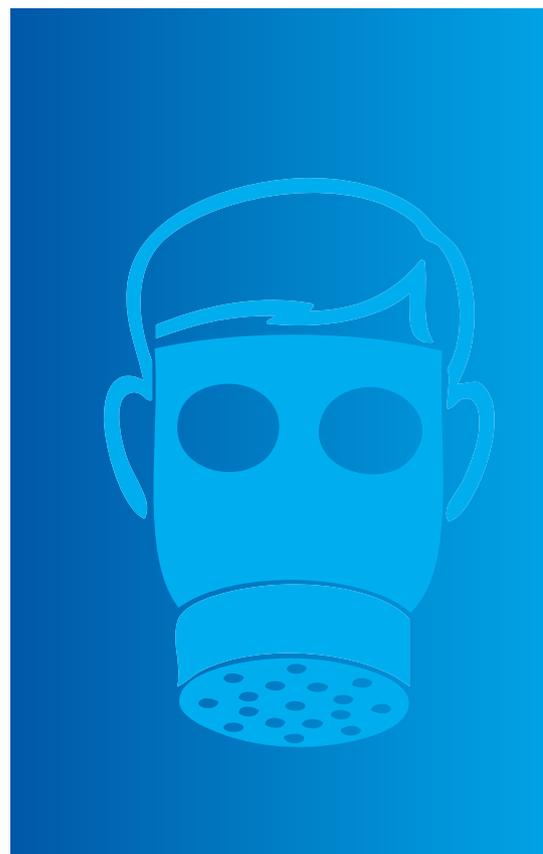




# A Guide to Respiratory Protective Equipment

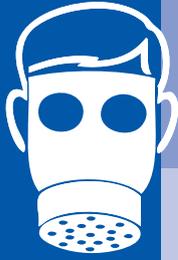




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## 1.0 Introduction

**Respiratory Protective Equipment (RPE) not worn or selected appropriately is totally ineffective and may give the user a false sense of protection.**

The aim of these guidelines is to provide basic information and general guidance on the selection, use and maintenance of respiratory protection in the workplace. The guidelines predominantly provide advice in relation to respirators; further specialist advice should be sought for breathing apparatus types, in consultation with a qualified Occupational Hygienist or appropriate Health and Safety Professional.

These guidelines are not intended to be a legal interpretation of Chapter 3 of Part 2 of the Safety, Health and Welfare at Work (General Application) Regulations, 2007 (S.I. No. 299 of 2007).

## 1.2 What is RPE?

Respiratory Protective Equipment (RPE) is a particular type of Personal Protective Equipment (PPE), used to protect the individual wearer against inhalation of hazardous substances in the workplace air. RPE should only be used where adequate control of exposure cannot be achieved by other means, in other words, as a last resort on the hierarchy of control measures (see figure 1). Employers are required to firstly attempt to eliminate the hazard at source. RPE should only be used after all other reasonably practicable control measures have been taken. PPE is considered a last resort because it only protects individual workers, is prone to failure or misuse, such as wearing the wrong RPE for the job, and employees wearing RPE may get a false sense of security when using RPE.

## 1.1 Who are these guidelines for?

These guidelines are for employers, employees and those responsible for health and safety in the workplace, in small to medium sized businesses in particular. They are designed to give practical advice to protect the health and safety of employees through the use of Respiratory Protection. The main topics covered will be the selection, fit testing, use and maintenance of RPE.

