



Public Input No. 19-NFPA 1970-2021 [Global Input]

1. Revise 7.13.6 to read as follows:

7.13.6Hoods with elastic or manually adjustable face openings shall be individually tested for resistance to shrinkage as specified in Section 8.24, Cleaning Shrinkage Resistance Test, and shall slide freely over the top half of the hood measuring device while in the relaxed state, shall not show any gaps when placed on the lower half of the hood measuring device, and shall not have the measurements made from the top of the hood to the marks at the back and both sides of the hood exhibit shrinkage of more than 5 percent.

2. Add new 7.13.6.1 to read as follows:

7.13.6.1Hoods designed to interface with a specific SCBA facepiece shall be individually tested for resistance to shrinkage as specified in Section 8.24, Cleaning Shrinkage Resistance Test, and the overlap of the outer edge of the hood and the specific SCBA facepiece shall not shrink more than 5 percent. The measurements from the top of the hood to the marks at the back and both sides of the hood shall not exhibit shrinkage of more than 5 percent.

3. Revise 8.6.16.4 to read as follows:

8.6.16.4Specimen face openings with elastic or manually adjustable face openings shall be placed over a hood measuring device as shown in Figure 8.6.16.4. Specimen face openings in the relaxed state shall slide freely over the top half of the device where the circumference measures 45.6 cm $\pm$ 0.6 cm (18.0 in. $\pm$ 0.25 in.). Specimen face openings shall then be placed around the lower half of the device where the circumference measures 54.5 cm $\pm$ 0.6 cm (21.5 in. $\pm$ 0.25 in.). Specimens shall then be visually inspected for gaps between the hood and the measuring device surface.

4. Add new 8.6.16.4.1 to read as follows:

8.6.16.4.1Specimen hoods with SCBA facepiece openings shall be measured as specified in 8.47.5.1 through 8.47.5.3.

5. Revise 8.6.16.11 to read as follows:

8.6.16.11Observations of the following for specimens with elastic or manually adjustable face openings shall be recorded and reported:

- (1) The ability of the face opening to slide freely over the top half of the hood measuring device
- (2) Gaps between the hood face opening and the bottom half of the hood measuring device before and after heat exposure

6. Add new 8.6.16.11.1 to read as follows:

8.6.16.11.1Specimen hoods with SCBA facepiece openings shall be measured as specified in 8.47.5.1 through 8.47.5.3.

7. Revise 8.6.16.12 to read as follows:

8.6.16.12The percent shrinkage of each of the three dimensions from the top of the hood to the marks along the basic plane shall be individually calculated, recorded, and reported. The percent shrinkage of the face opening overlap on specimens with specific SCBA facepiece openings shall be individually calculated, recorded, and reported.

8. Revise 8.6.16.13 to read as follows:

8.6.16.13The average percent shrinkage of the three dimensions from the top of the hood to the marks along the basic plane for all specimens shall be calculated, recorded, and reported.

The average percent shrinkage of the face opening overlap for each specimen with specific SCBA facepiece openings shall be individually calculated, recorded, and reported.

9. Revise 8.6.16.14 to read as follows:

8.6.16.14 Pass or fail performance for specimens with elastic or manually adjustable face openings shall be based on the face opening being able to slide freely in the relaxed state over the top half of the hood measuring device and any observations of gaps between the hood face opening and the hood measuring device. Pass or fail performance for specimens designed to interface with a specific SCBA facepiece shall be based on the average percent shrinkage of the face opening overlap for each specimen. Pass or fail performance shall also be based on the average percent shrinkage of the three dimensions from the top of the hood to the marks along the basic plane for each specimen. One or more hood specimens failing this test shall constitute failing performance.

10. Add new 8.6.16.15 to read as follows:

8.6.16.15 Pass or fail performance shall also be based on the average percent shrinkage of the three dimensions from the top of the hood to the marks along the basic plane for each specimen. One or more hood specimens failing this test shall constitute failing performance.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_1_TIA.pdf	NFPA 1971 TIA 18-1 Log No. 1277	
1971_TIA_Log_1277_PI19.pdf	1970_TIA_Log1277	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No 18-1, Log 1277 issued by the Standards Council on August 17, 2017 and per the NFPA Regs., it needs to be reconsidered by the Technical Committee for the next edition of the Document. Substantiation: Items 1. and 2. : When the new face opening measuring device was added during first draft, the requirements for SCBA specific hoods were removed. It was missed that this occurred during 2nd draft and there are currently no requirements for testing these types of hoods for Cleaning Shrinkage Resistance test. Items 3. thru 10.: When the new face opening measuring device was added during first draft, the requirements for SCBA specific hoods were removed. It was missed that this occurred during 2nd draft and there are currently no requirements for testing these types of hoods for Heat and Thermal Shrinkage Resistance test. Emergency Nature. The NFPA Standard contains an error or an omission that was overlooked during a regular revision process. Items 1. and 2.: Allowing the certification of these types of hoods without testing for cleaning shrinkage leaves a substantial gap in requirements, allowing potentially dangerous materials to be used in hoods that are designated to be worn with a specific SCBA. Items 3. thru 10.: Allowing the certification of these types of hoods without testing for heat and thermal shrinkage leaves a substantial gap in requirements, allowing potentially dangerous materials to be used in hoods that are designated to be worn with a specific SCBA.

Submitter Information Verification

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Submittal Date: Fri Jul 30 10:56:45 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: This text is already in the standard and is reflected exactly as printed in this PI with changes already made. No need for this PI as an FR.



Public Input No. 226-NFPA 1970-2021 [Global Input]

As related to selected test methods, implement a standard reference material that is tested periodically by the certification laboratory to enable a continuing assessment of test method repeatability, and which can further be used to promote reproducibility between laboratories.

Implement standard reference materials for the following tests

- 8.2 Flame Resistance Test 1
- 8.6 Heat and Thermal Shrinkage Resistance Test (garments)
- 8.7 Conductive Heat Resistance Test 1 (gloves)
- 8.9 Radiant Heat Resistance Test 1 (footwear)
- 8.10 Thermal Protective Performance (TPP) Test
- 8.12 Tear Resistance Test
- 8.20 Puncture Resistance Test
- 8.21 Cut Resistance Test
- 8.25 Water Absorption Test
- 8.51 Conductive and Compressive Heat Resistance (CCHR) Test

For each of these tests, specify in detail an agreed upon reference material that can be obtained in quantity and maintained in 1-2 locations. Put requirement into Equipment or Procedures portion of test method that dictates laboratories performing testing with standard reference material on a periodic basis (suggestion of monthly) and reporting information along with test results to test product.

Statement of Problem and Substantiation for Public Input

Test repeatability and reproducibility should be addressed for key tests using a standard reference material that can be periodically evaluated to ensure consistency. These data should further be documented with test reports for product evaluations. The use of a standard reference material will enable the creation of testing history to determine if variations occur in testing.

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Committee: FAE-SPF

Committee Statement

Resolution: The Committee agrees with the intent of providing standard reference materials for relevant test methods, but specific verification efforts will have to be undertaken to identify suitable reference material(s) applicable for each test method and verify their use as part of the individual test method procedures. A task group will investigate the potential use for establishing standard reference materials for priority tests during the period of public comment prior to the first draft.



Public Input No. 265-NFPA 1970-2021 [Global Input]

CHANGES TO PARTICULATE BLOCKING TEST METHOD

See Attached

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
CHANGES_TO_PARTICULATE_BLOCKING_TEST.docx		

Statement of Problem and Substantiation for Public Input

As currently written, there is only one source of testing for performing this test, which is relatively expensive and sometime difficult to access. Research conducted by NC State under a DHS AFG Research Grant specifically on hoods has shown that hood materials with very low air permeability performed on hood composites per ASTM F737 will provide passing results for particulate blocking efficiency (see attached figure of plot for air permeability versus particulate blocking efficiency [PBE]). Further, the same research has shown that the modifications specified for F2299, which make the testing exclusive to a single laboratory, do not provide any specific differentiation of the appropriate performing particulate blocking hoods when ASTM F737 is used as a screening test and that seams can be a significant source of particle penetration through the particulate-blocking hood.

The proposed changes:

- (1) remove certain modification of the ASTM F2299, including the modified test configuration.
- (2) add the performance of air permeability testing according to ASTM D737 as a means for screening materials on the need for evaluation for the measurement of particulate blocking efficiency; materials or seams with an air permeability below 25 CFM do not need to be tested.
- (3) specify the evaluation of seam samples representative of hood construction.

SEE ATTACHED

Submitter Information Verification

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Submittal Date: Tue Nov 09 14:25:11 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-306-NFPA 1970-2022](#)

Statement: As currently written, there is only one source of testing for performing this test, which is relatively expensive and sometime difficult to access. Research conducted by NC State under a DHS AFG Research Grant specifically on hoods has shown that hood materials with very low air permeability performed on hood composites per ASTM F737 will provide passing results for particulate blocking efficiency (see attached figure of plot for air permeability versus particulate blocking efficiency [PBE]). Further, the same research has shown that the modifications specified for F2299, which make the testing exclusive to a single laboratory, do not provide any specific differentiation of the appropriate performing particulate blocking hoods when ASTM F737 is used as a screening test and that seams can be a significant source of particle penetration through the particulate-blocking hood. The proposed changes: (1) remove certain modification of the ASTM F2299, including the modified test configuration. (2) add the performance of air permeability testing according to ASTM D737 as a means for screening materials on the need for evaluation for the measurement of particulate blocking efficiency; materials or seams with an air permeability below 25 CFM do not need to be tested. (3) specify the evaluation of seam samples representative of hood construction.

Other proposed changes to the test method include:

- Testing of both flat material and seams (seams have not been previously subjected to testing).
- A corrected description of the reference material.
- Changes to the conditioning procedures that now include a total of 4 heat exposures, 24 laundering cycles, 1 set of aggressive flexing procedures using a technique specified in other barrier product standards, and exposure to UV light, where the specific exposure levels are yet to be defined.
- The laundering procedures have been changed to a washer/extractor-based method since the top-loading method and equipment for washing material is no longer available.

The entirety of the proposed changes are intended to provide a more rigorous evaluation of protective hoods with particulate blocking capabilities that more realistically addresses the field performance of these products and their intended service life.



Public Input No. 282-NFPA 1970-2021 [Global Input]

Leaching Test

- (1) **Purpose:** Determine the ability of restricted substances and relevant contaminants to leach from a textile into a surrounding liquid medium (representing human sweat). Designed to determine the mobility of both organic and inorganic analytes present in textile that are available to interact with firefighter sweat.
- (2) **Extraction Fluid:** Sweat surrogate (mixture of eccrine (skin surface) sweat simulant and apocrine (via hair follicles) sweat simulant. [e.g. <https://www.pickeringsolutions.com/artificial-perspiration/#aatcc>]
- (3) **Material preconditioning:** flex and abraid
- (4) **Experimental Conditions:** $38 \pm 0.5^{\circ}\text{C}$
- (5) **Extraction Time:** 4 hours under rotary agitation at 30 ± 2 rpm.
- (6) **Test Method Summary** [REF: Modified from EPA SW-846 Test Method 131: Toxicity Characteristic Leaching Procedure]
 - (a) The solid phase is extracted with an amount of extraction fluid equal to 20 times the weight of the solid phase.
 - (b) The extraction fluid employed is a function of the alkalinity of the solid phase of the waste.
 - (c) A special extractor vessel is used when testing for volatile analysis
 - (d) Following extraction, the liquid extract is separate from the solid phase by filtration through a 0.6 to 0.8 μm glass fiber filter.
 - (e) **Apparatus**
 - i. Agitation Apparatus: The agitation apparatus must be capable of rotating the extraction vessel in an end-over-end fashion at 30 ± 2 rpm.
 - ii. Extraction Vessels:
 - i. Metals (HDPE bottles)
 - ii. Inorganics (borosilicate glass bottles)
 - iii. Volatiles and Semi-volatiles (Zero-Headspace Extraction Vessels), etc.
 - iii. Filters: Borosilicate glass fiber filters with an effective pore size of 0.6 to 0.8 μm .
 - (f) **Maximum Sample Holding Times**
 - i. Volatiles and Semi-volatiles: 14 days
 - ii. Metals: 28 days
- (7) **Reporting**
 - (a) Report only or set minimum levels acceptable

Statement of Problem and Substantiation for Public Input

There is currently no test included in the NFPA 1970/1971 process to evaluate the leachability of hazardous substances from the textiles to the sweat matrix at the skin level.

This new material-level test would look at a set of high hazard chemicals such as heavy metals, PFAS, and others that are present on new fabrics, pre-conditioned for flexing, abrasion, etc. at a high temp with a sweat solution next to it. Could assess different types of gear to determine how much got into the sweat solution and to see what is extractable out of the material. Ideally, this test will show which one of the materials or the material treatments actually play a role in total exposure through sweat.

It would be prudent to study some C-6 and C-4 (that are being used as replacements for C-8) so that potential issues can be addressed early. Utilize a standard test mix/challenge for the requirement and still allow departments to specify other chemical contaminants of interest.

Proposed temperature conditions are pulled from research by Horn et al. Horn's team evaluated the thermal response to

firefighting activities in residential structures and found that the highest mean skin temperatures observed during interior firefighting were $37.67 \pm 0.76^{\circ}\text{C}$ (measured at the neck, $n=16$) and during overhaul were $38.06 \pm 0.46^{\circ}\text{C}$ (measured at the neck, $n=15$). [REF: G. P. Horn, R. M. Kesler, S. Kerber, K. W. Fent, T. J. Schroeder, P. C. Fehling, B. Fernhall and D. L. Smith, "Thermal response to firefighting activities in residential structure fires: impact of job assignment and suppression tactic," Ergonomics, vol. 61, no. 3, pp. 404-419, 2018.]

This test method is modified from an EPA soil test method with modifications to account for textiles as well as temperature and time profiles relevant to firefighting operations.

Submitter Information Verification

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Submittal Date: Tue Nov 09 21:02:44 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-226-NFPA 1970-2022](#)

Statement: There is currently no test included in the NFPA 1970/1971 process to evaluate the leachability of hazardous substances from the textiles to the sweat matrix at the skin level. This new material-level test would look at a set of high hazard chemicals such as heavy metals, PFAS, and others that are present on new fabrics at a high temp with a sweat solution next to it. Could assess different types of gear to determine how much got into the sweat solution and to see what is extractable out of the material. Specific groups of chemicals have been targeted for the purpose of this initial requirement. The proposed temperature conditions are pulled from research by Horn et al. Horn et al. team evaluated the thermal response to firefighting activities in residential structures and found that the highest mean skin temperatures observed during interior firefighting were $37.67 \pm 0.76^{\circ}\text{C}$ (measured at the neck, $n=16$) and during overhaul were $38.06 \pm 0.46^{\circ}\text{C}$ (measured at the neck, $n=15$). [REF: G. P. Horn, R. M. Kesler, S. Kerber, K. W. Fent, T. J. Schroeder, P. C. Fehling, B. Fernhall and D. L. Smith, "Thermal response to firefighting activities in residential structure fires: impact of job assignment and suppression tactic," Ergonomics, vol. 61, no. 3, pp. 404-419, 2018.] This test method is modified from an EPA soil test method with modifications to account for textiles as well as temperature and time profiles relevant to firefighting operations.

Substantial additional work will be carried out for the validation of the new test procedures for its further consideration as part of the second draft.



Public Input No. 285-NFPA 1970-2021 [Global Input]

X.1 Application

X.1.1 This test shall apply to garment and hood materials.

X.1.2 If the garment or hood element is constructed of several layers, then all layers, arranged in correct order, shall be tested together.

X.2 Sample Preparation

X.2.1 Samples shall be at least 1 m (1 yd) squares of materials for garments and hoods.

X.2.2 Samples shall be conditioned as specified in ###.

X.3 Specimen

X.3.1 Specimens shall be sized as specified in ISO 6530, *Protective clothing – Protection against liquid chemicals – Test method for resistance of materials to penetration by liquids*.

X.3.2 A minimum of six specimens shall be tested.

X.4 Apparatus. The test apparatus and related equipment specified in ISO 6530 shall be used. [Consider replacing the standard absorbant material to ensure volatiles and semi-volatiles are captured appropriately.]

X.5 Procedure. Specimens shall be tested as specified in ISO 6530 against the following chemicals:

(1) Diesel fuel [**Consider a** variation of this procedures is to use diesel fuel, subject the sample to washing, and then conduct flame resistance test. This test approach has implications for responding to Hazmat calls, which often occur in turnout gear.]

(2) PAH and Phthalate Mixture (400 µg/mL anthracene, Di-n-octyl phthalate, phenanthrene, pyrene)

(3) Flame Retardants Mixture

(a) Polybrominated diphenyl ether flame retardants (PBDEs)

2,2',4,4'-tetra-bromodiphenyl ether (BDE) (BDE-47)

2,2',4,4',5-penta-BDE (BDE-99)

2,2',4,4',5,5'-hexa-BDE (BDE-153)

2,2',3,4,4',5,6-hepta-BDE (BDE-183)

deca-BDE (BDE-209)]

(b) Non-PBDE flame retardants (NPBFRs)

decabromodiphenylethane (DBDPE)

di (2-ethylhexyl)-2,3,4,5-tetrabromophthalate (TBPH)

hexabromocyclododecane (α-, β-, γ-HBCD)

(c) Organophosphate-based flame retardants (OPFRs)

tris (1,3-dichloro-2-propyl) phosphate (TDCPP)

tricresyl phosphate (TCP)

triphenyl phosphate (TPP)

X.6 Report. Both the index of penetration and the index of repellency shall be reported for each specimen as well as the index averages for each sample.

X.7 Interpretation. The average index of repellency shall be used to determine pass or fail performance.

Statement of Problem and Substantiation for Public Input

The intent of the proposed test method is to look at what the fire service comes in contact with on the fire scene and determine if they are repelled or become a secondary source of exposure.

The Water Absorption Test has been part of 1971 since its inception. It allows a maximum absorption principally based on weight of materials. The requirement was reduced from 30 to 15% two cycles ago. In Europe, they've had a runoff test based on ISO 6530, ASTM will have an equivalent soon.

This proposal uses a rounded trough where the specimen is placed in a trough over a blotter material that is set at a 45°

incline. Liquid chemical is dispensed at the top of the trough and a beaker collects any runoff. Three measurements are taken: (1) collect in beaker at bottom, (2) how much passes through to blotter, and (3) how much is retained in blotter).

This test is modified for chemicals from NFPA 1990 (so it is in use). Yellow highlights are the items that may need to change for NFPA 1971.

Notes:

1. Blotting paper may need to be another material so that some VOCs are not be lost.
2. Added in flame retardant mixtures (based on lists of suspected carcinogens, one source is the Kenneth Fent paper from 2019 which studied firefighter exposure to flame retardants). For this test, the chemicals that showed up in the highest amounts in the paper were selected and known carcinogens were added.
3. Picked one from each bromide level.
4. Organophosphates (halogenated and non-halogenated) were selected for highest amount measured.
5. Looked at the index of penetration and the index of repellency – want to know how much comes off and how much is repelled.
6. The solvent used in the test may impact what chemicals break through.

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Submittal Date: Tue Nov 09 21:31:35 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-225-NFPA 1970-2022](#)

Statement: The proposed test method was designed to look at what the fire service comes in contact with on the fire scene and determine if they are repelled or become a secondary source of exposure. The Water Absorption Test has been part of 1971 since its inception. It allows a maximum absorption principally based on weight of materials. The requirement was reduced from 30 to 15% two cycles ago. In Europe, they've had a runoff test based on ISO 6530, ASTM will have an equivalent soon. This proposal uses a rounded trough where the specimen is placed in a trough over a blotter material that is set at a 45° incline. Liquid chemical is dispensed at the top of the trough and a beaker collects any runoff. Three measurements are taken: (1) collect in beaker at bottom, (2) how much passes through to blotter, and (3) how much is retained in blotter. This test is modified for chemicals from NFPA 1990 that is already specified elsewhere.

The new performance test measures repellency and penetration by the exterior outer shell and intermediate moisture barrier layers as well as the individual absorption of specific PAH and phthalate chemical mixture into each layer and the underlying blotter layer that collects anything that penetrates both layers. Passing performance is based on none of the PAH and Phthalate chemicals mixture passing through both layers.

Substantial additional work will be used to investigate the efficacy of the new test method and criteria prior the completion of the second draft.



Public Input No. 298-NFPA 1970-2021 [Global Input]

Public Input: Disclose Levels of Restricted Substances

Establish certification procedures specific to component recognition

NEW 3.X Certified Component.

Any material, part, or subassembly used in the construction of the compliant product that has undergone an evaluation by a certification organization that allows the manufacturer to label the item as certified. (See also Certification/Certified.)

1.1.1

This standard provides minimum design, performance, testing, and certification requirements for the following:

(1) New structural and proximity firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components, and other components utilized to construct these elements, which further include optional requirements for the following:

- (a) Particulate barrier protective hood interface components
- (b) Structural firefighting protective ensembles and proximity firefighting ensembles that provide limited protection from liquid and particulate hazards

(2) New nonprimary work apparel and individual garments composing work apparel, which further include optional requirements for the following where such options are specified or claimed to be used in the construction of work apparel:

- (a) Flame resistance
- (b) Water resistance
- (c) Insect repellency

(3) New compressed breathing air open-circuit self-contained breathing apparatus (SCBA) and compressed breathing air combination open-circuit self-contained breathing apparatus and supplier air respirators (SCBA/SARs)

(4) New personal alert safety systems (PASS) for emergency services personnel that include stand-alone PASS, integrated PASS, and RF PASS in addition to PASS or RF PASS devices certified to an earlier edition of NFPA 1982 that incorporate parts, components, or software to meet the 2024 edition of NFPA 1970.

4.1.1.1

Chapters 4 through 8 of this standard shall specify the minimum design, performance, testing, and certification requirements for structural firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components, and other components utilized to construct these elements.

4.1.1.2

Chapters 4 through 8 of this standard shall specify the minimum design, performance, testing, and certification requirements for proximity firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components, and other components utilized to construct these elements.

4.6

Ensemble Element Manufacturers' Quality Assurance Program.

New 5.1.1.1

Certified components shall have a identifiable markings either on the product itself, or on the smallest unit packaging.

5.1.7

The information contained in Table 5.1.7 shall be ~~following information shall also be~~ printed legibly on each product label or printed directly on the product, or product packaging, where permissible, with all letters at least 1.5 mm (1/16 in.) in height:

- ~~(1) Manufacturer's name, identification, or designation~~
- ~~(2) Manufacturer's address~~
- ~~(3) Country of manufacturer~~
- ~~(4) Manufacturer's element identification number, lot number, or serial number~~

(5) Month and year of manufacturer, not coded

(6) Model name, number, or design

(7) Size or size range

(8) Principal materials(s) of construction

(9) Cleaning precautions

Labeling Item	Ensemble Elements	Components
(1) Manufacturer's name, identification, or designation	X	X
(2) Manufacturer's address	X	
(3) Country of manufacturer	X	X
(4) Manufacturer's element identification number, lot number, or serial number	X	X
(5) Month and year of manufacturer, not coded	X	X
(6) Model name, number, or design	X	X
(7) Size or size range	X	
(8) Principal materials(s) of construction	X	X
(9) Cleaning precautions	X	

Table 5.1.7 Information required to be present on product labeling

5.1.7.1

For garments only, where the principal material of construction is a component that is ~~listed~~certified, the component name under which it is ~~listed~~certified shall be identified.

New 5.1.3.1

Where the product being labeled is a certified component, the certification organization's label, symbol, or identifying mark shall be separate and distinct from the certification organization's label, symbol or identifying mark being used on ensemble elements.

In development to be submitted a global public input

6.1.X

Garment outer shells, moisture barriers, thermal barriers, trim, and reinforcement materials, stitching, provided on average sized garments larger than a total area of 225 cm², and/or intended to be in direct contact with the wearer's skin and/or undergarments shall be a certified components that meeting acceptable levels of restricted substances as specified in 7.21.

6.4.X

Helmet ear cover materials, suspension materials, and retention system materials shall be certified component meeting acceptable levels of restricted substances as specified in 7.21.

6.7.X

Glove shells, moisture barriers, linings, wristlets, stitching, and any materials provided on average sized gloves larger than a total area of 225 cm², and/or intended to be in direct contact with the wearer's skin shall be certified components meeting acceptable levels of restricted substances as specified in 7.21.

6.10.X

Footwear composite materials, including but not limited to exterior layers, barrier layers, linings, and textile, rubber, stitching or leather materials provided on average sized footwear larger than a total area of 225 cm², and/or intended to be in direct contact with the wearer's skin shall be certified components meeting acceptable levels of restricted substances as specified in 7.21.

6.13.X

Hood materials, including but not limited to knit or woven textile layers and the particulate blocking layer, stitching, and any other materials provided on hoods larger than a total area of 225 cm², and/or intended to be in direct contact with the wearer's skin shall be certified components meeting acceptable levels of restricted substances as specified in 7.21.

7.21 Acceptable Levels of Restricted Substances in Specified Protective Element Certified Components.

Components that are required to be certified for individual protective elements shall meet the requirements for acceptable restricted substances as established in Table 7.21 when tested as specified in 8.X, Test for Acceptable Levels of Specific Restricted Substances.

Insert Table 7.21 (lists individual chemicals or chemical classes and maximum allowable level of specific restricted substances)

8.X Test for Acceptable Levels of Specific Restricted Substances

8.X.1

Specified components of specified protective elements shall be evaluated for each listed restricted substance or category of restricted substances, as specified in Table 8.X.1, and be evaluated based on the accept the definition of “Hazardous Substance” as being: *A hazardous substance is any substance that poses a threat to human health and the environment. Hazardous substances are toxic, corrosive, ignitable, explosive, chemically reactive, persistent or bio-accumulative.*

Insert Table 8.X.1 (lists individual chemicals or chemical classes and applicable test method by type of material)

Substance	Test Method	Substance	Test Method
Aldehydes: Formaldehyde	Textile: ISO 14184-1 Leather: ISO 17226-1/2	Heavy Metals (extractable)	Textile: EN 16711 Leather: ISO 17072
Alkylphenols or alkylphenol ethoxylates	Textile/leather: ISO 21084 Polymer: different extraction	Organotin compounds	ISO/TS 16179
Azo dyes	Textile: EN 14362-1/-3 Leather: ISO 17234-1/-2	Pesticides	EPA 8081/8151A
Chloro-organic carriers	EN 17137	Phthalates	ISO 14389
Chlorophenols	Extraction with KOH / GC-MS	All fluorinated chemistry (polymer, non-polymer, perfluorinated, polyfluorinated, perfluoroalkyl acids, sulfonamides, PFAA precursors, branched/side-chain fluorinated polymers, carboxylates, sulfonates, etc.)	Total Organic Fluorine test on all: Particle Induced Gamma Ray Emission (PIGE) Spectroscopy GC-MS LC-MS/MS Textile EN 23702-1 Leather CEN TS 15968
Carcinogenic dyes	DIN 54231	Polycyclic aromatic hydrocarbons	TBA
Flame Retardants	ISO 17881	Volatile Organic Compounds	Headspace GC/MS
Persistent Organic Pollutants	ISO 17025 GC-NCI-MS		

Table 8.X.1. Test Methods for Evaluating Protective Element Components for Specific Restrictive Substances (default)

8.X.2

Alternative test methods shall be permitted if the test method is capable of providing a lower limit of quantification that is 10% of the specified limit established in Table 7.21 and that a 80% or better recovery of the from the specific material(s) can be demonstrated.

Substantiation:

- Unless formally banned and adhered to, firefighters do not know if restricted substances are used in turnout gear; proposed requirement allows for choices by organization as part of selection process.
- Current (UV Light Degradation Test 8.62) and/or future tests within the Standard do/could in effect mandate the use of constituents scientifically verified to be Hazardous Substances.
- Given the toxic exposures fire fighters experience in the course of their duties and as captured in independent research, all efforts must be made to eliminate unnecessary Hazardous Substance exposures through the supply of certified structural and proximity firefighting ensembles.
- Confidential Business Information is a caveat used to exclude disclosure of constituent make up of textiles, adhesives, coatings, finishes, treatments, and other core components of firefighting ensembles.

- Currently no disclosure is mandated, making it difficult to identify route cause exposures once ensembles are used in the duties of firefighting.
- The structure of the supply chain involved in the firefighter ensemble industry allows for plausible deniability and curtailment of responsibility and liability for hazardous chemical constituents within products supplied to the fire service.
- Given the toxic exposures fire fighters experience in the course of their duties and as captured in independent research, all efforts must be made to eliminate unnecessary Hazardous Substance exposures through the supply of certified structural and proximity firefighting ensembles.

Adaptation/Needs/Concerns:

- Testing must be verifiably unbiased and include MDL thresholds consistent with the current body of knowledge's acceptable minimum observable risk limits
- Testing of chemical classes should be used when possible to ensure all potential hazardous analytes are captured in testing
- Ensure certification is not obtained without clearly reported and validated absences of Hazardous Substances
- Place onus on product manufacturers, suppliers, mills to provide validated disclosure of Hazardous Substances issued from a 3rd party entity
- Mandate disclosure of current or historical financial conflicts of interest with the party requesting testing and the 3rd party tester
- Stipulate a resolve if a financial conflict of interest is identified

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Public_Input - _Disclose_Levels_of_Restricted_Substances_NFPA_1971_consolidated_1970.pdf	Disclosure Levels of Restricted Substances Public Input PDF	

Statement of Problem and Substantiation for Public Input

Substantiation:

- Unless formally banned and adhered to, firefighters do not know if restricted substances are used in turnout gear; proposed requirement allows for choices by organization as part of selection process.
- Current (UV Light Degradation Test 8.62) and/or future tests within the Standard do/could in effect mandate the use of constituents scientifically verified to be Hazardous Substances.
- Given the toxic exposures fire fighters experience in the course of their duties and as captured in independent research, all efforts must be made to eliminate unnecessary Hazardous Substance exposures through the supply of certified structural and proximity firefighting ensembles.
- Confidential Business Information is a caveat used to exclude disclosure of constituent make up of textiles, adhesives, coatings, finishes, treatments, and other core components of firefighting ensembles.
- Currently no disclosure is mandated, making it difficult to identify route cause exposures once ensembles are used in the duties of firefighting.
- The structure of the supply chain involved in the firefighter ensemble industry allows for plausible deniability and curtailment of responsibility and liability for hazardous chemical constituents within products supplied to the fire service.
- Given the toxic exposures fire fighters experience in the course of their duties and as captured in independent research, all efforts must be made to eliminate unnecessary Hazardous Substance exposures through the supply of certified structural and proximity firefighting ensembles.

Submitter Information Verification

Submitter Full Name: Neil McMillan

Organization: IAFF Local 162

Affiliation: Ottawa Professional Firefighters Association IAFF Local 162

Street Address:

City:

State:

Zip:**Submittal Date:** Wed Nov 10 04:41:25 EST 2021**Committee:** FAE-SPF**Committee Statement****Resolution:** FR-299-NFPA 1970-2022**Statement:** Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 300-NFPA 1970-2021 [Global Input]

Public Input: Complete Structural Firefighting Ensemble UV Light Test

Add new references:

ASTM D 4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, 2013(2017).

ASTM F 392/ F 392M, *Standard Test Method for Flex Durability of Flexible Barrier Materials*, 2011.

Add new preconditioning protocol:

8.1.19 Multi-environmental Conditioning Procedure

8.1.19.1

Samples of suitable sized garment, helmet ear cover, glove, and hood composites shall be prepared in the configuration as specified by the respective test method.

8.1.19.2

Composite samples shall be subject to the various conditions in the following order.

(1) Composite samples shall be laundered a total 10 laundering cycles as specified in 8.1.12 *(8.1.12 to be adapted to address helmet ear covers and hoods)*

(2) Composite samples shall be subjected to convective heat conditioning procedures as specified in 8.1.5.

(3) Composite samples for garment, helmet ear cover, glove, and hood shall be laundered a total 10 laundering cycles as specified in 8.1.12 *(8.1.12 to be adapted to address helmet ear covers and hoods)*

(4) Composite samples shall be subjected to convective heat conditioning procedures as specified in 8.1.5.

(5) Composite samples for garment, helmet ear cover, glove, and hood shall be laundered a total 10 laundering cycles as specified in 8.1.12 *(8.1.12 to be adapted to address helmet ear covers and hoods)*

(6) Composite samples shall be subjected to convective heat conditioning procedures as specified in 8.1.5.

(7) Composite samples shall be subject to exposure to 40 hours of continuous light exposure in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles.

(8) Composite samples shall be subject to repeated flexing as specified in 8.1.20.

(9) The specific layer of the composite to be tested shall be subject to repeated abrasion as specified in 8.1.21.

8.1.19.3

Specimens of the respective composite or material shall then be removed from the fully conditioned sample and subject to the test method as specified by the respective procedures of that test method.

8.1.20 Flexural Fatigue Procedure.

Samples shall be subjected to flexural fatigue in accordance with ASTM F 392, *Standard Test Method for Flex Durability of Flexible Barrier Materials*, with the following modifications:

(1) Samples shall be flexed at $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$) and a relative humidity of 65 percent $\pm$ 5 percent.

(2) In lieu of flexing conditions A, B, C, D, or E, test samples shall have a flex period of 3000 cycles at 45 cycles/min.

(3) The mandrels shall be spaced at a distance of $235 \text{ mm} \pm 6 \text{ mm}$ ($9 \frac{1}{4} \text{ in.} \pm \frac{1}{4} \text{ in.}$), in the starting position and 83 mm ($3 \frac{1}{4} \text{ in.}$) at the closed position.

(4) One cycle shall consist of a full flex and twisting action.

8.1.21 Abrasion Procedure.

Samples shall be abraded in accordance with ASTM D 4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, under the following conditions:

(1) A 2.3 kg (5 lb) tension weight shall be used.

(2) A 1.6 kg (3.5 lb) head weight shall be used.

(3) The abrasants shall be each of the material layers in the composite.

(4) Samples shall be abraded for a total of 60,000 cycles.

(5) Samples shall be abraded for half of the cycles against the outer layer of the composite, with the specimen facing the outer layer in its normal “as worn” orientation.

(6) Samples shall be then abraded for the remaining cycles against the inner layer of the composite with the specimen facing the inner layer in its normal “as worn” orientation.

Incorporate new preconditioning protocol in place of existing preconditioning with the following test methods

Garments

8.12 Tear Resistance Test

8.25 Water Absorption Resistance Test

8.26 Water Penetration Resistance Test

Helmet Ear Covers

8.12 Tear Resistance Test (new)

8.25 Water Absorption Resistance Test (new)

8.26 Water Penetration Resistance Test (new)

Gloves

8.20 Puncture Resistance Test

8.21 Cut Resistance Test

8.26 Water Penetration Resistance Test

Hoods

8.13 Burst Resistance Test

8.66 Particulate Blocking Test

Substantiation

- Currently, portions of the protective ensemble are subjected to multiple testing as specified by the individual test. Most of these conditions are limited in attempting to address the wide range of environmental and use conditions that different protective clothing elements sustain over their service life with uncertain performance to specific criteria associated with the test method. The proposed conditioning procedures attempt to model conditions more representative of field use that can be applied to certain tests for evaluating protective element performance.
- UV light is an exposure for full intact structural firefighting ensembles and a low threshold UV light test applied as a pre-conditioning test to a complete intact full ensemble is a viable alternative option (as compared with the current 8.62 UV Light Degradation Resistance Test) allowing for a more realistic light degradation scenario. This test should be performed prior to applications of other testing standards test currently necessary for certification.
- Scientifically defensible test criteria must be substantiated, verifiable, and approved through consensus of end-user stakeholders to ensure a repetition of past fallacious tests do not occur.

Statement of Problem and Substantiation for Public Input

- Currently, portions of the protective ensemble are subjected to multiple testing as specified by the individual test. Most of these conditions are limited in attempting to address the wide range of environmental and use conditions that different protective clothing elements sustain over their service life with uncertain performance to specific criteria associated with the test method. The proposed conditioning procedures attempt to model conditions more representative of field use that can be applied to certain tests for evaluating protective element performance.
 - UV light is an exposure for full intact structural firefighting ensembles and a low threshold UV light test applied as a pre-conditioning test to a complete intact full ensemble is a viable alternative option (as compared with the current 8.62 UV Light Degradation Resistance Test) allowing for a more realistic light degradation scenario. This test should be performed prior to applications of other testing standards test currently necessary for certification.
 - Scientifically defensible test criteria must be substantiated, verifiable, and approved through consensus of end-user stakeholders to ensure a repetition of past fallacious tests do not occur.
- The only UV Light Test currently applied to structural firefighting ensembles tests bare Moisture Barrier constituents. This is an unrealistic application, it is not scientifically validated and accomplishes nothing other than limiting materials which can be certified. As such this remedy would allow for realistic UV exposure testing on full ensemble materials in a manner in which they would experience these exposures in actual use.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 299-NFPA 1970-2021</u> <u>[Section No. 8.62]</u>	these Inputs denote the removal and replacement of the current UV Light Test
Submitter Information Verification	
Submitter Full Name: Neil McMillan	
Organization: IAFF Local 162	
Affiliation: Ottawa Professional Firefighters Association IAFF Local 162	
Street Address:	
City:	
State:	
Zip:	
Submittal Date: Wed Nov 10 07:20:07 EST 2021	
Committee: FAE-SPF	
Committee Statement	
Resolution: <u>FR-121-NFPA 1970-2022</u>	
Statement: Additional conditioning procedures are being added in order to challenge items being tested for durability. Testing to validate the parameters will need to be conducted between first and second revision.	



Public Input No. 31-NFPA 1970-2021 [Global Input]

1. Revise 2.3.2 ASTM Publications, 8.21.4, Table B.4 in two instances, Table B.5 and C.1.2.2

ASTM Publications, to read as follows:

**ASTM F1790/~~F1790M~~, Standard Test Methods for Measuring Cut Resistance of Materials
Used in Protective Clothing ~~with CPP Test Equipment~~, 2015, 2005.**

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PL_2_TIA.pdf	NFPA 1971 TIA 18-2 Log 1272	
1971_TIA_Log_1272_PL31.pdf	1970_TIA_Log1272	

Statement of Problem and Substantiation for Public Input

NOTE: This public input originates from Tentative Interim Amendment No. 18-2, Log 1272 issued by the Standards Council on April 17, 2017 and per the NFPA Regs., it needs to be reconsidered by the Technical Committee for the next edition of the Document. Substantiation: The above document was revised to update the edition of ASTM F1790 from the 2005 to the 2015 edition. ASTM F1790 was revised to change the way the cut resistance specimen was mounted to the machine. The cut resistance test is performed by using a blade to cut through a sample. Cut through is determined when the blade cuts through a specimen and makes electrical contact stopping the machine. In the 2005 edition, electrical contact was determined when the blade makes contact with a conductive strip which is located between the specimen and double-sided tape used to secure the specimen and the foil to the machine. Cut-through = Cut through specimen In the 2015 edition, electrical contact is determined when the blade makes contact with the machine itself – essentially cutting through the specimen and the double sided tape used to attach the specimen to the machine. The effect of this is that materials that would previously fail this performance requirement, could now be acceptable due to the additional layers now being required to cut through. Cut-through = Cut through specimen + Cut through tape No discussion or testing was performed by the TC to address this change, and the performance requirement was not revised to reflect this change in methodology. For reference: ASTM F1790-2005, Section 10.2.2 Specimen mounting: 10.2.2.1 Cover mandrel face with double-face tape. 10.2.2.2 Place a 6-mm [0.25-in.] strip of conductive foil centered down the length of the mandrel on the double-face tape. Clip the end of this foil to the mandrel, or attach it securely to the electrical circuit that detects cut through in some other fashion. 10.2.2.3 Without stretching or distorting it, place a specimen over the tape with the surface to be cut facing up. Apply firm pressure on the specimen. ASTM F1790-2015, Section 6.4 Mounting Tape—Double-sided tape shall be used to secure the test specimen to the apparatus. The tape should have a cloth carrier and rubber-based adhesive on both sides with a total thickness of 0.38 +/- 0.25 mm, weight of 473 +/- 33g/m2... (NOTE: There is no mention of the conductive foil.) Emergency Nature: The standard contains an error or an omission that was overlooked during the regular revision process. This oversight can result in previously unacceptable materials now being allowable by the standards.

