Fit2Fit Companion

to HSE INDG 479

Guidance on Respiratory Protective Equipment (RPE) fit testing

Quantitative Method

Ambient Particle Counting

January 2022

HSE Statement

"In preparing the Fit2Fit RPE Fit Testers Accreditation Scheme, BSIF and other industry stakeholders have worked closely with the experts in the Health and Safety Executive (HSE). Following this scheme is not compulsory and employers are free to take other actions to comply with the law. But if you follow this scheme you will be doing enough to demonstrate good practice."

Foreword

This guidance document has been produced by the British Safety Industry Federation (BSIF) Fit2Fit competence scheme technical committee as a companion document to the Health and Safety Executive (HSE) INDG 479 Guidance on respiratory protective equipment (RPE) fit testing.

The purpose of this companion is to provide complementary practical guidance to the requirements set out in HSE INDG 479 on conducting fit testing in the quantitative method - ambient particle counting. Practical guidance on quantitative method: controlled negative pressure and the qualitative methods are also available in this “Fit2Fit Companion” series.

In this document you will find the relevant HSE INDG 479 requirements referenced as H1, H2, H3 and so on and beneath that the complementary Fit2Fit guidance on the practical elements necessary to deliver effective fit testing, numbered F1, F2, F3 and so on.

Following this guidance is recommended to ensure the correct application of the fit test method.

The Control of Substances Hazardous to Health Regulations (CoSHH) Approved Code of Practice (ACoP) requires that fit testing is conducted by a competent person. The BSIF Fit2Fit Accreditation scheme is designed to provide a means by which fit testers can demonstrate their competence.

A fit tester may not be deemed competent just by following this guidance alone. Experience gained within the development of the scheme clearly demonstrates that to be a competent fit tester both training and practical experience is required.

Fit testing is vital element of an effective RPE programme and therefore this practical guidance while, aimed at fit testers, is also useful for technical specialists such as occupational hygienists and consultants.

Fit2Fit Companions can be found at www.fit2fit.org

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Introduction

H1- This guide gives advice on fit testing for the employer and those conducting fit tests.

H2- This guide provides:

- information on fit test methods;
- information on what can be achieved from a fit test; and
- the core information to be included in a fit test report.

H3- Following this guidance is not compulsory and you are free to take other actions to comply with the requirements of the law. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustration of good practice.

H4- HSE does not approve nor recommend any particular fit testing equipment. Any equipment included in this guidance provides representative information.

H5- Further advice on the practical aspects of fit testing is provided by the British Safety Industry Federation (BSIF); this can be found at www.fit2fit.org.

H6- Fit testing should be conducted by a competent person. Competence can be demonstrated by accreditation under the Fit2Fit RPE Fit Test Providers Accreditation Scheme. This scheme has been developed by the BSIF, together with industry stakeholders, and is supported by HSE. The scheme is not compulsory and employers are free to take other action to comply with the law. Further details on the scheme can be found at www.fit2fit.org.

H7- Where respiratory protective equipment (RPE) is used as a control measure under health and safety legislation, it is vital that the selected RPE is both adequate and suitable. General advice on selection of RPE is covered in the HSE guidance document Respiratory protective equipment at work: A practical guide (HSG53).[1]

H8- To ensure that the selected RPE has the potential to provide adequate protection for individual wearers, the Approved Codes of Practice (ACOPs) supporting the Control of Substances Hazardous to Health Regulations (COSHH)[2] the Control of Lead at Work Regulations,[3] the Control of Asbestos Regulations,[4] the Confined Space Regulations[5] and the Ionising Radiations Regulations[6] stipulate that tight-fitting RPE should be fit tested as part of the selection process.

H9- The performance of tight-fitting facepieces depends on achieving a good contact between the wearer's skin and the face seal of the facepiece. People's faces vary significantly in shape and size so it is unlikely that one particular model or size of RPE facepiece will fit everyone. Inadequate fit will significantly reduce the protection provided to the wearer. Any reduction in protection may lead to immediate or long-term ill health or can even put the RPE wearer's life in danger.

H10- Fit testing is therefore a method for checking that a specific model and size of tight-fitting facepiece matches the wearer's facial features and seals adequately to the wearer's face. It will also help to identify unsuitable facepieces which should not be used.

H11- A pre-use wearer-seal check should be carried out each time a fit-tested facepiece is worn and before entering the hazardous environment. This check is to determine whether the wearer has correctly donned a facepiece before entering a contaminated work area. The RPE manufacturer will provide instructions on how to carry it out. Note, however, that a pre-use wearer-seal check is not a substitute for fit testing.

