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Guidance and Considerations for General Purpose Textile Face Coverings: Adult

1. Foreword

1.1 Given the COVID-19 pandemic and related government recommendations of face covering use in public settings, this guidance was developed by a group of industry stakeholders to provide information to manufacturers. Considerations and recommendations are intended to help manufacturers more efficiently design and produce face coverings for general purpose (non-medical) use. This document contains voluntary guidance and practical considerations for:

- Regulatory Considerations
- Fit and Sizing Considerations
- Material and Construction Considerations
- Particle Filtration Considerations
- Breathing Resistance Considerations
- Laundering and Service Life Considerations
- Tie and Ear Loop Considerations
- Product Labeling and Marking Considerations

2. Purpose and Scope

2.1 This monograph contains voluntary guidance for design, construction and labeling of general-purpose, reusable textile face coverings for adults.

2.2 Guidance in this document applies to general-purpose face coverings intended for daily use by asymptomatic individuals.

2.3 Face coverings described in this document are intended for adult-use only.

2.4 Face coverings described in this document are not medical devices per the US Food and Drug Administration (FDA) or Health Canada; they are not personal protective equipment (PPE) as defined by the National Institute for Occupational Safety and Health (NIOSH).

3. Referenced Documents

NOTE: Use current versions of all publications unless otherwise specified.

3.1 Industry Methods:

3.1.1 AATCC LP1 Laboratory Procedure for Home Laundering: Machine Washing (see 19.1).

3.1.2 ASTM D3938 Standard Guide for Determining or Confirming Care Instructions for Apparel and Other Textile Products.

3.1.3 ASTM D4964 Standard Test

Method for Tension and Elongation of Elastic Fabrics (Constant Rate-of-Extension Type Tensile Testing Machine).

3.1.4 ASTM D5034 Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test).

3.1.5 ASTM F2100 Standard Specification for Performance of Materials Used in Medical Face Masks.

3.1.6 ASTM F2299 Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres.

3.1.7 ASTM D737 Standard Test Method for Air Permeability of Textile Fabrics.

3.1.8 EN 14683 Medical face masks—Requirements and test methods.

3.1.9 ISO 9237 Textiles—Determination of the permeability of fabrics to air.

3.2 US Regulations:

3.2.1 16 CFR 300 Rules and Regulations under the Wool Products Labeling Act of 1939

3.2.2 16 CFR 303 Rules and Regulations under the Textile Fiber Products Identification Act

3.2.3 16 CFR 423 Care Labeling of Textile Wearing Apparel and Certain Piece Goods

3.2.4 16 CFR 1610 Standard for the Flammability of Clothing Textiles

3.3 Canada Regulations:

3.3.1 Canada Consumer Product Safety Act (S.C. 2010, c. 21)

3.3.2 Textile Flammability Regulations (SOR/2016-194)

3.3.3 Textile Labelling Act (R.S.C., 1985, c. T-10)

3.3.4 Textile Labelling and Advertising Regulations (C.R.C., c. 1551)

4. Terminology

4.1 **breathing resistance**, n.—the differential pressure required to draw air through a measured surface area at a constant air flow rate. *Source*: EN 14683, an FDA-recognized consensus method for surgical masks.

NOTE: The term “breathability” is also associated with this definition, but due to possible confusion with vapor permeability, it is not used in this document. Fabrics designed to specifically allow escape of perspiration in the form of vapor are *not* typically suitable for face coverings.

4.2 **face covering**, n.—an item of clothing designed to reduce distribution of the wearer’s respiratory droplets (e.g., from breathing, coughing and/or sneezing). (Compare *medical face mask*.)

NOTE: For the purpose of this guidance, face coverings specifically:

- Fully cover user’s nose and mouth.
- Fit snugly against the sides of the face so there are no gaps.
- Do not cause difficulty breathing while wearing.

For the purpose of this guidance, face coverings specifically are not:

- Medical Devices.
- Personal Protective Equipment (PPE)
- Intended for use by healthcare personnel

4.3 **fit**, for face coverings, n.—the ability to cover the user’s nose and mouth while making consistent and snug contact with user’s face at the perimeter (see Fig. 1).

4.4 **healthcare personnel (HCP)**, n.—all persons, paid and unpaid, working in healthcare settings whose activities place them at risk for transmission of respiratory infections from patients. *Source*: CDC.

NOTE: Examples of such activities include those that require direct contact with patients and/or exposure to the patient care environment, including being in the patient room or in a triage or examination room or other potentially contaminated areas, and handling blood, body fluids, secretions, or excretions (except sweat) or soiled medical supplies, equipment or environmental surfaces.

4.5 **healthcare setting**, n.—a place where healthcare is delivered. (Compare *public setting*.) *Source*: FDA.