Submitter Information Verification

Submitter Full Name: TC on FAE-SPF

Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment

Street Address:

City:

State:

Zip:

Submission Date: Mon Aug 16 12:52:11 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-280-NFPA 1970-2022](#)

Statement: The referenced publications have been updated to reflect publications added or removed during the revision process as well as publications that have been revised by other organizations.



Public Input No. 311-NFPA 1970-2021 [Global Input]

Pertaining to NFPA 1971 and NFPA 1975 -- Inclusion of NFPA 1971 Station/Work Uniforms as part of NFPA 1971 Protective Garments

As a consolidated document, consideration should be given to the potential that permits the use of station/work uniforms as part of the overall insulation package to protective firefighters. Specific factors to be addressed in advancing a possible action of this type include:

1. Requiring station/work uniform to meet the optional requirements for flame resistance in NFPA 1975.
2. Requiring station/work uniform upper torso garments to be long sleeved.
3. Requiring station/work uniform lower torso garment to be full legged pants.
4. Permitting station work/uniform coveralls to be used that have long sleeves and full pants.
5. Requiring testing of station/work uniform materials for composite tests for TPP and CCHR for each unique composite involved.
6. Assessing the impact of using the station/work uniform materials on the full composite THL (and potentially evaporative resistance).
7. Creating specialized labeling, specifically including warnings, to address this possible combination.
8. Certifying the entire clothing "system" as compliant to the requirements of NFPA 1971 and separately for the uniform as compliant to the requirements of NFPA 1975.

Statement of Problem and Substantiation for Public Input

Some portions of the fire service are looking for ways to make their clothing systems more efficient to lessen the physiological burden on their members. The consideration of allowing station/work uniforms to contribute to thermal insulation is one way in which that may be possibly achieved under very carefully dictated circumstances. The proposed input is conceptual in nature but is intended to advance that flexibility of the standard that comes through consolidation to identify possible improvements in balancing protection, comfort, and function.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 10 11:21:56 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: While the committee finds that there is some merit to the proposal that an NFPA 1975 station/work uniform can, under some circumstances, become part of the overall protection offered by the protective coat and pants, there is a substantial amount of change in the NFPA 1971 requirements that would be necessary to adequately present this option, but more importantly, the proposed changes would offer significant logistical and enforcement problems since firefighters would always be required to wear a particular long-sleeved shirt with full length pants as part of their protective garments. This could be made more difficult by the fact that in warmer climates, many fire departments already permit the use of short sleeved shirts and shorts to be worn underneath protective ensembles. Additionally, approximately 75% of fire departments that rely on the protection provided by NFPA standards are largely or wholly comprised of volunteer firefighters¹. As such, many respond directly from home, primary employment, or other places where their attire would likely not be clothing meeting NFPA 1975. Consideration must be given to ensure garments are constructed to provide the requisite protection to these firefighters. 1 US Fire Department Profile 2018, Evarts and Stein, NFPA 2020. Available at <https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Emergency-responders/osfdprofile.pdf> This approach does warrant further consideration, but the aforementioned challenges, including the logistical arrangements for various types of departments would need to be carefully addressed before it could be implemented as part of the revised standard.



Public Input No. 313-NFPA 1970-2021 [Global Input]

Information in Test Reports that Applies to All Standards

Each technical committee should thoroughly review the reporting requirements for testing results. Currently, I consider many test requirements to be incomplete in reporting information that can be useful for identifying key findings associated with the testing and particularly to ensure consistent for all testing of products. The following requirements are recommended as part of test method reporting requirements:

1. For whole items that are submitted for testing, and particularly for annual testing, the unique identifier (serial or lot number and manufacturing date) shall be documented.
2. For whole items that are submitted for testing and the testing depends on how the item is positioned as part of the testing such as a helmet on a headform where a flame is applied, then a photograph or diagram shall be provided as part of the test report.
3. For whole items that are submitted for testing and the testing relies on the use of a human subject, the salient anthropometric dimensions pertinent to the evaluation shall be documented.
4. For items and components that submitted for testing and the testing involves the measurement of insulation characteristics, the unit area weight and thickness of the individual test samples shall be measured per ASTM D3776 and ASTM D1777 (or equivalent, appropriate test methods) and documented.
5. For items that are submitted for testing and testing provides a qualitative result based on observation of the item's behavior during a test, specific remarks shall be provided as notes with the test results, particularly as related to a specific type or aspect of failing results.

Statement of Problem and Substantiation for Public Input

More details are needed in test reports to fully document findings. The additional specification of test findings is helpful to the industry as a whole, primarily to ensure test interpretation and consistency.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 10 11:41:09 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-178-NFPA 1970-2022](#)

Statement: Specific changes have been made to certain test methods to provide additional information, which aids in discerning the variability of test results. These changes include the measurement and reporting of specimen thickness and weight as well as the provision of photographs and other information to help document how samples were positioned or specified for testing.



Public Input No. 318-NFPA 1970-2021 [Global Input]

This request is to modify the structural helmet standard to remove any aspects of design restrictive elements (i.e. suspension system/webbing suspension system) pertaining to the impact attenuating systems. See attachment.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA_1970_Public_Comment.docx		

Statement of Problem and Substantiation for Public Input

The current helmet standard specified that a (webbing) suspension system will be used. There are many scenarios (described in the attached document) where a firefighters could receive an impact to the side of the head. Webbing suspension systems provide inadequate impact attenuating properties to the lateral sides of the head. If the structural helmet standard is revised to remove design specific requirements, it will allow industry and academia to develop new and innovative solutions that can provide sufficient impact protection to all sides of the head. It would also still allow webbing suspension systems to be used.

Submitter Information Verification

Submitter Full Name: Brady Robinette
Organization: Lubbock Fire Rescue
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 10 14:30:24 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: Because the firefighting helmet is intended for firefighting and our efforts as a committee and of the manufacturers has been to reduce the weight of the helmet for the firefighters. Adding material weight and/or design not intended to enhance the firefighting capability of the helmet seems counterintuitive. Performing an NFPA 1851 risk assessment may determine the need for an additional helmet for that purpose.



Public Input No. 320-NFPA 1970-2021 [Global Input]

APPLICABLE TO NFPA 1971 PROTECTIVE HOODS TEST METHOD FOR HOOD OPENING SIZE IN SECTION 8.47

An alternative measurement device should be considered for this test that uses a more quantitative method. One proposed concept is to using a conical device as current employed by with graduations that allow for actual measurements of the opening size at different states of its deployment.

Statement of Problem and Substantiation for Public Input

The NFPA 1971 Task Group on Hoods identified the need for improvements for the way that hood openings are currently measured and discussed possible approaches for how this may be achieved. This is based on the observed subjectivity and variance in the test method currently and this input seeks to improve this by reducing the variation across the market.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 10 15:28:38 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-62-NFPA 1970-2022

Statement: The NFPA 1971 Task Group on Hoods identified the need for improvements for the way that hood openings are currently measured and discussed possible approaches for how this may be achieved. This is based on the observed subjectivity and variance in the test method currently and this input seeks to improve this by reducing the variation across the market. This change is best addressed where the test equipment is address in Section 8.6. At this time, only a slight improvement is made with the additional of graduations on the side of the cone. Additional research is being undertaken to identify further improvements to shift this from a qualitative to quantitative assessment.



Public Input No. 323-NFPA 1970-2021 [Global Input]

APPLICABLE TO NFPA 1971 PROTECTIVE HOODS TEST METHOD FOR PARTICULATE INWARD LEAKAGE IN SECTION 8.66

A more realistic conditioning protocol should be considered for evaluating particulate blocking hoods for their particulate inward leakage resistance as defined in Section 8.66. It is represented that these products are likely to undergo multiple cycles of laundering, donning/doffing, heat exposure, and other forms of environmental exposure to account for the expected service life of these products.

Statement of Problem and Substantiation for Public Input

The NFPA 1971 Task Group on Hood discussed the need for changes in the number of washes for conditioning and also provide realistic service life for particulate blocking hoods based on efficiency testing. This conditions should also consider other service life characteristics such as repeated donning and doffing.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull

Organization: International Personnel Protection, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Wed Nov 10 15:41:26 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-306-NFPA 1970-2022](#)

Statement: As currently written, there is only one source of testing for performing this test, which is relatively expensive and sometime difficult to access. Research conducted by NC State under a DHS AFG Research Grant specifically on hoods has shown that hood materials with very low air permeability performed on hood composites per ASTM F737 will provide passing results for particulate blocking efficiency (see attached figure of plot for air permeability versus particulate blocking efficiency [PBE]). Further, the same research has shown that the modifications specified for F2299, which make the testing exclusive to a single laboratory, do not provide any specific differentiation of the appropriate performing particulate blocking hoods when ASTM F737 is used as a screening test and that seams can be a significant source of particle penetration through the particulate-blocking hood. The proposed changes: (1) remove certain modification of the ASTM F2299, including the modified test configuration. (2) add the performance of air permeability testing according to ASTM D737 as a means for screening materials on the need for evaluation for the measurement of particulate blocking efficiency; materials or seams with an air permeability below 25 CFM do not need to be tested. (3) specify the evaluation of seam samples representative of hood construction.

Other proposed changes to the test method include:

- Testing of both flat material and seams (seams have not been previously subjected to testing).
- A corrected description of the reference material.
- Changes to the conditioning procedures that now include a total of 4 heat exposures, 24 laundering cycles, 1 set of aggressive flexing procedures using a technique specified in other barrier product standards, and exposure to UV light, where the specific exposure levels are yet to be defined.
- The laundering procedures have been changed to a washer/extractor-based method since the top-loading method and equipment for washing material is no longer available.

The entirety of the proposed changes are intended to provide a more rigorous evaluation of protective hoods with particulate blocking capabilities that more realistically addresses the field performance of these products and their intended service life.



Public Input No. 332-NFPA 1970-2021 [Global Input]

ADDITIONAL OF NEW CONDITIONING PROCEDURES TO BE APPLIED TO NFPA 1971 PROTECTIVE ELEMENTS

Add new references:

ASTM D 4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, 2013(2017).

ASTM F 392/ F 392M, *Standard Test Method for Flex Durability of Flexible Barrier Materials*, 2011.

Add new preconditioning protocol:

8.1.19 Multi-environmental Conditioning Procedure

8.1.19.1

Samples of suitable sized garment, helmet ear cover, glove, and hood composites shall be prepared in the configuration as specified by the respective test method.

8.1.19.2

Composite samples shall be subject to the various conditions in the following order.

(1) Composite samples shall be laundered a total 10 laundering cycles as specified in 8.1.12 *(8.1.12 to be adapted to address helmet ear covers and hoods)*

(2) Composite samples shall be subjected to convective heat conditioning procedures as specified in 8.1.5.

(3) Composite samples for garment, helmet ear cover, glove, and hood shall be laundered a total 10 laundering cycles as specified in 8.1.12 *(8.1.12 to be adapted to address helmet ear covers and hoods)*

(4) Composite samples shall be subjected to convective heat conditioning procedures as specified in 8.1.5.

(5) Composite samples for garment, helmet ear cover, glove, and hood shall be laundered a total 10 laundering cycles as specified in 8.1.12 *(8.1.12 to be adapted to address helmet ear covers and hoods)*

(6) Composite samples shall be subjected to convective heat conditioning procedures as specified in 8.1.5.

(7) Composite samples shall be subject to exposure to 40 hours of continuous light exposure in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles.

(8) Composite samples shall be subject to repeated flexing as specified in 8.1.20.

(9) The specific layer of the composite to be tested shall be subject to repeated abrasion as specified in 8.1.21.

8.1.19.3

Specimens of the respective composite or material shall then be removed from the fully conditioned sample and subject to the test method as specified by the respective procedures of that test method.

8.1.20 Flexural Fatigue Procedure.

Samples shall be subjected to flexural fatigue in accordance with ASTM F 392, *Standard Test Method for Flex Durability of Flexible Barrier Materials*, with the following modifications:

(1) Samples shall be flexed at $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$) and a relative humidity of 65 percent $\pm$ 5 percent.

(2) In lieu of flexing conditions A, B, C, D, or E, test samples shall have a flex period of 3000 cycles at 45 cycles/min.

(3) The mandrels shall be spaced at a distance of $235 \text{ mm} \pm 6 \text{ mm}$ ($9 \frac{1}{4} \text{ in.} \pm \frac{1}{4} \text{ in.}$), in the starting position and 83 mm ($3 \frac{1}{4} \text{ in.}$) at the closed position.

(4) One cycle shall consist of a full flex and twisting action.

8.1.21 Abrasion Procedure.

Samples shall be abraded in accordance with ASTM D 4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, under the following conditions:

(1) A 2.3 kg (5 lb) tension weight shall be used.

(2) A 1.6 kg (3.5 lb) head weight shall be used.

(3) The abrasants shall be each of the material layers in the composite.

(4) Samples shall be abraded for a total of 60,000 cycles.

(5) Samples shall be abraded for half of the cycles against the outer layer of the composite, with the specimen facing the outer layer in its normal "as worn" orientation.

(6) Samples shall be then abraded for the remaining cycles against the inner layer of the composite with the specimen facing the inner layer in its normal "as worn" orientation.

Incorporate new preconditioning protocol in place of existing preconditioning with the following test methods

Garments

8.12 Tear Resistance Test

8.25 Water Absorption Resistance Test

8.26 Water Penetration Resistance Test

Helmet Ear Covers

8.12 Tear Resistance Test (new)

8.25 Water Absorption Resistance Test (new)

8.26 Water Penetration Resistance Test (new)

Gloves

8.20 Puncture Resistance Test

8.21 Cut Resistance Test

8.26 Water Penetration Resistance Test

Hoods

8.13 Burst Resistance Test

8.66 Particulate Blocking Test

Statement of Problem and Substantiation for Public Input

Currently, portions of the protective ensemble are subjected to multiple testing as specified by the individual test. Most of these conditions are limited in their attempt to address the wide range of environmental and use conditions that different protective clothing elements sustain over the its service life with uncertain performance to specific criteria associated with the test method. The proposed conditioning procedures attempt to model conditions more representative of field use that can be applied to certain tests for evaluating protective element performance. The proposed series of requirements and applicable tests are intended as a starting point to address this topic across the span of protective elements. There are certain issues of practicality such as sample size that can be accommodated by the various types of equipment that would be utilized to conduct the various conditioning approaches. Moreover, specific instructions will be required to adapt certain conditioning procedures to different protective elements.

The scheme and sequence of representative conditioning techniques are taken from current approaches and are not expected to be the final approach, which must be subject to extensive validation testing to assure that the procedures do not have unintended consequence on products that have viable demonstrate field acceptability. The current proposed series of laundering is to be based on separately proposed washer/extractor procedures using a total of 30 launderings to be conducted in three batches with each batch following by an oven heat conditioning procedure already established in NFPA 1971. The UV exposure is the same as that used in the light degradation test but involves the samples tested in composite form as they would normally be exposed. The repeated flexing and abrasion conditioning protocols are intended to simulate wear conditions and were originally part of the 2013 edition of NFPA 1971 as applied to CBRN barrier layers. It is highly likely that the number of cycles and application of these different multiple conditioning procedures will be changed.

Tests selected for the implementation of these conditioning procedures are currently suggested to key tests that may be indicative of performance that could be affected by the service life conditions of the gear and may also be subject to change.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull

Organization: International Personnel Protection Inc.

Street Address:

City:**State:****Zip:****Submittal Date:** Wed Nov 10 16:55:26 EST 2021**Committee:** FAE-SPF

Committee Statement

Resolution: [FR-121-NFPA 1970-2022](#)**Statement:** Additional conditioning procedures are being added in order to challenge items being tested for durability. Testing to validate the parameters will need to be conducted between first and second revision.



Public Input No. 333-NFPA 1970-2021 [Global Input]

ESTABLISH NEW COMPONENT CERTIFICATION PROCEDURES APPLICABLE TO ALL STANDARDS (NFPA 1971, 1975, 1981, AND 1982)

NEW 3.3.X Certified Component.

Any material, part, or subassembly used in the construction of the compliant product that has undergone an evaluation by a certification organization that allows the manufacturer to label the item as certified. (See also Certification/Certified.)

1.1.1

This standard provides minimum design, performance, testing, and certification requirements for the following:

(1) New structural and proximity firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components, and other components utilized to construct these elements, which further include optional requirements for the following:

(a) Particulate barrier protective hood interface components

(b) Structural firefighting protective ensembles and proximity firefighting ensembles that provide limited protection from liquid and particulate hazards

(2) New nonprimary work apparel and individual garments composing work apparel, which further include optional requirements for the following where such options are specified or claimed to be used in the construction of work apparel:

(a) Flame resistance

(b) Water resistance

(c) Insect repellency

(3) New compressed breathing air open-circuit self-contained breathing apparatus (SCBA) and compressed breathing air combination open-circuit self-contained breathing apparatus and supplier air respirators (SCBA/SARs)

(4) New personal alert safety systems (PASS) for emergency services personnel that include stand-alone PASS, integrated PASS, and RF PASS in addition to PASS or RF PASS devices certified to an earlier edition of NFPA 1982 that incorporate parts, components, or software to meet the 2024 edition of NFPA 1970.

4.1.1.1

Chapters 4 through 8 of this standard shall specify the minimum design, performance, testing, and certification requirements for structural firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components, and other components utilized to construct these elements.

4.1.1.2

Chapters 4 through 8 of this standard shall specify the minimum design, performance, testing, and certification requirements for proximity firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components, and other components utilized to construct these elements.

4.6

Ensemble Element Manufacturers' Quality Assurance Program.

New 5.1.1.1

Certified components shall have a identifiable markings either on the product itself, or on the smallest unit packaging.

5.1.7

The ~~information contained in Table 5.1.7 shall be~~ following information shall also be printed legibly on each product label ~~or printed directly on the product, or product packaging, where permissible,~~ with all letters at least 1.5 mm (1/16 in.) in height:

(1) ~~Manufacturer's name, identification, or designation~~

(2) ~~Manufacturer's address~~

(3) ~~Country of manufacturer~~

(4) ~~Manufacturer's element identification number, lot number, or serial number~~

(5) ~~Month and year of manufacturer, not coded~~

(6) Model name, number, or design

(7) Size or size range

(8) Principal materials(s) of construction

(9) Cleaning precautions

Labeling Item	Ensemble Elements	Components
(1) Manufacturer's name, identification, or designation	X	X
(2) Manufacturer's address	X	
(3) Country of manufacturer	X	X
(4) Manufacturer's element identification number, lot number, or serial number	X	X
(5) Month and year of manufacturer, not coded	X	X
(6) Model name, number, or design	X	X
(7) Size or size range	X	
(8) Principal materials(s) of construction	X	X
(9) Cleaning precautions	X	

Table 5.1.7 Information required to be present on product labeling**5.1.7.1**

For garments only, where the principal material of construction is a component that is ~~listed~~certified, the component name under which it is ~~listed~~certified shall be identified.

New 5.1.3.1

Where the product being labeled is a certified component, the certification organization's label, symbol, or identifying mark shall be separate and distinct from the certification organization's label, symbol or identifying mark being used on ensemble elements.

Statement of Problem and Substantiation for Public Input

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are propose to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Submitter Information Verification**Submitter Full Name:** Jeffrey Stull**Organization:** International Personnel Protection, Inc.**Street Address:****City:****State:****Zip:****Submittal Date:** Wed Nov 10 17:09:59 EST 2021**Committee:** FAE-SPF**Committee Statement****Resolution:** FR-299-NFPA 1970-2022**Statement:** Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and

particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 334-NFPA 1970-2021 [Global Input]

PROPOSED DISCLOSURE OF RESTRICTED SUBSTANCES FOR TEXTILE, RUBBER, AND LEATHER COMPONENTS; THESE REQUIREMENTS ARE INTENDED FOR NFPA 1971 BUT CAN FURTHER BE APPLIED AS PART OF NFPA 1975, NFPA 1981, AND NFPA 1982

6.1.X

Garment outer shells, moisture barriers, thermal barriers, trim, and reinforcement materials provided on average sized garments larger than a total area of 225 cm² shall be a certified components that meeting acceptable levels of restricted substances as specified in 7.21.

6.4.X

Helmet ear cover materials, suspension materials, and retention system materials shall be certified component meeting acceptable levels of restricted substances as specified in 7.21.

6.7.X

Glove shells, moisture barriers, linings, wristlets, and any materials provided on average sized gloves larger than a total area of 225 cm² shall be certified components meeting acceptable levels of restricted substances as specified in 7.21.

6.10.X

Footwear composite materials, including but not limited to exterior layers, barrier layers, linings, and textile, rubber, or leather materials provided on average sized footwear larger than a total area of 225 cm² shall be certified components meeting acceptable levels of restricted substances as specified in 7.21.

6.13.X

Hood materials, including but not limited to knit or woven textile layers and the particulate blocking layer, and any other materials provided on hoods larger than a total area of 225 cm² shall be certified components meeting acceptable levels of restricted substances as specified in 7.21.

7.21 Acceptable Levels of Restricted Substances in Specified Protective Element Certified Components.

Components that are required to be certified for individual protective elements shall meet the requirements for acceptable restricted substances as established in Table 7.21 when tested as specified in 8.X, Test for Acceptable Levels of Specific Restricted Substances.

Insert Table 7.21 (lists individual chemicals or chemical classes and maximum allowable level of specific restricted substances). For the purpose of the initial submission, the following chemical classes and individual chemicals within these classes will be specified as currently identified for in the OEKO-TEX Standard III at the Product category III levels.

- *Alkylphenols or alkylphenol ethoxylates*
- *Azo dyes*
- *Chloro-organic carriers*
- *Chlorophenols*
- *Carcinogenic dyes*
- *Flame retardants*
- *Formaldehyde*
- *Heavy metals (extractable)*
- *Organotin compounds*
- *Pesticides*
- *Phthalates*
- *Perfluorochemicals; per- and polyfluorinated compounds*
- *Polycyclic aromatic hydrocarbons*

- *Volatile organic compounds*

8.X Test for Acceptable Levels of Specific Restricted Substances

8.X.1

Specified components of specified protective elements shall be evaluated for each listed restricted substance or category of restricted substances, as specified in Table 8.X.1.

Insert Table 8.X.1 (lists individual chemicals or chemical classes and applicable test method by type of material)

Substance	Test Method	Substance	Test Method
Aldehydes: Formaldehyde	Textile: ISO 14184-1 Leather: ISO 17226-1/-2	Heavy metals (extractable)	Textiles: EN 16711 Leather: ISO 17072
<u>Alkylphenols</u> or <u>alkylphenol ethoxylates</u>	Textile/leather: ISO 21084 Polymers: different extraction	Organotin compounds	ISO/TS 16179
Azo dyes	Textile: EN 14362-1 /-3 Leather: ISO 17234-1 /-2	Pesticides	EPA 8081/8151A
<u>Chloro-organic carriers</u>	EN 17137	Phthalates	ISO 14389
<u>Chlorophenols</u>	Extraction with KOH / GC-MS	<u>Perfluorochemicals</u> ; per- and <u>polyfluorinated compounds</u>	Textiles: EN 23702-1 Leather: CEN TS 15968
Carcinogenic dyes	DIN 54231	Polycyclic aromatic hydrocarbons	To be determined
Flame retardants	ISO 17881	Volatile organic compounds	Headspace GC/MS

Table 8.X.1. Test Methods for Evaluating Protective Element Components for Specific Restrictive Substances (default)

8.X.2

Alternative test methods shall be permitted if the test method is capable of providing a lower limit of quantification that is 10% of the specified limit established in Table 7.21 and that a 80% or better recovery of the from the specific material(s) can be demonstrated.

8.X.3

The specific levels of each restricted substance shall be reported or if no level is measured, as less than the detection limit of the test method.

Statement of Problem and Substantiation for Public Input

Unless formally banned and adhered to, firefighters do not know if restricted substances are used in turnout gear; proposed requirement allows for choices by organization as part of selection process. The proposed requirements are intended to promote the disclosure and adherence to establish maximum levels of certain restricted substances in firefighter PPE. As a starting point, a large subset of those compounds specified in the OEKO-TEX Standard 100 are specified along with the limits established for Category III products. Individual test methods for their quantification has been proposed as found in international restricted substance regulations and product reporting practices. Additional requirements related to the reporting and disclosure of restricted substance levels may be necessary.

Submitter Information Verification

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Submittal Date: Wed Nov 10 17:29:13 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-217-NFPA 1970-2022](#)

Statement: Unless formally banned and adhered to, firefighters do not know if restricted substances are used in turnout gear. The proposed requirement allows for an independent review for ascertaining if specific restricted substances are present in protective elements and only permits protective elements where the restricted substances, where present, are below acceptable levels. The proposed requirements are intended to

promote the disclosure and adherence to establish maximum levels of certain restricted substances in firefighter PPE. As a starting point, a large subset of those compounds specified in the OEKO-TEX Standard 100 are specified along with the limits established for Category II and III products. This specific set of requirements uses an approach that protective elements can only be certified using recognized components that have been subject to an independent review of restricted substances through a certification process. Additional efforts will be undertaken to ensure that the appropriate materials and components are included for each protective element. The committee will be investigating ways to best manage the demonstration of compliance for maximum levels of restricted substances in other ways through different certification or verification processes.



Public Input No. 335-NFPA 1970-2021 [Global Input]

PUBLIC INPUT TO ADD CLEANABILITY INDEX REQUIREMENT FOR PROTECTIVE ELEMENT MATERIALS IN NFPA 1971

7.1.X

Garment outer shells, moisture barriers, and thermal barriers shall be separately evaluated for ease of cleaning where the component supplier or element manufacturer reports the contaminant removal efficiency for semi-volatile organic compounds, heavy metals, and bacterial as specified in 8.X, Contamination Removal Efficiency Removal Tests.

7.4.X

Helmet ear cover materials, suspension materials, and retention system materials shall be evaluated for ease of cleaning where the component supplier reports the contaminant removal efficiency for semi-volatile organic compounds, heavy metals, and bacterial as specified in 8.X, Contamination Removal Efficiency Removal Tests.

7.7.X

Glove shells, moisture barriers, linings, and wristlets shall be evaluated for ease of cleaning where the component supplier reports the contaminant removal efficiency for semi-volatile organic compounds, heavy metals, and bacterial as specified in 8.X, Contamination Removal Efficiency Removal Tests.

7.10.X

Footwear composite materials, including but not limited to exterior layers, barrier layers, and linings shall be evaluated for ease of cleaning where the component supplier reports the contaminant removal efficiency for semi-volatile organic compounds, heavy metals, and bacterial as specified in 8.X, Contamination Removal Efficiency Removal Tests.

7.13.X

Hood materials, including but not limited to knit or woven textile layers and the particulate blocking layer shall be evaluated for ease of cleaning where the component supplier reports the contaminant removal efficiency for semi-volatile organic compounds, heavy metals, and bacterial as specified in 8.X, Contamination Removal Efficiency Removal Tests.

8.X Contamination Removal Efficiency Removal Tests.

8.X.1 Application

List materials by protective element

8.X.2 Sample Preparation

Reference applicable portions of NFPA 1851, Sections 12.4 and 12.5

Base laundering on A.7.3.9(5) for garments, helmet ear covers, gloves, and hoods; footwear to be determined.

8.X.3 Semi-volatile Organic Compound Contamination Removal Test.

Reference NFPA 1851, Sections 12.6 with modifications

8.X.4 Heavy Metal Contamination Removal Test.

Reference NFPA 1851, Sections 12.7 with modifications

8.X.5 Bacterial Contamination Removal Test.

Reference NFPA 1851, Sections 12.8 with modifications

8.X.6 Report.

Statement of Problem and Substantiation for Public Input

The ability for general cleaning to remove contaminants from gear is important for minimizing secondary sources of contamination to firefighters. The proposed requirements are based on procedures already established in NFPA 1851 but will use the default washer/extractor procedures that provided in the Annex of NFPA 1851 to assess cleaning of garment-like elements. Further adaptations of test requirements are expected for different elements as research information is gathered from work under a DHS Grant being conducted by the Fire Protection Research Foundation.

Submitter Information Verification

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Submittal Date: Wed Nov 10 17:43:40 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-208-NFPA 1970-2022](#)

Statement: The ability for general cleaning to remove contaminants from gear is important for minimizing secondary sources of contamination to firefighters. The proposed requirements are based on procedures already established in NFPA 1851 but will use the default washer/extractor procedures that provided in the Annex of NFPA 1851 to assess cleaning of garment-like elements. Further adaptations of test requirements are expected for different elements as research information is gathered from work under a DHS Grant being conducted by the Fire Protection Research Foundation. These requirements are intended only for initial certification of materials for which testing is applied.



Public Input No. 336-NFPA 1970-2021 [Global Input]

PUBLIC INPUT TO ADDRESS SHELL REPELLENCY FOR PROTECTIVE GARMENT, HELMET EAR COVER, GLOVE, AND FOOTWEAR SHELL MATERIALS

8.X Liquid Repellency Test.

8.X.1 Application

This test shall apply to garment outer shells, helmet ear cover outer layer materials, glove shell materials, and footwear outer layers.

8.X.2 Sample Preparation

8.X.2.1 Samples shall be at least measure at least 225 mm wide (9 in.) by 356 mm (14 in.) wide.

8.X.2.2 For components that are part of constructed products, facsimile samples representative of the material or layer of the element to be tested shall be permitted.

8.X.2.3 Samples shall be conditioned as specified in ###.

8.X.3 Specimen

8.X.3.1 Specimens shall be sized as specified in *ISO 6530, Protective clothing – Protection against liquid chemicals – Test method for resistance of materials to penetration by liquids*.

8.X.3.2 A minimum of six specimens shall be tested.

8.X.4 Apparatus. The test apparatus and related equipment specified in ISO 6530 shall be used.

8.X.5 Procedure.

8.X.5.1 Specimens shall be tested as specified in ISO 6530 against diesel fuel with the measurement of the index of repellency and index of absorption.

8.X.5.2 Within 12 hours, -0, +2 hours of ISO 6530 testing, diesel fuel contaminated specimens shall be subject to washing as specified in 8.1.X

8.X.5.3 A 75 mm (3 in.) by 305 mm (12 in.) specimen shall be removed from the washed specimen and subjected to flame resistance testing as specified in 8.3.

8.X.6 Report.

8.X.6.1 Both the index of penetration and the index of repellency shall be reported for each specimen as well as the index averages for each sample.

8.X.6.2 The flame resistance results as specified in 8.3 shall be reported.

8.X.7 Interpretation. The average index of repellency shall be used to determine pass or fail performance.

Statement of Problem and Substantiation for Public Input

The proposed test method is intended to address the impact of a product becoming contaminated with a flammable substance and its ability to not create a hazard from residual contaminant being present. Performance criteria are needed to support the implementation of this test method. Adaptation of some test requirements may be necessary to support its use with different protective elements.

Submitter Information Verification

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Submittal Date: Wed Nov 10 17:52:21 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-207-NFPA 1970-2022](#)

Statement: The proposed performance requirement and test method are intended to address the impact of a product (garment outer shell) becoming contaminated with a flammable substance and its ability to not create a hazard from residual contaminant being present following a single laundering using a standardized cleaning method. In this test method, diesel fuel has been selected as the challenge fuel mixture and exposure is conducted using a standardized runoff test, which is used to measure the level of fuel mixture repellency, penetration through the outer shell material, and absorption in the outer shell material. Diesel fuel samples are then subjected to cleaning after which a smaller specimen is cut from the cleaned sample for performing flame resistance testing. Flame resistance testing is then performed on the cleaned specimen where afterflame is used to determine compliance. Additional work is expected following first revision to further support the use of this test method and determine its applicability to other protective elements.



Public Input No. 337-NFPA 1970-2021 [Global Input]

Proposed change to NFPA 1971 Design Requirements for Protective Hoods

This document is a statement of intent to install new design requirements for protective hoods in the National Fire Protection Agency's (NFPA) 1971 Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting.

Design requirements for protective hoods are specified in section 6.13 Protective Hood Interface Component Design Requirements for Both Ensembles. Within this section the specified coverage and fitment of protective hoods is achieved by using an ISO size J headform (6.13.5). Hoods integrated into the protective coat are not required to meet this specification (6.13.3.1). Currently, this requirement is significantly limited in its application to a single head size. Additionally, this requirement precludes the proper measurement of hood interface fitment over a SCBA respirator face piece and does not specify hood face opening size or coverage requirements. In the case of hoods designed to interface with a specific SCBA face piece, the outer edge of the hood is required to overlap the SCBA face piece by no less than 13 mm (0.5 in) (6.13.6.2). As the initial requirement for coverage uses a single size headform and does not include any specification of coverage around the face opening; it is the purpose of this work to propose a change to the existing design requirement 6.13.5 and 6.13.5.1 to include both multiple sized headforms and a measurement of hood face opening coverage using the reference plane specified in 6.13.5.1 (Seen in figure 8.16.4.1 below).

6.13.5 In order to label or otherwise represent a protective hood as compliant with the requirements of this standard, the manufacturer shall provide protective hoods in the following sizes:

- (1) Small
- (2) Medium
- (3) Large

6.13.5.1 Hoods shall be donned properly, in accordance with the manufacturer's instructions for wearing, on the respective ISO sized Small, Medium, or Large headform.

6.13.5.2 In this position, the hood shall provide full coverage above the reference plane on each side measured downward from the reference plane at the coronal plane of 225 mm (9 in.), shall provide a minimum coverage in the back measured downward from the reference plane at the rear midsagittal plane of 330 mm (13 in.), and shall provide a minimum coverage in the front measured downward from the reference plane at the front midsagittal plane, including the face opening, or 305 mm (12 in.).

6.13.5.3 In this position, the hood shall provide a minimum full coverage around the circumference of the reference plane specified in Table 6.13.5.3.

Table 6.13.5.3 Minimum Coverage

Size	Minimum Coverage
Small	400 mm (15.7 in.)
Medium	420 mm (16.5 in.)
Large	440 mm (17.3 in.)

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
New_Hood_Method.docx	full text document with images and charts	

Statement of Problem and Substantiation for Public Input

Substantiation

The addition of a specification for minimum coverage along the reference plane aims to address the poor and inadequate overlap of the protective hood to the SCBA respirator face piece. While hoods designed to interface with specific SCBA face pieces are required to overlap the face piece a minimum of 13 mm (0.5 in.), no such requirement exists for "universal fit" hoods. Additionally, the use of the ISO size J headform fails to account for the larger coverage of the reference plane needed to ensure proper overlap onto the SCBA face piece. By using the reference plane already

specified in the existing standard manufactures shall be able to identify the adequate coverage each hood provides and size hoods appropriately.

To further explore the differences in fitment, 7 different model hoods were fitted to the small, medium, and large ISO headforms and measured for their reference plane coverage. A comparison of these measurement can be seen in the table below. Notably, hoods #1 and #2 had the poorest reference plane measurement across all tested combinations. With these measurements, hoods #3-#7 would meet the new standardized sizing.

Hood	Small Headform/SCBA	Medium Headform/SCBA	Large Headform/SCBA
1	350	360	400
2	380	395	410
3	430	445	460
4	415	435	450
5	415	435	460
6	420	420	440
7	445	460	480

Using these same hoods, headforms with appropriately sized respirators were photographed to show differences in fitment. These images, taken from the front, left, and right sides were able to clearly identify the differences in coverage. Seen below, these images are structure from the small headform (green) and respirator, to the medium headform (blue) and respirator, to the large headform (red) and respirator. Hoods #1 and #2 that did not meet requirement clearly show lesser coverage than the other hoods tested. While the fitment of each hood varied, the notable difference in hoods #3 - #7 were minimal.

Submitter Information Verification

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Submittal Date: Wed Nov 10 19:16:31 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-51-NFPA 1970-2022

Statement: Design requirements for protective hoods are specified in section 6.13. Within this section the specified coverage and fitment of protective hoods is achieved by using an ISO size J headform (6.13.5). Hoods integrated into the protective coat are not required to meet this specification (6.13.3.1). Currently, this requirement is significantly limited in its application to a single head size. Additionally, this requirement precludes the proper measurement of hood interface fitment over a SCBA respirator face piece and does not specify hood face opening size or coverage requirements. In the case of hoods designed to interface with a specific SCBA face piece, the outer edge of the hood is required to overlap the SCBA face piece by no less than 13 mm (0.5 in) (6.13.6.2). As the initial requirement for coverage uses a single size headform and does not include any specification of coverage around the face opening, it is the purpose of this work to change the existing design requirements in 6.13.5 and 6.13.5.1 to include both multiple sized headforms and a measurement of hood face opening coverage using the reference plane specified in 6.13.5.1.

The addition of a specification for minimum coverage along the reference plane aims to address the poor and inadequate overlap of the protective hood to the SCBA respirator face piece. While hoods designed to interface with specific SCBA face pieces are required to overlap the face piece a minimum of 13 mm (0.5 in.), no such requirement exists for "universal fit" hoods. Additionally, the use of the ISO size J headform fails to account for the larger coverage of the reference plane needed to ensure proper overlap onto the SCBA face piece. By using the reference plane already specified in the existing standard manufactures shall be able to identify the adequate coverage each hood provides and size hoods appropriately. To further explore the differences in fitment, 7 different model hoods were fitted to the small, medium, and large ISO headforms and measured for their reference plane coverage. A comparison of these measurement can be seen in the table below. Notably, hoods #1 and #2 had the poorest reference plane measurement across all tested combinations. With these measurements, hoods #3-#7 would meet the new standardized sizing.

Hood Small Headform/SCBA Medium Headform/SCBA Large Headform/SCBA

1 350mm 360mm 400mm

2 380mm 395mm 410mm

3 430mm 445mm 460mm

4 415mm 435mm 450mm

5 415mm 435mm 460mm

6 420mm 420mm 440mm

7 445mm 460mm 480mm

Using these same hoods, headforms with appropriately sized respirators were photographed to show differences in fitment. These images, taken from the front, left, and right sides were able to clearly identify the differences in coverage. Seen below, these images are structure from the small headform (green) and respirator, to the medium headform (blue) and respirator, to the large headform (red) and respirator. Hoods #1 and #2 that did not meet requirement clearly show lesser coverage than the other hoods tested. While the fitment of each hood varied, the notable difference in hoods #3 - #7 were minimal.

This first revision represents an identified process by which sizing requirements could be mandated for these products, further forcing other requirements related to performance. The NFPA 1971 committee deemed that it was important to address the sizing with the influx of particulate hoods, there is a need to regulate sizing to ensure regular fit for particulate hoods. Preliminary research findings from North Carolina State University have shown that particulate protection efficiency and physiological regulation is directly related to proper sizing/fit and should be addressed due to the differences in fit qualities based on differences in particulate blocking composites used in hoods. The relative fit of a hood to available respirator equipment headforms is one possible approach. Another approach is to adopt a standardized measurement system such as the use of a half-head measurement that has been found useful for characterizing size and fit.

For this proposed change, manufacturers are permitted to have whatever number of sizes that are unique to their materials, design, and manufacturing process so long as the respective number of sizes fully accommodate each of the five different ISO 169000-5 headforms.



Public Input No. 338-NFPA 1970-2021 [Global Input]

Reorganize and Group Tests by Category for NFPA 1971

Reorganize the Chapter 8 test methods by relevant category to put them into a more logical order and to permit future changes in deleting and adding new test method.

