JSP Ltd launched the Force 8 half mask with P3 Press to Check™ filters at the end of 2013. The Press to Check™ filter system was developed to enable the wearer of the Force 8 half mask to be able to easily check they had achieved an effective faceseal and were therefore getting a good level of protection. Soon after this launch, users began to approach JSP enquiring if the Press to Check™ fit check system could be considered to be a qualitative fit test.

Since early 2014, JSP Ltd has been supporting the Construction Dust Partnership (CDP), which is an HSE partnership with industry stakeholders. The CDP’s aim is to create better awareness of the need to use adequate and suitable Respiratory Protective Equipment (RPE). JSP’s support has included attending CDP events and running Construction Dust Awareness seminars.

Feedback from those attending the CDP events and dust seminars has outlined the benefits that duty holders could see of the Press to Check™ fit check system as:
- improving worker protection in difficult and challenging environments
- the potential to eliminate unnecessary bureaucracy
- a cost reduction from employers working in construction
- a more effective and convenient method of fit testing

HSE’s document OC282/28 does suggest that alternative methods of checking fit can be used if validated. JSP have carried out an extensive assessment with third parties to validate results from fit checking using the Press to Check™ 5 point check system. Results were validated against the quantitative Portacount fit test, a method detailed by HSE as a suitable method for checking fit.

The enclosed document details the findings of this assessment. In summary, we found that 97.1% of those that achieved a fit using Press to Check™ then went on to get a fit using the Portacount quantitative method. JSP are therefore of the opinion that the Press to Check™ Qualitative Fit Test is a viable qualitative fit test whose efficacy has been evaluated and demonstrated.

I invite you to read the enclosed document, to demonstrate that the Force 8 mask is adequate and suitable for your wearers, and to consider implementing the Press to Check™ system as a Qualitative Fit Test as part of your respiratory protection programme.

Yours sincerely,

Matthew Judson
Director – Respiratory & Technical Support, JSP Ltd.
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1. EXECUTIVE SUMMARY

1.1 The Proposition
That qualitative fit testing of the JSP Force 8™ half mask can be carried out using the JSP Press to Check™ 5 point fit check process.

1.2 Assessment Of The Press to Check™ Qualitative Fit Test
JSP developed an encapsulated filter to offer greater protection to the filter media, to improve filter media efficiency and to allow the 2-part filter casing to be closed with a unique hinging system. This system blocks airflow whilst not disrupting the integrity of the half mask’s faceseal whilst it is worn. The vacuum experienced from an effective seal on breathing-in enables an immediate and simple fit checking of the mask faceseal.

The use of this fit check system has been identified by several duty holders as a possible alternative to the traditional Qualitative Taste Fit Test.

JSP, two duty holders, and a Fit 2 Fit accredited fit tester have carried out two assessment activities with 214 test subjects to demonstrate that the Press to Check™ filter system does offer a viable alternative to the Qualitative Taste Fit Test. The assessments showed that an appropriate sized mask would give a better fit for the wearer. As a result, JSP has subsequently developed a size range of Force 8™ half mask respirators across the small, medium and large size range. To assist in the initial selection of a suitably sized mask, JSP have also developed a simple to use size guide gauge.

From the findings of the assessment activities, a 5 point fit check process has been defined as the Press to Check™ Qualitative Fit Test.

1.3 The Results
The assessment of two groups of subjects shows a high probability that use of the Press to Check™ fit check will correctly predict a pass or fail when compared with the Portacount method. The probability found was 97.1%.

1.4 Conclusion
Press to Check™ Qualitative Fit Test is a viable qualitative fit test whose efficacy has been evaluated and demonstrated.
2. GLOSSARY OF TERMS

ACoP - Approved Codes of Practice
AIHA - American Industrial Hygiene Association
ANSI/AIHA - American National Standards Institute
APF - Assigned Protection Factor
BS EN - British Standard European Standard
BSI - British Standards Institution
BSIF - The British Safety Industry Federation
CAR - Control of Asbestos Regulations 2012
CIS - Construction Information Sheet
CLAW - Control of Lead at Work 2002
CMCHA - Corporate Manslaughter and Corporate Homicide Act 2007
COSHH - Control of Substances Hazardous to Health 1999
CSR - Corporate and Social Responsibility
EN - European Standard
FFP - Filtering Face Piece (commonly known as 'dust' or 'paper disposable' masks)
HSE - Health and Safety Executive
HSG - Health and Safety Guidance
HSL - Health and Safety Laboratory
HSO - Health and Safety Officer
HSWA - Health and Safety at Work Act 1974
IRR - Ionising Radiation Regulations 1999
ISO - International Standard Organisation
ISRP - International Society for Respiratory Protection
NHS - National Health Service
NIOSH - National Institute for Occupational Safety and Health
NPF - Nominal Protection Factor
OC - Operational Circular
OSHAd - Occupational Safety and Health Administration
PCA - Principal Component Analysis
PEROSH - Partnership for European Research in Occupational Safety and Health
PtoC™ - Press to Check™
RPD - Respiratory Protective Device
RPE - Respiratory Protective Equipment
TIL - Total Inward Leakage
WPF - Workplace Protection Factor
UK - United Kingdom of Great Britain and Northern Ireland

3. THE CURRENT RESPIRATORY PROTECTION LANDSCAPE - A SUMMARY

This report has been written primarily from a UK legislation viewpoint. At the time of writing the UK HSE have in place requirements that are not replicated in many countries and many do not have comparable requirements.

All work sites where there are likely to be respiratory hazards present should have in place an RPE programme. This programme will set out how the hazard is to be controlled, as well as the use, maintenance and disposal of RPE. The use and specification of RPE is referenced in a number of documents, some regulatory and some guidance.