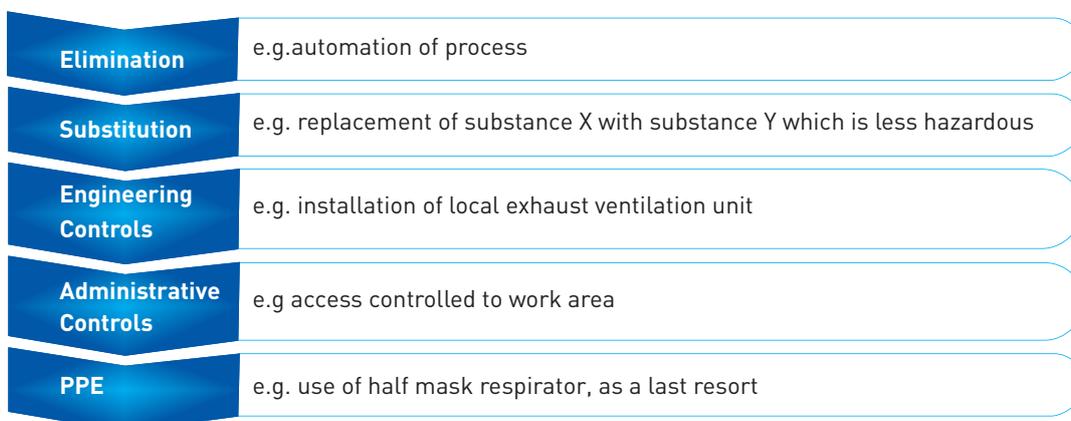
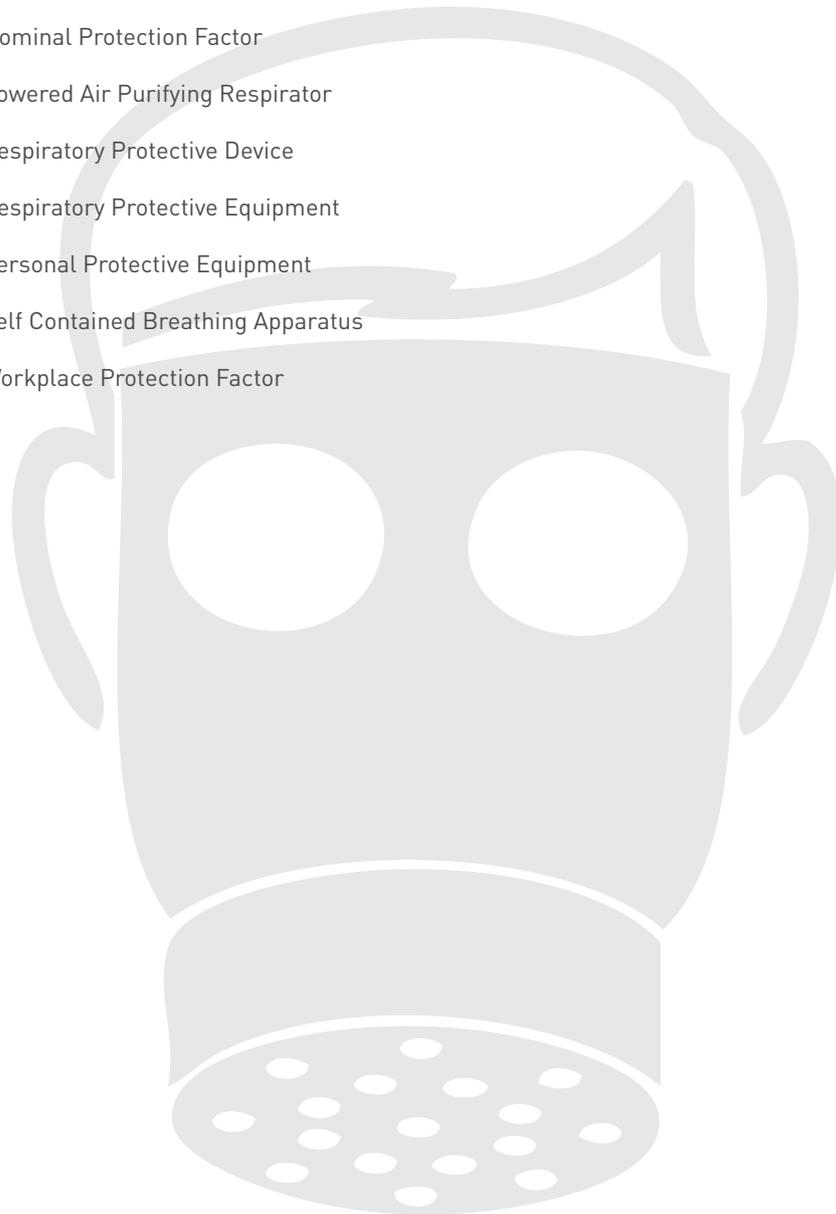