Introduction

H12- Tight-fitting facepieces (often referred to as masks) rely on having a good seal with the wearer's face. These are available as both non-powered and powered respirators, and breathing apparatus (BA) with either a half mask or a full-face mask. Their performance, irrespective of whether they are non-powered (negative pressure), powered or constant-flow airline BA relies heavily on the quality of fit of the facepiece to the wearer's face. An inadequate fit will significantly reduce the protection provided to the wearer.

H13- Examples of types of tight-fitting facepieces are shown in Figures 1, 2 and 3.

Figure 1 Disposable half mask

Figure 2 Reusable half mask

Figure 3 Full-face mask

F1- Fit2Fit

Please note that the Quantitative method (Ambient Particle Counting) can be used to face fit all types of tight fitting face masks.

Guidance for Employers

H14- This guidance assumes that you have chosen to use tight-fitting RPE as part of your control regime following an appropriate risk assessment. It also assumes that you have considered the wider aspects of RPE provision found on the HSE website at http://www.hse.gov.uk/respiratory-protective-equipment/index.htm and in the guidance document Respiratory protective equipment at work: A practical guide (HSG53).

H15- It is important to know that some pre-existing medical conditions (for example, breathing disorders such as asthma; skin allergies; or even heart problems) may restrict or prevent some workers wearing any RPE, or certain types of RPE. You will need to ensure that workers are fit to wear the selected and required RPE. If you are unsure, you (the employer) should arrange for appropriate medical assessment.

H16- Powered or constant-flow airline BA RPE with loose-fitting hoods or helmets do not require fit testing.

H17- Tight-fitting powered or constant-flow airline BA RPE under positive pressure still requires fit testing as studies have shown that during heavy exertion, inward leakage is possible.

H18- A fit test should be carried out as part of the initial selection of the RPE.

H19- A fit test should be repeated whenever there is a change to the RPE type, size, model or material or whenever there is a change to the circumstances of the wearer that could alter the fit of the RPE; for example:

- weight loss or gain;
- substantial dental work;
- any facial changes (scars, moles, effects of ageing etc) around the face seal area;
- facial piercings;
- introduction or change in other head-worn personal protective equipment (PPE).

H20- As part of your RPE programme, it is good practice to have a system in place to review when a repeat fit test may be required. For example, face shape will change through ageing alone.

F2- ***In support of the points above, Fit2Fit recommends that a suitable interval for repeat fit testing is 2 years. In some situations, however, more frequent repeat fit testing may be appropriate, particularly where RPE is being used as a primary or sole means of control.***

If there is a change in the make, model or size of RPE in use, a fit test is to be conducted prior to its first use.

Good practice is to discuss repeat fit testing at the initial fit testing stage so that an appropriate retest period can be entered into the fit test report.

Fit2Fit Guidance

H21- There are two basic types of RPE fit testing – qualitative and quantitative.

Qualitative fit testing (QLFT)

H22- Qualitative fit testing (QLFT) is a pass/fail test based on the wearer's subjective assessment of any leakage through the face seal region by detecting the introduction of bitter- or sweet-tasting aerosol as a test agent. QLFT methods are suitable for disposable and reusable half masks; they are not suitable for full-face masks. Although this type of test is based on subjective detection and response by the wearer of the RPE, it is important that it is administered by a fit tester competent in using this method.

Quantitative fit testing (QNFT)

H23- Quantitative fit testing (QNFT) provides a numerical measure of how well a facepiece seals against a wearer's face; this is called a fit factor. These tests give an objective measure of face fit. QNFT methods are suitable for disposable and reusable half masks and full face masks. Examples of QNFT methods are:

ambient particle counting

controlled negative pressure (CNP)

The fit factor, which is calculated by the fit test equipment, uses the following formula:

For the ambient particle counting method, the quantitative fit factor (QNFF) is calculated as the ratio of the two aerosol concentrations measurements as shown in formula (1):

$$QNFF = \frac{Co}{Ci} \qquad (1)$$

Where

Co is the challenge aerosol concentration outside the facepiece;
Ci is the challenge aerosol concentration inside the facepiece.

F3- Fit2Fit Guidance

The Ambient Particle Counting (APC) method requires a particle counting device which measures the concentration of particles inside and outside the facepiece while the wearer carries out a number of specified exercises. The ratio of these two numbers is called the Fit Factor. This method can either use particles in the ambient air (normal room air) or generated aerosols as the test challenge.