Since the publication of CIS36 – Construction Dust, and awareness raising activities carried out by stakeholders, JSP has seen increased efforts by duty holders, in the UK and other countries, to offer adequate and suitable RPE to their staff.

3.1 The Product Performance Standards

Several ENs and ISOs specify the performance and use of RPD/RPE. Currently the more familiar RPE standards in use in the UK include:

(This are more commonly known as dust masks, or paper disposable masks).

(Half masks are the familiar rubber type masks that cover the nose and mouth and fit under the chin).

(Dust filters to fit the half masks).

3.1.4 EN14387:2004+A1:2008 - Respiratory protective devices - Gas filter(s) and combined filter(s) - Requirements, testing, marking.
(Gas and vapour filters, or gas and vapour filters with dust filters to fit the half masks).

3.2 The Guidance Documents

A number of guidance documents are available, some published by standards bodies and some by the UK HSE, these include:

3.2.1 HSG53 - Respiratory protective equipment at work. A practical guide.
(Guidance document to help employers implement effective RPE programmes in the workplace.)

3.2.2 OC282/28 - FI Testing of Respiratory Protective Equipment Facepieces.
(Thi document is aimed at and provides supplementary information for inspectors. It is a useful guidance document for those carrying out fit testing.)

(A European Standard that is broadly similar to HSG53.)

3.2.4 CIS36 - Construction dust.
(Guidance document specific to the construction industry to help employers to implement an effective RPE programme.)
3.3 The Regulations and Requirements

UK law requires employers to control exposure to hazardous substances to prevent ill health. They have to protect both employees and others who may be exposed by complying with the Control of Substances Hazardous to Health Regulations 2002. The ACoPs supporting the COSHH, CLAW, CAR and the Ionising Radiation Regulations 1999 require that all reasonable steps be taken to prevent exposure to substances hazardous to health, or, where prevention is not possible, to reduce exposure to the lowest level reasonably practicable.

If, despite the use of suitable control measures (i.e. other than RPE) adequate control of exposure cannot be achieved, employers must provide suitable RPE. The RPE provided must reduce the exposure to a concentration that is as low as reasonably practicable, and in any case below any applicable exposure or control limits.

The ACoPS supporting the COSHH, CLAW and CAR Regulations recommend that the initial selection of tight-fitting face pieces should include a fit test. This is to ensure that the selected RPE has the potential to provide adequate protection for the wearer.

(Ref: OC282/28 Para 5, 6, 7)

3.4 Current Practice

3.4.1 Fit Testing

The UK HSE guidance, OC282/28, requires that any person needing a tight fitting respirator should have a face fit test carried out to ensure that the tight fitting respirator fits that particular user. Fit testing methods detailed within the UK HSE’s guidance fall into two categories – Qualitative or Quantitative.

3.4.1.1 Qualitative Methods

Experience suggests that, within the construction industry, this is the most commonly used method of fit testing, in particular the bitter taste test (often using Bitrex™ based solution).

Qualitative fit testing is a simple pass/fail test based on the wearer’s subjective assessment of the leakage, via the face seal region, of a test agent. These tests are relatively simple to perform and are suitable for half masks and filtering face pieces.

(Ref: OC282/28 Para 17)

3.4.1.2 Quantitative Methods

Quantitative fit testing provides a numerical measure of the fit, called a fit factor. These tests give an objective measure of face fit. They require specialised equipment and are more complicated to carry out than qualitative methods. Of the test methods available, again, experience suggests that the portable particle counting device method – in particular, TSI Portacount – is the most common method used. When a particle counting method is used, a minimum fit factor of 100 is required for both FFP3 and halfmasks.

(Ref: OC282/28 Para 20)

Other methods available are the laboratory test chamber and a controlled negative pressure assessment.
3.4.2 Training
Training should be a significant part of any RPE programme, both for the fit testers and for those using the product to gain protection from hazards.

The psychology of safety should be a key part of the training. To implement a successful RPE programme, users must have a positive attitude towards wearing RPE when situations require. They should be able to exercise choice in protecting their own wellbeing. The user should not feel that RPE has been imposed on them, which will, in all likelihood, result in low levels of compliance. Their ownership of their safety should be the goal of any training.

JSP has found users during Press To Check™ training to reach a very high ‘buy-in’. They have been able to understand the principles behind the filter process more easily. They have been able especially to assess the difference between a poorly fitted dust mask and a properly fitted half mask. This ‘buy-in’ is intuitive and ensures higher levels of ongoing compliance.

3.4.2.1 Fit Testers
Fit testers need to be competent in the test methods that they are employing to ensure that the results obtained are representative of the fit being achieved.

OC282/28 advises that fit testing should be carried out by a competent individual. The document lists the areas in which a competent person will have adequate knowledge, and have received adequate instruction. They are:

- selection of adequate and suitable RPE;
- examination of RPE and the ability to identify poorly maintained face pieces;
- ability to correctly fit a face piece and perform pre-use fit checks;
- ability to recognise a poorly fitting face piece;
- the purpose and applicability of fit testing; the differences between, and the appropriate use of, quantitative and qualitative fit testing methods;
- the purpose of the fit test exercises;
- preparation of face pieces for fit testing;
- how to carry out diagnostic checks on the face piece and the fit test equipment;
- capabilities and limitations of the fit test equipment;
- how to perform a correct fit test with the chosen method;
- be aware of and know 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, assigned protection factor and nominal protection factors; and
- UK HSE Regulations and the ACoP relating to fit testing.