NOTE: Healthcare settings include, but are not limited to, acute-care hospitals; long-term care facilities, such as nursing homes and skilled nursing facilities; physicians’ offices; urgent-care centers; outpatient clinics; home healthcare (i.e., care provided at home by professional healthcare providers), and emergency medical services. Settings include specific sites within non-healthcare settings where healthcare is routinely delivered (e.g., a medical clinic embedded within a workplace or school).

4.6 **medical device**, n.—any item intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease.



Fig. 1—Face covering covers the user's nose and mouth and makes contact at perimeter (dotted line).

Source: FDA

4.7 medical face mask, n.—an item of protective clothing designed to protect portions of the wearer's face, including the mucous membrane areas of the wearer's nose and mouth, from contact with blood and other body fluids during medical procedures. (Compare *face covering*.) Source: ASTM F2100.

4.8 particle filtration efficiency, n.—the efficiency of the filter material in capturing aerosolized particles, expressed as the percentage of a known number of particles that does not pass the medical face covering material at a given flow rate. Source: ASTM F2299, the FDA recognized consensus standard for surgical masks.

4.9 personal protective equipment (PPE), medical, n.—clothing, helmets, gloves, face shields, goggles, face coverings and/or respirators or other equipment designed to protect the wearer from injury or the spread of infection or illness. Source: FDA.

4.10 public setting, n.—a venue in which people may be in close proximity to others outside their immediate family or household. (Compare *healthcare setting*.)

NOTE: Public settings include (but are not limited to) grocery stores, pharmacies, parks, public transportation, and office environments.

4.11 service life, for textiles, n.—the maximum number of laundering cycles that can be performed before an item can no longer perform its intended end use.

NOTE: The properties defining service life for a face covering are:

- User Fit
- Particle filtration
- Breathing resistance
- Ear loop or tie attachment
- Ear loop or tie elastic recovery (if applicable)

5. Safety Precautions

5.1 The safety precautions specified in the monograph are not intended to be all inclusive.

5.2 It is the user's responsibility to reference applicable safety data sheets, use safe and proper techniques, and wear appropriate personal protective equipment when required.

5.3 Users MUST consult manufacturers for specific details such as safety data sheets, equipment operating instructions, and other recommendations. Consult and follow all applicable health and safety regulations (e.g., OSHA standards and rules).

6. Limitations

6.1 This guidance does not address all aspects of textile face covering design and performance.

6.2 Barrier and breathability properties apply to fabric only and may not be representative of complete face covering properties. This document does not include detailed protocols for evaluating complete face coverings.

6.3 This guidance does not apply to regulated respiratory protection. Refer to applicable regulations and standards for guidance on these items.

7. Regulatory Considerations

7.1 Follow all applicable national and local regulations. The list below is NOT intended to be comprehensive. Addi-

tional testing and/or certifications may be necessary.

7.2 For the United States:

7.2.1 Review US Consumer Products Safety Commission (CPSC) flammability guidance regarding 16 CFR 1610. Some fabrics may be exempt from testing based on weight/construction and/or fiber content.

7.2.2 Review US Federal Trade Commission (FTC) guidance regarding fiber labeling, country of origin, and manufacturer identification according to 16 CFR 303 and 16 CFR 300. Non-wool face coverings may be exempt from labeling requirements if they do not cover any part of the neck or shoulders.

7.2.3 Review FTC care label guidance regarding 16 CFR 423. Care labels are typically required to be permanently affixed to the apparel item, but it may be possible to apply for an exemption.

7.3 For Canada:

7.3.1 Review SOR/2016-194 for flammability guidance.

7.3.2 Review the Textile Labelling Act & the Textile Labelling and Advertising Regulations to ensure product includes all applicable labeling, fiber content, and claims requirements.

7.4 Labels should generally be "conspicuous and accessible" whether they are affixed to the face covering or the packaging. Label information should also be conspicuous and accessible in online, print media or other sales channels.

8. Fit and Sizing Considerations

8.1 Size face coverings to sufficiently cover the user's nose and mouth.

8.1.1 See Appendix 1 for CDC's and Health Canada sizing recommendations for homemade face coverings.

8.2 Design face covering so they do not obscure the wearer's visibility.

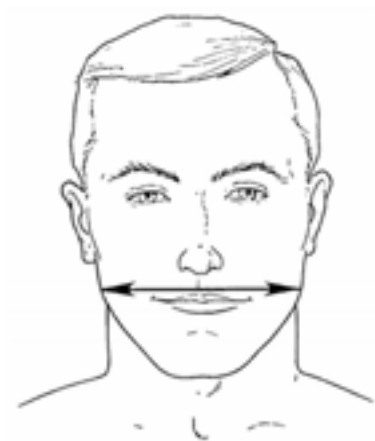
8.3 Design perimeter of face covering to make consistent and snug contact with user's face (and under chin), maximize airflow through covering material and minimize side leakage (see Fig. 1).