When the mask is equipped with P3 filters and the test is carried out correctly it can be assumed that any particles found inside the mask can be attributed to face seal leakage. However, this assumption requires that particles from the wearer's exhaled breath must be kept to a minimum. This can be achieved by the wearer refraining from smoking (including e–cigarettes) for approximately 60 minutes, and eating or drinking (except fresh water) for approximately 15 minutes prior to the fit test.

Guidance for Employers

H24- The type of fit test method used depends on the type of RPE to be fit tested. Table 1 shows which fit test methods are applicable.

Table 1 Fit test method selection

Fit testing method				
RPE (type and mask)		Quantitative (QNFT)		Qualitative (QLFT)
		Ambient particle counting	Controlled negative pressure [a]	Taste
Disposable respirator [b]	Half mask	Yes	No	Yes
Reusable respirator	Half mask	Yes	Yes	Yes
	Full-face mask	Yes	Yes	No
Powered respirator	Half mask	Yes	Yes	Yes
	Full-face mask	Yes	Yes	No
Constant flow airline BA	Half mask	Yes	Yes	Yes
	Full-face mask	Yes	Yes	No
Fresh air hose BA	Half mask	Yes	Yes	Yes
	Full-face mask	Yes	Yes	No
Demand valve BA	Half mask	Yes	Yes	Yes
	Full-face mask	Yes	Yes	No
Escape BA	Full-face mask	Yes	Yes	No

[a] Any leakage through the exhalation valve has to be eliminated.
[b] The ambient particle counting instrument may require additional functionality, such as the TSI N95 technology, to eliminate penetration of ambient particles through the filter material for masks with assigned protection factors (APFs) of 4 (FFP1) and 10 (FFP2).
APF is the workplace level of respiratory protection the facepiece is expected to provide, and is used when selecting adequate RPE.

H25- If it is not possible for the wearer to obtain an adequate fit with the first choice of facepiece you should attempt fit testing using an alternative make, model or size of tight-fitting facepiece. Where you cannot achieve an adequate fit you should select another type of RPE that does not rely on a tight-fitting face seal, such as a loose-fitting respirator hood or helmet.

H26- You should record the fit test by means of a report or certificate which should clearly state whether the result of the fit test was a pass or fail. Annex 1 shows the content that you should provide in a fit test report.

H27- The fit test report should be available to the employee and accessible to others such as enforcement authorities. Collective reports should be available to safety representatives. You should record RPE examinations and tests – and, where appropriate, any repairs made – and retain them for at least five years.

H28- The employer is responsible for meeting the cost of fit testing.

Guidance for fit testers

General

H29- As a fit tester you have duties under Health and Safety at Work legislation because if you do not carry out a fit test properly the wearer could be exposed to substances hazardous to health due to facepiece leakage.

H30- RPE fit testing should be carried out by a competent person. A fit tester should have adequate knowledge, and have received adequate instruction and training in the following areas:

- selection of adequate and suitable RPE;
- examination of RPE and the ability to identify poorly maintained facepieces;
- ability to correctly fit a facepiece and perform pre-use wearer-seal checks;
- ability to recognise a poorly fitting facepiece;
- awareness of external factors that may affect the fit of the facepiece or the fit test result;
- the purpose and applicability of fit testing;
- the differences between, and the appropriate use of, QNFT and QLFT methods;
- the purpose of the fit test exercises;
- preparation of facepieces for fit testing;
- how to carry out diagnostic checks on the facepiece and the fit test equipment;
- capabilities and limitations of the fit test equipment;
- how to perform a correct fit test with the chosen method;
- awareness and knowledge of how to prevent and correct problems during fit testing;
- interpretation of fit test results;
- an understanding of the differences between fit factor, workplace protection factor (WPF),* assigned protection factor and nominal protection factor (NPF)**; and
- HSE ACOPs and guidance that deal with fit testing of RPE.

*WPF is the protection provided by the RPE when used and measured in the workplace and is the ratio between the breathing zone concentration of the contaminant inside and outside of the facepiece. **NPF is the level of respiratory protection the facepiece is expected to provide under laboratory conditions and is the pass/fail for the particular European standard.

F4-

Fit2Fit Guidance

Following the guidance outlined in this document will help you to gain competence and comply with your duties as a fit tester. You can demonstrate competence in fit testing by gaining Fit2Fit Accreditation in your chosen fit test method(s).

Fit2Fit Accreditation is achieved by passing both the theoretical and the practical examinations set by the Fit2Fit scheme. It is an assessment of the individual and it is the individual that achieves accredited status which is valid for up to three years. Accreditation can only be awarded through the Fit2Fit Scheme operated by the BSIF.