Figure 1: The Hierarchy of Controls

## 2.0 Abbreviations Used

<b>APF</b>	Assigned Protection Factor
<b>BA</b>	Breathing Apparatus
<b>CE</b>	Conformite Europeene
<b>FFP</b>	Filtering Facepiece- number indicates filter type
<b>FF</b>	Fit Factor
<b>HEPA</b>	High Efficiency Particulate Air
<b>NPF</b>	Nominal Protection Factor
<b>PAPR</b>	Powered Air Purifying Respirator
<b>RPD</b>	Respiratory Protective Device
<b>RPE</b>	Respiratory Protective Equipment
<b>PPE</b>	Personal Protective Equipment
<b>SCBA</b>	Self Contained Breathing Apparatus
<b>WPF</b>	Workplace Protection Factor



### 3.0 What am I legally obliged to do?

The Safety Health and Welfare at Work Act, 2005 (S.I. No 10 of 2005) requires the provision of a safe place of work; this applies to employees, employers and the self employed. Section 19 of the Safety, Health and Welfare at Work Act 2005, requires that employers and those who control workplaces to any extent must identify the hazards in the workplaces under their control and assess the risks to safety and health at work presented by these hazards. The results of any risk assessments should be written into the safety statement.

#### Employers' duties

Legislation relating to RPE is contained in Chapter 3 of Part 2: Personal Protective Equipment of the Safety, Health and Welfare at Work (General Application) Regulations, 2007 (S.I. No 299 of 2007).

These regulations require the provision and assessment of PPE in the workplace. Employers shall determine the conditions of use of PPE, in particular, assess the **adequacy** of PPE selected. An employer shall ensure that the use of an item of PPE provided is normally confined to one employee. Where it is necessary for RPE to be used by more than one employee, arrangements should be made by the employer to have RPE cleaned and disinfected before use by another individual.

Personal Protective Equipment is required to be **maintained** and replaced appropriately. An employer must provide **information, training and instruction** for all PPE provided for use by an employee. The employer is also obliged to ensure that there is adequate **supervision** provided. The RPE must be provided without charge.

Schedule 2, Part A, to the Safety Health and Welfare at Work (General Application) Regulations, 2007 (S.I. No 299 of 2007) provides a non-exhaustive list of activities which may require provision of RPE.

In relation to mandatory signage required for RPE, Schedule 9 to the Safety, Health and Welfare at Work (General Application) Regulations 2007 (S.I. No. 299 of 2007) sets out the requirements for safety signs which must be used at all workplaces when hazards cannot be avoided or adequately reduced (see Appendix 5).

#### Employees' duties

Section 13 of the Safety, Health and Welfare at Work Act, 2005 places a duty on employees, having regard to their training and instructions to make correct use of PPE.

Employees should:

- Use RPE properly whenever it is required to be used
- Report any defects in or damage to the RPE immediately
- Participate in any training or instruction provided on RPE
- Inform their employer of any medical conditions they have that might be affected by the use of the RPE provided to them
- Ensure that RPE provided for their use is returned to storage after use

### 4.0 Standards

European harmonised standards for respiratory protective equipment have been developed as a means of demonstrating equipment conformity with the basic health and safety requirements of the EC Personal Protective Equipment Directive (89/686/EEC). This directive is implemented in Ireland as the European Communities (Personal Protective Equipment) Regulations, 1993.

Only equipment which meets these requirements is entitled to carry the **CE** mark and be sold for use in the EC. The numerous European Norm (EN) standards contain design, marking and performance requirements for manufacturers of the different types of equipment, a list is detailed in Appendix 4, certain standards also give guidance on usage and selection, such as EN 529.

## 5.0 Types of Respiratory Protective Equipment

There are two types of RPE that are commonly used in the workplace, either filtering devices or breathing apparatus device types (see figure 2).

### Filtering device types (negative respirators)

A range of different types exist, dust masks, half mask respirators, full face mask respirators and powered (fan assisted) respirators. These use filters to remove the contaminants in the workplace air. In a negative pressure device one or more air purifying filters are attached via an inhalation valve to a tight fitting face piece. The negative pressure relative to the ambient air outside the respirator is created by inhalation of air, drawing the contaminated air through the purifying filter.

### Breathing Apparatus (BA) types (positive respirators)

A range of different types exist, fresh air hose, airline, and demand valve; use an independent supply of breathing quality air, for example an air cylinder or compressor. Powered air purifying respirators, supplied air and self containing breathing apparatus are all positive pressure devices. The pressure on the inside of the respiratory inlet exceeds the ambient air pressure outside the respirator. As a general rule, positive pressure devices are used for more hazardous exposures.

Surgical masks are not considered RPE. Nuisance dust masks are excluded from this guidance.