(Ref. OC282/28, Part 1, Para 24)

3.4.2.2 Users of RPE
The user of the RPE should be trained in the donning, adjustment, fit checking and doffing of the respirator. The effectiveness of any RPD/RPE is entirely dependent on the way in which it is worn and adjusted. Fit checking is a considerable issue, in that the fit of the respirator must be the same during checking as when it is being used in a hazardous environment.

For FFPs it is generally accepted that the wearer cups their hands around the mask and exhales sharply to determine the integrity of the faceseal. If the respirator is reusable then they must also be trained in the storage and maintenance of the respirator. The condition of the RPE is as important as the integrity of the faceseal.

In addition, the user will need to be trained as a fit test subject. This is particularly important with respect to subjective qualitative test methods. The test subject is also the tester to some degree, and must understand how the assessment of fit is determined.

3.5 Some of the Challenges Faced

3.5.1 Interested Parties
There are several interested parties with respect to the use of RPE within the workplace. These include:

- The RPE user – the user of the RPE should be the most interested party, in that they are the one being protected if using RPE in the correct manner. They need to have the correct attitude to the use of RPE. This attitude can be built on a foundation of the correct training, so that they have a desire to use RPE and use it correctly.
- The HSO – the primary function of the HSO should be to create a positive health and safety culture in the workplace, to ensure that employers and workers comply with safety legislation, and that safety policies and practices are adopted and adhered to. They will be working in partnership with employers, employees, directors and trades unions to minimise:
  - operational losses;
  - occupational health problems, including long latency disease;
  - accidents;
  - injuries.

However, there will be commercial pressures that can lead to compromise, so one of the HSO’s biggest challenges is to achieve the above while still meeting commercial objectives.

- The Contractor/Site Owner – the key role of a contractor is to deliver the job on time and on budget. The budget and timescale will be under pressure but the correct attitude to respiratory health, and health and safety in general, must be maintained.
Board Directors of companies have a Duty of Care to employees (notwithstanding their obligations under HSWA and other legislation) such that major negligence could lead to criminal prosecution under CMCHA.

UK HSE Inspector – “As regulators,” the UK HSE Inspector’s “role is to determine that businesses are effectively and proportionately managing their health and safety risks to workers and others.” (Ref. HSE51 Para 2)

NHS – the long latency of respiratory disorders is significant in terms of NHS and benefit provider spending.

3.5.2 Multi-Location / Multi-Variable (Application/Hazard)
Many organisations will be operating multiple sites simultaneously and many of those sites will have a multiplicity of hazards. Consequently, the HSO is not always able to be on site. They will have to deal with day-to-day incidents on a reactive basis, this affects the ability to set up proactive RPE programmes.

For example, this has a significant impact with respect to new joiners who would not be able to work until a competent fit tester is available. What does the new starter do in the meantime?

3.5.3 Personnel Time Off Job and Co-ordination
Ensuring that all personnel who need tight fitting RPE are tested requires staff to be away from the work site to some extent which requires a considerable amount of co-ordination. Staff have to present themselves for test clean-shaven, not having smoked, not having eaten, and not having come from a dirty environment. (During data collection for this report, particle counting clearly showed when staff had come from a potentially hazardous dust environment.)

3.5.4 Tick-Box Mentality With No Controlled Follow-Up
The majority of HSO’s understand the need to carry out fit testing. It will be referenced in the RPE programme. The written RPE programme is usually the easiest thing to put in place. How ever well it may written, in reality, incidents and accidents on site could potentially result in validation of the programme and follow up actions being missed.

A successful RPE programme requires constant reviewing, adapting and training. Products that are more intuitive by their very nature enable a more successful programme implementation. Leadership focuses on the understanding ‘why we should’ rather than the non-committed ‘doing it because we have to’.

3.5.5 Uncontrolled Purchasing and ‘Commercial Pressure’
Many organisations will have in place purchasing agreements/restocking plans with distribution providers, under which a particular type of RPE is supplied for the site, usually at pre-agreed prices. Where the need for alternative RPE has been identified through fit testing, there will be agreement to supply more than one type of RPE. Effective control has to be exercised to ensure that staff are only wearing the mask for which they have been fit tested and that the distributor is actually supplying the product requested.

Similarly, local purchase arrangements and multi-supply arrangements must be well controlled. To many users, one FFP is much the same as another; after all, they all have very similar markings and appearance. Without strong product specification controls, the control of the RPE programme can move away from the HSO to the purchaser negating all the work done to get it established.

Half masks with unique bayonet filter couplings stop the ‘switch-selling’ of product alternatives that ‘do the same job’ when they have not been correctly fit-tested on users as replacement filters cannot be ‘mixed and matched’.

3.5.6 Subcontractors / Control on Site
In many industrial and construction operations it is not possible to have all specialisms on site, so it will be necessary to bring services in. All sub-contractor personnel will also need to be provided with adequate and suitable RPE, and this must be considered in terms of the RPE Programme and the supervision of staff (training and use of RPE).

Ideally, all subcontractors will come to site with evidence that they have been fit tested with the RPE that they are intending to use. If not, it will be necessary to ensure that this is carried out before work can commence.

3.5.7 Poor Fitting FFP3 Masks
The HSE Research Report RR1029 has identified that “Many of the FFP3 were poor at fitting the test subjects”. While the report was investigating the fit test pass criteria for FFP3 masks it does also report that fit checking an FFP3 does not give a reliable per-use fit check. At paragraph 3.4.1.1 of the report it was found that a positive pre-use fit check only resulted in a 41.9% probability that the user actually achieved a positive fit test result.
As previously detailed, there are many (in excess of 30) ENs and ISOs specifying the performance and use of RPD/RPE. Work is underway to consolidate them as ISO17420. The intention is that this standard will result in a reduction of work related respiratory disease. The standard is focused on the wearer rather than the product, and it should facilitate selection of adequate RPD/RPE, as products will be graded by their protection factor.