The Fit2Fit Accreditation scheme covers qualitative fit testing (QLFT), ambient particle counting (APC) and controlled negative pressure (CNP) fit testing methods. Both APC and CNP methods are included under the heading of "quantitative fit testing". Fit testers can become accredited for any or all of these methods. The Fit2Fit scheme competencies are based on those set out in INDG479.

Experience gained within the development of the Fit2Fit Accreditation scheme clearly demonstrates that to be a competent fit tester, both appropriate training and mentored practical experience is required.

Guidance for fit testers

H31- Facepieces used for fit testing can be one of the following:

- the wearer's individually assigned facepiece;
- a test facepiece of the same type, class and size; or
- a surrogate facepiece with the same sealing surfaces, materials, head straps and breathing resistance as the facepiece assigned to the wearer. You should confirm this with the RPE manufacturer/supplier.

H32- Where facepieces are issued on an individual basis it is recommended that the wearer is fit tested using their issued facepiece.

H33- Where this is not practicable use a test facepiece that exactly matches the wearer's facepiece.

H34- Fit test half and full-face masks as negative-pressure facepiece respirators by attaching a P3 filter, or a combined filter that incorporates a P3 filter, directly to the facepiece. Where practicable, the filter (or facepiece adapter) should be identical to, or similar to, the type of filter normally used with the respirator, ie of similar breathing resistance and weight. You will need to temporarily convert facepieces used with compressed-air-supplied BA and power-assisted respirators to negative-pressure respirators. Alternatively you may use an identical negative-pressure respirator facepiece with the same sealing surface (ie same mould of face blank and material) if available.

F5- ***The mask being used for the fit test should be in good condition and it must be equipped with particulate filters (or combination with particulate filters). When fit testing a negative pressure half mask the filter(s) should be as close as possible to the weight and dimensions of those used in the workplace.***

Fit2Fit

H35- Facepieces are available in several different sizes and shapes. The wearer may obtain a better fit (ie pass a fit test) by trying a respirator of a different size, model or make.

H36- The practice of multiple repeat fit tests with the aim of achieving a pass with a given facepiece, ie force fitting, should not be carried out. If after two fit tests the result is still a fail, an alternative facepiece should be tried.

H37- Visually examine the facepiece to be used for fit testing before carrying out a fit test. The examination should include the condition of the facepiece, especially around the face seal and facepiece connectors, the exhalation valve(s) and the head harness. You should properly inspect test facepieces and maintain them in accordance with the manufacturer's instructions.

H38- The fit tester should ensure that test facepieces are cleaned and disinfected before being used by different individuals. Test facepieces that cannot be adequately disinfected (eg disposable half masks) should not be used by more than one individual.

F6-

Fit2Fit Guidance

In order to take a sample of the air from inside the mask, it must be adapted to allow a sample of air to be drawn from within the breathing zone of the mask. The breaching zone in the context of a face fit is the "zone or area" inside of the mask just in front of the wearer's nose and mouth. Please see sections F13 and F14 on page 15 of this companion. Specialist adapters are available from RPE manufacturers for this purpose.

The filter efficiency of FFP1 or FFP2 masks is lower than FFP3 masks and therefore particles inside the mask may have penetrated the filter medium. In order to have an accurate measure of fit additional or supplementary equipment may be required, such as the N95 Technology for TSI Portacount.

Where fit test sampling adapters have been used for the fit test, these shall be completely removed and the RPE restored to its original configuration before being placed back into service.

H39- The fit tester should ensure that the fit testing equipment is in good working order, properly set up and checked or tested before conducting the fit test. Maintain and calibrate the fit test equipment in accordance with the manufacturer's instructions.

H40- Variation from the procedures and fit test equipment specified in this guidance may invalidate the fit test results unless the procedures and equipment used have previously been validated. The criteria for evaluating fit test methods given in BS ISO 16975-3 Annex C [7] are recommended.

F7-

Fit2Fit

Fit testing should be conducted in a safe and clean location which provides a degree of privacy, a suitable ambient particle concentration and a suitable power source.

H41- The following standards are recommended as suitable references:

- BS ISO 16975-3:2017, Respiratory protective devices – Selection, use and maintenance. Part 3: Fit-testing procedures
- European Standards covering inward leakage testing: BS EN 136,[8] BS EN 140[9] and BS EN 149.[10]

Guidance for fit testers

Preparing the wearer

H42- The fit tester should explain to the wearer the purpose of the fit test, what they will have to do, and the meaning of the fit test results.

