

Respiratory Protective Equipment (RPE)

What is RPE?

RPE is a form of personal protective equipment (PPE) that protects the individual worker from breathing in substances hazardous to health for example biological agents such as SARS-CoV-2, or Mycobacterium tuberculosis (TB), and chemicals, gases or vapours. It is acknowledged that people with COVID-19 caused by the SARS-CoV-2 virus may produce both droplets and infectious aerosol particles when breathing, speaking or coughing (www.gov.uk). Historically a clear distinction has been drawn between infections transmitted via the droplet or airborne route however learning as a result of the pandemic has shown that individuals who have COVID-19 infection can produce both droplets as well as the smaller aerosols when speaking, breathing or calling out.

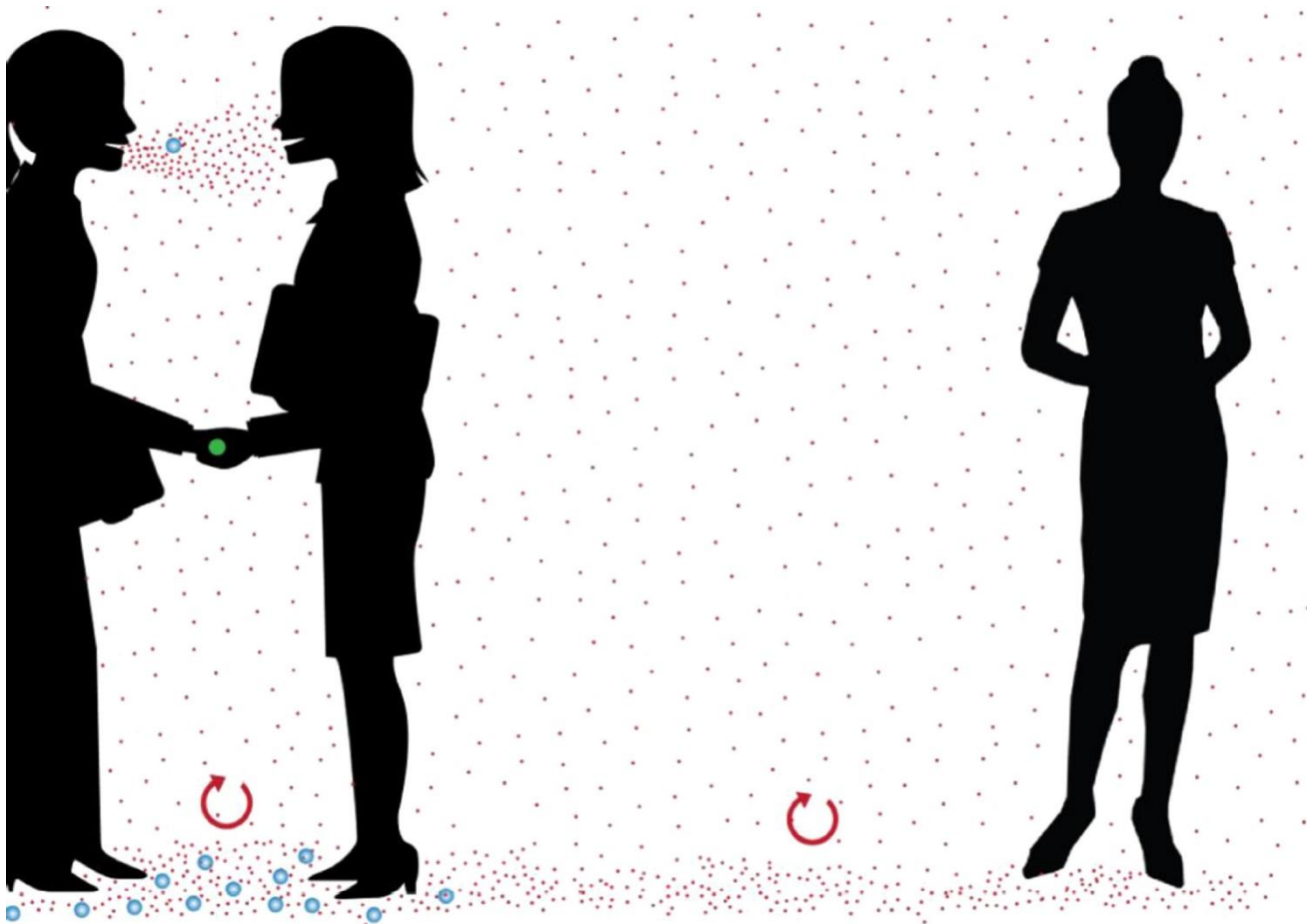


Figure 1 - Range of respiratory particles and potential spread over distance. Blue particles represent droplets, typically $>100\text{-}\mu\text{m}$ diameter, that fall to the floor under gravity within 2 m of the source. Red particles represent aerosols, typically $<100\ \mu\text{m}$, that stay suspended for longer, but eventually fall to the ground if the air is motionless for long enough (at least 30 min).

Source: Tang et al (2021)

Both droplets and aerosols contain virus particles which could transmit infection to health and care workers if they are not adequately protected. Whilst droplets can be larger and may fall quickly in the vicinity of the infected person, smaller droplets or aerosols may 'hang around' in the air and travel longer distances meaning it is possible to become infected from a greater distance, especially in indoor settings including health and care settings, prisons, police custody suites etc. The above illustration shows how aerosols are produced outside of traditional aerosol generating procedures. This will apply to home or workplaces as well as health and care settings.

The ability of droplets and aerosols to travel through the air is colloquially referred to as the 'airborne' route of infection.

Fluid resistant (FRSMs) or surgical face masks are designed to **provide a physical barrier** only to splashes and droplets and will cover the wearer's nose, mouth and respiratory tract. In principle, surgical masks that are worn correctly should provide adequate protection against **large droplets**, splashes and contact transmission. They may also slightly reduce risks associated with infectious aerosols, although this level of protection might not be sufficient to reduce the risk of transmission in the following example situations:

