



BSI Standards Publication

## **Aerospace series - Cables, electrical, aircraft use - Test methods**

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Part 411: Resistance to fluids

EUROPEAN STANDARD

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## Aerospace series - Cables, electrical, aircraft use - Test methods - Part 411: Resistance to fluids

Série aérospatiale - Câbles électriques à usage  
aéronautique - Méthodes d'essais - Partie 411 :  
Résistance aux fluides

Luft- und Raumfahrt - Elektrische Leitungen für  
Luftfahrtverwendung - Prüfverfahren - Teil 411:  
Beständigkeit gegen Flüssigkeiten

This European Standard was approved by CEN on 13 November 2017.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
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<b>Contents</b>		Page
<b>European foreword .....</b>		<b>3</b>
<b>1</b>	<b>Scope.....</b>	<b>4</b>
<b>2</b>	<b>Normative references.....</b>	<b>4</b>
<b>3</b>	<b>Terms and definitions .....</b>	<b>4</b>
<b>4</b>	<b>Test fluids .....</b>	<b>5</b>
<b>5</b>	<b>Procedures .....</b>	<b>5</b>
<b>6</b>	<b>Requirements.....</b>	<b>7</b>

## European foreword

This document (EN 3475-411:2018) 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.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2019, and conflicting national standards shall be withdrawn at the latest by February 2019.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 3475-411:2014.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## 1 Scope

This European Standard specifies two methods of determining the fluid resistance of a finished cable.

Method 1: occasional contamination.

Method 2: contamination test.

It shall be used together with EN 3475-100 and EN 3909.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3475-203, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 203: Dimensions*

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

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

EN 3475-503, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 503: Scrape abrasion*

EN 3909, *Aerospace series — Test fluids for electrical and optical components and sub-assemblies*

ISO 1817, *Rubber, vulcanized or thermoplastic — Determination of the effect of liquids*

MIL-PRF-87937D, *Performance specification: cleaning compound, aerospace equipment* <sup>1)</sup>

ASTM D740, *Standard Specification for Methyl Ethyl Ketone* <sup>2)</sup>

AMS 1476B, *Aircraft toilet flush fluid* <sup>2)</sup>

## 3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

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1) Published by: DoD National (US) Mil. Department of Defense. <http://www.defenselink.mil/>

2) Published by: ASTM National (US) American Society for Testing and Materials. <http://www.astm.org/>

## 4 Test fluids

Unless otherwise specified in the product standard, all fluids listed in EN 3909 are mandatory.

## 5 Procedures

### 5.1 General

**5.1.1** Unless specified in the product specification **method 2** shall be used.

**5.1.2** For each fluid to be tested, take two (2) clean specimen at least off 1 m in length from a finished cable. Where large cables are being tested a single specimen may be divided into two (2) after fluid exposure if the resulting pieces are of sufficient length to allow the post tests to be correctly carried out.

Strip approximately 25 mm of both ends of each specimen.

Measure the cable diameter EN 3475-203.

### 5.2 Method 1: occasional contamination test

**5.2.1** Mount the test samples in their normal operating configuration and maintain at room temperature or as specified in the product standard.

**5.2.2** Dip, brush or spray the test sample with the specified fluid which shall be maintained at the test temperature given in Table 1, or as specified in the product standard. Ensure that the entire surface of the sample is thoroughly wetted. Allow the sample to drain naturally for 5 min to 10 min; shaking or wiping is not permitted.

Transfer the test sample to a test chamber and maintain at the test temperature for the time specified in the product standard. If not specified, the parameters shall be  $(65 \pm 2) ^\circ\text{C}$  for  $\left(160^{+8}_0\right)$  h.

**5.2.3** At the end of the period allow the test sample to return to room temperature, and remain at room temperature for between 1 h and 2 h, before being subjected to final examination.

**5.2.4** Repeat this procedure, if specified by the product standard.

**5.3 Method 2: contamination test for aircraft applications** (to be conducted unless otherwise specified in the product specifications)

**5.3.1** For each fluid to be tested, take two (2) clean specimen at least off 1 m in length from a finished cable. Where large cables are being tested a single specimen may be divided into two (2) after fluid exposure if the resulting pieces are of sufficient length to allow the post tests to be correctly carried out.

