
**Preskusne metode z električnim oblokom za materiale in oblačila, ki jih uporabljajo delavci, ogroženi zaradi izpostavljenosti električnemu obloku
(istoveten CLC/TS 50354:2003)**

Electrical arc test methods for material and garments, for use by workers at risk from exposure to an electrical arc

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English version

**Electrical arc test methods
for material and garments,
for use by workers at risk
from exposure to an electrical arc**

Méthodes d'essai d'arc électrique
pour les matériaux et vêtements
utilisés par des travailleurs
exposés à un risque d'arc électrique

Störlichtbogenprüfverfahren
für Materialien und Kleidungsstücke
für Anwender, die einer
Störlichtbogenegefährdung ausgesetzt sind

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This Technical Specification was approved by CENELEC on 2003-10-06.
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CENELEC members are required to announce the existence of this TS in the same way as for an EN and to make the TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Foreword

ENV 50354:2001, prepared by the Technical Committee CENELEC TC 78, Equipment and tools for live working, was approved by CENELEC on 2000-09-15.

The text of ENV 50354 has been submitted to the formal vote for conversion into a Technical Specification and was approved by CENELEC as CLC/TS 50354 on 2003-10-06.

The following date was fixed:

- latest date by which the existence of the CLC/TS
has to be announced at national level (doa) 2004-03-23
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Introduction

CENELEC/TC 78 is of the opinion that clothing fulfilling this Technical Specification, ensures that the consequences for workers, after exposure to electric arcs, will not be aggravated by the clothing itself.

This Technical Specification specifies tests and classification for materials and clothing for wearing when at risk of exposure to an electric arc.

The addition of a box to the test rig increases the electric arc energy affecting the test material. This is an attempt to create a realistic scenario.

Specific dangers from accidental electric arcs arise from the high temperature, the pressure surge and the evaporation and spatter of hot and molten metal, the effects of heat flux, noise, UV-emissions, hot oil or the consequences of physical and mental shock.

This Technical Specification does not include electrical insulation protection.

1 Scope

The purpose of this Technical Specification is to ensure that the consequences for workers of exposure to electric arcs, will not be aggravated by the clothing itself.

The Technical Specification does not include protection from current passing through the human body nor thermal protection from the heat/energy generated by the electric arc.

The clothing shall be made of materials that have passed the Method 1 test.

The test methods are divided into two parts:

- method 1: Testing of material;
- method 2: Testing of clothing.

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.

ISO 3175-2	1998	Textiles - Dry cleaning and finishing - Part 2: Procedures for tetrachloroethene
ISO 6330	1984	Textiles - Domestic washing and drying procedures for textile testing

3 Definitions

For the purposes of this Technical Specification, the following definitions apply.

3.1

electric arc

self-maintained gas conduction for which most of the charge carriers are electrons supplied by primary-electron emission (IEV 121-03-12). The electric arc is generated by gas ionisation arising from an unintentional electrical conducting connection between line conductors or between a line conductor and the earth path of an electrical installation or an electrical device

3.2**arc tested clothing**

clothing which does not aggravate the electric arc consequences, by catching fire or by melting onto the skin

3.3**material**

the material(s) of which the garment is made, this may consist of single or multiple layers

3.4**garment**

a single item of clothing

3.5**clothing**

an assembly of garments worn by workers

3.6**burning time**

time for which a flame is visible

3.7**melting**

deformation of the material structure caused by change of state from solid to liquid

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4 Classification**4.1 Material**

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The material is divided into two classes :
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- class 1 : 4 kA;
- class 2 : 7 kA.

4.2 Clothing

The garment is divided into two classes :

- class 1 : 4 kA;
- class 2 : 7 kA.

5 Requirements**5.1 Material**

An arc tested material shall fulfill the following requirements when tested, according to its classification, as specified in Clause 6 :

Burning time : less than or equal to 5 s after exposure to the electrical arc,

Melting : no melting through to the inside of the material, except holes, as defined below,

Hole formation : maximum 5 mm holes, measured in any direction,

Heat flux : *under consideration.*

5.2 Clothing

An arc tested garment shall fulfill the following requirements when tested, according to its classification, as specified in Clause 6 :

Burning time : less than or equal to 5 s after exposure to the electrical arc,

Melting : no melting through to the inside of the garment, except holes, as defined below,

Hole formation : maximum 5 mm holes, measured in any direction,

Function : the fasteners shall be functional after exposure.

5.3 Other material

All other outer material used in the clothing shall at least pass the Class 1 test.

6 Tests

6.1 Test apparatus

6.1.1 General

Test box : See Figure 1.

Test setup : See Figure 2.

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Table 1 - Test apparatus

Distance from surface of electrode to material	300 mm $\pm$ 5 mm
Composition and dimensions of electrodes	Cu/Al, round, one of each Al-electrode shall be at the top Size : 25 mm $\pm$ 0,1 mm in diameter Electrolytic copper
Gap between arc electrodes	30 mm $\pm$ 1 mm

6.1.2 Method 1 - Testing of material

Size of test sample : (500 $\pm$ 10) mm x (500 $\pm$ 10) mm

Size of Test plate : (400 $\pm$ 10) mm x (400 $\pm$ 10) mm

Material of test plate : Plaster

Thickness of the plaster : Minimum 10 mm.

The sample shall be so fixed to ensure immediate contact with the test plate.

6.1.3 Method 2 – Testing of garment

A test mannequin comprised only of an upper body torso, made of non flammable, non metallic material with a chest measurement of $(1\,020 \pm 20)$ mm shall be used for the clothing test.

The test mannequin shall be arranged in such a way, that it remains in position for the duration of the electric arc.

The test mannequin shall be set up such that the middle of the sternum area is horizontally in line with the electrode gap.

The surface of the garment shall be (300 ± 5) mm from the front of the electrodes. The garment shall be so fixed to ensure immediate contact with the front of the mannequin.

6.2 Test procedure

6.2.1 General

For tests, two test samples shall be used.

6.2.2 Pre-treatment of the test samples

Before testing the test materials or clothing shall be washed five times in accordance with ISO 6330 method 2A (60 °C) and drying by procedure E (tumble drying) unless otherwise specified in the care labelling. Materials or clothing which are labelled as dry cleanable only, shall be dry cleaned five times in accordance with ISO 3175.

Before testing the test samples shall be stored at an ambient temperature of (20 ± 2) °C and a relative humidity of (65 ± 5) % for 24 h.

6.2.3 Electric arc characteristics

The characteristics of the electric arc are defined by the following parameters :

Table 2 - Characteristics of the electric arc

Voltage	400 Vac ± 5 %
Current	Class 1 : 4 kA ± 5 % Class 2 : 7 kA ± 5 %, The value of the predicted short-circuit current shall be verified by a suitable calibrated measuring instrument
Arc duration	500 ms $\pm 0,5$ %
Frequency	The test shall be carried out at a frequency of $(50 \pm 0,1)$ Hz
Connector between electrodes	Cu., Ø max. 0,5 mm, placed inside the electrodes

6.2.4 Testing

The materials and garments shall undergo the electric arc test within 2 h of preconditioning.

The test atmosphere shall be (25 ± 10) °C and 25 % to 75 % relative humidity.

The electric arc is ignited by the switching of a circuit breaker.

The electric arc is broken after the test duration.

7 Test report

The test report shall at least contain

- name of test laboratory,
- date,
- reference to this Technical Specification,
- identification reference to the materials tested,
- test results,
- the test shall be recorded on video.

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