Example:

8.1 Sample Preparation Procedures

[current listed procedures]

8.2 Thermal Hazard Test Methods

8.2.1 Flame Resistance Test 1 (8.2)

8.2.2 Flame Resistance Test 2 (8.3)

8.2.3 Flame Resistance Test 3 (8.4)

8.2.4 Flame Resistance Test 4 (8.5)

8.2.5 Heat and Thermal Resistance Test (8.6)

8.2.6 Conductive Heat Resistance Test 1 (8.7)

8.2.7 Conductive Heat Resistance Test 2 (8.8)

8.2.8 Conductive Heat Resistance Test 3 (8.60)

8.2.9 Conductive and Compressive Heat Resistance Test (8.51)

8.2.10 Radiant Heat Resistance Test 1 (8.9)

8.2.11 Radiant Heat Resistance Test 2 (8.61)

8.2.12 Radiant Heat Resistance Test 3 (8.53)

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Statement of Problem and Substantiation for Public Input

The test methods were originally in order when the garment elements were integrated with other protective elements. This approach has been used in NFPA 1990 and provides a more logical organization of test methods and better allows users of the standard to compare methods for similar properties among different elements.

Submitter Information Verification

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Organization: International Personnel Protection, Inc.

Street Address:

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Zip:

Submission Date: Wed Nov 10 19:47:02 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: The technical committee agrees that it would benefit document users and the committee if the test methods

were presented in a logical order. Document users will be able to more easily compare methods for different elements for similar properties. The technical committee will be able to process future test method additions and deletions more effectively. This work will be completed to be processed during Second Draft. This process has been successfully implemented by NFPA 1990.



Public Input No. 346-NFPA 1970-2021 [Global Input]

Global for Protective Gloves in NFPA 1971

Add an optional breathability requirement for full gloves with the test method to be determined.

Statement of Problem and Substantiation for Public Input

Breathability of gloves can be an important feature to minimize hand stress and provide for increased comfort. (FAE-SPF)

Submitter Information Verification

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Submittal Date: Thu Nov 11 19:36:56 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-92-NFPA 1970-2022

Statement: The hands are considered the radiator of the human body. It has a large amount of blood flow and a large surface area for heat to be lost in a small space. They (along with the foot) contain more sweat glands than any other body part. With that I think that it is import to make sure that gloves worn by firefighters are breathable to help with heat stress. To understand if changing the breathability of a glove would change the physiological performance of firefighter we ran a few virtual physiological models. In this model we ran a work/rest cycle for ~2 hours. We also used data from a common fire suit wearing a pair of breathable gloves. Then we simply increased the evaporative resistance of the glove to simulate an impermeable glove to see if it would change the core temperature or the skin temperature. When looking at results in a mild condition (25oC, 65%RH) not much difference was seen between a breathable glove and one that was impermeable when looking at whole body outputs such as the core or the mean skin temperature. However, the skin temperature of the hand was about 3oC difference between the breathable glove and the impermeable glove at the end of the simulation. When looking at results in hotter conditions (35oC, 40%RH), we observed a 0.1oC difference in core temperature and saw a 1.4oC difference in the hand temperature.



Public Input No. 347-NFPA 1970-2021 [Global Input]

Global for Protective Helmets in NFPA 1971

Add a definition for Helmet Positioning Index (HPI) and provide an annex section for how it is supposed to be set by the manufacturer in addition to how the index is used for testing helmets in this standard.

Require that the HPI be recorded for each test where its use is specified and include a photograph of the helmet set up as part of the test report for all testing in which the HPI is used.

Statement of Problem and Substantiation for Public Input

There is no information for what the HPI really is and how it is applied within NFPA 1971 for helmet testing. (FAE-SPF)

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Submittal Date: Thu Nov 11 19:42:31 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-72-NFPA 1970-2022](#)

Statement: Section 8.1.13 already exists to how the helmet positioning index (HPI) is defined in terms of the way the helmet is positioned on the headform. Nevertheless, additional changes have been made to ensure that the same is used for each test where helmet positioning on a headform is applied, for the manufacturer to document the basis of their HPI, and for the HPI to be documents as part of the report for any test where it is used.



Public Input No. 348-NFPA 1970-2021 [Global Input]

Global for Protective Footwear in NFPA 1971 (See attachment for Images)

Proposed changes for footwear should be considered for:

1. Allowing adjustment of the footwear dimensions to a lower height for certain sizes
2. Implementing tests for exterior layer water absorption based on ASTM methodology, drying time, and breathability.
3. Transforming radiant heat test 1 from a full footwear test to a composite based test.
4. Providing several clarifications for improving the heat and shrinkage resistance test as applied to footwear as specified in individual paragraphs within 8.6.14 as follows:
 - 8.6.14.3 Filled to capacity. It should be added if the boot has pull-up holes that fully penetrate the footwear from outside to inside (wording taken from 6.10.3.3) then these holes shall be closed off with heat tape or other means so the boot can be filled with beads to full capacity.
 - 8.6.14.3 Any closures shall be fastened. The top of the footwear should be filled and left it open.
 - 8.6.14.4 Shall be positioned so that it is level with the horizontal centerline. The exact technique for supporting the boot should be specified. A rack is preferred over suspending the boots.
 - 8.6.14.9 Footwear Separation. Separation within 1" of the top line of the boot should be excluded.
 - 8.6.14.11(c) Has a means of securing the footwear during flexing. This test method should also state that the means of securing should not damage the boot in any way.
 - 8.6.14.13 The measurements shall be made on the interior and transferred to the exterior. This approach is nearly impossible to be accurate. The below method can be employed to more accurately establish the test line.
 - 8.6.14.13 Plain white paper toweling shall be placed inside. The alternative of a "watermarkable inflatable foot" form should be permitted.
 - 8.6.14.15 The appearance of any liquid on the removed paper toweling shall be recorded and reported. An indication of the general area should also be given. Example: Top line (suggesting wicking) or vamp (pin hole).

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1970_Global_PI348.docx		

Statement of Problem and Substantiation for Public Input

No NFPA 1971 task group was convened to address footwear requirements. Many tests for footwear need to be reexamined and improved where necessary. (FAE-SPF)

Submitter Information Verification

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Submittal Date: Thu Nov 11 19:57:55 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-95-NFPA 1970-2022](#)

Statement: Currently, regardless of the wearer' leg length or stature, all footwear is required to have the same minimum height that may be cumbersome and hobbling for shorter firefighters. The committee recognizes there should be some minimum height that is suitable for all firefighters and the proposed changes may not adequately address those concerns. Further investigation should be undertaken to determine the suitability of the newly proposed minimum heights and their allowance across the entire spectrum of the firefighter population. This investigation should include the proper amount of overlap between the footwear and the pants. One of the proposed changes allows for a graduation of height based on the size of the footwear. Another change references a more precise method by which the height of the footwear is determined along with the height of the moisture protection, which may be in the form of an interior layer that cannot be readily observed. To address the latter change, a new section with Chapter 8 has been proposed.

A new paragraph 6.10.3.4 clarifies that thermal and physical protection is not required to be continuous in the gusset. Footwear test methods that test for thermal and physical protection (Conductive Heat 1, Cut Resistance, Puncture Resistance, and Radiant Heat Resistance) require composites from all areas of the boot except for the gusset.



Public Input No. 51-NFPA 1970-2021 [Global Input]

U.S. Department of Defense Publication A-A-55126B has been updated to A-A-55126C so may I request that all references to A-A-55126B be changes to A-A-55126C?

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_50_C_Cavanaugh.pdf	1971_PI_50_C.Cavanaugh	

Statement of Problem and Substantiation for Public Input

US Department of Defense Publication A-A-55126 has been updated from revision "B" to revision "C" and we request that NFPA 1971 have all references to A-A-55126B changed to A-A-55126C. Velcro USA, Inc. manufactures hook and loop fasteners that are certified by Underwriters Laboratory to NFPA 1971. NFPA 1971 requires specific test methods for break, peel and shear which are referenced in A-A-55126. The break test method was changed from ASTM 5034 to ASTM 5035 in revision "C" of A-A-55126 and this has an immediate impact on the testing performed by UL for our certification. We would like to have the updated break test method performed on our material but UL will not change the test method until the reference to A-A-55126 is changed from "B" to "C" in NFPA 1971.

Submitter Information Verification

Submitter Full Name: Catherine Cavanaugh
Organization: Velcro USA Inc
Street Address:
City:
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Submittal Date: Thu Aug 19 13:34:48 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-280-NFPA 1970-2022](#)

Statement: The referenced publications have been updated to reflect publications added or removed during the revision process as well as publications that have been revised by other organizations.



Public Input No. 60-NFPA 1970-2021 [Global Input]

Please see attachment for clarity in Tables and to view figures (A) Lsc and (B) Safetystitch w/two rows

Section 7.1.13

- **Purpose of Proposal:** The purpose of this proposal is to introduce data that supports raising the current sewn seam strength threshold requirement for the three categories of seams used to assemble a structural firefighter garment. The current requirements for the following types of seam were established in 1985: Major 'A' seam 670N; Major 'B' seam 450N; Minor seam 180N.
- (1) Data introduced in this proposal, and discussed later in Section 7.2.5, show that the break strength performance characteristics of the fabrics currently being used to manufacture 1971 structural garments have increased. The increase in break strength, ranges 100% to 400%, greater than the fabrics used 35 years ago. This public input proposes that performance improvements made in fabric development, from 100% to 400% higher, can be complemented by using a stronger sewing thread which delivers higher sewn seam strength performance than what was previously available.
 - (2) Despite significant improvements in sewing thread technology, there's been no increase in performance requirements for seam strength.

***PROPOSAL:**

- **Raise the minimum Major 'A' Seam strength to a requirement between 835N to 900N from the current requirement established in 1986 of 670N. This represents an increase in seam strength from 25% to 35%.**
- **Raise the minimum Major 'B' Seam strength to a requirement between 415N to 450N from the current requirement established in 1986 of 335N. This represents an increase in seam strength from 25% to 35%.**
- **Raise the minimum for Minor Seam strength to a requirement between 225N to 250N from the current requirement established in 1986 of 180N. This represents an increase in seam strength from 25% to 35%.**

Substantiation for Proposal

(a) These proposals help to confirm how the improved performance characteristics that fabric producers have made since 1986, and which are discussed in a Public Input for Section 7.2.5, can be combined with a stronger sewing thread, that will demonstrate higher seam break strength performance, both as a new garment and after multiple washings by an ISP.

Preliminary data from a wash durability study show that after 35 washings, the seam strength of Major 'A' seam is 25% greater than the current minimum requirement of 670N for a new garment.

(b) A review of fabric manufacturers' published data, discussed in Public Input for Section 7.2.5, show that the currently available fabrics being used are significantly stronger than fabric that was available in 1986, when the current seam strength performance requirements were established.

(c) The improvements made in sewing threads since 1986, support raising the Major 'A'; Major 'B'; and Minor seam strength performance, so that the assembled garments can meet the proposed thresholds in this Public Input.

(d) A review of the following data show how using TYPE II sewing threads can result in higher seam strength values for Major 'A' seams, Major 'B' seams, and Minor seams.

The following charts show how, increased break strengths of the TYPE II **Variegated Length Long Staple (VLLS), High Performance aramid sewing threads will mean an increase in sewn seam strength performance. This increase in performance will produce sewn seam strength that ranges from 25% to 35% stronger than the TYPE I* sewing thread that has been used since 1986.

TYPE I, Short Staple Meta-Aramid Sewing Thread

Thread

TYPE II, High Performance VLLS Meta-Aramid

NORMAL PERFORMANCE [1986 to Present]

Tex Size	Nominal Break Strength
Tex 90 - 100	6.0 lbf (26N)

HIGH PERFORMANCE [1995 to Present]

Tex Size	Nominal Break Strength
Tex 90	8.5 lbf (38N)

* The designator of TYPE I *Normal Performance and TYPE II **High Performance are used in Federal Standard A-A-55217 through March, 2011)

1

The following table shows the formula used in garment industry to calculate an estimated sewn seam strength

<u>TYPE</u> <u>TEX SIZE</u>	<u>AVG</u> <u>TOP/BOTTOM</u> <u>BREAK</u> <u>STRENGTH</u>	X	<u>STITCHES</u> <u>PER INCH</u>	X	<u>STITCH TYPE</u> <u>MULTIPLYER</u>	X	<u>ROWS OF</u> <u>STITCHING</u>	=	<u>ESTIMATED</u> <u>SEAM</u> <u>STRENGTH</u>	<u>APPROXIMATE</u> <u>SEAM STRENGTH</u> <u>IMPROVEMENT</u>
TYPE I TEX 90	26N	X	8	X	1.6	X	2	=	665N (150 lbf)	
TYPE II TEX 90	38N	X	8	X	1.6	X	2	=	970N (215 lbf)	+

FORMULA: *Average break strength of top and bottom sewing threads X stitches per inch X stitch type multiplier [1.5 or 1.6] stitching multiplier (for fabric assemblies used to construct a Major ‘A’ seam) = Estimated seam strength.*

Additional Substantiation

(1) Background

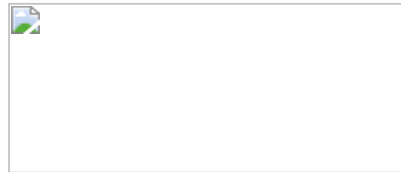
In 1985 representatives from two thread suppliers** co-sponsored the seam strength study used to establish the performance requirements for Major 'A' Seams, Major 'B' Seams, and Minor Seams that would be stipulated in the 1988 Edition of NFPA 1971.

The data learned from the 1985 study supported establishing the following 3 levels of performance for 3 categories of seams:

Major 'A' Seam	670N (150 lbf)	✗ Failure exposes wearer to immediate danger
Major 'B' Seam	330N (75 lbf)	✗ Failure reduces protection of garment by exposing underlayer
Minor Seam	180N (40 lbf)	✗ All other remaining seams

(2) The co-sponsors of the 1985 study acknowledged that the performance thresholds for seam strength for each category of seam (670N; 330N; 180N) would be adequate for the NOMEX® fabric that was being sold in 1986 to manufacture structural firefighter garments.

(3) The performance requirement in Section 7.1.13 of the current edition of NFPA 1971 (670N) is the same as it was in the 1988 Edition. The proposed new seam strength threshold, between 835N to 900N, would be used as the performance requirement for Major 'A' Seams that are assembled when using either of these Major 'A' constructions:



(A) LSc-2

(B) Safetystitch w/two rows

(4) As illustrated, the two Major 'A' seam assembly configurations, shown above as (A) and (B), create a multilayer fabric assembly – from 3 to 4 layers. The stronger sewing thread combined with the higher break strength fabrics discussed in the 2017/2018 Seam Strength Study can justify removing Section 7.1.13.2 from the NFPA 1971 Standard. This section indicates that if the fabric adjacent to the seam demonstrates a "seam slippage" failure, before reaching the expected seam strength performance requirement of 670N, it is not necessary to meet the seam strength threshold of 670N.

2017/2018 Seam Strength Study

(a) Data learned from a seam strength study in 2017/2018 show that when the higher break strength performance of the fabrics now being supplied, are assembled with higher break strength sewing threads, the sewn seam strength performance will be increased, from 25% up to 45% or higher, for every type of Major 'A', Major 'B', or Minor seam used to manufacture NFPA 1971 compliant garment.

The data which support these new requirements are available for presentation to the members of the technical committee.

** Phil Hicks from Threads USA, a sewing thread supplier that later merged with American & Efird, and

Additional Substantiation to Support Raising the Sewn Seam Strength
for NFPA 1971 Structural Firefighting Garments

Chart #1 below, titled ***CRITICAL OUTER SHELL SEWN SEAM STRENGTH PERFORMANCE CHARACTERISTICS***, is a compilation of fabric strength data taken from fabric producer literature. Data show that the fabrics currently being sold to garment manufacturers demonstrate performance threshold from approximately 100% to more than 400% stronger than the current threshold of 623N indicated in Section 19.2.2. The performance thresholds of these fabrics indicate that sewn seam strength can be increased from 25% to 35% or higher from the current requirement of 670N.

In addition to the fabric break strength, the chart also shows:

(1) How *fabric break strength* contributes to higher Major "A" sewn seam strength than the current requirement.

<u>BRAND SUPPLIER</u>	<u>FABRIC WEIGHT</u>	<u>WARP DIRECTION BREAK STRENGTH</u>	<u>ESTIMATED SEWN SEAM STRENGTH</u>	<u>ESTIMATED SEAM STRENGTH IMPROVEMENT</u>
		D5430	D1683	NFPA 1971 Requirement
(1) MILLENNIA TENCATE (NFPA Requirement)	7.5 osy	3248N 415% STRONGER THAN NFPA 1971 (623N)	1160N (AVG) (670N)	1160N 70% STRONGER THAN 670N Requirement
(2) PIONEER TENCATE (NFPA Requirement)	6.6 osy	1555N 150% STRONGER THAN NFPA 1971 (623N)	900N (AVG) (670N)	900N 34% STRONGER THAN 670N Requirement
(3) AGILITY TENCATE (NFPA Requirement)	6.6 osy	1597N 155% STRONGER THAN NFPA 1971 (623N)	984N (AVG) (670N)	984N 45% STRONGER THAN 670N Requirement
(4) ADVANCE TENCATE (NFPA Requirement)	7.2 osy	1290N 106% STRONGER THAN NFPA 1971 (623N)	835N (Est.) (670N)	835N 25% STRONGER THAN 670N Requirement
(5) PBI MAX Safety Components (NFPA Requirement)	7.0 osy	1881N 200% STRONGER THAN NFPA 1971 (623N)	925N (Est.) (670N)	925N 35% STRONGER THAN 670N Requirement
(6) ARMOR 7.0 Safety Components (NFPA Requirement)	7.0 osy	1900N 205% STRONGER THAN NFPA 1971 (623N)	930N (Est.) (670N)	930N 35% STRONGER THAN 670N Requirement

#1

CRITICAL OUTER SHELL ESTIMATED SEWN SEAM STRENGTH PERFORMANCE

CHARACTERISTICS

AVG: Data learned from (2017/2018) seam strength study

EST

seam strength calculation

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA_1971_Public_Input_Sec_7.1.13_V.Diaz.docx	1971_Sec_7.1.13_V.Diaz	

Statement of Problem and Substantiation for Public Input

See Attachment for full Substantiation including Tables and Figures.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
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[Public Input No. 61-NFPA 1970-2021 \[Global Input\]](#)

[Public Input No. 61-NFPA 1970-2021 \[Global Input\]](#)

Submitter Information Verification

Submitter Full Name: Vincent Diaz

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Submittal Date: Tue Sep 14 11:36:49 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: Feedback from ISPs and the fire service indicate there is no issue with seam strength – repairs are rarely, if ever, needed for seams alone. Increasing the minimum thread strength may result in a more design-restrictive environment with no apparent value to firefighters.



Public Input No. 61-NFPA 1970-2021 [Global Input]

Section 7.2.5

- **Purpose of Proposal:** To address the concept about having a minimum performance break strength requirement for fabrics used to construct NFPA 1971 garments that cannot meet other minimum performance requirements identified in the standards.

For Example:

Section 7.2.5 indicates that the fabric used to make NFPA 1971 garments must have a minimum fabric tensile break strength of 623N (140 lbf).

- Should it be expected that a fabric having a minimum tensile strength of 623N (140 lbf) would also be able to meet the other supplemental minimum performance and safety requirements:
 - Thermal Protective Performance (TPP) identified in Section 7.1.12?
 - Conductive and Compressive Heat Resistance identified in Section 7.1.9?
 - Total Heat Loss (THL) identified in Section 7.2.2?
 - Radiant Protection Performance (RPP) identified in Section 7.3.2?
 - Tear strength performance identified in Section 7.1.11?
 - Seam strength performance requirement identified in Section 7.1.13?

*** PROPOSAL:** Raise the minimum tensile break strength of outer shell fabric to 1200N from the current threshold of 623N. This increase is more representative of performance requirements of the fabrics currently being supplied, and which are needed to achieve both mechanical and protective characteristics related to safety and health.

[A] Substantiation

(1) The proposed increase in tensile strength will more accurately correlate to the fabrics currently being supplied, and which are able to meet the performance characteristics identified in Chapter 7 that are needed to be certified to NFPA 1971.

[B] Rationale

When a fabric has the minimum tensile strength requirement of 623N, identified in Section 7.2.5, and cannot meet all of the other performance requirements, firefighter safety can be jeopardized.

(1) A review of published data from the fabric producers show that the fabrics currently being used for NFPA 1971 certified garments demonstrate tensile strength that is from 2x to 5x stronger than the tensile strength requirement of 623N identified in NFPA 1971 Section 7.2.5.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA_1971_Public_Input_Sec_7.2.5_V.Diaz.docx	1971_Sec._7.2.5_V.Diaz	

Statement of Problem and Substantiation for Public Input

[A] Substantiation

(1) The proposed increase in tensile strength will more accurately correlate to the fabrics currently being supplied, and which are able to meet the performance characteristics identified in Chapter 7 that are needed to be certified to NFPA 1971.

[B] Rationale

When a fabric has the minimum tensile strength requirement of 623N, identified in Section 7.2.5, and cannot meet all of the other performance requirements, firefighter safety can be jeopardized.

(1) A review of published data from the fabric producers show that the fabrics currently being used for NFPA 1971 certified garments demonstrate tensile strength that is from 2x to 5x stronger than the tensile strength requirement of 623N identified in NFPA 1971 Section 7.2.5.

Related Public Inputs for This Document

Related Input**Relationship**

[Public Input No. 60-NFPA 1970-2021 \[Global Input\]](#)

[Public Input No. 60-NFPA 1970-2021 \[Global Input\]](#)

Submitter Information Verification

Submitter Full Name: Vincent Diaz

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Submittal Date: Tue Sep 14 11:54:16 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: Feedback from ISPs and the fire service indicate there is no issue with seam strength – repairs are rarely, if ever, needed for seams alone. Increasing the minimum thread strength may result in a more design-restrictive environment with no apparent value to firefighters.



Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]

1.1.1

This standard provides minimum design, performance, testing, and certification requirements for the following:

- (1) New structural and proximity firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components, which further include optional requirements for the following:

- (2) Particulate barrier protective hood interface components

- (3) Structural firefighting protective

ensembles

- (a) garments and proximity firefighting

ensembles

- (a) garments that provide limited protection from liquid and particulate hazards

- (4) New nonprimary work apparel and individual garments composing work apparel, which further include optional requirements for the following where such options are specified or claimed to be used in the construction of work apparel:

- (5) Flame resistance

- (6) Water resistance

- (7) Insect repellency

- (8) New compressed breathing air open-circuit self-contained breathing apparatus (SCBA) and compressed breathing air combination open-circuit self-contained breathing apparatus and supplier air respirators (SCBA/SARs)

- (9) New personal alert safety systems (PASS) for emergency services personnel that include stand-alone PASS, integrated PASS, and RF PASS in addition to PASS or RF PASS devices certified to an earlier edition of NFPA 1982 that incorporate parts, components, or software to meet the 2024 edition of NFPA 1970

Statement of Problem and Substantiation for Public Input

As part of the ensemble task group, this section is being revised to indicate that certification of particulate and liquid protective clothing shall be limited to garment's only.

At the time the current test method was introduced, there was an urgent need to address firefighter exposure to smoke particulate given concerns for increased rates of cancer among firefighters that may be attributed to direct exposure of skin to smoke particulates and gases as shown in:

(1) T. Fabian et al. (2010). "Firefighter Exposure to Smoke Particulates," Final Report DHS AFG Grant #EMW-2007-FP-02093, Project Number: 08CA31673;

(2) P. S. J. Lees (1995). "Combustion Products and Other Firefighter Exposures." *Occup Med: State of the Art Reviews* 10(4): 691-706;

(3) K. M. Kirk, M. Ridgway, Z. Splawinski and M. B. Logan. QFRS (2011). Fire fighter exposures to airborne contaminants during extinguishment of simulated residential room fires. Queensland, Australia: Queensland Fire and Rescue Service (QFRS) Scientific Branch, Research Report 2011-01.

The test was adapted from a similar application of particulate inward leakage used within NFPA 1994 for hazmat material and CBRN protective ensembles. However, there is a larger diversity of ensemble configurations for structural or proximity firefighting protective clothing and equipment that makes the current requirement completely impractical to apply for providing the intended benefit of improved protection from fireground particulate. In addition, the adopted pass/fail criteria create a much more rigorous requirement for firefighter protection than is warranted by known exposure data indicated from recent research. Changes have been made in the applicable chapters on administration, definitions, labeling and information, design requirements, performance requirements, and test methods to transition the optional certification from full ensembles to garments. This specific change allows for a practical application of the criteria for both enhanced particulate and liquid protection of garments to address firefighter exposure to smoke and other fireground hazards. The inward particle leakage performance criteria and test methodology have been adjusted to incorporate quantification of any

observed particulate found on the black indicator garment for comparison of those findings with a reasonable level of particulate exposure.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 126-NFPA 1970-2021	[Section No. A.4.1.1.3]
Public Input No. 127-NFPA 1970-2021	[Section No. 4.1.1.6]
Public Input No. 128-NFPA 1970-2021	[Section No. 4.1.2.2]
Public Input No. 129-NFPA 1970-2021	[Section No. 4.1.3.2]
Public Input No. 130-NFPA 1970-2021	[Section No. A.4.1.3.2]
Public Input No. 131-NFPA 1970-2021	[Sections 4.2.2.1, 4.2.2.2]
Public Input No. 132-NFPA 1970-2021	[Section No. 4.4.4.3]
Public Input No. 133-NFPA 1970-2021	[Section No. 4.5.2]
Public Input No. 134-NFPA 1970-2021	[Sections 5.2.1.1, 5.2.1.2]
Public Input No. 135-NFPA 1970-2021	[Sections 5.3.1.1, 5.3.1.2]
Public Input No. 136-NFPA 1970-2021	[Section No. 5.4.8]
Public Input No. 137-NFPA 1970-2021	[New Section after A.5.4.4]
Public Input No. 138-NFPA 1970-2021	[Section No. 6.19.1]
Public Input No. 139-NFPA 1970-2021	[Section No. 6.19.4]
Public Input No. 140-NFPA 1970-2021	[New Section after A.6.16.2]
Public Input No. 141-NFPA 1970-2021	[Section No. 6.19.7]
Public Input No. 142-NFPA 1970-2021	[Section No. 6.19.16]
Public Input No. 147-NFPA 1970-2021	[Section No. 7.20.1]
Public Input No. 148-NFPA 1970-2021	[Section No. 7.20.4]
Public Input No. 149-NFPA 1970-2021	[Section No. 8.48.1]
Public Input No. 150-NFPA 1970-2021	[Section No. 8.48.3.1]
Public Input No. 151-NFPA 1970-2021	[Section No. 8.48.13]
Public Input No. 152-NFPA 1970-2021	[New Section after A.8.48.7]
Public Input No. 153-NFPA 1970-2021	[Section No. 8.66]

Submitter Information Verification

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Committee: FAE-SPF

Committee Statement

Resolution: [FR-266-NFPA 1970-2022](#)

Statement: For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Given the new consolidation and changes to chapters common chapters and content, it is important to explain what the consolidation will accomplish and what it means for the fire service.



Public Input No. 307-NFPA 1970-2021 [Section No. 1.1.1]

1.1.1*

This standard provides minimum design, performance, testing, and certification requirements for the following:

- (1) New structural and proximity firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components, which further include optional requirements for the following:
 - (2) Particulate barrier protective hood interface components
 - (3) Structural firefighting protective ensembles and proximity firefighting ensembles that provide limited protection from liquid and particulate hazards
- (4) New nonprimary work apparel and individual garments composing work apparel, which further include optional requirements for the following where such options are specified or claimed to be used in the construction of work apparel:
 - (5) Flame resistance
 - (6) Water resistance
 - (7) Insect repellency
- (8) New compressed breathing air open-circuit self-contained breathing apparatus (SCBA) and compressed breathing air combination open-circuit self-contained breathing apparatus and supplier air respirators (SCBA/SARs)
- (9) New personal alert safety systems (PASS) for emergency services personnel that include stand-alone PASS, integrated PASS, and RF PASS in addition to PASS or RF PASS devices certified to an earlier edition of NFPA 1982 that incorporate parts, components, or software to meet the 2024 edition of NFPA 1970

An annex section for this paragraph should be created that discussed the purpose of consolidating the four standards. this annex language should address that the consolidation. Suggested language is.

A.1.1.1 This first consolidation of NFPA 1971, NFPA 1975, NFPA 1981, and NFPA 1982 is an attempt to put all relative ensemble specifications into one place for the benefit of end users. It further serves as the first step to begin a more comprehensive harmonization of terminology, certification, and other requirements for the entire ensemble (including clothing elements, SCBA, and wearable electronics) and to provide opportunities to address full system requirements that has not been possible where there were separate standards. In the first consolidated standard, relevant sections are provided sequential for each respective prior standard to allow for the continuing identification of product types associated with those standards to be referenced. Future consolidation efforts will look to provide more comprehensive attempts to further standardized requirements and test methodology for consistency across the entire protective ensemble.

Statement of Problem and Substantiation for Public Input

Given the new consolidation, I think some explanation is owed to the fire service for what will be accomplished in this new amalgamated standard and its future editions.

Submitter Information Verification

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Submittal Date: Wed Nov 10 10:27:47 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-266-NFPA 1970-2022](#)

Statement: For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Given the new consolidation and changes to chapters common chapters and content, it is important to explain what the consolidation will accomplish and what it means for the fire service.



Public Input No. 212-NFPA 1970-2021 [New Section after 1.2.2]

1.2.3*

This standard shall address optional, non-mandatory testing for full protective ensembles in different areas of overall systems performance as addressed in Annex H.

A.1.2.3

Annex H addresses ensemble attributes related to the integration and interoperability of multiple elements and includes specific test methods for evaluating full ensembles in terms of their protection levels, functionality, comfort, and other factors associated with ensemble integration and interoperability. Test methods are included that can be applied for purposes of research by research organization, demonstration of ensemble qualities by manufacturers by qualified laboratories, and for the assessment of full ensemble by end user organizations.

Statement of Problem and Substantiation for Public Input

The fire service is increasingly becoming aware that the different elements of clothing and equipment that make up their ensembles lack compatibilities and provide varying levels of performance. While NFPA standards address the specific design, performance, and testing requirements of the individual elements, there is the absence of full ensemble evaluations for assessing performance, function, and comfort for ensembles when integrated. This responsibility falls to individual fire departments and organizations but there are only a handful of test standardized test methods and few criteria to address how full ensembles should be designed, particularly for structural firefighting. In addition, the increasing use of electronics as part of protective ensembles has a significant impact on the end user in terms of their utility and should be addressed in the absence of specific standards.

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Submittal Date: Mon Nov 08 05:45:31 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-232-NFPA 1970-2022](#)

Statement: The fire service is increasingly becoming aware that the different elements of clothing and equipment that make up their ensembles lack compatibilities and provide varying levels of performance. While NFPA standards address the specific design, performance, and testing requirements of the individual elements, there is the absence of full ensemble evaluations for assessing performance, function, and comfort for ensembles when integrated. This responsibility falls to individual fire departments and organizations but there are only a handful of test standardized test methods and few criteria to address how full ensembles should be designed, particularly for structural firefighting. In addition, the increasing use of electronics as part of protective ensembles has a significant impact on the end user in terms of their utility and should be addressed in the absence of specific standards.



Public Input No. 68-NFPA 1970-2021 [Chapter 2]

Chapter 2 Referenced Publications

2.1 General.

The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1550, *Standard for Emergency Responder Health and Safety*, 2024 edition.

NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2020 edition.

NFPA 1852, *Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)*, 2019 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2018 edition.

NFPA 1972, *Helmets for Structural Fire Fighting*, 1992 edition. (withdrawn)

NFPA 1973, *Gloves for Structural Fire Fighting*, 1993 edition. (withdrawn)

NFPA 1974, *Protective Footwear for Structural Fire Fighting*, 1992 edition. (withdrawn)

NFPA 1976, *Standard on Protective Ensemble for Proximity Fire Fighting*, 2000 edition. (withdrawn)

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2013 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2018 edition.

NFPA 1983, *Standard on Life Safety Rope and Equipment for Emergency Services*, 2017 edition.

NFPA 1989, *Standard on Breathing Air Quality for Emergency Services Respiratory Protection*, 2019 edition.

2.3 Other Publications.

2.3.1 AATCC Publications.

American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

AATCC 35, *Water Resistance: Rain Test*, 2013.

AATCC 42, *Water Resistance: Impact Penetration Test*, 2013.

AATCC 42, *Water Resistance: Impact Penetration Test*, 2017.

AATCC 61, *Colorfastness to Laundering: Accelerated*, 2013.

AATCC 70, *Water Repellency — Tumble Jar Dynamic Absorption Test*, 2015.

AATCC 135, *Dimensional Changes of Fabrics after Home Laundering*, 2004.

AATCC 158, *Dimensional Changes on Dry-Cleaning in Perchloroethylene: Machine Method*, 2016.

2.3.2 ASA Publications.

Acoustical Society of America, Suite 300, 1305 Walt Whitman Road, Melville, NY 11747.

ANSI/ASA S1.4, *Specification for Sound Level Meters*, 1983, reaffirmed 2006.

ANSI/ASA S1.13, *Measurement of Sound Pressure Levels in Air*, 2005, reaffirmed 2010.

ANSI/ASA S3.2, *American National Standard Method for Measuring the Intelligibility of Speech over Communication Systems*, 2009, reaffirmed 2014.

2.3.3 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A666, *Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar*, 2015.

ASTM B16/B16M, *Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines*, 2010, reapproved 2015.

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, 2011.

ASTM B152/B152M, *Specification for Copper Sheet, Strip Plate, and Rolled Bar*, 2013.

ASTM D471, *Standard Test Method for Rubber Property—Effect of Liquids*, 2016.

ASTM D751, *Standard Test Methods for Coated Fabrics*, 2011.

ASTM D1003, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*, 2013.

ASTM D1683, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, 2011.

ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, 2017e1.

ASTM D1776/D1776M, *Standard Practice for Conditioning and Testing Textiles*, 2016.

ASTM D3359, *Standard Test Methods for Measuring Adhesion by Tape Test*, 2009 e2.

ASTM D3940, *Standard Test Method for Bursting Strength (Load) and Elongation of Sewn Seams of Knit or Woven Stretch Textile Fabrics*, 1983.

ASTM D4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, 2013.

ASTM D4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Test Method)*, 2012 e1.

ASTM D5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*, 2013.

ASTM D5169, *Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners*, 2015.

ASTM D5170, *Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners*, 2015.

ASTM D5587, *Standard Test Method for the Tearing Strength of Fabrics by Trapezoid Procedure*, 2015.

ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*, 2015.

ASTM D6775, *Standard Test Method for Breaking Strength and Elongation of Textile Webbing, Tape and Braided Material*, 2013.

ASTM D6797, *Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test*, 2015.

ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, 2016.

ASTM E162, *Standard Test Method for Surface Flammability of Materials Using Radiant Heat Energy Source*, 2015.

ASTM E809, *Standard Practice for Measuring Photometric Characteristics of Retroreflectors*, 2013.

ASTM E991, *Standard Practice for Color Measurement of Fluorescent Specimens Using the One-Monochromator Method*, 2011.

ASTM E1164, *Standard Practice for Obtaining Spectrometric Data for Object-Color Evaluation*, 2012.

ASTM E2152, *Standard Practice for Computing the Colors of Fluorescent Objects from Bispectral Photometric Data*, 2012.

ASTM E2153, *Standard Practice for Obtaining Bispectral Photometric Data for Evaluation of Fluorescent Color*, 2011.

ASTM F903, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Liquids*, 2010.

ASTM F1060, *Standard Test Method for Thermal Protective Performance of Materials for Protective Clothing for Hot Surface Contact*, 2008.

ASTM F1342/F1342M, *Standard Test Method for Protective Clothing Material Resistance to Puncture*, 2013 e1.

ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, 2016.

ASTM F1671/F1671M, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X-174 Bacteriophage Penetration as a Test System*, 2013.

ASTM F1790, *Test Methods for Measuring Cut Resistance of Materials Used in Protective Clothing*, 2005.

ASTM F1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, 2014.

ASTM F1939, *Standard Test Method for Radiant Heat Resistance of Flame Resistant Clothing Materials with Continuous Heating*, 2015.

ASTM F2010/F2010M, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand Dexterity Using a Modified Pegboard Test*, 2010.

ASTM F2299/F2299M, *Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres*, 2010.

ASTM F2412, *Standard Test Methods for Foot Protection*, 2011.

ASTM F2413, *Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear*, 2011.

ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy in Fire Fighter Protective Clothing Systems*, 2011.

ASTM F2894, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, 2014.

ASTM F2913, *Standard Test Method for Measuring the Coefficient of Friction for Evaluation of Slip Performance of Footwear and Test Surfaces/Flooring Using a Whole Shoe Tester*, 2011.

ASTM F2961, *Standard Test Method for Characterizing Gripping Performance of Gloves Using a Torque Meter*, 2015.

ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, 2013.

2.3.4 CENELEC Publications.

CENELEC, European Committee for Electrotechnical Standardization, CEN-CENELEC Management Centre, Avenue Marnix 17, B-1000, Brussels, Belgium.

BS EN 136, *Respiratory protective devices — Full face masks — Requirements, testing, marking*, 1998, Corrigendum, 2004.

2.3.5 CIE Publications.

US National Committee of the CIE, c/o Mr. Thomas M. Lemons, TLA — Lighting Consultants, Inc., 7 Pond Street, Salem, MA 01970-4819.

ISO/CIE 10526, *Colorimetric Illuminants*, 1999.

2.3.6 CSA Group Publications.

Canadian Standards Association, 178 Rexdale Blvd., Toronto, ON, Canada M9W 1R3.

CSA Z195, *Protective Footwear*, 2014.

2.3.7 EBU Publications.

EBU (European Broadcasting Union) Department of Technology & Innovation, L'Ancienne-Route 17A, Postal Box 45, 1218 Le Grand-Saconnex, Geneva, Switzerland.

EBU R 068, *Alignment level in digital audio production equipment and in digital audio recorders*, 2000.

2.3.8 FIA Publications.

Footwear Industries of America, 1420 K Street, NW, Suite 600, Washington, DC 20005.

FIA 1209, *Whole Shoe Flex*, 1984.

2.3.9 GSA Publications.

US General Services Administration, 1800 F Street, NW, Washington, DC 20405.

Federal Test Method Standard 191A, *Textile Test Methods*, 20 July 1978.

2.3.10 IEC Publications.

International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland.

IEC 60268-16, *Sound System Equipment — Part 16: Objective Rating of Speech Intelligibility by Speech Transmission Index*, 2011.

2.3.11 ISEA Publications.

International Safety Equipment Association, 1901 North Moore Street, Arlington, VA 22209-1762.

ANSI/ISEA 107, *American National Standard for High-Visibility Safety Apparel and Accessories*, 2015.

ANSI/ISEA Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices*, 2015.

2.3.12 ISO Publications.

International Organization for Standardization, ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.

ISO Guide 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, 1983.

ISO 4649, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*, 2010.

ISO 9001, *Quality management systems — Requirements*, 2008.

ISO 9001, *Quality management systems — Requirements*, 2015.

ISO 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*, 2004.

ISO/IEC 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*, 2004.

ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems*, 2011.

ISO 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems — Part 1: Requirements*, 2015.

ISO/IEC 17021-1, *Conformity assessment — Requirements for bodies providing audit and certification of management systems*, 2015.

ISO 17025, *General requirements for the competence of testing and calibration laboratories*, 2005.

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*, 2005, Technical Corrigendum, 2006.

ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes and services*, 2012.

ISO 17492, *Clothing for protection against heat and flame — Determination of heat transmission on exposure to both flame and radiant heat*, 2003.

ISO 17493, *Clothing and equipment for protection against heat — Test method for convective heat resistance using a hot air circulating oven*, 2000.

ISO/CIE 10526, *Calorimetric Illuminants*, 2007.

ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes, and services*, 2012.

IEC 61000-4-21, *Testing and measurement techniques — Reverberation chamber test methods*, 2011.

2.3.13 SAE Publications.

SAE International, Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE J211-1, *Instrumentation for Impact Test, Part 1 – Electronic Instrumentation*, 2014.

2.3.14 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous (Classified) Locations*, Sixth edition, 2002.

ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*, sixth edition, 2002.

2.3.15 US Department of Defense Publications.

Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.

A-A-55126B, *Commercial Item Description, Fastener Tapes, Hook and Loop, Synthetic*, 2006.