8.4 See Fig. 2 for key facial measurements to consider when sizing covering.

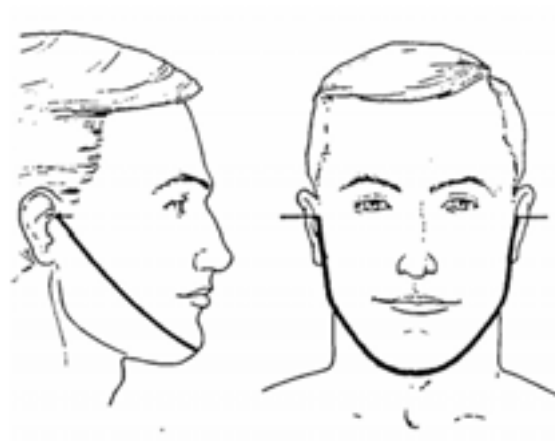
8.4.1 For specific measurements one may consult NIOSH's survey on anthropometric head and face data of respirator users. (www.nap.edu/resource/11815/Anthrotech_report.pdf)

9. Materials and Construction Considerations

9.1 This section is not intended to be design restrictive, but to provide practical options to manufacturers as to which fabrics and processing techniques have demonstrated promise, and those that have not.



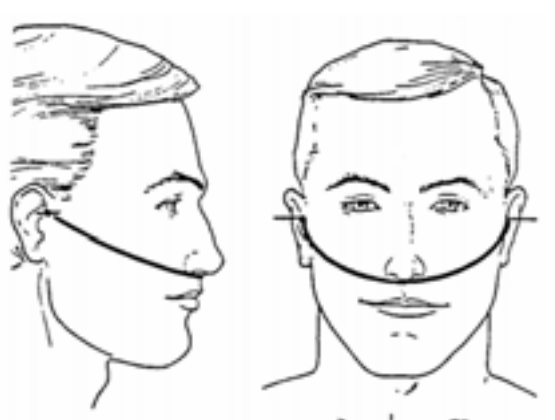
BIGONIAL BREADTH



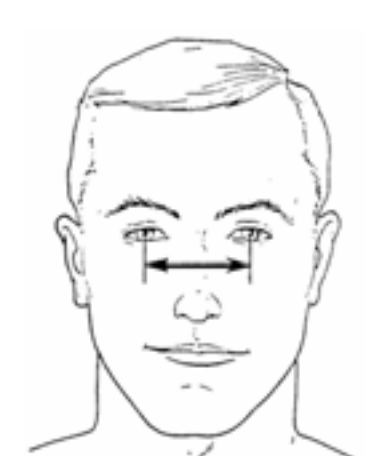
BITRAGION CHIN ARC



BIZYGOMATIC BREADTH



BITRAGION SUBNASALE ARC



INTERPUPILLARY BREADTH



MENTON-SELLION LENGTH

Fig. 2—Facial measurements to consider for sizing.

9.2 Fiber and Fabric Selection

9.2.1 Fiber content, construction, and fabric weight or thread count are good screening tools, but do not guarantee performance. Final material selections should be based on performance properties of particle filtration and breathing resistance.

9.2.2 Any mention of a specific fabric type in this document is an example only. This section is not intended to be an exhaustive list of suitable materials.

9.2.3 Fabrics marketed for apparel use that comply with regulatory requirements and meet minimum industry specifications that may be applicable to face coverings.

9.2.4 Multiple (2 to 3) layers of fabrics may be used to achieve desired performance. Single-layer face coverings may not provide adequate filtration unless they are proved by testing. More than three layers may restrict breathing and may be heavy and bulky for the wearer.

9.2.5 Consider fabric compatibility for multi-layer constructions. Fabrics with significantly different dimensional stability to laundering may cause fit or function issues if used together.

9.2.6 While aesthetic and quality characteristics are beyond the scope of this document, manufacturers may wish to consider evaluation for properties such as wrinkle resistance, pilling, and colorfastness to crocking, laundering, and perspiration.

9.2.7 Denser constructions and heavier fabric weights typically provide better particle filtration due to smaller spaces between the yarns or fibers. Keep in mind that fabrics and multi-layer assemblies providing high levels of particle filtration may also have high breathing resistance. A balance of particle filtration and breathing resistance is required for a functional face covering.

9.2.8 Fabrics with high stretch, including jersey knits, may pose a challenge because stretching increases the spaces between yarns. If used, such fabrics should be combined with a more stable layer in the construction of face coverings.

9.2.9 Fabrics with brushed or napped (“fuzzy”) surfaces may trap droplets well but may be irritating in direct contact with a wearer’s nose or mouth. Brushed or napped fabrics are best used as an outer or middle layer, with the raised surface towards the face (place at least one additional layer between the raised surface and the wearer’s face). Flannel is one example of a brushed surface fabric.

9.2.10 Some researches indicate that fabrics made of staple fibers and yarns show better filtration properties. These yarn types may help decreasing the open space between and within the yarns. Texturized multifilament yarns may also achieve this.

