

ARC FLASH PROTECTION

WHAT IS AN ARC FLASH?

An Arc Flash occurs when an electrical discharge travels through the air and releases an intense burst of energy. This flash is capable of causing serious harm to anyone caught by it, so adequate Arc Flash protection is of the utmost importance.

An electric arc, also known as an arc discharge, occurs when an electrical discharge or short circuit moves through the air. Voltage spikes, worn connections, cable strikes or gaps in insulation are just some of the reasons that an Arc Flash occurs. A flash of intense energy is the result.

The energy expelled by an Arc Flash event can be deadly, with temperatures reaching up to 35,000°F or more than 19,000°C. It goes without saying; this can burn clothing and human skin within fractions of a second, even if the operative is situated five or six metres away from the Arc Flash event.

An Arc Flash can result in an explosive pressure wave that can throw workers across the room and a sound blast that can rupture eardrums. It is also accompanied by a bright flash which can cause temporary or even permanent blindness.

An Arc Flash incident should be recognised as a real danger to your team.

Take a look at this ultra slo-mo film of an Arc Flash incident <https://www.youtube.com/watch?v=P35HRYHFz7c>

ELECTRIC ARC FLASH PROTECTION AND WHY YOU NEED IT

Thermal energy from an Arc Flash incident can be deadly. When someone is exposed to an Arc Flash incident, serious burns and other potentially life threatening injuries can be minimised and even avoided by effectively utilising Arc Flash garments.

An Arc Flash event may not be a daily occurrence in your business, but they are happening multiple times every working day in the UK. Risk assessment and precautions through safe working practices can be instigated by your company, and that will limit the possibility of an Arc Flash incident. These Arc Flash studies assess and analyse the risks in your working environment.

Wearing the correct Arc Flash protective garments for a specific risk level will further increase safety. There will always remain a risk, but there is significant Arc Flash protection available through wearing the correct garments.

PROTECT YOUR TEAM FROM ARC FLASH

Keeping your team safe is always top priority. And your team need to be protected against an Arc Flash incident if there is a risk of one occurring whilst they work.

Your first step may be to conduct an Arc Flash study at your site. This will help you ascertain what risks are posed to your team as they carry out their duties. A key element of an Arc Flash study is a discussion of an appropriate level of Arc Flash protective clothing.

Arc Flash protection is found in specialist garments – everything from insulating warm Arc Flash base layers to Arc Flash waterproof jackets and trousers. Enhanced and effective Arc Flash protection comes through wearing layers of protective garments manufactured from inherent fibres and which feature specific Arc Flash resilient components. In addition, the level of protection or Arc Rated Category and other information about the garment's level of protection should be clearly visible.

Not all Arc Flash protective garments are manufactured the same. Whilst many garments meet minimum standards you need to ensure that the level of protection and quality of garment are sufficient to provide the protection the wearer needs.

We believe when lives are at stake you should trust a specialist. Someone who is using 100% inherent fibres, that develops highly durable garments that will continue to offer a high level of protection throughout the life of the garment and that has a high level of production rigour to ensure a consistent quality and garment traceability.



UNDERSTANDING ARC FLASH PROTECTION CATEGORIES

An Arc number is a method used to identify the rating and the Arc Flash protection provided by a garment worn for a given work task. Some tasks will demand higher protection levels and this information should be provided to team members by you as a result of your risk assessment or Arc Flash study.

The National Fire Protection Association (NFPA) has identified four Arc risk category levels, which are numbered by severity from 1 to 4 (1 being the lowest and 4 being the highest risk). The Arc Category (Arc) is the level of Arc Flash protection clothing you must wear to protect against a minimum level of incident energy measured in calories/cm².



Faulty electrical equipment, depending upon the energy delivering capability, can cause an explosion or Arc Flash incident of a certain magnitude, again measured in calories/cm². The resulting explosion is able to deliver an amount of heat to a certain distance.

Each level of Arc Flash protection is rated to deliver a certain amount of flame resistance.

WHAT IS AN ARC FLASH STUDY?

An Arc Flash study is a risk assessment of a workplace environment that determines Arc Flash hazards. An expert in electrical safety conducts an assessment to ensure that a company understands the risks their workplace poses to their team and how to protect against them. Assessment providers may also offer training to increase your team's awareness and options for periodic reviews.

