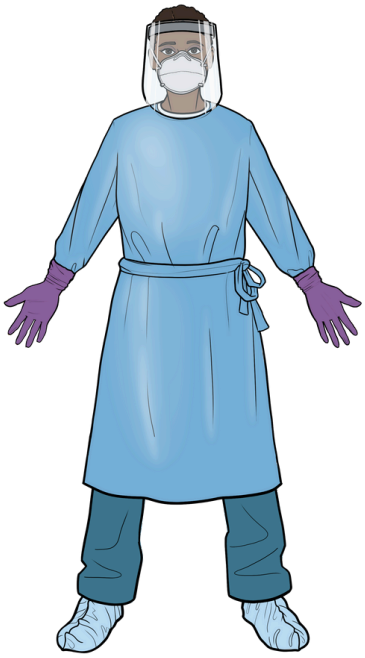
Description

Personal Protective Equipment (PPE) used in healthcare settings, particularly when caring for patients diagnosed with special pathogens, is designed to create a barrier between healthcare workers (HCW) and potential infectious agents, thereby minimizing the risk of transmission. This guide covers the PPE pieces and ensembles used in the care of patients who have, or may have, a high-consequence infectious disease (HCID). This group of "special pathogens" are those infectious agents that can cause serious illness and do not have readily available treatments, vaccines, or countermeasures. We will use "HCID" when referencing patients and illnesses, and "special pathogens" when referring to infectious agents.

Proper donning and doffing procedures are essential to ensure that PPE is effective and contamination is minimized. Training on the correct use and removal of PPE is critical for healthcare workers dealing with special pathogens to prevent breaches in infection control protocols.

In this document, PPE items have been grouped by coverage area. If viewing digitally, navigate directly to any area by clicking on the tabs above.



Content color-coded boxes for each PPE category:

Content in light blue boxes:
- Basics/general information

Content in dark blue boxes:
- More detailed information that will contribute to a greater understanding of the 3 PPE ensembles selection section

Content in light green boxes:
- Behavior best practices/ pro tips

Icons

We use a system of icons throughout the document that you can follow like a trail of breadcrumbs, from individual pieces of PPE to the full ensemble, to determine what is appropriate in your own context. While there is no complete list of special pathogens, PPE recommendations fall into these general categories: "Novel Respiratory Pathogens" which provides contact, eye, and respiratory protection, "Dry and Suspect" for the care of clinically stable, suspect cases of viral hemorrhagic fevers (VHF) or similar pathogens, and "Wet or Confirmed" for anyone confirmed with a VHF or similar pathogen or any suspect case that is wet (vomiting, diarrhea) or clinically unstable.

These icons refer to national guidance; local or jurisdictional requirements may increase the level of protection. Some jurisdictions may require increased levels of protection for VHF patients beyond what is shown in this guide.

Examples of NRP

Middle East Respiratory Syndrome, novel influenzas.

Examples of VHF

Ebola, Marburg, Lassa fever, Crimean Congo Hemorrhagic Fever (CCHF), Nipah.

Head and Neck Covers - Basics

A head and neck cover or surgical hood is added to PPE ensembles when total skin coverage is needed, such as for a confirmed or "wet" patient with a special pathogen like Ebola or Marburg virus, when used in combination with an N95® respirator and eye protection. (This protection may be provided by the hood of a powered air-purifying respirator or PAPR, if used).

Look for fluid-resistant material with a face opening large enough not to obstruct a mask or respirator worn underneath.

Head and Neck Covers - Details

Head and neck covers are included in the AAMI PB70:2022 standard with the minimum required protection of Level 1. Unrated head and neck covers are common, and their level of fluid resistance varies.[1]

Look for coated or laminated material that may offer improved fluid resistance. For safety, when using unrated or lower fluid-resistant level head covers, consider a splash or spray to the head or neck as a breach of PPE.

Do not use the hood of a coverall as a head cover unless careful consideration has been given to safe doffing practices.

Head and Neck Covers - Pro Tips

Some head and neck covers have ties to secure them in place, while others simply pull on over the head. Wrap any ties with the goal of covering as much skin as possible. Ensure that the coverage at the forehead overlaps with the face shield.

When donning, the order these items are put on will affect the safety of their removal.

Head coverings, especially those that are fluid resistant, may increase heat retention, causing discomfort.[2]

Use caution when removing a head and neck cover to maintain protection over your mouth and nose. Consider closing your eyes briefly if eye protection has already been removed. Remove in a controlled manner, and perform a glove change or hand hygiene before and after removal.

Eye Protection - Basics

Eye protection is used to protect the wearer from visible splashes and sprays as well as from exposure to very small droplets that we can't see. Coverage should surround the eyes without the gaps that may be present in safety glasses or corrective lenses. Ensure that your mask, respirator, corrective eyewear, head cover work together with your chosen eye protection.

Face shields should extend to the front of the ears and below the chin, and should not have an open top at the forehead.

Eye Protection - Details

ANSI/ISEA Z87.62-2021 Standard for Occupational and Educational Eye and Face Protection Devices for Preventing Exposures Caused by Sprays or Spurts of Blood or Body Fluids sets forth criteria related to the general requirements, testing, permanent marking(s), selection, care and use of protectors to minimize or prevent exposure to the wearer's eyes and/or face caused by spray or spurt of blood, body fluids and/or other potentially infectious materials.

Look for items marked "Z87" or "ANSI/ISEA Z87.62" and D3, which indicate they meet this 2021 standard.

Note that this is a voluntary standard, so not all suitable products may make this claim.

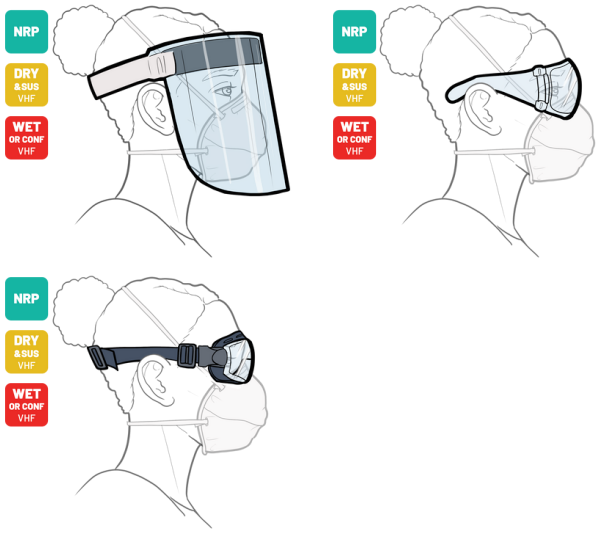
Eye Protection - Pro Tips

Avoid adjusting eye protection while in use. If adjustment is required for safety, perform hand hygiene or gloved hand hygiene before and after handling your goggles or face shield. Whenever possible, keep your eye protection in place until other pieces of PPE have been removed.

