

**WAC 296-842-22010 Follow these fit-testing procedures for tight-fitting respirators.**

**IMPORTANT :**

1. This section contains procedural requirements that apply during actual fit testing.

2. See WAC 296-842-15005 of this chapter for fit-testing requirements that apply to your overall program.

**Exemptions:** This section does **NOT** apply to employees who:

1. Voluntarily use respirators; or
2. Are required to use mouthpiece respirators.

(1) Follow the procedure in Table 11 to choose a respirator for fit testing:

(a) Prior to conducting fit tests; and

(b) Any time your employee must select a different respirator such as when a previously selected respirator fails a test.

(2) Select and follow at least one of the following fit test procedures:

(a) Qualitative fit-test procedures:

(i) Isoamyl acetate vapor (IAA, banana oil) in Table 12;

(ii) Saccharine aerosol in Table 13;

(iii) Bitrex™ aerosol in Table 14;

(iv) Irritant smoke in Table 15.

(b) Quantitative fit-test procedures:

(i) Ambient aerosol condensation nuclei counter such as the Portacount™, in Table 16;

(ii) Controlled negative pressure (CNP) such as the FitTester 3000™, in Table 17;

(iii) Generated aerosol in Table 18.

(3) Make sure employees perform the appropriate fit-test exercises listed in Table 19.

(4) Clean and maintain equipment according to the manufacturer's instructions.

(5) Make sure during fit testing employees wear any safety equipment that could:

(a) Interfere with respirator fit; and

(b) Be worn in the workplace. For example, chemical splash goggles.

(6) Check, prior to fit testing, for conditions that may interfere with the respirator seal or valve functions. If you find such conditions, do **NOT** conduct fit testing for that individual.

**Note:** Examples of conditions that may interfere with the respirator seal or valve functions include:

1. Moustache, stubble, sideburns, bangs, hairline, and other types of facial hair in areas where the respirator facepiece seals or that interfere with valve function.
2. Temple bars of corrective eyewear or headgear that extend through the face seal area.

(7) Follow the appropriate fit test exercises in Table 19 as indicated.

**Table 11**

<b>Procedure for Choosing a Respirator for Fit Testing</b>
<p>1. <b>Inform</b> the employee:</p> <ol style="list-style-type: none"><li>a. To choose the most comfortable respirator that provides an adequate fit</li><li>b. That each respirator sample represents a different size and, if more than one model is supplied, a different shape</li><li>c. That if fitted and used properly, the respirator chosen will provide adequate protection</li></ol>

## **Procedure for Choosing a Respirator for Fit Testing**

2. **Provide** a mirror and show the employee how to:

- a. Put on the respirator
- b. Position the respirator on the face
- c. Set strap tension.

**Note:**

This instruction does NOT take the place of the employee's formal training since it is only a review.

3. **Review** with the employee how to check for a comfortable fit around the nose, cheeks and other areas on the face.

Tell the employee the respirator should be comfortable while talking or wearing eye protection.

4. **Have the employee** hold each facepiece against the face, taking enough time to compare the fit of each. The employee can then either:

- a. Reject any facepiece that clearly does not feel comfortable or fit adequately; or
- b. Choose which facepiece is most acceptable and which are less acceptable, if any.

**Note:**

a. Supply as many respirator models and sizes as needed to make sure the employee finds a respirator that is acceptable and fits correctly

b. To save time later, during this step note the more acceptable facepieces in case the one chosen fails the fit test or proves unacceptable later.

5. **Have the employee wear** the most acceptable respirator for **AT LEAST 5 minutes** to evaluate comfort and fit. Do **ALL** of the following during this time:

- a. Ask the employee to observe and comment about the comfort and fit:
  - i. Around the nose, cheeks, and other areas on the face
  - ii. When talking or wearing eye protection
- b. Have the employee put on the respirator and adjust the straps until they show proficiency
- c. Evaluate the respirator's general fit by checking:
  - i. Proper chin placement
  - ii. Properly tightened straps (do **NOT** over tighten)
  - iii. Acceptable fit across the nose bridge
  - iv. Respirator size; it must span the distance from nose to chin
  - v. To see if the respirator stays in position
- d. Have the employee complete a successful seal check as specified in WAC 296-842-22020 of this chapter

Prior to the seal check they must settle the respirator on their face by taking a few slow deep breaths **WHILE SLOWLY**:

- i. Moving their head from side-to-side; and
- ii. Up and down.

**Procedure for Choosing a Respirator for Fit Testing**

- 6. **If the employee finds the respirator unacceptable**, allow the employee to select another one and return to Step 5. Otherwise, proceed to Step 7.
- 7. **Before starting the fit test**, you must:
  - a. Describe the fit test including screening procedures, employee responsibilities, and test exercises; and
  - b. Make sure the employee wears the respirator **AT LEAST** five minutes.

**Table 12**

**Isoamyl Acetate (Banana Oil) Vapor Test Procedure**

**Important:**

- 1. This is a qualitative fit-test (QLFT) procedure
- 2. The success of this test depends on preserving the employee's odor sensitivity to isoamyl acetate (IAA) vapor
  - a. Vapor accumulations in ambient air can decrease odor sensitivity. To prevent this:
    - i. Prepare **ALL** solutions in a location separate from screening and test areas
    - ii. Conduct screening and tests in separate well-ventilated rooms. For example, use an exhaust fan or laboratory hood to prevent IAA vapor from accumulating in the room air
  - b. Always use odor-free water, for example, distilled or spring water that is 25°C (77°F).
- 3. Isoamyl acetate is also known as isopentyl acetate.