4.1 ISO16976 Five Generic Face Shapes

As part of the development of the new standard, much work was done to create a new set of anthropometric data, which has been published as ISO16976-2:2010, Respiratory protective devices — Human factors — Part 2: Anthropometrics. As a result of this work, the standard identifies a range of head shapes/sizes that should be considered when developing RPE. The anthropometric study was conducted by the NIOSH in 2003:

“The survey consisted of three age strata (18 years to 29 years, 30 years to 44 years, 45 years to 66 years), two gender strata (male and female), and four racial/ethnic group strata (white, African American, Hispanic and other). The selected test panel could be seen as almost representative for the worldwide population, since the US population is multi-ethnic. Height, weight, 19 face dimensions and neck circumferences were measured using traditional methods. A total of 3997 subjects (2543 male and 1454 female) were measured.”

(Ref: ISO16976-2:2010 Clause 5)

From these measurements, five generic headforms were determined – small, medium, large, long narrow and short wide.

4.2 ISO17420 Draft

The standard consists of three parts:-
- Part 1: Supplied breathable gas devices
- Part 2: Filtering devices
- Part 3: Thread Connection

Within the context of this report, The Force 8 half mask and PtoC™ filters are within the remit of Part 2.

4.3 APF’s Now / In Future

As described in Clause 4 of the July 2012 draft of ISO17420 Part 2, “the classification of a RPD is determined by the appropriate combination of performance levels”.

Currently, adequate RPE should be selected in the workplace according to the APF. This can be found in a number of documents, including EN529 Respiratory protective devices – Recommendations for selection, use, care and maintenance – Guidance document. This document highlights the large variation across Europe in terms of the APF for various devices. Part of the work of writing ISO17420 is to determine some universally accepted APFs – a project under the PEROSH group.


Many workplace protection-factor studies have demonstrated that the laboratory performance is not indicative of the RPE’s performance when actually being worn in the workplace. The laboratory tests for the measurement of inward leakage are very different from the conditions under which actual wearers use the RPE.

Currently, in the UK, EN149 FFP3 respirators and EN140 half masks fitted with EN143 P3 filters both have the same APF of 20. While the permitted laboratory TIL for both devices is the same, the filtration efficiency requirements are very different: minimum 99% efficiency for the FFP3, and 99.95% for the P3 filter. Given how much easier it is to fit-check a half mask product than an FFP, and considering the evidence from laboratory and workplace testing of devices, it is reasonable to expect that APFs based on the ISO17420 performance classification levels should be different for these two types of device.

4.4 Best Practice / Early Adopters

UK HSE have set an APF 20 for silica dust/particles. While FFP3 RPD and a half mask with P3 filters, both have a classified APF of 20 in the UK, many duty holders are looking to the latter RPD as a way of providing better levels of protection to their staff. This is based on the points made above, that a rubber mask will seal better to the face than an FFP, and also due to the psychological effects of providing a half mask with filters.

4.4.1 Move to Half Masks

User psychology should be considered as part of training and understanding of the benefits of any type of RPE. Based on conversations with test subjects during the assessments, users think that the hazard to which they are being exposed is greater when they are provided with a half mask and filters than when they are given an FFP. Therefore, they will take the hazard more seriously and wear and look after the product properly.

HSOs have also identified that staff take better care of products that are perceived as being more expensive than those that are disposable. If the mask does become contaminated during handling, the materials of the half mask and filters, if encapsulated, can be easily cleaned.

HSO’s have also identified that the control of RPE, in particular that the device for which the individual has been fit tested, is easier with the more distinctive nature of half masks and filters as opposed to FFPs, including the unique bayonet coupling systems between the half mask and filter.
4.4.2 Wellbeing

Employers who take a positive stance in relation to well-being are more likely to have “engaged employees [who are] aligned with business goals”. (Heron, R.J.L. (2013). Editorial, Occupational Medicine, 314–319)

Well-being of the individual and the business requires that the RPE user is fully engaged with the RPE and why they should use it, making them want to look after their own health. Intuitive and easier to understand products, such as the PtoC™ filters, are helping people to understand why they should use RPE, and other types of PPE. This is unlikely to be achieved by providing staff with the minimum required protection, hence the move by HSOs to specify higher/better levels of product.

4.4.2.1 Wellbeing & Work – a PEROSH Project

Members of PEROSH project have described the concept of well-being as a positive concept and include various themes with in this. As part of the project, the group has worked together to produce the ‘Wellbeing Tree’ as a model of wellbeing at work.

4.4.2.2 A User’s Account – Roger Bisby, Professional Builder magazine

In June 2014, Roger Bisby wrote an article entitled ‘When the dust settles’ in Professional Builder, in which, having worn the Force 8 mask with the PtoC™ filters, he discusses well-being: “If we could live our lives backwards, the wiser old self would stop the young self doing many foolish things”. Bisby wrote the article having used familiar ‘paper’ type disposable masks throughout his construction career. He had used Force 8 to carry out a task he had often done in the past. Having carried out the PtoC™ fit check to make sure that he was protected he goes on to discuss the after-effects of working:-

“The day before I wore it, I had been hacking up a screed wearing a disposable mask. The result was that I had been coughing all day. The following day I wore the JSP mask on the same job and the difference was astounding. I had a really comfortable day.”

The tree is intended to enhance employers’ understanding of what wellbeing at work means. A tree was selected as an appropriate metaphor because of its scope in intuitively capturing the ‘transaction’ between wellbeing contributors and consequences (Lazarus & Folkman, 1984). Employers can use the tree to identify the range of factors affecting wellbeing at work, with view to helping them ‘grow’ a more sustainably productive and committed workforce.