- when in close contact (within 2m) with people suspected or known to have COVID-19. Note risks are increased when in close proximity to the patient's head/face for procedures such as mouth care, swallowing assessment, insertion of naso-gastric tube, chest percussion)
- where ventilation is unable to adequately remove the risk of infectious aerosols
- where staff are exposed to people suspected or known to have COVID-19 for extended periods of time or for shorter but more frequent periods such as in accident or emergency or 'out of hours' clinics.

It is for this reason, that FRSM's **should not be used** in situations where close exposure (less than 2m) to where **infectious aerosols** are likely (HSE 2008).

A filtering face piece masks (FFP) provides a higher level of protection from FRSMs. In addition to providing a physical barrier they also provide protection against infectious aerosols. In the UK these are provided generally as FFP3 masks. FFP2/N95 masks are provided in many other parts of the work as an alternative.

Currently IPC guidance advises on the use of different types of masks including fluid resistant surgical face masks (FRSMs) and FFP3 respiratory masks in specific situations. The selection of the right type of mask confined to pre-determined circumstances can be confusing to health and care professionals and ultimately is dependent on the risks of infection present.

This information chart is designed to support you to select the right type of mask and respiratory PPE depending on your role and the health and care activity being undertaken considering risks of infection that may be present in your work setting/situation.

Selecting the right RPE

RPE at work should be suitable for its intended use and CE-marked or of a type/standard approved by the Health and Safety Executive (HSE). It should be the right size and correctly fit the wearer. For RPE that requires tight-fitting facepieces the initial selection should include a **fit test**.

Each RPE type and class is categorised by an assigned protection factor (APF). The APF is a number rating that indicates **how much protection** that RPE can provide. For example, RPE with an APF of 10 will reduce the wearer's exposure by at least a factor of 10. You should always use

RPE fitted with the highest efficiency filter possible (protection factor of at least 20) to control exposure down to the lowest levels

Filters

Filters are classified as particle, gas/vapour, multi-gas or combined (particle and gas/vapour). If the filter is also usable with powered respirators, then they will also be marked 'TH' (turbo hood) for hood devices or 'TM' (turbo mask) for mask devices.

