



**NSAI**  
Standards

Irish Standard  
I.S. EN 61482-1-1:2009

Live working - Protective clothing against the thermal hazards of an electric arc -- Part 1-1: Test methods - Method 1: Determination of the arc rating (ATPV or EBT50) of flame resistant materials for clothing (IEC 61482-1-1:2009 (EQV))

## I.S. EN 61482-1-1:2009

*Incorporating amendments/corrigenda issued since publication:*

<i>This document replaces:</i> CLC/TS 61482-1:2003	<i>This document is based on:</i> EN 61482-1-1:2009 CLC/TS 61482-1:2003	<i>Published:</i> 16 July, 2009 1 April, 2007
This document was published under the authority of the NSAI and comes into effect on:  19 January, 2010		ICS number: 13.220.40 29.260
<b>NSAI</b> 1 Swift Square, Northwood, Santry Dublin 9	T +353 1 807 3800 F +353 1 807 3838 E standards@nsai.ie W NSAI.ie	<b>Sales:</b> T +353 1 857 6730 F +353 1 857 6729 W standards.ie
Údarás um Chaighdeáin Náisiúnta na hÉireann		

English version

**Live working -  
Protective clothing against the thermal hazards of an electric arc -  
Part 1-1: Test methods -  
Method 1: Determination of the arc rating (ATPV or  $E_{BT50}$ )  
of flame resistant materials for clothing  
(IEC 61482-1-1:2009)**

Travaux sous tension -  
Vêtements de protection contre les  
dangers thermiques d'un arc électrique -  
Partie 1-1: Méthodes d'essai -  
Méthode 1: Détermination  
de la caractéristique d'arc  
(ATPV ou  $E_{BT50}$ ) de matériaux  
résistant à la flamme pour vêtements  
(CEI 61482-1-1:2009)

Arbeiten unter Spannung -  
Schutzkleidung gegen thermische  
Gefahren eines Lichtbogens -  
Teil 1-1: Prüfverfahren -  
Verfahren 1: Bestimmung  
der Lichtbogenkennwerte  
(ATPV oder  $E_{BT50}$ ) von schwer  
entflammaren Bekleidungsstoffen  
(IEC 61482-1-1:2009)

This European Standard was approved by CENELEC on 2009-06-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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

**CENELEC**

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

**Central Secretariat: Avenue Marnix 17, B - 1000 Brussels**

**I.S. EN 61482-1-1:2009**

EN 61482-1-1:2009

- 2 -

**Foreword**

The text of document 78/793/FDIS, future edition 1 of IEC 61482-1-1, prepared by IEC TC 78, Live working, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61482-1-1 on 2009-06-01.

This European Standard supersedes CLC/TS 61482-1:2003.

EN 61482-1-1:2009 includes the following significant technical change with respect to CLC/TS 61482-1:2003:

- addition of a detailed analysis of the sensor response.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2010-03-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2012-06-01

Annex ZA has been added by CENELEC.

---

**Endorsement notice**

The text of the International Standard IEC 61482-1-1:2009 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

- |               |      |   |
|---------------|------|---|
| IEC 61482-1-2 | NOTE | Harmonized as EN 61482-1-2:2007 (not modified). |
| ISO 5077      | NOTE | Harmonized as EN ISO 5077:2008 (not modified).  |

---

## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO 3175-2	- <sup>1)</sup>	Textiles - Professional care, drycleaning and wetcleaning of fabrics and garments - Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene	EN ISO 3175-2	1998 <sup>2)</sup>
ISO 6330	- <sup>1)</sup>	Textiles - Domestic washing and drying procedures for textile testing	EN ISO 6330	2000 <sup>2)</sup>
ISO 9151	- <sup>1)</sup>	Protective clothing against heat and flame - Determination of heat transmission on exposure to flame	-	-
ISO 15025	2000	Protective clothing - Protection against heat and flame - Method of test for limited flame spread	EN ISO 15025	2002

---

<sup>1)</sup> Undated reference.

<sup>2)</sup> Valid edition at date of issue.

*This page is intentionally left BLANK.*

## CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references .....	6
3 Terms, definitions and symbols .....	7
3.1 Terms and definitions .....	7
3.2 Symbols and units .....	11
4 Principle of the test methods .....	11
4.1 Test method A.....	11
4.2 Test method B.....	12
5 Significance and use of the test methods.....	12
6 Test apparatus .....	12
6.1 General.....	12
6.2 Method A – Arrangement of the two-sensor panels.....	13
6.3 Method A – Panel construction.....	14
6.4 Method B – Arrangement of the mannequins .....	15
6.5 Method B – Mannequin construction.....	17
6.6 Sensor response .....	18
6.7 Calorimeter construction.....	18
6.8 Supply bus and electrodes .....	20
6.8.1 General .....	20
6.8.2 Electrodes .....	21
6.8.3 Fuse wire .....	22
6.9 Electric supply.....	22
6.10 Test-circuit control.....	22
6.11 Data acquisition system.....	22
7 Precautions .....	22
8 Specimen preparation.....	23
8.1 Test specimens .....	23
8.1.1 Test specimens for method A: two-sensor panel test .....	23
8.1.2 Test specimens for method B: four-sensor mannequin.....	23
8.2 Laundry conditioning of test specimens .....	23
9 Calibration.....	23
9.1 Data acquisition system precalibration .....	23
9.2 Calorimeter calibration check .....	23
9.3 Arc exposure and apparatus calibration for the two-sensor panels and the monitoring sensors .....	24
9.3.1 Test apparatus .....	24
9.3.2 Positioning of the two-sensor panels, mannequins and monitoring sensors .....	24
9.3.3 Apparatus calibration for the two-sensor panels and monitoring sensors .....	24
9.4 Confirmation of test apparatus setting .....	24
10 Test apparatus care and maintenance .....	25
10.1 Surface reconditioning.....	25
10.2 Care of sensor panels and mannequins.....	25
10.3 Care of electrodes.....	25