**Screening Preparations**

**Important:**

- Odor threshold screening determines if the employee can detect weak concentrations of IAA vapor.
- 1. Choose an appropriate location to conduct screening. Conduct screening and tests in separate well-ventilated rooms.
  - 2. Prepare a stock solution **AT LEAST** weekly as follows:
    - a. Add one milliliter (ml) of pure IAA to 800 ml of odor-free water in a one-liter glass jar with a metal lid using a measuring dropper or pipette
    - b. Seal the jar with the lid and shake it for 30 seconds
    - c. Clean the dropper or pipette.
  - 3. Prepare the odor test solution daily as follows:
    - a. Add 0.4 ml from the stock solution to 500 ml of water in a one liter glass jar with a metal lid using a clean pipette or dropper
    - b. Seal the jar with the lid and shake it for 30 seconds
    - c. Let this solution stand for 2-3 minutes so the IAA concentration above the liquid reaches equilibrium
    - d. Label this jar so you know the contents but the employee cannot know its contents, for example, "1."
- Note:**  
To maintain the integrity of the test, use labels that peel off easily **AND** periodically switch the labels.
- 4. Prepare a "test blank" solution as follows:

**Isoamyl Acetate (Banana Oil) Vapor Test Procedure**

- a. Add 500 ml of odor-free water to a one liter glass jar with a metal lid
  - b. Seal the jar
  - c. Label the jar so you know the contents but the employee cannot know its contents.
5. Type or neatly print the following instructions on a card and place it on the table in front of the two test jars:
- "The purpose of this test is to find out if you can smell banana oil at a low concentration. While both jars contain water, one ALSO contains a small amount of banana oil.*
- Make sure the lid is secure then pick up a jar and shake it for two seconds. Open the jar and sniff at the opening. Repeat this for the second jar.*
- Tell the individual conducting the fit test which jar contains banana oil."*

**Test Preparations**

6. Choose an appropriate location to conduct fit testing. Conduct screening and tests in separate well-ventilated rooms.
7. Assemble the fit test enclosure in the room.
- a. Invert a clear 55-gallon drum liner over a circular 2-foot diameter frame made of plywood or other lightweight rigid material OR construct a similar enclosure using plastic sheeting
  - b. Hang the frame with the plastic covering so the top of the enclosure is about six inches above the employee's head
  - c. Attach a small hook inside top center of the enclosure
  - d. Tape a copy of the test exercises (see Table 19) to the inside of the test enclosure where the employee can read it.
8. Have organic vapor cartridges or equivalent on hand for each employee's chosen respirator.
9. Have ready a 6 x 5-inch piece of paper towel or other porous absorbent single-ply material AND 0.75 ml of pure IAA. Do NOT apply IAA yet.
- Note:**  
As an alternative to using the paper towel, you may use an IAA test swab OR ampoule if it has been demonstrated to generate an equivalent test concentration.

**Screening**

10. Have the employee, while NOT wearing a respirator, follow the instructions on the card provided.
- a. If the employee correctly identifies the jar containing IAA, proceed to conduct testing (Step 11)
  - b. If the employee is NOT able to correctly identify the jar containing IAA, you must STOP and use a different fit test protocol.

**Testing**

11. BEFORE entering the fit test room, have the employee attach cartridges, put on, properly adjust, and seal check the respirator. Have the employee enter the test enclosure.

**Isoamyl Acetate (Banana Oil) Vapor Test Procedure**

12. Wet the paper towel with 0.75 ml of **pure** IAA **AND** fold it in half.

13. Pass the paper towel to the employee inside the enclosure **AND** instruct the employee to hang it on the hook at the top of the enclosure.

14. Wait two minutes for the IAA vapor to fill the enclosure.

a. While waiting, explain the fit test, including the purpose of the test exercises, the importance of cooperation, and that you must be informed if a banana-like odor is detected during the test

b. You may also demonstrate the test exercises.

15. Have the employee perform the appropriate fit-test exercises in Table 19.

a. If the employee does **NOT** detect IAA while performing test exercises, the fit test has been **PASSED**. Proceed as follows:

i. **BEFORE** leaving the enclosure, have the employee break the respirator seal and inhale. If they **detect** IAA, the test is valid

ii. When exiting the employee must remove the paper towel and give it to the individual conducting the fit test. This prevents IAA vapor from building up in the enclosure during subsequent tests

iii. The individual conducting the fit test must keep used paper towels in a self-sealing plastic bag to prevent area contamination

b. If the employee detects IAA during any test exercise, the fit test has **FAILED**. **STOP** and have the employee do the following:

i. Quickly return to the selection room to remove the respirator. This avoids decreasing the employee's odor sensitivity

ii. Select another respirator

iii. Repeat screening and testing

At this stage, if the employee fails the screening part of this procedure, the employee can repeat it **AFTER** waiting at least five minutes for odor sensitivity to return.