A-A-55634A, *Commercial Item Description, Zippers (Fasteners, Slide, Interlocking)*, March 23, 2004.

2.3.16 US Government Publications.

US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Statement of Standard for NIOSH CBRN SCBA Testing, 2002.

Title 29, Code of Federal Regulations, Part 1910.132, "Personal Protective Equipment: General Requirements," 1994.

Title 42, Code of Federal Regulations, Part 84, "Respiratory Protective Devices, Tests for Permissibility."

Title 47, Code of Federal Regulations, Subchapter A, General, Telecommunications, Chapter I, Federal Communications Commission, Part 15, Radio Frequency Devices.

2.3.17 US Military Publications.

US Army Developmental Test Command, ATTN: CSTE-DTC-TT-S, Aberdeen Proving Ground, MD 21005-5055.
Federal Specification CCC-C-419, *Cloth, Duck, Unbleached, Plied-Yarns, Army and Numbered*, 1985.

2.3.18 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

Test Operations Procedure (TOP) 10-2-022, *Chemical Vapor and Aerosol System-Level Testing of Chemical/Biological Protective Suits*, 2013.

US Department of Defense GL/PD 07-13C, *Purchase Description Coat, Army Combat Uniform*, US Army Natick Research, Development and Engineering Center, Attn: RDNS-WPW-C, Kansas Street, Natick, MA 01760-5019, 2011.

2.4 References for Extracts in Mandatory Sections.

NFPA 1801, *Standard on Thermal Imaging for the Fire Service*, 2021 edition.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1970_PROPOSED_CH_2_kl.docx	Revised Chapter 2 (entirety)	

Statement of Problem and Substantiation for Public Input

Several referenced publications require revision to title and/or publication date. The revised Chapter 2 provided in the Word document makes the necessary changes.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

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Submittal Date: Wed Sep 22 18:58:28 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-280-NFPA 1970-2022](#)

Statement: The referenced publications have been updated to reflect publications added or removed during the revision process as well as publications that have been revised by other organizations.



Public Input No. 40-NFPA 1970-2021 [Section No. 2.3.1]

2.3.1 AATCC Publications.

American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709.

AATCC 35, ~~Water Resistance: Rain Test~~, 2013.

AATCC 42, ~~Water Resistance: Impact Penetration Test~~, 2013.

AATCC 42, ~~Water Resistance: Impact Penetration Test~~, 2017.

AATCC 61, ~~Colorfastness to Laundering: Accelerated~~, 2013.

AATCC 70, ~~Water Repellency — Tumble Jar Dynamic Absorption Test~~, 2015.

AATCC 135, ~~Dimensional Changes of Fabrics after Home Laundering~~, 2004.

AATCC 158, ~~Dimensional Changes on Dry-Cleaning in Perchloroethylene: Machine Method~~, 2016.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1981_PI_9_TIA_LogNo_1419.pdf	1981_TIA_LogNo1419	
1981_TIA_Log_1419.pdf	1981_TIA_Log1419	

Statement of Problem and Substantiation for Public Input

Note: This Public Input originates from TIA 19-1, Log No. 1419 issued by the Standards Council July 17, 2019. Per the NFPA Regs., this TIA needs to be reconsidered for the Next Edition of the Document. The proposed amendment corrects an error that was made within the revision cycle of NFPA 1981. This error would eliminate washing machines used in the preconditioning procedures for Fabric heat and Fabric Flame testing that has been used for many years within the standard. This change reverts back to the previous edition which is also cited by many other standards within the project including NFPA 1971-2018.

Submitter Information Verification

Submitter Full Name: TC on FAE-RPE

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Submittal Date: Tue Aug 17 10:51:24 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-280-NFPA 1970-2022

Statement: The referenced publications have been updated to reflect publications added or removed during the revision process as well as publications that have been revised by other organizations.



Public Input No. 255-NFPA 1970-2021 [Section No. 2.3.3]

2.3.3 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A666, *Standard Specification for Annealed or Cold Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar*, 2015.

ASTM B16/B16M, *Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines*, 2010, reapproved 2015.

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, 2011.

ASTM B152/B152M, *Specification for Copper Sheet, Strip Plate, and Rolled Bar*, 2013.

ASTM D471, *Standard Test Method for Rubber Property—Effect of Liquids*, 2016.

ASTM D751, *Standard Test Methods for Coated Fabrics*, 2011.

ASTM D1003, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*, 2013.

ASTM D1683, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, 2011.

ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, 2017e1.

ASTM D1776/D1776M, *Standard Practice for Conditioning and Testing Textiles*, 2016.

ASTM D1835, *Standard Specification for Liquefied Petroleum (LP) Gases*, 2020.

ASTM D3359, *Standard Test Methods for Measuring Adhesion by Tape Test*, 2009 e2.

ASTM D3940, *Standard Test Method for Bursting Strength (Load) and Elongation of Sewn Seams of Knit or Woven Stretch Textile Fabrics*, 1983.

ASTM D4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, 2013.

ASTM D4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Test Method)*, 2012 e1.

ASTM D5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*, 2013.

ASTM D5169, *Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners*, 2015.

ASTM D5170, *Standard Test Method for Peel Strength (“T” Method) of Hook and Loop Touch Fasteners*, 2015.

ASTM D5587, *Standard Test Method for the Tearing Strength of Fabrics by Trapezoid Procedure*, 2015.

ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*, 2015.

ASTM D6775, *Standard Test Method for Breaking Strength and Elongation of Textile Webbing, Tape and Braided Material*, 2013.

ASTM D6797, *Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test*, 2015.

ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, 2016.

ASTM E162, *Standard Test Method for Surface Flammability of Materials Using Radiant Heat Energy Source*, 2015.

ASTM E809, *Standard Practice for Measuring Photometric Characteristics of Retroreflectors*, 2013.

ASTM E991, *Standard Practice for Color Measurement of Fluorescent Specimens Using the One-Monochromator Method*, 2011.

ASTM E1164, *Standard Practice for Obtaining Spectrometric Data for Object-Color Evaluation*, 2012.

ASTM E2152, *Standard Practice for Computing the Colors of Fluorescent Objects from Bispectral Photometric Data*, 2012.

ASTM E2153, *Standard Practice for Obtaining Bispectral Photometric Data for Evaluation of Fluorescent Color*, 2011.

ASTM F903, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Liquids*, 2010.

ASTM F1060, *Standard Test Method for Thermal Protective Performance of Materials for Protective Clothing for Hot Surface Contact*, 2008.

ASTM F1342/F1342M, *Standard Test Method for Protective Clothing Material Resistance to Puncture*, 2013 e1.

ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, 2016.

ASTM F1671/F1671M, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X-174 Bacteriophage Penetration as a Test System*, 2013.

ASTM F1790, *Test Methods for Measuring Cut Resistance of Materials Used in Protective Clothing*, 2005.

ASTM F1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, 2014.

ASTM F1939, *Standard Test Method for Radiant Heat Resistance of Flame Resistant Clothing Materials with Continuous Heating*, 2015.

ASTM F2010/F2010M, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand Dexterity Using a Modified Pegboard Test*, 2010.

ASTM F2299/F2299M, *Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres*, 2010.

ASTM F2412, *Standard Test Methods for Foot Protection*, 2011.

ASTM F2413, *Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear*, 2011.

ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy in Fire Fighter Protective Clothing Systems*, 2011.

ASTM F2894, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, 2014.

ASTM F2913, *Standard Test Method for Measuring the Coefficient of Friction for Evaluation of Slip Performance of Footwear and Test Surfaces/Flooring Using a Whole Shoe Tester*, 2011.

ASTM F2961, *Standard Test Method for Characterizing Gripping Performance of Gloves Using a Torque Meter*, 2015.

ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, 2013.

Statement of Problem and Substantiation for Public Input

PI 250 proposes a new Test Method, which references ASTM D1835. If PI 250 is incorporated into the First Draft, then PI 255 must accompany it to include the new referenced document.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]	PI-250 references this document.
Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]	

Submitter Information Verification

Submitter Full Name: Brian Shiels
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Submittal Date: Tue Nov 09 12:35:15 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-280-NFPA 1970-2022](#)

Statement: The referenced publications have been updated to reflect publications added or removed during the revision process as well as publications that have been revised by other organizations.



Public Input No. 4-NFPA 1970-2021 [New Section after 2.3.14]

2.3.14 UL Publications.

Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*, Sixth Edition, 2002.

ANSI/UL 121201, *Nonincendive Electric Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations*, 2017.

Statement of Problem and Substantiation for Public Input

(Submitted on behalf of the FAE-ELS HazLoc Harmonization Task Group)

Deletion of the existing 2.3.14 text is being proposed under PI #5, in conjunction with the addition of new/revised 2.3.14 text being proposed back again under this PI.

This two-step approach (instead of just simply revising the existing text of 2.3.14) is being proposed because the TerraView presentation of such a simple revision to the existing text is almost unreadable.

The new/revised 2.3.14 text being proposed under this PI contains a single corrected reference to UL 913, along with a new reference to UL 121201, with both being in accordance with the publication references under NFPA 1802 for RF/RSM devices.

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Committee Statement

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**Public Input No. 5-NFPA 1970-2021 [Section No. 2.3.14]****2.3.14 – UL Publications:**

~~Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.~~

~~UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous (Classified) Locations*, Sixth edition, 2002.~~

~~ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations*, sixth edition, 2002.~~

Statement of Problem and Substantiation for Public Input

(Submitted on behalf of the FAE-ELS HazLoc Harmonization Task Group)

Deletion of the existing 2.3.14 text is being proposed under this PI, in conjunction with the addition of new/revised 2.3.14 text being proposed back again under PI #4.

This two-step approach (instead of just simply revising the existing text of 2.3.14) is being proposed because the TerraView presentation of such a simple revision to the existing text is almost unreadable.

The new/revised 2.3.14 text being proposed under PI #4 contains a single corrected reference to UL 913, along with a new reference to UL 121201, with both being in accordance with the publication references under NFPA 1802 for RF/RSM devices.

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Public Input No. 50-NFPA 1970-2021 [Section No. 2.3.15]

2.3.15 US Department of Defense Publications.

Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.

A-A-55126B, *Commercial Item Description, Fastener Tapes, Hook and Loop, Synthetic*, 2006.

A-A-55634A ~~55634A~~, *Commercial Item Description, Zippers (Fasteners, Slide, Interlocking)*, ~~March 23~~ May 10, ~~2004~~ 2018.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_40_T_McCullough.pdf	1971_PI_40_T. McCullough	

Statement of Problem and Substantiation for Public Input

A-A-55634A has been updated with A-A-55634B.

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Public Input No. 274-NFPA 1970-2021 [Section No. 3.3]

3.3

—

General Definitions.

For the purposes of Chapters 9 through 12 of this standard, the terms defined in this section shall have the meanings stated unless modified by the mandatory requirements of this standard. Where terms are not defined herein, those terms shall have the ordinarily accepted meanings, or the meaning that the text implies. Terms used in the present tense shall include the past and future tense. Terms used in the masculine gender shall include female and neuter genders, terms used in the singular shall include the plural, and terms used in the plural shall include the singular.

3.3.1

—

Accessories (Accessory).

An item or items that could be attached to a certified product but are not necessary for the certified product to meet the requirements of the standard.

3.3.2

—

Alarm Signal.

An audible warning that is identifiable as an indication that an emergency services person is in need of assistance.

3.3.2.1

—

Evacuation Alarm.

An alarm initiated by a base station, transmitted to an RF PASS via an RF signal. The evacuation alarm warns emergency services personnel to evacuate the premises.

3.3.2.2

—

Loss-of-Signal Alarm.

A visual signal that is initiated automatically when the RF communication between a base station and RF PASS is lost

3.3.3

—

Arch.

The bottom curve of the foot from the heel to the ball.

3.3.4

—

Atmosphere-Supplying Respirator.

A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere and includes self-contained breathing apparatus (SCBA) and supplied air respirators (SAR). [See

also 3.3.

34

35 , Combination SCBA/SAR; 3.3.

174

180 , Self-Contained Breathing Apparatus (SCBA); and 3.3.

196

202 , Supplied Air Respirator (SAR).]

3.3.5

—

Barrier Hood.

See 3.3.

194

190 , Structural Firefighting Protective Barrier Hood.

3.3.6

—

Barrier Material.

The part of the composite that limits transfer from the face of the layer to the other side.

3.3.7

—

Basic Plane.

The anatomical plane that includes the superior rim of the external auditory meatus, the upper edge of the external openings of the ear, and the inferior margin of the orbit, which is the lowest point of the floor of the eye socket.

3.3.8

—

Belt.

An equipment item configured as a device that fastens around the waist only and is designated as a ladder belt or an escape belt.

3.3.9

—

Biological Terrorism Agents.

Liquid or particulate agents that can consist of biologically derived toxin or pathogen to inflict lethal or incapacitating casualties.

3.3.10 *

—

Bitrignon Coronal Arc.

The arc between the right and left trignon as measured over the top of the head in a plane perpendicular to the midsagittal plane.

3.3.11 *

—

Bitrignon Inion Arc.

The arc between trignon as measured over the inion.

3.3.12

—

Body Fluid–Borne Pathogen.

An infectious bacterium or virus carried in human, animal, or clinical body fluids, organs, or tissue.

3.3.13

—

Body Fluids.

Fluids that are produced by the body including, but not limited to, blood, semen, mucus, feces, urine, vaginal secretions, breast milk, amniotic fluid, cerebrospinal fluid, synovial fluid, and pericardial fluid.

3.3.14

—

Bootie.

A sock-like extension of the garment or suit leg that covers the entire foot.

3.3.15

—

Breathing Air.

See 3.3.

39

40 , Compressed Breathing Air.

3.3.16

—

Breathing Air Cylinder.

The pressure vessel or vessels that are an integral part of the SCBA and that contain the breathing gas supply; can be configured as a single cylinder or other pressure vessel, or as multiple cylinders or pressure vessels.

3.3.17

—

Breathing Air/Gas Container.

See 3.3.16 , Breathing Air Cylinder.

3.3.18

—

Brim.

A part of the shell of the helmet extending around the entire circumference of the helmet.

3.3.19

—

Brim Line.

A horizontal plane intersecting the point of the front opening of the helmet at the midsagittal plane.

3.3.20

—

Cargo Pockets.

Pockets located on the protective garment exterior.

3.3.21

—

CBRN.

An abbreviation for chemicals, biological agents, and radiological particulates hazards. (See also 3.3.22, CBRN Terrorism Agents.)

3.3.22 *

—

CBRN Terrorism Agents.

Chemicals, biological agents, and radiological particulates that could be released as the result of a terrorist

attack. (See also 3.3.

27

28, Chemical Terrorism Agents; 3.3.9, Biological Terrorism Agents; and 3.3.

455

161, Radiological Particulate Terrorism Agents.)

3.3.23

—

Certification/Certified.

A system whereby a certification organization determines that a manufacturer has demonstrated the ability to produce a product that complies with the requirements of this standard, authorizes the manufacturer to use a label on listed products that comply with the requirements of this standard, and establishes a follow-up program conducted by the certification organization as a check on the methods the manufacturer uses to determine continued compliance of labeled and listed products with the requirements of this standard. (See also 3.3.

445

121, NIOSH Certified.)

3.3.24

—

Certification Mark or Label.

The authorized identification symbol or logo of the certification organization.

3.3.25

—

Certification Organization.

An independent, third-party organization that determines product compliance with the requirements of this standard with a labeling/listing/follow-up program.

3.3.26

—

Certified Component

Any material, part, or subassembly used in the construction of the compliant product that has undergone an evaluation by a certification organization that allows the manufacturer to label the item as certified. (See also 3.3.23. Certification/Certified.)

3.3.27 Char.

The formation of a brittle residue when material is exposed to thermal energy.

3.3.

27—

28 Chemical Terrorism Agents.

Liquid, solid, gaseous, and vapor chemical warfare agents and toxic industrial chemicals used to inflict lethal or incapacitating casualties, generally on a civilian population, as a result of a terrorist attack. (See also 3.3.

~~28~~

29, Chemical Warfare (CW) Agents, and 3.3.

~~207~~

214, Toxic Industrial Chemicals.)

3.3.

~~28~~

29 Chemical Warfare (CW) Agents.

Liquid, solid, and gaseous chemical agents (most are liquids) traditionally used during warfare or armed conflict to kill or incapacitate an enemy.

3.3.

~~29~~

30 Chin Strap.

An adjustable strap for the helmet that fits under the chin to secure the helmet to the head.

3.3.

~~30~~

31 Closed-Circuit SCBA.

A recirculation-type SCBA in which the exhaled gas is rebreathed by the wearer after the carbon dioxide has been removed from the exhalation gas and the oxygen content within the system has been restored from sources such as compressed breathing air, chemical oxygen, liquid oxygen, or compressed gaseous oxygen.

3.3.

~~31~~

32 Coat.

See 3.3.

~~186~~

192, Structural Firefighting Protective Coat, and 3.3.

~~145~~

151, Proximity Firefighting Protective Coat.

3.3.

~~32~~

33 Collar.

The portion of the coat or coverall that encircles the neck.

3.3.

~~33~~

34 Collar Lining.

The part of collar fabric composite that is next to the skin when the collar is closed in the raised position.

3.3.

~~34~~

~~35 *~~

~~—~~

Combination SCBA/SAR.

An atmosphere-supplying respirator that supplies a respirable atmosphere to the user from a combination of two breathing air sources that both are independent of the ambient environment. (See also 3.3.4, Atmosphere-Supplying Respirator; 3.3.

~~174~~

180, Self-Contained Breathing Apparatus (SCBA); and 3.3.

~~196~~

202, Supplied Air Respirator (SAR).]

3.3.

~~35~~

36 Compliance/Compliant.

Meeting or exceeding all applicable requirements of this standard.

3.3.

~~36~~

37 Compliant Product(s).

Clothing or equipment that is certified to the applicable NFPA standard.

3.3.

~~37~~

38 *

—

Component.

Any material, part, or subassembly used in the construction of the compliant product.

3.3.

~~38~~

39 Composite.

The layer or layers of materials or components.

3.3.

~~39~~

40 *

—

Compressed Breathing Air.

A respirable gas mixture derived from either normal atmospheric air or from manufactured synthetic air, stored in a compressed state in storage cylinders and respirator breathing air cylinders, and supplied to the user in a gaseous form.

3.3.

~~40~~

41* Contamination

The accumulation of products of combustion and other hazardous materials on or in an ensemble element that includes carcinogenic, toxic, corrosive, or allergy-causing chemicals, body fluids, infectious microorganisms, or CBRN terrorism agents.

3.3.42 Coronal Plane.

The anatomical plane perpendicular to both the basic and midsagittal planes and containing the midpoint of a line connecting the superior rims of the right and left auditory meatuses.

3.3.

~~41~~

43 Overall.

See 3.3.

~~487~~

193 , Structural Firefighting Protective Overall, and 3.3.

~~146~~

152 , Proximity Firefighting Protective Overall.

3.3.

~~42~~

44 Crown.

The portion of the helmet that covers the head above the reference plane.

3.3.

~~43~~

45 Crown Straps.

The part of the helmet suspension that passes over the head.

3.3.

~~44~~

46 Cylinder.

See 3.3.16 , Breathing Air Cylinder.

3.3.

~~45~~

47 Demand SCBA.

See 3.3.

~~414~~

120 , Negative Pressure SCBA.

3.3.

~~46~~

48 Dielectric Test Plane.

A plane that runs diagonally through the headform from the intersection of the test line and midsagittal plane in the front of the headform to the intersection of the reference plane and midsagittal plane in the rear of the headform.

3.3.

~~47~~

49* Drag Rescue Device.

A component integrated within the protective coat element to aid in the rescue of an incapacitated fire fighter.

3.3.50 DRD

See 3.3.49 Drag Rescue Device

3.3.51 Drip.

To run or fall in drops or blobs.

3.3.

~~48~~

52 Ear Covers.

An interface component of the protective helmet element that provides limited protection to the helmet/coat interface area.

3.3.

~~49~~

53 EBSS.

Abbreviation for emergency breathing safety system.

3.3.

~~49~~

53 .1

~~—~~

UEBSS.

Abbreviation for Universal Emergency Breathing Safety System.

3.3.

~~50~~

54 Element(s).

See 3.3.

~~56~~

60 , Ensemble Elements.

3.3.

~~54~~

55 *

~~—~~

Emblems.

Shields, heraldry, lettering, or printing that designates a product, a governmental entity, or a specific organization, rank, title, position, or other professional status that is painted, screened, embroidered, sewn, glued, bonded, or otherwise attached to a product in a permanent manner.

3.3.

~~52~~

56 Emergency Breathing Safety System (EBSS).

A device on an SCBA that allows users to share their available air supply in an emergency situation.

3.3.

~~53~~

57 End-of-Service-Time Indicator (EOSTI).

A warning device on an SCBA that alerts the user that the reserve air supply is being utilized.

3.3.

~~54~~

58 Energy Absorbing System.

Materials or systems used to attenuate impact energy.

3.3.

~~55~~

59 Ensemble.

See 3.3.

~~488~~

194 , Structural Firefighting Protective Ensemble, and 3.3.

~~447~~

153 , Proximity Firefighting Protective Ensemble.

3.3.

~~56~~

60 Ensemble Elements.

The compliant products that provide protection to the upper and lower torso, arms, legs, head, hands, and feet.

3.3.

~~57~~

61 *

~~—~~

Entry Firefighting.

Extraordinarily specialized firefighting operations that can include the activities of rescue, fire suppression, and property conservation at incidents involving fires producing extreme levels of radiant, conductive, and convective heat.

3.3.

~~58~~

62 Fabric Component.

Any single or combination of natural or synthetic material(s) that are pliable and that are made by weaving, felting, forming, or knitting.

3.3.

~~59~~

63 Facepiece.

The component of an SCBA that covers the wearer's nose, mouth, and eyes.

3.3.

~~60~~

64 *

~~—~~

Faceshield.

The component of the helmet that provides limited protection to a portion of the wearer's face.

3.3.

~~61~~

65 Faceshield/Goggle.

The term that applies to the helmet component that is a faceshield, or goggle, or both.

3.3.

~~62~~

66 Facial Feature Headform.

The medium size reference headform specified in ANSI/ISEA Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices* .

3.3.

~~63~~

67 Findings.

All materials used in the construction of items, excluding textiles and interlinings.

3.3.

~~64~~~~68 *~~~~—~~**Flame Resistance.**

The property of a material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or nonflaming source of ignition, with or without subsequent removal of the ignition source. Flame resistance can be an inherent property of a material, or it can be imparted by specific treatment. (See also 3.3.

~~92~~~~97, Inherent Flame Resistance,~~~~3.3.~~~~65—~~**69 Fluorescence.**

The process by which radiant flux of certain wavelengths is absorbed and reradiated, nonthermally in other, usually longer, wavelengths.

~~3.3.~~~~66—~~**70 Follow-Up Program.**

The sampling, inspection, tests, or other measures conducted by the certification organization on a periodic basis to determine the continued compliance of labeled and listed products that are being produced by the manufacturer to the requirements of this standard.

~~3.3.~~~~67~~~~71 *~~~~—~~**Footwear.**See 3.3.~~490~~196, Structural Firefighting Protective Footwear, and 3.3.~~449~~155, Proximity Firefighting Protective Footwear.~~3.3.~~~~68—~~**72 Functional.**

The ability of an element or component of an element to continue to be utilized for its intended purpose.

~~3.3.~~~~69—~~**73 Garment(s).**See 3.3.~~494~~197, Structural Firefighting Protective Garment(s), 3.3.~~450~~156, Proximity Firefighting Protective Garment, and 3.3.~~220~~227, Work Apparel Garment.~~3.3.~~~~70—~~**74 Gas.**

Matter in a gaseous state at standard temperature and pressure.

~~3.3.~~~~74—~~**75 Gauntlet.**

An interface component of the protective glove element that provides limited protection to the coat/glove interface area. . .

3.3.

~~72~~

76 Glove.

See 3.3.

~~492~~

198 , Structural Firefighting Protective Glove, and 3.3.

~~454~~

157 , Proximity Firefighting Protective Glove.

3.3.

~~73~~

77 Glove Body.

The part of the glove that extends from the tip of the fingers to the wrist crease or to a specified distance beyond the wrist crease.

3.3.

~~74~~

78 Glove Liner.

The innermost component of the glove body composite that comes into contact with the wearer's skin.

3.3.

~~75~~

79 Glove Wristlet.

See 3.3.

~~2.4~~

228 , Wristlet.

3.3.

~~76~~

80 Goggles.

The component of the helmet that provides protection to the wearer's eyes and a portion of the wearer's face.

3.3.

~~77~~

81 Grading.

The process of proportioning components for construction of an element.

3.3.

~~78~~

82 *

~~—~~

Gusset.

The part of the protective footwear that is a relatively flexible material joining the footwear upper (quarter) and the tongue, which is intended to provide expansion of the footwear front to enable donning of the footwear while maintaining continuous moisture integrity of the footwear.

3.3.

~~79~~

83 Hardware.

Nonfabric components of the protective clothing and equipment including, but not limited to, those made of metal or plastic.

3.3.

~~80~~

84 Harness.

An equipment item; an arrangement of materials secured about the body used to support a person.

3.3.

~~84 Hazardous Materials~~

85* Hazardous Materials

Substances (solid, liquid, or gas) that when released are capable of creating harm to people, the environment, and property.

3.3.86 Hazardous Materials. Emergencies.

Incidents involving the release or potential release of hazardous materials.

3.3.

~~82~~

87 Haze.

Light that is scattered as a result of passing through a transparent object.

3.3.

~~83~~

88 Head and Torso Simulator (HATS).

A manikin with built-in ear and mouth simulators that provides a realistic reproduction of the acoustic properties of an average adult human head and torso.

3.3.

~~84~~

89 Headband.

The portion of the helmet suspension that encircles the head.

3.3.

~~85~~

90 Headform.

A device that simulates the configuration of the human head.

3.3.

~~86~~

91 Heads-Up Display (HUD).

Visual display of information and system condition status visible to the wearer.

3.3.

~~87~~

92 Helmet.

See 3.3.

~~193~~

199 , Structural Firefighting Protective Helmet, and 3.3.

~~152~~

158 , Proximity Firefighting Protective Helmet.

3.3.

~~88~~

93 Helmet Cover.

A removable helmet component that offers radiant reflective protection to the exterior of the helmet shell.

3.3.

~~89~~

94 Helmet Shroud.

The component element of the helmet that provides limited protection to the helmet/coat SCBA interface area.

3.3.

~~90~~

95 Hood.

See 3.3.

~~194~~

200 , Structural Firefighting Protective Hood.

3.3.

~~91~~

96 Identical SCBA.

SCBA that are produced to the same engineering and manufacturing specifications.

3.3.

~~92~~

97 Inherent Flame Resistance.

Flame resistance that is derived from the essential characteristic of the fiber or polymer.

3.3.

~~93~~

98 Insect Repellency.

A finish applied to textiles to provide a deterrent against bites from mosquitoes, midges, ants, ticks, and chiggers.

3.3.

~~94~~

99 Insole.

The inner component of the footwear upon which the foot rests.

3.3.

~~95~~

100 Interface Area.

An area of the body where the protective garments, helmet, gloves, footwear, or SCBA facepiece meet. Interface areas include, but are not limited to, the coat/helmet/SCBA facepiece area, the coat/trouser area, the coat/glove area, and the trouser/footwear area.

3.3.

~~96~~

101 Interface Component(s).

Any material, part, or subassembly used in the construction of the compliant product that provides limited protection to interface areas.

3.3.

~~97~~

102 Interlining.

Any textile that is incorporated into any garment as a layer between outer and inner layers.

3.3.

~~98~~

103 Ladder Shank.

See 3.3.

~~478~~

184 , Shank.

3.3.

~~99~~

104 Liner System

The moisture barrier and thermal barrier components as used in a garment.

3.3.105 Liquid Borne Pathogen.

See 3.3.12 , Body Fluid–Borne Pathogen.

3.3.

~~400~~

106 Lower Torso.

The area of the body trunk below the waist, excluding the legs, ankles, and feet.

3.3.

~~401~~

107 Major A Seam.

See 3.3.

~~472~~

178 .

2

1 , Major A Seam.

3.3.

~~402~~

108 Major B Seam.

See 3.3.

~~472~~

178.

~~3~~

2. Major B Seam.

3.3.

~~403~~

109 Major Seams.

Classes of seams that designate minimum sewn seam requirements.

3.3.

~~404~~

110 Manufacturer.

The entity that directs or controls any of the following: compliant product design, compliant product manufacturing, or compliant product quality assurance; or the entity that assumes the liability for the compliant product or provides the warranty for the compliant product.

3.3.

~~405~~

111 Manufacturing Facility.

A facility that is involved in the production, assembly, final inspection, or labeling of the compliant end product.

3.3.

~~406~~

112 Melt.

A response to heat by a material resulting in evidence of flowing or dripping.

3.3.

~~407~~

113 Microphone Measurement Point (MMP).

A point 1.5 m in front of and on the axis of the lip position of typical human mouth (or artificial mouth) and 1.5 m above the floor.

3.3.

~~408~~

114 Midsagittal Plane.

The plane, perpendicular to the basic and coronal planes, that bisects the head symmetrically.

3.3.

~~409~~

115 Minor Seam.

See 3.3.

~~472~~

178.4. Minor Seam.

3.3.

~~440~~

116 Model.

The collective term used to identify a group of elements or items of the same basic design and components from a single manufacturer produced by the same manufacturing and quality assurance procedures that are covered by the same certification.

3.3.

~~441~~

117 Moisture Barrier.

The component of an element or item that principally prevents the transfer of liquids.

3.3.

~~442~~

118 Mouth Reference Point (MRP).

A point 50 mm in front of and on the axis of the lip position of a typical human mouth (or artificial mouth).

3.3.

~~443~~

119 Nape Device.

A component used to aid in helmet retention.

3.3.

~~414~~

120. Negative Pressure SCBA.

An SCBA in which the pressure inside the facepiece, in relation to the pressure surrounding the outside of the facepiece, is negative during any part of the inhalation or exhalation cycle when tested by NIOSH in accordance with 42 CFR 84.

3.3.

~~415~~

121 *

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NIOSH Certified.

Tested and certified by the National Institute for Occupational Safety and Health (NIOSH) of the US Department of Health and Human Services in accordance with the requirements of 42 CFR 84, Subpart H.

3.3.

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122. Nonprimary Protective Garment.

A garment or clothing that is not designed nor intended to be the barrier of protection from a specific hazard exposure.

3.3.

~~417~~

123. Open-Circuit SCBA.

An SCBA in which exhalation is vented to the atmosphere and not rebreathed.

3.3.

~~418~~

124. Outer Shell.

The outermost component of an element or item not including trim, hardware, reinforcing material, pockets, wristlet material, accessories, fittings, or suspension systems.

3.3.

~~419~~

125 *

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Particulate Blocking Layer.

The layer(s) of an element or item that principally inhibits the ingress of particles.

3.3.

~~420~~

126 *

—

Particulates.

Finely divided solid matter that is dispersed in air.

3.3.

~~421~~

127. PASS.

Acronym for Personal Alert Safety Systems. See also 3.3.

~~425~~

131, Personal Alert Safety Systems (PASS).

3.3.

~~422~~

128. PASS Annunciator.

The component designed to emit audible signals.

3.3.

~~423~~

129. Patches.

See 3.3.

~~54~~

55, Emblems.

3.3.

~~424~~

130. Percent Inward Leakage.

The ratio of vapor concentration inside the ensemble versus the vapor concentration outside the ensemble expressed as a percentage.

3.3.

~~425~~

131. Personal Alert Safety Systems (PASS).

A device that continually senses for lack of movement of the wearer and automatically activates the alarm signal, indicating the wearer is in need of assistance; can also be manually activated to trigger the alarm signal.

3.3.

~~425~~

131.1

—

Integrated PASS.

A removable or nonremovable PASS that is an integral part of another item or items of protective clothing, protective equipment, or both.

3.3.

~~425~~

131.1.1

—

Nonremovable.

An integrated PASS that is not removable and cannot be used independently of the item or items with which it is integrated.

3.3.

~~425~~

131.1.2

—

Removable.

An integrated PASS that is removable so that it can be used independently of the item or items with which it is integrated.

3.3.

~~425~~

131.1.3

—

Stand-Alone PASS.

A PASS that is not an integral part of any other item of protective clothing or protective equipment.

3.3.

~~425~~

131.2

—

RF PASS.

A PASS that contains an optional RF transceiver that enables the PASS to automatically transmit an alarm signal and receive evacuation alarms via RF signals; responds to an evacuation alarm with an audible and visual signal.

3.3.

~~425~~

131.2.1

—

Base Station.

An RF transceiver used in conjunction with an RF PASS that monitors for an alarm signal and emits a visual signal when this alarm is received. The base station is capable of sending an evacuation alarm to the RF PASS.

3.3.

~~426~~

132. Pink Noise.

Noise that contains constant energy per octave band.

3.3.

~~427~~**133 Positive Pressure SCBA.**

An SCBA in which the pressure inside the facepiece, in relation to the pressure surrounding the outside of the facepiece, is positive during both inhalation and exhalation when tested by NIOSH in accordance with 42 CFR 84, Subpart H.

3.3.~~428~~**134 Pre-Alarm Signal.**

An audible warning that is identifiable as an indication that a PASS is about to sound the alarm signal.

3.3.~~429~~**135 Pressure Demand SCBA.**

See 3.3.

~~427~~

133 , Positive Pressure SCBA.

3.3.~~430~~**136 Primary Protective Garment.**

A garment that is designed, certified, and intended to be the barrier of protection from a specific hostile environment.

3.3.~~431~~**137 ***

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Product Label.

A marking provided by the manufacturer for each compliant product containing compliant statements, certification statements, manufacturer or model information, or similar data. The product label is not the certification organization's label, symbol, or identifying mark; however, the certification organization's label, symbol, or identifying mark is attached to or part of the product label.

3.3.~~432~~**138 Protective Clothing.**

See 3.3.

~~485~~

191 , Structural Firefighting Protective Clothing, and 3.3.

~~447~~

153 , Proximity Firefighting Protective Ensemble.

3.3.~~433~~**139 Protective Coat.**

See 3.3.

~~486~~

192 , Structural Firefighting Protective Coat, and 3.3.

~~445~~

151 , Proximity Firefighting Protective Coat.

3.3.~~434~~**140 Protective Coverall.**

See 3.3.

~~487~~

193 , Structural Firefighting Protective Coverall, and 3.3.

~~446~~

152 , Proximity Firefighting Protective Coverall.

3.3.

~~135~~

141 Protective Ensemble.

See 3.3.

~~188~~

194 , Structural Firefighting Protective Ensemble, and 3.3.

~~147~~

153 , Proximity Firefighting Protective Ensemble.

3.3.

~~136~~

142 Protective Footwear.

See 3.3.

~~190~~

196 , Structural Firefighting Protective Footwear, and 3.3.

~~149~~

155 , Proximity Firefighting Protective Footwear.

3.3.

~~137~~

143 Protective Garment.

See 3.3.

~~191~~

197 , Structural Firefighting Protective Garment(s), and 3.3.

~~150~~

156 , Proximity Firefighting Protective Garment.

3.3.

~~138~~

144 Protective Gloves.

See 3.3.

~~192~~

198 , Structural Firefighting Protective Glove, and 3.3.

~~151~~

157 , Proximity Firefighting Protective Glove.

3.3.

~~139~~

145 Protective Helmet.

See 3.3.

~~193~~

199 , Structural Firefighting Protective Helmet, and 3.3.

~~152~~

158 , Proximity Firefighting Protective Helmet.

3.3.

~~140~~

146 Protective Hood.

See 3.3.

~~194~~

200 , Structural Firefighting Protective Hood.

3.3.

~~141~~

147 Protective Trousers.

See 3.3.

~~495~~~~201 , Structural Firefighting Protective Trousers, and 3.3.~~~~453~~~~159 , Proximity Firefighting Protective Trousers.~~~~3.3.~~~~442—~~~~148. Protective Wristlet.~~~~See 3.3.~~~~2.4~~~~221 , Wristlet.~~~~3.3.~~~~443~~~~149 *~~~~—~~~~Proximity Firefighting.~~~~Specialized firefighting operations that can include the activities of rescue, fire suppression, and property conservation at incidents involving fires producing high levels of radiant heat as well as conductive and convective heat.~~~~3.3.~~~~444—~~~~150 Proximity Firefighting Protective Clothing.~~~~See 3.3.~~~~447~~~~153 , Proximity Firefighting Protective Ensemble.~~~~3.3.~~~~445—~~~~151 Proximity Firefighting Protective Coat.~~~~The element of the protective ensemble that provides protection to upper torso and arms, excluding the hands and head.~~~~3.3.~~~~446—~~~~152 Proximity Firefighting Protective Coverall.~~~~The element of the protective ensemble that provides protection to the torso, arms, and legs, excluding the head, hands, and feet.~~~~3.3.~~~~447—~~~~153 Proximity Firefighting Protective Ensemble.~~~~Multiple elements of compliant protective clothing and equipment that when worn together provide protection from some risks, but not all risks, of emergency incident operations.~~~~3.3.~~~~448—~~~~154 Proximity Firefighting Protective Ensemble with Optional Liquid and Particulate Contaminant Protection.~~~~A compliant proximity firefighting protective ensemble that is also certified as an entire ensemble to meet the optional requirements for protection from liquid and particulate contaminants.~~~~3.3.~~~~449—~~~~155 Proximity Firefighting Protective Footwear.~~~~The element of the protective ensemble that provides protection to the foot, ankle, and lower leg.~~~~3.3.~~~~450—~~~~156 Proximity Firefighting Protective Garment.~~~~The coat, trouser, and coverall elements of the protective ensemble.~~~~3.3.~~~~451—~~~~157 Proximity Firefighting Protective Glove.~~

The element of the protective ensemble that provides protection to the hand and wrist.

3.3.

~~452~~

158. Proximity Firefighting Protective Helmet.

The element of the protective ensemble that provides protection to the head.

3.3.

~~453~~

159. Proximity Firefighting Protective Trousers.

The element of the protective ensemble that provides protection to the lower torso and legs, excluding the ankles and feet.

3.3.

~~454~~

160. Puncture-Resistant Device.

A reinforcement to the bottom of protective footwear that is designed to provide puncture resistance.

3.3.

~~455~~

161 *

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Radiological Particulate Terrorism Agents.

Particles that emit ionizing radiation in excess of normal background levels, used to inflict lethal or incapacitating casualties, generally on a civilian population, as a result of terrorist attack.

3.3.

~~456~~

162. Rapid Intervention Crew/Company Universal Air Connection (RIC UAC).

A system that allows emergency replenishment of breathing air to the SCBA of disabled or entrapped fire or emergency services personnel.

3.3.

~~457~~

163. Rated Service Time.

The period of time, stated on the SCBA's NIOSH certification label, that the SCBA supplied air to the breathing machine when tested to 42 CFR 84, Subpart H.

3.3.

~~458~~

164. Recall System.

Procedures by which a manufacturer identifies a product, provides notice or safety alert, and repairs or withdraws the product as the corrective action.

3.3.

~~459~~

165. Reference Plane.

A dimensionally defined plane parallel to the basic plane that is measured from the top of the applicable headform or the basic plane.

3.3.

~~460~~

166. Reserve Air Supply.

The period of time available for emergency egress, self-rescue, or assisted rescue.

3.3.

~~461~~

167. Retention System.

The complete assembly by which the helmet is retained in position on the head.

3.3.

~~462~~

168. Retroreflection/Retroreflective.

The reflection of light in which the reflected rays are preferentially returned in the direction close to the opposite of the direction of the incident rays, with this property being maintained over wide variations of the direction of the incident rays.

3.3.

~~463~~**169. Retroreflective Markings.**

A material that reflects and returns a relatively high proportion of light in a direction close to the direction from which it came.

3.3.~~464~~**170. RF Interference.**

An unwanted radio-frequency signal that is present in the vicinity of an RF PASS system that could impede reception of an alarm signal or evacuation alarm.

