



# Personal respiratory protection

## What are respirators and why do we need to wear them?

Respirators or filtering facepiece respirators are disposable, negative-pressure, air purifying respirators made of a filtering material to filter out airborne microorganisms such as *Mycobacterium tuberculosis* (TB). Respirators are used to protect health workers (medical and non-medical) from inhaling TB and other airborne microorganisms. Respirators that meet specific standards (detailed below) and are used with a combination of other infection prevention and control measures can provide reasonable protection for health workers.

## Does WHO recommend respiratory protection?

Yes, the updated WHO TB infection prevention and control guidelines (World Health Organization 2019) recommends the use of respiratory protection for health workers. Recommendation 7 states, “Particulate respirators, within the framework of a respiratory protection programme, are recommended to reduce *M. tuberculosis* to health workers, persons attending health facilities or other persons in settings with a high risk of transmission.”



HCW wearing N95 respirator



Patient wearing surgical/procedure mask

## When do we need to wear respirators?

Health workers wear respirators when administrative and environmental controls are not adequate to minimize the risk of transmission of airborne infectious pathogens. Situations when respirators should be worn include, but are not limited to:

- **when health workers are near persons with presumptive or contagious TB in both TB- and non-TB specific settings** (*including outpatient departments, TB clinics, fever clinics, radiography, waiting areas, primary health clinics*)
- **during any aerosol-producing procedure such as sputum collection, bronchoscopic procedures, irrigation of abscesses, etc.**

Patients wear surgical/procedure masks.

## What type of respirator do I need?

There are three major types of respirators:

1. **Filtering-facepiece respirator**
2. **Elastomeric (“rubber”) half- or full-facepiece respirator with filters**
3. **Powered Air-Purifying Respirator (PAPR) with filter**

For most situations, a filtering-facepiece respirator is adequate. The most common filtering-facepiece respirators used for protection from airborne microorganisms are N95 (USA – certification standard: 42 CFR 84) and FFP2 (EU – certification standard: EN149:2001+A1:2009, superseded in part by ISO 16900). Other countries with respirator standards include Australia, China, South Korea, South Africa, etc. The filter in a N95 filtering-facepiece respirator is tested to ensure it is at least 95% efficient in removing particles 0.3  $\mu\text{m}$  in size (a bit smaller than TB), while a FFP2 filtering-facepiece respirator is tested to ensure it is at least 94% efficient in removing particles of the same size ( $\sim 0.4 \mu\text{m}$ ). Only FFP2 respirators are tested on a panel of human subjects to ensure minimum leakage around the face seal.

In some situations, elastomeric half-facepiece respirators with filters are preferred; however, they do not provide additional protection over an N95 or FFP2 respirator. In high-risk procedures, PAPRs with hoods maybe used. PAPRs provide a slightly higher amount of respiratory protection as well as splash/contact protection. The major limitation of PAPRs is they require a battery to operate a fan that pulls air through a filter and pushes it into the hood. An additional limitation of PAPRs is the cost of purchasing and maintaining.

