

GUIDANCE FOR DO-IT-YOURSELF RESPIRATORY FIT-TESTING DURING INCREASED DEMAND CONDITIONS

TIP No. 98-112-0420

INTRODUCTION

COVID-19 has greatly increased the demand for fit-testing of tight-fitting filtering facepiece respirators (FFR), such as N-95s and other similar respirators. The Respiratory Protection Program (RPP), as defined in Army Regulation (AR) 11-34 (*The Army Respiratory Program*, 2013), is a Commanders Program, which means that at each Installation a different configuration of people support the program. Consult with your Installation's RPP manager for details. Due to the variation of implementation and multiple questions, the U.S. Army Public Health Center (APHC) has created the following guidance:

1. The Army is following guidance provided by Occupational Safety and Health Administration (OSHA) on fit-testing. Current guidance is that initial fit-testing is required when using a different make, model or size of FFR. With the release of stockpiled personal protection equipment (PPE), this may mean that fit-testing happens more frequently. Fit-testing is not currently required for voluntary use of FFR.
2. Fit-testing must follow social distancing guidance when possible. There should be a minimum 6-feet of separation between people (other than the fit-testing subject and tester). This may impact fit-testing procedures by limiting the number of additional fit-testing hoods able to be set up in the fit-testing facility.
3. Fit-testing should be conducted in a well-ventilated space. Well-ventilated spaces are rooms with fume hoods or other dedicated functional exhaust, or if weather and the space permits, an outdoor area.
4. Fit-testing hoods should be either sanitized between uses or made out of disposable materials (clear waste bags) that are changed out between users. If using a commercial fit-testing hood, consult manufacturer for details on proper cleaning and sanitizing.
5. For individuals conducting fit tests PPE should include: cloth face covering (at a minimum) and gloves. Gloves must be changed out between fit-testing subjects. The testing subjects should wear the FFR and any other voluntary PPE that does not interfere with the testing.
6. Increased demand for fit-testing may result in manufactured fit-testing hoods not being readily available. Do-It-Yourself (DIY) guidance on building a disposable hood is available within this document.
7. Increased demand may also limit supplies of manufactured fit-testing solutions. Guidance on generating DIY fit-testing solutions is available within this document.

Performing Qualitative Fit-testing for Filtering Facepiece Respirators:

Full procedure for performing and documenting fit-testing can be found on this National Institute for Occupational Safety and Health (NIOSH) Website:

<https://www.cdc.gov/niosh/npptl/stps/pdfs/RCT-APR-0067-508.pdf>

This guidance is tailored to fit-testing for FFRs such as N-95s. All information is based on OSHA and NIOSH guidance.

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Do-it-yourself Testing Solution Instructions:

The DIY information in this guide should only be used when commercial off-the-shelf (COTS) qualitative fit-testing solution cannot be obtained. The COTS fit-testing solutions are more exact and appropriate for fit-testing, so they are preferred over DIY solutions. All information in this document is derived from Title 29 Code of Federal Regulations, Part 1910.134, “Respiratory Protection” Appendix A “Fit-testing Procedures (Mandatory).” (<https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134AppA>)

The OSHA describes four protocols for qualitative fit-testing. The protocols each uses a different testing solution: Isoamyl Acetate Solution, Saccharin Solution, Denatonim Benzoate (Bitrex™) Solution or Irritant Smoke (Stannic Chloride). Only the irritant smoke cannot be made DIY.

1. Isoamyl Acetate Solution.

As Isoamyl Acetate cannot be used to fit-test filtering face piece respirators, such as N-95s, the DIY method is not being provided here. Isoamyl Acetate may be used for elastomeric half-face or full-face respirators that are outfitted with organic vapor filter cartridges only.

