



When to select <99% Filtering Efficiency on a Condensation Nuclei Counter (CNC) instrument during Respirator set up

A **Condensation Nuclei Counter (CNC)** respirator fit testing instrument works by enlarging microscopic airborne particles so they can be counted. The instrument compares the particle concentration outside the respirator (**C_{out}**) with the particle concentration inside the respirator (**C_{in}**), and uses this ratio (**C_{out}/C_{in}**) to calculate a **fit factor**.

The CNC method counts all particles within a specified size range and is based on an important assumption: **any particles detected inside the respirator have entered through leaks in the face seal rather than through the filter media.**

Selecting the "<99% Filtering Efficiency" Option

When configuring a respirator for CNC fit testing, it is critical to determine whether the "<99% **Filtering Efficiency**" option should be selected. This setting depends on the filtration efficiency of the particulate filter being used for the fit test. Screenshots showing where this option is in various CNC software packages are provided in **Appendix A**.

Filters with ≥99% Filtration Efficiency

For filters with a rated filtration efficiency of **99% or greater**—such as **P3, F3, F4, F5, N100, P100, R100, FFP3, and P3 R** (among others)—the "<99% **Filtering Efficiency**" option should **NOT** be selected.

Because these filters capture virtually all particles across the particle sizes measured by the CNC instrument, any particles detected inside the respirator can reasonably be assumed to have entered through face seal leakage.

Filters with <99% Filtration Efficiency

For filters with a rated filtration efficiency of **less than 99%**—such as **P1, P2, F1, F2, N95, R95, P95, KN95, FFP1, and FFP2** (among others)—the "<99% **Filtering Efficiency**" option **MUST** be selected.

These filter classifications allow a small proportion of the most difficult-to-capture particles to pass through the filter while still meeting their performance requirements.



Why This Setting Matters

All particulate filter standards (e.g., AS/NZS, ISO, NIOSH and EN standards) are tested using particle sizes known as the **Most Penetrating Particle Size (MPPS)**. These particles are the most difficult for a filter to capture and therefore represent the filter's worst-case performance.

When the "<99% Filtering Efficiency" option is selected, the CNC instrument narrows the range of particle sizes that it counts. Specifically, it excludes the particle sizes associated with the MPPS. This is why the total particle count observed by the instrument decreases when this setting is enabled.

The remaining particles that are counted are known to be captured by these filters at **greater than 99% efficiency**. As a result, if such particles are detected inside the respirator, they are highly likely to have entered through a leak in the face seal rather than through the filter media itself. This allows the fit test to accurately assess respirator fit.

Consequences of Incorrectly Leaving the Setting Off

If the "<99% Filtering Efficiency" option is not selected when fit testing respirators fitted with filters such as **P1, P2, F1, F2, N95, R95, P95, KN95, FFP1 or FFP2**, particles at the MPPS can pass through the filter media and be counted inside the respirator.

The CNC fit testing method assumes that particles counted inside the respirator have entered through face seal leakage only. When particles are instead penetrating through the filter media, this assumption is incorrect.

The result is an artificially lower fit factor and a potential **false negative** outcome, where a respirator that fits well may incorrectly fail the fit test. This can lead to unnecessary retesting, respirator rejection, or incorrect conclusions about respirator fit.

Fit Testing with a Gas/Vapour Cartridge

A gas/vapour cartridge cannot be used for a fit test UNLESS a suitable rated particulate filter has been attached/stacked to it. For a fit test that is only conducted using a gas/vapour cartridge, the result should be voided/discarded and another fit test with an appropriate particulate filter should be conducted.

Please refer to the table below to assist in when to select the < 99% filtering efficiency option in your CNC instrument respirator set-up.



