



HOT MATERIALS AND SPATTER



Causes

- For welders and welding operators:
 - Contact with flame;
 - Electrocution;
 - Contact with hot fluids and materials;
 - Explosion ➔ Oxyfuel...
 - Radiation;



Figure 1 – Flame. Source: Welding flame. Source: <https://smartbizwpg.com/tag/manufacturing/>



Figure 2 –Welding. Source: <https://smartbizwpg.com/tag/manufacturing/>

Causes



Figure 3 & 4 - Torn glove. Source: VCL

Consequences

- Depending of the degree
- Scars
- Healing process can be very slow
- Psychological consequences: depression, anxiety,...



Figure 5 –Scars. Source: Anonymous

Consequences

- First degree:
 - Will heal quickly;
 - No major consequences → if not on a regular bases;
 - Sunburn;
- Second degree:
 - Blisters;
 - Healing process will take a lot longer;

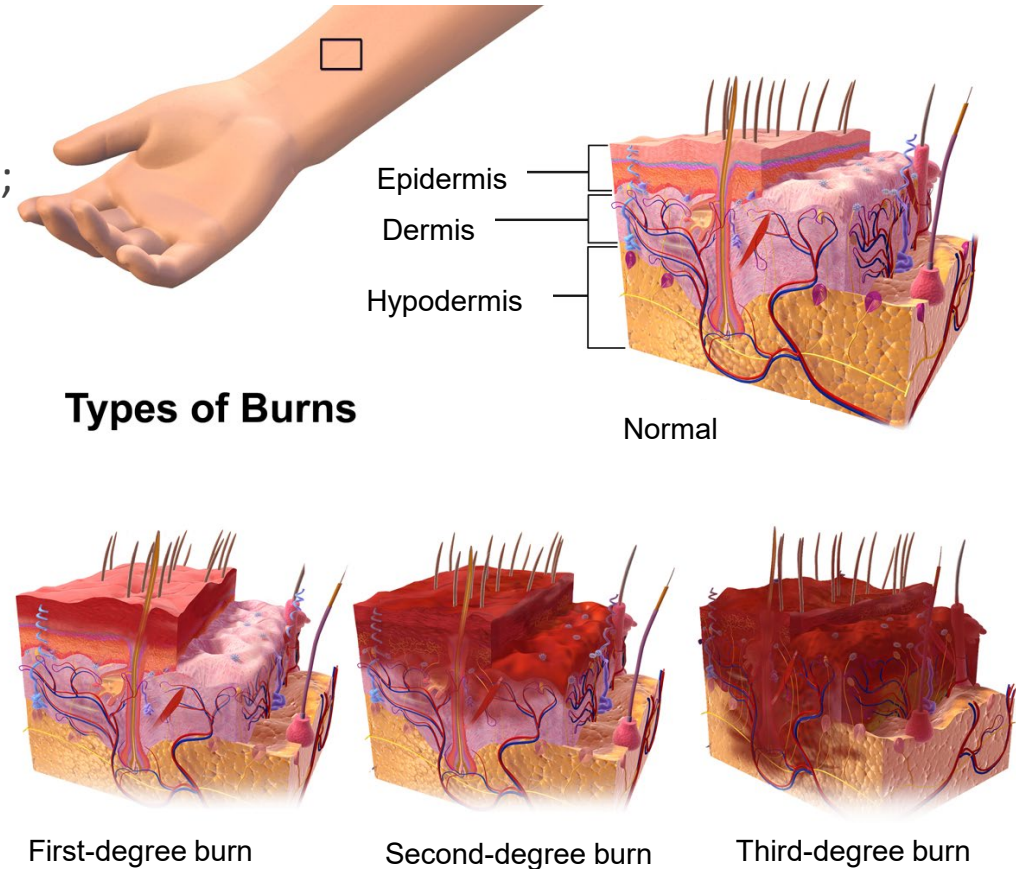


Figure 6 -Type of burns. Source: <https://es.wikipedia.org/wiki/Archivo:Burns.png>