Type of respirator	Pros	Cons	Cost
 <p><b>Filtering facepiece respirator</b></p>	<ul style="list-style-type: none"> <li>■ Light</li> <li>■ Commercially available</li> <li>■ Generally comfortable</li> <li>■ May provide splash protection</li> </ul>	<ul style="list-style-type: none"> <li>■ New users may find uncomfortable</li> <li>■ Limited re-use</li> <li>■ Straps wear out before filters</li> <li>■ Generally well fitting when clean shaven, but requires fit test to ensure it fits well</li> </ul>	<p><b>Relatively inexpensive</b> (1 to 10 USD/respirator) plus test costs</p>
 <p><b>Elastomeric (“rubber”) half- or full-facepiece respirator with filters</b></p>	<ul style="list-style-type: none"> <li>■ Commercially available</li> <li>■ Generally better face seal than filtering facepiece respirators</li> </ul>	<ul style="list-style-type: none"> <li>■ Heavy</li> <li>■ More difficult to communicate than with a filtering facepiece respirator</li> <li>■ May be reused until filter cartridge has increased resistance</li> </ul>	<p><b>Expensive</b> initial cost (50 to 100 USD) with annual cartridge replacement (10 to 30 USD)</p> <p>Lifecycle cost may be less than filtering facepiece respirators.</p>
 <p><b>PAPR with hood</b></p>	<p><b>When operated properly:</b></p> <ul style="list-style-type: none"> <li>■ Better protection than a filtering facepiece or elastomeric respirator</li> <li>■ More comfortable than other two</li> <li>■ Easier to communicate than the other two</li> </ul>	<ul style="list-style-type: none"> <li>■ May be stigmatizing</li> <li>■ Provides no protection once the battery dies</li> <li>■ Requires daily validation of airflow rate</li> <li>■ A little bulky</li> <li>■ Adversely affects peripheral vision</li> <li>■ May be reused as long as the filter cartridge is intact and airflow rate is adequate</li> </ul>	<p><b>Very expensive</b> initial cost (250 to 500 USD) with annual cartridge replacement (10 to 30 USD)</p> <p>Lifecycle cost may be near that of filtering facepiece respirators.</p>

## How long may I wear a respirator?

Generally, the answer is “It depends!” If hazards include the spread of droplet- or contact-transmitted microorganisms, the respirator should be disposed of after each use. Respirators can be expensive in low-resource settings (approximately 1 to 10 USD each), so to maximize the safe use of each respirator we recommend you:

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**Do not share your respirator with others!**



  - **Do not fold a respirator (unless so designed), it can damage the filter fibers**  
*(for example, bending and placing in pockets)*
  - **Do not hang it over the wall or door as the straps may be stressed and the used respirator can be exposed to bacteria and organisms in the air**
  - **Do not stretch or stress the straps, it can be a problem to fit to your face next time**
  - **Store it in a clean and dry location**  
*(never use plastic material, this will promote bacterial growth)*
  - **Do not wear a surgical or procedure mask under a respirator**
  - **Do not share your respirator with others!**

If a respirator is damaged, was exposed to or contaminated with blood or body fluids or breathing becomes difficult, replace it. Otherwise, respirators may be stored and reused according to the facility's infection prevention and control policy. A respirator that is infrequently used may be reused up to a month or more. A respirator that is used frequently, in a warm and humid environment may need to be changed daily. A respirator with weak straps may need to be changed after each use.

## How do I know if my respirator is a “real” respirator or a counterfeit respirator?

Great question; however, it is very difficult to determine if a respirator actually is officially tested and certified. It is easier to prove the opposite. All respirators should have a model number, filter classification, and standard to which it was tested stamped on the front. US 42 CFR 84 certified



**Which of the respirators is the counterfeit and why?**

*Answer at bottom of page†*

respirators (N95) should also have the approval number on the front. Respirators are stamped with this information **before** molding or cutting the filter material (see *photo #1 on left*). Words such as “complies with” or “meets the requirements” of a particular standard are a warning sign that they are not actually certified to meet that standard. ISO 9002 or ISO 13485 are **not** respirator standards. For US 42 CFR 84 certified particulate filtering-facepiece respirators (N95), you may verify if a particular model has been tested and approved; however, this is simply a way to rule out a respirator [www.cdc.gov/niosh/npptl/topics/respirators/disp\\_part/default.html](http://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/default.html)! Also see [www.cdc.gov/niosh/npptl/topics/respirators/disp\\_part/resp-source2.html](http://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/resp-source2.html) for additional information.

Ensure your respirator has two straps (top one up and bottom one down) and fit. Officially, tested and certified respirators have been counterfeited. For additional information, view a US Occupational Safety and Health Administration video titled “Counterfeit and Altered Respirators: The Importance of CDC/NIOSH Certification” [www.osha.gov/video/respiratory\\_protection/niosh.html](http://www.osha.gov/video/respiratory_protection/niosh.html).

