Qualitative Fit Testing – Quick Tips

Specific requirements for qualitative fit testing are detailed in the Occupational Safety and Health Administration's (OSHA's) Respiratory Protection Standard, 29 Code of Federal Regulation (CFR) 1910.134 Appendix A – Fit Testing Procedures (Mandatory).

All respirators that rely on a mask-to-face seal must be fit tested to validate the seal is air-tight. This fit test must be performed:

- prior to first issue,
- when there's a change in the model, style or size of respirator used,
- when there's a physical facial change in the person wearing the mask, and
- at least annually

Qualitative fit testing is one of two broad categories of testing that OSHA recognizes. The other option is quantitative fit testing. The qualitative fit test procedures rely on the subjective sensory (taste, irritation, smell) response of the respirator wearer to a particular test agent, while the quantitative procedures measure actual face seal leakage. For more details on quantitative fit testing see Quick Tips #318: Quantitative Fit Testing.

Fit Test Agents

In the mandatory qualitative fit test protocols, OSHA recognizes four test agents:

1. **Isoamyl Acetate (Isopentyl Acetate or Banana Oil)**This qualitative fit test agent uses a person's response to fruit-like banana aroma to detect leakage into the respirator. A drawback to this agent is lack of a strong reaction in some fit test subjects to the banana odor. Another drawback is it can only be used with respirators

equipped with organic vapor cartridges.

2. **Saccharin Solution** This qualitative fit test agent uses a person’s response to a sweet taste to detect leakage into the respirator. The drawback to this agent is lack of a strong reaction in some test subjects to a sweet taste.
3. **Bitrix™ (Denatonium Benzoate)**This qualitative fit test agent uses a person’s response to a bitter taste to detect leakage into the respirator. The advantage this agent has over Isoamyl Acetate and Saccharin is the bitter taste. Few enjoy a strong bitter taste so an unavoidable response by the test subject is readily noticed.
4. **Irritant Smoke (Stannic Chloride)**This qualitative fit test agent uses a person’s response to the irritating chemicals released in the “smoke” produced by a stannic chloride smoke tube to detect leakage into the respirator. The stannic chloride reacts with humidity producing a white smoke with a pungent odor. The drawback to Irritant smoke is that it can be toxic. The smoke contains two compounds: hydrogen chloride (HCl) and tin (Sn). Hydrogen chloride is highly corrosive to human tissue. Inhalation of a relatively low concentration will cause irritation to the upper respiratory tract and eyes. This is why it’s such an effective chemical to use for respiratory fit testing.

Even though these qualitative fit testing agents can be used to fit test both half-mask and full-face respirators, it is important to note that qualitative fit tests only validate an assigned protection (APF) of 10. OSHA has established an APF of 50 for full facepiece respirators, but in order to use a full facepiece beyond 10 times the permissible exposure limit (PEL), a quantitative fit test must be performed.

Respirator Selection and User Seal Checks

Employees must be trained on how to properly don a respirator, how to position it on the face, how to adjust the strap tension, and how to determine an acceptable fit prior to selecting a respirator. The employee then picks the most acceptable respirator from a sufficient number of samples and wears it at least five

minutes to assess the comfort (chin properly placed, adequate strap tension, fits across the nose bridge, spans the distance from the nose to chin and does not have a tendency to slip).

The test subject is then required to complete a user seal check as detailed in Appendix B-1 to 29 CFR 1910.134: User Seal Check Procedures (Mandatory).

- **Positive pressure check.** Close off the exhalation valve and exhale gently into the facepiece. The fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators, this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.
- **Negative pressure check.** Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for 10 seconds. Since the design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand, the test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.
- **Manufacturer's recommended user seal check procedures.** The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally as effective.

Fit Test Exercises

Before beginning the qualitative fit testing protocol, employees are given a description of the fit test and their responsibilities during the procedure. All four qualitative fit test protocols use these seven, 60-second exercises:

1. **Normal breathing:** standing position without talking.
2. **Deep breathing:** standing position without talking, breathing slowly and deeply.
3. **Turning head side-to-side:** standing position, slowly turning head side-to side, holding at extreme point and inhaling.
4. **Moving head up and down:** standing position, slowly moving head up and down and inhaling in the up position.
5. **Talking:** talk out loud slowly and loud enough to be heard clearly; read from a prepared text (Rainbow Passage*); count backward from 100 or recite a memorized poem.
6. **Bending over/jogging in place:** bend at the waist as if to touch toes. Jogging in place is substituted for testing done in a shroud that does not permit bending over at the waist.
7. **Normal breathing:** standing position without talking.

*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 about, 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."

Fit Testing Protocols

Paragraph B of Appendix A to 29 CFR 1910.134: Fit Testing Procedures (Mandatory) describes the procedure to follow for each of the four test agents:

1. Isoamyl Acetate – paragraph B2
2. Saccharin Solution – paragraph B3
3. Bitrix™ Solution – paragraph B4
4. Irritant Smoke – paragraph B5

OSHA also provides a fit testing video that provides a brief overview and general information regarding fit testing requirements.

Commonly Asked Questions

Q: What types of respirators need to be fit tested and fit checked (user seal check)?

A: Any tight-fitting respirator in use unless being used on voluntary basis, whether it is disposable or reusable. This means respirators that contact the skin to form a seal must be fit tested and fit checked (user seal check).

Q: What is the difference between a fit test and a user seal check (fit check)?

A: Both check and verify that the seal between the mask and skin is maintained, however, the procedures, who administers the test and circumstances when each is used differ. The procedures are detailed earlier in this Quick Tip. The employer is responsible for administering the fit test, and it is done by someone other than the user of the respirator. The user of the respirator performs the user seal check (fit check). The circumstances for performing a fit test are defined by OSHA: prior to first issue of a respirator, when there's a change in the model, style or size of respirator used, when there's a physical facial change in the person wearing the mask, and at least annually. The user seal check (fit check) is done each time the mask is put on, even if this occurs several times per day.

Sources

OSHA's Respirator Fit Testing Resource Page

29 CFR 1910.134 Respiratory Protection Standard Appendix A

29 CFR 1910.134 Respiratory Protection Standard Appendix B-1

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