

## TO 113 WELDING

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### 1 Introduction

This instruction considers personal protection in conjunction with different welding methods and welding work. The instructions do not address machines that use different types of welding equipment.

The welding method, the material to be welded and the welding time determine what substances are generated when welding and in what quantities. The welder's working method is an important factor in terms of exposure. Arranging local extraction close to the welding site and keeping away from the visible trail of welding fumes are good practices.

Local extraction is only effective in a zone approximately equal to the width of the extraction nozzle from the outer edge of the extraction device. Welders often have a bad habit of removing the respirator from their face while there are still fumes in the breathing zone. It must be possible to always use the respirator when welding fumes are present in the breathing zone. This creates challenges in the selection of protective equipment. You can also try to remove the welding fume cloud from the breathing zone by directing the air conditioning. If necessary, a more effective respirator should be chosen.

For welding, the default equipment is TH3P class respirators, which can be combined with hearing protectors or, if this is not possible, plugs, or cast hearing protectors are used.

To reduce exposure to electromagnetic radiation, keep the welding cable as far away from your body as possible.

Welding methods are divided into two main groups. The criteria for welders' clothing is according to the EN ISO 11611 standard.



## 2 Personal protective equipment used in welding

### 2.1 General information about the use of personal protective equipment in welding

1. A helmet must be used in welding in all areas where it is mandatory to use a protective helmet.
2. Welding gloves must be used in all welding. The category requirement of protective gloves for different types of welding is outlined in section 2.4.
3. Safety footwear must be of ankle-high or boot type and must have penetration-resistant and heat-resistant soles.
4. Protective clothing compliant with EN ISO 11611 category 2 is required in welding.
5. When welding stainless steel and high-alloy steels, a welder's face shield with a blower unit must be used. The air-fed welding helmet and blower must be made by the same manufacturer, as the headgear and blower are approved as a whole.
6. When using the blower unit, the following factors related to safe working must always be taken into account:
  - Always refer to your device's instructions for use. Before starting the welding work, check the functioning of the blower, the tightness of the face piece and its parts, and the condition of the hoses.
  - During operation, observe any changes in the breathing resistance; if the blower unit's power (air flow) decreases, replace the battery, or check to make sure that the hose from the blower is not flattened (working position - welding hoses).
  - Always service your mask after use, check the hoses and face piece, and get the battery charging after the working day.
7. In welding, electromagnetic fields are present, for example, in the vicinity of welding cables, and therefore the welder must keep the cables as far away from themselves as possible (not on the shoulder). Welding cables should be bundled together over as long a distance as possible, so that the magnetic fields attenuate each other.
8. When welding, always aim to position yourself in such a way that you are not above the welding gases. In tank work and confined spaces, take care to ensure clean breathing air.
9. In addition, a welder's respirator with a blower unit is recommended to be used in all welding.

Do not modify the protective equipment in any way. The edge gaskets of the welder's face shield are essential for protection; do not remove them. Use a blower protector only in the approved assembly. Do not combine components made by different manufacturers unless the producer of the blower has specifically permitted it.



The figure above illustrates the correct work method: the air hose of the blower unit must not be pinched.

### 2.2 Protective clothing

**Protective clothing compliant with EN ISO 11611 category 2 is required in welding.** The protective clothing protects from ignition, welding sparks, radiated heat and, to an extent, also heat. The clothing



can be in one or two parts, and additional protection, such as a hood, loose sleeves or gaiters, must be used as necessary.

## Use

Protect the neck area, including the back of the neck, and wrists and frontal part of the torso. Close the fasteners in clothing, keep sleeves rolled down and trouser legs on top of footwear. It is important to keep the fasteners in your clothing closed all the way up so that sparks cannot get inside the clothing. Wear fire-retardant intermediate clothing underneath the top layer of clothing. Do not use underwear made of synthetic fibers, as they can melt into the skin and increase the severity of burns!

Regularly change from dirty clothes into clean ones, as dirty clothes can easily catch fire from a spark! Also remember regular washing and replace damaged protective clothes with new ones.

## 2.3 Safety footwear

The best protection for the ankle region is provided by a **mid-high or boot type of leather footwear**. Safety footwear has toe guards and/or penetration-resistant and heat-resistant soles. Safety footwear must meet the requirements of EN ISO 20345:2004: impact test 200 J and compression test 15 kN, CE mark, safety footwear marking S3, penetration resistance marking, and heat-resistant sole HRO.

## 2.4 Protective gloves

The work of a welder involves the risk of exposure to contact allergy caused by chrome and nickel, and also to heat. Avoid contact or allergic rash and use protective gloves.

There are two types of gloves in terms of protection:

- Category B gloves are suitable for work requiring more finger agility, such as TIG welding.
- Category A gloves are suitable for other welding work. They are thicker, but provide more protection from heat than category B gloves.
- Standard EN 12477: "flame" and "hammer" symbol, CE mark, category A or B, glove size number, manufacturer's identifier.