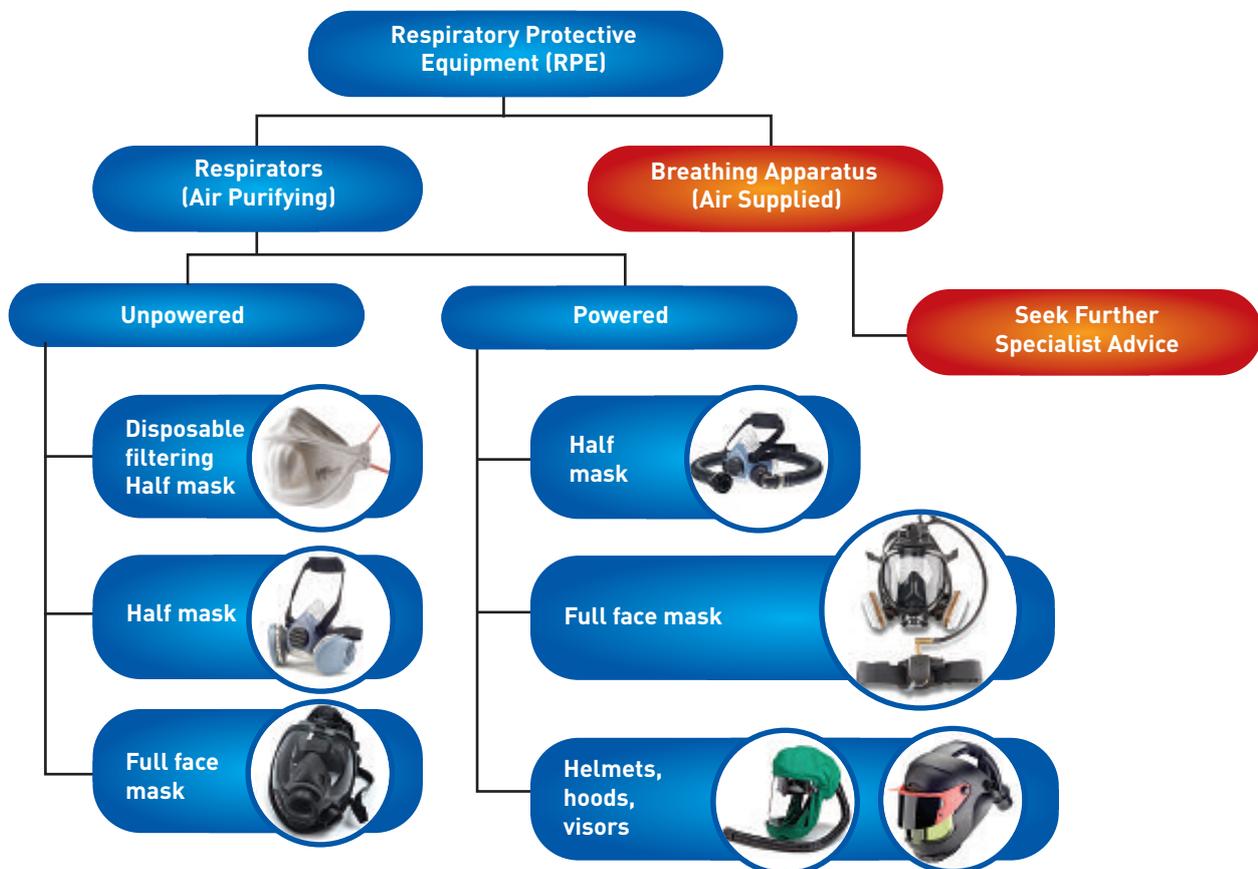


Figure 2: Respirator and Breathing Apparatus Types

## 6.0 Selection of Respiratory Protective Equipment

**The correct selection of appropriate RPE for the task undertaken is one of the most important steps in the RPE lifecycle process. Failing to select, fit-test, use, store and maintain correct RPE will lead to exposure of hazardous substance(s) at work. Using incorrect RPE can potentially lead to workplace fatalities, in areas of low oxygen concentration or confined spaces for example.**

There are four separate areas that need to be considered when selecting RPE, which you may need to discuss with your equipment supplier:

### 6.1 Equipment factors

- Must be CE-marked
- Must be adequate for the task in hand
- Must be compatible with the environment, the task, the wearer and other personal protective equipment used
- Must be in good working order

### 6.2 Work environment factors

- Is the atmosphere potentially oxygen deficient?
- Are any asphyxiants present or is there potential for sudden release and their likely concentrations?
- Is the atmosphere immediately dangerous to life or health?
- Is the atmosphere corrosive or likely to become so?
- Is the atmosphere explosive or likely to become so?
- What are the permeation capabilities of air contaminants (e.g. via facepiece and filters)?

