SLOVENSKI STANDARD
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Aerospace series - Cables, electrical, aircraft use - Test methods - Part 602: Toxicity

Luft- und Raumfahrt - Elektrische Leitungen für Luftfahrzeuge - Prüfverfahren - Teil 602: Giftigkeit

Série aérospatiale - Câbles électriques a usage aéronautique - Méthodes d'essais - Partie 602 : Toxicité

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Foreword

This document (EN 3475-602:2007) 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of an identical text or by endorsement, at the latest by February 2008, and conflicting national standards shall be withdrawn at the latest by February 2008.

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1 Scope

This test method is intended for use in determining the concentration of specific gas components of smoke released by cable insulation materials.

This test method should be used to measure and describe the properties of cable insulation materials in response to heat and flame under controlled laboratory conditions.

This standard should be used to measure and describe the properties of products in response to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.

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 3475-601, *Aerospace series — Cables, electrical, aircraft use — Test methods — Part 601: Smoke density.*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply.

3.1
ppm
parts per million, concentration

3.2
colorimetry
analytical procedure using colour comparison

3.3
potentiometry
determination of ionic concentration by electrochemical measurements

3.4
in situ
at the site (in this case: in the NBS chamber)

3.5
halogenides
group of chlorides, fluorides, bromides and iodides

They have a strong electrophilic character and are therefore very reactive.

3.6
absorbent
liquid suitable for collecting gas components

3.7
impinger bottle
special glass vessel for the absorption solution

3.8
test tube
glass tube filled with a special reagent for quantitative identification of a specific gas component

3.9
molarity
concentration of a solution expressed as mol (gr/molecular weight) of solute per litre of solution

3.10
ISA
Ionic Strength Adjuster

3.11
NTP
Normal Temperature and Pressure

3.12
NBS
National Bureau of Standards, Washington

4 Principle of method

The smoke gas produced under the conditions of the smoke density test described in EN 3475-601 is subjected to an analysis depending on the gas components to be investigated.

The concentration of non-reactive gas components is determined by means of the colorimetric procedure. In this case, test tubes filled with a solid reagent are used; if a specific gas component exists, the indicating layer discolours due to chemical reactions. The length of the colour change is a measure for the concentration.

The concentration of the reactive gases is determined by potentiometry; in this case, electrochemical potentials which can be converted into ppm concentrations after plotting of a calibration curve are measured with ion-specific electrodes in connection with a special reference electrode.

5 Preparation for analysis

5.1 General

The specimens arranged vertically in a closed test chamber, are chemically decomposed according to EN 3475-601 by thermal radiation alone or in combination with flaming.

The resulting smoke portions are optically measured according to this test method. In this connection, a gas sample is taken at a time, which has to specified in a test plan. The decomposition gases resulting from thermal degradation are determined qualitatively and quantitatively by means of the analytical procedure described herein.

5.2 Probes for gas sampling

The gases are sampled by means of three probes (internal diameter 6-8 mm) extending into the geometric center of the chamber.

Resistant probe materials (such as polypropylene or PTFE) are to be selected due to the reactive behaviour of the halogenides. The probes are to be connected gastight to the tube fittings for gas sampling at the upper side of the test chamber. Connections not used are to be sealed. One of the probes inserted into the chamber is to be provided with a rubber sleeve for attachment of the test tube for colorimetric "in situ" measurement.

5.3 Gas sampling system for non-reactive gases

5.3.1 General

Figures 1 and 2 show the basic set-ups for allowable gas sampling systems.

5.3.2 Pipe system for the gas bag

A pipe system with a maximum length of 3 m is to be installed between the gas sampling point at the chamber and the place of gas collection. If the gas pipe system cannot be heated, thermal insulation of the pipes is to be provided so as to avoid the formation of condensates. The pipes must have an inner width of 6 mm to 8 mm. Plastic hoses or pipes must be used and, depending on the suitability, polyethylene; butadiene or silicone rubber types can also be used. PTFE are recommended for special requirements with regard to corrosion resistance with temperature load.

The gas pipe end facing the chamber is to be provided with a stopcock.