H43- When you are conducting an ambient particle counting fit test the wearer should refrain from smoking (including e-cigarettes) for at least 60 minutes before the fit test.

H44- Do not conduct fit tests if there is any hair growth between the wearer's skin and the facepiece sealing surface, such as stubble beard growth, beard, moustache, sideburns or low hairline, which cross the respirator sealing surface. You should ensure that any type of non-PPE apparel or adornment (eg piercing) does not interfere with the fit of the facepiece.

H45- Inform wearers that they should be clean-shaven in the region of the face seal whenever they wear a tight-fitting facepiece at work.

F8- ***Fit tests should not be conducted if there is any hair growth between the skin and the mask sealing surface, such as stubble beard growth, beard, moustache, sideburns or low hairline which crosses the respirator sealing surface.***

This is also your opportunity to help wearers to understand the importance of always being clean shaven in the region of the face seal not only for the fit test, but every time that they are required to wear the mask in the workplace.

Research carried out by the HSE has demonstrated that protection could be significantly reduced where stubble or facial hair was present in the seal area.[11]

Figure 4: Example showing the face seal region (underneath the red line) that must be clean shaven for a half mask or Filtering Face Piece (FFP)

Figure 5: Example showing the face seal region (underneath the red line) that must be clean shaven for a full face mask

For clarity the definition of "clean shaven" in this context means that the wearer's face should have been shaved (in the area of the face seal) within 8 hours of the work shift commencing.[12]

Fit2Fit Guidance

H46- The fit tester should instruct the wearer in the test exercises appropriate to the fit test method used as shown in Annex 2.

F9-

Fit2Fit Guidance

Some wearers may be capable of wearing a respirator safely in the workplace, but be unable to complete all the exercises within the fit test protocol due to an underlying health issue. Under these circumstances, adaptations to the fit test exercises may be made to better reflect the wearer's range of movements. Any adaptations should be recorded. For those with short-term conditions, the fit test should be carried out after they have recovered.

The Fit Tester should instruct the wearer in the fit test exercises (Table 3) before the start of the test.

The APC fit test method will also require the use of a dynamic activity (eg. stepping using an aerobic step, static cycling, walking on a treadmill), therefore the wearer should also be instructed in the use of this equipment and be made aware of any relevant safety information.

The Fit Tester should maintain control of the wearer and ensure that the test exercises are conducted as instructed.

H47- The fit tester should ascertain that the wearer is medically fit to wear RPE and seek confirmation (preferably in writing) from the employer.

H48- The wearer should have received training in correct donning of the facepiece before the fit test. If you are also providing RPE training, you should show the wearer how to put on a facepiece, position it on the face, set the strap tension and determine an acceptable fit. A mirror should be available to assist the wearer in evaluating the fit and positioning of the facepiece.

H49- The wearer should be able to don the facepiece in accordance with the manufacturer's instructions, in the manner in which they have been trained, and without assistance from the fit tester.

F10-

Fit2Fit

The fit tester should closely observe the donning process to ensure that the mask has been donned correctly in accordance with the manufacturer's instructions and should closely inspect the fit for gaps etc.

RPD comfort is an important factor in wearer acceptance. Initial RPD wearers and anyone who changes the model or brand of RPD shall wear the RPD for a comfort-assessment period of approximately five minutes immediately prior to the fit test. If necessary, the person being fit tested may make adjustments to achieve a comfortable fit during this period. The comfort period will also allow purging of any particles which have become trapped inside the RPD upon donning. This is important for QNFT methods which use particle-counting technology. The comfort-assessment period allows the RPD wearer time to determine if the RPD is truly comfortable or not, and to make any necessary adjustments. Discomfort may become apparent only after the RPD.

Guidance for fit testers

H50- If the wearer needs to use in-facepiece spectacles they should wear them during the fit test.

H51- Wearers should wear any other PPE that could potentially interfere with the fit of the facepiece during the fit test. If they cannot wear the PPE properly without affecting the function of the RPE or vice versa, choose alternative PPE.

