

Personal Protective Equipment using Flame Equipment

Introduction

Statistics on fatal and major work accidents underline the importance of protection and prevention, for which personal protective equipment plays an important role.

The practice in good conditions of welding, cutting or heating with flame processes generates risks associated with:

- Fume (Smoke, dust, vapors, gases)
- Fire (use of flames, pressurized gas)
- Radiation (UV)
- Projections / Sparks
- Heat
- Falling objects
- Noise



In order to prevent these risks of flame process uses, collective protection has to be privileged, and the Personal Protective Equipment (PPE) shall be used when collective protection measures prove to be inadequate, impossible to implement or not economically viable.

For protective clothing, since 21 April 2018, the Directive 89/686 / EEC on PPE has been replaced by the new Regulation (EU) 2016/425. Why?

The new legislation favors the improvement of the safety of PPE on the market in order to ensure that all PPE marketed on the European market comply with the Regulation (EU)

Major changes from 21/04/2018

- Classification change for some product categories
- EC declaration of conformity to be provided (or an Internet link).
- 5 year validity / expiry date for new CE certificates.
- Mailing address of the manufacturer on the label
- Each PPE must be delivered with the Instruction of use translated for all countries

The risks / the solutions

THE RISKS

FACE & EYES

90% of all workplace eye injuries are preventable with the use of proper safety eyewear, welding goggles.
Only 1% of approximately 770 workers suffering face injuries were wearing face protection.

BODY

Every day, people are admitted to burn centers annually with severe arc flash burns.

HAND AND FOREARM

25% of all work place accidents involved hands and fingers.

LEGS

Risks of clothes catching fire from welding spatter and molten metal.

FEET

Risks are perforations, falling object, burns and slipping.

FUME

Health and safety risks: Inhalation of toxic substances and/or fine particles. Increased concentrations of nitrogen oxides and carbon monoxide, especially when working with the flame in confined spaces.



THE SOLUTIONS

SAFETY GLASSES

Goggles are mainly used to protect the eyes against the light produced by flame welding or cutting or against mechanical particles (grinding for example).

WELDING JACKET

Welding jacket of flame retardant material of leather to protect the upper body, against welding spatters, grinding particles which permit to avoid burns.

GLOVES

The choice of welding gloves will depend on the welding application in order to offer the right protection and comfort.

TROUSERS

Trousers of flame retardant material to protect the lower body against welding spatters, grinding particles and molten metal.

SHOES

Safety shoes permits to protect completely the bottom of the leg.

FUME

Use appropriate Extraction Systems to eliminate the fumes and gases produced. Ensure sufficient fresh air supply to dilute gaseous hazardous substances. Where Extraction Systems alone does not adequately control exposure, it should be supplemented by adequate and suitable respiratory protective equipment to protect against the residual fume.

Protection against radiation, heat and burns: Goggles

Goggles are mainly used to protect the eyes against the light produced by flame welding or cutting or against mechanical particles (grinding for example).

Reg. (EU) 2016/425

Make sure that the product is suitable for the intended use and conform with Reg. (EU) 2016/425 and Standards by fields of use - [Lens Marking] :

- ◆ EN 166:2001 for basic conditions
- ◆ EN 169:2002 for welding filters
- ◆ EN 170:2002 for UV filters
- ◆ EN 171:2002 for IR filters
- ◆ EN 172:1994+A1:2000+A2:2001 for sunglasses filters
- ◆ EN 175:1997 for personal eye-protection during welding



Specification according to EN175:1997

This standard applies to PPE for eye and face protection during welding and related procedures. The conforming PPE is designed to include protection filters with or without protective/reinforced oculars, certified in conformity to EN166:2001 and to EN169:2002.

Furthermore to select the right welding filters (shade) on the google, the EN 169 gives recommendation of use depending the flow of acetylene for brazing/welding or cutting process

Welding scale				
	q = acetylene flow rate l/h			
	q ≤ 70	70 < q ≤ 200	200 < q ≤ 800	q > 800
Flame welding Brazing and soldering	4	5	6	7
	q = acetylene flow rate l/h			
	900 ≤ q ≤ 2 000	2 000 < q ≤ 4 000	4 000 < q ≤ 8 000	
Oxy-cutting	4	6	7	

Table from EN 169

For applications with higher flow rates, in particular for heating or flame cutting applications of large thicknesses, it is necessary to use a welding helmet in order to protect yourself. Operators working nearby must wear glasses with suitable shades: From shade 3 for aids to a shade equivalent to that of the operator. Warning: in most cases, these attacks have a cumulative effect.

Protection against radiation, heat and burns: Leather clothes

The use of protective leather clothes that complies with current standards makes it possible to aim for the highest level of protection for users of flame processes.