Consequences



Figure 7 - Burned hand. Source: Cbede

Prevention

➤ Personal

- Wear PPE;
- Maintenance of the equipment;
- Training and information;
- Common sense;

➤ Environmental

- Keep flammable products stored safely:
 - Read what manufacturer advices;
- Protect others surrounding you:
 - Warn them!
- Organise your work space;



Figure 8 - Acetylene safety sheet. Source:Home Security



Figure 9 – Warning Sign. Source:EHS Practice

Prevention

- Watch out with aluminium:
 - Aluminium doesn't show that it's hot or has been;



Figure 10 - Welded aluminium. Source:<http://vertpickq.pw/Aluminium-tig-welding-welding-t-Welding.html>



Figure 11 – Welded stainlesssteel. Source:<http://vertpickq.pw/Aluminium-tig-welding-welding-t-Welding.html>

Prevention



Figure 12 – Tempering colors of steel. Source: Zaereth, Tempering colors of steel.

PPE

Workwear:

- Flame retardant, comfortable;
- Covers everything:
 - Overall;
 - Trousers + jacket;
- Leather, heavy cotton,...;
- No polyesters, nylon,...;

Limited flame spread performance requirements ISO 15025, Procedure A (code letter A1)

Properties	Requirement
Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
Flaming debris	No specimen shall give flaming or molten debris.
Hole formation	No specimen shall give hole formation of 5mm or greater in any direction, except for an interlining that is used for specific protection other than heat and flame protection.
Afterglow	Afterglow time shall be ≤ 2 s. A glowing inside the charred area is defined in ISO 15025 as afterglow without combustion and for the purpose of this clause is not regarded as afterglow.
Afterflame	Afterflame time shall be ≤ 2 s.

Table 1 – Performance requirements. Source: EN ISO 11611

PPE

EN ISO 11611

- Classes
 - Class 2 ➔ Higher levels spatter/radiant heat
 - Class 1 ➔ For lower levels of spatter/radiant heat

Table 2 – Limited flame spread performance requirements ISO 15025, Procedure B (code letter A2)

Properties	Requirement
Flame spread	No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge.
Flaming debris	No specimen shall give flaming or molten debris.
Afterglow	Afterglow time shall be ≤ 2 s. A glowing inside the charred area is defined in ISO 15025 as afterglow without combustion and for the purpose of this clause is not regarded as afterglow.
Afterflame	Afterflame time shall be ≤ 2 s.

Table 2 - Performance requirements . Source:EN ISO 15025

Table 3 – Summary of performance requirements			
Subclause	Requirement	Class 1	Class 2
6.2	Tensile strength - Woven outer textile material - Leather	400 N 80 N	400 N 80 N
6.3	Tear strength - Woven outer textile material - Leather	15 N 15 N	20 N 20 N
6.4	Burst strength - Test area of 7,3cm ² - Test area of 50 cm ²	200 kPa 100kPa	200kPa 100kPa
a	For ISO 15025. Procedure B, this requirement is not applicable.		

Table 3 - Performance requirements. Source: EN ISO 11611

Table 3 (continued)			
Subclause	Requirement	Class 1	Class 2
6.5	Seam strength - Textile material - Leather	225 N 225 N	225 N 225 N
6.6	Dimensional change of woven textile materials Dimensional change of knitted textile materials	± 3% ± 5%	± 3% ± 5%
6.7	Flame spread - Procedure A – mandatory - Procedure B – optional	ISO 15025, Procedure A (surface ignition) ISO 15025, Procedure B (edge ignition) No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge No hole formation (a) No flaming or molten debris Afterflame ≤ 2 s Afterglow ≤ 2 s	ISO 15025, Procedure A (surface ignition) ISO 15025, Procedure B (edge ignition) No specimen shall permit any part of the lowest boundary of any flame to reach the upper or either vertical edge No hole formation (a) No flaming or molten debris Afterflame ≤ 2 s Afterglow ≤ 2 s
6.8	Impact of spatter	15 drops	25 drops
6.9	Heat transfer (radiation)	RHTI 24 ≥ 7,0	RHTI 24 ≥ 16,0
6.10	Electrical resistance	> 10 ⁵ Ω	> 10 ⁵ Ω
6.11	Fat content of leather	≤ 15%	≤ 15%
a For ISO 15025. Procedure B, this requirement is not applicable.			

