

Specification for

Cable ties for installation under controlled tension on aircraft electric cable harnesses

Committees responsible for this British Standard

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

- Association of Manufacturers allied to the Electrical and Electronic Industry (BEAMA Ltd.)
- British Airways
- British Cable Makers' Confederation
- British Rubber Manufacturers' Association
- Civil Aviation Authority (Airworthiness Division)
- Electronic Components Industry Federation
- Ministry of Defence
- Society of British Aerospace Companies Limited

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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 British Aerospace Industry to improve the reliability of aircraft electrical cable harnesses. In addition to achieving a satisfactory cable tie, the correct tensioning of the tie using the recommended application tool is considered to be important for a successful installation. With this in view, a code of practice is in course of preparation which will cover the selection and installation of ties.

The importance of toxic fume emission when burning occurs 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 ties are manufactured should present the minimum hazard from toxic fumes and smoke emission when burning occurs.

WARNING NOTE. This standard calls for the use of substances and/or test procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the supplier or the user from statutory obligations relating to health and safety at any stage of manufacture or use.

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 14, 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 the design, performance, quality assurance requirements and test procedures for cable ties for installation under controlled tension on aircraft electric cable harnesses. Ties which have provision for marking are covered but the standard does not include accessories such as mounting brackets, separate identification tags, reuseable ties or application tools. Guidance on the storage of finished ties is given in Appendix A, and a recommended ordering procedure is given in Appendix B.

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

2 Definitions

For the purposes of this British Standard, the following definitions apply.

2.1

application tools

the tools used in completing and correctly tensioning the tie joint

2.2

cable

the complete assembly of conductor, insulation and metal braid, if any

2.3

harness (or bundle)

a number of cables or looms specifically formed and terminated to suit a particular installation

2.4

loom

any number of cables running together

2.5

breakout

any number of cables branching out from the main harness

2.6

tail

the portion of the tie removed after fixing

2.7

head

the portion of the tie containing the tie locking system

2.8

strap

the portion of the tie between its head and tail

3 Classification

3.1 General

Ties shall be classified by type according to the temperature range within which they are designed to operate and by class according to their resistance to flame, see 3.2 and 3.3.

3.2 Operating temperature range (type)

Type 1: – 55 °C to + 105 °C

Type 1W: – 55 °C to + 105 °C ultraviolet (UV) resistant

Type 2: – 55 °C to + 150 °C

Type 2W: – 55 °C to + 150 °C ultraviolet (UV) resistant

3.3 Flame resistance (class)

Class 1: after removal of the burner (see 8.5) any flame shall extinguish within 5 s.

Class 2: after removal of the burner (see 8.5) any flame shall extinguish within 5 s and no burning or flaming particles shall fall.

4 Design requirements

4.1 General

4.1.1 Ties shall be designed for installation under controlled tension by the use of an application tool. The head design, locking system and strap cross-sectional dimensions shall be such that the requirements of the tests given in clause 8 are met.

NOTE Ties are available with either internal or external serrations.

4.1.2 Ties shall comply with the design requirements given in Table 1.

4.2 Materials

Ties shall be made from materials which ensure that the finished tie complies with the appropriate requirements given in clause 8.

NOTE A material known to comply with clause 8 requirements for type 1 ties is heat stabilized nylon 66. A nominal 2 % carbon black is required in nylon 66 to provide the UV resistance capability of type 1W ties.

The inclusion of carbon black in nylon is known to increase the brittleness of cable ties particularly at low temperatures and it is recommended that the use of such ties be restricted to areas where UV resistance is essential.

4.3 Finish

The finish shall prevent abrasion to the harness and to adjacent harnesses or breakouts. In completing the joint, no sharp or abrasive edges shall be formed that could damage the cable insulation of the loom or any adjacent looms, or that could cause injury to an operator.

Table 1 — Design requirements

Size code	Loop tensile strength (min.)	Recommended bundle diameter		Strap length (min.)	Strap width (min.)
		min.	max.		
	N	mm	mm	mm	mm
1	80	1.5	16	90	2.0
2	130	1.5	28	140	3.3
3	130	1.5	44	180	3.3
4	220	1.5	28	140	4.0
5	220	1.5	39	180	4.0
6	220	1.5	63	250	4.0
7	220	1.5	93	270	4.0
8	360	5.0	47	200	7.3
9	360	5.0	86	330	7.3
10	530	5.0	89	340	7.3
11	530	5.0	102	360	7.3
1 MA ^a	80	5.0	16	90	2.0
1 MB ^a	80	1.5	16	90	2.0
5 MC ^a	220	10.0	39	180	4.0

NOTE The length of the tie will depend on the maximum permissible harness diameter and the method of application. In some cases, additional length may be provided to facilitate application.

^a Ties with provision for marking (M). See Figure 1 for details of designs A, B, and C.

4.4 Temperature ratings

The ties shall be capable of use within the following temperature ranges.

Type 1: -55°C to $+105^{\circ}\text{C}$

Type 2: -55°C to $+150^{\circ}\text{C}$

Type 2 ties shall have the number 2 embossed on or near the head.

4.5 Colour

4.5.1 Type 1 and 2 ties shall have either:

- a) a natural material finish; or
- b) a colour complying with BS 6746C.

NOTE The requirement for colouring and the colour required should be stated in the purchaser's contract or order.

4.5.2 Type 1W and 2W ties shall be black.

4.5.3 The colour shall be uniform throughout any coloured tie.

5 Type testing

5.1 Type tests

5.1.1 The manufacturer shall submit evidence to the satisfaction of the Approving Authority¹⁾ that ties complying with this standard satisfy the tests listed in Table 2.

5.1.2 In the event of a failure of a specimen to satisfy any test, two further sets of samples shall be tested. Both sets shall satisfy the appropriate tests, otherwise the ties shall be deemed not to comply with this standard.

5.1.3 The manufacturer shall inform the Approving Authority if any changes are made in the techniques or materials used in the production of the ties.

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

5.1.4 Type tests shall be carried out every five years.

5.2 Test conditions

Unless otherwise specified in clause 8 the tests shall be carried out under the following normal atmospheric conditions:

- a) a temperature of $20 \pm 5^{\circ}\text{C}$. In the event of a dispute, the tests shall be conducted at $23 \pm 2^{\circ}\text{C}$;
- b) relative humidity (r.h.) not greater than 80 %.

5.3 Conditioning of specimens

Before submission to type approval tests, the specimens shall be placed in a chamber maintained at a temperature of $49^{+3}_{-0}^{\circ}\text{C}$ with a relative humidity of $20 \pm 5\%$ for 24 h. Immediately upon removal from the chamber the specimens shall be stored at $20 \pm 5^{\circ}\text{C}$ in an airtight container for a minimum of 30 min. When required, the specimens shall be installed on the test fixtures immediately on removal from the airtight container.

5.4 Type test sequence and number of specimens

Tests shall be carried out in accordance with the sequence given in Table 2 for each tie for which approval is being sought. The number of specimens for each test shall be as given in Table 2.

¹⁾ 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, 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.