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# Aerospace series — Requirements and tests on user-applied markings on aircraft electrical cables



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A list of organizations represented on this committee can be obtained on request to its secretary.

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# Aerospace series - Requirements and tests on user-applied markings on aircraft electrical cables

Série aérospatiale - Exigences et méthodes d'essais sur les marquages utilisateurs de câbles électriques aéronautiques

Luft- und Raumfahrt - Anforderungen und Prüfungen der Anwenderkennzeichnung auf elektrischen Luftfahrzeugleitungen

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# Foreword

This document (EN 3838:2010) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

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# Introduction

Durability of function-related marking of aircraft electrical cables is of great importance throughout the life of an aircraft, during initial assembly, operation and maintenance operations in service.

Markings should, therefore, be made to a sufficiently high standard to satisfy requirements initially and for the remainder of the expected life marked cable or equipment containing it.

Markings are applied by the user to the cable insulation, jacket or sheath and should not degrade the performance of the cable. They should be applied in accordance with design requirements using a process approved by the Design Authority.

## 1 Scope

This standard specifies tests that should be performed on markings applied by the user to ensure that their durability is satisfactory and that, after application of markings directly to the cable insulation, jacket or sheath, the cable will meet the performance requirements laid down.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 3475-100, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 100: General*

EN 3475-201, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 201: Visual examination*

EN 3475-302:2006, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 302: Voltage proof test*

EN 3475-401:2002, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 401: Accelerated ageing*

EN 3475-405:2002, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 405: Bending at ambient temperature*

EN 3475-411, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 411: Resistance to fluids*

EN 3475-703:2002, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 703: Permanence of manufacturer's marking*

EN 3475-705, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 705: Contrast measurement*

EN ISO 4892-3:2006, *Plastics — Methods of exposure to laboratory light sources — Part 3: Fluorescent UV lamps (ISO 4892-3:2006)*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. For other definitions see EN 3475-100.

**3.1**
**marking**
identification mark applied directly to the cable insulation, jacket or sheath by any process that meets the requirements of this standard

NOTE The markings should be in accordance with the design requirements.

**3.2**
**aggressive marking system**
marking which can deform or damage the insulating layer of a cable

NOTE Hot-stamp is defined as such a method. Other methods of marking may be defined as aggressive by the Official Services.

# 4 Qualification tests

## 4.1 Tests

The tests in Table 1 shall be performed at the introduction of the marking process, at every change in technology or processing technique affecting the cable insulation, jacket or sheath or as required by the Official Services.

Tests shall be performed on the sizes for qualification defined in the cable specification for each colour, material and construction of cable, jacket and sheath which will be directly marked.

Before the tests defined in Table 1 are performed on specimens of user marked cable, ensure that the specimens have been subjected to any post marking curing which is normal for the defined marking process.

**Table 1**

| Title | Subclause |
|---|---|
| Visual examination of markings | 6.1 |
| Permanence of markings | 6.2 |
| Resistance to fluids | 6.3 |
| Heat ageing | 6.4 |
| Exposure to light | 6.5 |
| Marking contrast | 6.6 |
| Bending at ambient temperature | 6.7 |

## 4.2 Test sequence

The number of specimens for each test and the sequence of testing shall be as laid down in Table 2.

Each specimen shall be taken sequentially from a continuous length of cable.

**Table 2**

| Group | Number of specimens | Tests | |
|---|---|---|---|
| | | Title | Subclause |
| 1 | 5 | Visual examination of markings | 6.1 |
| | | Marking contrast | 6.6 |
| | | Permanence of markings | 6.2 |
| 2 | 1 per fluid | Visual examination of markings | 6.1 |
| | | Resistance to fluids | 6.3 |
| | | Marking contrast | 6.6 |
| 3 | 3 | Visual examination of markings | 6.1 |
| | | Heat ageing | 6.4 |
| | | Marking contrast | 6.6 |
| 4 | 3 | Visual examination of markings | 6.1 |
| | | Exposure to light | 6.5 |
| | | Visual examination of markings | 6.1 |
| 5 [a] | 3 | Visual examination of markings | 6.1 |
| | | Bending at ambient temperature | 6.7 |

[a] Group 5 tests only performed on markings made by aggressive marking systems.

## 5 Acceptance tests

The tests in Table 3 shall be performed on each production batch of markings. Visual examination shall be made on specimens taken each time production is started (e.g. at start of day or shift), at the beginning and end of each production run and at intervals not exceeding 10 000 m for single core cables and 800 m for multicore and screened cables.

**Table 3**

| Title | Subclause | | Applicable |
|---|---|---|---|
| Visual examination of markings | 6.1 | | All marking systems |
| Voltage test | 6.8 | 6.8.4.1 or 6.8.4.2 continuously | Tests on aggressive marking systems |

# 6 Test methods

## 6.1 Visual examination of markings

### 6.1.1 Object

The markings shall be examined to ensure that they are legible and comply with the specified requirements in respect of size and style of print and colour if specified.

### 6.1.2 Apparatus

A light source which provides an illumination of 500 lx min. on a flat work surface.

