

British Standard Aerospace Series

Sleeves for aircraft electric cables and equipment wires

Part 1. Specification for elastomeric sleeves for binding and identification

Série aérospatiale. Manchons pour câbles électriques et fils électriques d'équipements aéronautiques
Partie 1. Spécification pour les manchons en élastomère pour ligature et repérage

Luft-und Raumfahrt-Reihe. Hülsein für elektrische Kabel und Verdrahtung in Flugzeugen
Teil 1. Spezifikation für Elastomer-Hülsein für Ausbinden und Kennzeichnung

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Foreword

This British Standard has been prepared under the direction of the Aerospace Standards Policy Committee at the request of the aircraft industry to provide a statement of the requirements for sleeves for aircraft electric cables and insulated equipment wires. The standard is published in separate Parts: Part 1 relating to elastomeric sleeves, Part 2 to slip-on sleeves, Part 3 to heat-shrinkable sleeves and Part 4 to semi-rigid high-performance heat-shrinkable sleeving.

This new edition of this Part supersedes British Standard 2G 198 : Part 1 : 1982, which is withdrawn and introduces technical changes to bring the standard up-to-date but it does not reflect a full review of the standard, which will be undertaken in due course.

This Part refers to expandable sleeves in a range of colours, diameters, lengths and materials suitable for binding and identification purposes on electric cables and insulated equipment wires in aircraft. It applies to flexible sleeving that is used under mechanical strain not exceeding 50 % diametric extension.

Additional sizes have been added to increase the range of type 1 sleeves available. New test procedures have been added to this standard or existing tests modified to define more accurately the material characteristics required.

Sleeves complying with the requirements of this standard are not recommended for use as primary insulation.

Binding and identification sleeves for use under conditions less arduous than those provided for in this standard are dealt with in BS 3858.

General purpose sleeving and flexible sleeving not used under mechanical strain is specified in BS 6893. This standard does not apply to electrical conduit.

The sleeve type numbers used in G 198 : Part 1 : 1967 and 2G 198 : Part 1 : 1982 have been retained in this edition.

The importance of toxicity has been recognized, but no suitable test has been found to date which has proved acceptable for this standard. Pending the development of such a test, the materials from which the sleeves are manufactured should present the minimum hazard from toxic fumes and smoke emission.

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

Amendment No. 1
published and effective from 30 September 1991
to British Standard 3G 198 : Part 1 : 1989
(Aerospace Series)

**Sleeves for aircraft electric cables and
equipment wires**
**Part 1. Specification for elastomeric sleeves for
binding and identification**

Revised text

AMD 6389
September 1991

Clause 11.4 Circumferential extension

Delete the existing test 3 and substitute:

'*Test 3.* Two specimen sleeves 15 mm to 20 mm long shall be tested by fitting them over a mandrel three times the nominal internal diameter of the sleeve using the minimum quantity of a suitable lubricant. Each specimen shall be fitted to the mandrel at the first attempt. If unsuccessful, the sleeve shall be discarded and a further specimen chosen. After fitting, make a cut 1 mm to 2 mm long in one end through the complete wall thickness of each sleeve parallel to the axis of the mandrel.'

Delete the first sentence of test 4 and substitute:

'Sufficient specimens shall be aged in an oven at 95 ° C for 168 h.'

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Clause 11.9 Volume Resistivity

In the requirements column for '*Damp*' delete the existing sentence and substitute:

'The volume resistivity shall be not less than the values given above.'

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Table 2. Dimensions of type 1 sleeves

For size code 27, under the nominal internal diameter delete '55.0' and substitute '5.0'.

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Table 7. Production routine tests

After '*Resistance to fluids*' insert '(test 1)*' and at the bottom of the table insert '*Printed and unprinted.'

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Table 9. List of test fluids

For fluids (h), in column 1 delete the existing text and substitute:

'4 ± 0.1 % (V/V) formaldehyde + 1 ± 0.1 % (V/V)
o-cresol (general purpose reagent) in water'.

1. Scope

This Part of this British Standard specifies the design, performance requirements, quality assurance requirements and test procedures for the following types of expandable sleeves suitable for binding and identification purposes on electrical cables and insulated equipment wires in aircraft.

Type 1. These are sleeves which, when fitted, are suitable for use in the temperature range -65°C to 95°C for at least 1000 h and can withstand occasional contamination by mineral lubricating oils, petroleum fuels and mineral oil based or castor oil based hydraulic fluids. No higher temperature applications are covered for this type of sleeve in this standard.