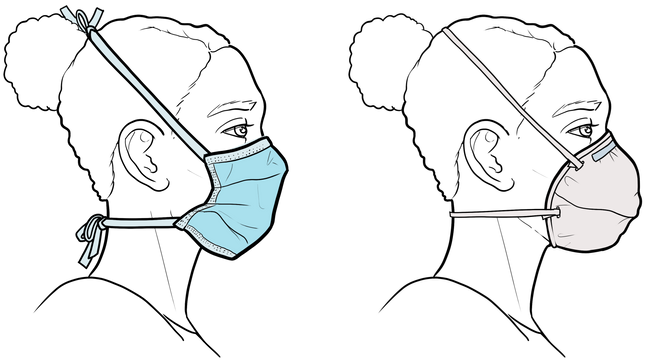
Throw away or Reuse?

Many types of eye protection are reusable after appropriate cleaning. Check the labeling or Instructions For Use (IFU) for the products you are using.

NOTE: When used in the care of a patient with a special pathogen, discard any items that cannot be safely decontaminated, such as those with elastic straps, foam padding, or any material that might absorb or retain contamination after use.



Is it a mask or is it a respirator?



Mask | Respirator

Mask

Face masks are designed to protect other people and a sterile field from large and small particles and droplets that may come from the nose and mouth of the wearer. Medical face masks also carry an ASTM Level of fluid resistance to protect HCWs from splashes and sprays. An ASTM Level 1 mask provides the lowest level of splash and spray protection, and a Level 3 provides the highest level. As the fluid resistance increases, so can the effort required to breathe through the filter material.

Face masks designed for use in surgical settings typically have ties to go over surgical caps. Medical, isolation, or procedure masks all refer to the same product and usually have elastic ear loops.

Medical face masks are not considered respiratory protective devices as small particles can pass through the gaps in the mask and enter our airways as we inhale.

Respirator

A respirator is designed to protect against hazardous aerosols. In the healthcare environment, aerosol hazards include particulates, such as potentially infectious particles, dust, and dirt, but may also include chemical gases or fumes, which are not addressed in this guide.

Respiratory protection in a healthcare workplace should be part of a Respiratory Protection Program, which guides important steps such as risk assessment, medical clearance, fit testing, training and education, and record keeping.

Respirators such as N95s® are designed to be tight-fitting, creating a seal around the nose and mouth to ensure that all the air we inhale has been filtered. Because the protection of an N95 is dependent upon its ability to fit tightly to the wearer's face, medical clearance, initial and annual fit testing, and training are required.

Respirators used in healthcare settings should be NIOSH Approved® and should not have an unfiltered exhalation valve, which could allow small particles to escape during exhalation.

Surgical N95 respirators are designed to provide both respiratory protection and some resistance to fluid splashes and sprays.

N95s belong to a category of respirators known as "filtering facepiece respirators" (FFRs). This class includes models labeled with the letters N, R, or P—indicating their resistance to oil-based aerosols (N = not resistant, R = somewhat resistant, P = oil-proof)—and the numbers 95, 99, or 100, which reflect their minimum filtration efficiency (95%, 99%, and 99.97%, respectively).

Masks - Basics

Medical face masks can be called many different names – surgical mask, isolation mask, or procedure mask, to name a few – but they all refer to similar devices.[3] Generally, those called surgical masks will have ties rather than ear loops so they can be tied in place over a surgical cap.

All these masks are designed to reduce the introduction of small droplets into the environment, such as in a sterile field or as source control for respiratory secretions, and to protect the wearer from splashes and sprays.

Masks - Details

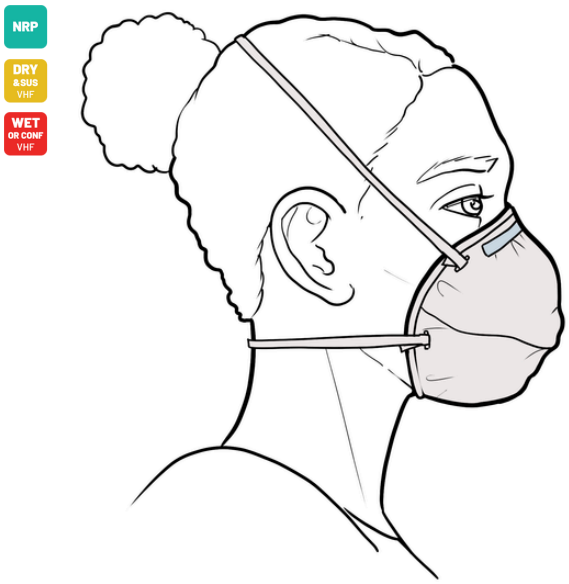
ASTM F2100-21 is the material performance standard for medical face masks. Mask materials are tested for bacterial filtration efficiency, differential pressure (how difficult the material is to breathe through), sub-micron particulate filtration efficiency (for viral-sized particles), resistance to penetration by synthetic blood (splash and spray), and flammability.

Masks - Pro Tips

While not designed for the wearer's protection, fit is still important! Ensure that your mask fits snugly on your face.
For tasks that might involve droplet splashes or sprays, consider moving up a Level for improved splash protection or protect your mask with a face shield.

NOTE: Remember to avoid touching or adjusting your mask. If you must adjust the fit, or once it is time to remove your mask, do so with clean gloves and perform hand hygiene immediately afterward!

See appendix (p.26) for discussion on different face mask levels.



N95 filtering facepiece respirator (FFR)

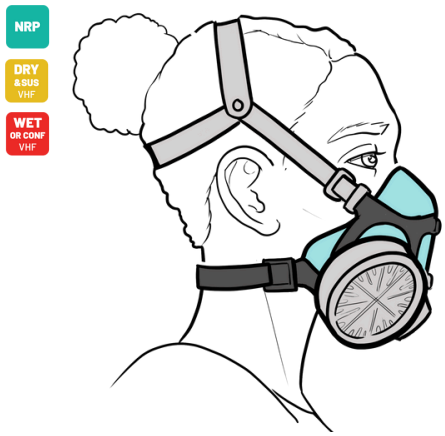
Elastomeric half-mask respirator

Respirators - Basics

N95s® are the most common respirators in the healthcare setting and are used to protect workers from dust or infectious aerosol particles. Because they fit tightly and form a seal to the wearer's face, all the air we inhale must travel through the respirator's layers of filter material, which traps even viral-sized particles. N95 respirators may have an expiration date and a shelf-life of 3 – 5 years is common. If no shelf-life is indicated, **see appendix p.29**.

Respirators are used with Novel Respiratory pathogens, wet or confirmed VHF patients, and other aerosol-transmissible diseases.

Information on powered respirators can be viewed on pages 9-10.