WHAT DOES AN ARC FLASH STUDY INVOLVE?

How big would the bang be? That is the central question that an Arc Flash study seeks to answer. Only by knowing this can you adequately protect your team against the Arc Flash risks of their working environment.

An Arc Flash study will identify areas of low risk, as well as those at high risk of an Arc Flash incident. This allows you to tailor your Arc Flash protection strategy accordingly. The study will also assess the potential severity of injury at a given distance and locate the protection boundary at which there is a severe danger of second-degree burns.

There are many facets to a successful Arc Flash assessment and generally, they are adapted to fit your specific industry and requirements. They can include Arc Flash calculations, fault level studies and comprehensive site surveys.

WHO NEEDS TO CARRY OUT AN ARC FLASH STUDY?

Companies in the UK are not currently obliged to perform Arc Flash assessments on their sites. This is in stark opposition to the USA, where there is more awareness about the dangers of Arc Flash incidents. An Arc Flash study may be optional, but the positive impact on safety within your organisation is likely to be significant.

Arc Flash protective clothing is vital to protect your team should they be at risk. An Arc Flash study will highlight what level of protection is needed, allowing you to make an informed decision about your team's Arc Flash protective clothing requirements. Arc Flash garments are available from specialist Arc Flash and non-specialist suppliers – we believe that when lives are at stake that you should trust a specialist. All garments that are rated for Arc Flash protection conform to EN Standards, but not all Arc Flash garments are created equal.

Take a look at what it takes to create a ProGARM garment and explore how our garments protect your team, the quality and durability of our garments and how the comfort and design of our garments contribute to protecting your team.

INCREASED ARC FLASH PROTECTION THROUGH LAYERS

Effective protection from Arc Flash incidents comes from not only a protective outer layer but protective mid and base layers too.

The added benefit of a range of safety overalls, polo shirts and garments is that when worn together they increase the level of protection from Arc Flash and flash fire incidents. For instance, layering a polo shirt with a sweatshirt not only adds the two protection levels together, the air gap between them adds additional insulation and protection.

Our products are listed with open arc ratings so you know exactly what level of protection each garment provides. The ARC incident energy levels are measured in calories per cm² this is referred to as the cal rating. These are then measured into 4 categories with a minimum cal rating per category required.

When you layer up garments you can increase the level of protection. For example, our C60.5200 polo shirt at 7.0 cal/cm² and our C60.5630 Sweatshirt at 14.4 cal/cm² when worn together achieve a cal/cm² rating of 31.0 cal/cm².



Two key benefits to wearing garments together as a layering system

1. Increased Time Before the Wearer sustains a Second Degree Burn

When FR garments are worn together or 'layered' the time before the wearer sustains a second degree burn is significantly longer than when the garments are worn individually. On average when the garments were tested individually, the average time before the wearer would receive a second degree burn was typically five seconds. By wearing more than one FR layer this time increased to 21.28 seconds, approximately four times longer before the wearer of the garment would sustain a burn injury

2. Greater 'Response Time', More Time to React if an Incident Occurs

When the garments are layered together the wearer benefits from a longer period of time between first feeling pain and sustaining a second degree burn. The greatest 'response time' achieved with our testing was 5.93 seconds.

Pain was felt at 13.67 seconds

Second degree burn was sustained at 19.60 seconds

Response time was 5.93 seconds

FR Clothing Testing

Here at Wise Safety we pride ourselves on ensuring that our products are tested and approved to the relevant EN standards. All of the garments in our FR range either meet or exceed current EN standards.

At Wise Safety we have strict quality procedures for our own brand garments and we carefully select the partner vendors we work with to ensure their products meet our exceptionally high quality standards.

In order to establish the quality of garments we conducted two sets of tests on our garments, both individually and on combinations of garments when worn together.

Thermal Mannequin Tests

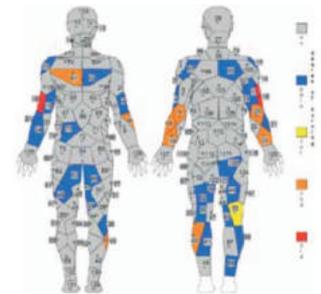
This extreme test looks at how a fabric performs in a flash fire, by engulfing a mannequin in flames. The Thermal mannequin is a life-sized, instrumented mannequin system which is one of the most advanced thermal burn injury evaluation devices in the world.