**Table 13**

**Saccharin Aerosol Test Procedure**

**Screening Preparations**

**Important:**

This is a qualitative fit-test (QLFT) procedure

Taste threshold screening determines whether the employee being tested can detect the taste of saccharin

The employee must **NOT** eat, smoke, chew gum or drink anything but plain water for at least fifteen minutes **BEFORE** the fit test. Sweet foods or drink consumed before the test may make the employee unable to detect saccharin during screening

Nebulizers must be thoroughly rinsed in water and shaken dry:

<b>Saccharin Aerosol Test Procedure</b>
<b>Screening Preparations</b>
<p>Each morning and afternoon</p> <p><b>OR</b></p> <p>At least every four hours.</p> <p>You may use commercially prepared solutions if they meet the requirements in this procedure.</p> <ol style="list-style-type: none"> <li>1. Obtain a test enclosure (hood) that meets the following specifications:               <ol style="list-style-type: none"> <li>a. Twelve inches in diameter by fourteen inches tall</li> <li>b. A clear front portion</li> <li>c. Enough space inside to allow free movement of the head when a respirator is worn</li> <li>d. A 3/4 inch (or 1.9 centimeter) hole to accommodate the nebulizer nozzle. The hole must line up in front of the wearer's nose and mouth.</li> </ol> </li> </ol> <p><b>Note:</b> An enclosure similar to the 3M hood assembly, parts #FT 14 and #FT 15 combined, meets these specifications This enclosure can also be used for testing.</p> <ol style="list-style-type: none"> <li>2. Obtain and assemble two clean DeVilbiss Model 40 Inhalation Medication Nebulizers OR equivalent.</li> <li>3. Prepare the screening solution as follows:               <ol style="list-style-type: none"> <li>a. Dissolve 830.0 milligrams of sodium saccharin USP in 100 ml of warm distilled water; or</li> <li>b. <b>IF</b> you have already prepared the fit-test solution, you can make the screening solution by adding 1 ml of this solution to 100 ml of distilled water.</li> </ol> </li> <li>4. Add about 1 ml of the screening solution to one of the nebulizers. Mark this nebulizer to distinguish it from the one to be used for fit testing.</li> </ol>
<b>Test Preparations</b>
<ol style="list-style-type: none"> <li>5. Prepare the fit-test solution as follows: Add 83.0 grams of sodium saccharin to 100 ml of warm water.</li> <li>6. Add about 1 ml of the test solution to the second nebulizer. Mark this nebulizer to distinguish it from the one to be used for screening.</li> <li>7. Have particulate filters ready for the employee's chosen respirator or have filtering-facepiece respirators ready.</li> </ol>
<b>Screening</b>
<ol style="list-style-type: none"> <li>8. Have the employee, while NOT wearing a respirator, put on the test enclosure.</li> <li>9. Instruct the employee to:               <ol style="list-style-type: none"> <li>a. Breathe through a slightly open mouth with tongue extended during screening AND testing</li> <li>b. Immediately report when a sweet taste is detected.</li> </ol> </li> <li>10. Insert the nebulizer into the front hole of the test enclosure AND administer saccharin as follows:               <ol style="list-style-type: none"> <li>a. Direct the nozzle away from the employee's nose and mouth</li> </ol> </li> </ol>

<b>Saccharin Aerosol Test Procedure</b>
<b>Screening Preparations</b>
<p>b. Complete 10 squeezes in rapid succession</p> <p>c. Each time firmly squeeze the bulb so it collapses completely, then release and allow it to fully expand.</p> <p>11. Ask the employee if a sweet taste is detected.</p> <p>a. If <b>YES</b>, screening is completed. Proceed to conduct testing, Step 14, <b>AFTER</b> you:</p> <p style="padding-left: 40px;">i. Ask the employee to remember the taste for reference during the fit test</p> <p style="padding-left: 40px;">ii. Note the employee's taste threshold as "10" regardless of the number of squeezes actually completed</p> <p>b. If <b>NO</b>, screening must continue. Proceed to Step 12.</p> <p>12. Repeat with 10 more squeezes. Then follow Step 11 again; <b>EXCEPT</b> this time note the employee's taste threshold as "20" <b>IF</b> a sweet taste is reported.</p> <p style="padding-left: 40px;">If a sweet taste is still <b>NOT</b> detected, repeat with 10 more squeezes and follow Step 11 one last time; <b>EXCEPT</b> this time note "30" for the taste threshold <b>IF</b> a sweet taste is reported.</p> <p>13. If <b>NO</b> sweet taste is reported after 30 squeezes, you must <b>STOP</b> and choose a different fit-test protocol for the employee.</p>
<b>Test</b>
<p><b>Important!</b></p> <p style="padding-left: 40px;">Periodically check nebulizers to make sure they do not clog during use. A test is <b>NOT</b> valid if the nebulizer is clogged at the end of the test.</p> <p>14. Have the employee attach particulate filters, put on, properly adjust, and seal check the respirator. Have the employee put on the test enclosure (hood).</p> <p>15. Instruct the employee to immediately report if a sweet taste is detected.</p> <p>16. Insert the nebulizer into the front hole of the test enclosure <b>AND</b> administer the same number of squeezes, either 10, 20, or 30, as noted during screening.</p> <p>17. Have the employee perform the appropriate fit-test exercises as described in Table 19. During this step:</p> <p style="padding-left: 40px;">a. Replenish the aerosol in the hood <b>EVERY</b> 30 seconds using 1/2 the number of squeezes used in Step 16, either 5, 10, or 15</p> <p style="padding-left: 40px;">b. The employee must report if a sweet taste is detected:</p> <p style="padding-left: 80px;">If <b>NO</b> saccharin is tasted, the test has been <b>PASSED</b></p> <p style="padding-left: 80px;">i. If saccharin is tasted the test has <b>FAILED</b>, have the employee select another respirator; and</p> <p style="padding-left: 80px;">ii. Repeat screening and testing.</p>