Respirators - Details

Elastomeric respirators are designed for re-use and have replaceable filters that can be selected based on the type of respiratory hazard. It is important to ensure that the correct filter is used for the anticipated risk. Elastomeric respirators are tight-fitting like N95s and require medical clearance, fit testing, and training prior to use. Like N95s, if an elastomeric respirator is used in the healthcare setting, it should not have an unfiltered exhalation valve, which could allow particles from the wearer to escape into the environment. The filters for elastomeric respirators have an expiration date and should be changed according to manufacturer's guidance.

*KN95s are not NIOSH-approved respirators and should not be used in the healthcare setting as protection against aerosolized particles.

Respirators - Pro Tips

- Perform a user seal check every time you put on a tight-fitting respirator to make sure you have a good seal before entering a contaminated space.
- Whenever possible, keep your respiratory protection in place until you are safely outside of a contaminated area.
- Remove the bottom strap first to help prevent the respirator from flipping down onto your neck or chest.
- Use hand hygiene after removing your respirator and avoid touching it while in use.
- Elastomeric respirators should be cleaned after each use, following manufacturer and facility guidelines.

Powered Respirators - Basics

Powered air-purifying respirators, or PAPRs*, are used when extra protection or extra comfort is needed – like for those who work in a biocontainment unit or who may spend several hours in an environment where respiratory protection is required – or for those unable to wear a tight-fitting respirator.

These devices typically consist of a helmet, face shield, hood, battery pack, fan motor, and filtration system; some models also feature disposable filters or hoods. Always ensure the filter you are using is appropriate for the respiratory risk. The filters (which may be labeled PAPR 100-N, PAPR 100-P or HE for High Efficiency) used for protection against infectious particles do not typically protect against chemical vapors or gases.

PAPRs can have an external assembly that is worn on the low back attached to a belt worn outside a gown or coverall or backpack (external motor PAPR) or may have the motor built into the helmet with a belt and battery worn inside the gown or coverall (internal motor PAPR).

Some new PAPR designs combine a tight-fitting mask with a motor-fan unit worn around the neck, but do not provide eye or head/neck coverage.

*CAPR is one manufacturer's term for their PAPR.

Powered Respirators - Details

APF Explained: Respirators of all types, including PAPRs, are rated for their ability to reduce the risk of breathing in things we want to avoid. The Assigned Protection Factor (APF) is the minimum ratio of the contaminants outside our respirator to those inside. Loose-fitting PAPRs and hoods have an APF of 25, which means, for instance, that for every 100 particles outside the respirator, 4 might make it to the inside (100/4 = 25). The APF of 25 is the minimum that the PAPRs can perform to meet the requirement. OSHA sets the APF for each type of respiratory protection.

External motor PAPRs have filters on or near the motor assembly. These filters may be reused; facilities should have strict guidelines on accessing, cleaning, storing, and disposing of these filters, including the PPE worn and safe disposal methods.

Internal motor PAPRs may have filter material integrated into the cap or hood, many of which are single-use only.

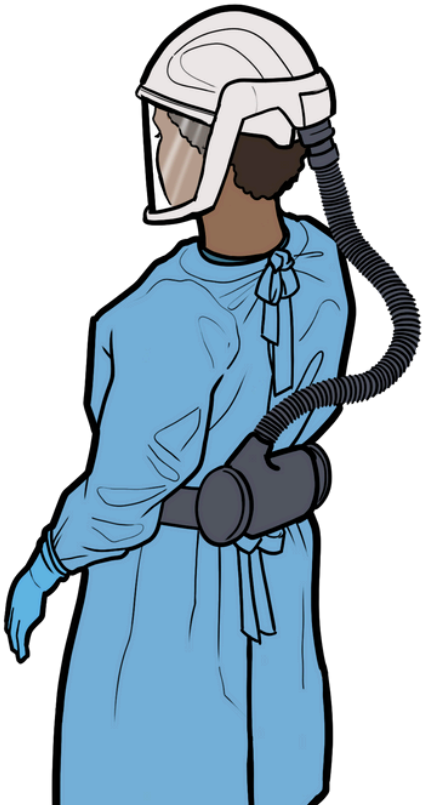
Powered Respirators - Pro Tips
As respirators, PAPRs require NIOSH approval and should be used as part of a Respiratory Protection Program, and users should be medically cleared before use.

Unlike N95® non-powered respirators, loose-fitting PAPRs do not require fit testing; however, training should include how to troubleshoot these devices in use, along with cleaning, care, and life of the battery and filter.

Some parts of the PAPR may be disposable, usually the hood and face shield, while others may require cleaning and decontamination.

The configuration of a PAPR has important considerations for how it is put on, what types of pathogens it is appropriate for, and how, when, and where it can be safely removed.

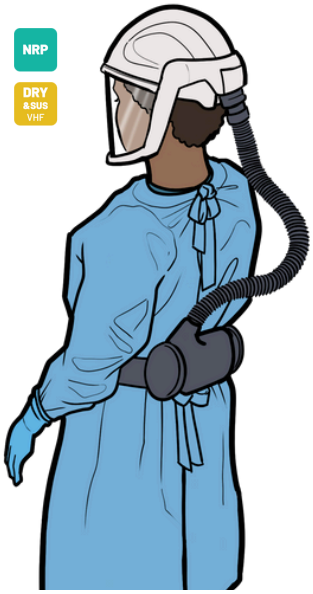
NOTE: When possible, maintain your respiratory and eye protection until the other articles of potentially contaminated PPE have been removed and you can move to a lower-risk area.



One more Pro Tip ...
Know where your air is coming from! When donning an external motor PAPR, ensure the air intake is not blocked by your PPE. Do not wear an external PAPR motor inside a gown or coverall.

These varying configurations may require modifications to the helmet, will have separate disposable parts, and require specific training to use safely.

- Each of these qualities – internal v. external motor, the location of the belt/motor relative to a gown or coverall, and the presence of a hood - will affect the order of donning and doffing.
- Use a trained observer to ensure the removal of a hooded PAPR is performed safely, avoiding the risk of self-contamination.



External motor PAPR for novel respiratory pathogens

External motor PAPR with hood

Internal motor PAPR with disposable hood

Some internal and external motor PAPRs have components that offer respiratory and eye protection ONLY, appropriate for **Novel Respiratory Pathogens and dry/suspect VHF patients.**

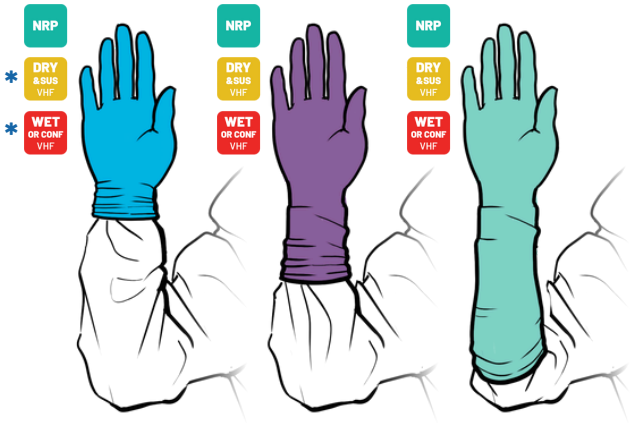
Other components of both styles of PAPRs can include full-coverage hoods that provide respiratory, eye, and full skin coverage required for wet or **confirmed VHF patients**.

