Firestone

INTEROFFICE

DATE July 19, 1976

TO Dr R S Brookman

FROM SAFETY & TRAINING-PLASTICS CO

REFERRING TO LETTER OF

SUBJECT PROCEDURE FOR RESPIRATOR FITTING

As per your request, the following comments are offered regarding a respirator fitting procedure

As part of the 1910 1017 Standard, OSHA requires that the user of a respirator receive fitting instructions including demonstrations and practice in wearing, adjusting and determining the fit of the respirator He must be allowed to test the facepiece-to-face seal and to wear it in a test atmosphere To this end, test procedures, summarized from several sources*, are provided below which will satisfy the fitting requirements by OSHA

In these comments, mainly only "qualitative" fitting tests will be provided "Quantitive" tests include placing a probe within a specific facepiece and reading the leakage directly on an analytical instrument This is an expensive procedure and may be of limited value to us since they are mainly used to help one determine what brand and line of respirators fits best The advantages of the qualitative tests are that they are fast, easily performed, require minimum investment, and some are easily performed in the field On the other hand, these tests rely on the wearer's subjective response so they are not entirely reliable

I Qualitative Fitting Tests

A Negative Pressure Test

1) These can be conducted by the wearer himself in the field It consists merely of closing off the inlet of the gas mask canister, cartridge(s) or filters by covering with the palm(s), or replacing the seal(s), or of squeezing the breathing tube so that it does not pass or provide air, inhaling gently so that the facepiece collapses slightly, and holding the breath for 10 seconds If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator is probably tight enough This test would be used with the type MSA half and full facepiece respirators (with breathing tubes), with dust masks and with all canister units It should be performed just before the wearer enters any toxic atmosphere It is recommended that this test be used only as a very gross determination for face fits The primary test drawback is that it requires the wearer to handle the mask after it has supposedly been positioned - which can modify the seal

B Positive Pressure Test

OCC 014441

1) This test has the same advantages and disadvantages as the negative pressure test It is conducted by closing off the

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exhalation valve and exhaling gently into the facepiece The fit is considered satisfactory if slight positive pressure can be built up inside the facepiece without any evidence of outward leakage Some respirators require that the exhalation valve cover(s) be removed for the test and then replaced - a sometimes difficult task if one keeps the respirator on This test would work with the type C, air supplied respirators, and with most gas masks The wearer should perform this test just before entering any hazardous atmosphere

Once the above tests have been completed, the subject can mov into the test atmosphere in Part C following,

C Isoamyl Acetate (Banana Oil) Test

1) This test is used to satisfy the requirement that the wearer have an opportunity to wear the respirator in a test atmosphere Generally it consists of creating an atmosphere containing isoamyl acetate around the wearer of an air line respirator or an air-purifying (gas mask) respirator with an organic vapor canister or cartridge(s) The proper canister or cartridge(s) must be replaced after the test

One variation of this test is to saturate a piece of cotton or cloth with the liquid and pass it close to the respirator near the sealing surface, and carefully avoiding the skin

A more complex, and better, version uses a room or small booth or hood covering the wearer's head and shoulders In this enclosure is generated a known concentration of isoamyl acetate, usually 100 ppm created by vaporizing 17 3 ml of isoamyl acetate for each 1000 FT^3 ($28m^3$) of enclosure volume

2) Test Procedure

a) Wearer puts on respirator If an air-purifying unit (gas mask) it must be equipped with an organic vapor canister or cartridge(s)

b) Wearer enters test enclosure - or pass saturated cotton near sealing surface

c) If wearer smells isoamyl acetate, he returns to clean air and readjusts the facepiece and/or headband tension (not unduly tight)

d) The wearer repeats step (b) If he does not smell the acetate, the seal is good If he still smells it an attempt should be made to find the source of leakage If the leak can not be found, another respirator should be tried

e) After the fit is obtained the correct canister or cartridge(s) must be placed on the unit

During testing the subject should make movements that approximate a normal working situation These may include, but not limited to, the following

a) Normal breathing
b) Deep breathing (don't hyperventilate)
c) Side-to-side and up-and-down head movements - exaggerated
d) Talking, by reading a prepared script
e) Other exercises as determined fitting to describe the action on the job

3) The major drawback of the isoamyl acetate test is that the odor threshold varies widely among individuals Further, the sense of smell is early dulled and may temporarily deteriorate during the test Another disadvantage is that the liquid is not unpleasant to smell, even in high concentrations Therefore, the wearer may say that the respirator fits even with a large leak - Usually because he likes the comfort of the particular respirator or is following the lead of someone else Conversely, a wearer may claim that a respirator leaks if it is uncomfortable, etc

D Irritant Smoke Test

1) This test is similar to the isoamyl test in concept It involves exposing the wearer to an irritating aerosol produced by commercially available smoke tubes normally used to check ventilation air flows I have some on hand for inspection if desired These tubes are filled with pumice impregnated with stannic chloride or titanium tetrachloride As air is passed thru the tube, via an aspirator bulb, a dense, highly irritating smoke is produced consisting of hydrocloric acid adsorbed on small solid particles

As a qualitative test the obvious advantage is that the wearer can not lie or fake the tightness of the respirator since he can not resist the smoke On the other hand the smoke is very irritating and must be carefully used to avoid injury Exhaust ventilation behind the wearer is needed to protect the person doing the test It can be used for both air-purifying and atmosphere - supplying units - but the air-purifying units must be equipped with a high-efficiency filter(s)

2) Test Procedure

a) The wearer puts on the respirator and stands with his back to a source of ventilation, such as a chemical fume hood

b) The tester tells the wearer to close his eyes, even if wearing a full facepiece unit, and to keep them closed until told to open them

c) The tester lightly puffs smoke over the respirator, holding the tube at least two feet from it Use

minimal puffs pausing between them so as to note the wearer's reaction

d) If the wearer detects no leakage, the tester may increase the smoke density and move the tube progressively closer to the subject, still closely watching his reactions

e) When the tube has been brought to within about six inches of the respirator with no leakage detected, the tester may start to direct smoke specifically at the sealing surface of the facepiece and at the exhalation valve, while the subject holds his head still

f) At this point, if no leakage occurs, the wearer may cautiously begin the head movements mentioned in the isoamyl acetate test The tester must remain especiall alert and ready to stop the smoke production

g) If leakage is detected at any time, the tester should stop the smoke and let the wearer readjust the facepiece and headbands The test should then be restarted at step (b)

This test is not as time consuming as it sounds and if the wearer keeps his eyes shut and the smoke is increased gradually, there is little danger or discomfort

* Note Data for these comments have been taken from a training manual written by the Los Alamos Scientific Laboratory of the University of California from ANSI Standard Z88 2-1969, Practices for Respiratory Protection and OSHA Standards

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