



Donning of BSL-3 personal protective equipment (PAPR & Coverall).

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This protocol describes the Personal Protective Equipment (PPE) donning procedure required for use at the Viral & Human Genomics Laboratory Biosafety Level 3 (BSL-3) biocontainment suite for work with risk group 3 pathogens or samples potentially harbouring risk group 3 pathogens.

This donning procedure requires the use of a 3M Versaflo TR-300 Powered Air-Purifying Respirator (PAPR), a Tyvek or TyChem coverall, plastic apron, neoprene boots and double nitrile gloves within the BSL-3 biocontainment suite or during field work requiring the use of this PPE (such as handling animals potentially infected with risk group 3 or 4 pathogens. This Standardized Operating Procedure (SOP) aims to facilitate training and compliance with the Centers for Disease Control & Prevention (CDC), National Center for Emerging and Zoonotic Infectious Diseases (NCEZID) and Division of Healthcare Quality Promotion (DHQP) guidelines as set forth on July 25, 2019 (https://www.cdc.gov/vhf/ebola/hcp/ppe-training/PAPRRespirator_Coveralls/donning_01.html).

This SOP relies on the presence of a Qualified Trained Observer (QTO) and corresponding PPE-Donning checklist to verify and document successful compliance with the SOP. The QTO is tasked with reading each step to the person donning the PPE, aiding the user at donning, visually verifying each step and documenting the checklist. The QTO is a dedicated and highly trained individual responsible of ensuring adherence to this SOP.

NOTE: Tyvek is a brand of nonwoven material composed of high-density polyethylene fibres made by DuPont that is lightweight, durable, tear-resistant, and water-resistant. Tychem is another DuPont product line designed to provide barrier protection against hazardous chemicals, toxic substances and biological hazards. Tychem garments are made from synthetic fabric technologies. The use of the Tyvek and Tychem names is for reference informational purposes only and does not constitute an endorsement of the brands.

Donning procedure

1. Engage QTO prior to donning, QTO is not required to wear full PPE on entrance, surgical scrubs will suffice.
2. Access the first BSL-3 anteroom (clean anteroom) and remove all personal belongings including jewellery, watches, ID cards, any piercings, and underwire bras.
3. Refrain from using hard plastic or metal hair barrettes or clips; instead, opt for small elastic hair bands but not full-size headbands.
4. Prescription eyewear is allowed as well as undergarments except underwire bras as they can oxidize over time due to the NaOCl decontamination solutions commonly used within BSL-3 and represent a sharps hazard within the BSL-3 suite.



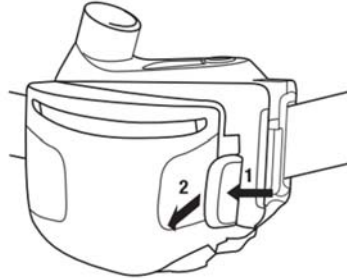


5. Remove personal clothing including camisoles or undershirts except the following undergarments: Sport-bras, panties, boxers or briefs and socks.
6. Remove your personal shoes.
7. If wearing ankle socks or low-cut socks, change them for mid-calf socks.
8. Don your assigned surgical scrubs.
9. Tuck your surgical scrub under mid-calf socks.
10. Cover socks with overshoes.
11. Stow all personal items in your assigned locker.
12. Don inner nitrile gloves.
13. Select a towel and move onto the second anteroom (shower anteroom) and place in towel rack.
14. Do not use shower on entering, the shower is only intended for use after leaving the BSL-3 suite and serves only as a transfer room on entrance.
15. Move on to third anteroom (PPE anteroom).
16. Carefully choose the correct size of Tychem coverall and conduct a thorough inspection for signs of wear, tears, and proper zipper functionality.
17. Sit down on the bench and don your Tychem coverall with utmost care, ensuring no damage or tearing occurs during the process. Refrain from fully zipping up your coverall at this moment.
18. If the socks do not offer adequate support for your surgical scrubs, use 2-inch tape for enhanced stability.
19. Carefully don neoprene boots of the correct size, ensuring that surgical scrubs are fully tucked into the boots and that the Tychem coverall completely overlaps the neoprene boots.
20. Take your designated PAPR blower motor and inspect for wear, damage, presence of filter and proper filter cartridge placement.

