

ARL 071 - Working guideline regarding respiratory protection

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Inhalation of hazardous gases, vapours, mists and/or dusts can cause damage to health. Personal safety at the workplace therefore often includes suitable respiratory protection as part of personal protective equipment (PPE). The employer must - if necessary - always provide the employees with reasonable PPE. He/she must ensure that the PPE is always used as intended. The employee is obliged to use the PPE made available to him/her and not to impair its effectiveness.

This working guideline provides guidance on the selection of respiratory protective devices. Respiratory protective devices are used if there is an ambient atmosphere that is hazardous to health and the health of the employees cannot be adequately protected by technical or organisational protective measures.

1 Product types - Filter units

The following product types are distinguished:

- Filter units
 - With negative pressure (normal ventilation)
 - Particle-filtering half-face masks (FFP)
 - Masks with replaceable filters
 - Half-face masks
 - Full-face masks
 - With overpressure (filter units with fan)
- Insulating devices
 - Hose devices
 - Container devices
 - Regeneration devices

1.1 Particle-filtering half-face masks (FFP1, FFP2, FFP3)

Half-face mask consisting entirely or mainly of filter material. Used for protection against dust and aerosols (mist). Covers the nose, mouth and chin, must be adequately sealed against the ambient atmosphere by additional equipment such as double straps, sealing frames and nose stirrups when speaking, when moving the head and when the skin is dry or damp (Figure 1). Exhaled air flows out through the filter material and/or an exhalation valve into the ambient atmosphere. Service life usually designed for one shift only.

1.2 Masks with replaceable filters

Consist of mask body and replaceable filter. The filter defines the protective effect and the protection factor of the mask. Used for protection against vapours, gases, particles and combinations thereof.



Fig. 1.1: Particle-filtering half-face mask

1.2.1 Half-face masks with particle filter (P1, P2, P3)

Covers nose, mouth and chin, consists of mask body with strap, connector and filter (Figure 2). It must provide an adequately tight seal against the ambient atmosphere when speaking, when moving the head and when the skin is dry or damp.



Fig. 1.2.1: Half-face mask with particle filter

1.2.2 Full-face masks

Consists of mask body with strap, connector and filter (Figure 3) It must provide an adequately tight seal against the ambient atmosphere when speaking, when moving the head and when the skin is dry or damp.



Fig.1.2.2.: Full-face mask

1.3 Filter units with fan

These are units with integrated fans. Aspirates ambient air through replaceable filter and feeds the purified air to the wearer via hood or mask (according to standard EN 14594).

Fan filtering devices filter the ambient air and supply it to the wearer under slight overpressure. Fan filtering devices can be used anywhere. The protective effect of fan filtering devices is only guaranteed with appropriate maintenance. Filters and batteries must be changed or recharged relatively often. They require special care.

1.4 Compressed air hose devices (insulating devices)

Compressed air hose devices supply the wearer with outside air via the compressed air line (Figure 4). They are frequently used wherever compressed air is already available for other reasons. It must be ensured that the compressed air used as breathing air is processed. It must be clean and be able to be cooled or heated and humidified as required. Such respiratory protective systems supply the wearer with processed air. This means that they do not create any resistance when inhaled and the risk of leakage is reduced.



Fig.1.4: left: Hood for a compressed air hose device; right: complete PPE: Compressed air hose device according to EN 14594 class 3 with hood, safety goggles, chemical protection suit (type 5) and gloves. The compressed air hose is connected to the belt and supplies the half-face mask and spray gun with air.

2 Filter

A distinction is made between:

- particle filter
- gas filter (activated carbon filter)

Gas filters are often combined with particle filters or particle filters are used as pre-filters. The class of the filter shows its protective effect. A higher filter performance usually causes a higher breathing resistance.

If the wearing of personal protective equipment is not required by law it is recommended by us. Country-specific laws must always be observed!

Attention regarding Switzerland: The occupational hygiene and furnishing measures laid down by SUVA must be observed.

2.1 Respiratory protection for suspended particles

Particle filters are made of the finest fabric or fleece materials. Depending on the properties of the pollutant, e.g. particle size, surface condition, density, the dust particles are separated on the fibre surface by various filtration mechanisms:

- Direct impact with the fibre
- Electrostatic effect between dust particles and fibre surface
- Approach through the air flow to the fibre surface

Via the electrostatic charging of their fibres, the smallest dust particles are separated in the fine dust layer and attached to the fibres. The use of several fine dust filter layers and special sealing lips distinguish particle-filtering half-face masks of protection levels FF P2 and FF P3. In the coarse dust filter layer, larger particles are mechanically prevented from entering the filter material.

Depending on the quality of the filter layer, there are 3 protection levels for particle-filtering half-face masks (see EN 529):

- FFP1: low retention capacity, up to 4 times the limit value
- FFP2: medium retention capacity, up to 10 times the limit value
- FFP3: high retention capacity, up to 30 times the limit value

Otherwise, the following classification regarding the quality of the filter sheets applies (see EN 529):

- P1: low retention capacity, up to 4 times the limit value
- P2: medium retention capacity, up to 10 times the limit value (15 for full-face masks)
- P3: high retention capacity, up to 30 times the limit value (400 for full-face masks)

Furthermore, the multiple of the limit value must not exceed the retention capacity of the filters.