Gloves - Basics

Double gloving allows staff caring for patients with a special pathogen to remove soiled gloves without having exposed skin. Using extended cuff gloves as the outer pair helps cover the cuff of a gown or coverall, reducing the risk of a gap in protection at the wrist.

When possible, using gloves of differing colors for the inner and outer layers helps detect holes or tears in the glove material and gives a visual clue to the wearer and the Trained Observer.

NOTE: Glove colors utilized in Know Your PPE are not intended to be prescriptive.



Regular cuff Extended cuff Elbow length

* If utilized as a third pair – see Pro Tips next page

Gloves - Details

Standard exam gloves are typically about 9.5" long with a thickness of 3 – 4 mils. Extended cuff gloves and the increased thickness of chemo, trauma, or surgical gloves may provide additional protection and resistance to chemicals, but can also lessen fingertip sensation and dexterity (some have double the fingertip thickness of standard exam gloves).

Extended cuff length ranges from 12 to 16".

Thicker latex, nitrile, and surgical gloves have been shown to perform better than vinyl (PVC) gloves or thinner gloves when subjected to repeated applications of alcohol-based hand sanitizer or other disinfectant methods.[4]

Gloves - Pro Tips

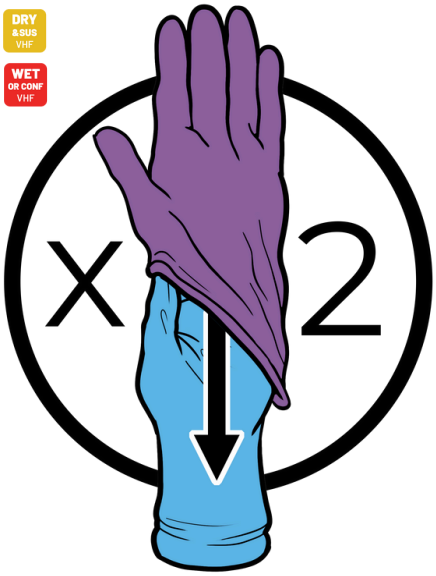
When in doubt, change them out!
Using sanitizers on gloves is a method for reducing potential contamination on gloves, especially during doffing; however, it is not a substitute for changing gloves once they are soiled or contaminated.

Ensure you can remove dirty gloves without contaminating other parts of your PPE by practicing with fluorescent material, water-based paint, or shaving cream. A glove-in-glove technique for removal can help contain exterior soiling.

Keep a supply of outer gloves in the room to enable caregivers the ability to change outer gloves as needed during patient care.

If non-sterile extended cuff gloves are not available or to reduce the need to stock extra supplies, caregivers can use sterile gloves that are extended cuffed by design.

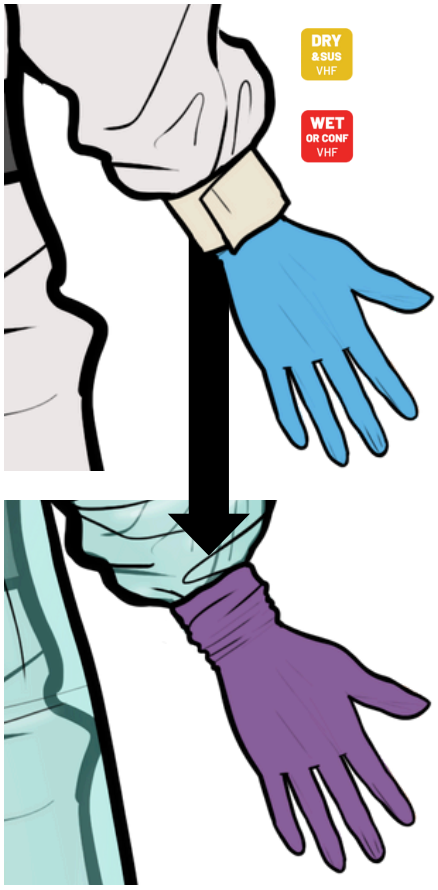
See page 14 for discussion on gloves and taping.

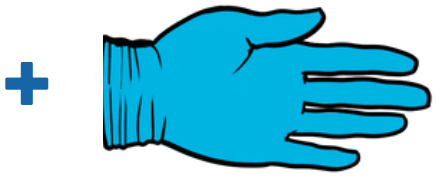


For VHF:

Wet or Confirmed VHF and Dry and Suspect VHF cases require the use of double gloves. Double gloving is designed to prevent caregivers from having any exposed skin, even when removing and changing soiled or contaminated gloves.[5]

Caregivers may wear a third pair of standard exam gloves if sensation and dexterity are not adversely affected.





NOTE: Caregivers may wear a third pair of standard exam gloves, as long as sensation and dexterity are not adversely affected.

NOTE: If extended cuff gloves are not available, caregivers can use sterile gloves that are extended cuffed by design.

Tape

Whether you are in an operating room or dealing with an infectious patient, your wrist area can be at a higher risk for contamination.

The folds and pleats of a gown or coverall sleeve may provide a channel for body fluids or other contamination to track downward onto the hand, and gaps can form between a sleeve and glove when arms are extended. The knit cuffs found on many gowns can absorb fluids and resist disinfection.

NIOSH researchers have been working on evaluating this risk and determining if taping gloves to sleeves decreases that risk.[6]

We don't have all the answers yet, but we can say that facilities should carefully evaluate how taping will affect safety, especially the order of doffing, the ability to change soiled gloves, and hand or gloved-hand hygiene.

If you choose to use tape:

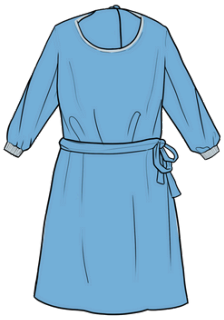
- Use a type that can be wiped or cleaned and does not tear the sleeve as the tape is removed.
- Avoid stretching tape that could create a tourniquet effect.
- Ensure that tape is not applied too tightly while donning by having the staff member make and hold a fist while the tape is applied.
- **NOTE: Do not tape outermost layer; soiled gloves should be changed as needed.**

Gowns - Basics

Gowns can be used to protect you from dry fomites, small droplets, or from contact with blood or body fluids - depending on the **Level of Protection** and the **location** of the **Critical Zones**, the areas of the gown that offer the most protection.

Gowns can be launderable or disposable, have full coverage around your body or an open back, and typically are only available in one or two sizes.

See appendix (p.27-28) for discussion on Fluid Resistance and Levels of Protection.