9.2.11 Wearer comfort is an important consideration in selecting fabric for the inner layer of a face covering. Consider fabrics that are soft or smooth for use against the skin.

9.2.12 Consider moisture management of the inner and/or middle layer. Fabrics that move or hold moisture away from the face may be more comfortable for the wearer. Humid environments also promote formation of larger droplets which are easier to retain with a face covering.

9.2.13 Coated or laminated fabrics may have undesirable properties including high breathing resistance and chemicals unsuitable for direct contact with mouth and nose.

9.2.14 Avoid fabrics and findings containing hazardous chemicals. Consult applicable Restricted Substances Lists (RSL, e.g., www.aafaglobal.org/AAFA/Solutions_Pages/RestrictedSubstanceList.aspx) for guidance.

9.2.15 Studies have been performed measuring the filtration performance of various commonly available fabrics. These can be consulted when selecting a fabric. (See Appendix B)

9.2.16 Examples of fabric types and fiber contents can be found in Appendix C.

9.3 Face Covering Construction

9.3.1 Avoid unnecessary seams as they may introduce potential areas for leakage. Seams and stitching create holes that may allow passage of more droplets than unstitched areas of fabric.

9.3.2 Avoid seams at nose and mouth area. Bulky seam allowances can cause pressure and discomfort to the wearer.

9.3.3 Use appropriate seam construction to prevent seam allowances from interfering with fit or breathability, particularly for multi-layer assemblies.

9.3.4 Use appropriate needle and thread to make the smallest possible holes in sewing.

9.3.5 Use appropriate stitch length to ensure secure construction without unnecessary holes.

9.3.6 Use pleats, darts, or other construction techniques to shape face coverings for a proper fit.

10. Particle Filtration Efficiency Considerations

10.1 The filtration efficiency is measured on the fabric of the covering only and indicates the potential for the fabric to be effectively used in a covering. It does not provide final (face covering) product effectiveness. The manufacturer should consider that the face covering design and seal to the face are very important.

10.2 Manufacturers can evaluate a covering’s fabric particle filtration using the below **recommended** methodology and specifications.

10.3 Base Particle Filtration

Method: ASTM F2299—Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres (or a technical equivalent method).

10.4 **Particle Size:** The best level of protection will be achieved with small particle sizes, but this will be hardest to achieve. Report efficiency at 3-micron. The user may consider testing at smaller sizes as well, for example, 0.5- and 1-micron particles will be more challenging and representative of actual use conditions.

10.5 **Face Velocity:** 10.4 cm/s

10.6 **Detection:** Optical with range at least 0.5-5 micron and able to report effective filtration at 3-micron. Calibration per ISO 21501-4.

10.7 **Other acceptable methods:** Methods that have been determined a practical equivalence to the one outlined above.

10.8 **Recommendation:** Woven face coverings should not fall below 70% efficiency at 3-micron before and after laundering to specified number of cycles.

10.9 The standard filtration test described will only evaluate the fabric performance. A crucial aspect of the face covering as an effective end product would be to assess the performance of the face covering, not just the fabric. Formal PPE guidelines would require human panel testing or head-form testing (cf. NIOSH), and require fit-testing on workers when using these face coverings for protection. As the latter would not be possible to conduct for general population face coverings, but end product evaluation of fit is still relevant, it is suggested and encouraged to evaluate face coverings for filtration efficiency, ideally maintaining a protection level of 70% at maximum 3-micron particles, and possibly lower sizes.

10.10 Available methodologies may include mannequin head forms, with specified air flow and particle distributions as described above. These tests may not be as accessible as fabric filtration tests, but are crucial to establish complete face coverings performance, whereas the tests above will only establish fabric performance.

11. Breathing Resistance Considerations

11.1 Face coverings must not impede the wearer’s breathing. Manufacturers can evaluate a fabric or fabric assembly for breathing resistance using a suitable air permeability test method. When preparing specimens, cut all materials to the specimen size specified in the applicable test method, or slightly larger. Stack layers in the order and orientation in which

they will be used in the complete face covering. Baste or overlock the perimeter of the assembly, stitching through all layers to create an assembly for testing.

11.2 Perform one of the following test methods on the material assembly. It is not necessary to evaluate the air permeability of individual layers in a multi-layer assembly.

11.2.1 EN 14683 (Annex C) using 8 L/min air flow, with standard diameter of 25 mm.

11.2.2 ASTM D737 using a standard 125 Pa pressure drop. Use the standard 38.3 cm² test area.

11.2.3 ISO 9237 using a standard 100 Pa pressure differential.

11.3 The following air permeability values are recommended for face coverings:

11.3.1 For EN 14683 (Annex C), a maximum of 36.7 Pa/cm².

11.3.2 For ASTM D737, a minimum of 37.5 ft³/min/ft² (1.14 L/min/cm²).

11.3.3 For ISO 9237, a minimum of 0.91 l/min/cm² (or 15 cm/s).

11.4 Test additional specimens after multiple laundering cycles (see Laundering and Care Considerations). Do not retest the same specimens.