### 6.1.3 Test specimen

The test specimen shall be a length of marked cable. The specimen shall not be tested until all drying, cooling or curing has been completed in accordance with the process specification.

### 6.1.4 Procedure

The test specimen shall be placed flat on the work surface and shall be visually examined from a distance of 0,3 m without additional magnification other than spectacles if worn. For initial examination only, a magnification of between six times and ten times shall be used to inspect for any mechanical damage to the insulation or conductors (EN 3475-201).

### 6.1.5 Requirements

The legend of the marking shall be uniform and clearly legible. Each individual character shall be easily identified.

In any case of disagreement concerning compliance with these conditions, the marking contrast test in 6.6 shall be performed.

## 6.2 Permanence of markings

### 6.2.1 Object

The marking shall be tested to ensure that it will withstand the specified scrape abrasion and retain legibility.

### 6.2.2 Apparatus

See EN 3475-703:2002, Clause 4.

### 6.2.3 Test specimen

See 6.1.3.

### 6.2.4 Procedure

See EN 3475-703, except that the load shall be 1 N and the number of cycles shall be 50 for ink jet marking and 100 for all other types of marking.

#### 6.2.5 Requirements

The printing shall remain legible as in 6.1 and comply with Clause 5 of EN 3475-703:2002 except that one of the five specimens may not be completely legible if this is due to a local defect of the cable top coat.

### 6.3 Resistance to fluids

#### 6.3.1 Object

The marking shall be tested to ensure that it remains legible after immersion in the test fluids specified in EN 3475-411.

#### 6.3.2 Apparatus

Suitable containers for immersing specimens and maintaining specified test temperature for duration of immersion.

#### 6.3.3 Specimen

See 6.1.3.

#### 6.3.4 Procedure

One specimen shall be immersed in each test fluid specified in EN 3475-411 for the time and temperature stated.

At the conclusion of immersion the specimens shall be removed from the fluids and after draining for 1 h at ambient temperature shall be dried by dabbing (not wiping) with a lint-free cloth and shall be visually examined.

#### 6.3.5 Requirements

See 6.1. Any deviation shall be reported.

### 6.4 Heat ageing

#### 6.4.1 Object

The marking shall be tested to ensure that it remains legible when heat aged at the temperature specified in the cable product standard.

#### 6.4.2 Apparatus

See EN 3475-401:2002, Clause 4.

#### 6.4.3 Specimen

See 6.1.3 and Clause 3 of EN 3475-401:2002.

#### 6.4.4 Procedure

Specimen shall be placed in an oven for 168 h at the cable operating temperature as specified in the product standard for the cable. See EN 3475-401.

#### 6.4.5 Requirements

The specimen shall meet the requirements of 5.4 of EN 3475-401:2002 and the marking shall remain legible as in 6.1.

### 6.5 Exposure to light

#### 6.5.1 Object

The marking shall be tested to ensure that it remains legible after exposure to laboratory light sources.

#### 6.5.2 Apparatus

See EN ISO 4892-3:2006, lamp type 1.

#### 6.5.3 Specimen

See 6.1.3.

#### 6.5.4 Procedure

See EN ISO 4892-3. The specimen shall be mounted so that the marks being tested face the light source and unless other wise specified in the product standard exposure mode 1 used.

#### 6.5.5 Requirements

Unless otherwise specified in the concerned product standard, after exposure for 168 h the contrast, as measured in 6.6, shall be not less than 40 %.

### 6.6 Marking contrast

#### 6.6.1 Object

The marking shall be examined to ensure that there is sufficient contrast between it and the surface on which it is made for its legibility to be acceptable in all light conditions.

#### 6.6.2 Apparatus

See EN 3475-705.

#### 6.6.3 Test specimen

See 6.1.3.

#### 6.6.4 Procedure

See EN 3475-705.

#### 6.6.5 Requirements

Unless otherwise specified in the concerned product standard, the contrast shall be not less than:

— 50 % initially;

— 40 % after application of specified tests.

## 6.7 Bending at ambient temperature

### 6.7.1 Object

The object of this test is to ensure that the application of the marking has not caused mechanical damage to the insulation.

### 6.7.2 Apparatus

See EN 3475-405:2002, Clause 4.

### 6.7.3 Test specimen

See 6.1.3 and EN 3475-405:2002, Clause 3.

### 6.7.4 Procedure

See EN 3475-405:2002, 5.1.

### 6.7.5 Requirements

See EN 3475-405:2002, 5.2.

## 6.8 Voltage test

### 6.8.1 Object

The specimen shall be tested to ensure that the application of the marking has not degraded the electrical performance of the insulation, sheath or jacket.

### 6.8.2 Apparatus

See EN 3475-302:2006, Clauses 3, 4 and 5.

### 6.8.3 Test specimen

See 6.1.3 and EN 3475-302.

### 6.8.4 Procedure

**6.8.4.1** Dry test as EN 3475-302:2006, Clause 4.

**6.8.4.2** Dry test (impulse) as EN 3475-302:2006, Clause 5.

### 6.8.5 Requirements

There shall be no perforation of the cable insulation, jacket or sheath and in the case of the impulse test the equipment shall not indicate a fault.

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