Gowns - Details

Whether it is a sterile surgical or procedure gown, isolation gown, or decontamination gown, all should have an ANSI/AAMI PB70 rating alerting you to the Level of Protection it provides and in which areas. Suspected and Dry VHF = Level 3 or higher; Confirmed or Wet VHF = Level 4.
See the Appendix for more on gown fluid resistance.[7]

Gowns - Pro Tips

- Shorter workers should avoid allowing the lower hem of the gown to contact the floor when they bend, crouch, or lean over. If a gown is too long to be worn safely due to contamination or trip risk, consider cutting the hem of a disposable gown **prior** to donning. If a gown is too short to meet lower leg coverage, consider adding an extended apron, sizing up the gown if possible, or utilizing taller boot covers.
- Some gowns have knit cuffs that are not protective and can trap liquid contamination; fold these cuffs under the sleeve or ensure that gloves completely cover the knit portion of the gown.
- If you may encounter blood or body fluids and don't have a Level 4 gown, consider adding a plastic apron, gown, or drape to protect yourself.

Doffing tips:

- Gently untie or break away the neck and waist ties to prevent aerosol generation.
- Avoid removing the gown over your head or touching your face, neck, or hair with contaminated sleeves or gloves.
- To remove, grasp the gown at the upper arm/shoulder area and pull the gown away from you, rolling it into a ball, keeping the contaminated side inside to reduce any contact between your clothing and the outer portion of the gown.

Coveralls - Basics

Coveralls can provide protection to the body, arms, and legs from both wet and dry contaminants, as well as infectious materials. Coveralls are available in many sizes, and most use linear sizing, which means they get taller and wider simultaneously. This can create folds of redundant fabric that may trap contamination.

The protection level the fabric provides is typically the same on all areas of the garment, but close attention should be paid to seams, zippers, and attachment points. Coveralls can provide more complete coverage to the back and sides than some gowns can.

Coveralls - Details

Body fluids that penetrate protective clothing materials can carry microbiological contaminants and pathogens. The ASTM test method F1670/F1671 screens protective clothing like coveralls for resistance to penetration with synthetic blood and bacteriophage – a very small surrogate microbe.

Some coveralls are also tested for resistance to chemical liquids and gases using ASTM F739; these garments tend to be heavier and less flexible, and are used for hazmat operations.

For protection from infectious materials, look for coveralls that specify that the garment itself, materials, **and seams** meet ASTM F1670/ISO16603 (surrogate blood) **and** F1671/ISO16604 (viral size particles) standard, or for those that have been certified by the NFPA 1950 (formerly NFPA 1999-2018).

Coveralls - Pro Tips

Make sure you can move safely in your coverall, including bending, crouching, and fully extending your arms without tearing or revealing any gaps.

Coveralls may come with attached "socks" or shoe covers, an attached hood, or finger loops, all of which can affect how you put them on and, importantly, how you remove them safely. Roll or fold the attached hood out of the way during donning.

While many healthcare workers have become accustomed to putting on and taking off gowns, training staff to use coveralls safely may require a great deal of additional time and repetition to achieve competency.

Staff may need a chair, stool, or grab bar to safely remove a coverall without risk of fall, and should be observed during doffing to identify risks of self-contamination. When possible, turn the coverall inside out as you remove it to avoid contact between your clothing and the outer portion of the coverall.

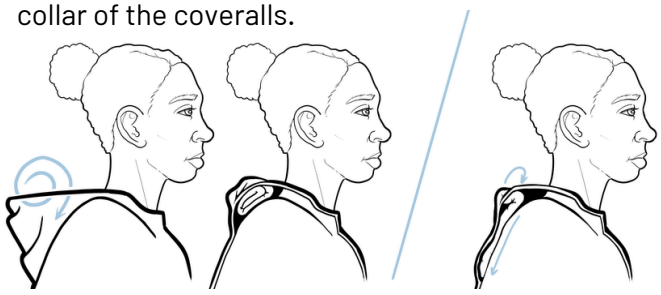
Coveralls sometimes have thumb loops. They can also have integrated feet or be open at the bottom.

Shoe covers should be worn over integrated coverall feet.

Boot covers are another option over coveralls.

Boots may be worn by EMS or those who transfer outside.

Integrated hoods should be rolled and tucked into the collar of the coveralls.



Rolling into coveralls

Tucking into coveralls

Aprons and Cover Gowns - Basics

Plastic aprons or cover gowns can be used to protect the components of a complex PPE ensemble, such as the zipper, storm flap, PAPR components, or can be used as a fluid barrier for less-protective layers of PPE, including a base gown.

When tasks may require close or prolonged contact with a risk of exposure to blood or body fluids, these can provide extra protection.

Many aprons and gowns used for this purpose have easy-to-break waist and neck ties.

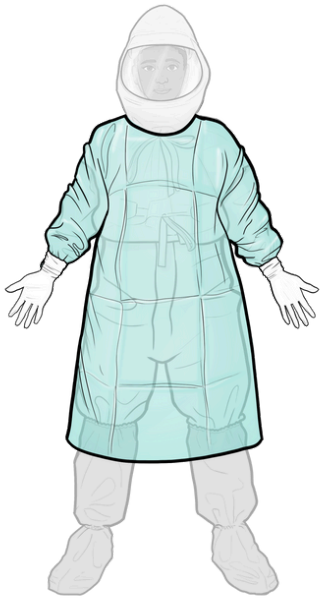
Plastic material or coating may make it possible to wipe off any contamination, if needed.

Aprons and Cover Gowns - Details

While this extra layer is worn for fluid resistance, we rely on the plastic "fabric' or plastic coating/lamination to resist penetration by blood or body fluids; most will not have an ANSI/AAMI PB70 or other rating. Use caution: some terms used by manufacturers such as "fluid resistant" do not carry required performance levels.

This extra layer can help bridge the gap in fluid protection for those who may only have unrated or lower-level gowns available.

Apron



Sleeved apron

Cover gown

Aprons and Cover Gowns - Pro Tips

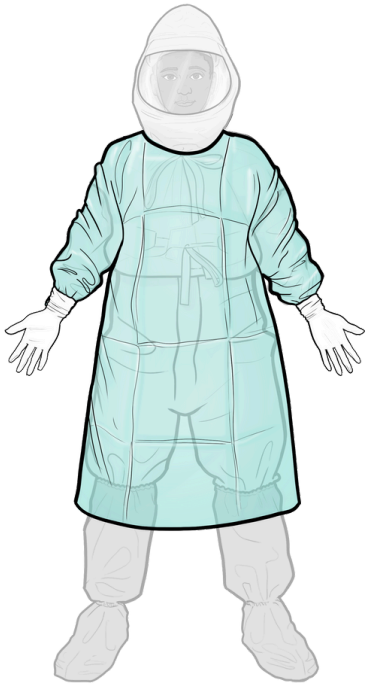
More is not always better!