11.5 Air permeability is measured on the fabric only. While this test indicates the potential for the fabric to be effectively used in a face covering, construction, printing, and other processes may also impact the breathing resistance of the finished face covering.

12. Laundering and Care Considerations

12.1 Machine laundering instructions are preferred. Avoid hand laundering instructions due to increased potential for contamination. Dry cleaning instructions may also be impractical for face coverings, which should be cleaned after every use.

12.2 Consider the most sensitive element in determining care instructions (e.g., the textile layer most prone to dimensional change.)

12.3 Determine the service life of the face covering.

12.3.1 Launder as directed in AATCC LPI, using temperature and cycle settings indicated by face covering care instructions (see 15.1).

12.3.2 Evaluate fit, particle filtration, air permeability and loop or tie attachment after multiple laundering cycles. Each cycle includes both washing and drying procedures.

12.3.3 To evaluate fit and loop/tie attachment after laundering, launder complete face covering(s).

12.3.4 To evaluate filtration and air permeability after laundering, make and launder one or more material assemblies with all textile layers in the order in

which they will be used in the complete face covering.

12.3.5 Multiple face coverings and/or assemblies may be laundered together.

12.3.6 Service life is the maximum number of laundering cycles after which the face covering is still fit for use based on the suggested criteria in this document, regulations and/or internal criteria.

12.3.7 It is not generally practical to evaluate performance properties after every laundering cycle. Select an interval based on the expected or desired service life. For example, for 50 cycles, evaluate after 25, 35, 45 and 50 cycles.

12.3.8 Evaluate a different area of the assembly, or a different assembly, for filtration after each interval.

12.3.9 Evaluate a different area of the assembly, or a different assembly, for breathing resistance after each interval.

12.3.10 Evaluate attachment of loops/ties after each interval.

12.3.11 Evaluate elastic recovery (if applicable) of different loops/ties after each interval.

13. Tie and Ear Loop Considerations

13.1 Provide ties or ear loops to secure face covering to user's face.

13.1.1 Ties typically offer a more customizable fit.

13.2 Ensure ties and ear loops are durable enough to withstand normal use of the face covering.

13.2.1 Verify attachment strength using ASTM D5034.

13.2.2 The recommended attachment strength for face covering ties and ear loops is a minimum of 10 lbf (44.5 N).

13.2.3 Test additional specimens after multiple laundering cycles (see Laundering and Care Considerations). Do not retest the same specimens.

13.3 For elastic ties and ear loops, ensure adequate elastic recovery to retain shape and fit.

13.3.1 Verify elastic recovery using ASTM D4964. Determine the maximum load based on elastic width:

- Width ≥ 1 " : 10 lbf (44.5 N)
- $1 > \text{width} > \frac{1}{2}$ " : 5 lbf (22.3 N)
- $\leq \frac{1}{2}$ " width: 2 lbf (8.93 N)

13.3.2 The recommended elastic recovery for face covering ties and ear loops is a minimum of 90% after 60 s.

14. Product Labeling and Marking Considerations

14.1 **Product Description:** Accurately describe the product as a *face covering* on all packaging and promotional material.

14.2 **Adult Use:** Clearly label product as "Adult Use Only", "Not for Children" or practical equivalent.

14.3 **Intended Use:** Do not include

any label, image or marking that suggests use beyond that what face covering was intended.

14.3.1 **Intended User:** Do not suggest use by a healthcare personnel, or user requiring respiratory protection.

14.3.2 **Intended Use Setting:** Do not suggest use in any setting that requires specific fluid and/or inhalation precautions to be taken, such as a healthcare setting or commercial setting.

14.3.3 **Social Distancing:** Do not suggest that use of face covering reduces the need for social distancing.

15. User Instruction Labeling

15.1 Follow all applicable national and local regulations.

15.2 **Wearing Instructions:** Include instructions on how a user puts on, wears, and removes face covering.

Recommendation: One example of removal instructions is: "Individuals should be careful not to touch their eyes, nose, and mouth when removing their face covering and wash hands immediately after removing." Refer to CDC, Health Canada, or other official sources for additional recommendations.

15.3 **Washing Instructions:** Include instructions for home laundering (see Laundering and Care Considerations).

Recommendation: May include a recommendation to wash after every use.

15.4 **Service Life (Maximum number of laundering cycles):** Include the maximum number of laundering cycles (per care instructions) before disposal. (see Laundering and Care Considerations).

15.5 **Fit:** Include guidance for assessing fit (see Fit Considerations) and a statement instructing user to dispose of face covering if it no longer covers nose and mouth or makes snug contact with face at perimeter.

15.6 **Disposal Instructions:** Include instructions for proper disposal of face covering. One example of disposal instructions is:

"At end of service life, dispose of face covering in a plastic bag to avoid cross-contamination."

