PPE Fit validation

Introduction

Just as it is important to select the right Personal Protective Equipment (PPE), it's also vital that the product fits the individual wearer correctly in order to provide adequate protection.

'Fit Validation' or 'Fit Testing' is a method to assess the fit quality achieved by the wearer for a given item of PPE, and whether they meet any applicable regulatory compliance.

There are many factors that can affect how well PPE fits the individual wearer, including:

- The size and shape of the individual
- The level of training received by the wearer
- Individual wearer motivation and attitude
- The extent to which the product has been put on effectively
- Whether there is facial hair that can affect the seal of a tight-fitting respirator
- Facial jewellery
- Other equipment or clothing

This is not an exhaustive list but highlights some of the most important points of fit. Incorrectly fitted PPE will result in a loss of protection and the amount of loss can vary depending on how poorly a product is fitted. In the case of something like fall protection, a poor fit could even result in no protection!

For example, a respirator with incorrectly adjusted nose clip or poorly adjusted straps, or a wearer with facial hair or stubble can result in a reduction in the level of protection provided. Other examples include incorrectly rolled foam earplugs, which can lead to a significant reduction in the actual level of attenuation achieved by the wearer if the pinna is not pulled upwards and outwards before inserting the earplugs into the ear. For head protection, poor adjustment of the head cradle coupled with high vertical clearance (i.e. helmet sitting too high on the head) can result in loss of protection. Similarly, eye and face protection with large gaps around the orbital area of the eye or other parts of the face can also lead to loss of protection.

More ergonomically designed products can help improve wearer comfort. For example, 3M™ SecureFit™ Protective Eyewear which feature a self-adjusting pressure system for improved fit and comfort. Regular training on the correct fitting and usage of PPE often helps overcome poor fitting. There are a range of helpful toolkits available from 3M to assist both the wearer and the trainer.

Examples of the tool kits include:

- Practical hands-on training sessions
- Videos and posters
- Fit checking/fit testing devices for assessing the fit of 3M respiratory, hearing and eyewear products
- 3M™ E-A-Rfit™ Dual-Ear System to measure the personal attenuation rating of an individual wearer

> **Lack of knowledge on how to fit a respirator and lack of care taken during the fitting procedure are two of the most common reasons why people fail a fit test the first time but then go on to pass at the second attempt.**

There are methods to objectively or subjectively validate fit (which are covered right in more details), but even in the absence of such methods there are simple steps that can be taken to assess the fit by the wearer.

Consider the following examples where the product size is normally indicated on the packaging, but the wearer can assess how well the product fits the individual:

- Protective coveralls – check for overall length and fit
  - Can a good fit be obtained without the need for turning up arms/legs of the coverall, which could increase the risk of injury or accident (e.g. trapping in machinery or trapping molten metal splash)?
- Safety harnesses - must form a snug fit for comfort and protection when worn with normal workwear
- Safety gloves and shoes – as in the case of other products, safety gloves and shoes must fit the individual wearer comfortably so that the product is worn for the entire duration of the working period and does not require individual adjustment that could increase risk of injury or accident

There are three types of PPE that have a recognised fit validation method:

Respiratory

Hearing

Eyewear
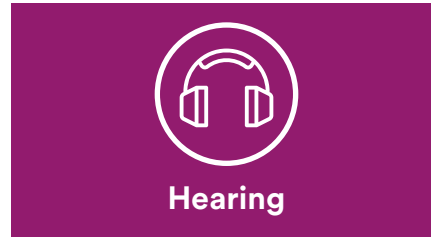
- Respiratory protective equipment – applicable to all tight-fitting filtering respirators ranging from disposable particulate respirators to full facepiece respirators fitted with filters, turbo units or used with breathing apparatus
- Hearing protection – applicable to a wide range of hearing protection devices ranging from disposable earplugs to reusable earmuffs
- Eye protection – applicable to a wide range of safety glasses, goggles and visors, checking for gaps around the orbital region of the eye as well as the wearer's field of view

Some fit validation methods are supported by published standards and validated by independent third parties. In particular, respiratory fit testing is mandated in many countries with a number of different methods available - both qualitative and quantitative - and is supported by published standards and guidance. Even when not mandated, respiratory, hearing and eye fit validation is often carried out as best practice or as part of a company's written health and safety management programme.

> "The value of fit validation is that it can improve wearer understanding and motivation to correctly put on PPE."

When to conduct fit validation

Fit validation is usually carried out on initial selection of PPE to ensure the product fits the wearer and helps achieve adequate protection. It should be repeated each time there is a change from one particular model or brand of PPE to another.

A physical change to the wearer such as weight gain or weight loss can affect the way the product fits an individual. For example, weight gain, weight loss or dentistry can affect the shape of a wearer's face which may adversely affect the quality of fit of a respirator leading to increased leakage around the edge of the respirator. Similarly, rapid weight change can also influence the shape and size of the ear canal which may affect the fit of earplugs – particularly with custom moulded products, resulting in lower attenuation. Therefore, fit validation should be repeated when there are signs of rapid weight changes. Local legislation may also require repeat fit validation.

Aims of fit validation

The main aims of fit validation:

- Help the user select the correct product and size for optimum protection
- Educate the wearer on the importance of achieving a correct fit
- Provide training on how to achieve a good fit
- Assess PPE compatibility, for example separate respiratory and eye protection products
- Help to select comfortable PPE
- Help improve compliance and improve wearer motivation

Fit validation is simply a 'moment in time' assessment and is not indicative of the true level of protection achieved by the wearer every time the product is worn. However, the value of fit validation is that it can provide training and improve wearer understanding and motivation to correctly put on the PPE and to carry out any pre-use fit checks to achieve an optimum fit every time the PPE is worn.