**5.3.2** Unless otherwise stated in the product standard, each specimen shall be wound seven (7) complete turns onto a mandrel of diameter 12 times the maximum specified outer cable diameter without torsion, but with sufficient tension to ensure the specimen remains fully in contact with the mandrel.

Remove the mandrel (if necessary the specimen may be tied using lacing cord so as to retain the coils).

**5.3.3** Immerse the test two (2) specimen fully in one of the specified test fluid with the ends 150 mm above the surface of the fluid which shall be maintained at the temperature specified in Table 1 for each of fluids listed in EN 3909 or the cable maximum rated temperature whichever is the lowest for  $(24 \pm 1)$  h.

**5.3.4** Remove the specimen from the fluid and transfer them to a chamber at  $(65 \pm 2)$  °C for  $(160^{+8}_0)$  h.

**5.3.5** At the end of the period allow the test sample to cool to room temperature, and remain at room temperature for between 1 h and 2 h, before being subjected to final examination.

**Table 1 (1 of 2)**

Fluid No.	Fluid type, see EN 3909		Test fluid	Flash point	Test temperature
1a	Fuels	Gasoline	ISO 1817 Liquid B	4	40
1b		Kerosene	ISO 1817 Liquid F	40	70
2a	Hydraulic fluid	Phosphate	ISO 1817 Liquid 103	160	70
2b		Silicone	NATO-S-1714	140	80
2c		Mineral	NATO-H-520, OM-18	80	80
3a	Oils	Mineral	NATO-O-1176, OMD-90	200	125
3b		Mineral	NATO-O-142, OM-12	120	70
3c		Synthetic Diester	ISO 1817 Liquid 101	260	150
3d		Synthetic Polyol ester	NATO-160 OX-26	15	150
4a	Cleaning fluids	Solvent	Isopropanol	12	50
4b		Solvent	Ethanol NATO-S-738 (Note 1)	16	25
4c		Solvent	Propanol 25 % + White spirit 75 % v/v	-	25
4d		Solvent	Methylethylketone ASTM-D740	4	25
4e		Detergent	MIL-PRF-87937D Type IV	-	25
4f		Sullage	AMS 1476B 5 % solution in water v/v	-	25

**Table 1 (2 of 2)**

Fluid No.	Fluid type, see EN 3909	Test fluid	Flash point	Test temperature	
5a	De-icing	Runway	50 % Inhibited Potassium Acetate in Water v/v	-	25
5b		Ground	Ethylene Glycol 80 % + Water 20 % v/v	-	25
5d		Flight	NATO-S-745 AL-5	-	25
6	Fire Extinguishants	-	See Note 2.	-	-
7a	Cooling	-	ISO 1817 Liquid 103	177	25

NOTE 1 This fluid was not included in the previous issue and should only be used in standards published after the publication date of this document unless listed in the product standard

NOTE 2 Because of the nature of these products in their normal condition in service i.e. gaseous, it is impossible to perform Fluid immersion tests in a liquid state under standard Laboratory conditions. Therefore no testing will be performed; research into alternative fluids and or test methods is being undertaken at the time of writing of this standard. Due to restrictions applicable by local laws, fire extinguishants shall not be discharged in non-critical situations.

## 6 Requirements

**6.1** The following fluid exposure the specimen shall be.

**6.1.1** Visually inspected EN 3475-201.

- a) There shall be no crazing or de-lamination of the insulation and covering;
- b) Marking shall remain legible;
- c) All colours shall remain recognizable.

**6.1.2** The cable diameter shall be measured EN 3475-203 variation of the overall diameter shall not exceed 5 %.

**6.2** The coiled part of each sample is then straightened and subjected to one of the following tests.

**6.2.1** Specimen (A) shall be subject to the ambient bend test EN 3475-405 followed by the voltage proof test EN 3475-302, as defined in the product standard.

**6.2.2** Specimen (B) shall be subject to:

- a) voltage proof test EN 3475-302, as defined in the product standard;
- b) scrape abrasion test, according to EN 3475-503 as defined in the product standard for ambient temperature.