## 2.5 Hearing protection

Welding also exposes the welder to strong impulse noise with rapid noise peaks. Hearing damage caused by impulse noise is associated with an elevated likelihood of tinnitus. Welding also exposes the welder to chemicals with harmful effects on the auditory system. These include carbon monoxide (acetylene welding), lead and manganese. The welding area should be well ventilated, as good ventilation also protects hearing. Hearing damage develops slowly, and it is irreparable. **Noise is the biggest cause of occupational disease among welders. Prevent noise damage and use hearing protection throughout the time in a noisy environment. Primarily cup hearing protectors, plug hearing protectors or cast hearing protectors.**

## 2.6 Eye and face protection

Protect the entire facial region by using a welder's face shield or an auto-darkening mask. The filter of the face shield must be a welding filter approved for welding work. A respirator can be connected to the welding helmet by means of a blower unit with a filter. Flame cutting glasses must be used, for example,

in oxy-acetylene and oxygen-liquified petroleum gas (O<sub>2</sub>/LPG) flame cutting, which are very common work tasks.

### Filters

A welding filter is a special filter that provides protection from bright light, or glare, and that reduces ultraviolet and infrared radiation. The filter darkness shade is classified with numbers 12–16. The darkness shade is selected based on the current (A, ampere) used in welding. Remember to clean the filter according to the instructions for use, and regularly check the condition of the face shield visually for cracks in the face shield or filter.

When welding stainless steel, it must be taken into account that thermal stresses are created in the welding seam, due to which weld slag can come off and be projected into the environment when the weld seam cools (in tack welding).

**It is important to also take care of the protection of bystanders or those working in the same space from radiation. Welding work should primarily be carried out in welding work areas equipped with welding curtains.**

## 2.7 Respirators

The recommended respirator is a filter respirator with a blower or a compressed air line respirator with a welder's face shield. Filters differ in terms of effectiveness, which is determined based on the equipment configurations.

**Combination of a blower respirator and welder's face shield.** The blower unit with filters is attached to the back side of the waist with a belt. The blower supplies the welder's face shield with filtered air through the hose. Solid impurities generated in welding are filtered by a P3 filter. The filters should be replaced regularly with new ones as they become saturated (filled).

**In welding stainless steel and high-alloy steels,** a welder's face shield with a blower unit must always be used. Moreover, a welder's face shield with a blower unit is recommended for all welding.

**Hazards of welding coated materials.** Paint, plastic and zinc coatings can release lots of hazardous fumes and gases into the air. When welding paint or plastic coatings, protective equipment with a filter must be used, and the filter must be **ABEKP3 or ABEP3**.

**Compressed air from the plant network must not be used as breathing air.** Compressed air in the plant network may contain small amounts of dehumidifier agent dust or oil. In addition, there is a risk that external gas or liquid may enter the compressed air network as a result of incorrect connections or gas/chemical leaks in the extensive factory network. **If you need clean breathing air separate from the compressed air system for coaling, for example, use a compressed air belt, pressure and a respirator headgear together.**

## 3 Additional points

**The red Mako 625224 TIG electrodes are prohibited for welding due to radiation! They may, however, be used for testing radiation meters. The red TIG electrode contains thorium, which is an alpha emitter and, measured with Polimaster, shows a dose rate of about 1µSv/h, which is not a high reading per se. The problem is the internal exposure caused by welding fumes and polishing dust. As**



thorium builds up inside the human body, it causes an increased risk of cancer over long career histories.

Safe welding is possible when appropriate work and safety equipment and protectors are used in a well-designed working environment. Welding and machining of metal generates smoke and vapor hazardous to health, which can contain metals (chrome, nickel) and gaseous compounds, such as ozone. Protection from these is required in welding.

Welding also generates noise, especially in the pre-treatment and finishing work related to welding. Thus, hearing protection is necessary. In addition, it is important to be protected from welding sparks, flame and ultraviolet (UV) radiation, light arc and electrical accidents. Fire safety must also be taken care of.


The ergonomics of welding can be improved by paying particular attention to working positions, such as by avoiding welding above shoulder level and by taking sufficient breaks. Accessories such as adjustable welding tables and manipulators, wire feeding devices and welding gun support arms also make the work lighter. A good working position may require the use of scaffolding or personnel hoists.

The primary method at the work place is the extraction of air impurities with functioning local extraction and good general ventilation. If this is not technically feasible, the employees must be provided with personal respirators. Protection is absolutely necessary as vapor and other airborne impurities can enter the lungs and, from there, the circulation and the rest of the body. Welding fumes can cause chronic bronchitis; zinc and copper fumes can cause metal fume fever. Metal fumes are a health hazard. The welding site of stainless steel must be marked and isolated from other people.

#### Marking of cancer risk zones and preventing unauthorized access to the area

A specifically designated stainless steel welding site must be fitted with warning signs that indicate the nature of the site. The employer must ensure that only employees who are required to have access to the stainless-steel welding site due to their work or duties can access the welding site during welding work. In addition to demarcating areas, additional warning signs are used during welding work or permanently. The demarcated area can be, for example, a subdivided separate stainless steel welding area with good ventilation and local extraction, or a separate stainless steel welding room, separated with welding curtains, with good ventilation and local extraction.

120x300



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ruostumattomia teräksiä**

- hitsauksessa muodostuu syöpävaarallisia yhdisteitä
- tarpeetonta oleskelua ja läpikulkua alueella vältettävä

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