Table 4 – Performance requirements . Source: EN ISO 11611

Table A.1 – Selection criteria for clothing for use in welding or allied processes (reference points)

Type of welder's clothing	Selection criteria relating to the process	Selection criteria relating to the environmental conditions
Class 1	<p>Manual welding techniques with light formation of spatters and drops, e.g.:</p> <ul style="list-style-type: none"> - Gas welding - TIG welding - MIG welding - Micro plasma welding - Brazing - Spot welding - MMA welding (with rutile-covered electrode). 	<p>Operation of machines, e.g.:</p> <ul style="list-style-type: none"> - Oxygen cutting machines - Plasma cutting machines - Resistance welding machines - Machines for thermal spraying - Bench welding
Class 2	<p>Manual welding techniques with heavy formation of spatters and drops, e.g.:</p> <ul style="list-style-type: none"> - MMA welding (with basic or cellulose-covered electrode) - MAG welding (with CO2 or mixes gases) - Self-shielded flux cored arc welding - Plasma cutting - Gouging - Oxygen cutting - Thermal spraying 	<p>Operations of machines, e.g.:</p> <ul style="list-style-type: none"> - In confined spaces - At overhead welding/cutting or in comparable constrained positions

Table 5 –Selection criteria . Source: EN ISO 11611

PPE

- Symbol declares that product is suitable for use during welding

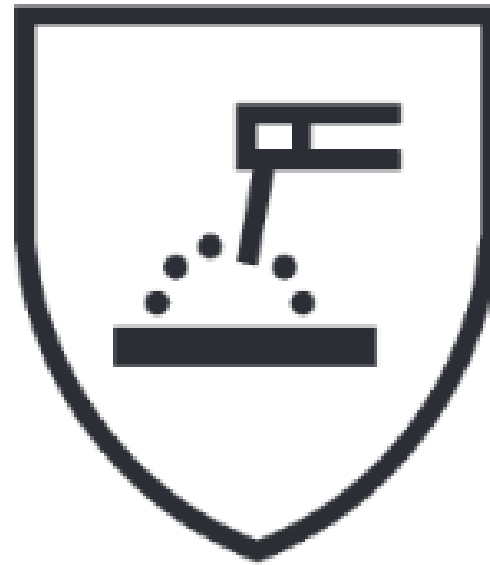


Figure 13 – Symbol for protective clothing. Source: ISO 11611

PPE

➤ Gloves:

- Heat resistant, fire resistant,...
- EN 12477 divides gloves in to two types:
 - Type A
 - Type B = for greater manoeuvrability
 - ➔ TIG welding

