

SUMMARISING 'ATPV' AND 'BOX TEST' METHODS FOR ARC FLASH PROTECTION CLOTHING



IEC61482 Protective Clothing against the Thermal Hazards of Arc Flash

EN Norms and Technical Requirements

Awareness of Arc Flash hazards and the protective clothing required is increasing in industry sectors where these hazards exist and in this document we hope to clarify some questions that you may have.

It is important to remember that any PPE is always a 'last line of defence' and that any protective clothing you provide to your workforce should be the result of first analysing your systems and procedures in order to minimise any risks present.

What is an Arc Flash?

An arc flash is a discharge of electrical energy that occurs in a fraction of a second and is caused by a short circuit through a gas - usually air - between conductor/s and the ground which results in hazards such as:

- Extreme Heat – 35,000°F (19,400°C)
- Fire with devastating results
- Flying debris including molten metal fragments
- Blast pressure upto 2000lbs/sq ft
- Sound blast upto 140dB – as loud as a gunshot
- Toxic fumes and smoke
- Plasma emission
- Extremely bright light including UV light

The results of an arc flash can clearly be very extensive and include severe burning, hearing loss, shrapnel wounds, shock hazards, memory loss and other physical injuries from being thrown across a work space.



CE Marking and Article 11B Auditing

Arc Flash protective clothing is classified as Category 3 PPE (of Complex Design) under the EC Directive 89/686/EEC Personal Protective Equipment and any production is subject to an EC quality assurance system to ensure continuous conformity of each item. These garments are not only CE marked but also carry a 4 digit number after the CE mark which indicates the notified body responsible for these Article 11B quality audits. You can find out more about this at: <http://progarm.eu/ce-certification/>

EN Norms

Some EN Norms relating to Arc Flash and Flame Resistant clothing are new or recently amended and are also often misunderstood or misinterpreted. ProGARM can offer advice to clarify which garments and test procedures you require ensuring the best protection for your

business. You can find out more about EN Norms for Arc Flash at: http://progarm.eu/index.php/iec_61482 and on other EN Norms that relate to many of the ProGARM garments at: <http://progarm.eu/en-norms/>

The Arc Flash Standards

ENV 50354 – the old standard

This EN Norm tested fabrics and garments against an Arc which was generated in a box made of plaster to simulate what would happen if an electrical arc of 4 kA or 7 kA happened within switch gear or other enclosed low voltage equipment. This test did not include any analysis of the differential between the measured heat transfer and the Stoll curve – this is now an essential part of the new IEC61482 standards. Stoll curve analysis is used to predict the likelihood of second degree burns to the wearer.

The new Arc Flash Standards



IEC61482-1 and the identical EN 61482-1 are split into two separate parts which cover the methods for testing of fabrics and garments that are designed to protect against the thermal hazards of an Arc Flash.

IEC61482-1-2/EN 61482-1-2 Test Method - Box Test

This test method supersedes ENV50354 and is commonly referred to as the Box Test. There are two test methods – one for fabrics which includes heat transfer measurements and Stoll curve differential analysis and one for the finished garment which includes a visual assessment and performance of components.

The Box Test method gives a protective classification of:

Class 1 – testing at an arc current of 4 kA and duration of 0.5s – Lower Level of Protection

Class 2 – testing at an arc current of 7 kA and duration of 0.5s – Higher Level of Protection

Note – the current of the actual electrical arc event is usually lower than the fault current of the equipment.

Unlike the ATPV Open Arc Test Method, the results of the Box Test are either a Pass or Fail and do not give a value of the incident energy. (See below on how the test results of the Open Arc Test are measured). However, the Box Test method enables the garment to be CE certified to one of the two classifications (Class 1 or Class 2) according to the results.

This Test Method is referred to for Low Voltage systems only – e.g. to replicate the potential hazard found in many service boxes or cabinets where the arc exposure is potentially directed at the front of the worker at the height of the breastbone.

The user must however, assess for himself whether the potential arc exposure hazard in front of his low voltage equipment is sufficiently simulated by:

- Either 4 kA Class 1 or 7 kA Class 2 value of Electrical Arc
- A duration of 0.5secs generated between the aluminium and copper electrodes
- The plaster box of specific dimensions
- A distance between the electrodes of 3cm
- A distance of 30cm between the electric arc and the person standing in front of the box

In reality many of these parameters will vary immensely in the real work environment and assumptions are commonly made that providing that the worker observes the parameters in the Box Test method, that Class 1 or Class 2 protective clothing will be sufficient. In reality, arc flash assessments show that these assumptions are not always true.

Arc Flash Studies and Risk Assessments

Arc Flash studies and risk assessments result in incident energy values at various working distances in front of the assumed arc flash for each piece of equipment on your site and each live working activity. These incident values are usually stated in units of cal/cm²

When choosing your protective clothing, a level of protection that exceeds the incident energy value (as a minimum) should be provided.

IEC61482-1-1/EN61482-1-1 Test Method – Open Arc Test



These are the test methods by which the protective performance of a fabric or garment can be assessed against the thermal hazards of an electric arc – we define this as it's **ATPV Arc Thermal Protective Value** and this is usually expressed in cal/cm².

During the simulated testing undertaken in the laboratory, various test specimens of fabrics and garments are exposed to varying, directly measured incident energy levels caused by the electric arc. The levels of exposure are being selected during the testing as appropriate for obtaining the heat transfer measurements needed for a full Stoll curve differential analysis.

This ATPV Test Method enable garments to be tested and certified to an actual ATPV value. There is no Pass/Fail result when compared to the Box Test method and the meaningfulness and reliability of the ATPV results, in regards of second degree burn predictions, is also higher.

IEE1684 and NFPA 70E are the most commonly used tools and guidelines for calculating incident energy levels at various working distances in front of the assumed arc flash for each piece of equipment on your site and for each live working activity.

It is clear from the above that the Open Arc IEC61482-1-1 Test Method allows the wearer to specify confidently a protective garment with an ATPV value that is at least as high as the level established in their arc flash studies and risk assessments.

In an ideal scenario, garments could be certified to both test methods. However, in the absence of this, it would be considered best practice to choose a garment that is CE certified to the Open Arc Test Method IEC61482-1-1 as this is the only method which can provide an ATPV value for both the fabric and as a complete garment.

IEC61482 Performance Standards

This IEC document contains information regarding the performance requirements for clothing designed to protect against the thermal hazards of an electric arc. It also details information on both test method options – the Open Arc ATPV and the Box Test.

Key design requirements for Arc Flash Garments

- Garments should have long sleeves
- No exposed external metal shall be permitted in the clothing. In internal metal and/or melting parts are used they shall be covered to the inside to avoid skin contact.
- All parts of the garment shall be made of arc thermal materials.
- Sewing threads must be made of inherent flame resistant fibres and shall not melt when tested at 260°C in accordance with the standard.
- The garment must have an ATPV of 4cal/cm² (167,5 kJ/m²) as a minimum according to IEC61482-1-1 or Class 1 according to IEC61482-1-2.

For full details on all the design and test requirements please refer to the International Standard IEC61482-2 which is available from websites such as www.bsigroup.com

ThermSAFE™

ThermSAFE™ Garment Components

ProGARM use ThermSAFE™ components that are all tested under arc conditions to ensure conformity. You can find out more about these components and how they affect the quality and longevity of our garments by contacting the ProGARM sales office.

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E & OE. These notes are intended to summaries and demystify some of the questions surrounding ATPV and Box Testing of Arc Flash Garments and are in no way representative of the EN standards themselves. For further information please contact the ProGARM Sales Office.

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