11	Test procedures .....	25
11.1	Test parameters .....	25
11.2	Sequence of tests .....	25
11.2.1	Panels .....	25
11.2.2	Mannequins .....	25
11.2.3	Test criteria .....	25
11.3	Initial temperature .....	26
11.4	Specimen mounting .....	26
11.4.1	Method A panels .....	26
11.4.2	Method B mannequins .....	27
11.5	Specimen characteristics .....	27
11.6	Test protocol .....	28
12	Interpretation of results .....	28
12.1	Heat transfer .....	28
12.1.1	Determining time zero .....	28
12.1.2	Plotting sensor response .....	28
12.1.3	Sensor response versus Stoll curve .....	30
12.1.4	Determination of heat attenuation factor (HAF) .....	32
12.2	Determination of breakopen threshold energy, $E_{BT50}$ .....	33
12.3	Arc rating .....	33
12.4	Visual inspection .....	33
13	Test report .....	34
	Annex A (normative) Measurement of char length .....	36
	Annex B (informative) Logistic regression technique .....	37
	Annex C (informative) Heat attenuation factor .....	39
	Bibliography .....	40
	Figure 1 – Method A – Arrangement of three two-sensor panels with monitoring sensors (plan view) .....	13
	Figure 2 – Method A – Two-sensor panel (face view) with monitoring sensors .....	14
	Figure 3 – Method A – Sliding two-sensor panel .....	15
	Figure 4 – Supply bus and arc electrodes showing the position of mannequin(s) and monitoring sensors .....	16
	Figure 5 – Positioning of electrodes and monitoring sensors .....	17
	Figure 6 – Four-sensor mannequin, front view .....	18
	Figure 7 – Calorimeter and thermocouple details .....	19
	Figure 8 – Typical installation of the copper sensor mounted in the panel and the calorimeter mounted in the monitoring sensor .....	20
	Figure 9 – Example of supply bus and arc electrodes for panels .....	21
	Figure 10 – Typical material clamping assembly .....	27
	Figure 11 – Typical sensor temperature-rise curve with time scale and baseline correction .....	29
	Table 1 – Human tissue tolerance to heat, second-degree burn [1] .....	31
	Table A.1 – Total tearing load .....	36

INTERNATIONAL ELECTROTECHNICAL COMMISSION

---

**LIVE WORKING –  
PROTECTIVE CLOTHING AGAINST THE THERMAL  
HAZARDS OF AN ELECTRIC ARC –**

**Part 1-1: Test methods –  
Method 1: Determination of the arc rating  
(ATPV or  $E_{BT50}$ ) of flame resistant materials for clothing**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61482-1-1 has been prepared by IEC technical committee 78: Live working.

This standard cancels and replaces IEC 61482-1:2002. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to IEC 61482-1:

- addition of a detailed analysis of the sensor response.

The text of this standard is based on the following documents:

FDIS	Report on voting
78/793/FDIS	78/805/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61482 series can be found, under the general title *Live working – Protective clothing against the thermal hazards of an electric arc*, on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition; or
- amended.

# **LIVE WORKING – PROTECTIVE CLOTHING AGAINST THE THERMAL HAZARDS OF AN ELECTRIC ARC –**

## **Part 1-1: Test methods – Method 1: Determination of the arc rating (ATPV or $E_{BT50}$ ) of flame resistant materials for clothing**

### **1 Scope**

This part of IEC 61482 specifies test methods to measure the arc thermal performance value of materials intended for use in heat- and flame-resistant clothing for workers exposed to the thermal effects of electric arcs and the function of garments using these materials. These test methods measure the arc thermal performance value of materials which meet the following requirements: less than 100 mm char length and less than 2 s afterflame after removal from flame, when tested in accordance with ISO 15025, procedure B (bottom-edge ignition) on the outer material, and the char length measured using a modified ISO method as described in Annex A.

These methods are used to measure and describe the properties of materials, products, assemblies or garments, in response to convective and radiant energy generated by an electric arc in open air under controlled laboratory conditions.

The materials used in these methods are in the form of flat specimens for method A and garments for method B.

Method A is used to determine the arc rating of materials and material assemblies when tested in a flat configuration.

Method B is used to measure garment response, not arc rating, to an arc exposure including all the garment findings, sewing thread, fastenings, fabrics and other accessories when tested on a male mannequin torso. Method B is also used for accident replication.

It is the responsibility of the user of this part of IEC 61482 to establish appropriate safety and health practices prior to use. For specific precautions, see Clause 7.

The test methods in this part of IEC 61482 are not directed to classify by protection classes. Methods determining protection classes are prescribed in IEC 61482-1-2.

### **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, *Textiles – Professional care, drycleaning and wetcleaning of fabrics and garments – Part 2: Procedure for testing performance when cleaning and finishing using tetrachloroethene*

ISO 6330, *Textiles – Domestic washing and drying procedures for textile testing*

This is a free preview. Purchase the entire publication at the link below:

[Product Page](#)

- 
- [Looking for additional Standards? Visit Intertek Inform Infostore](#)
  - [Learn about LexConnect, All Jurisdictions, Standards referenced in Australian legislation](#)
-