating continuity	Maximum values shall be as given in Table 1 to Table 6 This test shall be carried out on sizes 20 to 26 only. Use non-activated flux complying with 4.6.2 of BS 2011-2.1T:1981 and solder of grade KP of BS 219. Solder bath temperature 235 ± 3 °C. Wetting time 2.0 s 2 500 ± 75 V r.m.s. 5 000 ± 150 V r.m.s. 8 000 ± 250 V peak Test temperature 200 ± 2 °C. Time 168 h. Mandrel diameter and force shall be as given in Table 10 50 000 h minimum at 135 ± 2 °C Minimum adherence forces shall be as given in Table 10 Five cycles from room temperature to 135 ± 2 °C holding the top temperature for 1 h and allowing the cable to return to room temperature between cycles. Maximum length of conductor exposed at each end is 1.0 mm for sizes 26 to 10, and one-quarter maximum outside diameter for sizes 8 to 0000 Mandrel diameter and tension shall be as given in Table 10. Test temperature 135 ± 2 °C. Time 100 h																							
10.	Strand plating adherence																								
12.	Electrical resistance of conductor																								
14.	Solderability																								
14(a).	Method 1																								
14(b).	Method 2																								
15.	Conductor strand adhesion																								
16.	High voltage																								
16(a).	Immersion																								
16(b). ^a	Dry spark																								
16(c). ^a	Dry impulse																								
17.	Insulation resistance																								
18.	Surface resistance																								
19.	Accelerated ageing																								
20.	Thermal endurance																								
21.	Adherence of insulation on conductor																								
22.	Delamination and shrinkage																								
23.	Delamination and insulation blocking																								

^a Either test 16(b) or 16(c) may be carried out.

^a Either test 16(b) or 16(c) may be carried out.