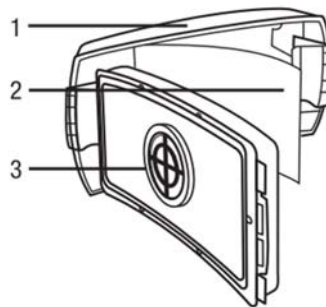




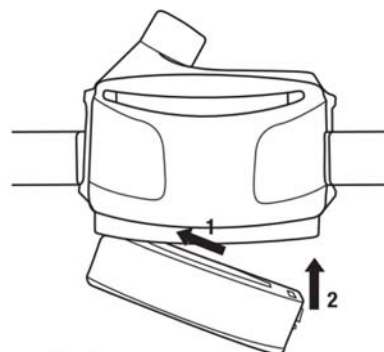
21. Press button #1 and pull filter cover towards front of PAPR blower motor unit (arrow #2 in image below).



22. Make sure that the 3M TR-300 high efficiency (HE) filter (item #3 in image below) and pre-filter (item #2 in image below) is in the PAPR blower motor as shown in image below.

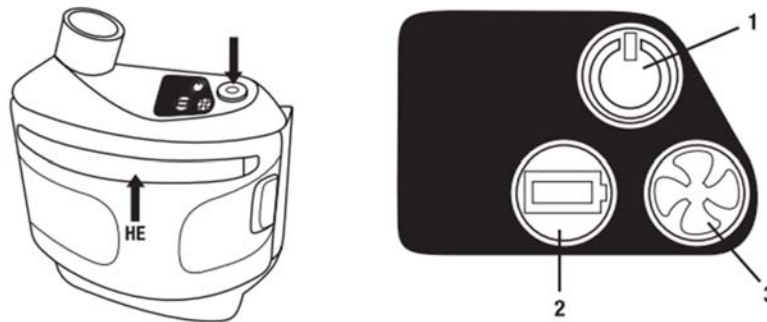


23. Remove your PAPR battery from wall charger and inspect the hinge and latch on the battery pack to ensure it is clean and undamaged.
24. Check battery charge status by pressing the indicator button on the underside of the battery pack. Batteries not fully charged (not having all green indicator LED lights on) should not be used.
25. Hook the left edge of the battery pack into its holder on the bottom of the PAPR motor blower unit (arrow #1 in the image below).

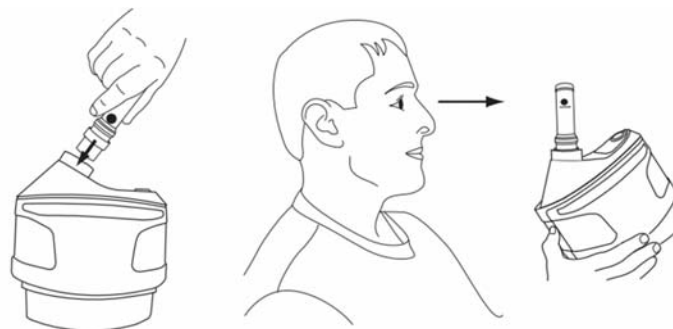




26. Push the right side of the battery pack into the motor/blower until the latch fully engages with an audible click (arrow #2 in the image above).
27. Grasp the battery pack and gently pull to confirm battery is locked into place.
28. Turn your PAPR blower motor on by pressing the power button (#1 on image below) for 2 seconds on the top of the motor/blower. The unit will perform a self-diagnostic test. During the test the green power on (1), amber low battery (2) and red low flow (3) LEDs will flash 2 to 3 times and audible alarms will be activated.



29. Insert the TR-970 air flow indicator into the PAPR blower motor outlet. Ensure that the ball in the TR-970 air flow indicator moves freely within its tube and that the seal at the bottom end of the air flow indicator tube is in place.
30. Allow the PAPR blower motor unit to run for 1 minute to allow the air flow to stabilize.
31. With the airflow indicator in a vertical position, ensure that the bottom of the floating ball rests at, or above, the minimum flow mark (see image below).