Particle filters trap and hold particles from the air flowing through them and are classified according to their efficiency. The filter (or the facepiece it is built into) will be marked with the letter P (for particle) and a number to indicate efficiency, or the level of protection provided

- P1 = Low efficiency.
- P2 = Medium efficiency.
- P3 = High efficiency. P3 is the requirement for COVID-19 based on UK guidance for hazard group 3 respiratory pathogens for example SARS-CoV-2, MERS, SARS and Mycobacterium tuberculosis (TB)

Filters are additionally marked with NR (not reusable) or R for reusable. NR filters are designed for a single work shift of no more than eight hours and must be disposed of safely. Reusable RPE will need to undergo thorough examination and, where appropriate, testing at suitable intervals. This should be monthly, or every three months if used less frequently.

Exposure to Biological Agents and micro-organisms

Exposure in the workplace to biological agents and/or micro-organisms, such as bacteria, viruses, fungal spores and parasites should be either prevented, or where this is not reasonably practicable, adequately controlled. Note: The workplace may include a person's own home for community and domiciliary care or paramedic support.

Figure 1 illustrates the legal duty of the employer in assessing risks posed to HCWs from biological agents which are hazardous to health.

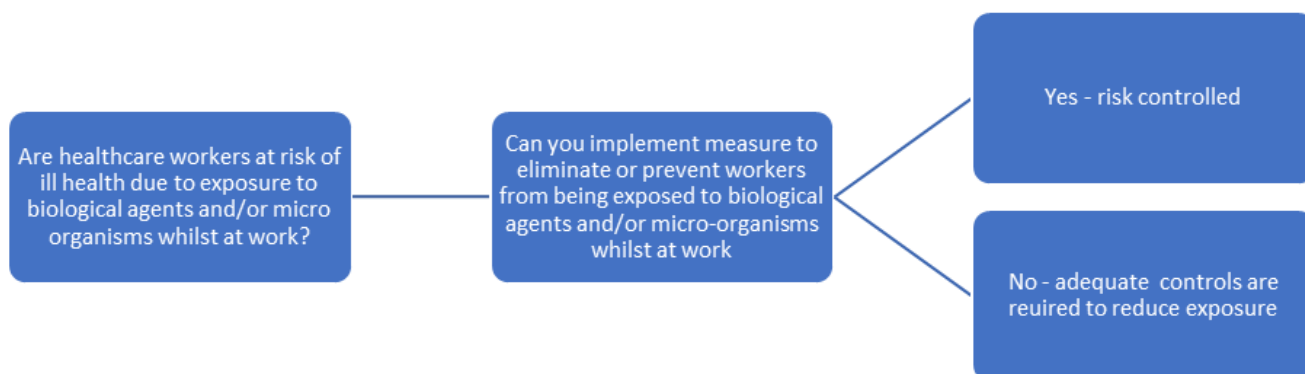


Figure 1 Can you prevent exposure? * This may include the use of RPE. Refer to [Worker Respiratory Infection Tool](#).


The use of RPE may be needed to control exposure if the risk assessment shows healthcare workers are at risk as a result of contact with people who are infected/potentially infected with micro-organisms transmitted as aerosols by the airborne route. This could include working with a patient who is infected with COVID-19 and carrying out procedures involving contact with respiratory discharges. There is a growing body of evidence that supports the transmission of COVID-19 through respiratory particles produced when infected individuals talk, breath and call out. Refer to [‘About the toolkit’](#).

When in an airborne state, biological agents/micro-organisms can be classed as particles, and are usually removed by particle filter-type RPE.

RPE suitable for use to prevent inhalation of a biological agent/micro-organism.

The following, taken from the [Health and Safety Executive’s guidance booklet \(HSG 53\)](#) illustrates the diverse types of respiratory equipment available and the associated protection level provided. Information on the duration of continuous wearing and other requirements e.g. fit testing is also listed.

1) Disposable half mask respirators (eg. FFP3- filtering face piece 3)



Classification of RPE	Protection Factor
FFP1	4
FFP2	10
FFP3	20
Work rate	Medium
Continuous Wear Time	Less than 1 hour
Effective against	solid or liquid particles
Fit Testing Required	YES
Fit Testing Options	Qualitative - yes Quantitative yes
Applicable standards	BS EN 149
Dispose of masks marked NR (not reusable) after a single shift (8 hours).	

