

Required Procedures for Respiratory Protection Program

Chapter 296-842 WAC

Rule

Table 18
Generated Aerosol Test Procedure

Important:

- This is a quantitative (QNFT) fit-test procedure.
- In this method, a test aerosol is used to challenge the facepiece seal while aerosol concentrations inside and outside the facepiece are measured during test exercises.
- Special equipment is needed to generate, disperse, detect, and measure test aerosols.

Test Preparations

1. Test aerosol.
 - Use a particulate, for example, corn oil, polyethylene glycol 400, di-2-ethyl hexyl sebacate, or sodium chloride.
2. Instrumentation.
 - Do **all** the following:
 - Obtain and use aerosol generation, dilution, and measurement systems appropriate for particulates.
 - Use an aerosol-generating instrument that will maintain test concentrations within a 10% variation.
 - Select a sampling instrument that allows for a computer record or strip chart record to be created.
 - The record must show the rise and fall of test agent concentration during each inhalation and exhalation at fit factors of at least 2000.

Note:
Integrators, or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise, may be used if a record of the readings is made.

 - Minimize the time interval between the activity and the recording of the activity so you can clearly connect what you see to what is being recorded. For example, use a small diameter and length of sampling line.
3. Test enclosure.
 - Do **all** the following:
 - Make sure the enclosure is equipped and constructed to effectively:
 - Maintain a uniform concentration of the test agent inside the enclosure. For example, the enclosure must be large enough to allow **all** employees freedom of movement during testing **without** disturbing the test concentration or measurement instrument.
 - Keep the test agent from contaminating the air outside the enclosure. For example, use a HEPA filter to purify exhausted air.
 - Allow the individual conducting the fit test to view the employee during the test.
 - Make sure the tubing used to collect samples from the enclosure **and** respirator is the same material, diameter, **and** length. This makes the effect of aerosol loss caused by deposition in each sample line equal.
 - If sodium chloride is used, relative humidity inside the enclosure must be kept below 50%.



Required Procedures for Respiratory Protection Program

Chapter 296-842 WAC

Rule

Table 18 (Continued) Generated Aerosol Test Procedure	
Test Preparation	
<p>4. Prepare test respirators.</p> <ul style="list-style-type: none"> • Do all the following: <ul style="list-style-type: none"> - Inspect test respirators regularly for missing parts and damage - Keep test respirators in proper working order - Make sure in-mask sampling probes are: <ul style="list-style-type: none"> • Designed and installed so the air sample will be drawn from the employee's breathing zone; midway between the nose and mouth and • The probe extends inside the facepiece at least ¼ inch. - Make sure sampling ports such as probes, or adapters on respirators are constructed and installed so they do not: <ul style="list-style-type: none"> • Block air flow into the sampling line • Leak • Interfere with the respirator's fit or performance • Have high efficiency particulate air (HEPA) filters OR P100 series filter available. <ul style="list-style-type: none"> - Replace filters when increased breathing resistance is detected or when the test agent has altered the filter material's integrity. 	
Test	
<p>Important:</p> <ul style="list-style-type: none"> • Throughout the test, maintain the employee's exposure to any test agent below the established exposure limit. Exposures allowed must be based on exposure time and exposure limit duration. • If a single peak penetration exceeds 5% for half facepieces or 1% for full facepieces: <ul style="list-style-type: none"> - Stop the test and - Have the employee select another respirator for testing. <p>5. Have the employee attach filters, put on, adjust, and seal check the respirator.</p> <ul style="list-style-type: none"> • Be sure to crimp the sampling line to avoid pressure leaks during the seal check. and • Have the employee adjust the respirator straps, without assistance, so the fit is comfortable. Do not over-tighten. <p>6. Optional Step. To save time conduct a screening test to quickly identify poorly fitting respirators</p> <p>Note: You may use a qualitative screening test or an ambient aerosol condensation nuclei counter instrument in the count mode.</p>	



Required Procedures for Respiratory Protection Program

Chapter 296-842 WAC

Rule



Table 18 (Continued) Generated Aerosol Test Procedure	
Test (Continued)	
<p>7. Make sure test aerosol concentration is reasonably stable.</p> <ul style="list-style-type: none"> - If a canopy or shower curtain enclosure is used, determine stability of the test aerosol concentration after the employee enters the enclosure. <p>8. Have the employee enter the test enclosure and connect the respirator to the sample lines.</p> <p>9. Immediately after entering the enclosure measure test aerosol concentration inside the respirator.</p> <ul style="list-style-type: none"> - Make sure the peak penetration does not exceed 5% for half facepieces, or 1% for full facepieces. <p>10. Have employee perform the appropriate fit test exercises in Table 19.</p> <ul style="list-style-type: none"> - Do not adjust the respirator once exercises begin. <p>11. Calculate the overall fit factor as specified in Steps 12-13. The fit test is:</p> <ul style="list-style-type: none"> - Passed if the minimum fit factor of 100 for half facepieces or 500 for full facepieces is obtained. or - If a passing fit factor is not obtained, the test has failed and you must have the employee select and test another respirator. 	
Calculations	
<p>Important:</p> <ul style="list-style-type: none"> • Do not count the grimace exercise measurements during these calculations. • Take into account the limitations of instrument detection when determining fit factors. <p>12. Calculate individual fit factors for each exercise by applying the following:</p> <p style="margin-left: 40px;">Exercise Fit Factor (ffE) = $\frac{\text{Average test enclosure concentration}}{\text{Test aerosol concentration inside the respirator}}$</p> <ul style="list-style-type: none"> • To determine the average test enclosure concentration use one of the following methods: <ul style="list-style-type: none"> - Arithmetic average of the concentration before and after each test (an average of 2 values per entire test) - Arithmetic average of concentration before and after each exercise (an average of 2 values per exercise). - True average measured continuously during the respirator sample • Determine the test aerosol concentration inside the respirator in one of the following ways: <ul style="list-style-type: none"> - Average peak penetration values. Determine aerosol penetration for each exercise by: <ul style="list-style-type: none"> • Using integrators or computers that calculate the actual test agent penetration or • Average the peak heights shown on the strip chart recording, graph, or by computer integration. - Maximum peak penetration. Use strip chart recordings to determine the highest peak penetration for each exercise and use this value. - Area under the peaks. Use computerized integration or other appropriate calculations to integrate the area under individual peaks for each exercise. <p>13. Using individual exercise fit factors (ffE) calculate the overall fit factor by doing all of the following:</p> <ul style="list-style-type: none"> - Convert each exercise fit factor to a penetration value - Determine the average penetration value - Convert the average penetration value back to a fit factor or - Use this equation to calculate the overall fit factor: <p style="margin-left: 40px;">Overall fit factor = $\frac{n}{1/\text{ffE}1 + 1/\text{ffE}2 + 1/\text{ffE}3 \dots + 1/\text{ffE}n}$</p>	