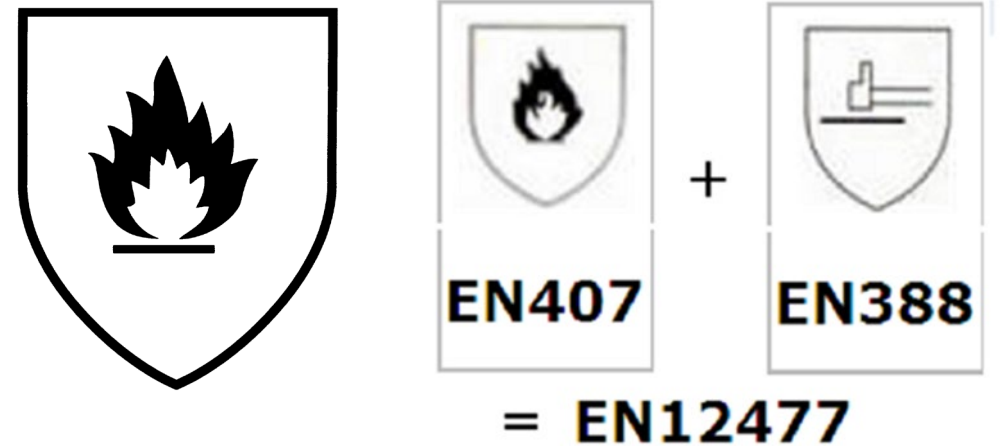
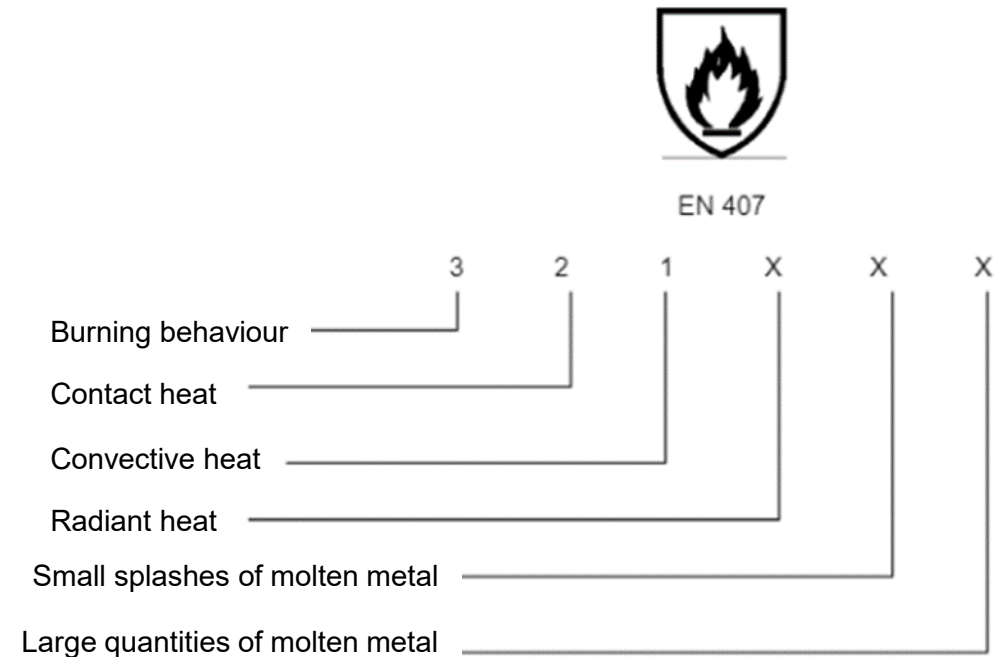


Figure 14- Symbols. Source: EN 12477

PPE

➤ EN 407 ➔ Marking and numbers



The sign X, instead of a number, means that the glove is not designed for the use covered by the responding



Figure 15 -Aconite. Source: Anonymous



Figure 16 -Sleeve . Source:www.allesvoorlassen.nl/werkplaats-magazijn/persoonlijke-beschermingsmiddelen?prod_id=269624



Figure 17 -TIG finger. Source: www.weldingtipsandtricks.com/aluminum-welding-training.html



Figure 18 — Welding cap. Source:www.miganglia.co.uk/weldas-fire-fox-welding-cap-wild.html



Figure 19 -Shoe cove. Source: <https://sales.paxpat.com/steiner-all-leather-welders-spats-5-high-pair.html>



Figure 20 -Leather skir. Source: www.allesvoorlassen.nl/lastoebehoren/lashandschoenen-en-laskleding/weldas-laskleding-en-werk-en-lashandschoenen?prod_id=269594

European, National Regulations and Recommendations

- EN12477: 'Protective Gloves for Welders'
- EN407: 'Protective Gloves against Thermal Risks (Heat and/or Fire)'
- EN388: 'Protective Gloves against Mechanical Risks'
- EN ISO 14116: 'Protective Clothing - Protection against Flames – Limited Flame Spread Materials, Material Assemblies and Clothing'
- EN ISO 11611: 'Protective Clothes for use in Welding and Allied Processes'