Covered by over 100 sensors and dressed in test garments, thermal mannequin tests help manufacturers to ensure optimal product performance.

This test simulates the exposure of a garment to a typical excess fuel fire with temperatures rising up to 1,000°C. It predicts the garment's protective performance and integrity against heat, flame and fire during such a typical fire incident.

The heat sensors record the temperature rise on the surface of the mannequin while a computer programme calculates:

- The predicted percentage of second- and third-degree burns a person might suffer on their body under similar conditions
- The position of the burns, and the percentage of burns compared to the total of the body
- The burn evolution over the measuring time, resulting in the person's chance to survive the incident (in %) in conjunction with the person's age

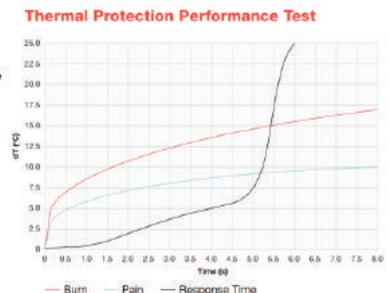


Thermal Protection Performance (TPP) Test

Originally developed by DuPont™, the results of this test show the difference in time between feeling pain and receiving a second degree burn. We have called this time period 'response time' as this is the time a person would have to get themselves away from a hazard should an incident occur. For example, if your hand were to touch a hot object there is a period of time, however small, when you are sustaining a burn but you can't feel it. If the period of time between first feeling pain and sustaining a burn were longer, then you would have more time to react, you could either remove the hazard or get away from the danger which would result in a lesser injury.

The test simulates circumstances typical for a fire: a constant combination of 50% radiant heat and 50% convective heat. Radiant heat is that which is radiated out from an element, warming an object and convective heat is usually the dominant form of heat transfer in liquids and gases. In this test both forms of heat warm either side of the test garment sample simultaneously.

The test measures the time that elapses and the amount of heat energy per surface area (TPP value) at which the temperature and energy transferred to the back of the fabric (i.e. which would be next to the skin) reaches a level which would cause a second-degree burn to the wearer of the garment.



Arc Flash Testing Quantifying The Arc Rating of a Protective Garment

IEC 61482 Series

The International Electro Technical Commission (IEC) has developed a series of International Standards for clothing to protect against the thermal hazards of an electric arc. The following test procedures are available for electric arc testing:

1 IEC 61482 - 1 "Open Arc Test Method"

The arc rating is most commonly quantified by the Arc Thermal Performance Value (ATPV) determined by the open arc test method IEC 61482-1.

The ATPV represents the maximum incident thermal energy in units of energy per surface area (e.g. kJ/m² or cal/cm²) that a fabric can support before the wearer will suffer 2nd degree burns.

The break-open threshold energy (or EBT) is another fabric characteristic. It represents the highest incident energy exposure value on a fabric where the garments do not exhibit break-open. The formation of holes in the fabric caused by break-open would allow heat or flames to pass through. Workers are assumed safe if the arc rating of their clothing (or ATPV value) exceeds the electric arc incident energy as calculated in the worst case scenario of a risk assessment. Materials or assemblies are given an ATPV value, expressed in kilojoules per square metre (kJ/m²), which can be converted into the familiar cal/cm².

2 IEC 61482-1-2 "Box Test"

The box test is another way to measure the protective performance of clothing against the thermal effects of an electric arc, and is defined in the IEC 61482-1-2 test method. In this test, the fabric is exposed to an electric arc confined in a specific box with a specific electrode arrangement.

A fabric passes the test:

- If the heat transferred behind the fabric does not cause second degree burn
- If the after flame time is below 5 seconds
- If there is no melting to the inner side of the fabric
- If hole caused by the arc is not larger than 5 mm in every direction (in the inner most layer)

The box test standard defines two testing conditions, known as Class 1 and Class 2. Test conditions for Class 1 try to simulate typical exposure conditions for a shortcircuit current of 4 kA protected by devices limiting the duration of the arc to 0.5 seconds in confined space, and of 7 kA respectively for Class 2.