Fit validation methods

Respiratory fit testing

Tight-fitting respirators must seal well to the wearer's face in order to provide the expected protection. If there is a leak in the face seal region, the wearer may be exposed to harmful airborne contaminants. Fit testing is required by law in many different countries around the world and is being increasingly adopted by companies as best practice even where there is not a mandatory requirement to fit test.

Any tight-fitting facepiece should therefore be fit tested. These include filtering facepiece respirators (disposable respirators, commonly referred to as 'dust masks'), half-masks with filters and full-face masks with filters. Any tight-fitting facepiece that is connected to a powered or supplied air system should also be fit tested; this includes tight-fitting face masks used with turbos, breathable compressed air or self-contained breathing apparatus.

Fit testing should be conducted during the selection process and conducted with other head worn PPE fitted, but also in addition, fit testing should be performed:

- Whenever a different size, style, model or make of respirator is used
- When any facial changes occur that could affect fit, such as significant weight fluctuation or dental work

Fit test methods can be defined as being either qualitative (QLFT) or quantitative (QNFT):

Qualitative (QLFT)

Qualitative fit testing is subjective, requiring the wearer to provide input to the fit test. The predominant methods use either a Saccharin or Bitrex® test solution, sprayed into an over hood, which the respirator wearer decides if they can taste whilst conducting a number of fit test exercises. If the test solution is not tasted during the fit test, then the test is deemed a pass (with an assumed fit factor of 100 for the respirator). Other methods are available and used in some countries, for example isoamyl acetate (banana oil) or stannic acid (irritant fumes). Qualitative methods are used to fit test filtering facepieces and half-masks (with particulate or combination filters).

Quantitative (QNFT)

A quantitative fit test is an objective method that can be used to fit test most tight-fitting respirators. It involves using an instrument to measure leakage around the face seal and produces a numerical result called a "Fit Factor." The two main QNFT methods in use are Ambient Particle Counting and Controlled Negative Pressure.

For more information on respirator fit testing please refer to the 3M document, 'How to implement and manage an effective respirator fit testing programme'.

Figure 1. Ambient Particle Counting – TSI PortaCount® Respirator Fit Tester Model 8038 being used to conduct a Quantitative Fit Test (QNFT) upon a subject wearing a filtering facepiece respirator

Figure 2. Controlled Negative Pressure – OHD® Qantifit® being used to conduct a Quantitative Fit Test (QNFT) upon a subject wearing a reusable respirator. Image: courtesy of OHD®

Figure 3. 3M™ Qualitative Fit Test Apparatus Kit and Bitrex® Fit Test kit being used to conduct a Qualitative Fit Test (QLFT) upon a subject wearing a filtering facepiece respirator

Fit validation methods

Hearing fit validation

The fit of hearing protection on the wearer, and its compatibility with other head-worn PPE should be validated. As for respiratory protection, if the hearing protection – either muffs or plugs – do not fit the wearer's head or ear canal well, external noise may penetrate the inner ear leading to noise induced hearing loss. 3M have developed a hearing fit validation method to assess the fit of the hearing protector on the wearer and their compatibility with other head-worn PPE.

The 3M™ E-A-Rfit™ Dual-Ear Validation consists of a specially designed loudspeaker, digital signal processor and specially designed, dual-element microphones making it possible to measure the sound level inside the wearer's ear canals while the hearing protector is worn. The 3M™ E-A-Rfit™ Dual-Ear Validation System can test both earmuff and plugs. Both ears are accurately measured simultaneously, and in less than 5 seconds, a personal attenuation rating (PAR) is displayed.

The benefits of validation the fit of hearing protectors are confirmation of product selection, training in correct insertion of plugs and fitting of muffs, and the assessment of the loss of protection caused by other head-worn PPE that may interfere with the seal of the muff.

By conducting fit validation on hearing protectors, the level of personal attenuation can be measured giving reassurance for your hearing loss prevention programme.

Hearing fit validation should be conducted during the initial selection process and repeated when other head-worn PPE that may interfere with the seal of the muff is present. In addition, significant weight change may affect the fit of plugs and so a repeat fit validation is recommended in this situation.

Figure 4. The 3M™ E-A-Rfit™ Dual-Ear Validation System

Eyewear fit validation

Safety eyewear should perform in four areas of protection:

- **View** – offer a good field of view without major obstructions
- **Security** – provides security of fit during head movements
- **Coverage** – the wearer should have good coverage from the brow to cheek bone as well as lateral coverage to help protect the soft tissues of the eye
- **Gaps** – there should be minimal gap between eyewear and the wearer's face. There should be no clear path for a flying projectile to proceed through the eyewear gap to the wearer's eyes. For goggles there should be no visible gap

Although not mandated in any regulation, 3M have developed and recommend a 6-step method using special tools to help assess the fit of eyewear on individual workers.
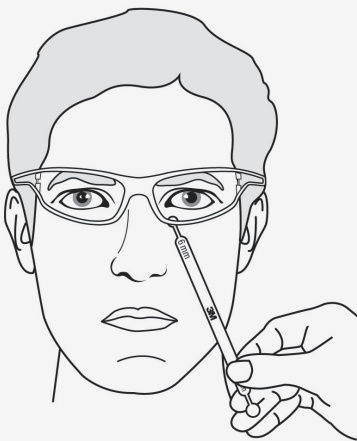
The 3M™ Eyewear Fit System is a process that goes beyond normal sizing and adjustment helping to select suitable eye protection considering both fit and comfort.

3M Eyewear Fit System:

1. Style selection
2. Ergonomic check
3. Eyewear fit validation
4. Worker education
5. Ergonomic re-check
6. Record keeping

Figure 5. Gap assessment

For advice and support
on implementing a fit testing
programme, please contact
your local 3M representative.

3M