3.3.~~465~~**171. RF Transceiver.**

A radio system capable of both transmitting and receiving a modulated radio-frequency (RF) signal that is then converted to an audio and/or data signal; used to transmit and receive signals such as the alarm signal and the evacuation alarm for RF PASS.

3.3.~~466~~**172. RIC.**

Abbreviation for rapid intervention crew/company.

3.3.~~467~~**173. Safety Alert.**

The procedure by which a manufacturer notifies users, the marketplace, and distributors of potential safety concerns regarding a product.

3.3.~~468~~**174. Sample.**

(1) The ensemble, element, component, or composite that is conditioned for testing. (See also 3.3.181. Specimen.)(2) Ensembles, elements, items, or components that are randomly selected from the manufacturing facility's production line, from the manufacturer's or manufacturing facility's inventory, or from the open market.

3.3.~~469~~**175. SAR.**

Abbreviation for supplied air respirator. [See 3.3.

~~496~~

202, Supplied Air Respirator (SAR).]

3.3.~~470~~**176. SCBA.**

Abbreviation for self-contained breathing apparatus. [See 3.3.

~~474~~

180, Self-Contained Breathing Apparatus (SCBA).]

3.3.~~471~~**177. SCBA/SAR.**

Abbreviation for combination open-circuit SCBA and supplied air respirator. [See 3.3.

~~34~~

35, Combination SCBA/SAR; 3.3.

~~474~~

180, Self-Contained Breathing Apparatus (SCBA); and 3.3.

~~496~~

202, Supplied Air Respirator (SAR).]

3.3.

~~472~~**178. Seam.**

Any permanent attachment of two or more materials in a line formed by joining the separate material pieces.

3.3.~~472~~**178 .1 ***

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Major A Seam.

Outermost layer seam assemblies where rupture could reduce the protection of the garment by exposing the garment's inner layers.

3.3.~~472~~**178 .2**

—

Major B Seam.

Inner layer seam assemblies where rupture could reduce the protection of the garment by exposing the next layer of the garment, the wearer's station/work uniform, other clothing, or skin.

3.3.~~472~~**178 .3**

—

Major Seam.

Seam assemblies where rupture exposes the wearer to immediate danger.

3.3.~~472~~**178 .4**

—

Minor Seam.

Remaining seam assemblies that are not classified as Major, Major A, or Major B seams.

3.3.~~473~~**179. Seam Assembly.**

The structure obtained when materials are joined by means of a seam.

3.3.~~474~~**180 ***

—

Self-Contained Breathing Apparatus (SCBA).

An atmosphere-supplying respirator that supplies a respirable air atmosphere to the user from a breathing air source that is independent of the ambient environment and designed to be carried by the user.

3.3.~~475~~**181. Separate/Separation.**

A material response evidenced by splitting or delaminating.

3.3.~~476~~**182. Service Life.**

The period for which compliant product may be useful before retirement.

3.3.~~477~~**183. Service Time.**

See 3.3.

~~457~~

163 , Rated Service Time.

3.3.

~~478~~

184. Shank.

The component of footwear that provides additional support to the instep.

3.3.

~~479~~

185. Shell.

See 3.3.

~~448~~

124 , Outer Shell.

3.3.

~~480~~

186. Sound Pressure Level (SPL).

The local pressure deviation from the ambient (average, or equilibrium) atmospheric pressure caused by a sound wave.

3.3.

~~481~~

187. Specimen.

The conditioned ensemble, element, item, or component that is tested. Specimens are taken from samples. (See also 3.3.

~~468~~

174 , Sample.)

3.3.

~~482~~

188. Speech Transmission Index (STI).

A measure of intelligibility of speech quality on a scale of intelligibility, whose values vary from 0 (completely unintelligible) to 1 (perfect intelligibility).

3.3.

~~483~~

189. Structural Firefighting.

The activities of rescue, fire suppression, and property conservation in buildings, enclosed structures, vehicles, marine vessels, or like properties that are involved in a fire or emergency situation.

3.3.

~~484~~

190. Structural Firefighting Protective Barrier Hood.

The optional interface element of the protective ensemble that provides limited thermal, physical, and barrier protection to the coat/helmet/SCBA facepiece interface area.

3.3.

~~485~~

191. Structural Firefighting Protective Clothing.

See 3.3.

~~488~~

194 , Structural Firefighting Protective Ensemble.

3.3.

~~486~~

192. Structural Firefighting Protective Coat.

The element of the protective ensemble that provides protection to the upper torso and arms, excluding the hands and head.

3.3.

~~487~~

193. Structural Firefighting Protective Coverall.

The element of the protective ensemble that provides protection to the torso, arms, and legs, excluding the head, hands, and feet.

3.3.

~~488~~~~194 *~~

—

Structural Firefighting Protective Ensemble.

Multiple elements of compliant protective clothing and equipment that when worn together provide protection from some risks, but not all risks, of emergency incident operations.

3.3.~~489~~**195. Structural Firefighting Protective Ensemble with Optional Liquid and Particulate Contaminant Protection.**

A compliant structural firefighting protective ensemble that is also certified as an entire ensemble to meet the optional requirements for protection from liquid and particulate contaminants.

3.3.~~490~~**196. Structural Firefighting Protective Footwear.**

The element of the protective ensemble that provides protection to the foot, ankle, and lower leg.

3.3.~~491~~**197. Structural Firefighting Protective Garment(s).**

The coat, trouser, and coverall elements of the protective ensemble.

3.3.~~492~~**198. Structural Firefighting Protective Glove.**

The element of the protective ensemble that provides protection to the hand and wrist.

3.3.~~493~~**199. Structural Firefighting Protective Helmet.**

The element of the protective ensemble that provides protection to the head.

3.3.~~494~~**200. Structural Firefighting Protective Hood.**

The interface element of the protective ensemble that provides limited protection to the coat/helmet/SCBA facepiece interface area.

3.3.~~495~~**201. Structural Firefighting Protective Trousers.**

The element of the protective ensemble that provides protection to the lower torso and legs, excluding the ankles and feet.

3.3.~~496~~~~202 *~~

—

Supplied Air Respirator (SAR).

An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user; also known as an *airline respirator*. [See also 3.3.4, *Atmosphere-Supplying Respirator*; 3.3.

~~34~~

35, *Combination SCBA/SAR*; and 3.3.

~~474~~

180, *Self-Contained Breathing Apparatus (SCBA)*.]

3.3.~~497~~**203. Surrogate Cylinder.**

A breathing air cylinder for testing only in which the mass of the breathing air is replaced by a substitute mass.

3.3.~~498~~**204. Suspension.**

The energy-attenuating system of the helmet that is made up of the headband and crown strap.

3.3.

499—

205. Sweatband.

That part of a helmet headband, either integral or attached, that comes in contact with the wearer's forehead.

3.3.

200—

206. Synthetic Breathing Air.

A manufactured breathing air that is produced by blending nitrogen and oxygen. (See also 3.3.

39

40, Compressed Breathing Air.)

3.3.

201—

207 Tensile Strength

The force at which a fiber or fabric will break when pulled in one dimension.

3.3.208 Textile Fabric.

A planar structure material consisting of yarns or fibers.

3.3.

202—

209 Thermal Barrier.

The component of an element or item that principally provides thermal protection.

3.3.

203—

210 Toe Cap.

A reinforcement to the toe area of footwear designed to protect the toes from impact and compression.

3.3.

204

211 *

—

Tongue.

The part of the protective footwear that is provided for lace up protective footwear with a closure that extends from the vamp to the top line of the footwear between sides of the footwear upper and is exposed to the exterior environment when the footwear is correctly donned.

3.3.

205—

212 Top.

The intersection between the midsagittal plane and the coronal plane extended to the helmet surface.

3.3.

206—

213 Top Line.

The top edge of the protective footwear that includes the tongue, gusset, quarter, collar, and shaft.

3.3.

207—

214 Toxic Industrial Chemicals.

Highly toxic solid, liquid, or gaseous chemicals that have been identified as mass casualty threats that could be used to inflict casualties, generally on a civilian population, during a terrorist attack.

3.3.

208—

215 Trim.

Retroreflective and fluorescent materials attached to the outermost surface of the protective ensemble for visibility enhancement. Retroreflective materials enhance nighttime visibility, and fluorescent materials enhance daytime visibility. "Trim" is also known as "visibility markings." (See also 3.3.222* Visibility Markings.)

3.3.

209—

216. Trouser.See 3.3.~~495~~201. Structural Firefighting Protective Trousers, and 3.3.~~453~~159. Proximity Firefighting Protective Trousers.3.3.~~240~~**217. UAC.**Abbreviation for universal air connection.3.3.~~241~~**218. UEBSS.**See 3.3.~~49~~53.1.3.3.~~242~~**219. Universal Air Connection (UAC).**The male fitting, affixed to the SCBA, and the female fitting, affixed to the filling hose, to provide emergency replenishment of breathing air to an SCBA breathing air cylinder. Also known as Rapid Intervention Crew/Company Universal Air Connection.3.3.~~243~~**220. ***~~—~~**Upper.**The part of the protective footwear including, but not limited to, the toe, vamp, quarter, shaft, collar, and throat, but excluding the sole with heel, puncture-resistant device, and insole.3.3.~~244~~**221. Upper Torso.**The area of body trunk above the waist and extending to the shoulder, excluding the arms and wrists, and hands.3.3.~~245~~**222. ***~~—~~**Visibility Markings.**Retroreflective and fluorescent conspicuity enhancements.3.3.~~246~~**223. Water Resistance.**A finish or an inherent property that limits the absorption of water.3.3.~~247~~**224. Wear Surface.**The bottom of the footwear sole, including the heel.3.3.~~248~~**225. Winter Liner.**An optional component layer that provides added insulation against cold.3.3.~~249~~**226. Work Apparel.**

Nonprimary protective garments certified as compliant with this standard that are intended to be worn by emergency services personnel while on duty.

3.3.

~~220~~

227. Work Apparel Garment.

Textile apparel that cover the torso and limbs or parts of limbs, excluding heads, hands, and feet.

3.3.

~~221~~

228. Wristlet.

The interface component of the protective element or item that provides limited protection to the protective coat/glove interface area.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA_1970_P1_3.3_CLEAN.docx	This file should match what I pasted to replace section 3.3 General Definitions.	

Statement of Problem and Substantiation for Public Input

Several additions and updates were required from the consolidation and from recent revisions to other related standards. Renumbering and references have been updated to account for all of these changes.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 276-NFPA 1970-2021 [Sections A.3.3.10, A.3.3.11, A.3.3.22, A.3.3.34, A.3.3.37, ...]	

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Submittal Date: Tue Nov 09 20:12:29 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-301-NFPA 1970-2022

Statement: This change is being made to include the definition for General Definitions from the former NFPA 1975. The committee determined this is important for the consolidation. Because 3.3 can no longer have text, the definition is being added to the annex.

**Public Input No. 65-NFPA 1970-2021 [New Section after 3.3.60]**Fit Testing

Members that perform a fit test with facial hair and can subsequently pass the test may be permitted to maintain that facial hair for use with SCBA.

Statement of Problem and Substantiation for Public Input

The goal should be able to successfully pass a fit test. Whatever facial hair allows for the passing of the test should be permitted. This allows for members who suffer from skin conditions caused from shaving to maintain a neat and professional appearance for their job and maintain a proper seal of the facepiece.

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Submittal Date: Mon Sep 20 12:09:59 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: The 1981 technical committee determined that "Fit Testing" is not a part of NFPA RPE documents 1981, 1852 or 1989 and the technical committee has no option to address the submitter's public input. It is beyond the scope of NFPA RPE-TC and is addressed in NFPA 1500 (specifically 1500, 7.16.3). 29 CFR 1910.134(g) (1) stipulates that no facial hair may interfere with the seal. Not having a proper face seal can affect the duration of the SCBA in addition to exposing the firefighter to environmental risks. Definitions cannot incorporate requirements, so this language would be more appropriate in another section.



Public Input No. 6-NFPA 1970-2021 [New Section after 3.3.80]

3.3.81 Hazardous (Classified) Location (HazLoc).

A location where fire or explosion hazards might exist due to flammable or combustible material (i.e. flammable gases, flammable liquid-produced vapors, combustible liquid-produced vapors, combustible dusts, or ignitable fibers/flyings).

3.3.81.1 Intrinsic Safety (IS).

Type of protection where any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.

3.3.81.1.1 Associated Apparatus.

Electrical equipment which contains both intrinsically safe circuits and non-intrinsically safe circuits and is constructed so that the non-intrinsically safe circuits cannot adversely affect the intrinsically safe circuits.

3.3.81.1.2 Intrinsically Safe Apparatus.

Electrical equipment in which all the circuits are intrinsically safe circuits.

3.3.81.1.3 Intrinsically Safe Circuit.

A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under prescribed test conditions.

3.3.81.1.4 Intrinsically Safe System.

An assembly of interconnected intrinsically safe apparatus, associated apparatus, and interconnecting cables, in that those parts of the system that are used in hazardous (classified) locations are intrinsically safe circuits.

3.3.81.2 Nonincendive (NI).

Type of protection applied to electrical equipment such that, in normal operation and in certain specified regular expected occurrences, it is not capable of igniting a surrounding atmosphere of flammable or combustible material.

3.3.81.2.1 Associated Equipment.

Electrical equipment which contains both nonincendive circuits and other than nonincendive circuits and is constructed so that the other than nonincendive circuits cannot adversely affect the nonincendive circuits.

3.3.81.2.2 Maximum External Capacitance, Co.

Maximum value of capacitance in a circuit that can be connected to the connection facilities of associated equipment functioning as a source.

3.3.81.2.3 Maximum External Inductance, Lo.

Maximum value of inductance in a circuit that can be connected to the connection facilities of associated equipment functioning as a source.

3.3.81.2.4 Maximum Input Current, Ii.

Maximum current that can be applied to the connection facilities of nonincendive equipment functioning as a sink.

3.3.81.2.5 Maximum Input Voltage, Ui.

Maximum voltage that can be applied to the connection facilities of nonincendive equipment functioning as a sink.

3.3.81.2.6 Maximum Internal Capacitance, Ci.

Total equivalent internal capacitance which is considered as appearing across the connection facilities of nonincendive equipment functioning as a sink.

3.3.81.2.7 Maximum Internal Inductance, Li.

Total equivalent internal inductance which is considered as appearing at the connection facilities of nonincendive equipment functioning as a sink.

3.3.81.2.8 Maximum Output Current, Io.

Maximum output current in a circuit that can be provided by the connection facilities of associated equipment functioning as a source under normal operation.

3.3.81.2.9 Maximum Output Voltage, Uo.

Maximum output voltage in a circuit that can appear under open-circuit conditions at the connection facilities of associated equipment functioning as a source under normal operation.

3.3.81.2.10 Nonincendive Circuit.

A circuit, other than nonincendive field wiring, in which any arc or thermal effect produced under normal operating conditions is not capable of igniting a specified flammable or combustible material in air. The circuit is evaluated under prescribed test conditions.

3.3.81.2.11 Nonincendive Equipment.

Equipment having electrical/electronic circuitry that is incapable, under normal operating conditions, of causing ignition of a specified flammable or combustible material in air due to arcing or thermal means.

3.3.81.2.12 Nonincendive System.

An assembly of interconnected nonincendive equipment, associated equipment, and interconnecting cables, in that those parts of the system that are used in hazardous (classified) locations are nonincendive circuits.

Statement of Problem and Substantiation for Public Input

(Submitted on behalf of the FAE-ELS HazLoc Harmonization Task Group)

Addition of HazLoc-related definitions that address UL 913-based intrinsic safety terms and UL 121201-related nonincendive terms to reflect the inclusion of UL 913 and UL 121201 as HazLoc-related certification options.

These definitions align with those include in NFPA 1802 for RF/RSM devices, and are structured in a tiered approach that provides all HazLoc definitions together to minimize the repeating of text and to facilitate better understanding.

Also, addition of definitions for the electrical parameter designations (i.e. Uo, Io, Co, Lo on the power sources and Ui, Ii, Ci, Li on the power receivers) from Table 16.1.8.2.2.2 (Table 6.22.2.1.2 from UL 1802). These definitions are based on the industry definitions from UL 121201, with modifications to correlate to the terms used in Table 16.1.8.2.2.2 (Table 6.22.2.1.2 from UL 1802).

Submitter Information Verification

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Submittal Date: Tue Jun 29 22:19:04 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-281-NFPA 1970-2022](#)

Statement: Addition of HazLoc-related definitions that address UL 913-based intrinsic safety terms and UL 121201-related nonincendive terms to reflect the inclusion of UL 913 and UL 121201 as HazLoc-related certification options.

These definitions align with those include in NFPA 1802 for RF/RSM devices, and are structured in a tiered approach that provides all HazLoc definitions together to minimize the repeating of text and to facilitate better understanding.

Also, addition of definitions for the electrical parameter designations (i.e. Uo, Io, Co, Lo on the power sources and Ui, Ii, Ci, Li on the power receivers) from Table 16.1.8.2.2.2 (Table 6.22.2.1.2 from UL 1802). These definitions are based on the industry definitions from UL 121201, with modifications to correlate to the terms used in Table 16.1.8.2.2.2 (Table 6.22.2.1.2 from UL 1802).

Explanatory material is added to address the new HazLoc-related definitions and to address why Division 2 NI requirements are being proposed in addition to the existing Division 1 IS requirements. This explanatory material aligns with those included in NFPA 1802 for RF/RSM devices.

**Public Input No. 79-NFPA 1970-2021 [Section No. 3.3.125.1.3]**

3.3.125.1.3 – 2 Stand-Alone PASS.

A PASS that is not an integral part of any other item of protective clothing or protective equipment.

Statement of Problem and Substantiation for Public Input

"Stand-alone PASS" is not a sub-set of "Integrated PASS" so should have same paragraph level as Stand-alone Pass and not a sub-section of it

Submitter Information Verification

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Submittal Date: Mon Sep 27 10:52:27 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-282-NFPA 1970-2022](#)

Statement: "Stand-alone PASS" is not a sub-set of "Integrated PASS" so should have same paragraph level as Stand-alone Pass and not a sub-section of it

**Public Input No. 303-NFPA 1970-2021 [New Section after 3.3.196]****TITLE OF NEW CONTENT****Supplementary Voice Communications System -****Optional Electronic Voice Amplification Communication System in addition to nonelectroinic transmission system.****Statement of Problem and Substantiation for Public Input**

Missing definition

Submitter Information Verification**Submitter Full Name:** John Morris**Organization:** 3M Company**Street Address:****City:****State:****Zip:****Submittal Date:** Wed Nov 10 09:50:27 EST 2021**Committee:** FAE-SPF**Committee Statement****Resolution:** FR-283-NFPA 1970-2022**Statement:** Adding new definition.

**Public Input No. 305-NFPA 1970-2021 [New Section after 3.3.215]****Voice Communications System**

Nonelectronic transmission system to project sound.

Type your content here ...

Statement of Problem and Substantiation for Public Input

missing definition

Submitter Information Verification

Submitter Full Name: John Morris

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Submittal Date: Wed Nov 10 10:16:22 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-284-NFPA 1970-2022

Statement: Adding new definition.



Public Input No. 214-NFPA 1970-2021 [Chapter 4]

Chapter 4 – Certification (NFPA 1971)

4.1 – Administration

4.1.1 * – Scope:

4.1.1.1 –

Chapters 4 through 8 of this standard shall specify the minimum design, performance, testing, and certification requirements for structural firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components:

4.1.1.2 –

Chapters 4 through 8 of this standard shall specify the minimum design, performance, testing, and certification requirements for proximity firefighting protective ensembles and ensemble elements that include coats, trousers, coveralls, helmets, gloves, footwear, and interface components:

4.1.1.2.1 –

Chapters 4 through 8 of this standard shall also specify optional requirements for particulate barrier protective hood interface components:

4.1.1.3 * –

Chapters 4 through 8 of this standard shall also specify additional optional requirements for structural firefighting protective ensembles and proximity firefighting protective ensembles that will provide limited protection from liquid and particulate hazards:

4.1.1.3.1 –

Chapters 4 through 8 of this standard shall not specify requirements for protection against CBRN terrorism agents:

4.1.1.4 –

Chapters 4 through 8 of this standard shall specify requirements for new structural firefighting protective ensembles, new proximity firefighting protective ensembles, or new elements for both ensembles:

4.1.1.5 * –

Chapters 4 through 8 of this standard shall not specify requirements for any accessories that could be attached to the certified product, but are not necessary for the certified product to meet the requirements of this standard:

4.1.1.6 –

Other than for the certification of structural or proximity protective ensembles to the optional complete ensemble liquid and particulate hazard protection requirements, Chapters 4 through 8 of this standard shall not specify the respiratory protection that is necessary for proper protection with structural or firefighting protective ensembles:

4.1.1.7 –

Certification of compliant structural firefighting protective ensembles, compliant proximity firefighting protective ensembles, and compliant elements of both ensembles to the requirements of Chapters 4 through 8 of this standard shall not preclude certification to additional appropriate standards where the ensemble or ensemble element meets all the applicable requirements of each standard:

4.1.1.8 –

Chapters 4 through 8 of this standard shall not be construed as addressing all of the safety concerns associated with the use of compliant protective ensembles or ensemble elements. It shall be the responsibility of the persons and organizations that use this standard to conduct testing of protective ensembles or ensemble elements to establish safety and health practices and determine the applicability of regulatory limitations prior to use:

4.1.1.9 –

Chapters 4 through 8 of this standard shall not be construed as addressing all of the safety concerns, if any, associated with the use of this standard by testing facilities. It shall be the responsibility of the persons and organizations that use this standard to conduct testing of protective ensembles or ensemble elements to establish safety and health practices and determine the applicability of regulatory limitations prior to using Chapters 4 through 8 for any designing, manufacturing, and testing:

4.1.1.10 –

Nothing herein shall restrict any jurisdiction or manufacturer from exceeding these minimum requirements:

4.1.2 * – Purpose:

4.1.2.1 –

The purpose of Chapters 4 through 8 of this standard shall be to establish minimum levels of protection for firefighting personnel assigned to fire department operations including but not limited to structural firefighting, proximity firefighting, rescue, emergency medical, and other emergency first responder functions.

4.1.2.1.1 –

To achieve this purpose, Chapters 4 through 8 of this standard shall establish minimum requirements for structural firefighting protective ensembles and ensemble elements designed to provide firefighting personnel limited protection from thermal, physical, environmental, and bloodborne pathogen hazards encountered during structural firefighting operations.

4.1.2.1.2 –

To achieve this purpose, Chapters 4 through 8 of this standard shall establish minimum requirements for proximity firefighting protective ensembles and ensemble elements designed to provide firefighting personnel limited protection from thermal exposures where high levels of radiant heat as well as convective and conductive heat are released, and from physical, environmental, and bloodborne pathogen hazards encountered during proximity firefighting operations.

4.1.2.2 –

The purpose of Chapters 4 through 8 of this standard shall also be to establish a minimum level of protection for structural and proximity firefighting personnel from exposure to liquid and particulate contaminants as an option for compliant structural firefighting ensembles, for compliant proximity firefighting ensembles, and for compliant elements for both ensembles.

4.1.2.3 *

Controlled laboratory tests used to determine compliance with the performance requirements of Chapters 4 through 8 of this standard shall not be deemed as establishing performance levels for all situations to which personnel can be exposed.

4.1.2.4 –

Chapters 4 through 8 of this standard shall not be utilized as a detailed manufacturing or purchasing specification but shall be permitted to be referenced in purchase specifications as minimum requirements.

4.1.3 – Application.**4.1.3.1 –**

Chapters 4 through 8 of this standard shall apply to the design, manufacturing, testing, and certification of new structural firefighting protective ensembles, new proximity firefighting protective ensembles, and new elements of both ensembles for protection from thermal, physical, environmental, and bloodborne pathogen hazards encountered during structural firefighting operations.

4.1.3.2 *

Chapters 4 through 8 of this standard shall apply to the design, manufacturing, testing, and certification of new structural firefighting protective ensembles, new proximity firefighting protective ensembles, and new elements of both ensembles for additional optional protection from liquid and particulate contaminants.

4.1.3.3 –

Chapters 4 through 8 of this standard shall not apply to any protective ensembles, ensemble elements, or protective clothing for any other types of firefighting operations.

4.1.3.4 –

Chapters 4 through 8 of this standard shall not apply to structural firefighting protective ensembles manufactured according to previous editions of NFPA 1971.

4.1.3.5 –

Chapters 4 through 8 of this standard shall not apply to structural firefighting protective clothing and equipment manufactured according to past editions of NFPA 1971, NFPA 1972, NFPA 1973, and NFPA 1974.

4.1.3.6 –

Chapters 4 through 8 of this standard shall not apply to proximity firefighting protective ensembles manufactured according to previous editions of NFPA 1976.

4.1.3.7 –

Chapters 4 through 8 of this standard shall not apply to proximity firefighting protective clothing and equipment manufactured according to past editions of NFPA 1976.

4.1.3.8 *

Chapters 4 through 8 of this standard shall not apply to any accessories that could be attached to the certified product, before or after purchase, but are not necessary for the certified product to meet the requirements of Chapters 4 through 8.

4.1.3.9 –

Chapters 4 through 8 of this standard shall not apply to the use of structural firefighting protective ensembles, proximity firefighting protective ensembles, or elements of these ensembles since these requirements are specified in NFPA 1550.

4.1.4 – Units:**4.1.4.1 –**

In Chapters 4 through 8 of this standard, values for measurement are followed by an equivalent in parentheses, but only the first stated value shall be regarded as the requirement.

4.1.4.2 –

Equivalent values in parentheses shall not be considered as the requirement, as these values are approximate.

4.2 – General:**4.2.1 –**

The process of certification for product as being compliant with Chapters 4 through 8 of this standard shall meet the requirements of Section 4.2, General; Section 4.3, Certification Program; Section 4.4, Inspection and Testing; Section 4.5, Recertification; Section 4.6, Manufacturers' Quality Assurance Program; Section 4.7, Hazards Involving Compliant Product; Section 4.8, Manufacturers' Investigation of Complaints and Returns; and Section 4.9, Manufacturers' Safety Alert and Product Recall Systems.

4.2.2 –

All compliant products that are labeled as being compliant with Chapters 4 through 8 of this standard shall meet or exceed all applicable requirements specified in Chapters 4 through 8 and shall be certified.

4.2.2.1 –

The certification organization shall only permit the certification of complete protective ensembles, which include protective garments, protective helmet, protective gloves, protective footwear, interface components where necessary for certification, and protective hood where the hood is not part of the protective garments, to the optional requirements for protection against liquid and particulate contaminants.

4.2.2.2 –

The certification organization shall further require that the protective ensemble manufacturer specify the respiratory protection component of the ensemble by manufacturer, type, and model in order for the ensembles to be certified to the optional requirements for protection against liquid and particulate contaminants.

4.2.2.3 –

The respiratory protection shall be a specific model self-contained breathing apparatus (SCBA) that is certified as compliant with Chapters 14 through 18 of this standard.

4.2.3 –

All certification shall be performed by a certification organization that meets at least the requirements specified in Section 4.3, Certification Program, and that is accredited for personal protective equipment in accordance with ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes, and services*. The accreditation shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*.

4.2.4 * –

Manufacturers shall not claim compliance with portions or segments of the requirements of Chapters 4 through 8 of this standard and shall not use the NFPA name or the name or identification of this standard in any statements about their respective products unless the products are certified as compliant to this standard.

4.2.5 –

All compliant products shall be labeled and listed.

4.2.6 –

All compliant products shall also have a product label that meets the requirements specified in Section 5.1, Product Label Requirements for Both Ensembles.

4.2.7 –

The certification organization's label, symbol, or identifying mark shall be part of the product label, shall be attached to the product label, or shall be immediately adjacent to the product label.

4.2.8 –

The certification organization shall not issue any new certifications to the 2013 edition of NFPA 1971 on or after the NFPA effective date for the 2018 edition, which is August 21, 2017.

4.2.9 –

The certification organization shall not permit any manufacturer to continue to label any products that are certified as compliant with the 2013 edition of NFPA 1971 on or after August 21, 2018.

4.2.10 –

The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2013 edition of NFPA 1971 from all products that are under the control of the manufacturer on August 21, 2018, and the certification organization shall verify this action is taken.

4.3 – Certification Program.**4.3.1 * –**

The certification organization shall not be owned or controlled by manufacturers or vendors of the product being certified.

4.3.2 –

The certification organization shall be primarily engaged in certification work and shall not have a monetary interest in the product's ultimate profitability.

4.3.3 –

The certification organization shall be accredited for personal protective equipment in accordance with ISO/IEC 17065, *Conformity assessment — Requirements for bodies certifying products, processes, and services*. The accreditation shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*.

4.3.4 –

The certification organization shall refuse to certify products to Chapters 4 through 8 of this standard that do not comply with all applicable requirements of this standard.

4.3.5 * –

The contractual provisions between the certification organization and the manufacturer shall specify that certification is contingent on compliance with all applicable requirements of Chapters 4 through 8 of this standard.

4.3.5.1 –

The certification organization shall not offer or confer any conditional, temporary, or partial certifications.

4.3.5.2 –

Manufacturers shall not be authorized to use any label or reference to the certification organization on products that are not compliant with all applicable requirements of Chapters 4 through 8 of this standard.

4.3.6 * –

The certification organization shall have laboratory facilities and equipment available for conducting proper tests to determine product compliance.

4.3.6.1 –

The certification organization laboratory facilities shall have a program in place and functioning for calibration of all instruments, and procedures shall be in use to ensure proper control of all testing.

4.3.6.2 –

The certification organization laboratory facilities shall follow good practice regarding the use of laboratory manuals, form data sheets, documented calibration and calibration routines, performance verification, proficiency testing, and staff qualification and training programs.

4.3.7 –

The certification organization shall require the manufacturer to establish and maintain a quality assurance program that meets the requirements of Section 4.6, *Manufacturers' Quality Assurance Program*.

4.3.7.1 * –

The certification organization shall require the manufacturer to have a product recall system specified in Section 4.9, *Manufacturers' Safety Alert and Product Recall Systems*, as part of the manufacturer's quality assurance program.

4.3.7.2 –

The certification organization shall audit the manufacturer's quality assurance program to ensure that the quality assurance program provides continued product compliance with Chapters 4 through 8 of this standard.

4.3.8 –

The certification organization and the manufacturer shall evaluate any changes affecting the form, fit, or function of the compliant product to determine its continued certification to Chapters 4 through 8 of this standard.

4.3.9 *

The certification organization shall have a follow-up inspection program of the manufacturer's manufacturing facilities of the compliant product with at least two random and unannounced visits per 12-month period to verify the product's continued compliance. Where portions of the production process are carried out by multiple facilities, the certification organization shall determine the appropriate follow-up program according to which facility or facilities most closely meet the definition provided in 3.3.105 (Manufacturing Facility).

4.3.9.1

As part of the follow-up inspection program, the certification organization shall select sample compliant product at random from the manufacturing facility's production line, from the manufacturer's or manufacturing facility's in-house stock, or from the open market.

4.3.9.2

Sample product shall be evaluated by the certification organization to verify the product's continued compliance in order to assure that the materials, components, and manufacturing quality assurance systems are consistent with the materials, components, and manufacturing quality assurance that were inspected and tested by the certification organization during initial certification and recertification.

4.3.9.3

The certification organization shall be permitted to conduct specific testing to verify the product's continued compliance.

4.3.9.4

For products, components, and materials where prior testing, judgment, and experience of the certification organization have shown results to be in jeopardy of not complying with Chapters 4 through 8 of this standard, the certification organization shall conduct more frequent testing of sample product, components, and materials acquired in accordance with 4.3.9.1 against the applicable requirements of Chapters 4 through 8.

4.3.10

The certification organization shall have in place a series of procedures, as specified in Section 4.7, Hazards Involving Compliant Product, that address reports of situations in which a compliant product is subsequently found to be hazardous.

4.3.11

The certification organization's operating procedures shall provide a mechanism for the manufacturer to appeal decisions. The procedures shall include the presentation of information from both sides of a controversy to a designated appeals panel.

4.3.12

The certification organization shall be in a position to use legal means to protect the integrity of its name and label. The name and label shall be registered and legally defended.

4.4 – Inspection and Testing.**4.4.1**

For both initial certification and recertification of compliant products, the certification organization shall conduct both inspection and testing as specified in this section.

4.4.2

All inspections, evaluations, conditioning, and testing for certification or for recertification shall be conducted by a certification organization's testing laboratory that is accredited in accordance with the requirements of ISO 17025, *General requirements for the competence of testing and calibration laboratories*.

4.4.2.1

The certification organization's testing laboratory's scope of accreditation to ISO 17025, *General requirements for the competence of testing and calibration laboratories*, shall encompass testing of personal protective equipment.

4.4.2.2

The accreditation of a certification organization's testing laboratory shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*.

4.4.3

A certification organization shall be permitted to utilize conditioning and testing results conducted by a product or component manufacturer for certification or recertification provided the manufacturer's testing laboratory meets the requirements specified in 4.4.3.1 through 4.4.3.5.

4.4.3.1

The manufacturer's testing laboratory shall be accredited in accordance with the requirements of ISO 17025, *General requirements for the competence of testing and calibration laboratories*.

4.4.3.2 –

The manufacturer's testing laboratory's scope of accreditation to ISO 17025, *General requirements for the competence of testing and calibration laboratories*, shall encompass testing of personal protective equipment.

4.4.3.3 –

The accreditation of a manufacturer's testing laboratory shall be issued by an accreditation body operating in accordance with ISO 17011, *Conformity assessment — General requirements for accreditation bodies accrediting conformity assessment bodies*.

4.4.3.4 –

The certification organization shall approve the manufacturer's testing laboratory.

4.4.3.5 –

The certification organization shall determine the level of supervision and witnessing of the conditioning and testing for certification or recertification conducted at the manufacturer's testing laboratory.

4.4.4 * –

Sampling levels for testing and inspection shall be established by the certification organization and the manufacturer to ensure a reasonable and acceptable reliability at a reasonable and acceptable confidence level that products certified to Chapters 4 through 8 of this standard are compliant, unless such sampling levels are specified herein.

4.4.4.1 * –

For certification of structural firefighting helmet elements, a test series shall consist of 14 helmets.

4.4.4.1.1 –

A minimum of three test series shall be required for certification.

4.4.4.1.2 –

Each helmet shall be subjected to the specified environmental conditioning and test or tests.

4.4.4.2 * –

For certification of proximity firefighting helmet elements, a test series shall consist of 14 helmets.

4.4.4.2.1 –

A minimum of three test series shall be required for certification.

4.4.4.2.2 –

Each helmet shall be subjected to the specified environmental conditioning and test or tests.

4.4.4.3 –

For certification of any ensembles with the optional liquid and particulate contaminant protection requirements, the ensembles and components shall be subjected to the specified environmental conditioning and test or tests.

4.4.5 –

Inspection and evaluation by the certification organization shall include a review of all product labels to ensure that all required label attachments, compliance statements, certification statements, and other product information are at least as specified for the products identified in Section 5.1, Product Label Requirements for Both Ensembles; Section 5.2, Additional Product Label Requirements for Structural Firefighting Ensemble Elements Only; and Section 5.3, Additional Product Label Requirements for Proximity Firefighting Ensemble Elements Only.

4.4.6 –

Inspection and evaluation by the certification organization shall include an evaluation of any symbols and pictorial graphic representations used on product labels or in user information, as permitted in 5.1.5 to ensure that the symbols are clearly explained in the product's user information package.

4.4.7 –

Inspection and evaluation by the certification organization shall include a review of the user information required by Section 5.4, User Information Requirements for Both Ensembles, to ensure that the information has been developed and is available.

4.4.8 –

Inspection and evaluation by the certification organization for determining compliance with the design requirements specified in Chapter 6 shall be performed on whole or complete products.

4.4.9 –

Testing to determine product compliance with the performance requirements specified in Chapter 7 shall be conducted by the certification organization in accordance with the specified testing requirements of Chapter 8.

4.4.9.1 –

Testing shall be performed on specimens representative of materials and components used in the actual construction of the compliant product.

4.4.9.2 –

The certification organization also shall be permitted to use sample materials cut from a representative product.

4.4.10 –

The certification organization shall accept from the manufacturer, for evaluation and testing for certification, only product or product components that are the same in every respect to the actual final product or product component.

4.4.11 –

The certification organization shall not allow any modifications, pretreatment, conditioning, or other such special processes of the product or any product component prior to the product's submission for evaluation and testing by the certification organization.

4.4.12 –

The certification organization shall not allow the substitution, repair, or modification, other than as specifically permitted herein, of any product or any product component during testing.

4.4.13 –

The certification organization shall not allow test specimens that have been conditioned and tested for one method to be reconditioned and tested for another test method unless specifically permitted in the test method.

4.4.14 –

The certification organization shall test an ensemble element with the specific ensemble(s) with which it is to be certified.

4.4.15 –

Any change in the design, construction, or material of a compliant product shall necessitate new inspection and testing to verify compliance to all applicable requirements of Chapters 4 through 8 of this standard that the certification organization determines can be affected by such change. This recertification shall be conducted before labeling the modified product as being compliant with Chapters 4 through 8 :

4.4.16 –

The manufacturer shall maintain all design and performance inspection and test data from the certification organization used in the certification of the manufacturer's compliant product. The manufacturer shall provide such data, upon request, to the purchaser or authority having jurisdiction.

4.5 – Recertification:**4.5.1 –**

All individual elements of the protective ensemble that are labeled as being compliant with Chapters 4 through 8 of this standard shall undergo recertification on an annual basis. This recertification shall include the following:

- (1) Inspection and evaluation to all design requirements as required by Chapters 4 through 8 on all manufacturer models and components:
- (2) Testing to all performance requirements as required by Chapters 4 through 8 on all manufacturer models and components with the following protocol:
 - (3) Where a test method incorporates testing both before and after laundering conditioning specified in 8.1.2 and the test generates quantitative results, recertification testing shall be limited to the conditioning that yielded the worst case test result during the initial certification for the model or component.
 - (4)* Where a test method incorporates testing both before and after laundering conditioning specified in 8.1.2 and the test generates nonquantitative results, recertification shall be limited to a single conditioning procedure in any given year. Subsequent annual recertifications shall cycle through the remaining conditioning procedures to ensure that all required conditionings are included over time.
 - (5) Where a test method requires the testing of three specimens, a minimum of one specimen shall be tested for annual recertification.
 - (6) Where a test method requires the testing of five or more specimens, a minimum of two specimens shall be tested for annual recertification.

4.5.2 –

At least one sample of each compliant product and component shall be tested for overall performance as specified in Chapter 7 according to the following protocol:

- (1) Where a test method incorporates testing both before and after laundering conditioning specified in 8.1.2 and the test generates quantitative results, recertification testing shall be limited to the conditioning that yielded the worst-case test result during the initial certification for the model or component.
- (2)* Where a test method incorporates testing both before and after laundering conditioning specified in 8.1.2 and the test generates nonquantitative results, recertification shall be limited to a single conditioning procedure in any given year. Subsequent annual recertifications shall cycle through the remaining conditioning procedures to ensure that all required conditionings are included over time.
- (3) Where a test method requires the testing of less than five specimens, a minimum of one specimen shall be tested for annual recertification.
- (4) Where a test method requires the testing of five or more specimens, a minimum of two specimens shall be tested for annual recertification.

4.5.3 –

Any change that affects the element's performance under the design or performance requirements of Chapters 4 through 8 of this standard shall constitute a different model.

4.5.4 –

For the purpose of Chapters 4 through 8 of this standard, models shall include each unique pattern, style, or design of the individual element.

4.5.5 –

Samples of manufacturer models and components for recertification shall be acquired as part of the follow-up program in accordance with 4.3.7 and shall be permitted to be used toward annual recertification.

4.5.6 –

The manufacturer shall maintain all design and performance inspection and test data from the certification organization used in the recertification of manufacturer models and components. The manufacturer shall provide such data, upon request, to the purchaser or authority having jurisdiction.