2. Saccharin Solution.

Items Needed:

- Balance able to measure with 0.01 gram (g) resolution
- 100-milliliter (mL) graduated cylinder
- 5-mL graduated cylinder
- Sealable container able to hold at least 100 mL
- Deionized or distilled water (DI water)—procured at any big box store
- Sodium saccharin (CAS 81-07-2)—procured at any big box store or through a chemical distributor

Solution Preparation Procedure:

The testing solution can be made using a stock solution (A) or directly (B).

Stock Solution Method (A):

- Measure 83 g of sodium saccharin
- Measure 100 mL of warmed DI water
- Dissolve sodium saccharin in DI water in sealable container
- Label container as “Saccharin Stock Solution” and with date of preparation

Screening Solution:

- Measure 1 mL of stock solution
- Measure 99 mL of DI water
- Add water and stock solution to sealable container
- Label container as “Saccharin Screening Solution” and with date of preparation

Direct Solution Method (B):

- Weigh 0.83 g of sodium saccharin
- Measure 100 mL warmed DI water

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- Dissolve sodium saccharin in DI water in sealable container
- Label container as “Saccharin Screening Solution” and with date of preparation

3. Denatonim Benzoate (Bitrex™) Solution

Items Needed:

- Balance able to measure with 0.001-g resolution
- 100-mL graduated cylinder
- Sealable container capable of holding 150 mL of solution
- Deionized of DI water—procured at any big box store
- Sodium Chloride (NaCl) or noniodized table salt—procured at any big box store or supermarket
- Denatonium benzoate (also known as Bitrex) (CAS 3734-33-6)—procure through a chemical distributor

Solution Preparation Procedure:

- Create a 5% NaCl solution
 - o Measure 5g of NaCl
 - o Measure 95 mL of DI water
 - o Mix together in sealable container
- Measure 0.035 g of denatonium benzoate
- Add denatonium benzoate to 5% NaCl solution
- Seal container and mix well
- Label container “Denatonium Benzoate Screening Solution” and with date of preparation

Fit-testing Solution Suppliers:

Table 1 provides a subset of possible suppliers of the chemicals needed for the DIY mixing of quantitative fit-testing solutions. Please note the list is not exhaustive and does not represent an endorsement.

Table 1. Fit-testing Solution Suppliers

Product	GSS Part Number	Sigma-Aldrich Part Number	Fisher Scientific Part Number	Big Box Store
Isoamyl acetate	A0033-500ML	W205508	A0033500ML	No
Deionized/Distilled Water	267502	6442	23-751628	Yes (Walmart®, Target®, Amazon®, grocery stores)
Sodium Saccharin	S6047-250G	PHR1348	S394-500	Yes (Walmart, Target, Amazon, grocery stores)
Denatonium benzoate	D5765-10G	D5765	AAJ6104814	Limited (Amazon)

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Nebulizers Used in Fit-Testing:

The OSHA protocol states that testing should be done “using a DeVilbiss® Model 40 Inhalation Medication Nebulizer or equivalent”. This type of nebulizer may be in high demand, and availability may be limited.

There are other nebulizers available from a variety of manufacturers, including but not limited to 3M® and TSI®. Please note the list is not exhaustive and does not represent an endorsement. An additional resource may be nebulizers borrowed from Installation medical treatment facility.

Cleaning and Sanitizing Fit-testing Hoods:

These instructions are generalized for commercially manufactured fit-testing hoods. They are based on Powered Air-Purifying Respirator (PAPR) cleaning and sanitizing protocols created by 3M. It is highly recommended that the manufacturer’s cleaning directions are followed.

Cleaning is recommended after each use. Wear nitrile or other disposable gloves and a face covering when cleaning the hood. As with any disinfecting agent, follow the User Instructions and/or U.S. Environmental Protection Agency (EPA) label in regards to usability, application, and contact time; also, and ensure all components are thoroughly rinsed with fresh, warm water and thoroughly dried before use or storage. If hood is soiled, it must be cleaned before disinfection. Clean all parts of the fit-test hood assembly, both inside and outside, with a clean soft cloth dampened with warm water containing a mild pH neutral (pH 6-8) detergent (refer to specific product instructions for water and temperature guidance). Do not soak the hood during cleaning.