F11- ***The details (make and model) of the other PPE such as eyewear or safety helmets or associated equipment worn during the fit test should be recorded on the fit test report itself. The fit test should be conducted with the facepiece worn in the manner in which it is normally used in the workplace. Not every individual may be able to obtain a satisfactory fit. For example certain facial characteristics may interfere with the RPE fit, such as hollow temples, protruding cheek bones, deep skin creases, scars, the absence of teeth or dentures, facial injury and swelling of the mouth and the face. Users of tight-fitting facepieces who have dentures, should be fit tested: with dentures, if they would normally wear them while wearing the RPE in the workplace; and conversely, without dentures if they would not normally wear them while wearing the RPE in the workplace. Fit testers should be aware that other factors such as make up and cosmetics, facial jewellery and certain hair styles can also adversely affect the seal of RPE facepieces.***

H52- **Preparing for a quantitative fit test – all methods —** Use, maintain and calibrate QNFT equipment in accordance with the manufacturer's recommendations. Before using the equipment, check its stability as instructed by the manufacturer. Retain all records of maintenance, calibration and pre-use checks.

F12- ***You should only ever use fit test equipment which has passed its pre-use checks and is within calibration.*** Fit2Fit

H53- The minimum fit factor in a quantitative face-fit test, that should be achieved to pass a fit test, will depend on the type and class of facepiece being tested. Table 2 shows the HSE-required minimum fit factors that should be achieved in each of the fit test exercises used with a particular type of fit testing device.

Table 2 Required minimum fit factors for quantitative fit testing

Facepiece type	Quantitative fit test methods	
	Ambient particle counting	Controlled negative pressure
Disposable half mask APF 4 (FFP1)[a]	100	n/a
Disposable half mask APF 10 (FFP2)[a]	100	n/a
Disposable half mask APF 20 (FFP3)	100	n/a
Half face mask	100	100
Full-face mask	2,000	2,000

[a] When using a PortaCount, APF 4 (FFP1) and APF 10 (FFP2) disposable half masks can only be fit tested if N95 technology is employed.

Preparing for a quantitative fit test using the ambient particle counting method

H54- The fit test exercises for the ambient particle counting method are given in Table 3.

H55- Fit the facepiece with a sample probe positioned so that the air sample withdrawn from the facepiece is representative of the air breathed by the wearer. Position the open end of the sampling tube in the wearer's breathing zone, close to the face and approximately mid-way between the nose and mouth. Do not isolate the sample probe from the nose and mouth region by a physical partition; for example, by the inner mask of a full-face mask. For half masks and full-face masks, use a suitable fit test adapter and position the open end of the sampling tube as described above.

F13- Fit2Fit

The following figures 6, 7 & 8 illustrate appropriately positioned sample tubes within the breathing zone inside of the face piece.

Figure: 6

Figure: 7

Figure: 8

F14- Fit2Fit Guidance

The air coming into a facepiece is not perfectly mixed, meaning that leakage may be more concentrated in some parts of the facepiece than in others. When fit testing, the sample from inside the facepiece should represent what the wearer inhales. Since air must pass through the region just in front of the wearer's nose and mouth (known as the breathing zone) before it can be inhaled, this is the ideal location to take a representative sample.

For filtering facepieces, a disposable fit testing port should be attached as close to the breathing zone as possible. If the facepiece has an exhalation valve, the port should be attached to one side of it. If the facepiece doesn't have an exhalation valve, the port should be attached centrally.

For half masks, an adaptor should be used with rigid and/or flexible tubing, such that the end of the tubing is located in the breathing zone. This may require the tubing to pass through a valve.

For full face masks, an adaptor should be used with rigid and/or flexible tubing, such that the end of the tubing is located in the breathing zone. If the full face mask has an inner half mask the tubing will likely need to pass through a valve or other opening in the inner half mask.

If you cannot obtain a fit test adaptor it is acceptable to use a permanent port in a half mask or full face mask. NOTE: If a permanent port has been fitted this mask must not be used in the workplace. In both cases, the permanent port should be positioned so that it causes as little obstruction to the wearer as possible (for example, not in the centre of a full face mask visor). Rigid and/or flexible tubing must be used to extend the sample line into the breathing zone.

Any tubing used in the sample line should be of a similar diameter to the tubing provided by the manufacturer of the ambient particle counter. Tubing should be as short as possible while still following the recommendations given above.

Whichever type of probe is used, it is critical that the sample tube is not blocked, twisted or impeded in any way. Such blockages can lead to falsely low in-mask counts and hence falsely high fit factors.

Guidance for Fit Testers

H56- When fitting the sample probes to half and full-face masks, use suitable sampling adapters to avoid puncturing the facepiece. RPE manufacturers and fit test equipment suppliers can provide suitable fit test adapters to fit most facepiece types. These adapters should enable fit testing on wearer-issued facepieces. When fitting the sampling adapter to the facepiece, take care not to block off or restrict the flow of air through the sampling tube.