Type 2. These are sleeves which, when fitted, are suitable for use in the temperature ranges:

- (a) -65°C to 100°C for at least 1000 h;
- (b) up to 120°C for at least 168 h;
- (c) up to 225°C for one period of 5 min.

These sleeves can withstand occasional contamination with fuels, lubricants (including ester-based types) and hydraulic fluids (but not ester-based types of hydraulic fluid).

Type 3. These sleeves which, when fitted, are suitable for use in the temperature ranges:

- (a) -65°C to 150°C for at least 1000 h;
- (b) up to 190°C for at least 168 h;
- (c) up to 300°C for one period of 5 min.

These sleeves are resistant to fuels, lubricants and hydraulic fluids, including ester-based lubricants and ester-based hydraulic fluids.

Type 4. These are sleeves which, when fitted, are suitable for use in the temperature ranges:

- (a) -65°C to 190°C for at least 1000 h;
- (b) up to 260°C for at least 168 h;
- (c) up to 350°C for one period of 5 min.

These sleeves are not suitable for use where they are likely to be contaminated with fuels, but they have moderate resistance to lubricants and hydraulic fluids.

NOTE 1. The low temperatures quoted for types 1 and 2 sleeves apply to non-flexing applications.

NOTE 2. 'Suitable for use in the temperature ranges' means the retention of an absolute elongation of 50 % minimum measured at normal conditions (see 8.2), after the times and temperatures specified (see 11.16).

NOTE 3. Sleeve performance is dependent on correct fitting by the user. It is assumed that the sleeves have been cut cleanly and are without blemish after installation. Any subsequent damage will cause premature failure.

Guidance for the storage of finished sleeves is given in appendix A, and appendix B describes a recommended ordering procedure.

2. References

Reference is made in this standard to the following publications:

BS 135, 458, 805	Specifications for benzene, xylenes and toluenes
BS 903	Methods of testing vulcanized rubber
	Part A16 Determination of the effect of liquids

	Part A19 Heat resistance and accelerated air ageing tests
	Part C2 Determination of volume resistivity
BS 1384	Measurement of photographic transmission density
BS 1595	isoPropyl alcohol
BS 2011	Basic environmental test procedures
	Part 2.1J Test J. Mould growth
BS 2782	Methods of testing plastics
	Method 230A Determination of volume resistivity
	Method 540B Methods of exposure to laboratory light sources (xenon arc lamp, enclosed carbon arc lamp, open-flame carbon arc lamp, fluorescent tube lamps)
BS 3858	Binding and identification sleeves for use on electric cables and wires
BS 4487	Inhibited 1,1,1-trichloroethane (methylchloroform)
BS 5252	Framework for colour co-ordination for building purposes
BS 6580	Specification for corrosion inhibiting, engine coolant concentrate ('antifreeze')
BS 6746C	Colour chart for PVC insulation and sheath of electric cables
BS 6893	Flexible insulating sleeving for electrical purposes
3F 68	Specification for controlled storage of vulcanized rubbers for use in aerospace applications
3G 100	General requirements for equipment for use in aircraft
	Part 2 All equipment
	Section 3 Environmental conditions
	Subsection 3.12 Fluid contamination

* Defence Standard 81-41 Part 6 General requirements for packaging supplies for the Services

* Defence Standard 91-46/1 Damping fluids; dimethyl silicone

* Defence Standard 91-48/1 Hydraulic fluids, petroleum; superclean (H515/OM15) and normal (H520/OM18)

The latest editions of these standards shall be used.

NOTE. The latest revision of an Aerospace Series Standard is indicated by a prefix number.

3. Materials

3.1 Materials. Sleeves shall be made from materials which ensure that the finished sleeve complies with the appropriate requirements of clause 11. No reclaimed or ground vulcanized waste shall be added.

NOTE. Materials known to comply with the requirements of clause 11 are as follows:

Type no.	Material
1	Polychloroprene rubber
2	Mixture or co-polymer of butadiene acrylonitrile rubber and polyvinyl chloride
3	Fluorinated silicone rubber or modified fluorinated silicone rubber
4	Silicone rubber

3.2 Overlays. Overlays may be used to provide added protection for the sleeve or marking, provided the finished

sleeves comply with the requirements of clause 11. For the purposes of this standard the overlay shall be regarded as part of the sleeve.

4. Colour

4.1 The colour of binding sleeves and printed and unprinted identification sleeves shall be either natural, clear or reasonably matching one of those listed in BS 6746C or pale yellow approximating to 10 C 31 of BS 5252 : 1976 (see appendix B).