**Table 14**

<b>Bitrex™ Aerosol Test Procedure</b>
<p><b>Important!</b></p> <p style="padding-left: 40px;">This is a qualitative fit-test (QLFT) procedure</p>

**Bitrex™ Aerosol Test Procedure**

Bitrex™ (denatonium benzoate) is routinely used as a taste aversion agent in household liquids that children should not drink and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers

The employee must **NOT** eat, smoke, chew gum or drink anything but plain water for at least fifteen minutes **BEFORE** the fit test.

**Screening Preparations**

**Important!**

Taste threshold screening determines whether the employee being tested can detect the taste of Bitrex™

Nebulizers must be thoroughly rinsed in water and shaken dry:

Each morning and afternoon

**OR**

At least every four hours.

You may use commercially prepared solutions if they meet the requirements in this procedure.

1. Obtain a test enclosure that meets the following specifications:

- a. Twelve inches in diameter by fourteen inches tall
- b. A clear front portion
- c. Enough space inside the front to allow free movement of the head when a respirator is worn
- d. 3/4 inch (or 1.9 centimeter) hole to accommodate the nebulizer nozzle. The hole must line up in front of the wearer's nose and mouth.

**Note:**

An enclosure similar to the 3M hood assembly, parts #FT 14 and #FT 15 combined, meets these specifications

This enclosure can also be used for testing.

2. Obtain and assemble two clean DeVilbiss Model 40 Inhalation Medication Nebulizers OR equivalent:

3. Prepare the screening solution as follows:

- a. Make up a 5% salt solution by dissolving 5.0 grams of salt (sodium chloride) into 100 ml of distilled water
- b. Dissolve 13.5 milligrams of Bitrex™ in the salt solution.

4. Add about 1 ml of the screening solution to one of the nebulizers.

Mark this nebulizer to distinguish it from the one to be used for fit testing.

**Test Preparations**

5. Prepare the fit test solution.

- a. Dissolve 10.0 grams of salt (sodium chloride) into 200 ml of distilled water
- b. Add 337.5 milligrams of Bitrex™ to the warmed salt solution.

6. Add about 1 ml of the test solution to the second nebulizer.

**Bitrex™ Aerosol Test Procedure**

Mark this nebulizer to distinguish it from the one used for screening.

7. Have particulate filters ready for the employee's chosen respirator or have filtering-facepiece respirators ready.

**Screening**

**Important:**

The employee must **NOT** eat, smoke, chew gum or drink anything but plain water for at least fifteen minutes **BEFORE** the screening and test

8. Have the employee, while **NOT** wearing a respirator, put on the test enclosure.

9. Instruct the employee to:

- a. Breathe through a slightly opened mouth with tongue extended during screening **AND** testing
- b. Immediately report when a bitter taste is detected.

10. Insert the nebulizer into the front hole of the test enclosure **AND** administer Bitrex™ as follows:

- a. Direct the nozzle away from the employee's nose and mouth
- b. Complete 10 squeezes in rapid succession
- c. Each time firmly squeeze the bulb so it collapses completely, then release and allow it to fully expand.

11. Ask the employee whether a bitter taste is detected.

- a. If **YES**, screening is completed. Proceed to conduct testing, Step 14, **AFTER** you:
  - i. Ask the employee to remember the taste for reference during the fit test
  - ii. Note the employee's taste threshold as "10," regardless of the number of squeezes actually completed
- b. If **NO**, screening must continue. Proceed to Step 12.

12. Repeat with 10 more squeezes. Then follow Step 11 again; **EXCEPT** this time note the employee's taste threshold as "20" **IF** a bitter taste is reported.

If a bitter taste is still **NOT** detected repeat with 10 more squeezes and follow Step 11 one last time; **EXCEPT** this time note "30" for the taste threshold **IF** a bitter taste is reported.

13. If **NO** bitter taste is reported after 30 squeezes, you must **STOP** and choose a different fit-test protocol for the employee.

**Test**

14. Have the employee attach particulate filters, put on, properly adjust, and seal check the respirator. Have the employee put on the test enclosure.

15. Instruct the employee to:

- a. Breathe through a slightly opened mouth with tongue extended during screening **AND** testing
- b. Immediately report when a bitter taste is detected.

16. Insert the nebulizer into the front hole of the test enclosure **AND** administer the same number of squeezes, either 10, 20, or 30, as noted during screening.

**Bitrex™ Aerosol Test Procedure**

17. Have the employee perform the appropriate fit-test exercises as described in Table 19. During this step:
- a. Replenish the aerosol in the hood **EVERY** 30 seconds using 1/2 the number of squeezes used in Step 16, either 5, 10, or 15
  - b. The employee must report if a bitter taste is detected:
    - i. If **NO** Bitrex™ is tasted, the test has been **PASSED**
    - ii. If Bitrex™ is tasted the test has **FAILED**. Have the employee:
      - A. Select another respirator; and
      - B. Repeat all screening and testing steps.