16. Performance Claims, Advertising and Promotional Literature

16.1 Follow all applicable national and local regulations.

16.2 Particular claims may be allowable but must follow federal guidelines (See Section 7: Regulatory Considerations) for claims substantiation in US and Canada respectively. Given the context of this guidance, manufacturers should avoid making the specific claims regarding:

- Use as surgical mask, or liquid barrier protection

- Anti-microbial or anti-viral properties
- Respiratory protection and particulate filtration efficiency (e.g., 95%)

16.3 Manufacturers should not include claims that would create undue risk to the user and/or categorize product as a “medical device” or “personal protective equipment”.

16.3.1 The product should not make any reference to a medical purpose.

16.3.2 The product should not make any reference to “PPE” or personal protective equipment.

16.4 Do not make claims or logos that imply approval by US National Institute for Occupational Safety and Health (NIOSH), US Centers for Disease Control and Prevention (CDC), Health Canada, or another safety-related agency.

16.5 COVID-19 (or other infections disease): No printed matter, including advertising or promotional materials, relating to the use of the authorized face covering may represent or suggest that such product is safe or effective for the prevention or treatment of patients during the COVID-19 pandemic.

17. Summary of Recommendations (Evaluation Protocol)

17.1 Table I is a summary of recommendations in the form of an evaluation protocol. This protocol does not consider applicable regulations.

18. Notes

18.1 Available from AATCC, PO Box 12215, Research Triangle Park NC 27709, USA; +1.919.549.8141; ordering@aatcc.org; www.aatcc.org.

19. History

19.1 Developed in 2020 by AATCC Committee RA113.

Appendix A Government Positions on Cloth/Textile Coverings

A1. Below are links to government guidance regarding textile coverings worn by general public:

Health Canada:

- www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks/about-non-medical-coverings-face-coverings.html
- www.canada.ca/en/public-health/news/2020/04/ccmoh-communication-use-of-non-medical-coverings-or-facial-coverings-by-the-public.html

United States CDC:

- www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-faq.html
- www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-faq.html

www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-faq.html

See Fig. A1 for CDC’s sizing recommendations for homemade coverings:

See information on cloth face coverings for additional information:

CDC:

- www.cdc.gov/coronavirus/2019-ncov/downloads/cloth-face-coverings-information.pdf
- www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-faq.html

Health Canada:

- www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks/about-non-medical-masks-face-coverings.html#_Appropriate_non-medical_mask
- www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/prevention-risks/sew-no-sew-instructions-non-medical-masks-face-coverings.html#_Sew_method

Appendix B Studies of Fabric Filtration and Air Permeability

B1. Below are links to government guidance regarding textile coverings worn by general public.

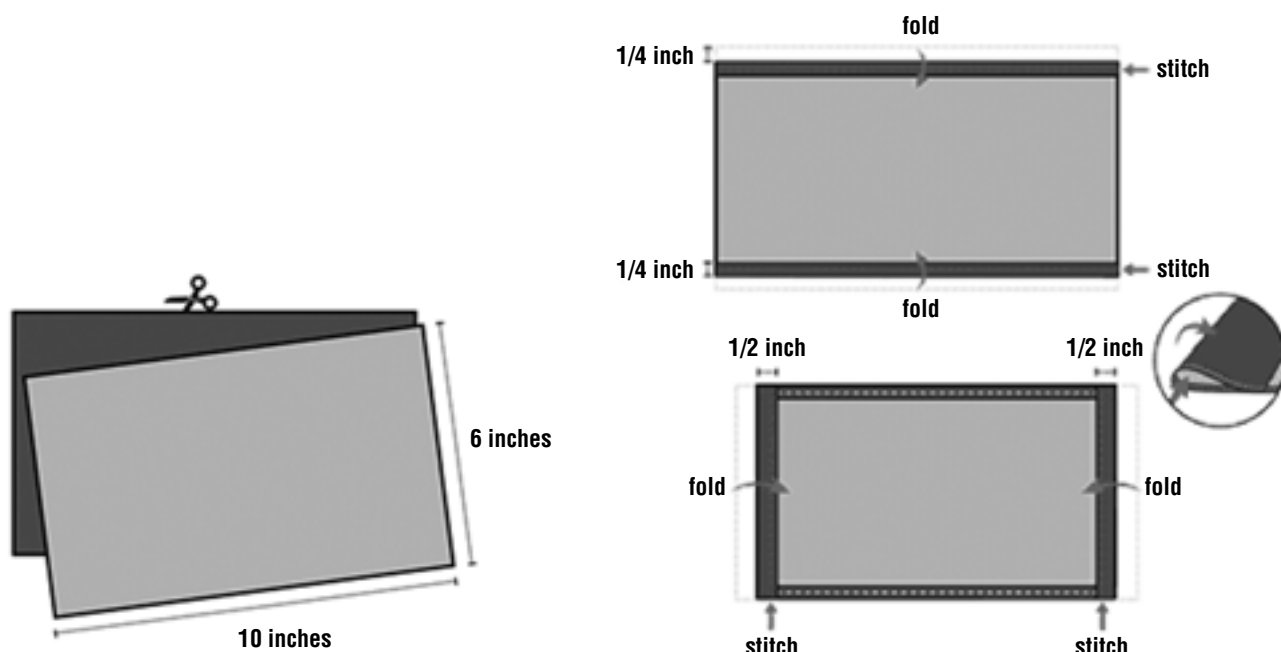


Fig. A1—CDC recommended dimensions and construction for a cloth face covering.

