ENGMAR

EFFICIENT PROTECTION

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WHAT ARE WELDING FUMES?

During welding, hazardous substances in **particle form and gases** are generated. These are mixtures, of which 95% arise from the filler material. The exact composition depends to a large extent on the **materials used** and the processes applied.

THE RELEASED PARTICLES HAVE DIFFERENT SIZES

Nanoparticules: Mass fraction of nanoparticles that can circulate throughout the organism via the circulatory system and can cross the blood-brain barrier. Size ≤ 0.1µm

Fraction A: mass fraction of inhaled particles, which penetrates into the pulmonary alveoli, size ≤ 10 µm

Fraction E: mass fraction of all suspended particles that can be inhaled through the mouth and nose.

In addition, gaseous hazardous substances such as ozone, nitrous gases and carbon monoxide are also present.

POSSIBLE EFFECTS ON HEALTH

TOXIC

Some substances cause acute or chronic toxic effects. Compliance with the general limit value for dust is not enough here; it is necessary to comply with the substance-specific limit values. This applies, for example, to particulate substances such as manganese, zinc or copper oxide, and gaseous substances such as carbon monoxide and nitrous gases.

HARMFUL

The particle load causes chronic inflammation, e.g. chronic lung diseases. The workplace exposure limits depend on national legislation and is of 5mg/m3 in the US. There is no such limit in the UK.

CARCINOGENIC

Hazardous substances in particle form, for example chromium(VI) compounds, nickel oxides and gases, for example ozone, which are carcinogenic.

Extraction table

Extraction nozzle

Extraction wall

THE TUTORIAL

USE ALTERNATIVE COLD JOINING TECHNIQUES

1

There are several alternative joining methods to welding that might be worth considering: mechanical fasteners like riveting, brazing and adhesives.

REDUCTION OF THE WELDING FUMES EMITTED

2

The release of hazardous substances can be reduced by various measures:

- **Use of lower-emission processes**, e.g. through automation, or submerged arc welding.
- **Use of optimised process parameters**, e.g. through digitally controlled process variants.
- **Use of other filler materials or gases**, e.g. by reducing the CO_2 content in the shielding gas.
- **Remove grease and all surface coatings** before welding. Paint and resin coatings may release toxic components when heated.

LOCAL EXHAUST VENTILATION (LEV)

3

The amount of particulate matter emitted is highly, in order to comply with workplace exposure limits, emissions must be captured as directly as possible at the point of emission. A wide variety of extraction devices can be used for this purpose:

- **Extraction torches**: They extract directly at the point of emission and are therefore the most efficient method. Another advantage is that the extraction does not have to be additionally adjusted.
- **Extraction arms with laminar nozzle**: Welding fumes are captured by our laminar extraction nozzles over a width of up to 800mm.
- **Extraction tables and walls**: are particularly suitable when different processes are carried out at the same workplace.
- **Extraction hoods** for automated processes: Since robots often work in a higher ampere range and with longer duty cycles, the welding fumes must be extracted here before they penetrate other work areas.

RESPIRATORY PROTECTIVE EQUIPMENT (RPE) AND PERSONAL PROTECTIVE EQUIPMENT (PPE)

4

GENERAL VENTILATION, CONTROL MEASURES AND TRAINING

5

To ensure a permanent solution, the following points are important:

- If the aforementioned measures are not sufficient to comply with the required workplace limit value, additional hall ventilation can help. This sets the air in motion and filters it, while at the same time bringing in new air from outside.
- All extraction systems must be checked every 14 months at the latest. In addition, preventive maintenance must be carried out.
- Ensure health surveillance
- Also ensure that all employees are informed about the dangers of welding fumes, the correct use of protective measures and the necessary maintenance measures.

THE LAW ON WELDING

The law obliges you to protect your workers by controlling the health risks from welding fumes. This obligation applies to specialist welders, workers who carry out welding work occasionally, but also to operators working in the same environment.

WORKPLACE EXPOSURE LIMITS (WELs)

Worldwide, about 11 million people work as welders and another 110 million are exposed to welding fumes at work. Several countries have an occupational exposure limit (OEL) for welding fumes of 5 mg/m^3 and a similar OEL for respirable dust. Given the accumulating evidence of serious health effects from welding fumes <5 mg/m^3 , adequate protection of workers, including a stricter health-based OEL, is urgently needed.

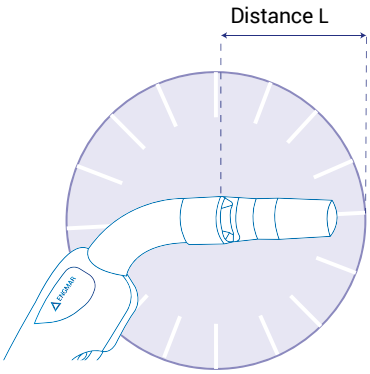
The European Commission has mandated the European Chemicals Agency (ECHA) to propose an OEL for welding fumes at EU level in accordance with the Carcinogens and Mutagens Directive (CAD). Some countries have already introduced such OELs, e.g. Denmark (0.5-1.7 mg/m^3 depending on the welding process and material) and the Netherlands (1 mg/m^3).