The image of the tree – in particular a fruit tree – provided a powerful metaphor for the holistic approach to wellbeing at work that we’re trying to communicate. The many different factors that contribute to workplace wellbeing are the roots of the tree, implying a clear relationship between investing in workforce wellbeing, and the benefits of doing so – the ‘growth’ of the tree, and the fruit it produces.

http://www.shponline.co.uk/health-and-wellbeing-taking-root/

5. INTRODUCTION OF THIS PAPER’S PROPOSITION

At the ISRP’s 17th International Conference, “Moving Forward with Respiratory Protection” in September 2014 several papers were presented with the theme of “faster fit testing”. In the introduction to the paper “Evaluation of a Faster Fit Testing Method for Filtering Facepiece Respirators Based on the TSI PortaCount®”, the authors state that “fit testing is an important part of a respirator program and less burdensome fit test methods for tight fitting respirators may help increase compliance”.

Both OC282/28 and HSG53 indicate that a pre-use fit check should be carried out, paragraphs 32 and 80 respectively. Indeed, HSG53 paragraph 80 states “For reusable masks this can be done by placing a hand over the filter or inlet valve(s) and breathing in. If there is a good seal, the user will experience the mask sucking in respectively. Indeed, HSG53 paragraph 80 states “For reusable masks this can be done by placing a hand over the filter or inlet valve(s) and breathing in. If there is a good seal, the user will experience the mask sucking in toward their face. The wearer should hold their breath for ten seconds and the facepiece should not loosen.” This was one of the design requirements of the Press to Check™ filter.
5.1 Can Press to Check™ Be Used As An Alternative Qualitative Fit Test?

Within the guidance document OC282/28 Part 1 Para 4it is stated – “Fit test equipment, and test procedures in this guidance should be used. Other equipment and procedures may be used providing that their suitability has been evaluated and can be demonstrated.” This white paper sets out to demonstrate that PtoC™ is an alternative qualitative fit test. In addition, PtoC™ provides an ongoing daily face fit reassurance.

5.2 Press to Check™ Is A Suitable Qualitative Face Fit Test

The Press to Check™ encapsulated filter system has been developed to improve respiratory protection by:-

- encapsulating the filter media in a hard case to protect them and prevent damage;
- channeling the air across the filter media more effectively to ensure maximum usage of the filter media;
- allowing the filter case to be closed to facilitate immediate and simple on mask fit checking without disrupting the seal during the test process.

Allowing the user to check that they have the correct fit before entering and while they are in the hazard area ensures they have the best level of protection. This, in turn, means they have greater confidence in the RPE they are using, which should have a beneficial effect on the quality of their work.

The encapsulation is hinged, which allows the user to close the filter without the need for an additional device, meaning the face seal can be quickly checked. By sealing the filter, the user replicates a blocked filter and is therefore challenging the face seal in the way that it would be during normal use. As the filter can be closed without any movement of the mask the face seal integrity is not affected. The action of blocking the filter also trains the wearer in what to expect as the filter becomes blocked during work, so they know when it is time to change them for fresh ones.

5.3 User Desire To Use Press to Check™ As An Alternative Qualitative Fit Test

HSOs have a duty to ensure that the staff for which they are responsible are as well protected as they can be. This means they must not only put in place the appropriate engineering controls to stop/reduce airborne respiratory hazards but also provide adequate and suitable RPE. With many manufacturers in the market, and a large amount of guidance information available, choosing adequate RPE is not difficult. However, ensuring that a particular RPD is suitable for the user is more complex.

OC282/28 provides guidance on fit testing for suitability, but there are often practical issues with ensuring this is carried out, as has been detailed.

HSOs are therefore looking for a simplified approach that gives reassurance that their staff are protected. Having reviewed JSP’s Force 8 and PtoC™ filter system, several HSOs have told JSP that this combination of RPD can provide better protection for their staff.

6. PRESS TO CHECK™ ASSESSMENT

6.1 Development Of The Press to Check™ Filter

In October 2012, JSP started development of an encapsulated P3 filter to fit the Force 8 half mask (project P302). The design brief included (but was not limited to):-

- Filter to be used with Force 8;
- Filter media size to be similar in size to current JSP equivalent;
- Filter to have protective cover on the outside – air flow from the back;
- Cover to snap fit on to filter carrier;
- Incorporate ‘lozenge’ shape of original P3 filter to filter cover (small rad to large rad);
- Avoid interference with user’s face;
- Consider fit checking – as described in HSG53 paragraph 80;

The product prototypes were first shown at the AAA Show in Dusseldorf in October 2013. Type Approval of the filter was first granted by BSI, certificate CE518694, dated 23 December 2013.

6.2 Proposal Of Press to Check™ As An Alternative Qualitative Fit Test

JSP was initially approached in June 2014 by a UK duty holder’s Health & Safety Director, who proposed using PtoC™ as an alternative to Qualitative Face Fit Testing.

He referenced OC282/28 Part 1 Para 4 and 5 where it states:–

4. 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.

5. Fit test equipment, and test procedures in this guidance should be used. Other equipment and procedures may be used providing that their suitability has been evaluated and can be demonstrated.

He was of the opinion that the ability to readily and quickly carry out a fit check using the unique hinged-filter encapsulation represents a greater level of protection for his workforce than system being used by company at the time, i.e. annual Qualitative fit testing, with the user then expected to wear the FFP in the same way every donning. Fit checking an FFP involves cupping the hands around the mask and then breathing out sharply, With an exhalation valve, much of the air will pass out of the valve. The wearer will be pushing the mask back against the face and therefore changing the seal that they would have during normal use. As shown in the HSE’s report RR1029, fit checking of an FFP mask has proved to give a very low confidence level (see para 3.5.7).