B1.1 *Testing the Efficacy of Homemade Masks: Would They Protect in an Influenza Pandemic?*

Davies, A., Thompson, K., Giri, K., Kafatos, G., Walker, J., & Bennett, A. (2013). Testing the Efficacy of Homemade Masks: Would They Protect in an Influenza Pandemic? *Disaster Medicine and Public Health Preparedness*, 7(4), 413-418. doi: 10.1017/dmp.2013.43

www.cambridge.org/core/journals/disaster-medicine-and-public-health-preparedness/article/testing-the-efficacy-of-homemade-masks-would-they-protect-in-an-influenza-pandemic/0921A05A69A9419C862FA2F35F819D55/core-reader

B1.2 *Aerosol Filtration Efficiency of Common Fabrics Used in Respiratory Cloth Masks*

Abhiteja Konda, Abhinav Prakash, Gregory A. Moss, Michael Schmoldt, Gregory D. Grant, and Supratik Guha

ACS Nano **2020** 14 (5), 6339-6347. doi: 10.1021/acsnano.0c03252

<https://pubs.acs.org/action/showCitFormats?doi=10.1021%2Facs.nano.0c03252&href=/doi/10.1021%2Facs.nano.0c03252>

B1.3 *Simple Respiratory Protection—Evaluation of the Filtration Performance of Cloth Masks and Common Fabric Materials Against 20–1000 nm Size Particles*

Samy Rengasamy, Benjamin Eimer, Ronald E. Shaffer, Simple Respiratory Protection—Evaluation of the Filtration Performance of Cloth Masks and Common Fabric Materials Against 20–1000 nm Size Particles, *The Annals of Occupational Hygiene*, Volume 54, Issue 7, October 2010, Pages 789–798, <https://doi.org/10.1093/annhyg/meq044>

<https://academic.oup.com/annweh/article/54/7/789/202744>

B1.4 *Study performed by the Manufacturing Development Center at the Wake Forest Institute for Regenerative Medicine*

<https://newsroom.wakehealth.edu/News-Releases/2020/04/Testing-Shows-Type-of-Cloth-Used-in-Homemade-Masks-Makes-a-Difference>

Appendix C Considerations and Examples of Fiber Contents and Fabrics

C1. For your reference, Table A1 shows examples of fiber contents and fabrics used in studies. This is not an exhaustive list of acceptable options.

NOTE: Fiber content, construction, and fabric weight or thread count are good screening tools, but do not guarantee performance. Final material selections should be based on performance properties of particle filtration and breathing resistance.

Table I—Summary of Recommended Evaluation and Criteria for General Purpose Textile Face Coverings

