



TechNote

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MEDICAL MASKS AND BARRIER FACE COVERINGS

Medical masks and barrier face coverings are worn over the nose and mouth to reduce the transmission of biohazards. They provide limited protection to the covered areas of the face from blood or bodily fluids and provide source control – limited protection of others from the wearer’s exhalations. Such masks are not respirators and are not certified by the U.S. National Institute for Occupational Safety and Health (NIOSH). Those used in health care applications fall under the AEL designation O1EM-01-MASK, Emergency Medical Single Use Mask.

Overview

Emergency responders use different types of protective face coverings for different missions, including NIOSH-rated respirators, medical face masks, and non-medical barrier face coverings. These face coverings consist of a filter material that mechanically blocks particulates but allows air to pass through when the wearer inhales. When NIOSH-rated respirators are not required, responders may wear other face coverings for general purpose infection control when interacting with members of the public. Medical face masks worn by responders for biohazard protection are addressed in a National Fire Protection Association (NFPA) standard for emergency medical operations, NFPA 1999 [1]. The materials in these medical face masks are rated for sub-micron particulate filtration efficiency, fluid resistance and flammability following standard performance specifications in ASTM F2100-20 [2]. Other non-medical barrier face coverings, like dust masks or cloth masks, typically have not been regulated. However, a recent publication, ASTM F3502-21 [3], provides standard specifications for those face coverings.



Medical Mask

Image from [U.S. Food and Drug Administration](https://www.fda.gov/oc/ohrt/ohrt-2019-001)

Medical Face Masks

Medical face masks help protect others from the wearer’s respiratory secretions during breathing, coughing or talking. They also protect the wearer’s nose and mouth from sprays or splatter that may contain bacteria or viruses. They are not intended to be used more than once. Medical masks typically consist of multiple layers: one or more filtering layers of non-woven fabric made from small fibers and an outer moisture-resistant layer. The side of the mask designed to be worn facing outward may be a darker color than the absorbent side worn toward the skin. Pleats allow the wearer to extend the mask to cover the lower face.

ASTM Standard Specification F2100-20 for medical mask materials designates three categories of increasing barrier performance as Levels 1, 2, and 3. Filtration efficiency is at least 95% for Level 1, and 98% for both Levels 2 and 3. Resistance to liquids increases for each level.

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) program to help emergency responders improve their procurement decisions.

Located within the Science and Technology Directorate, the National Urban Security Technology Laboratory (NUSTL) manages the SAVER program and conducts objective operational assessments of commercial equipment and systems relevant to the emergency responder community.

The SAVER program gathers and reports information about equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

SAVER publications focus on answering two main questions: “What equipment is available?” and “How does it perform?”

SAVER knowledge products are created for the nation’s first responders and made available to help them make operational and procurement decisions.

To explore the full reports library and to learn more, visit SAVER online at www.dhs.gov/science-and-technology/SAVER.

For additional information on the SAVER program, email NUSTL at NUSTL@hq.dhs.gov.



Homeland Security

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The standard does not include design criteria, fit testing, nor specify the means to affix the mask to the face. While the terms “surgical” and “medical” mask are sometimes used interchangeably, in the ASTM standard masks worn for surgical purposes are differentiated as having ties for adjusting fit, while other medical masks use ear loops for easier donning and doffing. NFPA 1999 compliant masks are made of material that meets the ASTM F2100 Level 3 barrier performance specifications. They also include a wire to shape over the wearer’s nose and a means to secure the mask on the head without tying.

Non-Medical Barrier Face Coverings

Other barrier face coverings may be worn outside of healthcare and where respiratory protection from hazardous material is not required. Such face coverings may include disposable face masks that resemble medical masks but are made of materials not tested to ASTM F2100, non-industrial dust masks, or various types of cloth masks. These non-respirator, non-medical face masks are available in different designs using single or multiple layers, flat or pleated styles, woven cotton, synthetic fabrics or fibrous materials. They may attach to the face using loops that fit over the ears or via a strap that goes around the head. These non-certified coverings have varying efficiencies for blocking particles depending on the material used, their construction, and fit.

The Centers for Disease Control and Prevention (CDC) issues general guidelines for masks worn by the public, providing updates to address evolving situational needs and product availability. General CDC guidance for the use of masks to slow the spread of COVID-19 notes that masks made of two or three layers of tightly woven fabric that do not let light pass through when held up to a light source offer better protection than those made of a single layer or loose knit fabrics [4].

Published in March 2021, ASTM F3502–21 “Standard Specification for Barrier Face Coverings” describes minimum performance, testing, and design requirements for non-respirator, non-medical barrier face coverings used primarily for source control.

The specifications address masks worn by workers who are “outside a healthcare setting and are not required by regulatory agencies such as the Occupational Safety and Health Administration to wear respiratory protection to prevent the inhalation of hazardous substances” [5].

The standard includes design criteria that prohibit exhalation vents or valves and set minimum areas of face coverage. It describes test procedures to designate two levels of sub-micron particulate filtration efficiency. A level 1 designation (lower performance) means that the material filtration efficiency is at least 20%. A level 2 designation (higher performance) corresponds to at least 50% filtration efficiency. It also includes airflow resistance tests for two classifications of mask breathability. For re-usable face coverings, the tests are conducted both on pristine samples as well as specimens subjected to the maximum number of cleaning cycles specified by the manufacturer. Manufacturers are also required to perform a design analysis to assess leakage of exhaled air.

Compliance with the standard is voluntary. If they choose to, manufacturers may have their products tested by an independent accredited laboratory. Products that comply with the standard will be labelled accordingly and are listed on a CDC website [6].

References

- [1] Standard on Protective Clothing and Ensembles for Emergency Medical Operations, NFPA 1999, 2018.
- [2] Standard Specification for Performance of Materials Used in Medical Face Masks, ASTM F2100-20, 2020.
- [3] Standard Specification for Barrier Face Coverings, ASTM F3502–21, 2021. <https://www.astm.org/COVID-19/>
- [4] Centers for Disease Control and Prevention (CDC), “Types of Masks and Respirators,” September 10, 2021. <https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/types-of-masks.html>
- [5] New Specification for Barrier Face Coverings, ASTM WK73471, 2020. <https://www.astm.org/database.cart/workitems/wk73471>
- [6] CDC, “Barrier Face Coverings and Workplace Performance/ Performance Plus Masks,” July 30, 2021. <https://www.cdc.gov/PPEInfo/RG/FaceCoverings>