5.3.3 Collection of gases

Foil bags with a capacity of 10 l to 15 l and a high mechanical and chemical resistance are to be used for the collection of the non-reactive gas components to be analyzed. Polyvinylidene fluoride with low gaseous diffusion and water vapour permeability is recommended as foil material so that a change in the gas composition due to diffusion processes is negligible:

Permeability of gas for	O_2	max. 20 cm^3 NTP/m^2 per 24 h
	N_2	max. 6 cm^3 NTP/m^2 per 24 h
	CO_2	max. 140 cm^3 NTP/m^2 per 24 h
	Water vapour	max. 13 g/m^2 per 24 h

Furthermore, the bags used must be provided with a stopcock.

5.3.4 Gas collection

Two approved gas collection processes are available, collection by means of vacuum or by suction pump.

Vacuum method:

A vacuum tank with a minimum capacity of 15 l is recommended for collecting the gas components to be analyzed in the above-stated foil bag.

The design of the tank should be 5 l greater then the volume of the bag. The evacuation pressure is to be monitored by a vacuum gauge.

The vacuum tank is to be provided with a ventilation valve and a connection for the vacuum pump.

The tank cover of 10 mm thick acrylic glass minimum is provided with a hole into which a quick-release coupling is to be installed gastight in order to connect the gas bag, on the one side, with the gas pipe, on the other side.

A vacuum pump producing a vacuum in the tank capable of filling a gas bag according to within 20 s is to be used.

Procedure:

The shut-off valve at the chamber is to be closed. The gas bag is to be connected to the gas sampling system via the quick-release coupling while ensuring that the shut-off valve at the gas bag is open. The tank is to be sealed with a cover.

The vacuum pump is to be switched on and the following components are to be evacuated:

— gas pipe;

— gas bag;

— vacuum tank.

At the time of sampling, the stopcock at the test chamber (1) and the stopcock at the vacuum tank (2) are opened. The other shut-off valves are still closed. After filling of the gas bag, both stopcocks (1) and (2) in the supply line are to be closed. Then the vacuum tank is vented via the ventilation valve (5) and the pump is switched off. The stopcock at the bag is closed and the filled bag is disconnected from the quick-release coupling and to be immediately analyzed.

Suction pump method:

The following procedure can also be used as an alternative to the vacuum method for filling the foil bag. The set-up of the equipment up to the suction pump is in accordance with 5.3.2. A manifold is to be installed at the inlet and outlet of the pump as shown in Figure 2.

The manifold is used to vent the gas bag and to flush the gas pipe.

The suction pump capable of filling a gas bag according to within 20 s is to be used.

Procedure:

The shut-off valve (1) at the chamber is to be closed. The gas bag is to be connected to the coupling (8) in front of the pump manifold. The shut-off valves (2) and (4) are to be opened. The shut-off valve at the gas bag is to be opened. The suction pump is to be switched on and the gas bag is to be evacuated. The shut-off valve at the gas bag and the shut-off valve (2) are to be closed and the pump is to be switched off. The shut-off valve (3) is opened and the shut-off valve (4) is closed. The closed gas bag is to be connected to the coupling (6) at the pump outlet and the shut-off valve at the gas bag is to be opened. At the time of sampling, the shut-off valve (1) at the test chamber is opened. The suction pump is to be switched on. After 30 s at the earliest, the shut-off valve (3) is closed and the shut-off valve (4) in front of the gas bag is opened. After filling the gas bag, the shut-off valve (4), the gas bag valve and the chamber shut-off valve (1) are all to be closed. The suction pump is to be switched off. The filled bag is disconnected from the suction pump and the contents immediately analyzed.

5.4 Gas sampling for reactive Gases

5.4.1 “In situ” measurements for colorimetric determination of Hydrogenchloride (HCl) and Hydrogenfluoride (HF)

The samples for measuring the hydrogen fluoride and chloride with colorimetric test tubes are taken directly from test chamber by means of a suction pump.

The suction capacity of the pump under load must comply with the values specified by the manufacturer of the test tubes. A gas pipe of the material and diameter recommended in 5.3.2 connects the probe to the suction pump. A shut-off valve is to be installed in front of the suction pump as well as a volumetric flowmeter for flow control. The basic set-up is shown in Figure 3.

Procedure:

Prior to the commencement of the test, both tips of the test tube are broken off with a tube opener and inserted into the probe with the arrow pointing towards the pump.