Evaluation	Method/Citation	Recommendation Criteria
General Labeling		
Product Description	Visual Inspection	Should accurately describing the product as face covering.
Intended Use	Visual Inspection	Should not include any labeling or marking that would convey use beyond that which face covering was intended.
Intended User	Visual Inspection	Should not include any labeling or marking that would convey use by a healthcare personnel, or user requiring respiratory protection
Intended Use Setting	Visual Inspection	Should not include any labeling or marking that would convey use in setting that requires specific fluid and/or inhalation precautions to be taken, such as a healthcare setting or commercial setting
Adult Use Only—Labeling	Visual Inspection	Should be labeled “Adult Use Only”, “Not for Children” or practical equivalent
User Instruction Labeling		
Wearing Instructions	Visual Inspection	Should include manufacturer’s instructions on how user is put on, wear, and remove face covering. Instructions for removal of covering should include (or practical equivalent) to: “Individuals should be careful not to touch their eyes, nose, and mouth when removing their face covering and wash hands immediately after removing”
Washing Instructions	Visual Inspection	Should include instructions for manufacturer’s recommended laundering
Service Life Labeling	Visual Inspection	Face coverings should include the maximum number of laundering cycles (per care instructions) before disposal.
Fit	Visual Inspection	Should include a statement instructing user to dispose of face covering if it no longer fits.
Disposal Instructions	Visual Inspection	Should include instructions for manufacturer’s recommended procedure for proper disposal of face covering.
Performance Claims, Advertising and Promotional Literature		
Medical Device/ Medical Purpose	Visual Inspection	The product should not make any claims referring to a medical purpose, to use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment, or prevention of disease
Personal Protective Equipment Use	Visual Inspection	The product should not make any claims referring to “PPE” or personal protective equipment.
Specific Claims	Visual Inspection	Should not make the following claims: • Use as surgical covering, or liquid barrier protection • Anti-microbial or anti-viral properties • Respiratory protection and particulate filtration efficiency (e.g., 95%)
Health Agencies Logos and Approvals	Visual Inspection	Should not make claims or logos that imply approval by US National Institute for Occupational Safety and Health (NIOSH), US Centers for Disease Control and Prevention (CDC), Health Canada, or another safety-related agency.
COVID-19 Related Labeling	Visual Inspection	No printed matter, including advertising or promotional materials, relating to the use of the authorized face covering may represent or suggest that such product is safe or effective for the prevention or treatment of patients during the COVID-19 pandemic.
Attachment Ties and Straps		
# of test specimens shall be per method instruction. Confirm face covering meets below recommendations before and after total claimed washes.		
Elastic Extension Straps	ASTM D4964	Should exhibit a 90% recovery after 60 seconds. Maximum Load determined by elastic width. • Width ≥ 1": 10 lbf (44.5 N) • 1" > width > ½": 5 lbf (22.3 N) • ≤ ½" width: 2 lbf (8.93 N)
Tie and Attachments on Reusable Face Coverings	ASTM D5034	Attachments should withstand a minimum of 10 lbf (44.5 N),
Laundering and Care		
# of test specimens shall be per method instruction.		
Laundering	AATCC LP1	After laundering to specified number of washes, face covering should not exhibit: • Particle filtration and/or breathability falls below recommended 70% PFE or air permeability limits OR • Change in dimensions that no longer allows acceptable user “fit” OR • Physical change that renders covering no longer useable (e.g., strap failure)
Particle Filtration		
# of test specimens shall be per method instruction. Confirm face covering meets below recommendations before and after total claimed washes.		
Filtration efficiency	ASTM F2299 (or technical equivalent)	Face covering shall demonstrate a particle filtration efficiency of >70% with maximum 3-micron particle size at a face velocity of 10.4 cm/s. Testing shall be performed on “as-received” samples and after claimed number of washes.
Breathing Resistance—Air Permeability		
# of test specimens shall be per method instruction. Confirm face covering meets below recommendations before and after total claimed washes.		
Air permeability	EN 14683 (Annex C)	Using 8 L/min air flow, with standard diameter of 25 mm. Should exhibit a maximum of 36.7 Pa/cm².
	ASTM D737	Using a standard 125 Pa pressure drop. Use the standard 38.3 cm² test area. Should exhibit a minimum of a minimum of 37.5 ft³/min/ft²
	ISO 9237	Using a standard 100 Pa pressure differential. Should exhibit a minimum of 0.91 L/min/cm² (or 15 cm/s).

Table A1—Example Fabrics for General Purpose Textile Face Coverings.

Examples of Fiber Content for Outer Layer
Cotton or cotton rich blends (over 60% are preferable because of their absorbency can draw moisture). Reference: https://academic.oup.com/cid/article/41/7/e67/310340. • Polyester may be an option, depending on the fabric density.
Examples of Fabric for Outer Layer
• Woven—plain, satin, sateen, twill 190 g/m² or more — 400 thread count or more, sheet/ pillow case (sateen weave) — 180 picks per inch heavy quilting fabric (plain weave) — 120-160 picks per inch plain weave • Knit—interlock, brushed/napped fleece, spacer, rib, pique
Examples of Fiber Content for Inner Layer (against skin)
• Cotton • Nylon • Polyester Reference: https://academic.oup.com/annweh/article/54/7/789/202744
Examples of Fabric for Inner Layer (against skin)
• Woven—plain, satin, sateen, terry, — Taffeta 45 g/m² — flannel (twill or plain weave) 160 g/m² • Knit—interlock, brushed/napped fleece, space, rib, pique — 28 gauge to 36 gauge (finer gauges create thinner fabric) — Stitch counts greater than 20 wales per inch × 28 courses per inch
Examples of Fiber Content for Optional Filter Layer (between inner and outer layer)
• Natural or synthetic fiber spacers • Nylon or polyester (nonwoven) interfacing • Nylon microfiber (woven or knit) • Polypropylene nonwoven (e.g., common in reusable grocery bags) • Wool felt
Examples of Fabric for Optional Filter Layer (between inner and outer layer)
• Woven — satin, plain, twill—120 to 180 g/m² — terry—300-400 g/m² cotton as a kitchen towel • Knit—interlock, brushed/napped fleece, spacer, rib, pique (28 gauge or finer) • Nonwoven—(must not restrict breathing) Blue shop towels—hydro knit fabric • Composite/laminate—(must not restrict breathing) — Gore-tex (50 D, 101 g/m²) is not recommended. See www.gore-tex.com/pressroom/press-release/gore-tex-brand/statement-from-wl-gore-associates-regarding-gore-tex-materials-and-covid-19.