4.6 – Manufacturers' Quality Assurance Program.**4.6.1 –**

The manufacturer shall provide and operate a quality assurance program that meets the requirements of this section and that includes a product recall system as specified in 4.3.7.1 and Section 4.9, Manufacturers' Safety Alert and Product Recall Systems.

4.6.2 –

The operation of the quality assurance program shall evaluate and test compliant product production to the requirements of Chapters 4 through 8 of this standard to assure production remains in compliance.

4.6.3 * –

All the following entities shall either be registered to ISO 9001, *Quality management systems—Requirements*, or shall be listed as a covered location under an ISO 9001 registered entity:

- (1) Manufacturer
- (2) Manufacturing facility
- (3) The entity that directs and controls compliant product design
- (4) The entity that directs and controls compliant product quality assurance
- (5) The entity that provides the warranty for the compliant product
- (6) The entity that puts their name on the product label and markets and sells the product as their own

4.6.3.1 –

Registration to the requirements of ISO 9001, *Quality management systems—Requirements*, shall be conducted by a registrar that is accredited for personal protective equipment in accordance with ISO 17021, *Conformity assessment—Requirements for bodies providing audit and certification of management systems*. The registrar shall affix the accreditation mark on the ISO registration certificate.

4.6.3.2 –

The scope of the ISO registration shall include at least the design and manufacturing systems management for the type of personal protective equipment being certified.

4.6.4 * –

Where the manufacturer uses subcontractors in the construction or assembly of the compliant product, the locations and names of all subcontractor facilities shall be documented and the documentation shall be provided to the manufacturer's ISO registrar and the certification organization.

4.6.5 –

Where manufacturers construct custom-sized or special-fitting gloves for accommodating the special needs of individual firefighters, the manufacturer shall employ the same manufacturing methods as used in the construction of required glove sizes.

4.6.5.1 –

The manufacturer shall notify the certification organization as required in 4.3.8 and shall obtain written approval from the certification organization prior to proceeding with any modifications to an existing certified glove design.

4.6.5.2 –

Custom fitting gloves shall be individually evaluated to verify the integrity of the glove moisture barrier using air or other similar method to ensure that the glove is constructed in a leak-free manner.

4.7 – Hazards Involving Compliant Product:**4.7.1 –**

The certification organization shall establish procedures to be followed where situation(s) are reported in which a compliant product is subsequently found to be hazardous. These procedures shall comply with the provisions of ISO Guide 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, and as modified herein.

4.7.2 * –

Where a report of a hazard involved with a compliant product is received by the certification organization, the validity of the report shall be investigated.

4.7.3 –

With respect to a compliant product, a hazard shall be a condition or create a situation that results in exposing life, limb, or property to an imminently dangerous or dangerous condition.

4.7.4 –

Where a specific hazard is identified, the determination of the appropriate action for the certification organization and the manufacturer to undertake shall take into consideration the severity of the hazard and its consequences to the safety and health of users.

4.7.5 –

Where it is established that a hazard is involved with a compliant product, the certification organization shall determine the scope of the hazard, including products, model numbers, serial numbers, factory production facilities, production runs, and quantities involved.

4.7.6 –

The certification organization's investigation shall include, but not be limited to, the extent and scope of the problem as it might apply to other compliant products or compliant product components manufactured by other manufacturers or certified by other certification organizations.

4.7.7 –

The certification organization shall also investigate reports of a hazard where compliant product is gaining widespread use in applications not foreseen when the standard was written, such applications in turn being ones for which the product was not certified, and no specific scope of application has been provided in Chapters 4 through 8 of the standard, and no limiting scope of application was provided by the manufacturer in written material accompanying the compliant product at the point of sale.

4.7.8 –

The certification organization shall require the manufacturer of the compliant product, or the manufacturer of the compliant product component if applicable, to assist the certification organization in the investigation and to conduct its own investigation as specified in Section 4.8, *Manufacturers' Investigation of Complaints and Returns*.

4.7.9 –

Where the facts indicating a need for corrective action are conclusive and the certification organization's appeal procedures referenced in 4.3.11 have been followed, the certification organization shall initiate corrective action immediately, provided there is a manufacturer to be held responsible for such action.

4.7.10 –

Where the facts are conclusive and corrective action is indicated, but there is no manufacturer to be held responsible, such as when the manufacturer is out of business or the manufacturer is bankrupt, the certification organization shall immediately notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

4.7.11 * –

Where the facts are conclusive and corrective action is indicated, the certification organization shall take one or more of the following corrective actions:

- (1) Notification of parties authorized and responsible for issuing a safety alert when, in the opinion of the certification organization, such a notification is necessary to inform the users.
- (2) Notification of parties authorized and responsible for issuing a product recall when, in the opinion of the certification organization, such a recall is necessary to protect the users.
- (3) Removing the mark of certification from the product.
- (4) Where a hazardous condition exists and it is not practical to implement 4.7.11 (1), 4.7.11 (2), or 4.7.11 (3); or the responsible parties refuse to take corrective action; the certification organization shall notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

4.7.12 –

The certification organization shall provide a report to the organization or individual identifying the reported hazardous condition and notify them of the corrective action indicated or that no corrective action is indicated.

4.7.13 * –

Where a change to an NFPA standard(s) is felt to be necessary, the certification organization shall also provide a copy of the report and corrective actions indicated to the NFPA and shall also submit either a Public Input for a proposed change to the next revision of the applicable standard or a proposed Temporary Interim Amendment (TIA) to the current edition of the applicable standard.

4.8 – Manufacturers' Investigation of Complaints and Returns:**4.8.1 –**

Manufacturers shall provide corrective action in accordance with ISO 9001, *Quality management systems — Requirements*, for investigating written complaints and returned products.

4.8.2 –

Manufacturers' records of returns and complaints related to safety issues shall be retained for at least 5 years.

4.8.3 –

Where the manufacturer discovers, during the review of specific returns or complaints, that a compliant product or compliant product component can constitute a potential safety risk to end users that is possibly subject to a safety alert or product recall, the manufacturer shall immediately contact the certification organization and provide all information about their review to assist the certification organization with their investigation.

4.9 – Manufacturers' Safety Alert and Product Recall Systems:**4.9.1 –**

Manufacturers shall establish a written safety alert system and a written product recall system that describes the procedures to be used in the event that it decides, or is directed by the certification organization, to either issue a safety alert or to conduct a product recall.

4.9.2 –

The manufacturer safety alert and product recall system shall provide the following:

- (1) The establishment of a coordinator and responsibilities by the manufacturer for the handling of safety alerts and product recalls
- (2) A method of notifying all dealers, distributors, purchasers, users, and the NFPA about the safety alert or product recall that can be initiated within a 1 week period following the manufacturer decision to issue a safety alert or to conduct a product recall, or after the manufacturer has been directed by the certification organization to issue a safety alert or conduct a product recall
- (3) Techniques for communicating accurately and understandably the nature of the safety alert or product recall and in particular the specific hazard or safety issue found to exist
- (4) Procedures for removing product that is recalled and for documenting the effectiveness of the product recall
- (5) A plan for either repairing, or replacing, or compensating purchasers for returned product

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Chapter_4_Consolidation_NFPA_1971.docx	Chapter 4 Consolidation	

Statement of Problem and Substantiation for Public Input

Consolidation of Certification requirements within NFPA 1970 that includes all common certification elements from NFPA 1971, NFPA 1975, NFPA 1981 and NFPA 1982. This consolidation effort will reduce a significant amount of redundancy between these standards now included in NFPA 1970, and will be consistent with the consolidation efforts already completed for Sections 1 through Section 3 of this new standard.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 215-NFPA 1970-2021 [Chapter 9]	
Public Input No. 216-NFPA 1970-2021 [Chapter 14]	
Public Input No. 218-NFPA 1970-2021 [Chapter 19]	

Submitter Information Verification

Submitter Full Name: William Fithian
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Submittal Date: Mon Nov 08 09:12:17 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-298-NFPA 1970-2022](#)

Statement: Moving 1971 specific info to new chapter 5 annex material as part of the consolidation and updating references. End users sometimes have difficulties navigating certification listing websites for identifying compliant products. The listed name provided by the certification organization should correspond to the name used by the manufacturer, at least as found on the product label, such as the required model or other identification.

Adding new certification requirements for recognized components to identify testing requirements related to restricted substances. Also, wanted to add a five-year window for which data can be accepted toward a new certification. Adding separate requirements for component supplier quality assurance so ISO 9001 is optional, which is aligned with current practice (for example, NFPA 2112).

The delay between the effective date of the newly issued standard and the actual publication of that standard continues to exceed what is reasonable for the certification organizations to complete all testing

required. Over the years, the "gap" was typically between 1 to 3 months. More recently, some standards are being published up to 6 months from issuance. This "gap" causes issue because the certification organizations are not able to issue certifications to the "old" edition after the effective date, and they are also not able to issue certifications to the "new" standard because the finished standard is unavailable. In the case where a standard is published 6 months after issuance, the COs are only given 6 months to test and update all certifications. This is impossible to do, especially where the testing program is as extensive as the one in this standard. This proposal adds 6 months to the previously allowed 12 months so that if the standard is published months after the effective date, the COs still have the ability to complete the necessary testing and file updates.

Moving 1971 specific annex info to new chapter 5 as part of the consolidation. Updating references.

Removing annex item that addresses the update to ISO 9001 as this is no longer applicable.



Public Input No. 143-NFPA 1970-2021 [Section No. 4.1.1.2.1]

~~4.1.1.2.1 –~~

~~Chapters 4 through 8 of this standard shall also specify optional requirements for particulate barrier protective hood interface components.~~

Statement of Problem and Substantiation for Public Input

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods should become mandatory.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 144-NFPA 1970-2021 [Section No. 5.2.6]	
Public Input No. 145-NFPA 1970-2021 [Section No. 6.14]	
Public Input No. 146-NFPA 1970-2021 [Section No. 7.14]	

Submitter Information Verification

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Committee: FAE-SPF

Committee Statement

Resolution: [FR-299-NFPA 1970-2022](#)

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 13-NFPA 1970-2021 [New Section after 4.1.1.4]

TITLE OF NEW CONTENT

4.1.1.4* Chapters 4 through 8 of this standard shall not apply to firefighting overhaul operations as it relates to protective coats and trousers. Coats and trousers for overhaul shall meet the requirements of NFPA 1951— *Standard on Protective Ensembles for Technical Rescue Incidents*. All other elements of the protective ensemble for structural firefighting shall apply.

A4.1.1.10 Statistics show that firefighters are far more likely to suffer or die from heat stress related issues than from thermal exposure. In overhaul operations, the thermal protection required for fire attack are not needed. The thermal barrier adds unnecessarily to heat stress. There might be environmental conditions such as cold environments that may necessitate the use of a garment with thermal insulation. By substituting the use of structural coats and pants with NFPA 1951 compliant coats and trousers (or coveralls) for overhaul, firefighters can operate in a safer environment. All other elements (helmet, hood, gloves, and footwear) of the structural ensemble, including SCBA with mask donned, should be worn.

Statement of Problem and Substantiation for Public Input

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Submitter Information Verification

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Committee: FAE-SPF

Committee Statement

Resolution: [FR-299-NFPA 1970-2022](#)

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 15-NFPA 1970-2021 [New Section after 4.1.1.5]

TITLE OF NEW CONTENT

4.1.1.5* This standard shall not specify PPE requirements for non-structural fire responses.

A4.1.1.5 Firefighters often wear structural firefighting PPE when mitigating responses that do not involve structural firefighting. Departments should consider providing their members with PPE suitable for non-structural firefighting incidents such as, but not limited to: technical rescue, vehicle extrication, medical, search and rescue, wildland and urban interface, and non-fire roadway incidents. There might be environmental conditions such as cold environments that may necessitate the use of a garment with thermal insulation.

Statement of Problem and Substantiation for Public Input

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

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Committee: FAE-SPF

Committee Statement

Resolution: FR-299-NFPA 1970-2022

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for

reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 127-NFPA 1970-2021 [Section No. 4.1.1.6]

4.1.1.6

Other than for the certification of structural or proximity protective ~~ensembles-garments~~ to the ~~optional complete ensemble liquid- optional liquid~~ and particulate hazard protection requirements, Chapters 4 through 8 of this standard shall not specify the respiratory protection that is necessary for proper protection with structural or firefighting protective ensembles.

Statement of Problem and Substantiation for Public Input

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles is being changed to the certification of garments only. See PI125

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Submittal Date: Tue Nov 02 15:34:38 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-299-NFPA 1970-2022

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for

reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 128-NFPA 1970-2021 [Section No. 4.1.2.2]

4.1.2.2

The purpose of Chapters 4 through 8 of this standard shall also be to establish a minimum level of protection for structural and proximity firefighting personnel from exposure to liquid and particulate contaminants as an option for compliant structural firefighting ensembles garments , for compliant proximity firefighting ensembles garments , and for compliant elements for both ensembles garments .

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

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Committee: FAE-SPF

Committee Statement

Resolution: FR-299-NFPA 1970-2022

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for

reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 14-NFPA 1970-2021 [New Section after 4.1.2.4]

TITLE OF NEW CONTENT

4.1.2.5 The purpose of this standard shall not be to establish minimum levels of protection for non-fire fighting incidents such as, but not limited to: technical rescue, vehicle extrication, medical, search and rescue, wildland and urban interface, and non-fire roadway incidents.

Statement of Problem and Substantiation for Public Input

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Submitter Information Verification

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Committee: FAE-SPF

Committee Statement

Resolution: [FR-299-NFPA 1970-2022](#)

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 129-NFPA 1970-2021 [Section No. 4.1.3.2]

4.1.3.2*

Chapters 4 through 8 of this standard shall apply to the design, manufacturing, testing, and certification of new structural firefighting protective ensembles, new proximity firefighting protective ensembles, and new garment elements of both ensembles for additional optional protection from liquid and particulate contaminants.

4.1.3.2.1

This standard shall also apply to the design, manufacturing, testing, and certification of new structural fire fighting protective hoods and new proximity fire fighting protective hoods for additional optional protection from particulate contaminants.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See P1125 for the full substantiation

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
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Submittal Date: Tue Nov 02 15:40:03 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-299-NFPA 1970-2022

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all

products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 131-NFPA 1970-2021 [Sections 4.2.2.1, 4.2.2.2]

Sections 4.2.2.1, 4.2.2.2

4.2.2.1 –

The certification organization shall only permit the certification of complete protective ensembles, which include protective garments, protective helmet, protective gloves, protective footwear, interface components where necessary for certification, and protective hood where the hood is not part of the protective garments, to the optional requirements for protection against liquid and particulate contaminants.

4.2.2.2 –

The certification organization shall further require that the protective ensemble manufacturer specify the respiratory protection component of the ensemble by manufacturer, type, and model in order for the ensembles to be certified to the optional requirements for protection against liquid and particulate contaminants.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See P1125 for the full substantiation

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Committee: FAE-SPF

Committee Statement

Resolution: [FR-299-NFPA 1970-2022](#)

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all

products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 328-NFPA 1970-2021 [Section No. 4.2.5]

4.2.5

All compliant products shall be labeled and listed.

4.2.5.1

The certification organization shall be required to identify the element or component in the certification listing as used by manufacturer to identify the product to end users.

Statement of Problem and Substantiation for Public Input

End users sometimes have difficulties navigating certification listing websites for identifying compliant products. The listed name provided by the certification organization should correspond to the name used by the manufacturer, at least as found on the product label, such as the required model or other identification.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull

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Submittal Date: Wed Nov 10 16:29:45 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-298-NFPA 1970-2022](#)

Statement: Moving 1971 specific info to new chapter 5 annex material as part of the consolidation and updating references. End users sometimes have difficulties navigating certification listing websites for identifying compliant products. The listed name provided by the certification organization should correspond to the name used by the manufacturer, at least as found on the product label, such as the required model or other identification.

Adding new certification requirements for recognized components to identify testing requirements related to restricted substances. Also, wanted to add a five-year window for which data can be accepted toward a new certification. Adding separate requirements for component supplier quality assurance so ISO 9001 is optional, which is aligned with current practice (for example, NFPA 2112).

The delay between the effective date of the newly issued standard and the actual publication of that standard continues to exceed what is reasonable for the certification organizations to complete all testing required. Over the years, the "gap" was typically between 1 to 3 months. More recently, some standards are being published up to 6 months from issuance. This "gap" causes issue because the certification organizations are not able to issue certifications to the "old" edition after the effective date, and they are also not able to issue certifications to the "new" standard because the finished standard is unavailable. In the case where a standard is published 6 months after issuance, the COs are only given 6 months to test and update all certifications. This is impossible to do, especially where the testing program is as extensive as the one in this standard. This proposal adds 6 months to the previously allowed 12 months so that if the standard is published months after the effective date, the COs still have the ability to complete the necessary testing and file updates.

Moving 1971 specific annex info to new chapter 5 as part of the consolidation. Updating references.

Removing annex item that addresses the update to ISO 9001 as this is no longer applicable.



Public Input No. 213-NFPA 1970-2021 [Sections 4.2.8, 4.2.9, 4.2.10]

Sections 4.2.8, 4.2.9, 4.2.10

4.2.8

The certification organization shall not issue any new certifications to the ~~2013 edition~~ 2018 edition of NFPA 1971 on or after the NFPA effective date ~~for the 2018 edition, which is August 21, 2017~~ of the 2024 edition.

4.2.9

The certification organization shall not permit any manufacturer to continue to label any products that are certified as compliant with the ~~2013 edition~~ 2018 edition of NFPA 1971 on or after ~~August 21, 2018~~ the effective date of the 2024 edition of the standard, plus 18 months.

4.2.10

The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the ~~2013 edition~~ 2018 edition of NFPA 1971 from all products that are under the control of the manufacturer on ~~August 21, 2018, and~~ the effective date of the 2024 edition of the standard, plus 18 months; and the certification organization shall verify this action is taken.

Statement of Problem and Substantiation for Public Input

The delay between the effective date of the newly issued standard and the actual publication of that standard continues to exceed what is reasonable for the certification organizations to complete all testing required. Over the years, the "gap" was typically between 1 to 3 months. More recently, some standards are being published up to 6 months from issuance. This "gap" causes issue because the certification organizations are not able to issue certifications to the "old" edition after the effective date, and they are also not able to issue certifications to the "new" standard because the finished standard is unavailable. In the case where a standard is published 6 months after issuance, the COs are only given 6 months to test and update all certifications. This is impossible to do, especially where the testing program is as extensive as the one in this standard. This proposal adds 6 months to the previously allowed 12 months so that if the standard is published months after the effective date, the COs still have the ability to complete the necessary testing and file updates.

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Submittal Date: Mon Nov 08 08:55:58 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-298-NFPA 1970-2022

Statement: Moving 1971 specific info to new chapter 5 annex material as part of the consolidation and updating references. End users sometimes have difficulties navigating certification listing websites for identifying compliant products. The listed name provided by the certification organization should correspond to the name used by the manufacturer, at least as found on the product label, such as the required model or other identification.

Adding new certification requirements for recognized components to identify testing requirements related to restricted substances. Also, wanted to add a five-year window for which data can be accepted toward a new certification. Adding separate requirements for component supplier quality assurance so ISO 9001 is optional, which is aligned with current practice (for example, NFPA 2112).

The delay between the effective date of the newly issued standard and the actual publication of that standard continues to exceed what is reasonable for the certification organizations to complete all testing required. Over the years, the "gap" was typically between 1 to 3 months. More recently, some standards are being published up to 6 months from issuance. This "gap" causes issue because the certification organizations are not able to issue certifications to the "old" edition after the effective date, and they are also not able to issue certifications to the "new" standard because the finished standard is unavailable. In the

case where a standard is published 6 months after issuance, the COs are only given 6 months to test and update all certifications. This is impossible to do, especially where the testing program is as extensive as the one in this standard. This proposal adds 6 months to the previously allowed 12 months so that if the standard is published months after the effective date, the COs still have the ability to complete the necessary testing and file updates.

Moving 1971 specific annex info to new chapter 5 as part of the consolidation. Updating references.

Removing annex item that addresses the update to ISO 9001 as this is no longer applicable.



Public Input No. 132-NFPA 1970-2021 [Section No. 4.4.4.3]

4.4.4.3

For certification of any ~~ensembles~~ garments with the optional liquid and particulate contaminant protection requirements, the ~~ensembles~~ garments and interface components shall be subjected to the specified environmental conditioning and test or tests.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Submittal Date: Tue Nov 02 15:46:39 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-299-NFPA 1970-2022

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for

reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Tentative Interim Amendment

NFPA[®] 1971

Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting

2018 Edition

Reference: 8.71.2.3

TIA 18-3

(SC 18-12-9 / TIA Log #1404)

Pursuant to Section 5 of the NFPA *Regulations Governing the Development of NFPA Standards*, the National Fire Protection Association has issued the following Tentative Interim Amendment to NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2018 edition. The TIA was processed by the Technical Committee on Structural and Proximity Fire Fighting Protective Clothing and Equipment, and the Correlating Committee on Fire and Emergency Services Protective Clothing and Equipment, and was issued by the Standards Council on December 7, 2018, with an effective date of December 27, 2018.

A Tentative Interim Amendment is tentative because it has not been processed through the entire standards-making procedures. It is interim because it is effective only between editions of the standard. A TIA automatically becomes a public input of the proponent for the next edition of the standard; as such, it then is subject to all of the procedures of the standards-making process.

1. *Revise 8.71.2.3 to read as follows:*

8.71.2.3* A reference sample shall be prepared that consists of a composite constructed using two layers of ~~8.49.0~~ 8.49.0 oz-/yd² ± ~~0.41.0~~ 0.41.0 oz-/yd², 100 percent meta-aramid, 1 × 1 rib knit with a stitch count of 37 courses/in. ± 2 courses/in. and 21 wales/in. ± 2 wales per in.

Issue Date: December 7, 2018

Effective Date: December 27, 2018

(Note: For further information on NFPA Codes and Standards, please see www.nfpa.org/docinfo)

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NATIONAL FIRE PROTECTION ASSOCIATION



Public Input No. 325-NFPA 1970-2021 [New Section after 4.4.9.2]

4.4.9.3

Where the certification organization has findings of non-compliance during initial or follow-on testing, the certification organization shall have procedures in place requiring the manufacturer to undertake a root cause analysis, providing a rationale for their non-compliant results, and a corrective action for how the subject element, material, or component is changed or specific problems with the testing is to be addressed in any retesting.

Statement of Problem and Substantiation for Public Input

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

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Committee: FAE-SPF

Committee Statement

Resolution: FR-299-NFPA 1970-2022

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 326-NFPA 1970-2021 [Section No. 4.4.15]

4.4.15

Any change in the design, construction, or material of a compliant product shall necessitate new inspection and testing to verify compliance to all applicable requirements of Chapters 4 through 8 of this standard that the certification organization determines can be affected by such change. This recertification shall be conducted before labeling the modified product as being compliant with Chapters 4 through 8.

4.4.15.1

The manufacturer shall require the product or component manufacturer to provide a new unique product or component name and apply a separate listing for any retesting of an already qualified product that results in new performance properties that represents a significant change from the original test properties.

Statement of Problem and Substantiation for Public Input

Is it misleading if a product attains a new level of protective performance where it has already been found compliant under at significantly different level of performance and retains the same name, particularly if the product claims change. If a manufacturer "reengineers" a product to provide different reported performance attributes while still maintaining compliance, than the product should be renamed and should carry a separate listing to distinguish it from the former product.

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Committee: FAE-SPF

Committee Statement

Resolution: [FR-299-NFPA 1970-2022](#)

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 133-NFPA 1970-2021 [Section No. 4.5.2]

4.5.2

At least one sample of each compliant product and component shall be tested for overall performance as specified in Chapter 7 according to the following protocol:

- (1) Where a test method incorporates testing both before and after laundering conditioning specified in 8.1.2 and the test generates quantitative results, recertification testing shall be limited to the conditioning that yielded the worst-case test result during the initial certification for the model or component.
- (2) * Where a test method incorporates testing both before and after laundering conditioning specified in 8.1.2 and the test generates nonquantitative results, recertification shall be limited to a single conditioning procedure in any given year. Subsequent annual recertifications shall cycle through the remaining conditioning procedures to ensure that all required conditionings are included over time.
- (3) Where a test method requires the testing of less than five specimens, a minimum of one specimen shall be tested for annual recertification, unless otherwise specified in this standard.
- (4) Where a test method requires the testing of five or more specimens, a minimum of two specimens shall be tested for annual recertification, unless otherwise specified in this standard.
- (5) Testing of garments for the optional liquid and particulate contaminant protection shall only be performed during initial certification.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Committee: FAE-SPF

Committee Statement

Resolution: [FR-299-NFPA 1970-2022](#)

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.

**Public Input No. 280-NFPA 1970-2021 [Chapter 5]****Chapter 5** Labeling and Information (NFPA 1971)**5.1** Product Label Requirements for Both Ensembles.**5.1.1***

Each element of both protective ensembles shall have at least one product label permanently and conspicuously located inside each element when the element is properly assembled with all layers and components in place.

5.1.2

Multiple label pieces shall be permitted in order to carry all statements and information required to be on the product label. However, all label pieces comprising the product label shall be located adjacent to each other.

5.1.3*

The certification organization's label, symbol, or identifying mark shall be permanently attached to the product label or shall be part of the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high. The label, symbol, or identifying mark shall be at least 6 mm ($\frac{1}{4}$ in.) in height and shall be placed in a conspicuous location.

5.1.4

All worded portions of the required product label shall be printed at least in English.

5.1.5

Symbols and other pictorial graphic representations shall be permitted to be used to supplement worded statements on the product label(s).

5.1.6

The compliance statements specified in Section 5.2 for structural firefighting protective ensemble elements and in Section 5.3 for proximity firefighting protective ensemble elements shall be printed legibly on the product label.

5.1.7

The following information shall also be printed legibly on each product label with all letters at least 1.5 mm ($\frac{1}{16}$ in.) in height:

- (1) Manufacturer's name, identification, or designation
- (2) Manufacturer's address
- (3) Country of manufacture
- (4) Manufacturer's element identification number, lot number, or serial number
- (5) Month and year of manufacture, not coded
- (6) Model name, number, or design
- (7) Size or size range
- (8) Principal material(s) of construction
- (9) Cleaning precautions

5.1.7.1

For garments only, where the principal material of construction is a component that is listed, the component name under which it is listed shall be identified.

5.1.7.2

For garments only, where the thermal liner, moisture barrier, and outer shell are separable, each separable layer shall also have a label containing the information required in 5.1.7(4) through 5.1.7(8).

5.1.7.3*

For principal materials of construction of footwear, at least the outer shell, moisture barrier, and thermal liner shall be listed. Generic names of materials shall be permitted to be used. Additional materials that are used throughout the majority of the footwear shall also be listed on the label.

5.1.7.4*

For principal materials of construction of helmets, the shell material shall be listed.

5.1.7.5*

For principal materials of construction of gloves, at least the outer shell, moisture barrier, thermal liner, and glove interface component (wristlet) shall be listed. Generic names of materials shall be permitted to be used. If used, the type of leather shall be listed. Any additional materials that are used throughout the significant portion of the glove's construction shall also be listed on the label.

5.2 Additional Product Label Requirements for Structural Firefighting Ensemble Elements Only.**5.2.1**

The following compliance statement shall be printed legibly on the product label for each structural firefighting protective ensemble element, unless the requirements in 5.2.1.1 prevail. The appropriate term for the element type — garment, helmet, glove, footwear, hood — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm ($\frac{3}{32}$ in.) in height.

THIS STRUCTURAL FIREFIGHTING PROTECTIVE (insert appropriate element term here) MEETS THE (insert appropriate element term here) REQUIREMENTS OF NFPA 1971, 2018 EDITION.

DO NOT REMOVE THIS LABEL.

5.2.1.1

Where an entire ensemble is also certified as compliant with the optional requirements for protection against liquid and particulate contaminants, each element of the entire ensemble shall have at least the additional following compliance statement on the product label in place of the compliance statement specified in 5.2.1. The appropriate term for the element type — garment, helmet, glove, footwear, hood — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm ($\frac{3}{32}$ in.) in height.

LIQUID AND PARTICULATE PROTECTIVE ENSEMBLE

THIS ELEMENT IS NOT INTENDED AS PART OF A HAZARDOUS MATERIALS PROTECTIVE ENSEMBLE.

THIS STRUCTURAL FIREFIGHTING PROTECTIVE (insert appropriate element term here) MEETS THE (insert appropriate element term here) REQUIREMENTS OF NFPA 1971, 2018 EDITION, AND THE OPTIONAL REQUIREMENTS FOR LIQUID AND PARTICULATE CONTAMINANT PROTECTION WHEN WORN TOGETHER WITH THE OTHER SPECIFIED ELEMENTS AND INTERFACE COMPONENTS OF THE ENSEMBLE.

DO NOT REMOVE THIS LABEL.

5.2.1.2

The garment element of the ensemble meeting the optional requirements for protection against liquid and particulate contaminants shall list those items of the certified ensemble by manufacturer name and model number on the product label.

5.2.2

Where other protective item(s) or detachable components must be used with structural firefighting protective ensemble elements in order for an element to be compliant with this standard, at least the following statement and information shall also be printed legibly on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high. The appropriate term for the element type — garment, helmet, glove, footwear, hood — shall be inserted in the statement text where indicated. Following this statement, the additional protective items or detachable components shall be listed by type, identification, and how properly assembled.

FOR COMPLIANCE WITH THE STRUCTURAL FIREFIGHTING (insert appropriate element term here) REQUIREMENTS OF NFPA 1971, THE FOLLOWING PROTECTIVE ITEMS MUST BE WORN IN CONJUNCTION WITH THIS [insert appropriate element term here]:

(List additional items or detachable components here.)

DO NOT REMOVE THIS LABEL.

5.2.3

For helmets only, the helmet manufacturer shall place a unique manufacturer's part number, the symbol of the certification organization, and the words "NFPA 1971, 2018 ED." permanently on each replaceable performance critical part of the goggle lens or faceshield.

5.2.4

For hoods only, where the hood is designed to interface with a specific SCBA facepiece(s), the hood manufacturer shall add an item to the items specified in 5.1.7.

5.2.4.1

The hood manufacturer shall designate the specific SCBA facepiece(s), model(s) and size(s) in the new item of 5.1.7.

5.2.4.2

Where the hood is designed to be used with a specific SCBA facepiece(s), the hood manufacturer shall add to the hood product label the following statement:

FOR COMPLIANCE WITH THE STRUCTURAL FIREFIGHTING REQUIREMENTS OF NFPA 1971, THIS HOOD CAN ONLY BE USED WITH THE FOLLOWING NOTED SCBA FACEPIECE(S) [insert SCBA facepieces(s), model(s), and size(s) here].

5.2.5

For garments only, **where a DRD is installed**, the garment manufacturer shall place a manufacturer's identification number, lot number or serial number, the size or size range, the symbol of the certification organization, and the words "**NFPA 1971, 2018 ED.**" on the drag rescue device (DRD).

5.2.6 (NEW)

Where a drag rescue device (DRD) is not present, the following additional statement shall be added to the product label: "THIS PROTECTIVE COAT (COVERALL) DOES NOT HAVE A DRAG RESCUE DEVICE (DRD). AN ALTERNATIVE MEANS OF FIREFIGHTER EXTRICATION MUST BE DETERMINED BY YOUR DEPARTMENT IN ADVANCE AND DEPLOYED."

5.2.6

For particulate blocking hoods only, the following additional language shall be provided on the product label:

THIS HOOD PROVIDES LIMITED PARTICULATE BLOCKING PROTECTION.

5.3 Additional Product Label Requirements for Proximity Firefighting Ensemble Elements Only.**5.3.1**

The following compliance statement shall be printed legibly on the product label for each proximity firefighting protective ensemble element. The appropriate term for the element type — garment, helmet, glove, footwear — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm ($\frac{3}{32}$ in.) in height.

THIS PROXIMITY FIREFIGHTING PROTECTIVE [insert appropriate element term here] MEETS THE [insert appropriate element term here] REQUIREMENTS OF NFPA 1971, 2018 EDITION.

DO NOT REMOVE THIS LABEL.

5.3.1.1

Where an entire ensemble is also certified as compliant with the optional requirements for protection against liquid and particulate contaminants, each element of the entire ensemble shall have at least the additional following compliance statement on the product label in place of the compliance statement specified in 5.3.1. The appropriate term for the element type — garment, helmet, glove, footwear — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm ($\frac{3}{32}$ in.) in height.

LIQUID AND PARTICULATE CONTAMINANT PROTECTIVE ENSEMBLE

THIS ELEMENT IS NOT INTENDED AS PART OF A HAZARDOUS MATERIALS PROTECTIVE ENSEMBLE.

THIS PROXIMITY FIREFIGHTING PROTECTIVE [insert appropriate element term here] MEETS THE [insert appropriate element term here] REQUIREMENTS OF NFPA 1971, 2018 EDITION, AND THE OPTIONAL REQUIREMENTS FOR LIQUID AND PARTICULATE CONTAMINANT PROTECTION, WHEN WORN TOGETHER WITH THE OTHER SPECIFIED ELEMENTS AND INTERFACE COMPONENTS OF THE ENSEMBLE.

DO NOT REMOVE THIS LABEL.

5.3.1.2

The garment element of the ensemble meeting the optional requirements for protection against liquid and particulate contaminants shall list those items of the certified ensemble by manufacturer name and model number on the product label.

5.3.2

Where other protective item(s) or detachable components must be used with proximity firefighting protective ensemble elements in order for an element to be compliant with this standard, at least the following statement and information shall also be printed legibly on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high. The appropriate term for the element type — garment, helmet, glove, footwear — shall be inserted in the statement text where indicated. Following this statement, the additional protective items or detachable components shall be listed by item/component identification or part number, and where applicable, how properly assembled.

FOR COMPLIANCE WITH THE PROXIMITY FIREFIGHTING (insert appropriate element term here) REQUIREMENTS OF NFPA 1971, THE FOLLOWING PROTECTIVE ITEMS MUST BE WORN IN CONJUNCTION WITH THIS [insert appropriate element term here]:

[List additional items or detachable components here.]

DO NOT REMOVE THIS LABEL.

5.3.2.1

For proximity firefighting helmets, the list of additional items or detachable components shall include, as a minimum, the shroud, cover (except where the helmet cover is part of the shroud), and faceshield.

5.3.3

For helmets only, the helmet manufacturer shall place a unique manufacturer's part number, the symbol of the certification organization, and the words "**NFPA 1971, 2018 ED.**" permanently on each replaceable performance critical part of the faceshield.

5.3.4*

For the helmet shroud and cover (except where the helmet cover is part of the shroud), the manufacturer shall place a label on the shroud and cover (except where the helmet cover is part of the shroud) with a unique manufacturer's part number or identification and the following statement. The appropriate term for the item, shroud or cover, shall be inserted in the statement text where indicated.

FOR COMPLIANCE WITH THE PROXIMITY FIREFIGHTING REQUIREMENTS OF NFPA 1971-2018, THIS [insert appropriate item term here] CAN ONLY BE USED WITH THE FOLLOWING NOTED HELMET(S) AND ADDITIONAL ITEM(S): [insert helmet manufacturer's name and specific helmet model; and item name (shroud or cover) and shroud or cover part number, or identification where applicable].

5.3.5

For garments only, the garment manufacturer shall place a manufacturer's identification number, lot number or serial number, the size or size range, the symbol of the certification organization, and the words "**NFPA 1971, 2018 ED.**" on the DRD.

5.4 User Information Requirements for Both Ensembles.**5.4.1**

The manufacturer shall provide at least the user information that is specified in 5.4.4 with each structural and proximity firefighting element.

5.4.2

The manufacturer shall attach the required user information, or packaging containing the user information, to the element in such a manner that it is not possible to use the element without being aware of the availability of the information.

5.4.3

The required user information, or packaging containing the user information, shall be attached to the element so that a deliberate action is necessary to remove it. The manufacturer shall provide notice that the user information is to be removed only by the end user.

5.4.4*

The manufacturer shall provide at least the following instructions and information with each element:

- (1) Pre-use information
 - (2) [Safety considerations](#)
 - (3) [Limitations of use](#)
 - (4) [Marking recommendations and restrictions](#)
 - (5) [A statement that most performance properties of the element cannot be tested by the user in the field](#)
 - (6) [Warranty information](#)
- (7) Preparation for use
 - (8) [Sizing/adjustment](#)
 - (9) [Recommended storage practices](#)
- (10) Inspection frequency and details
- (11) Don/doff
 - (12) [Donning and doffing procedures](#)
 - (13) [Sizing and adjustment procedures](#)
 - (14) [Interface issues](#)
- (15) Proper use consistent with NFPA 1550 and 29 CFR 1910.132, General Requirements of Subpart I, "Personal Protective Equipment"
- (16) Maintenance and cleaning
 - (17) [Cleaning instructions and precautions with a statement advising users not to use an element that is not thoroughly cleaned and dried](#)
 - (18) [Inspection details](#)
 - (19) [Maintenance criteria and methods of repair where applicable](#)
 - (20) [Decontamination procedures for both chemical and biological contamination](#)
- (21) Retirement and disposal criteria and considerations
- (22) A statement that the moisture barrier has not been evaluated for all chemicals that can be encountered during firefighting operations and information that the effects of chemical exposure on the moisture barrier are to be evaluated per the inspection procedures in NFPA 1851

5.4.5

For the DRD only, the manufacturer shall provide specific information on the use, inspection, maintenance, cleaning, and retirement of the DRD. Additional instructions shall be provided on the removal and reinstallation of the DRD into the garment.

5.4.6

For footwear only, the manufacturer shall establish and provide, upon request, a size conversion chart for each model or style footwear element based on toe length, arch length, and foot width as measured on a Brannock Scientific Foot Measuring Device.

5.4.7

For helmets only, the manufacturer shall provide a list of items that are installed on, attached to, or packaged with the compliant helmet that meet the requirements of 6.4.8.

5.4.8

For protective ensembles certified to the optional liquid and particulate contaminant protection requirements, the manufacturer shall provide the following additional instruction and information with the ensemble:

- (1) A statement that only the ensemble and the specific elements with which the ensemble has been certified must be worn together to ensure that the optional liquid and particulate contaminant protection is provided
- (2) A list of the specific elements and interface components that must be worn as part of the liquid and particulate contaminant protective ensemble, including each type of CBRN SCBA that the ensemble has been certified with
- (3) A list of specific limitations associated with the use of the ensemble for a response involving liquid and particulate contaminant hazards, including but not limited to a statement that the ensemble is not a hazardous materials protective ensemble and that protection will not be provided from vapors or all liquids and particulates
- (4) Specific care and maintenance provisions associated with properly maintaining the unique performance properties of the ensemble, its elements, or interface components

5.4.9

When the optional requirements for liquid and particulate contaminant protection necessitate a specific action to engage interface areas, the manufacturer shall provide details explaining those procedures.

Statement of Problem and Substantiation for Public Input

5.2.5

While the drag rescue device (DRD) was incorporated as a life-saving feature for protective coat, limited information is available to suggest that its use provides the intended benefits for rapid extraction of a downed firefighter that cannot be achieved by other means. Therefore, it is suggested that the DRD become optional and if absent, the manufacturer provide a warning that the organization establish specific procedures for the rapid extrication of downed firefighters by some other identified means. NFPA 1500 that governs the use of PPE for fire departments currently incorporates language in paragraph 7.2.6 that requires fire department to have a standard operating procedure for rapid extrication of firefighters that may or may not depend on the coat having a DRD. This proposed change requires labeling of the DRD only when present.

