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Topic: Control of welding fume.

Applicability: UK only

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In February 2019, the UK Health and Safety Executive (HSE) issued a Safety Alert about the change in enforcement expectations for control of welding fume.[1] All welding fume (including mild steel) is now classed as a carcinogen which can cause lung cancer and has the potential to cause kidney cancer. The reclassification of welding fume as a human carcinogen followed the outcome of published research by the International Agency for Research on Cancer (IARC).[2]

In November 2019, the HSE published further guidance[3] on the expected controls measures to protect workers from the health risks of inhaling welding fume. Action is required to protect both those welding – whether regular or sporadic – and other workers nearby who may be exposed to welding fume.

It is important that employers understand the type and nature of their welding operations in order to select and implement corrective control measures. Different types of welding, whether indoor or outdoor, and different frequency of application may require different control solutions.

Welding hazards

The terms 'welding fume' and 'metal fume' are commonly used to describe all respiratory hazards from welding activities. The constituents of welding fume include very fine metal particles and various gases and vapours. The welding fume formed originates mainly from the consumables used, e.g. electrodes and filler wire, and from the base metal. Gases and vapours are generated by the act of welding or gases that are intentionally used to shield the molten metal of the weld from oxidisation. Contaminants and coatings, such as paint, on the surface of the metals being welded can also decompose and generate gases and vapours.

Shielding gases, (such as argon, helium, nitrogen and carbon dioxide), can present a risk as they can act as asphyxiants by diluting the concentration of oxygen in the air, by displacement. Control of exposure and safe management of welding and allied tasks are particularly important when these are being carried out in confined spaces.

Control of exposure

Each welding and allied task situation is different. The hazard varies and is dependent on the process, e.g. the welding method, the welding consumable, the shielding gas, the base metal, any surface coatings or contaminants, and the location where the task is done.

Types of control

For each welding and allied task implementation of the following control measures should be considered: Mechanical general ventilation, local exhaust ventilation (LEV) and Respiratory Protection Equipment (RPE).

Local Exhaust Ventilation (LEV)

LEV is an extract ventilation system that captures and extracts contaminated air from close proximity of the process. LEV is often considered a primary control measure as it removes the contaminate at source thus protecting the welder and others nearby from exposure to welding fume.

Various types of LEV are available which include: on-torch extraction, extract benches, extract booths movable LEV.

Respiratory Protection Equipment (RPE)

The welding method, duration, location, and other control measures in place will determine whether RPE is required. Where adequate control of exposure cannot be achieved by using LEV alone or where the location or conditions under which the welding activity is taking place prevents the use of LEV, then suitable RPE should be provided to the welder to reduce their exposure.

Suitable RPE will depend on the level of hazard present and the location where the task is taking place. The selection of RPE should consider the amount of welding fume created, the working environment and the requirements of the task and the welder.

RPE options include: FFP3 Filtering Facepiece Particulate Respirators, Reusable Respirator with P3 Particulate Filter(s), Powered Air Respiratory System connected to Welding Headtop, Supplied Air Respiratory System connected to Welding Headtop.

Where the duration of the welding or allied task is expected to be longer that 1 hour, then the HSE recommends that powered or supplied air RPE be used.

Table definitions

The new guidance defines the frequency and duration of welding activity and how this can impact on the control measures, such as ventilation and respiratory protective equipment, deemed to be adequate for the task.

Table 1. provides a summary to the selection of control measures for welding applications and uses the following definitions:

- **High-intensity welding:** repeated welding throughout the shift. Welding arc time of more than 1 hour per welder per shift
- **Low-intensity welding:** welding lasting less than 1 hour per welder per shift
- **Regular welders** will weld for most of their shift and carry out different types of welding and other associated activities in the same day, depending on the requirements of their job. Their exposure to welding fume will be regular and of a significant duration or high intensity
- **Sporadic welders** will carry out welding infrequently when it is incidental to their main manufacturing operation. Engineered fume controls will not normally be expected for occasional welding carried out less than once each week and lasting less than 1 hour. In these situations, ensure that respiratory protective equipment (RPE) and good general ventilation is provided to control exposure to welding fume. But you must also consider the protection of others nearby and ensure the general ventilation is effective at removing and dispersing the welding fume
- **Mechanical general ventilation:** uses fans mounted in the ceiling or high up on a wall to extract the air in the room and draw in clean air to disperse airborne contaminants
- **Local exhaust ventilation (LEV):** uses an air-flow to capture and extract contaminated air close contaminated air close to the process

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Table 1. Guide to the selection of control measures for welding applications

Welding and allied tasks	Frequency and duration of application	Location	Mechanical general ventilation	LEV	RPE Negative pressure* Respirator (A,B)** (Min APF of 20)	RPE Powered welding respirator (C)** (Min APF of 20)	RPE Powered welding respirator (C) (Min APF of 40)	RPE Supplied air welding respirator (D) (Min APF of 40)	RPE Supplied air breathing apparatus (Min APF of 40)
Gas, MMA, FCA, MIG, MAG	Sporadic or occasional low intensity welding	Indoors		✓					
			✓		✓	✓	✓	✓	
	Regular high-intensity welding	Indoors		✓	✓	✓	✓	✓	
Gas, MMA, FCA, MIG, MAG, TIG	Regular high-intensity welding	Outdoors			✓ Where LEV is not reasonably practicable	✓ Where LEV is not reasonably practicable	✓ Where LEV is not reasonably practicable		
TIG and Resistance spot welding	Sporadic or occasional low intensity welding	Indoors	✓		If adequate control from mechanical general ventilation alone is not possible, suitable RPE will be required				
TIG and Resistance spot welding	Regular high-intensity welding	Indoors		✓	If adequate control from LEV alone is not possible, or it is not reasonably practicable to provide LEV, suitable RPE will be required				
All	All	Confined space						✓**	✓**
Arc-air gouging	All	Indoors		✓			✓ For tasks <30 mins	✓ For tasks >30 mins	✓ For tasks >30 mins
Plasma arc cutting	All	Indoors		✓	If adequate control from LEV alone is not possible, or it is not reasonably practicable to provide LEV, suitable RPE will be required				
Manual gas and oxy-gas cutting	All	Indoors	✓		✓	✓	✓	✓	
		Outdoors			✓	✓	✓		