As an additional layer to a PPE ensemble, an apron or additional gown can be used for tasks that may have a higher risk of exposure to body fluids and potentially infectious materials. However, these additional layers may retain more heat and further complicate the removal of PPE.

This supplemental PPE may be used episodically when higher-risk, greater fluid-exposure tasks are anticipated and then removed or as a regular part of a complex PPE ensemble to cover portions of the PAPR hood, belt, or zipper.

Removing this "dirtiest, first" layer when doffing may reduce the risk of transferring contamination to the rest of our PPE and make removal of remaining PPE safer.

Apron



Sleeved apron

Cover gown

Shoe and Boot Covers - Basics

Shoe and boot covers can help protect our legs and shoes from both wet and dry sources of contamination.

These may be worn over a footed coverall to provide additional protection or with a gown to provide coverage head-to-toe. If used with a gown, ensure the boot cover extends high enough – or the gown low enough – to avoid exposed clothing beneath.

Look for fluid-resistant material with a non-slip bottom that can be easily put on and taken off over your shoes.

Shoe and Boot Covers - Details

Shoe and boot covers may have elastic at the top of the foot, ankle, or at the knee, while others have hook-and-loop closures or ties to secure them in place. The fit, height, and securement method all impact safe removal, making training and practice essential to staff safety and to prevent transfer of contamination.

If knee-high boot covers are worn with a coverall, consider "blousing" any extra coverall fabric over the top of the boot cover to prevent trapping contamination.

Shoe and Boot Covers - Pro Tips

Removing shoe or boot covers can be a challenge! For some people and PPE ensembles, you may need a stool, chair, or grab bar to remove foot covers safely - some use a wipeable shoehorn.

Any time you have touched your foot coverings or other things on the floor, make sure to perform hand or gloved-hand hygiene, or change your outer gloves.

Boot covers

Shoe covers

Shoe covers over boot covers

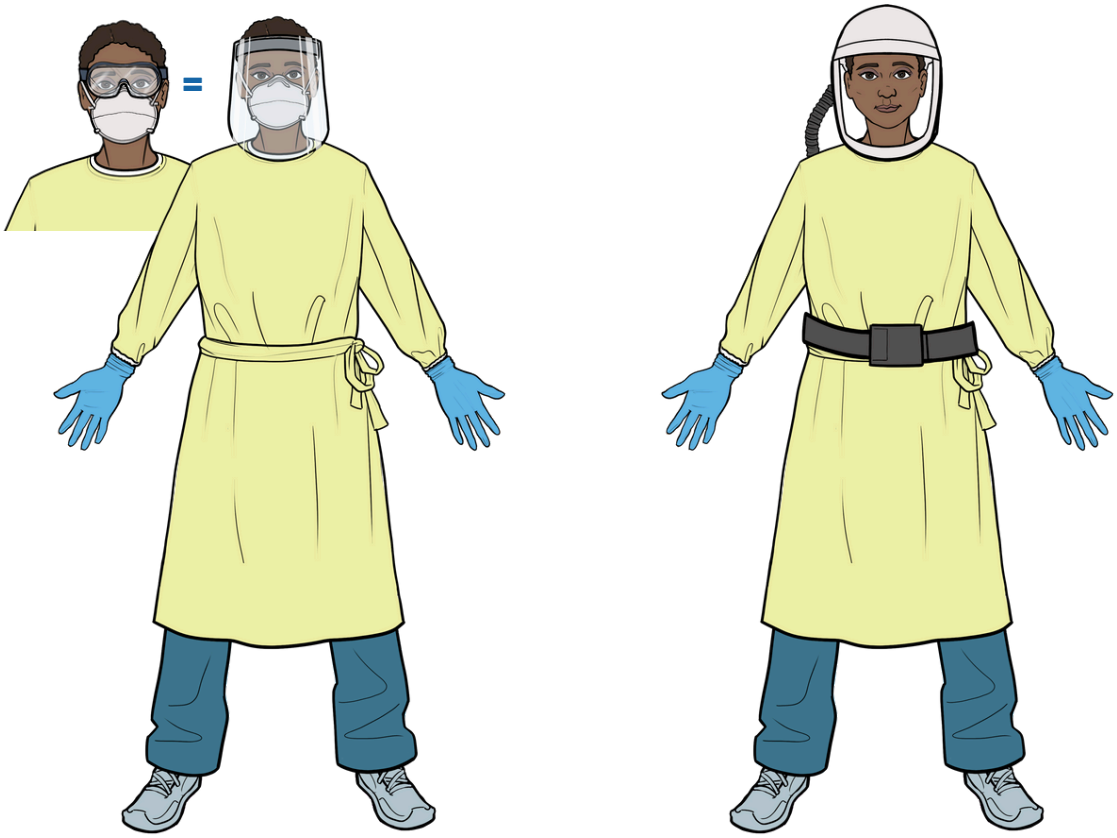
NRP

Novel Respiratory Pathogen

For Novel Respiratory Pathogen (NRP) choose:

- Respiratory protection with a NIOSH Approved N95®, elastomeric, or PAPR (powered air-purifying respirator)
- Eye protection with a full face shield or tight-fitting goggles
- Isolation gown (choose the gown level of protection based on risk of exposure to fluids)[1]
- Gloves

