Respirator Fit Testing Requirements and Procedures – Quick Tips

Make sure you know everything about OSHA's Respiratory Protection Standard from fit testing to record keeping.

When the Occupational Safety and Health Administration's (OSHA's) revised Respiratory Protection Standard, 29 Code of Federal Regulations (CFR) 1910.134, became effective on April 8, 1998, it provided employers with an all-inclusive reference for fit testing guidelines. Before its revision, the standard made reference to testing a respirator's "face-piece-to-face seal" but provided no additional guidance on how to perform the test. The revised standard specifies what respirators need fit testing, the kinds of fit tests allowed, the procedures for conducting them and how frequently fit tests must be performed.

What's Covered

29 CFR 1910.134(f) states, "Before an employee may be required to use any respirator with a negative or positive pressure tight-fitting facepiece, the employee must be fit tested with the same make, model, style and size of respirator that will be used." This means all respirators that rely on a mask-to-face seal need to be checked with either a qualitative fit test (QLFT) or quantitative fit test (QNFT) to determine whether the mask provides an acceptable fit to the user. The relative workplace exposure level determines what constitutes an acceptable fit and which fit test procedure is required. For negative-pressure air-purifying respirators, users may rely on either a QLFT or a QNFT procedure for exposure levels less than 10 times the occupational exposure limit. Exposure levels greater than 10 times the occupational exposure limit must utilize a QNFT procedure. Fit testing of tight-fitting positive-pressure respirators such as atmosphere-supplying respirators or tight-fitting, powered air-purifying respirators must be accomplished by performing a QLFT or QNFT in the negative pressure mode using one of two methods:

1. The mask can be converted into a negative-pressure respirator and equipped with filters appropriate to the fit test protocol being followed, or
2. An identical negative-pressure respirator can be used as a surrogate for fit testing as long as it has the same sealing surfaces as the positive-pressure respirator.

Fit Testing Procedures

Within the standard, employers are provided the option of conducting either a QLFT or QNFT. The individual performing the fit test procedure requires no special certification. However, the individual must be able to prepare the test solutions, calibrate the equipment, perform the tests properly, recognize invalid tests and ensure that test equipment is in proper working order. The ability to calculate fit factors is also a requirement for the individual administering a QNFT.

Within Appendix A of the standard, the following four acceptable QLFT protocols are defined and complete instructions are provided: isoamyl acetate (more commonly known as banana oil), saccharin solution aerosol, Bitrex solution aerosol, and irritant smoke (stannic chloride).

The test method performed will dictate the type of air-purifying element that's used on the facepiece. The isoamyl acetate QLFT requires respirators equipped with organic vapor cartridges. Both the saccharin and Bitrex QLFT require respirators equipped with particulate filters (either 95, 99 or 100 series filters are acceptable). To perform the irritant smoke test, the respirator must be equipped with either a P100 series particulate filter or HEPA filter.

It's important to note that when performing the irritant smoke test, no form of enclosure or hood for the test subject is to be used. The other QLFTs all require the use of an enclosure.

The standard defines a QLFT as "a pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent." The downside to a QLFT is that it relies on the subjective response of the individual being tested, so reproducibility and accuracy may vary. The upside is that a QLFT is simple to perform, and the necessary testing equipment is accessible and economical.

As defined in the standard, a QNFT is "an assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator." A QNFT uses an instrument to take a sample from within the wearer's breathing zone while the respirator is being worn. In addition to the instrument, a challenge agent and a probed respirator (or probed adapter for a standard respirator) are necessary to perform a QNFT. A QNFT is more precise than a QLFT; it's also less commonly performed because of the complexity of the procedure and the prohibitive cost of the testing equipment. The protocol for a QNFT is also detailed in Appendix A of 29 CFR 1910.134. There are three approved methods for QNFT:

- **Generated aerosol** uses an aerosol, typically corn oil, that is dispensed in a high concentration into a booth or test chamber and a photometer-based aerosol detector that measures the challenge agent that leaks into the facepiece. This type of quantitative fit testing is the least used of the three types due to the large size of the unit and the high maintenance involved in cleaning the booth and the components.
- **Ambient aerosol condensation nuclei counting (CNC) instruments**, such as TSI brand Porta Count equipment, use laser technology to measure aerosol concentrations inside and outside the respirator without the person having to stand in a test chamber or booth. The challenge agent measured consists of ambient microscopic dust and aerosol particles that are in the air we

breathe every day. The particle concentration outside the respirator is measured against the concentration inside the respirator. The ratio of these two numbers is the fit factor.
- **Controlled negative-pressure (CNP) systems**, such as Occupational Health Dynamics (OHD) Quantifit equipment, create a fixed vacuum on the facepiece by temporarily cutting off the breathing air with special adapters. The instrument measures the airflow, or leak rate, needed to maintain the vacuum on the mask. The fit factor is then computed by taking an average breathing rate and dividing that number by the measured leak rate. The person being fit tested must remain motionless for the 10 seconds needed to conduct the test. OSHA also requires CNP fit testing to include its REDON protocol. This protocol includes exercises performed facing forward and bending over, shaking the head and two re-donnings of the respirator facepiece.

Advantages of QNFT vs. QLFT

There are several advantages to a QNFT:

- An objective test that eliminates the subjectivity of a person's sense of smell, taste and sensitivity to challenge agents.
- Suitable for determining higher levels of fit that may be required for full-face masks, gas masks or other respirators.
- Provides faster, more precise and hard copy documentation of the instrument results.
- Eliminates the chances of deception often found in QLFT.

Frequency

29 CFR 1910.134(f)(2) states, "The employer shall ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different respirator facepiece (size, style, model or make) is used, and at least annually thereafter." In addition, fit testing must be repeated "whenever the employee reports, or the employer, PLHCP (physician or other licensed healthcare professional), supervisor or program administrator makes visual observations of changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery or an obvious change in body weight." Also, an employee who's passed a fit test but later finds the fit of the respirator unacceptable must be given a reasonable opportunity to select a new facepiece and be retested. A recent study published by the National Institute for Occupational Safety and Health (NIOSH) gives support to the frequency of fit-testing established in this standard. The study found respirator fit does change over time. After one year, an estimated 10 percent of respirators did not fit properly. Two and three years later, that figure rose to 20 percent and 26 percent, respectively. Additionally, nearly one-quarter of subjects who lost more than 20 pounds were unable to maintain an acceptable fit.

Record Keeping

The employer is responsible for recording the results of fit testing. As stated under 29 CFR 1910.134(m)(2), the following information must be recorded: the name of the employee; the type of test performed (QLFT or QNFT); specific respirator tested; date of the test; and the results of the test. This information must be retained until the next fit test is administered.

Fit Checking

Fit testing must not be confused with a respirator fit check. A fit check, or “user seal check” as it’s referred to in Appendix B-1 to 29 CFR 1910.134, should be performed each time a tight-fitting respirator is donned to ensure there’s an adequate seal. The appendix provides guidelines for performing positive- and negative-pressure fit checks and states, “User seal checks are not substitutes for QLFTs or QNFTs.”

Sources

29 CFR 1910.134, Respiratory Protection Standard

National Institute of Occupational Safety and Health (NIOSH), Fit Test Study. Ziqing Zhuang, PhD; Michael Bergman, MS; and Jaclyn Krah, MA. January 2016.

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