5.2.6(NEW)

While the drag rescue device (DRD) was incorporated as a life-saving feature for protective coat, limited information is available to suggest that its use provides the intended benefits for rapid extraction of a downed firefighter that cannot be achieved by other means. Therefore, it is suggested that the DRD become optional and if absent, the manufacturer provide a warning that the organization establish specific procedures for the rapid extrication of downed firefighters by some other identified means. NFPA 1500 that governs the use of PPE for fire departments currently incorporates language in paragraph 7.2.6 that requires fire department to have a standard operating procedure for rapid extrication of firefighters that may or may not depend on the coat having a DRD. This proposed change addresses the need for a separate warning if the protective coat/coverall does not have a DRD.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 286-NFPA 1970-2021 [Section No. 6.1.9.1]	
Public Input No. 287-NFPA 1970-2021 [Sections 7.1.21, 7.1.22]	
Public Input No. 288-NFPA 1970-2021 [Section No. 8.58.1.1]	
Public Input No. 290-NFPA 1970-2021 [Section No. 8.59.1]	

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 20:58:42 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: The fire service still considers having a DRD a mandatory part of the life saving garments to be available when needed. The technical committee is looking at ways to improve the usability and accessibility of the device in further revisions.



Public Input No. 178-NFPA 1970-2021 [Section No. 5.1.7]

5.1.7

The following information shall also be printed legibly on each product label with all letters at least 1.5 mm ($\frac{1}{16}$ in.) in height:

- (1) Manufacturer's name, identification, or designation
- (2) Manufacturer's address
- (3) Country of manufacture
- (4) Manufacturer's element identification number, lot number, or serial number
- (5) Month and year of manufacture, not coded
- (6) Model name, number, or design
- (7) Size or size range
- (8) Principal material(s) of construction
- (9) Cleaning precautions

5.1.7.1

For garments only, where the principal material of construction is a component that is listed, the component name under which it is listed shall be identified.

5.1.7.2

For garments only, where the thermal liner, moisture barrier, and outer shell are separable, each separable layer shall also have a label containing the information required in 5.1.7(4) through 5.1.7(8).

5.1.7.3*

For principal materials of construction of footwear, at least the outer shell, moisture barrier, and thermal liner shall be listed. Generic names of materials shall be permitted to be used. Additional materials that are used throughout the majority of the footwear shall also be listed on the label.

5.1.7.4*

For principal materials of construction of helmets, the shell material shall be listed.

5.1.7.5*

For principal materials of construction of gloves, at least the outer shell, moisture barrier, thermal liner, and glove interface component (wristlet) shall be listed. Generic names of materials shall be permitted to be used. If used, the type of leather shall be listed. Any additional materials that are used throughout the significant portion of the glove's construction shall also be listed on the label.

5.1.7.6

Any garment, manufactured with known Per- and Polyfluoroalkyl Substances (PFAS) shall have a warning label affixed to all separable layers. This label shall include the known PFAS and what layer contains the PFAS.

Statement of Problem and Substantiation for Public Input

Currently, turnout gear is being manufactured with the use of certain chemicals that are known Per- and Polyfluoroalkyl Substances, commonly known as PFAS. These chemicals are widely known to cause an increased risk of certain health conditions including cancer. For years, end-users of turnout gear have been wearing these garments with no knowledge of being exposed to PFAS chemicals. While, manufacturers explain what some garments are made out of, there has been no specific disclosure of these materials being made with PFAS. The end-user should have the right to understand what they are wearing on a daily basis. This would be the first step to acknowledge that garments contain chemicals known to cause increased health risks.

Submitter Information Verification

Submitter Full Name: Travis Temarantz

Organization: Wilkes-Barre City Firefighter's Union IAFF Local 104

Affiliation: Local 104 Executive Board Member and Cancer Committee Chair

Street Address:

City:

State:**Zip:****Submittal Date:** Wed Nov 03 12:36:16 EDT 2021**Committee:** FAE-SPF

Committee Statement

Resolution: [FR-214-NFPA 1970-2022](#)

Statement: The proposed language provides a basis for the manufacturer to indicate that specific protective elements do not intentionally use PFAS in protective elements, if present, both on the product label and in more detailed information that is to be provided upon request by the AHJ. These requirements are provided in a form that is consistent for the PFAS disclosure requirements for multiple states and are intended to provide a uniform way of disclosing this information. Additional efforts prior to second draft are likely needed to improve the methods for substantiating claims for no PFAS being present.



Public Input No. 154-NFPA 1970-2021 [Section No. 5.1.7.1]

5.1.7.1

For garments only, where the principal material of construction is a component that is ~~listed~~ certified, the component name under which it is ~~listed~~ certified shall be identified.

Statement of Problem and Substantiation for Public Input

The term listed is no longer utilized when referring to certified products. Updating terminology.

Submitter Information Verification

Submitter Full Name: Amanda Newsom**Organization:** UL LLC**Street Address:****City:****State:****Zip:****Submittal Date:** Wed Nov 03 09:52:07 EDT 2021**Committee:** FAE-SPF

Committee Statement

Resolution: [FR-110-NFPA 1970-2022](#)

Statement: Changing the term "listed" to "recognized" since this is new latest terminology used.



Public Input No. 188-NFPA 1970-2021 [New Section after 5.1.7.5]

5.1.8* . Non-visual/machine readable tags providing a means for electronic dissemination or tracking of information shall be permitted in addition to the labels required in Section 5.1.

5.1.8.1 . Non-visual/machine readable tags shall be permitted to include all or a portion of the information required in Section 5.1.

5.1.8.2 . Non-visual/machine readable tags shall meet the applicable requirements in Section 7.

Statement of Problem and Substantiation for Public Input

Many fire departments are now using RFID or other machine readable devices to track their PPE. Currently these devices are not specifically covered in the standard. This proposal offers a suggestion for how new requirements would be structured.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 189-NFPA 1970-2021 [Section No. 7.1.3.1]	
Public Input No. 190-NFPA 1970-2021 [Section No. 7.1.5]	
Public Input No. 191-NFPA 1970-2021 [Section No. 7.4.4]	
Public Input No. 192-NFPA 1970-2021 [Sections 7.7.6, 7.7.7, 7.7.8]	
Public Input No. 193-NFPA 1970-2021 [Sections 7.13.3, 7.13.4, 7.13.5]	
Public Input No. 194-NFPA 1970-2021 [New Section after A.5.1.7.5]	

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

Organization: LION Group, Inc.

Street Address:

City:

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Zip:

Submittal Date: Thu Nov 04 14:13:57 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-138-NFPA 1970-2022](#)

Statement: Many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.



Public Input No. 112-NFPA 1970-2021 [Sections 5.2, 5.3]

Sections 5.2, 5.3

5.2 Additional Product Label Requirements for Structural Firefighting Ensemble Elements Only.

5.2.1

The following compliance statement shall be printed legibly on the product label for each structural firefighting protective ensemble element, unless the requirements in 5.2.1.1 prevail. The appropriate term for the element type — garment, helmet, glove, footwear, hood — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm ($\frac{3}{32}$ in.) in height.

THIS STRUCTURAL FIREFIGHTING PROTECTIVE (insert appropriate element term here) MEETS THE (insert appropriate element term here) REQUIREMENTS OF NFPA- NFPA 1970 (1971) , ~~2018 EDITION~~ 2024 EDITION .

DO NOT REMOVE THIS LABEL.

5.2.1.1

Where an entire ensemble is also certified as compliant with the optional requirements for protection against liquid and particulate contaminants, each element of the entire ensemble shall have at least the additional following compliance statement on the product label in place of the compliance statement specified in 5.2.1. The appropriate term for the element type — garment, helmet, glove, footwear, hood — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm ($\frac{3}{32}$ in.) in height.

LIQUID AND PARTICULATE PROTECTIVE ENSEMBLE

THIS ELEMENT IS NOT INTENDED AS PART OF A HAZARDOUS MATERIALS PROTECTIVE ENSEMBLE.

THIS STRUCTURAL FIREFIGHTING PROTECTIVE (insert appropriate element term here) MEETS THE (insert appropriate element term here) REQUIREMENTS OF NFPA- NFPA 1970 (1971) , ~~2018 EDITION~~ 2024 EDITION , AND THE OPTIONAL REQUIREMENTS FOR LIQUID AND PARTICULATE CONTAMINANT PROTECTION WHEN WORN TOGETHER WITH THE OTHER SPECIFIED ELEMENTS AND INTERFACE COMPONENTS OF THE ENSEMBLE.

DO NOT REMOVE THIS LABEL.

5.2.1.2

The garment element of the ensemble meeting the optional requirements for protection against liquid and particulate contaminants shall list those items of the certified ensemble by manufacturer name and model number on the product label.

5.2.2

Where other protective item(s) or detachable components must be used with structural firefighting protective ensemble elements in order for an element to be compliant with this standard, at least the following statement and information shall also be printed legibly on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high. The appropriate term for the element type — garment, helmet, glove, footwear, hood — shall be inserted in the statement text where indicated. Following this statement, the additional protective items or detachable components shall be listed by type, identification, and how properly assembled.

FOR COMPLIANCE WITH THE STRUCTURAL FIREFIGHTING (insert appropriate element term here) REQUIREMENTS OF NFPA- NFPA 1970 (1971) , THE FOLLOWING PROTECTIVE ITEMS MUST BE WORN IN CONJUNCTION WITH THIS [insert appropriate element term here]:

(List additional items or detachable components here.)

DO NOT REMOVE THIS LABEL.

5.2.3

For helmets only, the helmet manufacturer shall place a unique manufacturer's part number, the symbol of the certification organization, and the words "~~NFPA- "NFPA 1970 (1971)~~ , ~~2018 ED~~ 2024 ED ." permanently on each replaceable performance critical part of the goggle lens or faceshield.

5.2.4

For hoods only, where the hood is designed to interface with a specific SCBA facepiece(s), the hood manufacturer shall add an item to the items specified in 5.1.7.

5.2.4.1

The hood manufacturer shall designate the specific SCBA facepiece(s), model(s) and size(s) in the new item of 5.1.7.

5.2.4.2

Where the hood is designed to be used with a specific SCBA facepiece(s), the hood manufacturer shall add to the hood product label the following statement:

FOR COMPLIANCE WITH THE STRUCTURAL FIREFIGHTING REQUIREMENTS OF NFPA- NFPA 1970 (1971) , THIS HOOD CAN ONLY BE USED WITH THE FOLLOWING NOTED SCBA FACEPIECE(S) [insert SCBA facepieces(s), model(s), and size(s) here].

5.2.5

For garments only, the garment manufacturer shall place a manufacturer's identification number, lot number or serial number, the size or size range, the symbol of the certification organization, and the words **"NFPA 1970 (1971) , 2018-ED 2024 ED ."** on the drag rescue device (DRD).

5.2.6

For particulate blocking hoods only, the following additional language shall be provided on the product label:

THIS HOOD PROVIDES LIMITED PARTICULATE BLOCKING PROTECTION.

5.3 Additional Product Label Requirements for Proximity Firefighting Ensemble Elements Only.**5.3.1**

The following compliance statement shall be printed legibly on the product label for each proximity firefighting protective ensemble element. The appropriate term for the element type — garment, helmet, glove, footwear — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm ($\frac{3}{32}$ in.) in height.

THIS PROXIMITY FIREFIGHTING PROTECTIVE [insert appropriate element term here] MEETS THE [insert appropriate element term here] REQUIREMENTS OF NFPA- NFPA 1970 (1971) , 2018 EDITION 2024 EDITION .

DO NOT REMOVE THIS LABEL.

5.3.1.1

Where an entire ensemble is also certified as compliant with the optional requirements for protection against liquid and particulate contaminants, each element of the entire ensemble shall have at least the additional following compliance statement on the product label in place of the compliance statement specified in 5.3.1. The appropriate term for the element type — garment, helmet, glove, footwear — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm ($\frac{3}{32}$ in.) in height.

LIQUID AND PARTICULATE CONTAMINANT PROTECTIVE ENSEMBLE

THIS ELEMENT IS NOT INTENDED AS PART OF A HAZARDOUS MATERIALS PROTECTIVE ENSEMBLE.

THIS PROXIMITY FIREFIGHTING PROTECTIVE [insert appropriate element term here] MEETS THE [insert appropriate element term here] REQUIREMENTS OF NFPA- NFPA 1970 (1971) , 2018 EDITION 2024 EDITION , AND THE OPTIONAL REQUIREMENTS FOR LIQUID AND PARTICULATE CONTAMINANT PROTECTION, WHEN WORN TOGETHER WITH THE OTHER SPECIFIED ELEMENTS AND INTERFACE COMPONENTS OF THE ENSEMBLE.

DO NOT REMOVE THIS LABEL.

5.3.1.2

The garment element of the ensemble meeting the optional requirements for protection against liquid and particulate contaminants shall list those items of the certified ensemble by manufacturer name and model number on the product label.

5.3.2

Where other protective item(s) or detachable components must be used with proximity firefighting protective ensemble elements in order for an element to be compliant with this standard, at least the following statement and information shall also be printed legibly on the product label. All letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high. The appropriate term for the element type — garment, helmet, glove, footwear — shall be inserted in the statement text where indicated. Following this statement, the additional protective items or detachable components shall be listed by item/component identification or part number, and where applicable, how properly assembled.

FOR COMPLIANCE WITH THE PROXIMITY FIREFIGHTING (insert appropriate element term here) REQUIREMENTS OF NFPA- NFPA 1970 (1971) , THE FOLLOWING PROTECTIVE ITEMS MUST BE WORN IN CONJUNCTION WITH THIS [insert appropriate element term here]:

[List additional items or detachable components here.]

DO NOT REMOVE THIS LABEL.

5.3.2.1

For proximity firefighting helmets, the list of additional items or detachable components shall include, as a minimum, the shroud, cover (except where the helmet cover is part of the shroud), and faceshield.

5.3.3

For helmets only, the helmet manufacturer shall place a unique manufacturer's part number, the symbol of the certification organization, and the words "~~NFPA~~ **NFPA 1970 (1971)**, ~~2018-ED~~ **2024 ED** ." permanently on each replaceable performance critical part of the faceshield.

5.3.4*

For the helmet shroud and cover (except where the helmet cover is part of the shroud), the manufacturer shall place a label on the shroud and cover (except where the helmet cover is part of the shroud) with a unique manufacturer's part number or identification and the following statement. The appropriate term for the item, shroud or cover, shall be inserted in the statement text where indicated.

FOR COMPLIANCE WITH THE PROXIMITY FIREFIGHTING REQUIREMENTS OF NFPA 1971-2018, THIS [insert appropriate item term here] CAN ONLY BE USED WITH THE FOLLOWING NOTED HELMET(S) AND ADDITIONAL ITEM(S): [insert helmet manufacturer's name and specific helmet model; and item name (shroud or cover) and shroud or cover part number, or identification where applicable].

5.3.5

For garments only, the garment manufacturer shall place a manufacturer's identification number, lot number or serial number, the size or size range, the symbol of the certification organization, and the words "~~NFPA~~ **NFPA 1970 (1971)**, ~~2018-ED~~ **2024 ED** ." on the DRD.

Statement of Problem and Substantiation for Public Input

Modification of compliance statements based on the inclusion of NFPA 1971 into NFPA 1970. This model follows language utilized in NFPA 1990 and NFPA 2500.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

Organization: LION Group, Inc.

Street Address:

City:

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Zip:

Submittal Date: Mon Nov 01 15:17:06 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-274-NFPA 1970-2022

Statement: Changes reflect the standard number change and edition change for labeling. Additional label changes are made to reflect the particulate blocking hood requirements as well as particulate blocking ensemble changes to particulate blocking garments.



Public Input No. 134-NFPA 1970-2021 [Sections 5.2.1.1, 5.2.1.2]

Sections 5.2.1.1, 5.2.1.2

5.2.1.1

Where ~~an entire ensemble~~ the garment is also certified as compliant with the optional requirements for protection against liquid and particulate contaminants, ~~each element of the entire ensemble shall have at least the additional~~ the garment element shall have the following compliance statement on the product label in place of the compliance statement specified in 5.2.1.- ~~The appropriate term for the element type — garment, helmet, glove, footwear, hood — shall be inserted in the compliance statement text where indicated. All~~ All product label letters and figures shall be at least 2.5 mm (3/32 in.) in height.

LIQUID AND PARTICULATE PROTECTIVE ENSEMBLE GARMENT

~~THIS ELEMENT~~ GARMENT IS NOT INTENDED AS PART OF A HAZARDOUS MATERIALS PROTECTIVE ENSEMBLE.

~~THIS STRUCTURAL FIREFIGHTING PROTECTIVE (insert appropriate element term here) MEETS THE (insert appropriate element term here) REQUIREMENTS~~ [COAT OR PANT] MEETS THE [COAT OR PANT] REQUIREMENTS OF NFPA 1971, 2018 EDITION, AND THE OPTIONAL REQUIREMENTS FOR LIQUID AND PARTICULATE CONTAMINANT PROTECTION ~~WHEN WORN TOGETHER WITH THE OTHER SPECIFIED ELEMENTS AND INTERFACE COMPONENTS OF THE ENSEMBLE . THIS [COAT OR PANT] MUST BE WORN WITH A [COAT OR PANT] THAT IS ALSO CERTIFIED AS MEETING THE OPTIONAL REQUIREMENTS FOR LIQUID AND PARTICULATE CONTAMINANT PROTECTION .~~

DO NOT REMOVE THIS LABEL.

5.2.1.2 –

~~The garment element of the ensemble meeting the optional requirements for protection against liquid and particulate contaminants shall list those items of the certified ensemble by manufacturer name and model number on the product label.~~

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 02 16:32:27 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-274-NFPA 1970-2022

Statement: Changes reflect the standard number change and edition change for labeling. Additional label changes are made to reflect the particulate blocking hood requirements as well as particulate blocking ensemble changes to particulate blocking garments.



Public Input No. 144-NFPA 1970-2021 [Section No. 5.2.6]

5.2.6 –

~~For particulate blocking hoods only, the following additional language shall be provided on the product label:~~

~~THIS HOOD PROVIDES LIMITED PARTICULATE BLOCKING PROTECTION.~~

Statement of Problem and Substantiation for Public Input

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods should become mandatory. See Public Input 143.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 143-NFPA 1970-2021 [Section No. 4.1.1.2.1]	

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 03:43:20 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-63-NFPA 1970-2022](#)

Statement: The proposed changes make the optional particulate blocking requirements mandatory for all hoods and affects the scope, labeling, design, and performance requirements in NFPA 1971.

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods are being made mandatory.

Further with the increased availability of particulate blocking materials and end products, the fire service should not continue to allow inferior protection from the particulate contaminants on the fire ground: this exposure to fireground soot can be more significantly minimized with the mandated use of particulate blocking hoods. There is sufficient evidence to show that the technology is proven and works with a variety of vendors being able to produce the particulate blocking products and their effectiveness in limiting exposure to particulate as addressed in the following reference:

Richard M. Kesler , Alex Mayer , Kenneth W. Fent , I-Chen Chen , A. Shawn

Deaton , R. Bryan Ormond , Denise L. Smith , Andrea Wilkinson , Steve Kerber & Gavin P. Horn

(2021): Effects of firefighting hood design, laundering and doffing on smoke protection, heat stress

and wearability, Ergonomics, DOI: 10.1080/00140139.2020.1867241

PI numbers 122, 123, 144, 145 all concern the mandatory requirement for particulate hoods.

PI 143 was incorporated into this document as it was decided by the hoods task group that particulate blocking hoods would become mandatory. Eliminating the standard non-particulate hood will provide a higher level of protection from contaminants with the mandatory implementation of particulate protective

hoods.

Research has shown that smoke particulates reach the top of the head in fireground exposures for particulate-blocking hoods and beyond the areas of the currently specified areas of the particulate blocking material. It is noted that a significant amount of particulate penetration can occur around the face opening that can compromise protection. Further it is possible that the hood bib can become pulled out from underneath the coat collar and particulate blocking material should be in place for this circumstance. The proposed changes in coverage of the particulate-blocking layer are intended to provide more comprehensive protection to the end user.



Public Input No. 135-NFPA 1970-2021 [Sections 5.3.1.1, 5.3.1.2]

Sections 5.3.1.1, 5.3.1.2

5.3.1.1

Where ~~an entire ensemble is~~ the garment is, also certified as compliant with the optional requirements for protection against liquid and particulate contaminants, ~~each element of the entire ensemble shall have at least the additional following~~ the garment element shall have the following, compliance statement on the product label in place of the compliance statement specified in 5.3.1. ~~The appropriate term for the element type — garment, helmet, glove, footwear — shall be inserted in the compliance statement text where indicated.~~ All product label letters and figures shall be at least 2.5 mm ($\frac{3}{32}$ in.) in height.

LIQUID AND PARTICULATE CONTAMINANT PROTECTIVE ENSEMBLE GARMENT

~~THIS ELEMENT~~ GARMENT IS NOT INTENDED AS PART OF A HAZARDOUS MATERIALS PROTECTIVE ENSEMBLE.

~~THIS PROXIMITY FIREFIGHTING PROTECTIVE [insert appropriate element term here COAT OR PANT] MEETS THE [insert appropriate element term here COAT OR PANT] REQUIREMENTS OF NFPA 1971, 2018 EDITION, AND THE OPTIONAL REQUIREMENTS FOR LIQUID AND PARTICULATE CONTAMINANT PROTECTION, WHEN WORN TOGETHER WITH THE OTHER SPECIFIED ELEMENTS AND INTERFACE COMPONENTS OF THE ENSEMBLE . THIS [COAT OR PANT] MUST BE WORN WITH A [COAT OR PANT] THAT IS ALSO CERTIFIED AS MEETING THE OPTIONAL REQUIREMENTS FOR LIQUID AND PARTICULATE CONTAMINANT PROTECTION .~~

DO NOT REMOVE THIS LABEL.

5.3.1.2 –

~~The garment element of the ensemble meeting the optional requirements for protection against liquid and particulate contaminants shall list those items of the certified ensemble by manufacturer name and model number on the product label.~~

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 02 16:41:02 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-275-NFPA 1970-2022

Statement: Changes reflect the standard number change and edition change for labeling. Additional label changes are made to reflect the particulate blocking hood requirements as well as particulate blocking ensemble changes to particulate blocking garments.

**Public Input No. 304-NFPA 1970-2021 [Section No. 5.4.1]****5.4.1**

The manufacturer shall provide at least the user information that is specified in 5.4.4 with each structural and proximity firefighting element. This information shall be permitted to be delivered from the manufacturer in various formats, including but not limited to, printed materials or instructions to access the information electronically/digitally.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
.1636557140472		

Statement of Problem and Substantiation for Public Input

This is editorial to clarify that user instructions can be delivered in various ways. The proposed text already exists in NFPA 1851.

Submitter Information Verification

Submitter Full Name: Patricia Freeman
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Affiliation: MSA/Globe
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 10 10:09:52 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-111-NFPA 1970-2022

Statement: This addition is to clarify that user instructions can be delivered in various formats. The text is consistent with NFPA 1851.



Public Input No. 110-NFPA 1970-2021 [Section No. 5.4.2]

5.4.2*

The manufacturer shall attach the required user information, or packaging containing the user information, to the element in such a manner that it is not possible to use the element without being aware of the availability of the information.

Statement of Problem and Substantiation for Public Input

Adding recommended language to clarify the use of digital access of the information. This language is utilized in other standards within this project to describe the process currently used in the field.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 111-NFPA 1970-2021 [New Section after A.5.3.4]	

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Mon Nov 01 14:47:04 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-112-NFPA 1970-2022

Statement: This addition is to provide additional annex material to clarify that user instructions can be delivered in various formats. This language is utilized in other standards within this project to describe the process currently used.



Public Input No. 136-NFPA 1970-2021 [Section No. 5.4.8]

5.4.8

For protective ~~ensembles~~ garments certified to the optional liquid and particulate contaminant protection requirements, the manufacturer shall provide the following additional instruction and information with the ensemble garment :

- (1) A statement that ~~only the ensemble and the specific elements with which the ensemble has been certified must be worn together to ensure that the optional liquid and particulate contaminant protection is provided~~
 - A list of the specific elements and interface components that must be worn as part of the liquid and particulate contaminant protective ensemble, including each type of CBRN SCBA that the ensemble has been certified with
 - A list of specific limitations associated with the use of the ensemble for a response involving liquid and particulate contaminant hazards, including but not limited to a statement that the ensemble is not a hazardous materials protective ensemble and that protection will not be provided from vapors or all liquids and particulates
- (2) Specific care and maintenance provisions associated with properly maintaining the unique performance properties of the ~~ensemble, its elements, or interface components~~ garment, if such provisions are necessary beyond normal care and maintenance instructions.
- (3)* The manufacturer shall provide a list of the specific elements, including manufacturer and model or style number, used in the ensemble testing for garment certification and any specific interfacing or donning instructions applied during that testing.
- (4) The manufacturer shall indicate that the full test reports for both the overall liquid integrity and inward particulate leakage tests are available to the purchaser upon request.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Zip:
Submittal Date: Tue Nov 02 16:46:39 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-234-NFPA 1970-2022

Statement: Revising the labeling required as it relates to the certification of garments instead of ensembles for the optional liquid and particulate protection.



Public Input No. 286-NFPA 1970-2021 [Section No. 6.1.9.1]

6.1.9.1

Each coat element shall be permitted to have a DRD installed in the upper torso portion of the element.

6.1.9.1.1

~~The~~ Where present, the DRD shall be accessible from the exterior of the garment.

6.1.9.1.2

~~The DRD~~ Where present, the DRD shall be easily accessible for deployment, shall be designed to minimize the risk of accidental deployment, and shall allow for visual inspection.

6.1.9.1.3

~~The DRD~~ Where present, the DRD shall be fully functional and shall not require any subsequent actions in order to be used, other than deploying the DRD, when the garment is donned in accordance with the manufacturer's instructions.

6.1.9.1.4

~~The DRD~~ Where present, the DRD shall be designed to allow deployment and operation of the DRD while the incapacitated firefighter is wearing an SCBA.

6.1.9.1.5

~~The DRD~~ Where present, the DRD shall be designed so that when deployed, the DRD secures the firefighter by the upper torso or shoulders so that the DRD pulls directly on the body and shall not pull only the garment.

Statement of Problem and Substantiation for Public Input

While the drag rescue device (DRD) was incorporated as a life-saving feature for protective coat, limited information is available to suggest that its use provides the intended benefits for rapid extraction of a downed firefighter that cannot be achieved by other means. Therefore, it is suggested that the DRD become optional and if absent, the manufacturer provide a warning that the organization establish specific procedures for the rapid extrication of downed firefighters by some other identified means. NFPA 1500 that governs the use of PPE for fire departments currently incorporates language in paragraph 7.2.6 that requires fire department to have a standard operating procedure for rapid extrication of firefighters that may or may not depend on the coat having a DRD. These proposed changes make the DRD optional, but establishes minimum design criteria if the DRD present.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 280-NFPA 1970-2021 [Chapter 5]	
Public Input No. 287-NFPA 1970-2021 [Sections 7.1.21, 7.1.22]	
Public Input No. 288-NFPA 1970-2021 [Section No. 8.58.1.1]	
Public Input No. 290-NFPA 1970-2021 [Section No. 8.59.1]	

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 21:43:12 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-117-NFPA 1970-2022](#)

Statement: The annex language is to help end users in considering important factors for how they select a DRD. The fire service still considers having a DRD a mandatory part of the life saving garments to be available when needed. The technical committee is looking at ways to improve the usability and accessibility of the device in further revisions.



Public Input No. 293-NFPA 1970-2021 [Section No. 6.1.9.1]

6.1.9.1

Each coat element shall have a DRD installed in the upper torso portion of the element.

6.1.9.1.1

The DRD shall be accessible from the exterior of the garment.

6.1.9.1.2

The DRD shall be easily accessible for deployment, shall be designed to minimize the risk of accidental deployment, and shall allow for visual inspection. The access for deployment shall be aided by oversized tabs, flaps, or the like to aid in grasping with a gloved hand.

6.1.9.1.3

The DRD shall be fully functional and shall not require any subsequent actions in order to be used, other than deploying the DRD, when the garment is donned in accordance with the manufacturer's instructions.

6.1.9.1.4

The DRD shall be designed to allow deployment and operation of the DRD while the incapacitated firefighter is wearing an SCBA. Oversized tabs, flaps or the like shall be included to aid in grasping the DRD for deployment.

6.1.9.1.5

The DRD shall be designed so that when deployed, the DRD secures the firefighter by the upper torso or shoulders so that the DRD pulls directly on the body and shall not pull only the garment.

Statement of Problem and Substantiation for Public Input

Improvements for the improved success based on general feedback from end user questioning in regards to the challenges surrounding deployment of the DRD from within the coat are targeted with this input. The improvements in design requirements to add larger or more pronounced tabs, flaps or the like to aid in the deployment of the DRD should be included to aid in the efficiency of the use of such potential life saving equipment. With larger, thicker or more pronounced areas to grasp while wearing structural gloves should aid in the ease of deployment in stressful situations.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 292-NFPA 1970-2021 [Section No. 8.59]	

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 22:40:52 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-117-NFPA 1970-2022

Statement: The annex language is to help end users in considering important factors for how they select a DRD. The fire service still considers having a DRD a mandatory part of the life saving garments to be available when needed. The technical committee is looking at ways to improve the usability and accessibility of the device in further revisions.



Public Input No. 267-NFPA 1970-2021 [Section No. 6.4.3]

6.4.3

The helmet retention system shall include a chin strap and a nape device. The chin strap shall have a minimum width of ~~19~~ of 15.9 mm (~~3/4 in.~~ 5/8 in.).

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Sec_6_4_3_NFPA_1971_Revision_-_MSA_Comment_Draft.docx		

Statement of Problem and Substantiation for Public Input

Substantiation:

A minimum chinstrap width prevents firefighter discomfort and ensures product robustness in the fire ground. However, NFPA 1971's minimum width of 19 mm (3/4 in) is notably larger than the minimum allowed by similar protective helmet standards as shown in the attached table. A slight reduction in minimum chinstrap width, for example to 15.9 mm (5/8 in), could help reduce helmet assembly weight for firefighters, and it could also offer some firefighters with enhanced comfort and adjustment without allowing "too thin" chin straps that could dig into the skin or neck. It should be noted that a minimum chinstrap width should be maintained, and that 19 mm (3/4 in) chin straps could still be specified as a department's preference. Also, by reducing the minimum chinstrap width to 15.9 mm opens the opportunity for "standard" webbing sizes and webbing hardware such as buckles and attachments.

Submitter Information Verification

Submitter Full Name: John Rihn
Organization: Globe Manufacturing/Mine Safety
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 14:38:07 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-73-NFPA 1970-2022

Statement: Allows for the adaptation of three- and four-point chin strap designs.



Public Input No. 30-NFPA 1970-2021 [Section No. 6.4.5]

6.4.5

The helmet. If, integrated with the helmet, the faceshield or the faceshield/goggle component, when deployed, shall provide at least the following field of vision:

- (1) Dihedral angle of at least 85 degrees
- (2) Upper dihedral angle of at least 10 degrees
- (3) Lower dihedral angle of at least 40 degrees

(1)

6.4.5.1

The field of vision shall be measured from the center of the eye.

6.4.5.2

The helmet with the faceshield or the faceshield/goggle component deployed shall be positioned in accordance with the HPI as described in 8.1.13 on a facial feature headform as defined in 3.3.62. Where the crown clearance of the helmet is adjustable, the helmet shall be mounted with the least amount of clearance.

Additional Proposed Changes

File Name	Description	Approved
1971_PI_3_Held.pdf	1971_PI3	

Statement of Problem and Substantiation for Public Input

NOTE: This public input appeared as "Reject but Held" in Public Comment No. 35 of the A2017 Second Draft Report for NFPA 1971 and per the Regs. at 4.4.8.3.1. This change allows for the inclusion of face and eye protection if the protection is integrated into the helmet so that it is beneath the shell when in the stowed position. It prohibits the use of externally mounted eye and face protection. NFPA 1500, Standard on Fire Department Occupational Safety and Health Program (2013 revision) chapter 7.18 is the section on Face and Eye Protection states the following: 7.18.1 Primary eye protection appropriate for a given specific hazard shall be provided for and used by members exposed to that specific hazard. 7.18.1.1* Primary eye protection shall meet the requirements of ANZI Z87.1 Practice for Occupational and Educational Eye and Face Protection. 7.18.1.2 Face protection shall be in addition to primary eye protection unless SCBA is being used. 7.18.1.3 The helmet faceshield alone shall not shall not be considered and shall not be used as primary eye protection. 7.18.2 The full facepiece of SCBA shall constitute face and eye protection when worn. 7.18.2.1 SCBA that has a face-mounted regulator that when disconnected provides a direct path for lying objects to strike the face or eyes shall have the regulator attached in order to be considered face and eye protection. 7.18.3 When operating in the hazardous area at an emergency scene without the full facepiece of respiratory protection being worn, members shall wear primary eye protection that is designed to protect the member's eyes from the expected hazard. Eye and face protection should be considered as "stand alone" elements or omitted completely from this standard. This issue as proposed during the public input period and the TC did not accept the language to remove externally eye and face protection from helmets. The substantiation stated "...The TG concluded that removing the faceshield or goggles or both from the standard at this time would be a step backwards. During structural fire fighting the SCBA facepiece provides eye protection but during other routine operations the faceshield or goggles or both will provide better eye protection for the fire fighter when properly worn". And, "We were unable to locate any data that shows fire fighter injuries would be reduced if the faceshield or goggles or both were removed from the helmet." Of course, there is no data that shows injuries would be reduced. There is no database that captures this type information. The existing design requirements add unnecessary weight to the helmet and creates a top-heavy helmets. There have been lawsuits filed about the "bobblehead" effect of existing helmets. More importantly, the current design allows for the faceshield and goggles or both, to be exposed to the toxic fire environment and abrasion. Few, if any, faceshields, goggles, "flip-downs" or any combination thereof, currently mounted and in-service on helmets are clean and abrasion free enough to provide the fire fighter good visibility when deployed. Cancer awareness and prevention is paramount in any fire fighter health discussion. Yet, NFPA 1971 currently allows for goggles that can have a face seal that, by design, come in direct contact with the contaminated helmet when stowed, and then placed directly against the fire fighter's face when deployed. Minimizing all these health and safety issues is clearly NOT a step backwards. It is a step forward.

Submitter Information Verification

Submitter Full Tc On Fae-Spf

Name:

Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment

Street Address:**City:****State:****Zip:**

Submittal Date: Mon Aug 16 12:45:31 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: The removal of and changes to the faceshield and goggles design/ performance from the helmet requirements would result in a decrease in safety to the firefighters.



Public Input No. 33-NFPA 1970-2021 [Section No. 6.5.2 [Excluding any Sub-Sections]]

Helmets shall consist of at least all of the following assembled components:

- (1) Shell
- (2) Energy absorbing system
- (3) Retention system
- (4) Fluorescent and retroreflective trim
- (5) Ear covers
- (6) ~~A faceshield or goggles, or both~~

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_6_Held.pdf	1971_PI6	

Statement of Problem and Substantiation for Public Input

This Public Input appeared as "Reject but Hold" in Public Comment No. 34 of the (A2017) Second Draft Report for NFPA 1971 and per the Regs. at 4.4.8.3.1. NFPA 1500, Standard on Fire Department Occupational Safety and Health Program (2013 revision) chapter 7.18 is the section on Face and Eye Protection states the following: 7.18.1 Primary eye protection appropriate for a given specific hazard shall be provided for and used by members exposed to that specific hazard. 7.18.1.1* Primary eye protection shall meet the requirements of ANZI Z87.1 Practice for Occupational and Educational Eye and Face Protection. 7.18.1.2 Face protection shall be in addition to primary eye protection unless SCBA is being used. 7.18.1.3 The helmet faceshield alone shall not shall not be considered and shall not be used as primary eye protection. 7.18.2 The full facepiece of SCBA shall constitute face and eye protection when worn. 7.18.2.1 SCBA that has a face-mounted regulator that when disconnected provides a direct path for flying objects to strike the face or eyes shall have the regulator attached in order to be considered face and eye protection. 7.18.3 When operating in the hazardous area at an emergency scene without the full facepiece of respiratory protection being worn, members shall wear primary eye protection that is designed to protect the member's eyes from the expected hazard. Eye and face protection should be considered as "stand alone" elements or omitted completely from this standard. This issue as proposed during the public input period and the TC did not accept the language to remove externally eye and face protection from helmets. The substantiation stated "...The TG concluded that removing the faceshield or goggles or both from the standard at this time would be a step backwards. During structural fire fighting the SCBA facepiece provides eye protection but during other routine operations the faceshield or goggles or both will provide better eye protection for the fire fighter when properly worn". And, "We were unable to locate any data that shows fire fighter injuries would be reduced if the faceshield or goggles or both were removed from the helmet." Of course, there is no data that shows injuries would be reduced. There is no database that captures this type information. The existing design requirements add unnecessary weight to the helmet and creates a top-heavy helmets. There have been lawsuits filed about the "bobblehead" effect of existing helmets. More importantly, the current design allows for the faceshield and goggles or both, to be exposed to the toxic fire environment and abrasion. Few, if any, faceshields, goggles, "flip-downs" or any combination thereof, currently mounted and in-service on helmets are clean and abrasion free enough to provide the fire fighter good visibility when deployed. Cancer awareness and prevention is paramount in any fire fighter health discussion. Yet, NFPA 1971 currently allows for goggles that can have a face seal that, by design, come in direct contact with the contaminated helmet when stowed, and then placed directly against the fire fighter's face when deployed. Minimizing all these health and safety issues is clearly NOT a step backwards. It is a step forward.

Submitter Information Verification

Submitter Full Name: Tc On Fae-Spf

Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment

Street Address:

City:

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Zip:

Submittal Date: Mon Aug 16 15:22:41 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: The removal of and changes to the faceshield and goggles design/ performance from the helmet requirements would result in a decrease in safety to the firefighters.



Public Input No. 34-NFPA 1970-2021 [Section No. 6.5.2.1]

6.5.2.1

Where a faceshield is selected in accordance with 6.5.2(6), the faceshield component shall be attached to the helmet so that it is beneath the shell when in the stowed position.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_8_Held.pdf	1971_PI_8_Held	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. 37 of the (cycle) Second Draft Report for NFPA 1971 and per the Regs. at 4.4.8.3.1. This change prohibits the use of faceshields being mounted externally to the helmet where they are exposed to the toxins and mechanical damage encountered during structural fire fighting. NFPA 1500, Standard on Fire Department Occupational Safety and Health Program (2013 revision) chapter 7.18 is the section on Face and Eye Protection states the following: 7.18.1 Primary eye protection appropriate for a given specific hazard shall be provided for and used by members exposed to that specific hazard. 7.18.1.1* Primary eye protection shall meet the requirements of ANZI Z87.1 Practice for Occupational and Educational Eye and Face Protection. 7.18.1.2 Face protection shall be in addition to primary eye protection unless SCBA is being used. 7.18.1.3 The helmet faceshield alone shall not be considered and shall not be used as primary eye protection. 7.18.2 The full facepiece of SCBA shall constitute face and eye protection when worn. 7.18.2.1 SCBA that has a face-mounted regulator that when disconnected provides a direct path for flying objects to strike the face or eyes shall have the regulator attached in order to be considered face and eye protection. 7.18.3 When operating in the hazardous area at an emergency scene without the full facepiece of respiratory protection being worn, members shall wear primary eye protection that is designed to protect the member's eyes from the expected hazard. Eye and face protection should be considered as "stand alone" elements or omitted completely from this standard. This issue as proposed during the public input period and the TC did not accept the language to remove externally eye and face protection from helmets. The substantiation stated "...The TG concluded that removing the faceshield or goggles or both from the standard at this time would be a step backwards. During structural fire fighting the SCBA facepiece provides eye protection but during other routine operations the faceshield or goggles or both will provide better eye protection for the fire fighter when properly worn". And, "We were unable to locate any data that shows fire fighter injuries would be reduced if the faceshield or goggles or both were removed from the helmet." Of course, there is no data that shows injuries would be reduced. There is no database that captures this type information. The existing design requirements add unnecessary weight to the helmet and creates a top-heavy helmets. There have been lawsuits filed about the "bobblehead" effect of existing helmets. More importantly, the current design allows for the faceshield and goggles or both, to be exposed to the toxic fire environment and abrasion. Few, if any, faceshields, goggles, "flip-downs" or any combination thereof, currently mounted and in-service on helmets are clean and abrasion free enough to provide the fire fighter good visibility when deployed. Cancer awareness and prevention is paramount in any fire fighter health discussion. Yet, NFPA 1971 currently allows for goggles that can have a face seal that, by design, come in direct contact with the contaminated helmet when stowed, and then placed directly against the fire fighter's face when deployed. Minimizing all these health and safety issues is clearly NOT a step backwards. It is a step forward.