IEC 61482-2/CDV - Performance Requirements for Garments

Flame resistant garments are CE marked to the above standard. This standard contains performance specifications for protective clothing tested according to either "open arc" or "arc in a box".

The standard requires the following: • A single layer garment having a minimum of ATPV = 4 cal/cm² (167.5 kJ/m²) when test to the open arc test method or Class 1 when tested to the box test method

- Garments must be sewn with inherently flame resistant threads
- When garments have a higher rating of arc protection on the front than the back, the torso, sleeves and legs must be in the same arc rated material, as the front
- Garments must have no exposed external metal (any internal metal or melting parts are to be covered inside to avoid contact with the skin)
- The garment label will show the lowest ATPV or Class if different panels on the garment are used



IEC 61482-2
ATPV= ? cal/cm²
and/or Class ?

- The double triangle symbol will be on the label with the ATPV and/or Class underneath it
- Upper (i.e. torso) garments only will be visually tested to the IEC Open Arc or Box test and the fastenings are to still perform after the arc test
- Additional User Information will be provided to include that no undergarments which melt under arc exposure are to be worn and that other PPE should be worn for full body protection (e.g. helmets and gloves)

EN Standards

EN ISO 11612:2008 - Protective Clothing to Protect against Heat and Flame

This standard specifies performance requirements for garments made from flexible materials, which are designed to protect the wearer's body (except the hands) from heat and/or flame.

The performance requirements set out in EN ISO 11612:2008 are applicable to garments which could be worn for a wide range of end uses, where there is a need for clothing with limited flame spread properties and where the user can be exposed to radiant or convective or contact heat or to molten metal splashes.

The following parameters are used:

Code A1 – Limited flame spread to outer surface

Code A2 – Limited flame spread to edge

Code B – Convective heat

Code C – Radiant heat

Code D – Molten aluminium splash

Code E – Molten iron splash

Code F – Contact heat

EN ISO 14116:2008 - Protective Clothing to Protect against Heat and Flame – Limited Flame Spread

This standard specifies the performance requirements for the limited flame spread properties of materials and protective clothing in order to reduce the possibility of the clothing burning and itself constituting a hazard.

Protective clothing complying with EN ISO 14116:2008 is intended to protect workers against occasional and brief contact with small igniting flames, in circumstances where there is no significant heat hazard and without presence of another type of heat. When protection against heat hazards is necessary in addition to protection against limited spread flammability, then standards, such as EN ISO 11612, are more appropriate (see above).

EN ISO 11611:2008 - Protective Clothing for use in Welding and Allied Processes

Clothing is intended to protect the wearer against spatter (small splashes of molten metal), short contact time with flame, radiant heat from the arc, and minimise the possibility of electrical shock by short-term, accidental contact with live electrical conductors at voltages up to approximately 100v in normal conditions of welding.

EN 1149-5:2008 - Protective Clothing -Electrostatic Properties - Part 5: Material Performance and Design Requirements

This European Standard specifies material and design requirements for electrostatic dissipative protective clothing, used as part of a total earthed system, to avoid incendiary discharges.

The standard specifies three areas -

- 1) Performance requirements of materials
- 2) Design requirements
- 3) Marking and guidance

BS EN 13034:2005 - Protective Clothing against Liquid Chemicals

This standard specifies the minimum requirements for limited use and re-useable limited performance chemical protective clothing. Limited performance chemical protective clothing is intended for use in cases of a potential exposure to a light spray, liquid aerosols or low pressure, low volume splashes, against which a complete liquid permeation barrier (at the molecular level) is not required.

Chemical protective suits (Type 6) cover and protect at least the trunk and the limbs, e.g. one-piece coveralls or two piece suits, with or without hood, boot-socks or boot-covers.

Arc Flash protection in your sector

Arc Flash incidents are common across industries such as power generation, utilities, industrial, electrical and the rail industry. Arc Flash protective clothing can help prevent serious burns and permanent injury to those working in these sectors.

If you operate in any of these five key industry sectors, you should be considering Arc Flash protection for your team.

