

INSTRUCTIONS FOR BEST PRACTICES TO DECONTAMINATE PREVIOUSLY WORN FILTERING FACEPIECE RESPIRATORS (FFRS) USING MOIST HEAT

DISCLAIMER

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, has resulted in intermittent significant shortages of filtering facepiece respirators (FFRs) such as N95 masks used to protect workers from exposure to the virus. Normally, N95 masks are considered disposable and are not reused. However, the Centers for Disease Control and Prevention (CDC) has provided guidance for decontamination and reuse of FFRs where shortages exist.¹ Moist heat is one of the recommended means by which FFRs may be decontaminated for reuse and is the focus of these instructions. While specific manufacturers of FFRs, multicookers, and multicooker accessories will be presented in this document, this is not an official endorsement of any of these brands or models, but serves as examples of the types of models considered appropriate for this work. Manufacturer information should be consulted to determine if a specific multicooker, multicooker accessory, or FFR model is suitable for treatment with moist heat. Masks for which moist heat has been reported as not degrading performance by the manufacturer, CDC, or in testing by the Department of Homeland Security (DHS) Science and Technology Directorate (S&T) include²:

- 3M Models: 1860³, 1870+, 8000, 8004, 8210³, 8511³
- Kimberly Clark Model: PFR-95
- Moldex Models: 2200, 2201
- Northern Safety Model: 7210³

Individuals assume all responsibility and risk for the use of these instructions for the best practices to decontaminate previously worn FFRs. DHS does not assume any liability for the instructions for best practices contained herein nor do such instructions for best practices create any warranty. Reliance on such instructions for best practices is solely at your own risk. Further, it is important to note that there are multiple steps and variables which may create risk depending upon how the user implements the instructions for best practices.

OBJECTIVE

Provide a method for FFR decontamination with moist heat that employs equipment and materials available to consumers. In addition, the decontamination cycle should be sufficiently fast to allow reuse each day.

¹ <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html>

² <https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html>; Bergman, M. et al., J. Engineered Fibers and Fabrics, 2010, 5(4), pp. 33-41; Bergman, M. et al. J. ISRP, 2011, 28(1), pp. 48-59. Viscusi, D.J., et al. J. Occupational and Environmental Hygiene, 2011, 8(7), pp. 426-36. Heimbuch, B.K., et al., Am. J. of Infection Control, 2011, 39(1), pp. e1-e9

³ Masks models that S&T have tested

EQUIPMENT AND MATERIALS

Multicooker/Electric Pressure Cooker: A multicooker that has a sous vide function or equivalent capability that allows the user to manually set the time and temperature to 149 °F (65 °C) and 30 minutes is needed. Examples of suitable multicookers include:

Make	Model
Instant Pot®	Duo Evo Plus (6 or 8 quart) Aura Pro Multi-Use Duo Crisp Viva
SOUS°V Pot®	Precision cooker
Gtime	Electric pressure cooker (6 or 8 quart)
Luby	Electric pressure cooker
Geek Chef®	11-in-1 multi-functional cooker



Rack: A rack that fits inside the multicooker that keeps the FFRs out of the water. For a specific example, in the Duo Evo Plus, a hard-boiled egg rack, which is 1.25 inches high, was sufficient for this need. Note, the rack that comes with the Duo Evo Plus is not high enough for this purpose. Options include:

Make	Model
Hapway	Stainless steel steamer basket with egg steam rack
Aozita	Steamer basket for Instant Pot
Aiduy	12-piece pressure cooker accessories
Guestway	Egg cooker steamer rack

Measuring Cup or Ruler: Measuring cup to measure 500 mL (2 $\frac{1}{8}$ cups) of water for a 6-quart pot, 700 mL (3 cups) of water for an 8-quart pot, or an amount of water sufficient to cover the bottom of the pot with 0.5 inches of water.

Water: Distilled, bottled, or filtered water or equivalent.

Binder Clips: If the rack sent with the multicooker is too low, binder clips can be used to it raise up the rack, so the filters are kept above the water.

Paper Bag: FFRs were placed in a brown paper lunch bag for this effort.

Bag Closure: Stapler or paper clip.

Gloves: Clean reusable or clean disposable gloves.

INSTRUCTIONS

1. Follow the manufacturer's directions for setup and use of the multicooker, including completing any first cycle instructions.
2. Measure out the necessary amount of water, 500 mL (2 $\frac{1}{8}$ cups) for a 6-quart pot or 700 mL (3 cups) for an 8-quart pot, and place in the bottom of the pot. (Note: the objective is to have a height of 0.5 inches of water in the pot; a ruler may be used to measure water depth).
3. Place the rack into the pot and ensure that it will keep the FFRs out of the water when they are placed into the multicooker. If the rack is not high enough, adjust the rack (e.g., extend the legs with binder clips) to keep the FFRs out of the water.



4. Put on clean disposable or reusable gloves to remove the mask or to handle the mask if it is already removed.
5. Place the mask or masks into the paper bag with the exterior facing down. Be careful not to handle the bag with the same hand that touches the mask to limit the spread of virus from the gloves to the exterior of the bag. (Note: DHS has shown that up to three masks can be nested into the same paper bag and the virus is still inactivated below detection with this treatment.)
6. Remove the gloves and place in a trash receptacle set aside for potentially contaminated materials.
7. Close the bag by folding the opening over twice and stapling or using a paper clip.
8. Place the bag into the pot, resting on the rack and ensure that it is short enough to allow the lid to be placed on the multicooker.



- Place the lid onto the multicooker and lock it into place per the manufacturer's instructions.
- Following the instructions specific to your multicooker, select the sous vide mode.



- Select an option that allows you to set the temperature and time; may be a "Custom" option as shown in the figure or another option.
- When prompted by the multicooker, enter the temperature to 149 °F (65 °C). (Note: the order and method for setting temperature and time may differ between models).



- When prompted by the multicooker, enter the time to 30 minutes.



14. Press start to begin the cycle. Check multicooker for indication that the cycle has begun.
15. Let the multicooker complete the cycle.
16. Remove the top per the directions for the multicooker following completion of the cycle. (Note: the contents should not be under pressure if the temperature is set correctly.)
17. Open the paper bag and keep at typical indoor ambient conditions until FFR is dry to the touch (~1 hour). If multiple FFRs were treated in the same paper bag, then, while wearing clean disposable or reusable gloves, the FFRs should be removed, separated, and allowed to dry on a clean surface.



18. Once dry, inspect the mask to ensure no damage occurred to the straps, other accessories, or that the sealing edge did not become warped.
19. If any defect is observed, discard the mask.
20. If no defect is observed, then the mask is ready for reuse.

The ability to treat an FFR with moist heat at 149 °F (65 °C) for 30 minutes up to 10 times has been reported by one manufacturer for some FFR models (3M 1804, 3M 1860, 3M 1870+, and 3M 8210).⁴ DHS S&T has demonstrated that this process does not degrade performance after five cycles for four mask models (3M 1860, 3M 8210, 3M 8511, NS 7210). After the mask has completed the number of decontamination cycles for which mask performance has been verified, the mask should be discarded.

⁴ <https://multimedia.3m.com/mws/media/1824869O/decontamination-methods-for-3m-filtering-facepiece-respirators-technical-bulletin.pdf>