



## Respirator Fit Testing

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## PORTACOUNT® Plus Respirator Fit Tester



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## Who is TSI?






- Instrumentation manufacturer
- Founded 1961
  - Research
  - Industry
  - Defense

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## What is Respirator Fit Testing?

A means for making sure workers and first responders obtain the protection they need from their respiratory protection equipment

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## Why fit test?



- Training
- Sizing



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## Why fit test?



We still have to educate....



"Why do you always get to wear the good mask?"

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## What is a fit factor?



- The ratio of outside concentration to inside concentration

$$\text{Fit Factor} = \frac{C_{\text{outside}}}{C_{\text{inside}}}$$



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## What respirators need fit testing?



- All tight-fitting respirators
  - Industrial (full and half face)
  - SCBA
  - Gas masks
  - Disposable masks



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## Pass/fail levels



### OSHA

100 for half masks  
500 for full face masks\*

### ANSI and UK

100 for half masks  
1000 for full face masks\*

### AV – Arbetsmiljöverket

2000 for handling Asbestos

\*100 for positive pressure full face masks tested in negative pressure mode

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## Where do the pass/fail levels come from?



- In most cases, the minimum fit factor for a fit test is the respirators rating (called an Assigned Protection Factor) multiplied by a safety factor of 10.

- Minimum fit factor = APF X 10

Half mask:  $APF=10 \times 10 = 100$

Full face:  $APF=50 \times 10 = 500$

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## Fit Test Exercises



- All fit test methods involve a set of exercises designed to stress the face seal of the mask.
- OSHA requires the test subject to wear the mask for 5 minutes prior to the start of the fit test. It's known as the "comfort assessment period." This requirement applies to all fit test methods.
- UK HSE requires mask to be pre worn for 3-5 minutes
- No smoking for 45 minutes before test

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## The Overall Fit Factor



- For QNFT, a fit factor is measured for each exercise. At the end of the test, these values are used to compute the overall fit factor, which represents the final result of the fit test.

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## OSHA PortaCount Protocol



- Normal breathing
- Deep breathing
- Head side to side
- Head up and down
- Grimace
- Talk out loud
- Bend or jog in place
- Normal breathing



Total time for fit test is  
7 min 15 sec

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## UK HSE Fit Test Protocol



- Normal breathing
- Deep breathing
- Head side to side
- Head up and down
- Bending over
- Talk out loud
- Normal breathing



Total time for fit test is  
about 8.5 min

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## Fit Test Methods



Qualitative (QLFT)



Quantitative (QNFT)



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## QLFT



- Uses chemical stimulant to test fit.  
If chemical is detected, fit is inadequate
- Requires threshold test
- Time consuming
- Subjective
- Requires honesty

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## QLFT methods



- Saccharin (sweet taste)
- Bitrex (bitter taste)
- Isoamyl acetate (banana odor )
- Irritant smoke (respiratory irritant)
  
- Developed in the lab vs. QNFT
- Fit factor limited to 100

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## Saccharin QLFT



- Requires taste threshold testing
- If test subject senses sweet taste, test fails.
- Mouth must be open with tongue out.
- Tedious procedure
  
- Each fit test requires 75 – 225 squeezes of atomizer bulb.



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## QLFT limitations



- Maximum fit factor that can be assured is only 100
- Not suitable for testing full face masks that need a minimum fit factor of 500 or higher.
- Tedious procedure is operator-dependant
- Procedure often not followed exactly, which voids results.

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## Quantitative Fit Testing



- Fit is measured by an instrument
- Test subject cannot deceive test
- No fit factor limit

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## Advantages of QNFT



- Unlimited fit factor allows fit testing of any mask regardless of fit factor needed
- Test subject cannot deceive test
- Fit test is automated
- Results are documented

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## QNFT Methods



- Oil-mist / chamber systems
- Ambient aerosol systems
- Controlled negative pressure systems

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## Oil-mist Chamber QNFT



- The original method. Still considered the “Gold” standard.
- Expensive
- Non-portable
- High maintenance
- Requires highly trained operator



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## Ambient Aerosol QNFT

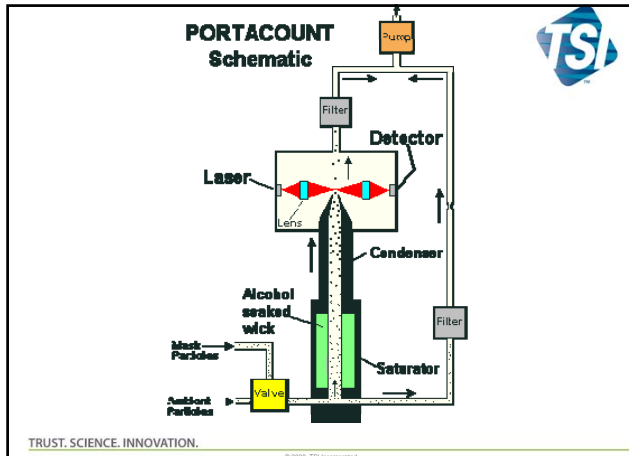


- Same concept as oil-mist, only no chamber or aerosol generator
- Less expensive
- Portable
- The TSI PortaCount is an ambient aerosol QNFT instrument