H57- The positioning and the combined weight of the fit test adapter, sample probe and sample tubes should not interfere with the fit of the facepiece. This is particularly important when fit testing disposable or lightweight half masks. Sample probes should be lightweight and the sample tubes must be supported to avoid any drag on the fit of the facepiece.

H58- The wearer's exhaled breath can contain particles that can be detected by the particle counting device. These wearer-generated particles can result in a falsely low fit test result. Having an ambient challenge concentration of at least 3000 particles/cc for fit testing disposable and reusable half masks, and 10,000 particles/cc for fit testing full-face masks, will reduce the likelihood of false fails.

H59- An ambient particle count that varies significantly over the duration of the test can also give rise to errors in the fit factor. Avoid excessively dusty and smoky environments. Seek further advice from the fit test equipment supplier if necessary.

F15- ***When fit testing filtering facepieces or lightweight half masks, the weight of the twin tube should be supported either by a lanyard or by the wearer.***

To achieve or maintain the recommended minimum ambient particle count, consideration should be given to using an aerosol generator or using lit candles, etc.

Fit2Fit

H60- Very high fit factors, ie figures over 100,000, could indicate a problem with the application of the fit test; if this happens check the validity of the result.

Conducting the fit test – all methods

H71- Observe the wearer throughout the fit test to ensure that the correct test exercises are conducted. Also watch for facial and head movements that may cause face seal leakage. If the wearer sneezes or coughs during the fit test this can affect the fit test result and you may have to repeat the fit test.

H72- You should also ensure the safety of the wearer – this is especially important if the wearer is walking on a treadmill or stepping during the fit test.

F16- ***The fit test exercises and dynamic activity should be explained and demonstrated (where required) to the wearer and they should be asked to confirm that they are happy to carry them out. If a permanent injury or medical condition prevents them from carrying out a certain exercise the exercise regime may be modified to accommodate their needs. A record should be kept and noted on the fit test report of any modification to the exercises.***

Fit2Fit

H73- Inform the wearer of the fit test result; ie a pass or fail. Take care when providing information on the numerical fit factor results; informing a wearer that a high fit factor has been achieved may give them false confidence in the RPE and it may cause them to be less careful when donning and using the RPE in the workplace. Stress to the users that practical experience in the workplace has shown that the protection obtained is often less than that achieved in the fit test.

F17- Fit2Fit

Following a FAIL result, the fit tester should check the fit of the mask on the wearer's face before removing it, inspect the mask and filter for any faults not found at the initial inspection and check the fit test equipment before attempting to retest.

Incorrect donning of the mask is one of the most commonly encountered reasons for fit test failures. It is essential that wearers are adequately trained in how to correctly put on the mask and conduct a wearer seal check, before a fit test is carried out.

H74- If a poor fit is likely to be caused by inadequate training, the wearer's employer should be informed.

F18- Fit2Fit

As part of the post fit test debriefing, the wearer should be reminded that the fit test result is only valid for the specific make, model and size of mask which they wore during the fit test. This is also an appropriate time to discuss circumstances which may call for repeat face fit testing.

The fit tester should also remind the wearer that facial hair will reduce the effectiveness of the face seal and that the wearer should be clean shaven in the area of the face seal every time they wear the mask.

Annex 1

H75-

Fit test report

A record of the fit test shall be produced. The fit test report should clearly identify the following (where applicable):

a. the name of person fit tested;
b. the make, model, material and size of the facepiece;
c. the type of filters fitted to the facepiece during the fit test;
d. the presence or absence of in-facepiece spectacles;
e. the make and model of any PPE and/or RPE accessory worn during the fit test;
f. whether the facepiece used was the subject's issued facepiece, a company pool facepiece or a test facepiece;
g. the test exercises performed during the fit test;
h. the fit test method employed; ie ambient particle counting device, CNP or qualitative taste test agents;
i. for quantitative tests, the measured fit factor for each individual test exercise and the overall fit factor;
j. the pass level used in the test;
k. the result of the fit test in terms of a pass or fail;
l. the date of the test; and
m. the details of the person who performed the test, name of firm, address etc.

The fit test report should also record, where appropriate:

n. the condition of the wearer's own facepiece;
o. whether the wearer required assistance donning and carrying out a wearer seal check before the fit test;
p. how many repeat tests were needed to obtain a pass and the reasons why; and
q. the serial number or other means of identifying the equipment employed in the fit test.