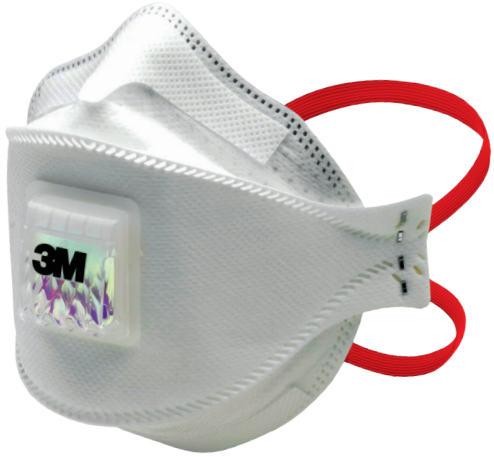
*Fit testing is required. **Depends on risk assessment.

Please note: To achieve the expected level of protection, respirators that comprise a tight-fitting face seal, e.g. FFP3 disposable respirator, require the wearer to be suitably fit tested and clean shaven in the area of the face seal.

For advice on selecting the most appropriate 3M RPE for you, your situation and your workforce contact your local 3M representative or our health and safety helpline on **0870 60 800 60 (UK)**.

Examples of suitable RPE (depending on your risk assessment) may include:

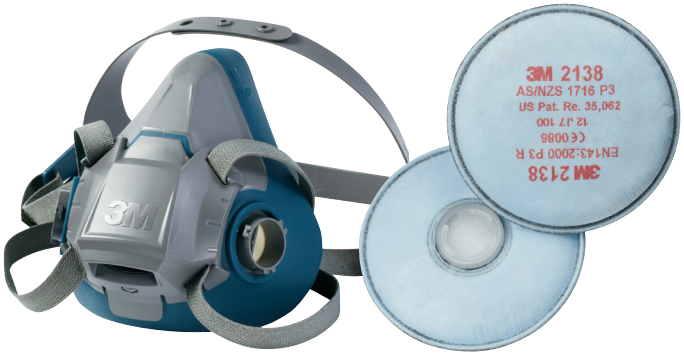
A FFP3 Disposable Respirator



3M™ Aura™ Particulate Respirator 9332+Gen3

APF = 20

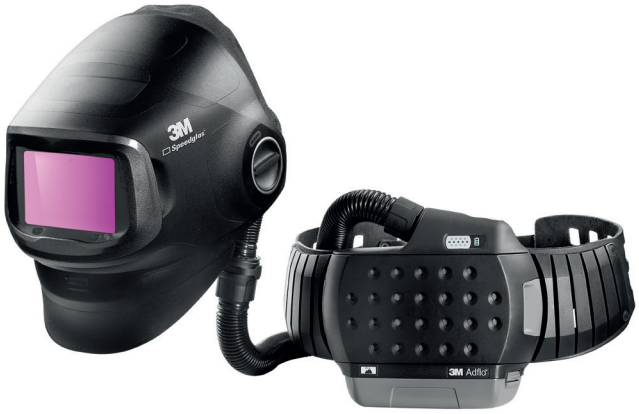
B Reusable Respirator with P3 Particulate Filter(s)



3M™ Reusable Half Face Mask 6500 Series with 3M™ 2138 P3 R Particulate Filter

APF = 20

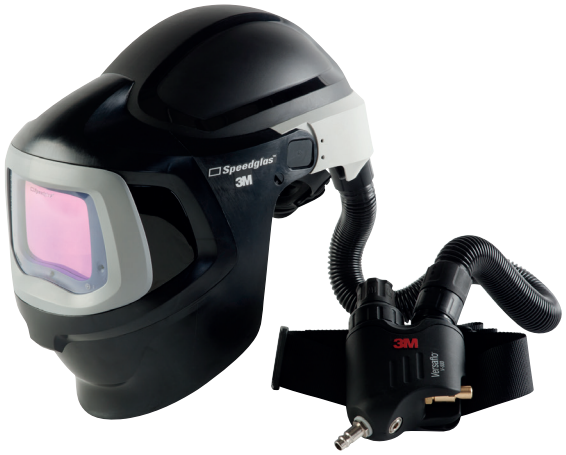
C Powered Air Respiratory System connected to Welding Headtop



3M™ Speedglas™ Welding Helmet G5-01 with 3M™ Adflo™ Powered Air Respirator

APF = 40 in this combination (TH3)

D Supplied Air Respiratory System connected to Welding Headtop



3M™ Speedglas™ Welding Helmet 9100MP with 3M™ Versaflo™ Supplied Air Regulator V500E

APF = 40* in this combination (3B)

References

1 Change in Enforcement Expectations for Mild Steel Welding Fume http://www.hse.gov.uk/safetybulletins/mild-steel-welding-fume.htm [Accessed 28 November 2019].

2 IARC Monographs on the Evaluation of Carcinogenic Risks to Humans Volume 118 http://publications.iarc.fr/569. [Accessed 28 November 2019].

3 HSE Welding fume: protect your workers http://www.hse.gov.uk/welding/ [Accessed 28 November 2019].

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