- POWER GENERATION – Your team are at risk of an Arc Flash incident inside and outside power stations
- UTILITIES – Workers in the field require protection from Arc Flash dangers, especially if they are breaking ground on a regular basis
- PETROCHEMICALS – We know that awareness of Arc Flash dangers is now an integral part of your risk assessments. Arc Flash garments are becoming the safety clothing of choice for many in this sector
- RAIL – Arc Flash protection on the railways is vital. Arc Flash protective garments are available that comply with the special requirements of UK regulations for high visibility
- INDUSTRIAL ELECTRICAL – Those working with high voltage power supplies, in distribution centres and industrial and commercial maintenance teams are all at risk of Arc Flash incidents. Make sure they are protected

Base Layer

When exposure to heat and flame is involved, safety managers are faced with the critical task of selecting FR clothing that provides the best protection without exceeding their budget. While standards and requirements for PPE solutions may vary across environments, the goal of all FR clothing remains the same: protect the skin and prevent it from getting burned. One of the most important pieces of clothing in achieving this goal is the base layer garment, the last line of defence between flame and heat and bare skin.

Selecting the Correct Base Layer

Many workers who confront extreme conditions on a day-to-day basis wear cotton garments as their base “protective” layer. While inexpensive and permitted under current industry safety standards, this has some serious drawbacks, even if the cotton is chemically treated to be flame-resistant.

Firstly, the cotton in these base layer garments absorbs moisture and holds it close to the skin, creating an uncomfortable situation and creating the possibility of significant steam burns. Also, in an emergency situation, undergarments such as these may actually ignite, resulting in more severe injuries than if the wearer had been wearing no base layer at all.

Base layer garments made of inherently FR fibres will not burn, melt or ignite when exposed to direct flame and have exceptional electrical resistance. These fabrics are comfortable, dry quickly and wick moisture effectively, even when worn in extreme conditions.



C60.8220



C60.8210

Mid Layer

A comprehensive FR clothing compliance program needs to be present to educate workers on the value of layering appropriate FR clothing and accessories to provide maximum personal comfort, while still maintaining appropriate protective qualities for all items of clothing worn.

Historically there was little choice in FR garments, just a selection of coverall choices. Some of the more popular new options for FR workwear that work well as layered garments include knits, such as sweatshirts. Knitted garments are more flexible and provide less resistance to movement.

By choosing mid layer options you can provide higher levels of protection against heat and flame risks, but also provide a system for different weather and temperature conditions, ultimately offering comfort and flexibility to the wearer whilst providing adequate protection.



C60.5430



C60.5200



C60.5280



C60.5630

Inherent Workwear

Inherent FR fabrics provide comfort for the wearer and specifier as the flame resistant properties cannot be washed out or removed by abrasion of the fabric. Inherent fabrics usually include aramid fibres such as DuPont™ Nomex® or Modacrylics such as ProGarm VXS fabric. Aramid fibres are naturally FR as the properties are present in the molecular structure of the fibre. Modacrylic fibres have chemicals added to the textile process which modifies the fibre to make it FR. Inherent fibres offer the best level of protection in both flash fire and electric arc hazards and often are available in lighter weight fabric compositions.

Examples of some of the our Arc Flash workwear range



C60.5808



C60.5816



C60.6100



C60.6458

Outerwear

Range of outerwear and waterproof outerwear to cover all external applications in all weather conditions.



C60.5790



C60.9910



C60.9440



C60.9880



C60.9751

Hand protection and accesories



C60.2678



C60.8700



C60.8300



C60.8100

Eye, face and head protection



C60.2660



C60.2690



C60.2688

Garment decoration - Embroidery and heatseals

Wise Safety badge many thousands of garments per year at our in house dedicated decorating centre. We can either embroider or heat seal any company logo to your garments, plus the wearer's name can be added if required.

FR garments require specialist treatment when personalising them to ensure the process does not compromise the safety of the garments.

Our in house embroidery team has the knowledge to ensure we use the correct Madeira FR thread, to the correct FR levels. We source our heat seals from a badging expert who is unrivaled in their technical expertise in any type of transfer to any type of fabric. Heat seals are then applied in house by our own decoration team.



Specialist Safety Advice

If you have a query about the hazardwear you're currently using, or require assistance in choosing new products to trial in your workplace, we have experts available who can come and meet with you. If you would like to meet with one of our Technical Specialists, please contact us on 0151 5640 or email us sales@wisesafetyuk.com