**Table 15**

**Irritant Smoke (Stannic Chloride) Test Procedure**

**Important:**

**DO NOT USE A TEST ENCLOSURE OR HOOD FOR THIS FIT TEST!**

This is a qualitative fit-test (QLFT) procedure. During this test an employee is exposed to irritating smoke containing hydrochloric acid produced by a stannic chloride ventilation smoke tube to detect leakage. The smoke will irritate eyes, lungs, and nasal passages.

Employee sensitivity varies, and certain employees may respond more intensely than others exposed to irritant smoke. The individual conducting the fit test must take precautions to minimize the employees' exposure to irritant smoke.

Conduct fit testing in an area with adequate ventilation to prevent exposure of the individual conducting the fit test and build-up of irritant smoke in the ambient air.

**Screening AND Test Preparations**

**Important:**

Sensitivity screening is necessary to determine whether the employee can detect a weak concentration of irritant smoke **AND** whether any gross facepiece leakage is detected.

1. Obtain only stannic chloride (ventilation) smoke tubes, **AND** an aspirator squeeze bulb **OR** use a low-flow air pump set to deliver 200 milliliters of air flow per minute.
2. Equip the employee's chosen respirator with P100 series filters if a negative pressure air-purifying respirator will be tested. If a powered air-purifying respirator (PAPR) will be tested equip the respirator with high-efficiency particulate air (HEPA) filters.

**Screening**

**Important!**

When performing sensitivity screening checks use only the **MINIMUM** amount of smoke necessary to elicit a response from the employee.

3. Advise the employee that the smoke can be irritating to eyes, lungs, and nasal passages **AND** instruct the employee to keep eyes closed while exposed.

<b>Irritant Smoke (Stannic Chloride) Test Procedure</b>
<p>4. Break both ends of the ventilation smoke tube <b>AND</b> fit a short piece of plastic tubing, for example, two-to-six inches of tygon tubing, over one end to prevent exposure to the sharp end of the tube. Connect the other end to an aspirator bulb or a low-flow air pump set to deliver a flow of 200 ml per minute.</p> <p>5. While the employee is <b>NOT</b> wearing a respirator, have the employee smell a weak concentration of irritant smoke to become familiar with its irritating properties.</p> <p style="padding-left: 40px;">Carefully direct a small amount of irritant smoke toward the employee.</p>
<b>Test</b>
<p>Test 6. Have the employee attach respirator filters, put on, adjust, and seal check the respirator without assistance. The employee must be proficient at these tasks.</p> <p>7. Remind the employee to keep eyes closed during testing.</p> <p>8. Direct a stream of irritant smoke toward the respirator's face seal area as follows:</p> <ol style="list-style-type: none"> <li>a. Begin at least 12 inches from the facepiece <b>AND</b> move the smoke around the whole perimeter of the mask</li> <li>b. Gradually make two more passes around the perimeter of the facepiece, moving to within 6 inches of the respirator</li> <li>c. <b>STOP</b> at any time the employee detects smoke in the facepiece. If this occurs a different respirator will need to be chosen and tested, beginning with sensitivity screening.</li> </ol> <p>9. Have the employee perform appropriate fit-test exercises in Table 19 <b>IF</b> the employee has <b>NOT</b> had an involuntary response such as evidence of coughing, flinching, or other response, <b>OR</b> detected smoke in the facepiece.</p> <p style="padding-left: 40px;">Continue to direct smoke from a distance of 6 inches around the facepiece perimeter</p> <p style="padding-left: 40px;">If smoke is detected at any time the test has <b>FAILED</b>. A different respirator must be chosen and tested, starting with sensitivity screening</p> <p style="padding-left: 40px;">If <b>NO</b> smoke is detected proceed to Step 10.</p> <p>10. Have the employee remove the respirator <b>AND</b> perform another sensitivity screening check as follows:</p> <ol style="list-style-type: none"> <li>a. Continue to use the smoke tube used for fit testing</li> <li>b. Carefully direct a <b>SMALL</b> amount of irritant smoke toward the employee <ol style="list-style-type: none"> <li>i. The test has been <b>PASSED IF</b> the employee responds to the smoke</li> <li>ii. The fit test is <b>VOIDED IF</b> the employee does <b>NOT</b> respond to the smoke.</li> </ol> </li> </ol>

**Table 16**

<b>Ambient Aerosol Condensation Nuclei Counter (Portacount™) Test Procedure</b>
<p><b>Important:</b></p> <p style="padding-left: 40px;">This is a quantitative (QNFT) fit-test procedure</p>

**Ambient Aerosol Condensation Nuclei Counter  
(Portacount™) Test Procedure**

This method uses a particle counting instrument that measures and compares the particle concentration both inside and outside the respirator facepiece while the employee performs a series of test exercises

Particles in the ambient air are used as the test aerosol.

**Test Preparations**

1. Obtain a test instrument such as a Portacount™.
2. Have probed respirators available for each respirator model and size the employer uses, **OR** have a sampling adapter available if the employee's actual or chosen respirator will be tested.

**Note:**

A probed respirator has a special fitting installed on the facepiece designed to connect with the end of the test instrument's plastic sampling tube so that air samples can be taken inside the facepiece. Probed respirators can be obtained from the respirator manufacturer, or distributor, **AND** can only be used for fit-testing purposes

Contact TSI Inc., **OR** the respirator's manufacturer to obtain probed respirators or facepiece sampling adapters.