† Respirator #2 is counterfeit. The labels were stamped **after** the “respirator” was manufactured and the label does not include the CDC/NIOSH approval number (TC-48A-3713). In addition, the straps and filter material are thinner than the **real** respirator! Note that this respirator manufacturer and model is on the CDC/NIOSH website: [https://www.cdc.gov/niosh/npptl/topics/respirators/disp\\_part/default.html](https://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/default.html)

## What is a respirator fit test and do I need it?

A respirator cannot protect you if it doesn't fit you! A respirator has potentially three sources of leakage:

1. Filter
2. Seal to your face
3. Valve

The most common source of leakage is the seal to your face due to improper donning, improper selection of style or size of the respirator, or a combination of both. Of course, beards or facial hair will adversely affect the seal of the respirator to your face.

Please see the ETTI technical sheet on fit testing: [www.stoptb.org/wg/ett](http://www.stoptb.org/wg/ett)



### Why fit test?

**One size does not fit all!**

**One model does not fit all!**

**User seal check does not ensure adequate fit**



## What should be in our written respiratory protection program?

All facilities using respirators should have a respiratory protection program in place. A written program should include at least the following elements:

- **Selection of respirators**  
*include a list of respirators – sizes and styles used/available*
- **Respirator use**  
*when, where, and how to use respirators through training and IEC materials, including signage of risk, **no** facial hair unless using a PAPR, etc.*
- **Medical evaluations of respirator wearers**  
*minimal requirements for N95 & FFP2 respirators*
- **Respirator fit-testing**  
*qualitative, preferably with Bitrex*
- **Reuse, storage, and disposal of respirators**
- **Training about respiratory hazards at your workplace**
- **Monitoring and evaluation of your respiratory program**

## Further reading

WHO guidelines on tuberculosis infection prevention and control 2019 update  
<https://apps.who.int/iris/bitstream/handle/10665/311259/9789241550512-eng.pdf?ua=1>

CDC TB Respiratory Protection Program In Health Care Facilities – Administrator’s Guide  
[www.cdc.gov/niosh/docs/99-143/pdfs/99-143.pdf?id=10.26616/NIOSH PUB99143](http://www.cdc.gov/niosh/docs/99-143/pdfs/99-143.pdf?id=10.26616/NIOSH PUB99143)

CDC A Guide to Air-Purifying Respirators  
[www.cdc.gov/niosh/docs/2018-176/pdfs/2018-176-508.pdf](http://www.cdc.gov/niosh/docs/2018-176/pdfs/2018-176-508.pdf)

US OSHA Respirator Fit Testing  
[www.osha.gov/video/respiratory\\_protection/fittesting\\_transcript.html](http://www.osha.gov/video/respiratory_protection/fittesting_transcript.html)

US OSHA Respiratory Protection Videos  
[www.osha.gov/SLTC/respiratoryprotection/training\\_videos.html](http://www.osha.gov/SLTC/respiratoryprotection/training_videos.html)



**The End TB Transmission Initiative (ETTI) is a working group of the Stop TB Partnership that supports the global fight against TB by focusing its efforts on preventing and controlling the transmission of TB.**

The ETTI’s vision is to provide leadership in ending TB transmission in institutional and community settings worldwide thereby preventing TB infection and disease. To achieve its vision, the collective initiative advocates for and leads implementation of effective TB infection prevention and control

To learn more about ETTI and to keep up to date on ETTI activities, please join to receive our newsletter [www.stoptb.org/wg/ett/newsletter.asp](http://www.stoptb.org/wg/ett/newsletter.asp).

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- Website: <http://stoptb.org/wg/ett/>
- E-mail: [ettinitiative@gmail.com](mailto:ettinitiative@gmail.com)

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