Disinfect the fit-test hood assembly with the disinfectant cleaner. Follow the User Instructions and/or EPA label for the selected disinfectant. Surfaces must be visibly wet with disinfectant for the full specified contact time.

Rinse the disinfection solution from the fit-test hood assembly by wiping with a clean cloth dampened with fresh water. Rinse the cloth often to help ensure effective removal of the disinfectant solution.

All components should be allowed to air dry completely prior to reuse or storage. Air dry in an uncontaminated atmosphere, where the temperature does not exceed 120 °F. Before use, inspect the hood following the inspection procedures in the instructions for that item.

DIY Fit Test Hood for Qualitative testing

Before beginning, collect the following materials:

(2) wire clothes hangers (or other rigid but bendable wire)


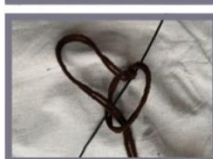
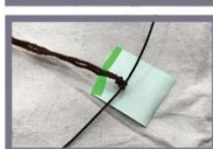

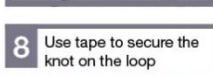
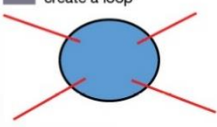




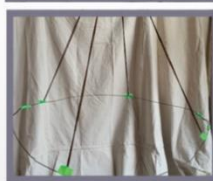


(4) 24 inch pieces of string, twine, or lite rope

Sturdy tape (duct, packing)

Carabiner or other clip (Optional)

(1) Large Clear garbage bag

Laminated copy of required exercise for fit test and rainbow passage (it can be disinfected)

<p>1 Take a wire hanger and untwist the hook end</p>		<p>9 Repeat steps 7&8, 3 times in equal measurements around the loop</p>	<p>14 Feed the knotted end of string through the hole in the garbage bag</p>
<p>2 Straighten all bends</p>		<p>10 Tie the four ends of string together in single, strong knot</p>	<p>15 Secure the hole in bag against the sting with tape</p>
<p>3 Repeat with the second hanger</p>		<p>11 Connect the carabiner to the knot (optional)</p>	
<p>4 Twist the ends of the two hangers together, so you have a single long wire</p>		<p>12 Take the garbage bag and cut a small hole in the center of the bottom</p>	<p>16 Hang the completed DIY Fit Testing Hood with the loop approximately 6 feet from the ground</p>
<p>5 Twist the ends of the long wire together to create a loop</p> 		<p>13 Drape the garbage bag over the wire loop – adjust until the loop supports the bag evenly</p>	
<p>6 Use tape to reinforce and protect the sharp ends</p>	<p>8 Use tape to secure the knot on the loop</p> 		
<p>7 Tie a piece of string to a single point of the loop</p>			
			
			

Using the DIY Fit Testing Hood		
1	2	3
<p>Tape the laminated copy of the exercises and rainbow passage to loop inside of garbage bag</p>	<p>Cut a small slit in the garbage bag to allow the nebulizer to be held inside and operated during fit testing</p>	<p>Discard the DIY Fit Test hood garbage bag and replace with a new one in-between users or disinfect the with EPA registered household disinfectant (follow directions for dwell time)</p>

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Exercises Required for Qualitative Fit-testing:

This can be printed out and laminated, the test subject can hold it or you can tape it inside of the hood.

1. **Normal breathing.** In a normal standing position, without talking, the subject shall breathe normally.
2. **Deep breathing.** In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.
3. **Turning head side to side.** Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.
4. **Moving head up and down.** Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).
5. **Talking.** The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

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.

6. **Bending over.** The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type Quantitative Fit-Testing [QNFT] or Qualitative Lift-Testing [QLFT] units that do not permit bending over at the waist.
7. **Normal breathing.** Same as exercise (1).