3. Follow the test instrument manufacturer's instructions for test preparation, including particle, zero, and system checks. Make sure the instrument's pass **OR** fail criterion is programmed to the following **MINIMUM** performance levels:
  - a. For half-facepiece respirators, an overall minimum fit factor of 100 as a passing level
  - b. For full-facepiece respirators, an overall minimum fit factor of 500 as a passing level
4. Have high-efficiency particulate air (HEPA) filters, **OR** other respirator filters available that are capable of preventing significant penetration by particles generated by the test instrument such as, P100 or N95 series filters.

If you will use a sampling adapter instead of probed respirators be sure to have the correct type for the respirators chosen.

**Test**

5. Properly attach the sampling line to the facepiece probe or sampling adapter.
6. Have the employee attach respirator filters, put on, properly adjust, and wear the respirator five minutes **BEFORE** the fit test. During this time you and the employee must evaluate the respirator's general fit by checking:
  - a. Proper chin placement
  - b. Properly tightened straps (do **NOT** over tighten)
  - c. Acceptable fit across the nose bridge
  - d. Respirator size. It must span the distance from nose to chin
  - e. To see if the respirator stays in position.

**Ambient Aerosol Condensation Nuclei Counter  
(Portacount™) Test Procedure**

**Note:**

Wearing the respirator for five minutes permits the employee to make certain the respirator is comfortable AND allows for purging of ambient particles trapped inside the facepiece.

7. Have the employee perform a seal check. Make sure the sampling line is crimped to avoid leakage during the seal check. If **NO** leakage is detected, proceed to Step 8. If leakage is detected:

- a. Determine the cause; and
- b. If leakage is due to a poorly fitting facepiece, have the employee:
  - i. Choose another respirator size or model; and
  - ii. Start again at Step 6.

8. Start the fit test cycle.

- a. Follow the manufacturer's instructions for operating the test instrument
- b. Have the employee perform the appropriate fit-test exercises in Table 19

The test instrument will automatically stop and calculate the overall fit factor. Use this result to determine whether or not the test is passed

The test has been **PASSED** if the overall fit factor is at least 100 for a half facepiece, **OR** 500 for a full facepiece

The test has **FAILED** if the overall fit factor is below 100 for a half facepiece or 500 for a full facepiece.

**Note:**

If the test has failed, have the employee select another respirator model or size following Table 11 AND repeat this procedure.

**Table 17**

**Controlled Negative Pressure (CNP) Test Procedure**

**Important!**

This is a quantitative fit-test (QNFT) procedure

This method determines respirator fit by measuring how much the facepiece leaks when it is subject to a slight negative pressure **AFTER** various premeasurement activities

Instruments used must have a nonadjustable test pressure of 15.0 mm water pressure

Measurements occur while employees remain still **AND** hold their breath for 10 seconds

No test aerosols are used. Respirator cartridges are not needed for this test. Sampling manifolds that replace the filter cartridges are available from the instrument manufacturer, and allow fit testing of an employee's own respirator.

**Test Preparations**

1. Make sure the individual conducting the fit test is thoroughly trained to perform this test.
2. Obtain a CNP test instrument such as a FitTester 3000™. Make sure:

### Controlled Negative Pressure (CNP) Test Procedure

- a. Defaults are set at:
  - i. -15mm (-0.58 inches) of water test pressure; and
  - ii. A modeled inspiratory flow rate of 53.8 liters per minute
- b. It has an effective audio warning device or visual screen tracing that signals when employees fail to hold their breath.

**Note:**

You are not required to obtain test recording and printing equipment such as computers OR printers. Hand recording results is acceptable

To see default settings, check the instrument's "REDON protocol."

3. Obtain facepiece adapters appropriate for each test respirator.

**Note:**

Adapters are either a one-piece (for SCBA facepieces), OR two-piece (for dual cartridge facepieces) device providing a manifold and breathing valve system. For positive pressure respirators, you will need to obtain an additional fitting, available from the respirator manufacturer, to convert the facepiece to negative pressure

To obtain adapters, contact the CNP instrument's distributor, Occupational Health Dynamics, OR the respirator manufacturer.

### Test

**Important!**

The respirator must not be adjusted once the fit-test exercises begin. Any adjustment voids the test and the test must be repeated.

4. Explain the test procedure to the employee.
5. Train the employee on how to hold a breath for at least 10 seconds.
6. Prepare the respirator for the fit test as follows:
  - a. Remove or prop open the inhalation valves. If a breathing tube is present, disconnect it
  - b. Replace cartridges, if present, with the manifold and breathing valve adapter

For positive pressure facepieces, mount the manufacturer's additional fitting followed by the manifold-breathing valve adapter
  - c. Connect the respirator to the CNP device according to the CNP instrument manufacturer's directions.
7. Have the employee put on, adjust, and seal check the respirator without assistance.
8. Turn on the instrument AND have the employee stand and perform the fit-test exercises in Table 19. Once exercises begin, any adjustments will void the test and you must begin again.
9. Once test exercises are completed, ask the employee about facepiece comfort. If the employee states the respirator is unacceptable, repeat the fit test using another size or model.

### Controlled Negative Pressure (CNP) Test Procedure

10. Determine the overall fit factor for each employee by calculating the harmonic mean of the fit-testing exercises as follows:

$$\text{Overall fit factor} = \frac{n}{1/\text{ffE1} + 1/\text{ffE2} + 1/\text{ffE3} \dots + 1/\text{ffEn}}$$

Where:

n = The number of exercises;

ffE1 = The fit factor for the first exercise;

ffE2 = The fit factor for the second exercise;

ffE3 = The fit factor for the third exercise;  
and

ffEn = The fit factor for the nth exercise.