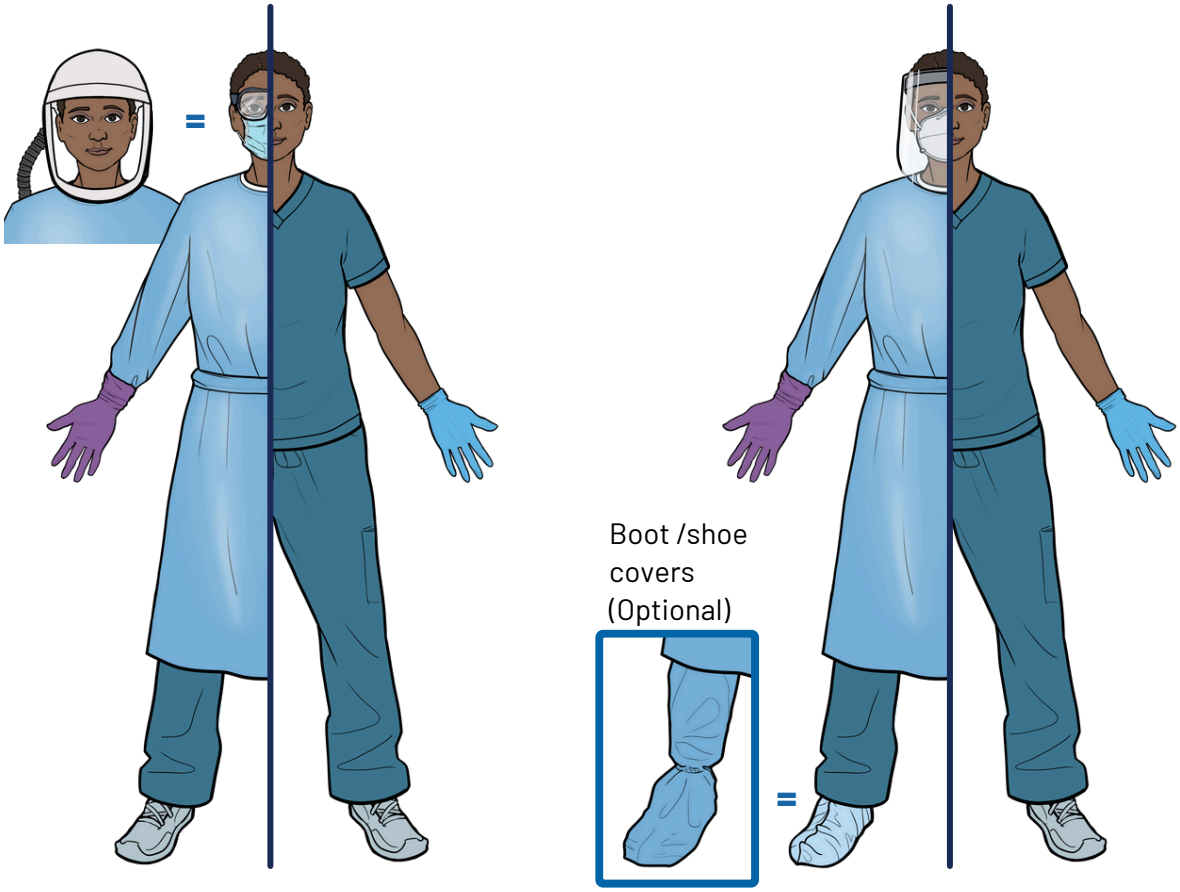
These ensembles represent the minimum level of protection recommended.



DRY
AND SUSPECT
Viral Hemorrhagic Fever (VHF)

For Dry / Suspect VHF choose:

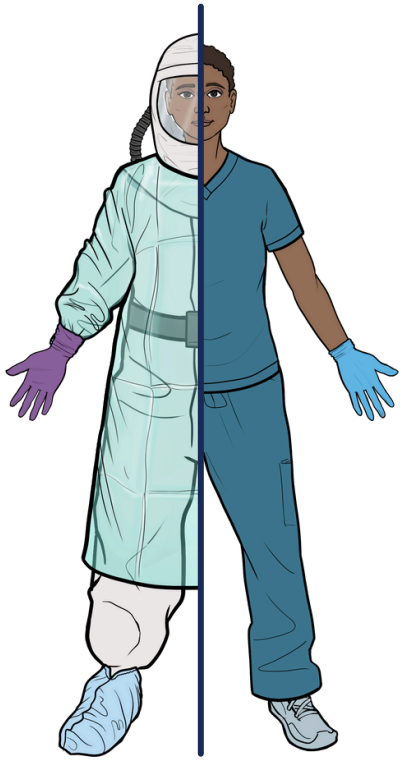
- Eye protection: Full face shield, integrated face shield of powered respirator, or tight-fitting goggles
- Nose and mouth coverage: Medical mask or optional respiratory protection with a NIOSH Approved N95®, elastomeric, or powered air-purifying respirator (PAPR)
- Torso/Body coverage: Fluid-resistant gown (Level 3 or 4) or coverall[1]
- Gloves: 2 pairs of gloves, outer pair with extended cuffs



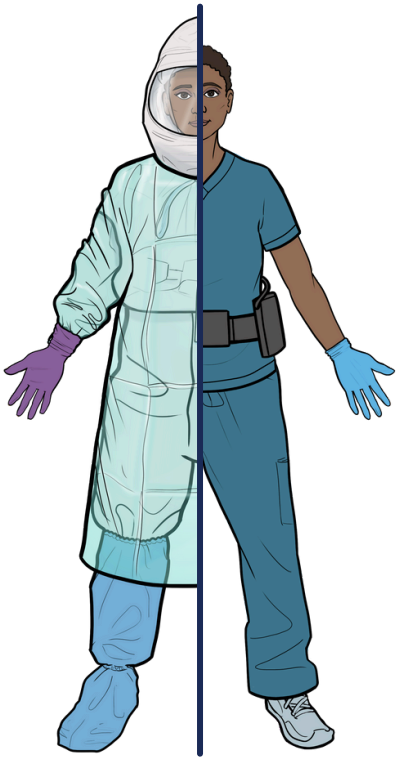
WET
OR CONFIRMED
Viral Hemorrhagic Fever (VHF)

For Wet VHF choose:
Wet/Confirmed VHF choose an ensemble that provides total body coverage and respiratory protection. Outer layers[1] should be fluid-impervious whenever possible, with two layers of gloves, the outer layer with extended cuffs.

- NIOSH Approved N95® or elastomeric respirator with a fluid-resistant head and neck cover
- Full face shield
- ANSI/AAMI PB70 Level 4 gown or ASTM F1670/F1671 coverall
- Shoe or boot covers
- 2 pair of gloves, outer are extended cuff



- PAPR (external motor)
- ANSI/AAMI PB70 Level 4 gown or ASTM F1670/F1671 coverall
- Shoe/boot covers
- 2 pair of gloves, outer are extended cuff



- PAPR (internal motor)
- ANSI/AAMI PB70 Level 4 gown or ASTM F1670/F1671 coverall
- Shoe boot covers
- 2 pair gloves, outer are extended cuff

Standards, guidance, and requirements for PPE come from multiple organizations and agencies, among them:

AAMI (Association for the Advancement of Medical Instrumentation): A nonprofit organization that develops and publishes quality standards for medical instruments and supplies such as surgical attire.

ANSI (American National Standards Institute): Coordinates the network of manufacturers' voluntary standards systems. ANSI oversees standards used in many sectors, from healthcare to construction and agriculture, and represents the U.S. on the International Organization for Standardization (ISO). ANSI accredits standards developed by other organizations, ensuring they meet specific criteria, but does not create the standards themselves.

ASTM International (formerly the American Society for Testing and Materials): A standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials and products, including protective clothing, and the test methods that are used to determine important safety considerations such as viral and bacterial filtration efficiency, fluid resistance, and permeability by synthetic blood.

FDA (United States Food and Drug Administration): The FDA regulates medical devices sold in the United States to assure their safety and effectiveness and participates in developing and using consensus standards created by outside organizations. The medical devices covered by the FDA range from hospital gowns, gloves, masks, and tongue depressors to pacemakers and surgical robots.

ISEA (International Safety Equipment Association): ISEA develops product performance consensus standards for safety equipment, including eye protection, hard hats, and many others used for construction safety, and in hospitals, laboratories, and factories. ISEA standards are then approved by the American National Standards Institute.