(Ref. RR1029 para 3.4.1.1)

With the PtoC™ filters on a half mask the wearer is able to carry out a fit check every donning without affecting the face seal. The fit check can very easily be repeated at any time during the work, without fear of contaminating the filter.

(Ref. HSG53 para 80)
6.3 Initial Assessment

The initial assessment for the duty holder was carried out on 18th and 19th August 2014. The assessment was carried out at the duty holder’s offices. A total of 59 individuals presented for assessment, the majority of them were office-based staff and not familiar with RPE, or fit testing.

The PtoC™ fit-check exercise carried out during the initial assessment was to:-
- Don the mask;
- Adjust the mask for a comfortable fit;
- Looking ahead, press the filter case together sealing the filters;
- Breathe in deeply;
- If leakage occurred, release the filters and adjust the mask and then repeat;
- If no leakage occurred, release the filters.

6.3.1 Mask Adaptation

JSP provided Force 8 masks for the fit testing. Only a medium size mask was available, with two material options: thermoplastic rubber and silicone-rich thermoplastic rubber. The silicone-rich mask is more flexible.

The masks were adapted for TSI Portacount fit testing by the addition of an adaptor between the left-hand filter and the mask. This allowed for a sample probe positioned within the breathing zone of the subject and at a position near to the subject’s lips. The open end of the sampling tube was fitted with a “ball” probe and positioned close to the subject’s face, between the nose and mouth.

6.3.2 Press to Check™ Assessment

When subjects presented for test, they were first inspected for facial features known to cause issues with respirator fit, such as:-
- Facial hair;
- Cleft chins;
- Scars on the face sealing area;
- Depressions around the temple/cheekbones;
- Unusual chin profiles (chisel feature);
- Unusual nose shapes;
- Very large/small or angular faces.

6.3.3 Assessment of Data

The data collected from the assessment was reviewed, taking into account observations made, a report was prepared for the duty holder.

The findings can be summarised as follows:-
- 83.1% accuracy, if all false-positives are included, (for instance, wearers with stubble who got a positive PtoC™ fit but should not be using a tight fitting RPD);
- 84.5% accuracy, by excluding people who (in all likelihood) failed the Portacount test because they smoked;
- 94.2% accuracy, by also excluding people who were seen fiddling with the mask during the Portacount test;
- 98.0% accuracy, if an enhanced ‘5 Point’ Press to Check™ testing regime is implemented.

6.4 Press To Check™ '5 Point' Fit Check

During initial testing it became apparent that the single PtoC™ exercise was not a robust enough check to ensure that a good fit was achieved on the mask. During the TSI Portacount fit-test exercises the subject’s head is required to move up and down, as well as side to side. This has the effect of stretching the subject’s skin in the area of the face seal. During the initial test it was observed that those subjects with looser skin, depressions around the temple/cheekbones, and unusual chin profiles achieved lower fit factors in the TSI Portacount test, despite passing the initial PtoC™ exercise. (See Para 7.2 below.)

A 5-position PtoC™ fit check was therefore proposed to the duty holder and has been adopted by JSP as advice to users. (The 5-position PtoC™ fit check was used during the second assessment.)

Subjects were then introduced to the mask and its features. The process of fit checking was demonstrated. The subjects then donned the mask and adjusted for a comfortable fit; guidance was given, if needed. If a positive PtoC™ was achieved the subject was asked to wait with the mask in place without further adjustment before going for a TSI Portacount test.

The TSI Portacount test followed the UK HSE OC282/28 protocol within the TSI software. The programme was set to allow the test to continue should the subject not achieve a fit factor above 100 in any particular test.

Following completion of the TSI Portacount test, the PtoC™ test was repeated on those that had not achieved a fit factor of 100 in all exercises. Facial measurements were then taken to determine the face shape in accordance with ISO16976-2:2010 Annex B measures A – K, and plotting in line with Figure 7 (see below).

Observations from initial subject presentation, PtoC™ fit checking, TSI Portacount testing, post-test PtoC™ fit check (in some cases) and facial dimensions were recorded, as well as images of each test subject.

6.3.3 Assessment of Data

The data collected from the assessment was reviewed, taking into account observations made, a report was prepared for the duty holder.

(Ref: JSP Press to Check™, Frost & Sullivan)

The findings can be summarised as follows:-
- 83.1% accuracy, if all false-positives are included, (for instance, wearers with stubble who got a positive Press to Check™ fit but should not be using a tight fitting RPD);
- 84.5% accuracy, by excluding people who (in all likelihood) failed the Portacount test because they smoked;
- 94.2% accuracy, by also excluding people who were seen fiddling with the mask during the Portacount test;
- 98.0% accuracy, if an enhanced ‘5 Point’ Press to Check™ testing regime is implemented.
A plain adaptor with no fittings was fitted to the right-hand side to ensure balance of the mask when worn. Although balance of the mask had not been highlighted in the previous test, the right adaptor was added to remove any potential issues.

### 6.5.2 Press to Check™ Assessment

When subjects presented for test, they were first inspected for facial features known to cause issues with respirator fit, such as:
- Facial hair;
- Cleft chins;
- Scars on the face-sealing area;
- Depressions around the temple/cheekbones;
- Unusual chin profiles (chisel feature);
- Unusual nose shapes;
- Very large/small or angular faces.

During this assessment many subjects presented for test with stubble, even though the subjects had been requested to present clean-shaven. When questioned, many of the subjects felt that shaving the night before or earlier in the previous day did mean that they were clean-shaven. Some of the subjects did later return clean-shaven. Some were tested to present clear evidence that even a small amount of stubble will affect the performance of a tight-fitting respirator face seal.