The test is **PASSED IF** the overall fit factor obtained is at least 100 for a half facepiece, or at least 500 for a full facepiece

The test has **FAILED IF** the fit factor is less than 100 for a half facepiece; 500 for a full facepiece

If the test has **FAILED** you must have the employee select another respirator model or size following the steps in Table 11 **AND** repeat this procedure, starting at Step 6.

Table 18

### Generated Aerosol Test Procedure

#### Important:

- This is a quantitative (QNFT) fit-test procedure
- In this method, a test aerosol is used to challenge the facepiece seal while aerosol concentrations inside and outside the facepiece are measured during test exercises
- Special equipment is needed to generate, disperse, detect, and measure test aerosols.

#### Test Preparations

##### 1. Test aerosol.

Use a particulate, for example, corn oil, polyethylene glycol 400, di-2-ethyl hexyl sebacate, or sodium chloride.

##### 2. Instrumentation.

Do **ALL** the following:

- a. Obtain and use aerosol generation, dilution, and measurement systems appropriate for particulates
- b. Use an aerosol-generating instrument that will maintain test concentrations within a 10% variation
- c. Select a sampling instrument that allows for a computer record or strip chart record to be created

The record must show the rise and fall of test agent concentration during each inhalation and exhalation at fit factors of at least 2000.

**Note:** Integrators, or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise, may be used if a record of the readings is made.

- d. Minimize the time interval between the activity and the recording of the activity so you can clearly connect what you see to what is being recorded. For example, use a small diameter and length of sampling line.

##### 3. Test enclosure.

Do **ALL** the following:

- a. Make sure the enclosure is equipped and constructed to effectively:
  - i. Maintain a uniform concentration of the test agent inside the enclosure. For example, the enclosure must be large enough to allow **ALL** employees freedom of movement during testing **WITHOUT** disturbing the test concentration or measurement instrument
  - ii. Keep the test agent from contaminating the air outside the enclosure. For example, use a HEPA filter to purify exhausted air

### Generated Aerosol Test Procedure

- iii. Allow the individual conducting the fit test to view the employee during the test
- b. Make sure the tubing used to collect samples from the enclosure **AND** respirator is the same material, diameter, **AND** length. This makes the effect of aerosol loss caused by deposition in each sample line equal
- c. If sodium chloride is used, relative humidity inside the enclosure must be kept below 50%.

#### 4. Prepare test respirators.

Do **ALL** the following:

- a. Inspect test respirators regularly for missing parts **AND** damage
- b. Keep test respirators in proper working order
- c. Make sure in-mask sampling probes are:
  - i. Designed and installed so the air sample will be drawn from the employee's breathing zone; midway between the nose and mouth; and
  - ii. The probe extends inside the facepiece at least 1/4 inch
- d. Make sure sampling ports such as probes, or adapters on respirators are constructed and installed so they do **NOT**:
  - i. Block air flow into the sampling line
  - ii. Leak
  - iii. Interfere with the respirator's fit or performance

Have high efficiency particulate air (HEPA) filters **OR** P100 series filter available

Replace filters when increased breathing resistance is detected **OR** when the test agent has altered the filter material's integrity.

### Test

#### **Important!**

Throughout the test, maintain the employee's exposure to any test agent below the established exposure limit. Exposures allowed must be based on exposure time and exposure limit duration

If a single peak penetration exceeds 5% for half facepieces **OR** 1% for full facepieces:

**STOP** the test; and

Have the employee select another respirator for testing.

#### 5. Have the employee attach filters, put on, adjust, and seal check the respirator.

- a. Be sure to crimp the sampling line to avoid pressure leaks during the seal check; and
- b. Have the employee adjust the respirator straps, without assistance, so the fit is comfortable. Do **NOT** over tighten.

#### 6. **OPTIONAL Step.** To save time conduct a screening test to quickly identify poorly fitting respirators.

#### **Note:**

You may use a qualitative screening test **OR** an ambient aerosol condensation nuclei counter instrument in the count mode.

#### 7. Make sure test aerosol concentration is reasonably stable.

If a canopy or shower curtain enclosure is used, determine stability of the test aerosol concentration **AFTER** the employee enters the enclosure.

#### 8. Have the employee enter the test enclosure and connect the respirator to the sample lines.

#### 9. Immediately after entering the enclosure measure test aerosol concentration inside the respirator.

Make sure the peak penetration does **NOT** exceed 5% for half facepieces, **OR** 1% for full facepieces.

#### 10. Have employee perform the appropriate fit-test exercises in Table 19.

Do **NOT** adjust the respirator once exercises begin.

#### 11. Calculate the overall fit factor as specified in Steps 12-13. The fit test is:

- a. **PASSED IF** the minimum fit factor of 100 for half facepieces **OR** 500 for full facepieces is obtained; or
- b. IF a passing fit factor is **NOT** obtained, the test has **FAILED** and you must have the employee select and test another respirator.

### Calculations

#### **Important!**

Do **NOT** count the grimace exercise measurements during these calculations

Take into account the limitations of instrument detection when determining fit factors.