2.2 Respiratory protection filters for gases and vapours

Gas filters are used with either half-face or full-face masks and are divided into three classes according to their retention capacity (absorption capacity) (EN 14387):

- Class 1: Low retention capacity, maximum for 0.1 vol% or 1,000 ppm¹⁾
- Class 2: Average retention capacity, maximum for 0.5 vol% or 5,000 ppm¹⁾
- Class 3: High retention capacity, maximum for 1 vol% or 10,000 ppm¹⁾

¹⁾ values apply to class A - organic gases/vapours

Likewise, the protection factors also apply here, i.e. with a full-face mask, at most 400 times the limit value!

Filter types according to EN 529

Designation	Colour code	suitable for
A	brown	organic gases/vapours with boiling point > 65 °C
AX	brown	organic gases/vapours with boiling point ≤ 65 °C For single use only!
B	grey	inorganic gases/vapours except CO
Hg-P3	red-white	Mercury Maximum holding time 50 hours!
E	yellow	Sulphur dioxide and other acid gases/vapours
K	green	Ammonia
NO-P3	blue-white	Nitrous gases For single use only!

Note: Even in state-of-the-art spray booths that are regularly cleaned and maintained, the workplace limits are often exceeded when spraying isocyanate-containing paints. To counteract this health hazard, effective respiratory protection must always be worn. So-called paint spray masks or particle-filtering half-face masks (fine dust masks) are not sufficient. Fine dust masks have no protective effect against gases and vapours.

2.3 Combinations

If several gases/vapours are present at the same time, against which different types of gas filters are to be used, multi-type gas filters (e.g. ABEK) must be used. If the situation is unclear, an ABEK filter should be used in any case.

Combination filters simultaneously protect against the respective gases and particles.

Example: Class protection factor A2P2

A2: Gas filter type A (organic compounds) - medium category

P2: Particle filter of medium filter performance

Annex 1 lists which application requires which respiratory protection.

3 Organisational protective measures

During spraying, no other work may be carried out in the spray rooms and discharged vapours must not endanger other workers. Spraying work may only be carried out by employees who are familiar with the risks involved. Reduce aerosol exposure.

The aerosol exposure can be significantly reduced by the following measures:

- Selection of a spraying machine with as little mist as possible
- Setting the optimum air pressure for compressed air guns
- Guiding the spray jet perpendicular to the surface of the workpiece
- Avoiding spray painting against the air flow

Maintenance

The technical equipment, especially the extraction system, must be checked regularly for proper functioning. In particular, dirty filters must be replaced in a timely manner.

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Never make changes to the respiratory protective mask.

Limited service life

All types of filtering masks and filter cartridges have a limited lifetime. Masks or filters must therefore always be replaced in good time to ensure effective protection. Particle-filtering half-face masks should be changed, for example, if the filter fleece is clogged with particles. The mask wearer becomes aware of this when breathing with difficulty. Filtering half-face masks that cannot be cleaned must be replaced at the end of a work shift. Gas filters must be replaced when the pollutant odour is perceived through the filters. Most gas and particle filters or filtering half-face masks have a maximum storage period of 3 years. Gas filters that have been removed from their original packaging may be stored, even unused, for a maximum of 6 months!

4 PSA-V 2014 - Training

According to the Ordinance on Personal Protective Equipment (PSA-V 2014), employers must ensure that employees are trained in putting on and taking off respiratory protective devices and in functional testing. Particularly in the field of respiratory protection, instruction, exercises and inspections of PPE must be carried out at specified intervals. This must be done by a demonstrably competent person for the respective respiratory protective products. Exercises for putting on and taking off respiratory protective devices must be carried out at intervals of no more than six months. These exercises must repeat instruction about the functional testing.

The training shall include in particular:

1. operating conditions, handling and maintenance,
2. correct putting on and taking off of the respiratory protective devices,
3. functional testing,

4. permitted wearing period,
5. behaviour in emergencies,
6. any necessary measures between the wearing periods,
7. role of safety and warning devices

The respiratory protective mask is only effective if it is correctly selected, fitted and worn throughout the period of exposure to a hazardous substance.

The following applies to the testing of respiratory protective devices:

1. Filtering and insulating devices must be inspected at least quarterly by qualified persons to ensure that they are in proper condition and that the protective function is maintained. This does not apply to disposable filter masks.
2. Filtering and insulating devices may only be used if the necessary tests have been carried out.

5 Bibliography

- TRGS 430 Isocyanates - Risk assessment and protective measures
- M719, Safety compact, AUVA, respiratory protective filter against suspended particles, gases, vapours, 2017
- SUVA Pro, Spray painting with polyurethane paints, 2012

Other standards:

- EN 136 Full-face masks
- EN 143 Particle filters
- EN 149 Particle-filtering half-face masks
- EN 405 Half-face masks for use with replaceable filters
- EN 529 Respiratory protective devices - Recommendations for selection, use, care and maintenance
- EN 12941 Fan filtering devices with hood
- EN 12942 Fan filtering devices with full-face masks or half-face masks
- EN 14387 Gas filters and combination filters
- EN 14594 Compressed air hose units