F19-

Copies of fit test reports should be provided to the employer and a copy retained by the fit tester. Good practice is that fit test reports should include the recommended date of the next test.

Where fit test data is required by the customer in electronic format only, the data should still include the content as listed above.

Fit test data and reports may contain some personal information which will be subject to data protection regulations.

Fit2Fit

H76-

Fit test exercises

For QLFT and quantitative ambient particle counting methods, the fit test protocol should include a minimum of seven exercises; each test exercise should be performed for at least one minute. During the quantitative fit tests, the exercises should allow for an in-facepiece sample period of at least 60 seconds.

Annex 2

F20- Fit2Fit

When using the ambient particle counting method check that the timing in the software shows an in-facepiece sample period of 60 seconds. The total exercise time will be higher than this due to instrument purge and ambient sample times. The fit tester should ensure that purge and sample timings are appropriate to the test equipment in use. The test protocol should comprise the seven test exercises in Table 3.

H76-

Table 3 Fit test exercises for qualitative methods and quantitative ambient particle counting methods

Exercise	Description
(i) Normal breathing	The wearer should breathe normally with no head movements or talking.
(ii) Deep breathing	The wearer should breathe slowly and deeply, taking care not to hyperventilate.
(iii) Turning head side to side	The wearer should slowly turn their head from side to side between the extreme positions on each side (approximately 15–20 times per minute). The head shall be held at each extreme momentarily, so the wearer can inhale at each side.
(iv) Moving head up and down	The wearer should slowly move their head up and down (approximately 15–20 times per minute). The wearer should be instructed to inhale in the up position (ie when looking toward the ceiling).
(v) Talking	The wearer should talk slowly and loudly enough to be heard clearly by the fit tester. The wearer should read from a standard reading passage or count down from 100.
(vi) Bending over	From a normal standing position, the wearer should bend at the waist as if to touch their toes and then return to an upright position. Repeat approximately 10–15 times throughout the duration of the exercise.
(vii) Normal breathing	Same as exercise (i).

During QNFT the fit test exercises (except for the bending exercise) should be performed while the wearer is doing one of the following:

1. cycling on an exercise bike;
2. walking on a treadmill; or
3. carrying out a stepping exercise.

Note: Take care when asking people to exercise and be aware of the risks of slips and trips.

F21-

1, 2 & 3 above are designed to induce a physical workload on the wearer.

F22- Fit2Fit Guidance

The use of the "Rainbow Passage" below is the preferred standard reading passage to be used in the talking exercise.

'When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colours. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow'

References

REFERENCES

1. The selection, use and maintenance of respiratory protective equipment – A practical guide HSG53 HSE 2013 www.hse.gov.uk/pUbns/priced/hsg53.pdf
2. The Control of Substances Hazardous to Health Regulations 2002 (as amended). Approved Code of Practice and guidance L5 (Sixth edition) HSE 2013 www.hse.gov.uk/pubns/priced/l5.pdf
3. The Control of Lead at Work Regulations 2002 – Approved Code of Practice and guidance L132 (Third edition) HSE 2002 www.hse.gov.uk/pubns/priced/l132.pdf
4. Managing and working with asbestos. Control of Asbestos Regulations 2012. Approved Code of Practice and guidance L143 (Second edition) HSE 2013 www.hse.gov.uk/pubns/books/l143.htm
5. Safe work in confined spaces. Confined Spaces Regulations 1997 Approved Code of Practice, Regulations and guidance L101 (Third edition) HSE 2014 www.hse.gov.uk/pubns/books/l101.htm
6. Work with ionising radiation. Ionising Radiations Regulations 2017. Approved Code of Practice and guidance L121 (Second edition) HSE 2018 www.hse.gov.uk/pubns/books/l121.htm
7. BS ISO 16975-3:2017 Respiratory protective devices – Selection, use and maintenance. Part 3: Fit-testing procedures British Standards Institution
8. BS EN 136:1998 Respiratory protective devices: Full face facepiece – Requirements, testing, markings British Standards Institution
9. BS EN 140:1998 Respiratory protective devices: Half facepieces and quarter facepieces – Requirements, testing, markings. British Standards Institution
10. BS EN 149:2001 + A1:2009 Respiratory protective devices – Filtering half masks to protect against particles – Requirements, testing, marking. British Standards Institution
11. The effect of wearer stubble on the protection given by Filtering Facepieces Class 3 FFP 3 and Half Masks: Frost Harding et al 2015
12. BS EN 529 European Standard: Respiratory Protective Devices – recommendation for selection, use and maintenance – guidance document BS EN 529: 2005

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