- What is the physical state (e.g. gas, mist, dust, fume) of the contaminant?
- What is the temperature and humidity of the atmosphere?

### 6.3 Task related factors

- What are the work rates involved?
- Are there visibility requirements?
- Are there any mobility requirements including spatial conditions of the environment?
- Are there any communication requirements?
- Is there likely to be thermal strain on wearer?
- Are any other accessories worn in the area in contact with the device?
- What tools are to be used?
- Are there any other pieces of personal protective equipment to be worn in addition to a respiratory protective device?
- What is the duration of wear?
- Will manual handling be involved and how will this affect the type of RPE chosen?

### 6.4 Individual factors- the following need to be taken into consideration during RPE selection

- Medical fitness of the wearer (e.g. asthma, bronchitis or heart disease)
- Facial characteristics of the wearer including facial hair
- Physical characteristics of the wearer
- Use of spectacles
- Use of contact lenses
- Assessment of the fit of tight-fitting facepiece

**Example Scenario:**

- Having conducted a risk assessment for a timber processing task and using the hierarchy of controls it has not been possible to eliminate all the risks involved in the task. RPE is required to control the residual risk associated with timber processing dust exposure four times a day when other controls are in place.
- The work is not being undertaken in a confined space or a space lacking oxygen. The hazard is exposure to a softwood dust from a woodworking process over an 8 hour shift. It is known from monitoring results, that the average daily personal exposure of workers in the workshop to softwood dust is 30mg/m<sup>3</sup>.
- Softwood dust has an Occupational Exposure Limit Value (OELV) of 5mg/m<sup>3</sup> and is also a sensitiser. The appropriate type of filter for the filtering RPE is type P-particulate filter to protect against wood dust, a P2 filter is selected, since the level of respiratory protection required is calculated by dividing the measured level of the contaminant in the air by the OELV which is 30/5= 6.
- Therefore the RPE needs to have an APF of >6, so an FFP2 mask should be selected, since it gives a protection factor of 10, as recommended by the company's PPE supplier, provided it is worn correctly.
- The RPE was individually fit tested and each employee was shown how to carry out pre-use checks, don correctly, fit check before use, clean and store the RPE. This fit testing was recorded in a logbook with dates of when each piece of RPE was put into use (see Appendix 2 for a sample RPE testing programme template).
- The section supervisor's ensures the RPE is being worn all the time during work while the timber processing is taking place. The RPE is stored in a clean area away from the timber processing zone.
- The RPE should undergo regular maintenance by a competent person during its usage lifespan, as recommended by the manufacturer.

## 7.0 Filters

### 7.1 Filter Types

Choosing the correct filter type is a critical aspect in the RPE selection process. Use of the incorrect filter such as a particulate filter for protection against vapours will result in no protection being given and the equipment will be completely ineffective.

There are 3 main filter types:

- Particle filter (P sign and filtration efficiency number 1, 2 or 3)



- Gas/vapour filter



- Combined filters (for particles, gases & vapours)



**Table 1: Types of particle, gas and vapour filters (courtesy of NSAI)**

Substance	Filter Type	Colour
Particles	P	White
Organic gases and vapours (BP>65°C) as specified by the manufacturer	A	Brown
Inorganic gases and vapours as specified by the manufacturer (excluding carbon monoxide-CO)	B	Grey
Sulphur dioxide and other acid gases and vapours as specified by the manufacturer	E	Yellow
Ammonia and organic ammonia derivatives as specified by the manufacturer	K	Green
Mercury	Hg – incorporates P3 filter and for single use only	Red-White
Oxides of nitrogen	NO – incorporates P3 filter and for single use only	Blue-White
Organic gases and vapours (BP ≤65 °C) substance as specified by the manufacturer	AX single use only	Brown
Filters against specific substances as specified by the manufacturer	SX marked with the name of the chemical	Violet, Violet-White if combined with particle filter

**Note:** Many of these filters can be used with filtering devices relying on the breathing action of the wearer (negative pressure devices) and also with powered devices. Filters may carry two sets of classification, one for negative pressure devices the other for the powered devices. The powered device marking is not relevant when used with negative pressure devices and vice versa.