Respirator Style	Common Particulate Filter Ratings Used in Australia (but not limited to)	Select <99% Filtering Efficiency CNC Machine
Disposable/Filtering Facepiece	P1, P2 - AS/NZS 1716 F1, F2 – AS/NZS ISO 17420.2 N95, P95, R95 – NIOSH US FFP1, FFP2 – European Standards KN95 – Chinese Standard	Yes
	Note: Under AS/NZS 1716 it does not have a >99% disposable/filtering facepiece rating F3, F4, F5 – AS/NZS ISO 17420.2 N99, N100, R99, R100, P99, P100 – NIOSH US FFP3 – European Standards	No
Reusable/Elastomeric Half Face*	P1, P2 - AS/NZS 1716 F1, F2 – AS/NZS ISO 17420.2 N95, P95, R95 – NIOSH US P1 R, P2 R – European Standards	Yes
	P3 - AS/NZS 1716 F3, F4, F5 – AS/NZS ISO 17420.2 N99, N100, R99, R100, P99, P100 – NIOSH US P3 R – European Standards	No
Reusable/Elastomeric Full Face	<i>Note: To fit test a full face, a filter of ≥ 99% must be used. A <99% filter cannot be used e.g. P2, N95, KN95 etc.</i> P3 - AS/NZS 1716 F3, F4, F5 – AS/NZS ISO 17420.2 N99, N100, P99, P100, R99, R100 – NIOSH US P3 R – European Standards	No

*It is common practice that many fit testers will use a ≥99% particulate filter e.g. P3, on Reusable/Elastomeric Half Face respirators as generally, they will also connect to the same brand/connection type reusable/elastomeric full face as part of their fit testing equipment. If fit testing a Reusable/Elastomeric Half Face and changing between <99% and ≥99% particulate filters, be sure to review your respirator set-up each time is correct to the filter efficiency being used.

Should you have any questions, please email respfit@aioh.org.au

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Appendix A – Pictures of Different CNC Software and CNC Machine Screens where to select <99% filtering efficiency

TSI FitPro Ultra

Operator: STR
Active Database: STR Private Testing

Respirators

Respirator List FILTER

Manufacturer

EDIT SIZES NEW

Pass level Actions

New Respirator

MANUFACTURER (REQUIRED)

MODEL (REQUIRED)

STYLE (REQUIRED)

PASS LEVEL (REQUIRED)

APPROVAL (OPTIONAL)

☐ N95
Filter efficiency less than 99%

Elastomeric Facepiece ☐ Filtering Facepiece ☒

☒ Use Auto Description

DESCRIPTION

CANCEL SAVE

TSI FitPro+

FitPro+: Default

File Database PortaCount Report Setup Help

Edit Respirator Table

Respirator List

Manufacturer *

Model *

Style *

Fit Factor *

Pass Level

Approval

Description

☒ Auto Description

☐ Filter efficiency less than 99% (*N95* required)

New Delete

Save Exit



TSI PortaCount Respirator Fit Tester 8038 Machine Screen

The screenshot shows a 'Create New Entry' window for a 'Respirator List'. The form includes the following fields and controls:

- Manufacturer ***: Text input field.
- Model ***: Text input field.
- Style ***: Text input field.
- Pass Value ***: Spin box set to 100.
- Approval**: Text input field with a checkbox labeled **N95** (highlighted with a red box).

Buttons: **Save** (top right), **Cancel** (bottom right).

* Required Fields

AccuTec-IHS AccuFIT DataManager

The screenshot shows the 'RESPIRATOR DATABASE PORTAL Mask Fit Tester <New_Database>' window. The main title is 'RESPIRATOR DATABASE PORTAL – NEW ENTRY'. A large **SAVE** button is centered. Below it is a table with the following columns:

Manufacturer	Model	Type	Pass Value

Below the table, there is a checkbox labeled **Filter efficiency less than 99%** (highlighted with a red box). An **EXIT** button is located at the bottom right.



AccuTec-IHS AccuFIT9000 Pro Machine Screen

Respirators | Demo 09/04/2020 10:24

RESPIRATOR DATABASE PORTAL - NEW MASK

Manufacturer	Model	Type	Pass Value

☐ Filter efficiency less than 99%

Save Exit

OHD AeroFit Machine Screen

Home Add Respirator

Choose Respirator Type:



Full Face



Half Face



Filtering Facepiece Respirator

Is the respirator less than 99% efficient?

☐ Yes (N-95 / FFP1 / FFP2) ☐ No (P-100 / FFP3)

 



OHD AeroFit Logic Software

Add Respirator

Model Name *

e.g., 3M 6000 Series

Face Type

Half

Parameter

FFR

☒ N95 Mode

Filter Efficiency <99%

Cancel

Add Respirator