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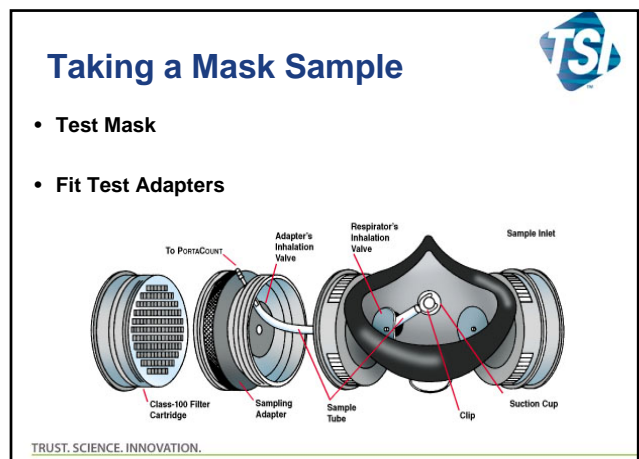
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### PortaCount Development History

Originally developed for the US Army in the mid 1980s  
 PortaCount Model 8010 released in 1987  
 PortaCount Plus Model 8020 released in 1991  
 Military version M41 fielded in mid 1990s  
 N95-Companion accessory released 1997

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## Fit Testing Positive-pressure Masks



- Fit test in negative-pressure mode (OSHA requirement)
- QLFT or QNFT allowed
- Thinking is that if mask fits OK in negative-pressure mode it will provide rated performance in positive-pressure mode (see application note ITI-024)

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## Fit Testing Disposable Respirators



- For P3 disposables, use the PortaCount alone.
- For P1 and P2, use the PortaCount along with the N95-Companion



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## The N95-Companion



- Allows only certain size particles to reach the PortaCount. A particle size that cannot pass through series-95 respirators (e.g. P1 and P2 TB masks).
- The N95-Companion makes a P1 or P2 mask look like a P3 mask to the PortaCount
- The PortaCount is making the measurement
- Complies with HSE 282/28
- The only QNFT method available for FFP 1, 2 & 3

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Respirator Type	Use PortaCount Alone	Use PortaCount plus N95
Full Face Mask		
Half face (elastomeric)		
P3 disposable		
P2 disposable		
P1 disposable		

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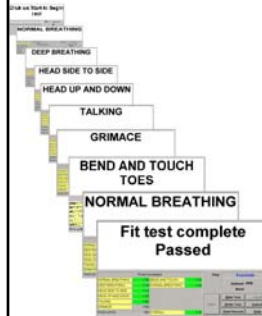
## PortaCount Universal Fit Test System



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## FitPlus Fit Test Software

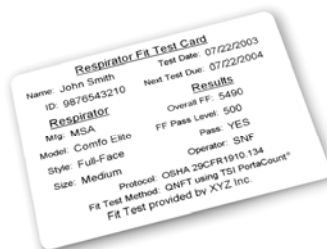


- Automates the test
- Maintains records
- Print Reports
- Fit test cards!

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## Respirator Fit Test Cards



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## Demonstration



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**Any Questions?**



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**Thank you**



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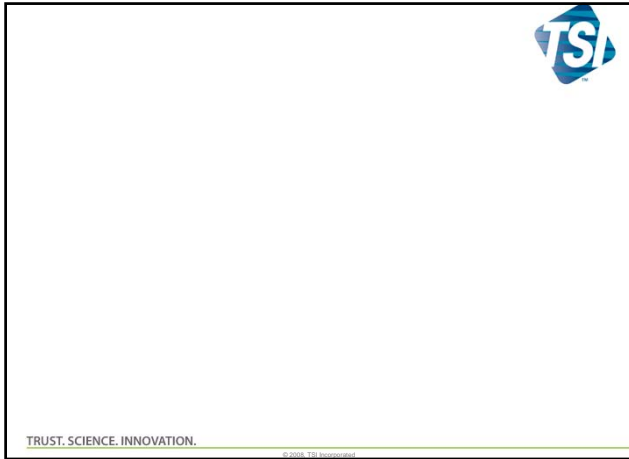
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