These clothes will protect the operator against burns; projections, radiation. These clothes must also be hardly combustible to limit the inflammation.

Main EN Standards are for leather clothes are:

- European Regulation on Personal Protective Equipment (EU) 2016/425
- EN ISO 13688:2013: (general requirements for innocuousness, ergonomics and sizes),
- UNI EN ISO 11611:2015: (use in welding operations and related procedures)

Clothes that can be used in flame process are:

- Jackets
- Trousers
- Apron
- Sleeves
- Gaiters

These clothes for welders in Class 2 suitable for use during manual welding techniques in which major drops and splatters are formed.

Warning: in the presence of oxygen, clothes soiled with grease can be ignited; it must be clean

Protection against radiation, heat and burns: Gloves

Gloves must be made from leather that has undergone specific tests against the thermal risks associated with welding.

European Directive (UE) 2016/425: harmonization of member states' PPE legislation.

EN 21420 Protective gloves - general requirements

EN 388:2019 Protective gloves against mechanical risks

EN 407:2004 Protective gloves against thermal risk

EN 12477:2001+(A1:2005) Protective gloves for welders

A mechanical performance score as well as a thermal performance score will be awarded according to the standard EN 388 and EN 407.

Mechanical hazards

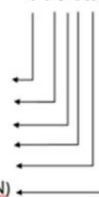
TEST

- Abrasion resistance (1-4)
- Resistance to cutting with a blade (1-5)
- TDM Resistance to cutting with a blade (A-F)
- Resistance to tearing (1-4)
- Resistance to perforation (1-4)
- Attenuation of impact on knuckles (≥ 9 kN/ ≥ 7 kN)

EN 388:2019



4 1 3 4 x x



Protection against radiation, heat and burns: Shoes

European directive UE 2016/425 9 March 2016 stipulates that wearing safety shoes is compulsory for workshop work. Furthermore, the use of suitable safety shoes protects feet from the risk of falling objects but also from the specific risks of flame processes, like hot projections or liquid metal in the cutting process.

The EN ISO 20345 standard describes several levels of protection:

Safety level	Protective Shell	Shockproof sole	Anti-static sole	Anti-perforation sole	Water-repellent shoe
SPB	✓			✓	
S1	✓	✓	✓		
S2	✓	✓	✓		✓
S1P	✓	✓	✓	✓	
S3	✓	✓	✓	✓	✓



The criteria of choice are:

- 1 - The level of protection according to the standard EN ISO 20345 :2011
- 2 - High or low shoes
- 3 - Upper in:
 - full-grain leather (water resistant)
 - split leather
 - fabric (no water resistant),
 - pigmented split leather.
- 4 - Outsole:
 - PU+PU (dual density polyurethane lightweight),
 - PU+TPU (lightness and flexibility + more strength of the thermoplastic polyurethane),
 - PU + nitrile rubber for extreme temperatures (up to 300 °C).
- 5 - Antipuncture midsole:
 - in steel
 - no metallic for more comfort.
- 6 - Toe protection:
 - steel
 - aluminium (30% lighter),
 - fiberplast (extra lightweight).

The EN ISO 20349-1:2017 specifies requirements and test methods for footwear protecting users against risks, such as those encountered in foundries.

Protection against fume: Fume extraction System

With at-source extraction the welder is more protected and accumulation of welding fumes in the work shop decreases. Source capture methods are preferably integrated in the workspace. The new legislation favors the improvement of safety for suction systems. Regulatory references:

EN ISO 21904-1 Health and safety in welding and allied processes — Equipment for capture and separation of welding fume — Part 1 (4): General requirements

EN ISO 21904-2 Health and safety in welding and allied processes — Equipment for capture and separation of welding fume —Part 2: Requirements for testing and marking of separation efficiency

EN ISO 21904-4 Health and safety in welding and allied processes — Equipment for capture and separation of welding fume —Part 4 : Determination of the minimum air volume flow rate of capture devices

Where Extraction Systems alone does not adequately control exposure, it should be supplemented by adequate and suitable respiratory protective equipment to protect against the residual fume. Regulatory references:

- EN 12941 Respiratory protective devices - Powered filtering devices incorporating a helmet or a hood
- EN 14594 Respiratory protective devices - Continuous flow compressed air line breathing devices.

Note: In 2018 IARC has classified welding fumes and UV radiation from welding as Group 1 carcinogens

Protection against noise: Hear protection

Noise can be harmful for the health: it does not only lead to hearing damage but can also cause other unwanted, and long lasting, negative effects (psychological and social problems, fatigue, cardiovascular problems...).

The European standards are grouped under two series:

The three parts of the EN 13819 series 'Hearing protectors – Testing' series

The ten parts of the EN 352 series 'Hearing protectors – Safety requirements' series

Important note: for all kind of protection refer always also to the National Regulations

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