Apart from a then general OEL for welding fumes, there are also specific OELs for components such as chromium, nickel, aluminium, lead and manganese, which may be present to varying degrees depending on the welding technique and material. These limit values are set at national level and must already be complied with to protect welders.

REQUIREMENTS OF STANDARD 21904

In order to guarantee the quality of the extraction performance, EN ISO 21904 prescribes the speeds to be observed in the extraction area:

Power	Induced speed
< 200 A	≥ 0,25 m/s
> 200 A	≥ 0,35 m/s



The formula for calculating the induced speed:

$$v = \frac{Q}{(4\pi L)^2}$$

It is assumed that a spherical suction zone is formed around the suction nozzles in which the velocity is the same. Based on the extraction volume Q and the distance L, the so-called induced velocity v can be calculated. At present, the formula is only used for MIG/MAG extraction torches.

Manufacturers of extraction torches are required to state the extraction volume at the gas nozzle, the extraction connection piece as well as the vacuum required for this purpose. These are the minimum values required to maintain the specified induced air velocity.

Only with the help of the motor curve of the extraction unit, it can be determined whether it provides the necessary power. The maximum extraction volume, or the maximum pressure, is not sufficient for this. A check of of the velocity induced at the extraction nozzle is possible mathematically by determining by determining the extraction volume at the gas nozzle of the torch using a pitot tube or hot-wire device as well as an air-tight device.

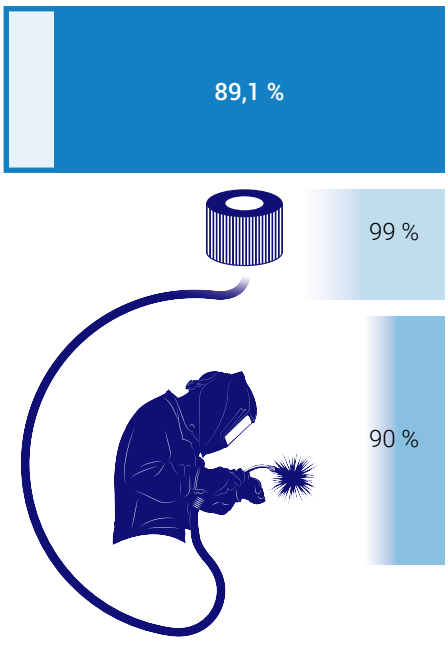
ENGMAR will be happy to assist you in this area

BASIC PRINCIPLES OF WELDING FUME EXTRACTION:

RELATIONSHIP BETWEEN DISTANCE TO THE EMISSION POINT AND EXTRACTED AIR VOLUME

DISTANCE TO THE POINT OF EMISSION	EXTRACTED AIR VOLUME	SOLUTIONS
70 cm	2100 - 4000 m^3/h 1800 - 3600 m^3/h	Extraction walls
40 cm	700 - 1500 m^3/h	Extraction arms
15 cm	100 - 150 m^3/h	Extraction nozzles
0 cm	20 - 150 m^3/h	Extraction torches

COMPARISON BETWEEN EXTRACTION TORCH AND EXTRACTION ARM



EFFICIENCY

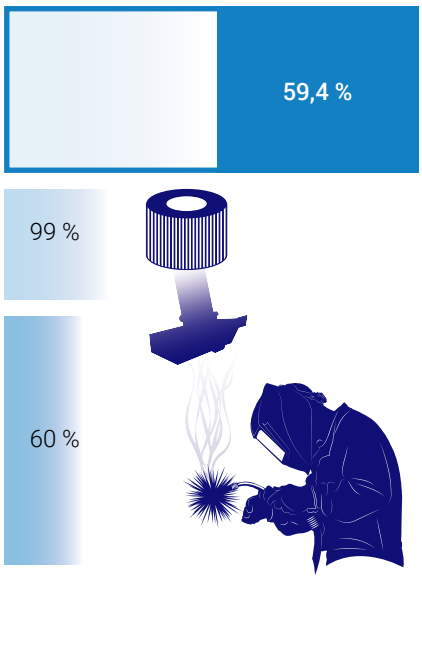
Efficiency is the combination of extraction and separation rate. It provides information about the overall quality of the extraction.

SEPARATION RATE

The separation rate indicates the degree to which the extraction system has filtered the captured air.

CAPTURE RATE

The degree of capture designates the amount of generated welding fumes that is captured and enters the extraction system. The capture rate diminishes with the distance from the point of emission.



Extraction torch

Extraction arm

Your specialist dealer

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La FRENCH FAB

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