4.2 The colour of sleeves shall be uniform and evenly dispersed throughout.

5. Finish

The sleeves shall be smooth and free from bubbles, pinholes, creases and other defects that may affect performance.

6. Printing

6.1 When required, sleeves shall be indelibly printed with a character or legend to the specific requirements of the purchaser and such printing shall not be affected by normal handling.

6.2 The printing shall be black or blue-black, except on sleeves that would not provide adequate contrast where it shall be white.

NOTE. The term blue-black normally covers the range purple to black.

The characters shall be of medium weight sanserif type, clearly printed and of uniform density, e.g.

A B C D E 6 7 8 9 0

The character(s) shall be underlined or have a dot following the legend when the printed legend is capable of misinterpretation without such a device (see figure 1).

The printing shall be longitudinal on the sleeve (see figure 1).

6.3 The size of characters and the number of times they are printed on each sleeve shall be as shown in table 1. When sleeves are marked more than once, the printing shall be equally spaced around the sleeve.

NOTE. See appendix B for ordering procedure.

7. Dimensions

The internal diameters and related wall thicknesses of the sleeves shall comply with the requirements of tables 2, 3 and 4 (see appendix B).

Sleeves shall be supplied to lengths specified by the purchaser (see appendix B). They shall be cut to the tolerances specified in table 5.

8. Type testing

8.1 Type tests. The manufacturer shall produce evidence to the satisfaction of the Approving Authority* that sleeves supplied to this standard fulfil all the requirements of the tests listed in table 6, details of which are given in clause 11.

In the event of a failure of a specimen to comply with the requirements of any test, two additional sets of samples shall be taken and tested. Both sets shall comply with the appropriate test requirements, otherwise the sleeves shall be deemed not to comply with the requirements of this standard.

*The Approving Authority for civil aircraft applications is the Civil Aviation Authority, Airworthiness Division, or an organization approved by them, and for Ministry of Defence applications is the Procurement Executive, DGDQA/TS Material Centre, Royal Arsenal East, London SE18 6TD.

If any changes are made in the techniques or materials used in the production of the sleeves, the manufacturer shall inform the Approving Authority.

NOTE. Following such changes, the Approving Authority may require a repetition of type testing.

Type tests shall be repeated every five years.

8.2 Test conditions. Unless otherwise specified in a particular test, the tests shall be carried out under normal atmospheric conditions as follows.

(a) Temperature of 20 ± 5 °C. In the event of a dispute, the tests shall be conducted at 23 ± 2 °C.

(b) Relative humidity (r.h.) not greater than 65 %.

9. Production and quality testing

9.1 Production routine tests. Production routine tests shall be applied to samples taken at random from every batch and shall consist of the tests listed in table 7.

9.2 Production quality tests. The frequency of application of each production quality test shall be to the requirements of the Approving Authority and will depend on the maintenance of the basic formulation of the sleeve material and printing ink, and the manufacturing conditions, e.g. temperature and time of cure. Production quality tests shall be applied to samples taken at random from batches and shall consist of the tests listed in table 8.

9.3 Batch. A batch of sleeves shall consist of those sleeves of the same type, nominal internal diameter and colour (printed if required) produced from a single mix provided that the curing conditions of temperature and time are maintained constant throughout.

10. Packaging and identification

Each package shall be marked with the following information:

- (a) material;
- (b) type number;
- (c) size;
- (d) length and quantity of sleeves;
- (e) manufacturer's name;
- (f) batch number and date of manufacture;
- (g) number of this British Standard, i.e. BS 3G 198: Part 1.

If packed in non-transparent packages, the outside of the packet shall in addition be marked to show the colour of the sleeves and the legend printed on them.

NOTE 1. Marking BS 3G 198 : Part 1 on or in relation to a product is a claim by the manufacturer that the product has been manufactured in accordance with the requirements of the standard. The accuracy of such a claim is therefore solely the manufacturer's responsibility. Enquiries as to the availability of third party certification to support such claims should be addressed to the Director, British Standards Institution, Maylands Avenue, Hemel Hempstead, Herts HP2 4SQ in the case of certification marks administered by BSI or to the appropriate authority for other certification marks.

NOTE 2. Packaging requirements will vary and should be specified by the purchaser in the order. For UK Government Services these instructions will be based on Def Stan 81-41 Part 6, 'General requirements for packaging supplies for the Services', available from Ministry of Defence, Directorate of Standardization, Kentigern House, 65 Brown Street, Glasgow G2 8EX.