**Generated Aerosol Test Procedure**

12. Calculate individual fit factors for **EACH** exercise by applying the following:

$$\text{Exercise fit factor (ffE)} = \frac{\text{Average test enclosure concentration}}{\text{Test aerosol concentration inside the respirator}}$$

- a. To determine the average test enclosure concentration use one of the following methods:
  - i. Arithmetic average of the concentration before and after each **test** (an average of two values per entire test)
  - ii. Arithmetic average of concentration before and after each **exercise** (an average of two values per exercise)
  - iii. True average measured continuously during the respirator sample
- b. Determine the test aerosol concentration inside the respirator in one of the following ways:
  - Average peak penetration values. Determine aerosol penetration for each exercise by:
    - i. Using integrators or computers that calculate the actual test agent penetration; or
    - ii. Average the peak heights shown on the strip chart recording, graph, or by computer integration
  - c. Maximum peak penetration. Use strip chart recordings to determine the highest peak penetration for each exercise and use this value
  - d. Area under the peaks. Use computerized integration or other appropriate calculations to integrate the area under individual peaks for each exercise.

13. Using individual exercise fit factors (ffE) calculate the **overall fit factor** by doing **ALL** of the following:

- a. Convert each exercise fit factor to a penetration value;
  - b. Determine the average penetration value;
  - c. Convert the average penetration value back to a fit factor; or
- Use this equation to calculate the **overall fit factor**:

$$\text{Overall fit factor} = \frac{n}{1/\text{ffE1} + 1/\text{ffE2} + 1/\text{ffE3} \dots + 1/\text{ffEn}}$$

Where:

- n = The number of exercises;
- ffE1 = The fit factor for the first exercise;
- ffE2 = The fit factor for the second exercise;
- ffE3 = The fit factor for the third exercise; and
- ffEn = The fit factor for the nth exercise.

**Table 19**

**Fit-Test Exercises**

**Important:**

This list applies when you use any fit test

Employees tested must perform **ALL** exercises marked with an "X" as described for the fit-test procedure used

Once exercises begin, any adjustments made void the test **AND** you must begin again

After test exercises are completed, you must ask the employee about the comfort of the respirator. If it has become unacceptable, have the employee choose another one for testing

When the controlled negative pressure procedure is used, **STOP and repeat** the test if the employee adjusts the respirator **OR** takes a breath and fails to hold it for 10 seconds

Controlled negative pressure tests conducted according to the method published in 29 C.F.R. 1910.134, Appendix A are an acceptable alternative to the method outlined below.

Description of Required Fit-Test Exercises	Fit-Test Procedures		
	Qualitative Procedures	Quantitative Procedures; EXCEPT the CNPP	Controlled Negative Pressure Procedure (CNPP)
Normal breathing			

<b>Fit-Test Exercises</b>			
Breathe normally, while standing for one minute	X	X	
Deep breathing Breathe slowly and deeply while standing for one minute Take caution to avoid hyperventilating	X	X	
Head side to side Slowly turn head from side to side while standing for one minute, pausing at each extreme position to inhale Be careful to <b>NOT</b> bump the respirator	X	X	
Head up and down Slowly move head up and down while standing for one minute, inhaling in the up position Be careful to <b>NOT</b> bump the respirator	X	X	
Talking Talk slowly and loud enough to be heard clearly by the individual conducting fit testing for one minute. Choose <b>ONE</b> of the following: Read from a prepared text such as the Rainbow Passage <sup>1</sup> Count backward from 100 Recite a memorized poem or song.	X	X	
Grimace Smile or frown for fifteen seconds.		X	
Bending over Bend over to touch toes while standing. Repeat at a comfortable pace for one minute <b>OR</b> Jog in place for one minute if the test enclosure, such as a hood, does not permit bending over	X	X	
Normal breathing Breathe normally while standing for one minute	X	X	
Face forward <b>Premeasurement activity:</b> Stand and breath normally, without talking, for 30 seconds <b>Measurement position:</b> Face forward while holding breath for 10 seconds			X
Bending over <b>Premeasurement activity:</b> While standing, bend at the waist, as if to touch toes <b>Measurement position:</b> Hold the bending position with face parallel to the floor while holding breath for 10 seconds			X
Head shaking <b>Premeasurement activity:</b> Vigorously shake head from side to side for about 3 seconds while shouting <b>Measurement position:</b> Face forward, while holding breath for 10 seconds			X
Redon-1 <b>Premeasurement activity:</b> Loosen all facepiece straps and remove the respirator completely, then put it back on <b>Measurement position:</b> Face forward while holding breath for 10 seconds			X

<b>Fit-Test Exercises</b>			
Redon-2 Repeat the premeasurement activity and measurement position described in Redon-1			X

<sup>1</sup>The Rainbow Passage:

"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 colors. 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 reach, his friends say he is looking for the pot of gold at the end of the rainbow."

[Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, and 49.17.060. WSR 17-18-075, § 296-842-22010, filed 9/5/17, effective 10/6/17. Statutory Authority: RCW 49.17.050 and 29 C.F.R. Subpart Z. WSR 09-19-119, § 296-842-22010, filed 9/22/09, effective 12/1/09. Statutory Authority: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060. WSR 07-05-072, § 296-842-22010, filed 2/20/07, effective 4/1/07; WSR 03-20-114, § 296-842-22010, filed 10/1/03, effective 1/1/04.]