32. Check the airflow indicator card for the expected ball height according to the altitude at which the PAPR blower motor unit is being used.
33. The Viral and Human Genomics Lab of UASLP's Faculty of Medicine is located in the city of San Luis Potosí which has an altitude of 1840 m and the BSL-3 facility is normally operated at 20°C.





Therefore, according to the table below, the minimum expected air flow for these conditions would be “K level”.

		°C						
		-10	0	10	20	30	40	50
m	°F	14	32	50	68	86	104	122
	-305	-1000	A	B	C	D	E	F
0	0	B	C	D	E	F	G	H
305	1000	C	D	E	F	G	H	I
610	2000	D	E	F	G	H	I	J
915	3000	E	F	G	H	I	J	K
1219	4000	F	G	H	I	J	K	L
1524	5000	G	H	I	J	K	L	M
1829	6000	H	I	J	K	L	M	N
2134	7000	I	J	K	L	M	N	O
2439	8000	J	K	L	M	N	O	P
2744	9000	K	L	M	N	O	P	Q
3048	10000	L	M	N	O	P	Q	R
3353	11000	M	N	O	P	Q	R	S
3658	12000	N	O	P	Q	R	S	T
3963	13000	O	P	Q	R	S	T	U
4268	14000	P	Q	R	S	T	U	V
4573	15000	Q	R	S	T	U	V	W
4877	16000	R	S	T	U	V	W	X
5182	17000	S	T	U	V	W	X	Y

34. If the airflow indicator ball fails to rise at or above the minimum flow level, do not use the unit and inform lab supervisor or QTO of fault.
35. Remove the airflow indicator and with the PAPR blower motor unit still on, place your hand firmly against the air outlet preventing airflow for 30 minutes. The PAPR blower motor unit should speed up the fan, activate and audible alarm and the red fan shaped LED light on the top of the motor/blower should flash. This confirms proper operating status.
36. Remove your hand from the end of the breathing tube; the audible alarm and the flashing red LED should both stop when the motor returns to a slower speed.
37. Put your designated PAPR blower motor around your waist, securing the plastic belt for optimal support while ensuring comfort.
38. Retrieve your designated corrugated tube and inspect for wear or damage, outer plastic liner should be undamaged and properly tightened to both ends without interfering with or obstructing any of the connectors.
39. Connect the corrugated tube bayonet’s end to your PAPR blower motor ensuring a secure connection with an audible click sound.
40. Retrieve your designated PAPR hood and inspect for damage and integrity.





41. Complete zipping-up your Tychem coverall and integrated head cover.
42. Don your PAPR hood by placing hood behind your head and pulling it towards your face until the elastic band wraps around the front of your neck. Use your gloved hands to ensure a proper and comfortable fit.
43. Adjust PAPR hood headband and eyewear at this time.
44. Connect or have the QTO connect the corrugated tube coming from your PAPR blower motor unit to your PAPR hood.
45. Don outer nitrile gloves and tape them over your Tychem coverall.
46. Stand before your QTO and signal for his attention. Your QTO should inspect and document proper fit of PAPR blower motor battery, PAPR blower motor unit belt, corrugated tube connections and of your PAPR hood assembly.
47. Stand upright and extend arms outward. Your QTO will now inspect armpit seams, groin seams and zipper integrity and closure.
48. Retrieve your plastic apron and have the QTO adjust the neckband over your PAPR hood assembly and below the rear corrugated air-feed tube.
49. Your QTO will also adjust the plastic apron waistband around your waist but under the rear corrugated air-feed tube leading to the PAPR blower motor unit.
50. Your QTO will now instruct you to turn your head 90° to the left and 90° to the right slowly without moving your body. PAPR hood should move with your head during these movements and not rotate around it. Adjust PAPR hood headband if this is not the case.
51. Your QTO will now instruct you to turn your body 90° to the left at the waistline and 90° to the right at your waistline. PAPR blower motor unit and Tychem coverall should not shift during these movements. Adjust PAPR blower motor unit belt if this is not the case or change to a smaller fit of Tychem coverall.
52. Your QTO will now instruct you to bow forwards without losing balance. PAPR hood, PAPR blower motor unit, plastic apron and Tychem coverall should not shift during these movements. Adjust PPE accordingly if this is not the case.
53. Your QTO will now instruct you to slowly kneel half-way to the floor. PAPR blower motor belt and plastic apron should not interfere with this movement. Adjust PAPR blower motor belt or apron laces if this is not the case.
54. Once donning and mobility of PPE is assured by your QTO, he will give you a thumbs-up signal and ask you to step aside for other members of the BSL-3 team to be helped with PPE fitment.