Green = required

2) Reusable half mask respirators – particle filter



Classification of RPE	Protection Factor	
Half mask + P1 filter	4	
Half mask + P2 filter	10	
Half mask + P3 filter	20	
Work rate	Medium	
Continuous Wear Time	Less than 1 hour	
Effective against	solid or liquid particles	
Fit Testing Required	YES	
Fit Testing Options	Qualitative YES	Quantitative YES
Applicable standards	BS EN 140 mask and BS EN 143 filter; BS EN 1827	
Always clean and store the mask properly – pay special attention to the valves		

Green is what is required

3) Full face mask respirators – particle filter



Classification of RPE	Protection Factor	
P1	4	
P2	10	
P3	40	
Work rate	Medium	
Continuous Wear Time	Less than 1 hour	
Effective against	solid or liquid particles	
Fit Testing Required	YES	
Fit Testing Options	Qualitative NO	Quantitative YES
Applicable standards	BS EN 136 mask and BS EN 143 filter	
Always clean and store the mask properly – pay special attention to the valves. Badly perished and deformed exhalation valves will be incapable of sealing.		

4) Powered respirators with masks



Classification of RPE	Protection Factor	
TM1	4	
TM2	10	
TM3	40	
Work rate	Medium to heavy	
Continuous Wear Time	More than 1 hour	
Effective against	solid or liquid particles also gas or vapour depending on filter	
Fit Testing Required	YES	
Fit Testing Options	Qualitative NO	Quantitative YES
Applicable standards	BS EN 12942	
In the event of the fan failing, a degree of protection is still offered but wearer should exit to safe area.		

5) Powered respirators with hoods/helmets



Classification of RPE	Protection Factor	
TH1	10	
TH2	20	
TH3	40	
Work rate	Medium	
Continuous Wear Time	More than 1 hour	
Effective against	solid or liquid particles also gas or vapour depending on filter	
Fit Testing Required	NO	
Applicable standards	BS EN 12941	
Never keep working if the fan stops or the flow rate falls – leave the work area immediately		

Note re use of valved respirators.

NHS England issued a [National Patient Safety Alert](#) on the infection risk when using FFP3 respirators with valves or Powered Air Purifying Respirators (PARPs) during surgical and invasive procedures

Occupational medicine specialists point out that for workers who may be required to wear RPE for prolonged periods, concerns about comfort and maintaining a consistent fit during a shift may outweigh theoretical advantages of reduced virus emissions from the wearer (Agius et al 2021). Should the use of valved respirators be considered then a multi-disciplinary risk assessment should be undertaken to determine if and where these might be used safely.

Innovation in RPE

The examples of respiratory protective equipment above represent examples available now. Innovation in the design, including comfort, re-use and transparency of masks is evolving and it is anticipated that more types of masks will be available in the future.

[Evaluating the protection afforded by surgical masks against influenza bioaerosols, HSE research report RR619](#)

[Respiratory protective equipment at work: A practical guide HSG53 \(hse.gov.uk\)](#)

[Personal Protective Equipment at Work \(Second edition\). Personal Protective Equipment at Work Regulations 1992 \(as amended\). Guidance on Regulations L25 \(hse.gov.uk\)](#)

References

Agius R, Cherrie J and Noone P (2021) Valved respirators may be preferable during the COVID-19 pandemic. Occupational Medicine. Volume 71, Issue 6-7, August-October 2021, Pages 302–303, <https://doi.org/10.1093/occmed/kqab065>

Stop COVID-19 hanging around! UK Government campaign (November 2021)
<https://www.gov.uk/government/news/new-campaign-to-stop-COVID-19-hanging-around>

Tang J, Bahnfleth W.P., Bluysen P.M et al (2021) Dismantling myths on the airborne transmission of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) Journal of Hospital Infection DOI: <https://doi.org/10.1016/j.jhin.2020.12.022>

Health and Safety Executive, Respiratory protective equipment at work: A practical guide
<https://www.hse.gov.uk/pubns/priced/hsg53.pdf>