Particle filters are divided into three classes:

- P1=low efficiency filters
- P2=medium efficiency filters
- P3=high efficiency filters

Gas/Vapour filters are also divided into three classes:

- A1/B1 = low capacity filter
- A2/B2 = medium capacity filters
- A3/B3 = high capacity filters

These are then further divided according to the gases they protect against.

Filters can also be combined or multi type; for further information refer to **IS EN 133 Respiratory Protective Devices-Classification**. The manufacturer's recommendations should be followed on replacement of filters.

### 7.2 Protection Factors

A respiratory protective device is considered adequate if it has the capacity to reduce the wearer's exposure to a hazardous substance to acceptable levels (e.g. to comply with occupational exposure limit values). Each RPD has a protection factor (PF) assigned to it, which is the ratio of the airborne concentration of the substance outside the device to that inside the device.

Therefore, you need to determine the expected concentration of the contaminant(s) in the air (a monitoring programme may be required to establish

this) in order to calculate the PF required. PF's have a wide range from low protection factors to high e.g. from 4 to 2000.

There are three types of protection factor (PF):

- **APF-Assigned Protection Factor**, which best reflects the workplace conditions, is the value to use when selecting RPE. Some APFs for specific types and classes of device are published in IS EN 529:2005 (Annex C). For example, an APF of 4 gives a lower level of protection than an APF of 20.
- **NPF-Nominal Protection Factor**, this level of protection is unlikely to be achieved in real use situations, since the testing is carried out in a laboratory situation and does not give a good estimate of the effectiveness of the respirator.
- **WPF-Workplace Protection Factor**, this is the ratio between the breathing zone concentration of the contaminant outside the face-piece and the concentration inside the face-piece of the contaminant in a correctly functioning RPD e.g. a concentration of 400ppm Chloroform in the atmosphere and a concentration of 1ppm inside the mask gives an WPF of 400.

For example, an airborne dust contaminant which has an Occupational Exposure Limit Value of 5mg/m<sup>3</sup> may be present in concentrations of up to 60mg/m<sup>3</sup>. Thus a particle filter will need to reduce the concentration by a minimum of a factor of 12. Thus a P3 particle filter should be selected which has an APF of 20.

CE Marked Particle Filter Type	APF (what is likely to be attained in practice)
P1	4
P2	10
P3	20

Table 2: Filter types and APFs

Decisions about the types of RPE to be used in the event of an accident, incident or emergency should be made with regard to the level and type of risk and a worst case estimate of the likely concentration of a hazardous substance and any possible combustion product (s) in the air or other hazards generated in the workplace during the incident, therefore a higher Protection Factor may be required.

## 8.0 Facepiece Fit Testing

It is recommended that fit testing is carried out for all tight fitting respirators. The purpose of fit testing is to ensure a good fit of the mask to the individual and is applicable to tight fitting filtering face masks. It is also useful for checking that the wearer can put on a respirator face piece correctly themselves. The correct establishment of a tight seal on the face piece at all times is vital to prevent exposure.

There are 2 methods of Fit Testing: Qualitative or Quantitative.

### 8.1 Qualitative fit testing

This is suitable for disposable filtering face pieces. Qualitative methods are based on the wearer detecting leakage through the face seal region using a bit-



Qualitative method of fit testing

ter/sweet tasting aerosol or odour compounds e.g. Saccharin, this is a pass or fail test only.

### 8.2 Quantitative fit testing

This is suitable for full and half face mask respirators and gives a numerical measure of the fit. Specialised equipment is required to conduct the measurement, which typically involves a laboratory test chamber or a portable fit testing device. This is a more stringent pass/fail test that demonstrates the level of performance of the respirator with a measurable result for a particular mask on a particular individual. Fit factors (FF) are calculated from quantitative testing in a laboratory; your fit testing service provider should be able to help you select the most appropriate method in conjunction with a qualified Occupational Hygienist.