NIOSH (National Institute for Occupational Safety and Health): This US federal institute is a research institute focused on the study of worker safety and health and is responsible for conducting research and making recommendations for the prevention of work-related injury and illness.

NPPTL (National Personal Protective Technology Laboratory): A division of NIOSH responsible for testing and approving respirators and other personal protective equipment (PPE) used in workplaces. NPPTL also conducts research, surveillance, and standards development related to personal protective equipment and new technology. They certify that new respirators meet minimum performance and respiratory protection standards, develop and implement science-based national recommendations for respirators and other PPE, including new methods to test the effectiveness of PPE.

NFPA (National Fire Protection Association): A nonprofit safety and standards organization that develops and publishes codes and standards for fire and electrical safety, including firefighter and medic PPE. The new NFPA 1950 will include the NFPA 1999 Standard on Protective Clothing and Ensembles for Emergency Medical Operations.

What Are the Different Medical Face Masks Levels? ASTM F2100-25

Characteristic	Level 1	Level 2	Level 3
BFE: Bacterial Filtration Efficiency. Must filter out 95% or more of bacteria-sized particles	≥95	≥98	≥98
ΔP: Differential Pressure, mm H_2O	<24.5	<29.4	<29.4
PFE: Particle Filtration Efficiency. Must be able to filter out particles 0.1 micron in size	≥80	≥85	≥85
Fluid resistance: Resistance to penetration of synthetic blood under pressure in mm Hg	80mm Hg	120mm Hg	160 mm Hg
Implications for use	No or low risk of splash or spray	Some risk of splash or spray	Surgical, trauma, or high risk of splash or spray

Fluid Resistance and Levels of Protection

ANSI/AAMI Levels of protection

The fluid resistance of gowns, surgical hoods, and foot coverings is covered by ANSI/AAMI PB70:2022 and rated for their ability to resist penetration by water for Levels 1, 2, and 3. Level 4 apparel are also tested for their ability to resist penetration by synthetic blood and viral-sized particles using the ASTM F1670 and F1671 methods, which are also used for coveralls.

The fluid resistance of medical face masks covered by ASTM F2100-25 on page 26.

These test methods apply to many different articles of PPE, including:

- Gowns
- Head and neck covers
- Surgical hoods
- Foot coverings

ANSI/AAMI PB70:2022- Liquid barrier performance of protective apparel

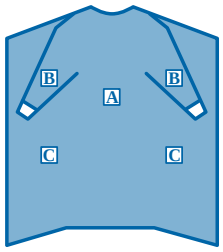
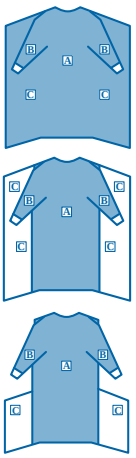
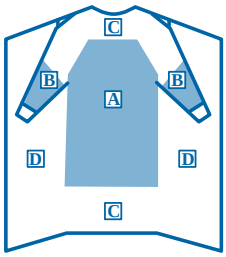
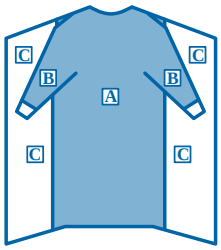
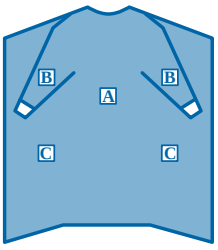
Level	Test	Implications for Use
Unrated	None: protective qualities are unknown	Tasks with no anticipated exposure to blood or body fluids in covered areas
1	AATCC 42: Water resistance, impact penetration	Tasks with limited fluid exposure, minimal splash risk
2 NRP	AATCC 42, AATCC 127, (or NWSP 80.3) 20cm: Water resistance, impact penetration, hydrostatic pressure	Tasks with some fluid exposure, splash risk; some resistance to pressurized water
3 DRY & SUS VHF	AATCC 42, AATCC 127, (or NWSP 80.3) 50cm: Water resistance, impact penetration, increased hydrostatic pressure	Tasks with some fluid exposure, splash risk; increased resistance to pressurized water
4 WET OR CONF VHF	F1670/F1671: Synthetic blood and viral penetration	Resists penetration of pressurized synthetic blood and viral sized particles; tasks with anticipated exposure to blood and body fluids

Critical zones:

In addition to understanding the Level of Protection articles of PPE might provide, it is also important to know if that protective level applies to the entire article or garment, or only to certain parts, called Critical Zones. Protection levels may not apply to seams and attachment points.

The critical zone for protective headwear, such as surgical hoods, includes the front and does not extend past the ear.

Here is a diagram showing the critical zones (dark) and non-critical zones (light) for gowns.

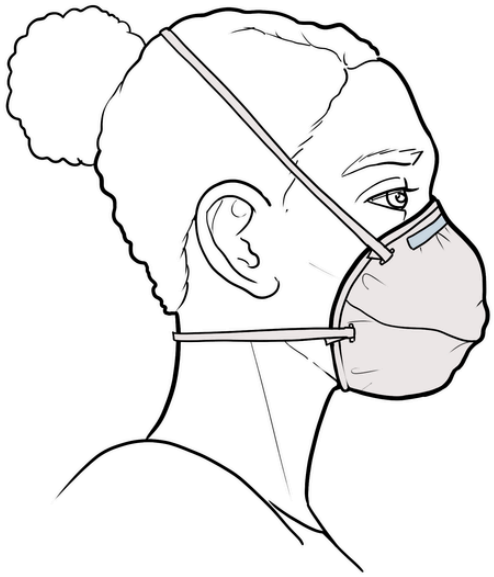
Gown Type				
Isolation	**Procedure**	**Surgical**	**Surgical-E**	**Decontamination**
Entire gown, except cuffs, ties, and and hems, offer the same level of protection. **Minimum protection level = Level One**	**Full Coverage** - entire garment protective, intends to cover back of wearer. **Non-Protective Back** - front and sleeves offer protection, the back of the gown does not. **Open Back** - does not intend to cover the back of the wearer. **Minimum protection level = Level One**	Critical Zones will be noted on packaging and indicate the portions of the garment that offer the protection level claimed. The remainder of the garment may be minimally protective. **Minimum protection level = Level One**	Extended area designated as Critical Zone includes shoulders, arms, and entire front of garment from neckline to hem. The back of the garment may be minimally protective. **Minimum protection level = Level One**	Entire gown, except cuffs, ties, and attachment points offer protection. **Minimum protection level = Level Three**
				

The ASTM F1670/1671 test is also used for testing the fluid resistance of coveralls

What to do when shelf life isn't on the packaging:

Find the approval number (TC-84A-XXXX), model/part number, and lot number on one of the respirator units, the product packaging, or the approval label included on or in the packaging.

Review the approval label to identify the name and contact information of the approval holder or private label entity. Contact the approval holder or private label entity with the approval number, model/part number, and lot number to inquire about the product's shelf life.



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