Subjects were then introduced to the mask and its features. The process of the 5-position PtoC™ fit check was demonstrated. The subjects then donned the mask and adjusted it for a comfortable fit; guidance was given, if needed. If a positive PtoC™ was achieved the subject was asked to wait with the mask in place without further adjustment before going for a TSI Portacount test.

The TSI Portacount test was carried out following the UK HSE OC282/28 protocol within the TSI software. The programme was set to allow the test to continue should the subject not achieve a fit factor above 100 in any particular test.

Following completion of the TSI Portacount test, the PtoC™ test was repeated on those that had not achieved a fit factor of 100 in all exercises. Facial measurements were then taken in accordance with ISO16976-2:2010 Annex B, dimensions A – K. Using the PCA method detailed in ISO16976-2:2010 Clause 8.3, each individual was plotted on the headform distribution diagram. See figure 7 below.

Observations from initial subject presentation, PtoC™ fit checking, TSI Portacount testing, post-test PtoC™ fit check and facial dimensions were recorded, as well as photographic images of each test subject.
A Comparative Assessment of the Press To Check™ Qualitative Fit Check and the Portacount Quantitative Fit Test

7. OBSERVATIONS IN TESTING

7.1 Face Shapes and Sizes

During both assessments the size and shape of the subjects’ faces were measured. With the exception of five subjects, the variety of face sizes/shapes fitted into the diagram shown in ISO16976-2:2010, see Figure 7 above. During the initial assessment of mostly office-based white-collar workers, including a high percentage of women, it became apparent that the single-size mask that JSP had available at the time did not provide a complete solution. However, during both assessments, some non-medium-sized faces did achieve a PtoC™ fit, and a fit factor in excess of 100 during TSI Portacount testing. The results from the assessment support the comments made in OC282/28 with respect to fit being adversely affected by the following facial features:

- Depressions around the temple/cheekbones;
- Unusual chin profiles (chisel feature);
- Unusual nose shapes;
- Very large/small or angular faces.

JSP has subsequently developed a size range of Force 8™ half mask respirators across the small, medium and large size range. To assist in the initial selection of a suitably sized mask, JSP have also developed a simple to use size guide as shown in figure 8.

7.2 5-Position Press To Check™ Method

During initial testing it became apparent that the single PtoC™ exercise was not a robust enough check to ensure that a good fit was achieved on the mask. During the fit test exercises the subject’s head is required to move up and down, as well as from side to side. This has the effect of stretching the subject’s skin in the area of the face seal. During the initial test it was observed that those subjects with looser skin, depressions around the temple/cheekbones, and unusual chin profiles achieved lower fit factors.

A 5-position PtoC™ fit check was therefore proposed to the duty holder and has been adopted by JSP as advice to users.

The 5-position exercises are as follows:-

- Look forward, press filter case together, breathe in – if not fitted, adjust and repeat. If fitted, release and go to next position.
- Look up, press filter case together, breathe in – if not fitted, adjust and repeat above. If fitted, release and go to next position.
- Look down, press filter case together, breathe in – if not fitted adjust and repeat all above. If fitted, release and go to next position.
- Look left, press filter case together, breathe in – if not fitted, adjust and repeat all above. If fitted, release and go to next position.
- Look right, press filter case together, breathe in – if not fitted, adjust and repeat all above. If fitted, release filters, you are ready to work.

Don the mask and tighten straps securely.

Press the filter together to create a seal

Inhale and change direction. No air should come through.

Fig 8. Force 8™ face size guide

Fig 9. Press to Check™ Fit Test
7.3 Unshaven Personnel

Prior to both assessments the respective HSOs were requested to inform their staff that they should present for testing clean-shaven. During both assessments it became clear that there were several interpretations as to the meaning of clean-shaven.

Fig 10. Indication of what is meant by “clean shaven”

Generally speaking, the office-based staff in the initial assessment were more clean-shaven than the blue-collar workers involved with the actual tunnelling operations in the second assessment. The issues around being clean-shaven and wearing a tight-fitting respirator were explained. This appeared to have a greater effect with the blue collar staff, with many going away and coming back clean-shaven.

The understanding of the second group, the blue collar staff, was enhanced greatly by the results collected from the TSI Portacount test for clean-shaven subjects and those with stubble. Both Press to Check™ and Portacount testing supported the UK HSE view that a faceseal cannot be achieved with any degree of stubble and facial hair.

7.4 Facial Piercings

A low number of subjects presented with facial piercings. Both Press to Check™ and Portacount testing supported the UK HSE view that facial piercings may affect the ability of the user to gain a faceseal with a respirator.

7.5 Skin Conditions

Particularly at the initial office-based assessment, several subjects presented with facial features that resulted in poor fits by both Press to Check™ and Portacount. These conditions were:

- Loose/aged skin;
- Cleft chins;
- Scars on the face-sealing area;
- Skin conditions, such as acne and eczema.

These findings support UK HSE comments in OC282/28 and HSG53.

7.6 Smokers and Chest Conditions

Several subjects who admitted to smoking achieved a Press to Check™ fit but did not achieve an acceptable fit factor during the TSI Portacount test. Despite being asked not to smoke for at least an hour before presenting for test, they had smoked within that timescale. Several subjects who came straight from the work site also achieved a poor fit-factor result. Following checks with the HSO, these poor fit factors were linked to the environment they had been working in.

Two subjects who presented claiming to have cold/flu symptoms achieved a PtoC™ fit check, but a low fit factor with the TSI Portacount. These results support the UK HSE comments in OC282/28 that subject-generated particles can result in a falsely low fit-test result.