Quantitative method of fit testing



Quantitative method of fit testing

### 8.3 Conducting Fit Testing

RPE fit testing should be conducted by a competent person (as defined in Part 1 of the Safety, Health and Welfare at Work Act, 2005) who has adequate knowledge and has received training in fit testing. There is currently no recognised certification for persons who perform respirator fit testing. Manufacturers of fit testing equipment may offer suitable training or advise you on how to perform relevant tests, when initially selecting RPE. The **IS EN 529:2005** standard also includes fit testing when assessing the suitability of selected RPE in the section on **Adequacy and Suitability**.

### 8.4 Repeat Fit Testing

A repeat fit test should be conducted in the following circumstances:

- Where the wearer loses or gains weight
- Develops any facial changes (scars, moles, etc) around the face seal area
- Or when the employer's health and safety policy requires it

If an employee does not pass a fit test for an RPD one may obtain a better fit by trying a respirator of a different size or model or made by another manufacturer. Alternatively a respirator that doesn't rely on a tight face seal, such as a hood type may be selected. Tight fitting face piece respirators must not be worn by individuals who have a beard or moustache. Respirators that do not rely on a tight seal such as hoods or helmets may be used by these individuals instead.

The testing of power assisted or breathing apparatus face pieces is carried out with the respirator temporarily converted into a negative pressure respirator by adapting the face piece to use a P3 filter instead of the air supply. Respirator manufacturers can supply these adapters. There is no requirement to fit test loose fitting equipment, however the employer should establish that the full protection is afforded by the equipment.

## 9.0 Misuse of RPE

RPE can be misused a number of different ways through incorrect initial selection, incompatibility with other PPE being worn, wearer compatibility issues or maintenance and cleaning not being carried out. Extra precautions should be taken when working in confined spaces, due to the potential for reduced oxygen levels, it is never suitable to use a filtering respirator in a confined space; a breathing apparatus should be provided instead.

## 10.0 Training and Records

### 10.1 Training

All wearers should be given both initial and regular refresher training for use of RPE. At a minimum, the training should cover: why RPE is required, how it works, the limitations of RPE, how to maintain RPE, how to perform a fit check before each use and how to correctly put on and remove RPE.

All supervisors should also be trained to monitor the correct use of RPE and employees should be supervised in this regard. Supervisors should also be aware of the reasons for providing RPE.

### 10.2 Records

An Employer should keep records of:

- Risk assessment(s)
- Evidence of review of RPE effectiveness
- Assessment of adequacy and the suitability of the device e.g. fit test certificates
- Repair and maintenance
- Details of the training provided to the wearers, supervisors and those who maintain RPE

## 11.0 Storage and Maintenance

### 11.1 Storage

RPE should be stored under suitable conditions, complying with the manufacturer's instructions, to prevent damage or contamination. RPE should not be stored in areas that are contaminated or with contaminated work clothing. Storage should be readily accessible and convenient to the place of work. RPE awaiting repair or cleaning should be clearly marked "for repair" or "for cleaning" and stored separately.

Where there is a risk to persons handling contaminated RPE, it should, before being dispatched for disposal/cleaning be packed in suitable containers to prevent the escape of the hazardous contaminant. They should be labelled to indicate the hazardous material.

### 11.2 Maintenance

Proper maintenance is essential to ensure the RPE works correctly and provides the appropriate level of protection. Maintenance should include, where appropriate, cleaning, disinfection, examination, repair, testing and record keeping. Cleaning of reusable RPE is required, following the manufacturer's instructions for cleaning and disinfecting using recommended cleaning agents and procedures. Maintenance of RPE should only be carried out by a competent person and is a requirement of the Safety, Health and Welfare at Work (General Application) Regulations, 2007.

### 11.3 Pre-Use Checks

Checks should be undertaken prior to use of the RPE to ensure it has not been damaged or deteriorated since the last use. Certain physical checks can be carried out by the employee using the RPE such as:

- Are there any signs of wear and tear or damage?
- Are all the components within expiry dates?
- Are valves and seals fully intact if present?
- Ensure the RPE works properly by performing a fit check, the RPE manufacturer should provide instructions on how to carry out a pre-use fit check of the face piece.

If any problems are found, these should be reported to the employer.

