



Respirator fit testing

Why is fit testing important?

Fit testing is important to ensure the respirator fits tightly to the face of the wearer (user) and protects them from inhaling infectious aerosol containing *Mycobacterium tuberculosis* and other airborne pathogens. Leakage of unfiltered air into the breathing zone through any gap between the face and the respirator increases the risk of TB exposure to individuals working in high TB transmission risk settings. This leakage can be detected by performing a respirator fit test. The size, shape and configuration of every face is different and can potentially change over time. Therefore, it is important that several different respirator models and sizes are available, and every health worker should be fit tested with respirators he/she may use in high risk settings. This is why respirator fit testing is an essential component of an effective personal respiratory protection program.

What is fit testing?

A “respirator fit test” (29 CFR 1910.134) tests the efficiency of a respirator to remove *M. tuberculosis* and other particles from the air (see https://www.osha.gov/video/respiratory_protection/fittesting_transcript.html). It takes about 15-20 minutes per person to complete a fit test and is performed periodically thereafter. After passing a fit test with a respirator, you must use the exact same make, model, style, and size respirator on the job.

There are two types of fit tests: qualitative and quantitative. Qualitative fit testing is normally used for filtering facepiece respirators called “N95” or “FFP2” as well as for elastomeric (“rubber”) respirators. (See ETTI respirator technical information sheet here: <http://www.stoptb.org/wg/ett/>).

Qualitative fit testing is easier and more common than quantitative fit testing. A qualitative fit test is a pass/fail test method that uses your sense of taste in order to detect leakage through or around the respirator. Qualitative fit testing does not measure the actual amount of leakage. The primary qualitative fit test methods are described below and include:

- **Saccharin, which leaves a sweet taste in your mouth; and**
- **Bitrex® (Denatonium benzoate), which leaves a bitter taste in your mouth.**

Quantitative fit testing uses a aerosol meter to measure the actual amount of particles inside and outside the respirator and does not rely upon individual's sense of taste to detect leakage. The respirators used during this type of fit testing should have a probe attached to the facepiece and connected to the meter by a hose.

Who and when?

Every health worker working in high TB transmission settings should be fit tested when he/she starts work, when using a new respirator model or size, in case of face configuration change (weight gain or loss, new facial hair style, major dental work, new facial scarring, etc.) and periodically thereafter. Respirator fit testing should be conducted on a representative amount of potential wearers if a national TB program (NTP) or facility administration plans to change respirator model(s) for procurement to avoid wasting resources on ineffective or counterfeit which can leave health workers without essential means to protect themselves from acquiring TB.



What equipment is needed for qualitative fit testing?

To conduct qualitative respirator fit test, you need a kit which usually contains:

1. Test hood
2. Nebulizer for sensitivity solution
3. Nebulizer for test solution
4. Sensitivity solution (Bitrex® or Saccharin)
5. Test solution (Bitrex® or Saccharin)

How is a qualitative fit test done?

Before conducting the respirator fit test, a sensitivity test is performed to screen the individual's taste threshold to the sweet or bitter testing agent. This step is performed without wearing respirator, by spraying the aerosol of sensitivity ("weak") solution under the hood. The test subject breathes through his/her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter (for Bitrex®) or sweet (for Saccharin) taste.

The fit test includes the following consecutive one-minute exercises while the test subject wears a respirator under the hood (standing):

1. Normal breathing
2. Deep breathing
3. Moving head side to side
4. Moving head up and down
5. Talking
6. Walking or jogging
7. Normal breathing

Based on number of nebulizer “squirts” during the sensitivity test, use the same number of squirts at the beginning of the fit test and then half that number of squirts every 30 seconds with the test solution nebulizer (stronger concentration) to create a steady-state concentration of test agent aerosol under the hood.

The test subject shall indicate if at any time during the fit test the bitter or sweet taste is detected. If the test subject does not report tasting the test agent, the test is passed. If the taste is detected, the fit is deemed unsatisfactory and the test is failed. Fit testing results should be documented and kept in facility records. Facilities and NTPs should procure and distribute respirators in different styles and sizes aimed to offer every health worker well-fitting respirators based on fit testing records.



Elapsed time	# of “squirts”	Exercise
0:00	10 / 20 / 30	Normal breathing
0:30	5 / 10 / 15	
1:00	5 / 10 / 15	Deep breathing
1:30	5 / 10 / 15	
2:00	5 / 10 / 15	Head side-to-side
2:30	5 / 10 / 15	
3:00	5 / 10 / 15	Head up-and-down
3:30	5 / 10 / 15	
4:00	5 / 10 / 15	Talk non-stop
4:30	5 / 10 / 15	
5:00	5 / 10 / 15	Walk/jog in place
5:30	5 / 10 / 15	
6:00	5 / 10 / 15	Normal breathing
6:30	5 / 10 / 15	
7:00	Stop	

Who can conduct a qualitative fit test?

Any nurse (infection control or occupational health nurse) or technician can be trained to conduct qualitative fit tests and keep records. It is reasonable to combine periodic fit testing with annual IPC training for health workers. The respirator portion of training should include correct respirator donning (putting on), doffing (taking off), use, care, disposal and other components of personal respiratory protection program.



What if someone does not pass the fit test?

Not everyone can get a good fit with every respirator ... even if the manufacturer states “one size fits all”! If the test subject fails the fit test, then another make, model, style, and/or size respirator must be tried until one is found that fits properly. Therefore, an employer needs to provide every health worker with a reasonable selection of sizes and models to choose from. When the individual completes the fit testing process, it’s very important that he/she knows which make, model, style, and size respirator fits properly, and when and where it is needed to wear for protection.

What is a user seal check?

A fit test should not be confused with a user seal check. A user seal check is a quick check performed by the wearer each time the respirator is put on before entering high risk area. It helps to indicate if the respirator to be readjusted. Seal check the respirator after careful donning in accordance to the manufacturer’s instructions as follows:

- if the respirator is not fitted with an exhalation valve, exhale and inhale sharply (*you should feel the respirator expand and collapse slightly*)
- if respirator is fitted with an exhalation valve, inhale sharply (*negative pressure should be felt inside the respirator – face piece should collapse slightly*)
- if you detect air leaks, re-adjust the head straps and/or nosepiece

A user seal check is not a substitute for a fit test!



Can fit testing solutions be self-prepared?

The Bitrex® sensitivity test solution:

Add 13.5 milligrams of denatonium benzoate USP to 100 ml of 5% saline (NaCl) solution.

The Bitrex® fit test solution:

Add 337.5 mg of denatonium benzoate USP to 200 ml of a 5% saline (NaCl) solution.

The Saccharin sensitivity solution:

Dissolve 0.83 grams of sodium saccharin USP in 100 ml of warm water

- or -

Add 1 ml of the Saccharin fit test solution in 100 ml of distilled water.

The Saccharin fit test solution:

Add 83 grams of sodium saccharin to 100 ml of warm water.

This document was made possible through the support of Stop TB Partnership's End TB Transmission Initiative (ETTi) Working Group provided by the United States Agency for International Development (USAID), under the terms of cooperative agreement number STBP/USAID/GSA/2018-04.