55. Do not move on to BSL-3 suite unless instructed to do so by your QTO.

References

1. Ebola: Personal Protective Equipment (PPE) Donning and Doffing Procedures. Centers for Disease Control and Prevention, National Center for Emerging and Zoonotic Infectious Diseases (NCEZID), Division of Healthcare Quality Promotion (DHQP) www.cdc.gov/vhf/ebola/hcp/ppe-training/PAPRRespirator_Coveralls/donning_01.html.
2. User Instructions for 3M™ Versaflo™ Powered Air Purifying Respirator TR-300 Belt Mounted Assemblies <https://multimedia.3m.com/mws/media/7548670/3m-versaflo-powered-air-purifying-respirator-tr-300-user-instructions.pdf>.
3. Documents for 3M™ Versaflo™ Powered Air Purifying Respirator TR-300+ Quick User Guide <https://multimedia.3m.com/mws/media/16013310/guidance-document-tr300.pdf>.

Revision history

- 1.0 Original document.





Verification checklist for the donning of BSL-3 personal protective equipment.

Created: Jul 28, 2023; Last modified: Jul 28, 2023, Version: 1.0

User name: _____ Date (dd/mmm/yyyy): _____

1. Engages QTO prior to entering first (clean) anteroom with 1 hour notice. yes no
2. Removes jewellery, watches, ID cards, any piercings, hair clips and underwire bras. yes no
3. Removed personal clothing except undergarments and is wearing scrubs. yes no
4. Surgical scrubs tucked into mid-calf socks. yes no
5. Removed personal shoes and placed shoe-covers over socks. yes no
6. Stows all personal items in assigned locker. yes no
7. Dons inner nitrile gloves. yes no
8. Moves towel into second (shower) anteroom. yes no
9. Selects correct size of Tychem coverall and conducts thorough inspection. yes no
10. Dons Tychem coverall carefully and slowly. yes no
11. Required 2" tape to fix surgical scrub pants to socks. no yes
12. Dons neoprene boots of the correct size and places scrubs over boots. yes no
13. Retrieves designated PAPR blower motor and inspects for damage and filters. yes no
14. Capable of opening PAPR blower motor unit and verifying filter placement. yes no
15. Inspects PAPR battery for damage and latch functionality. yes no
16. Inspects PAPR battery charge. yes no
17. Correctly installs battery pack into PAPR blower motor unit and verifies attachment. yes no
18. Turns PAPR blower motor unit on and follows self-diagnostic test. yes no
19. Can mention the self-diagnostic test indicator LED sequence and alarm. yes no
20. Checks TR-970 air flow indicator and checks ball freedom of movement. yes no
21. Correctly installs TR-970 air flow indicator and checks air flow for 1 minute. yes no
22. Capable of describing expected PAPR air flow for altitude and temperature. yes no
23. Capable of testing and interpreting a low-airflow alarm using hand against air outlet. yes no
24. Places PAPR blower motor unit around waistband correctly. yes no
25. Inspects and connects corrugated tube to PAPR blower motor unit with audible click. yes no
26. Inspects PAPR hood integrity. yes no
27. Zips coverall completely and places coverall hood. yes no
28. Dons PAPR hood assembly and adjusts correctly. yes no
29. Dons outer nitrile gloves and tapes them over Tychem coverall. yes no
30. Signals for QTO attention and asks for PPE inspection. yes no
31. Retrieves designated plastic apron and assures comfortable fit after donning. yes no
32. Required PAPR hood adjustment after head rotation. no yes
33. Required PPE adjustment after head rotation. no yes
34. Required PPE adjustment after bowing. no yes
35. Required PPE adjustment after kneeling. no yes
36. Acknowledges thumbs-up from QTO and moves aside. yes no
37. Enters BSL-3 biocontainment suite without being instructed to do so. no yes

Qualified Trained Observer

Lab Manager or Lab Supervisor