## 12.0 References and Further Information

European Agency for Safety and Health at Work, Respiratory Sensitisers Factsheet 39

Health and Safety Authority, Guidelines on Occupational Asthma

Health and Safety Authority, Guidelines to the Safety, Health and Welfare at Work (Chemical Agents), Regulations, 2001 (S.I. No. 619 of 2001)

Health and Safety Authority, Guide to the Safety, Health and Welfare at Work (General Application) Regulations, 2007- Chapter 3 of Part 2: Personal Protective Equipment

Health and Safety Executive, UK (2005) Respiratory Protective Equipment at Work-a practical guide HSG 53

Irish Standard IS EN 529 Respiratory Protective Devices-Recommendations for selection, use, care and maintenance

UK Clean Air Take Care Campaign: <http://www.cleanairtakecare.org/>

## 13.0 Appendix

### Appendix 1: Checklist for Respiratory Protective Equipment:

Criteria	Y/N	Action Required
Are all employees provided with RPE identified by the risk assessment?		
Does your purchasing policy for new RPE recognise the need for CE marking?		
Are employees trained in the use of RPE?		
Are staff aware of the dangers involved if RPE is not worn or not worn correctly?		
Are employees effectively supervised to ensure RPE is worn correctly?		
Has RPE been considered only as a last resort only where other controls are impracticable?		
Are employees aware of their legal obligation to use RPE supplied for their health & safety and to properly care for it?		
Are expiry dates determined for relevant RPE components?		
Are all items of PPE compatible?		
Does RPE fit the wearer correctly?		
Does the RPE selected give the appropriate level of protection?		
Is RPE checked regularly by a competent person?		

### Appendix 2: Sample RPE Testing Programme Template

User Name	RPE Type	Supplier	Serial No.	Initial test date	Status (tested/not tested/retest due)	Date retesting required

### Appendix 3: European Standards

Below is a non-exhaustive list of European Standards relating to RPE:

Standard Number	Title
<b>Respiratory Protective Devices</b>	
IS EN 529	Respiratory Protective Devices Recommendations for selection, use, care and maintenance
IS EN 132	Definition of terms and pictograms
IS EN 133	Respiratory Protective Devices-Classification
IS EN 134	Nomenclature of Components
IS EN 136	Respiratory protective devices-full face masks-requirements, testing, marking
IS EN 140	Respiratory protective devices- half masks and quarter masks- requirements, testing, marking
IS EN 142	Respiratory protective devices- mouthpiece assemblies-requirements, testing, marking
IS EN 143	Respiratory protective devices- particle filters-requirements, testing, marking
IS EN 144	Respiratory protective devices-gas cylinder valves-Part 1/2/3
IS EN 149	Respiratory protective devices- filtering half masks to protect against particles-requirements, testing, marking
IS EN 13274	Respiratory Protective Devices-Methods of Test (Parts 1-8).

#### Appendix 4: List of Relevant Legislation:

Below is a non-exhaustive list of sections of the Safety, Health and Welfare at Work Act, 2005 (S.I. No. 10 of 2005) that apply to RPE:

- Section 8-Duties of Employers
- Section 9-Information to Employees
- Section 10- Instruction, training & Supervision of Employees
- Section 12-General Duties of Employers to persons other than their Employees
- Section 13-Duties of Employee
- Section 14-Interference, misuse
- Section 15-General duties of persons in control of workplaces
- Section 16-General duties of designers, manufacturers, importers and suppliers of articles and substances
- Section 18- Protective and Preventative measures
- Section 19-Hazard identification and risk assessment
- Section 20- Safety Statement

Below is a non-exhaustive list of sections of the Safety Health and Welfare at Work (General Application) Regulations, 2007 (S.I. No 299 of 2007) that apply to RPE:

Chapter 3 of Part 2: Personal Protective Equipment, the following regulations apply:

- Regulation 62-Provision of PPE
- Regulation 63-Assessment of PPE
- Regulation 64-Condition of Use and Compatibility

- Regulation 65-Personal Use
- Regulation 66-Maintenance and Replacement of Personal Protective Equipment
- Regulation 67-Information, Training and Instruction

**Note:** Schedule 2 to the Safety Health and Welfare at Work (General Application), Regulations, 2007 (S.I. No 299 of 2007) provides a non-exhaustive list of activities which may require provision of RPE.

Other Regulations which may apply to RPE depending on the situation include:

The Safety, Health and Welfare at Work (Confined Spaces) Regulations, 2001 (S.I. No. 218 of 2001)

The Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 (S.I. No. 619 of 2001)

The Safety, Health and Welfare at Work (Biological Agent) Regulations, 1994 (S.I. No. 146 of 1994)

#### Appendix 5: RPE Sign



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