Of particular note was an individual who had transferred to a stores person role, having spent many years working within a respiratory-hazard environment. Although not a smoker and no longer working in the hazardous area, with a very good fit Portacount gave a low fit factor.

7.7 Movement of the Mask

During instruction on how to fit the mask and how the fit test was to be carried out, the subjects were advised that, once fitted and checked, subsequent movement of the mask would upset the seal that had been achieved during the fit-check exercises. Several wearers during both assessments were seen to fiddle with the mask between the fit check and fit test, and some were seen to adjust the mask during fit testing.

In addition, several subjects did not follow instructions and carried out the bending exercise at a rate significantly greater than the 10–15 per minute instructed. They were seen to knock the mask against their arms during the bending exercise.

7.8 Test Equipment

During the first day of the second assessment, it was found that a few subjects recorded low fit factors, having had a positive PtoC™ fit check both before and after the TSI Portacount test. Examination of the half mask and the sample tube showed moisture droplets, which probably resulted in a falsely low fit factor.

7.9 Test Environment

During initial assessment at the duty holder’s offices it was necessary to generate ambient particles using the TSI aerosol generator. This produced an ambient particle count of 10700 – 19000. It was necessary to stop the testing on several occasions to raise the ambient particle count.

The second assessment was carried out in a building that was being used only for storage purposes during the development of the site. There was an evident build-up of dust in the building resulting from its lack of use and cleaning. TSI Portacount measurement of the ambient particle count was in the range 9000 – 24000 over the three days of testing. It was therefore not necessary to generate additional ambient particles.
8. THE RESULTS

During the assessments, it was clear that a medium-size mask was not suitable for many individuals who did not have a medium face. Therefore, only results for those that had a medium-size face were considered in the following analysis. This does mean that many results that did demonstrate a good fit, both with PtoC™ and TSI Portacount, were not analysed. The Fit2Fit-accredited tester identified results that should not be included as part of the analysis for various reasons, including having smoked within 60 minutes and moisture in sampling tubes.

The results from the assessment can be evaluated in more than one way. A typical approach would be to use statistical techniques, but there are also published ways in which to assess alternative fit tests. This section of the report will look at some of the methods.

8.1 Numerical Analysis

8.1.1 Probability of achieving a fit.

The proposition of this paper is that PtoC™ will successfully predict a fit factor in excess of 100 for the Force 8 half mask. In terms of probability, this is a specific event. Looking at the results we can see that for all of those medium-sized subjects who achieved a positive PtoC™ fit check, 65 out of 67 achieved a fit factor in excess of 100 in the TSI Portacount test. Therefore, the study states that there is a 97.10% probability that qualitative fit testing of the JSP Force 8 half mask carried out using the JSP Press to Check™ 5-point fit-check exercise will also give a fit factor in excess of 100.

- 97.10% achieved a fit factor in excess of 100, the minimum requirement for a halfmask as specified in OC282/28;
- 97.00% achieved a fit factor in excess of 200;
- 64.70% achieved a fit factor in excess of 1000.

This supports the statements in Para 4.3 in this report above, that APF of a half mask fitted with P3 filters should be higher than 20 and that wearers are better protected when wearing a half mask.

8.1.2 Why not standard deviation?

Standard deviation techniques would be the first-choice assessment of many. While these work very well with limited variability of score result, in respect of Portacount Quantitative Fit Testing, score results vary considerably. In the testing carried out we saw a variation in score from below 100 to over 61,000. A pass is achieved at a score of over 100 across the 7 tests so the variability in test scores causes a large skewing factor. This skewing gives a high mean average and too large a spread to make interpretation of the results meaningful using standard deviation techniques.

8.1.3 Why not use ANSI/AIHA Z88.10-2010 Criteria For Evaluating New Fit Test Methods?

Annex A2 of the above standard references a protocol for assessing the performance of an alternative face fit test method. While this is a well documented approach and has been referenced in a number of papers, it is not suitable for the evaluation of Press to Check™, and alternative Qualitative Fit Test due to:

8.1.3.1 Within the introduction to the Annex it states “While the ideal comparison procedure has yet to be proven this annex provides a specific procedure for evaluating fit test methods against the current body of knowledge.”

Press to Check™ is outside that body of knowledge. The annex then goes on to state “A proposed modification to an accepted QNFT protocol can be evaluated using the accepted protocol for that instrument as the reference standard.” Press to Check™ is not an alternative QNFT protocol but an alternative qualitative face fit test (QLFT).

8.1.3.2 The design of the comparative testing is based around a different type of product that would allow for the following:

“At least 50 of these paired tests must have reference method fit factors greater than 5% of the required fit factor and less than the required fit factor.”

(Ref. ANSI/AIHA Z88.10-2010 Annex A2)

With Press to Check™ the aim is that a check is done before use and therefore having results less than the fit factor requirement is not feasible.

8.2 Summary of Results

This report supports the JSP hypothesis that the facility to close off the airflow through the Press to Check™ filter when fitted to a JSP Force 8™ halfmask is a valid alternative qualitative fit test. The results show that if a successful PtoC™ fit is achieved there is a 97.1% probability that the user will have a fit factor in excess of 100 when a subsequent TSI Portacount test is carried out. That is, a Pass fit factor.

This is significantly greater than the correlation found by the HSE in their report RR1029. That report compared the fit checking and testing of FFP3 disposable masks. The fit check for a FFP3 mask typically requires the wearer to cover the face piece with their hands, to exhale sharply and to detect any leakage. The HSE found a probability that 41.9% of wearers achieved a positive fit test result following what they thought was a positive fit check.

This report and the HSE report show that the wearer can successfully self determine a good fit of the Force 8™ and Press to Check™ filters more accurately than that of an FFP3 disposable mask.
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