Submitter Information Verification

Submitter Full Name: Tc On Fae-Spf
Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 15:26:39 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The removal of and changes to the faceshield and goggles design/ performance from the helmet requirements would result in a decrease in safety to the firefighters.



Public Input No. 35-NFPA 1970-2021 [Section No. 6.5.5]

6.5.5

~~Faceshield~~ If provided, the faceshield /goggle components shall meet the respective requirements for goggles or faceshields and be marked "~~Z87+~~" "Z87" in accordance with ANSI/ISEA Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices*.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_7_Held.pdf	1971_PI7	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. 36 of the (A2017) Second Draft Report for NFPA 1971 and per the Regs. at 4.4.8.3.1. This change addresses face and eye protection if the protection is stowed beneath the shell of the helmet. If not protected during stowage, unnecessary safety and health risks are encountered by the fire fighter. NFPA 1500, Standard on Fire Department Occupational Safety and Health Program (2013 revision) chapter 7.18 is the section on Face and Eye Protection states the following: 7.18.1 Primary eye protection appropriate for a given specific hazard shall be provided for and used by members exposed to that specific hazard. 7.18.1.1* Primary eye protection shall meet the requirements of ANZI Z87.1 Practice for Occupational and Educational Eye and Face Protection. 7.18.1.2 Face protection shall be in addition to primary eye protection unless SCBA is being used. 7.18.1.3 The helmet faceshield alone shall not shall not be considered and shall not be used as primary eye protection. 7.18.2 The full facepiece of SCBA shall constitute face and eye protection when worn. 7.18.2.1 SCBA that has a face-mounted regulator that when disconnected provides a direct path for flying objects to strike the face or eyes shall have the regulator attached in order to be considered face and eye protection. 7.18.3 When operating in the hazardous area at an emergency scene without the full facepiece of respiratory protection being worn, members shall wear primary eye protection that is designed to protect the member's eyes from the expected hazard. Eye and face protection should be considered as "stand alone" elements or omitted completely from this standard. This issue as proposed during the public input period and the TC did not accept the language to remove externally eye and face protection from helmets. The substantiation stated "...The TG concluded that removing the faceshield or goggles or both from the standard at this time would be a step backwards. During structural fire fighting the SCBA facepiece provides eye protection but during other routine operations the faceshield or goggles or both will provide better eye protection for the fire fighter when properly worn". And, "We were unable to locate any data that shows fire fighter injuries would be reduced if the faceshield or goggles or both were removed from the helmet." Of course, there is no data that shows injuries would be reduced. There is no database that captures this type information. The existing design requirements add unnecessary weight to the helmet and creates a top-heavy helmets. There have been lawsuits filed about the "bobblehead" effect of existing helmets. More importantly, the current design allows for the faceshield and goggles or both, to be exposed to the toxic fire environment and abrasion. Few, if any, faceshields, goggles, "flip-downs" or any combination thereof, currently mounted and in-service on helmets are clean and abrasion free enough to provide the fire fighter good visibility when deployed. Cancer awareness and prevention is paramount in any fire fighter health discussion. Yet, NFPA 1971 currently allows for goggles that can have a face seal that, by design, come in direct contact with the contaminated helmet when stowed, and then placed directly against the fire fighter's face when deployed. Minimizing all these health and safety issues is clearly NOT a step backwards. It is a step forward.

Submitter Information Verification

Submitter Full Name: Tc On Fae-Spf
Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 15:48:32 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The removal of and changes to the faceshield and goggles design/ performance from the helmet

requirements would result in a decrease in safety to the firefighters.

**Public Input No. 340-NFPA 1970-2021 [Section No. 6.7]****6.7 Protective Glove Elements Design Requirements for Both Ensembles.****6.7.1**

Protective glove elements shall have at least the applicable design requirements specified in this section when inspected and evaluated by the certification organization as specified in Section 4.4, Inspection and Testing.

6.7.2

Gloves shall consist of a composite meeting the performance requirements of Section 7.7, Protective Glove Elements Performance Requirements for Both Ensembles.

6.7.2.1

The composite shall be permitted to be configured as a continuous or joined single layer or as continuous or joined multiple layers.

6.7.2.2

Supplemental gloves that are provided to meet the performance requirements of Chapters 4 through 8 of this standard but are not intended to be worn continuously with the wearing of the gloves shall not be permitted.

6.7.2.3

Where a glove is made up of multiple layers, all layers of the glove shall be individually graded per size.

6.7.2.4

Where the coat sleeve end terminates in a garment-glove interface and the interface demonstrates liquid integrity and continuous thermal protection in accordance with Section 7.16, Protective Wristlet and Garment-Glove Interface Component Performance Requirements for Both Ensembles, gloves shall not be required to meet the requirements in 6.7.3 through 6.7.3.4.

6.7.3

The glove shall consist of a glove body.

6.7.3.1

The glove shall extend from the tip of the fingers to at least 50 mm (2 in.) beyond the wrist crease.

6.7.3.2

The portion of the glove that extends from the tip of the fingers to 50 mm (2 in.) beyond the wrist crease shall be considered to be the glove body and shall meet the glove body requirements in Sections 7.7, Protective Glove Elements Performance Requirements for Both Ensembles; 7.8, Additional Performance Requirements for Structural Firefighting Protective Glove Elements Only; and 7.9, Additional Performance Requirements for Proximity Firefighting Protective Glove Elements Only, as applicable.

6.7.3.3

The portion of the glove that extends greater than 50 mm (2 in.) beyond the wrist crease but less than or equal to 125 mm (5 in.) beyond the wrist crease, where present, shall be considered to be the glove interface component and shall meet the glove interface component requirements in Sections 7.7, 7.8, and 7.9, as applicable.

6.7.3.4

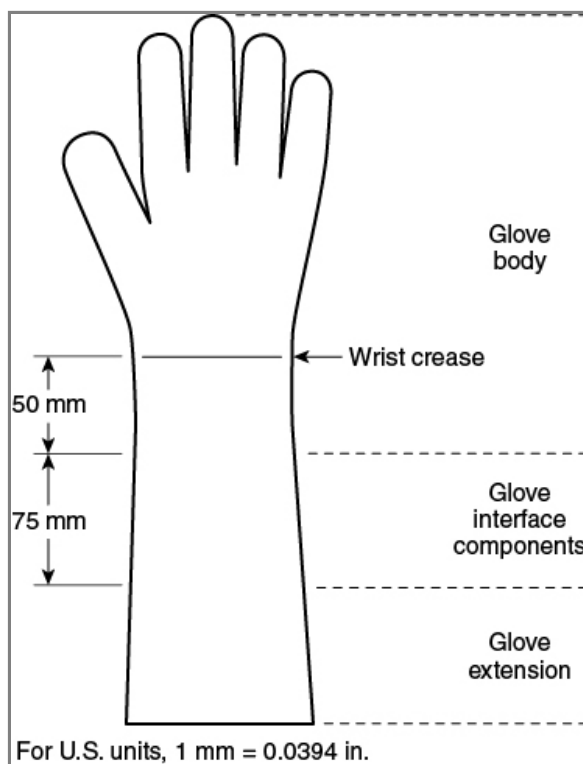
The portion of the glove that extends greater than 125 mm (5 in.) beyond the wrist crease up to the end of the entire glove, where present, shall be considered to be the glove extension and shall meet the glove extension requirements in Sections 7.7, 7.8, and 7.9, as applicable.

6.7.3.5*

The location of the wrist crease shall be determined by the following procedures, as shown in Figure 6.7.3.5:

- (1) The location of the wrist crease shall be determined by first placing the glove on a measurement board palm down and securing (locking) the fingertips down onto the board.
 - (2) A 1 lb weight shall be attached to the end of the glove body, glove interface component, or glove extension. The weight shall not be attached to a knitted wristlet glove interface component. The weight shall be applied evenly across the glove.
 - (3) The weight shall be allowed to hang freely for 60 seconds prior to taking any measurements.
 - (4) * The bottom of digit three shall be found by drawing a line on the back side of the glove from the finger crotches on either side of digit three. A point shall then be placed at the center of that line. Depending on the index finger length for the glove size, the distance to the wrist crease shall be determined by laying a ruler parallel with the length of the glove from the point representing the bottom of digit three to a second point using one of the following dimensions that corresponds to the index finger length. The second point shall be marked on the back of the glove.
- (5) 64 [N (normal), W (wide), and XW (extra-wide)]: 8.36 cm (3.29 in.)
- (6) 70 (N, W, and XW): 9.46 cm (3.72 in.)
- (7) 76 (N, W, and XW): 10.68 cm (4.20 in.)
- (8) 82 (N, W, and XW): 11.73 cm (4.62 in.)
- (9) A straight line shall be drawn across the back of the glove perpendicular to the two points. This line shall be extended around the side edges of the glove.
 - (10) The glove shall be removed from the measurement board. A line shall be drawn on the palm side of the glove by connecting the lines from the side edges of the glove.
 - (11) The resulting straight line around the circumference of the glove shall be the location of the wrist crease.

Figure 6.7.3.5 Location of Wrist Crease.

**6.7.4**

All sewing thread utilized in the construction of gloves shall be made of an inherently flame-resistant fiber.

6.7.5

* —

For selection of the proper glove size, the dimensions for index finger length and hand breadth shall be measured as follows:

- (1) Using a straight ruler, the index finger length shall be measured to the nearest 1 mm ($\frac{1}{16}$ in.) from the tip of the index finger to the base of the finger located by the crease as shown in Figure 6.7.5(a) :
- (2) Using a set of calipers or similar measuring device, the hand breadth shall be measured to the nearest 1 mm ($\frac{1}{16}$ in.) across the back of the hand knuckles from metacarpal II landmark (thumb side of index finger or digit 2) to the metacarpal V landmark (outside of little finger, or digit 5), as shown in Figure 6.7.5(b) :

Figure 6.7.5(a) Measurement Location for Index Finger Length.

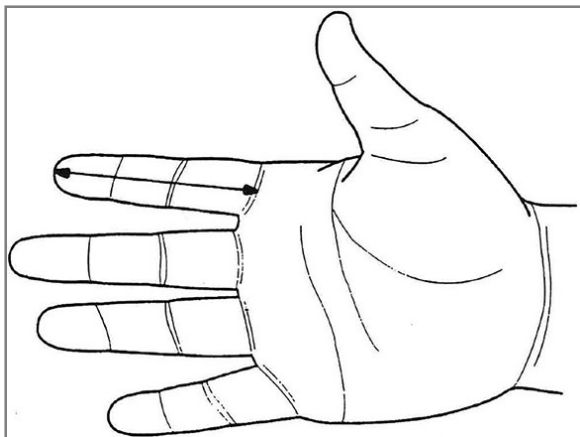
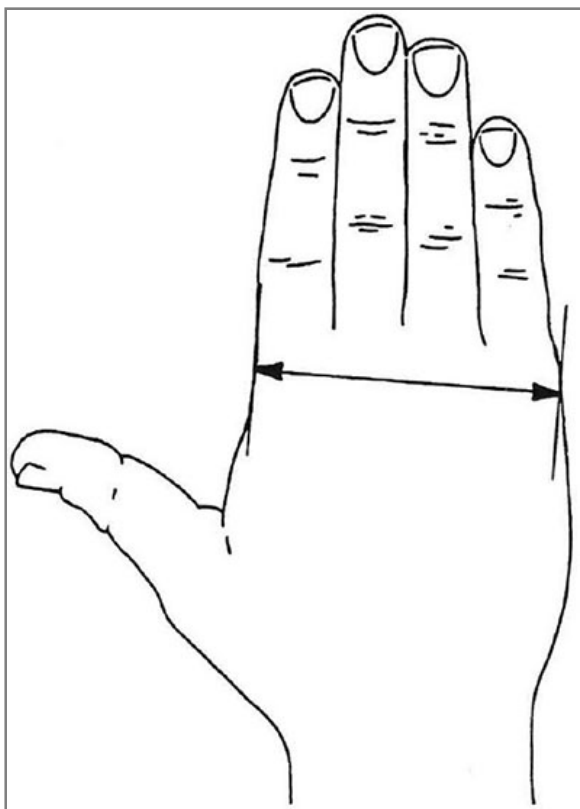


Figure 6.7.5(b) Measurement Location for Hand Breadth.

**6.7.6 * —**

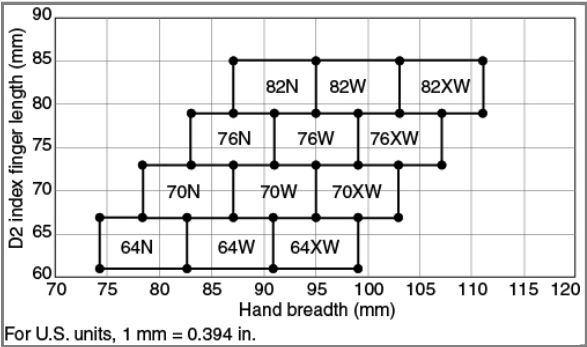
In order to label or otherwise represent a glove as compliant with the requirements of Chapters 4 through 8 of this standard, the manufacturer shall provide gloves in the following sizes:

- (1) 64N (normal)
- (2) 70N (normal)
- (3) 76W (wide)
- (4) 76N (normal)
- (5) 76W (wide)
- (6) 82N (normal)
- (7) 82W (wide)

6.7.6.1 –

The glove sizes from 64N through 82W indicated on the label shall be determined by the hand dimensions given in Figure 6.7.6.1 :

Figure 6.7.6.1 NFPA 1971 Size Definitions:



6.7.7 ± –

The glove size indicated on the label shall be determined by the hand dimensions given in Figure 6.7.6.1 :

6.7.7.1 –

Where custom sized or specially fitted gloves are provided, the glove size indicated on the label shall be determined by the closest hand dimensions given in Figure 6.7.6.1 , followed by the word “Custom.”

In order to be labeled as compliant with this standard, gloves shall be provided in a minimum of 7 unique sizes that accommodate a range of specific hand sizes for both men and women based achieving accommodation of the 5th to 95th percentile dimensions in both hand breadth and hand length as established in the NIOSH Anthropometric Data Base.

6.7.5.1

Manufacturers shall be permitted to establish their own unique sizing system and method of designating glove sizing based on their respective glove designs.

6.7.5.2

For the purposes of testing, glove sizes shall be selected as follows:

- (1) Where one size of glove is specified for testing, the manufacturer glove representing the middle size shall be evaluated.
- (2) Where two sizes of gloves are specified for testing, the smallest and largest glove sizes shall be evaluated.

Additional Proposed Changes

File Name	Description	Approved
1970_6.7.5_NIOSH_Firefighter_Antropometric_Data_Base_Synopsis_J.Stull.pdf		
1970_Section_6.7.5-6.7.7_J.Stull.docx		

Statement of Problem and Substantiation for Public Input

The most recently adopted sizing system has failed to provide improvements in the availability of gloves for smaller hands, particularly women. The proposed sizing approach is intended to allow manufacturers latitude by creating their own size system but ensuring that sizing address a specific range of hand sizes based on Anthropometric data measured in the early 2010s by NIOSH.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protec
Street Address:
City:
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Submittal Date: Thu Nov 11 18:23:45 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-88-NFPA 1970-2022

Statement: The most recently adopted sizing system has not adequately induced improvements in the availability of gloves for smaller hands, particularly women. For the purposes of the first revision of NFPA 1971 within NFPA 1970, a hybrid approach has been implemented that preserves the current sizing system based on the wearer hand dimensions of index length and hand breadth, but alternatively allows glove manufacturers to apply their own sizing system, accounting for their own unique designs and construction features.

The proposed alternative sizing approach is intended to allow manufacturers latitude by creating their own size system but ensuring that sizing address a specific range of hand sizes based on Anthropometric data measured in the early 2010s by NIOSH. The committee plans to continue working on other sizing approaches to determine if a different approach is more likely to encourage the fire service glove industry in providing a broader range of gloves to better accommodate individuals with varying hand dimensions.



Public Input No. 217-NFPA 1970-2021 [Section No. 6.10.3.3]

6.10.3.3

~~Thermal, physical, and moisture~~ Moisture protection shall be continuous circumferentially to within 50 mm (2 in.) of the footwear top line at all locations, with the exception of the area inside of and within 13 mm (½ in.) around pull-up holes that fully penetrate the footwear from outside to inside. The height of ~~thermal, physical, and moisture~~ the moisture protection at all locations of the boot shall be no less than 250 mm (9.84 in.) when measured as described in 6.10.3.1 .

6.10.3.4

Thermal and physical protection shall be continuous circumferentially to within 50 mm (2 in.) of the footwear top line at all locations, with the exception of the gusset and the area inside of and within 13 mm (1/2 in.) around pull-up holes that fully penetrate the footwear from outside to inside. The height of thermal and physical protection at all locations of the boot , with the exception of the gusset, shall be no less than 250 mm (9.84 in.) when measured as described in 6.10.3.1 .

Statement of Problem and Substantiation for Public Input

Clarifies that thermal and physical protection is not required to be continuous in the gusset. Footwear test methods that test for thermal and physical protection (Conductive Heat 1, Cut Resistance, Puncture Resistance, and Radiant Heat Resistance) require composites from all areas of the boot except for the gusset.

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Mon Nov 08 09:25:33 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-95-NFPA 1970-2022](#)

Statement: Currently, regardless of the wearer' leg length or stature, all footwear is required to have the same minimum height that may be cumbersome and hobbling for shorter firefighters. The committee recognizes there should be some minimum height that is suitable for all firefighters and the proposed changes may not adequately address those concerns. Further investigation should be undertaken to determine the suitability of the newly proposed minimum heights and their allowance across the entire spectrum of the firefighter population. This investigation should include the proper amount of overlap between the footwear and the pants. One of the proposed changes allows for a graduation of height based on the size of the footwear. Another change references a more precise method by which the height of the footwear is determined along with the height of the moisture protection, which may be in the form of an interior layer that cannot be readily observed. To address the latter change, a new section with Chapter 8 has been proposed.

A new paragraph 6.10.3.4 clarifies that thermal and physical protection is not required to be continuous in the gusset. Footwear test methods that test for thermal and physical protection (Conductive Heat 1, Cut Resistance, Puncture Resistance, and Radiant Heat Resistance) require composites from all areas of the boot except for the gusset.



Public Input No. 122-NFPA 1970-2021 [Section No. 6.14]

6.14 ~~Optional~~ Protective Barrier Hood Interface Component Design Requirements.

6.14.1 –

Barrier hoods shall meet all design criteria specified in Section 6.13, Protective Hood Interface Component Design Requirements for Both Ensembles.

6.14.2

The portions of the particulate blocking hood interface component that include a particulate blocking material specifically for meeting the requirements of 7.14.1 shall include all areas of the hood to at least 37 mm (1.5 in.) above the reference plane when measured at the coronal plane and all areas of the hood to at least 200 mm (8 in.) at the sides when measured at the coronal plane and 225 mm (9 in.) at the front and rear when measured at the midsagittal plane below the reference plane as measured when the hood is placed on an ISO Size J headform.

6.14.3

Binding including the elastic and stitching around the particulate blocking hood face opening shall be permitted to exclude particulate blocking material specifically for meeting the requirements of 7.14.1 for a distance of 50 mm (2 in.) from the leading edge of the hood face opening. The distance shall be measured in eight separate locations with the hood lying on a flat surface with the face opening facing upwards and measured from the innermost row of stitching to the face opening leading edge.

Statement of Problem and Substantiation for Public Input

With available technology and availability on the market of particulate blocking material, we should not continue to allow inferior protection from the particulate contaminants on the fire ground. The issue of firefighter exposure to particulate contaminants should be further eliminated with the mandated use of particulate blocking hoods. There is sufficient evidence to show that the technology is proven and works with a variety of vendors being able to produce the particulate blocking products. The logical next step is to eliminate the use of non particulate blocking material construction in hoods.

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 02 12:03:24 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-68-NFPA 1970-2022](#)

Statement: Deleting this section. See FR 303 for new 6.14.8-6.14.10.

The proposed changes make the optional particulate blocking requirements mandatory for all hoods and affects the scope, labeling, design, and performance requirements in NFPA 1971.

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods are being made mandatory.

Further with the increased availability of particulate blocking materials and end products, the fire service should not continue to allow inferior protection from the particulate contaminants on the fire ground: this exposure to fireground soot can be more significantly minimized with the mandated use of particulate blocking hoods. There is sufficient evidence to show that the technology is proven and works with a variety of vendors being able to produce the particulate blocking products and their effectiveness in limiting exposure to particulate as addressed in the following reference:

Richard M. Kesler , Alex Mayer , Kenneth W. Fent , I-Chen Chen , A. Shawn

Deaton , R. Bryan Ormond , Denise L. Smith , Andrea Wilkinson , Steve Kerber & Gavin P. Horn

(2021): Effects of firefighting hood design, laundering and doffing on smoke protection, heat stress and wearability, Ergonomics, DOI: 10.1080/00140139.2020.1867241

PI numbers 122, 123, 144, 145 all concern the mandatory requirement for particulate hoods.

PI 143 was incorporated into this document as it was decided by the hoods task group that particulate blocking hoods would become mandatory. Eliminating the standard non-particulate hood will provide a higher level of protection from contaminants with the mandatory implementation of particulate protective hoods.

Research has shown that smoke particulates reach the top of the head in fireground exposures for particulate-blocking hoods and beyond the areas of the currently specified areas of the particulate blocking material. It is noted that a significant amount of particulate penetration can occur around the face opening that can compromise protection. Further it is possible that the hood bib can become pulled out from underneath the coat collar and particulate blocking material should be in place for this circumstance. The proposed changes in coverage of the particulate-blocking layer are intended to provide more comprehensive protection to the end user.



Public Input No. 145-NFPA 1970-2021 [Section No. 6.14]

6-

~~6.14 – Optional Protective Barrier Hood Interface Component Design Requirements.~~

~~6.14.1 –~~

~~Barrier hoods shall meet all design criteria specified in Section~~

~~13~~

~~, Protective Hood Interface Component Design Requirements for Both Ensembles.~~

~~6.14.2 7~~

The portions of the ~~particulate blocking~~ hood interface component that include a particulate blocking material specifically for meeting the requirements of 7.14.1 shall include all areas of the hood to at least 37 mm (1.5 in.) above the reference plane when measured at the coronal plane and all areas of the hood to at least 200 mm (8 in.) at the sides when measured at the coronal plane and 225 mm (9 in.) at the front and rear when measured at the midsagittal plane below the reference plane as measured when the hood is placed on an ISO Size J headform.

~~6.14 13.3-8~~

Binding including the elastic and stitching around the ~~particulate blocking~~ hood face opening shall be permitted to exclude particulate blocking material specifically for meeting the requirements of 7.14.1 for a distance of 50 mm (2 in.) from the leading edge of the hood face opening. The distance shall be measured in eight separate locations with the hood lying on a flat surface with the face opening facing upwards and measured from the innermost row of stitching to the face opening leading edge.

Statement of Problem and Substantiation for Public Input

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods should become mandatory. See Public Input 143.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 143-NFPA 1970-2021 [Section No. 4.1.1.2.1]	

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
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Zip:
Submission Date: Wed Nov 03 03:47:19 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-68-NFPA 1970-2022](#)

Statement: Deleting this section. See FR 303 for new 6.14.8-6.14.10.

The proposed changes make the optional particulate blocking requirements mandatory for all hoods and affects the scope, labeling, design, and performance requirements in NFPA 1971.

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods are being made mandatory.

Further with the increased availability of particulate blocking materials and end products, the fire service should not continue to allow inferior protection from the particulate contaminants on the fire ground: this exposure to fireground soot can be more significantly minimized with the mandated use of particulate blocking hoods. There is sufficient evidence to show that the technology is proven and works with a variety of vendors being able to produce the particulate blocking products and their effectiveness in limiting exposure to particulate as addressed in the following reference:

Richard M. Kesler , Alex Mayer , Kenneth W. Fent , I-Chen Chen , A. Shawn

Deaton , R. Bryan Ormond , Denise L. Smith , Andrea Wilkinson , Steve Kerber & Gavin P. Horn

(2021): Effects of firefighting hood design, laundering and doffing on smoke protection, heat stress and wearability, Ergonomics, DOI: 10.1080/00140139.2020.1867241

PI numbers 122, 123, 144, 145 all concern the mandatory requirement for particulate hoods.

PI 143 was incorporated into this document as it was decided by the hoods task group that particulate blocking hoods would become mandatory. Eliminating the standard non-particulate hood will provide a higher level of protection from contaminants with the mandatory implementation of particulate protective hoods.

Research has shown that smoke particulates reach the top of the head in fireground exposures for particulate-blocking hoods and beyond the areas of the currently specified areas of the particulate blocking material. It is noted that a significant amount of particulate penetration can occur around the face opening that can compromise protection. Further it is possible that the hood bib can become pulled out from underneath the coat collar and particulate blocking material should be in place for this circumstance. The proposed changes in coverage of the particulate-blocking layer are intended to provide more comprehensive protection to the end user.



Public Input No. 317-NFPA 1970-2021 [Section No. 6.14]

6.14 Optional Protective Barrier Hood Interface Component Design Requirements.

6.14.1

Barrier hoods shall meet all design criteria specified in Section 6.13, Protective Hood Interface Component Design Requirements for Both Ensembles.

6.14.2

The portions of the particulate blocking hood interface component that include a particulate blocking material specifically for meeting the requirements of 7.14.1 shall include all areas of the hood ~~to at least 37 mm (1.5 in.) above the reference plane, at least 200 mm (8 in.) above at the reference plane sides~~ when measured ~~at the downward from the coronal plane and all areas of the hood to~~ at least 200 mm ~~305 mm (8 in 12 in .)~~ at the ~~sides rear of the hood when measured at the coronal plane and 225 mm (9 in.) downward from the coronal plane, and at least 279 mm (11 in.) at the front and rear of the hood when measured at the midsagittal plane below the reference plane as measured when the~~ downward from the coronal plane when the hood is placed on an ISO Size J headform.

6.14.3

Binding including the elastic and stitching around the particulate blocking hood face opening shall be permitted to exclude particulate blocking material specifically for meeting the requirements of 7.14.1 for a distance of ~~50 mm~~ 25 mm ~~(2 in 1 in .)~~ from the leading edge of the hood face opening. The distance shall be measured in eight separate locations with the hood lying on a flat surface with the face opening facing upwards and measured from the innermost row of stitching to the face opening leading edge.

Statement of Problem and Substantiation for Public Input

Some research has shown that smoke particulates reach the top of the head for particulate-blocking hoods and beyond the areas of the currently specified areas of the particulate blocking hood. The proposed changes in coverage of the particulate-blocking layer is intended to provide more comprehensive protection to the end user. This public input is being submitted on the behalf of the NFPA 1971 Task Group on Hoods.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
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Submittal Date: Wed Nov 10 14:14:14 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-68-NFPA 1970-2022](#)

Statement: Deleting this section. See FR 303 for new 6.14.8-6.14.10.

The proposed changes make the optional particulate blocking requirements mandatory for all hoods and affects the scope, labeling, design, and performance requirements in NFPA 1971.

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods are being made mandatory.

Further with the increased availability of particulate blocking materials and end products, the fire service should not continue to allow inferior protection from the particulate contaminants on the fire ground: this exposure to fireground soot can be more significantly minimized with the mandated use of particulate blocking hoods. There is sufficient evidence to show that the technology is proven and works with a variety of vendors being able to produce the particulate blocking products and their effectiveness in limiting exposure to particulate as addressed in the following reference:

Richard M. Kesler , Alex Mayer , Kenneth W. Fent , I-Chen Chen , A. Shawn

Deaton , R. Bryan Ormond , Denise L. Smith , Andrea Wilkinson , Steve Kerber & Gavin P. Horn

(2021): Effects of firefighting hood design, laundering and doffing on smoke protection, heat stress

and wearability, Ergonomics, DOI: 10.1080/00140139.2020.1867241

PI numbers 122, 123, 144, 145 all concern the mandatory requirement for particulate hoods.

PI 143 was incorporated into this document as it was decided by the hoods task group that particulate blocking hoods would become mandatory. Eliminating the standard non-particulate hood will provide a higher level of protection from contaminants with the mandatory implementation of particulate protective hoods.

Research has shown that smoke particulates reach the top of the head in fireground exposures for particulate-blocking hoods and beyond the areas of the currently specified areas of the particulate blocking material. It is noted that a significant amount of particulate penetration can occur around the face opening that can compromise protection. Further it is possible that the hood bib can become pulled out from underneath the coat collar and particulate blocking material should be in place for this circumstance. The proposed changes in coverage of the particulate-blocking layer are intended to provide more comprehensive protection to the end user.



Public Input No. 115-NFPA 1970-2021 [Section No. 6.14.2]

6.14.2

The portions of the particulate blocking hood interface component that include a particulate blocking material specifically for meeting the requirements of 7.14.1 shall include all areas of the hood ~~to at least 37 mm (1.5 in.) above the reference plane when measured at the coronal plane and all areas of the hood to at least 200 mm (8 in.) at the sides when measured at the coronal plane and 225 mm (9 in.) at the front and rear when measured at the midsagittal plane below the reference plane as measured when the hood is placed on an ISO Size J headform as described in 6.13. There shall be no areas of the hood that do not include particulate blocking material that meet the requirements of 7.14.1.~~

Statement of Problem and Substantiation for Public Input

There should not be an option to allow less than total coverage of particulate material since the technology allows this level of protection for end users. Not requiring protection based off of the assumption that other ensemble components will overlap and provide adequate protection is not acceptable. The hood should be able to protect the firefighter with coverage from particulates in all areas of the hood. NC State research has been able to determine that there is particle penetration in areas of the hood/helmet and hood/coat interface where the standard currently does not require particulate blocking material for particulate blocking hood options. The language should be amended to not allow particulate hoods that do not contain particulate blocking material in all areas of the hood as constructed which is described in section 6.13

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 116-NFPA 1970-2021 [Section No. 6.14.3]	

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
State:
Zip:
Submittal Date: Mon Nov 01 16:55:27 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-68-NFPA 1970-2022](#)

Statement: Deleting this section. See FR 303 for new 6.14.8-6.14.10.

The proposed changes make the optional particulate blocking requirements mandatory for all hoods and affects the scope, labeling, design, and performance requirements in NFPA 1971.

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods are being made mandatory.

Further with the increased availability of particulate blocking materials and end products, the fire service should not continue to allow inferior protection from the particulate contaminants on the fire ground: this exposure to fireground soot can be more significantly minimized with the mandated use of particulate blocking hoods. There is sufficient evidence to show that the technology is proven and works with a variety of vendors being able to produce the particulate blocking products and their effectiveness in limiting exposure to particulate as addressed in the following reference:

Richard M. Kesler , Alex Mayer , Kenneth W. Fent , I-Chen Chen , A. Shawn

Deaton , R. Bryan Ormond , Denise L. Smith , Andrea Wilkinson , Steve Kerber & Gavin P. Horn

(2021): Effects of firefighting hood design, laundering and doffing on smoke protection, heat stress and wearability, Ergonomics, DOI: 10.1080/00140139.2020.1867241

PI numbers 122, 123, 144, 145 all concern the mandatory requirement for particulate hoods.

PI 143 was incorporated into this document as it was decided by the hoods task group that particulate blocking hoods would become mandatory. Eliminating the standard non-particulate hood will provide a higher level of protection from contaminants with the mandatory implementation of particulate protective hoods.

Research has shown that smoke particulates reach the top of the head in fireground exposures for particulate-blocking hoods and beyond the areas of the currently specified areas of the particulate blocking material. It is noted that a significant amount of particulate penetration can occur around the face opening that can compromise protection. Further it is possible that the hood bib can become pulled out from underneath the coat collar and particulate blocking material should be in place for this circumstance. The proposed changes in coverage of the particulate-blocking layer are intended to provide more comprehensive protection to the end user.



Public Input No. 319-NFPA 1970-2021 [New Section after 6.14.3]

6.14.4*

Manufacturers shall declare sizing for particulate blocking hood interface components in terms of relevant head dimensions as measured on appropriate ISO 16900 headforms.

A.6.14.4

Some particulate blocking hood interface components do not have the one-size-fits all availability that is common for many knit material based hoods. It is important for manufacturers to represent how these sizes are characterized for end users to make appropriate sizing choices.

Statement of Problem and Substantiation for Public Input

This public input is intended to represent a placeholder for further committee consideration by which sizing requirements could be mandated for these products, further forcing other requirements related to performance. The NFPA 1971 task group felt it was important to address the sizing with the influx of particulate hoods, there is a need to regulate sizing to ensure regular fit for particulate hoods. Preliminary research findings from North Carolina State University have shown that particulate protection efficiency and physiological regulation is directly related to proper sizing/fit and should be addressed due to the differences in fit qualities based on differences in particulate blocking composites used in hoods. The relative fit of a hood to available respirator equipment headforms is one possible approach. Another approach is to adopt a standardized measurement system such as the use of a half-head measurement that has been found useful for characterizing size and fit.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull

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Submittal Date: Wed Nov 10 14:36:55 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-51-NFPA 1970-2022

Statement: Design requirements for protective hoods are specified in section 6.13. Within this section the specified coverage and fitment of protective hoods is achieved by using an ISO size J headform (6.13.5). Hoods integrated into the protective coat are not required to meet this specification (6.13.3.1). Currently, this requirement is significantly limited in its application to a single head size. Additionally, this requirement precludes the proper measurement of hood interface fitment over a SCBA respirator face piece and does not specify hood face opening size or coverage requirements. In the case of hoods designed to interface with a specific SCBA face piece, the outer edge of the hood is required to overlap the SCBA face piece by no less than 13 mm (0.5 in) (6.13.6.2). As the initial requirement for coverage uses a single size headform and does not include any specification of coverage around the face opening, it is the purpose of this work to change the existing design requirements in 6.13.5 and 6.13.5.1 to include both multiple sized headforms and a measurement of hood face opening coverage using the reference plane specified in 6.13.5.1.

The addition of a specification for minimum coverage along the reference plane aims to address the poor and inadequate overlap of the protective hood to the SCBA respirator face piece. While hoods designed to interface with specific SCBA face pieces are required to overlap the face piece a minimum of 13 mm (0.5 in.), no such requirement exists for "universal fit" hoods. Additionally, the use of the ISO size J headform fails to account for the larger coverage of the reference plane needed to ensure proper overlap onto the SCBA face piece. By using the reference plane already specified in the existing standard manufacturers shall be able to identify the adequate coverage each hood provides and size hoods appropriately. To further explore the differences in fitment, 7 different model hoods were fitted to the small, medium, and large ISO headforms and measured for their reference plane coverage. A comparison of these measurement can be seen in the table below. Notably, hoods #1 and #2 had the poorest reference plane measurement across all tested combinations. With these measurements, hoods #3-#7 would meet the new standardized sizing.

Hood Small Headform/SCBA Medium Headform/SCBA Large Headform/SCBA

1 350mm 360mm 400mm

2 380mm 395mm 410mm

3 430mm 445mm 460mm

4 415mm 435mm 450mm

5 415mm 435mm 460mm

6 420mm 420mm 440mm

7 445mm 460mm 480mm

Using these same hoods, headforms with appropriately sized respirators were photographed to show differences in fitment. These images, taken from the front, left, and right sides were able to clearly identify the differences in coverage. Seen below, these images are structure from the small headform (green) and respirator, to the medium headform (blue) and respirator, to the large headform (red) and respirator. Hoods #1 and #2 that did not meet requirement clearly show lesser coverage than the other hoods tested. While the fitment of each hood varied, the notable difference in hoods #3 - #7 were minimal.

This first revision represents an identified process by which sizing requirements could be mandated for these products, further forcing other requirements related to performance. The NFPA 1971 committee deemed that it was important to address the sizing with the influx of particulate hoods, there is a need to regulate sizing to ensure regular fit for particulate hoods. Preliminary research findings from North Carolina State University have shown that particulate protection efficiency and physiological regulation is directly related to proper sizing/fit and should be addressed due to the differences in fit qualities based on differences in particulate blocking composites used in hoods. The relative fit of a hood to available respirator equipment headforms is one possible approach. Another approach is to adopt a standardized measurement system such as the use of a half-head measurement that has been found useful for characterizing size and fit.

For this proposed change, manufacturers are permitted to have whatever number of sizes that are unique to their materials, design, and manufacturing process so long as the respective number of sizes fully accommodate each of the five different ISO 169000-5 headforms.



Public Input No. 116-NFPA 1970-2021 [Section No. 6.14.3]

6.14.3 –

~~Binding including the elastic and stitching around the particulate blocking hood face opening shall be permitted to exclude particulate blocking material specifically for meeting the requirements of 7.14.1 for a distance of 50 mm (2 in.) from the leading edge of the hood face opening. The distance shall be measured in eight separate locations with the hood lying on a flat surface with the face opening facing upwards and measured from the innermost row of stitching to the face opening leading edge.~~

Statement of Problem and Substantiation for Public Input

There shall be no areas of a particulate blocking hood that do not contain particulate blocking material to meet the requirements of 7.14.1

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 115-NFPA 1970-2021 [Section No. 6.14.2]	

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
State:
Zip:
Submittal Date: Mon Nov 01 17:14:26 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-68-NFPA 1970-2022](#)

Statement: Deleting this section. See FR 303 for new 6.14.8-6.14.10.

The proposed changes make the optional particulate blocking requirements mandatory for all hoods and affects the scope, labeling, design, and performance requirements in NFPA 1971.

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods are being made mandatory.

Further with the increased availability of particulate blocking materials and end products, the fire service should not continue to allow inferior protection from the particulate contaminants on the fire ground: this exposure to fireground soot can be more significantly minimized with the mandated use of particulate blocking hoods. There is sufficient evidence to show that the technology is proven and works with a variety of vendors being able to produce the particulate blocking products and their effectiveness in limiting exposure to particulate as addressed in the following reference:

Richard M. Kesler , Alex Mayer , Kenneth W. Fent , I-Chen Chen , A. Shawn

Deaton , R. Bryan Ormond , Denise L. Smith , Andrea Wilkinson , Steve Kerber & Gavin P. Horn

(2021): Effects of firefighting hood design, laundering and doffing on smoke protection, heat stress

and wearability, Ergonomics, DOI: 10.1080/00140139.2020.1867241

PI numbers 122, 123, 144, 145 all concern the mandatory requirement for particulate hoods.

PI 143 was incorporated into this document as it was decided by the hoods task group that particulate

blocking hoods would become mandatory. Eliminating the standard non-particulate hood will provide a higher level of protection from contaminants with the mandatory implementation of particulate protective hoods.

Research has shown that smoke particulates reach the top of the head in fireground exposures for particulate-blocking hoods and beyond the areas of the currently specified areas of the particulate blocking material. It is noted that a significant amount of particulate penetration can occur around the face opening that can compromise protection. Further it is possible that the hood bib can become pulled out from underneath the coat collar and particulate blocking material should be in place for this circumstance. The proposed changes in coverage of the particulate-blocking layer are intended to provide more comprehensive protection to the end user.



Public Input No. 138-NFPA 1970-2021 [Section No. 6.19.1]

6.19.1 Liquid and Particulate Contaminants Protective Ensemble Design Requirements for Both Ensembles.

~~6.19.1.1 –~~

~~Liquid and particulate contaminant protective ensembles shall have at least the applicable design requirements specified in this section where inspected and evaluated by the certification organization as specified in Section 4.4, Inspection and Testing.~~

~~6.19.1.2 –~~

~~Liquid and particulate contaminant protective ensembles, including SCBA, shall be designed to protect the wearer's upper and lower torso, head, arms, legs, hands, and feet.~~

~~6.19.1.3 –~~

~~Liquid and particulate contaminant protective ensemble elements shall include garments, helmet, gloves, footwear, interface components, and hood when the hood is not already part of the protective garment.~~

~~6.19.1.4 –~~

~~The manufacturer shall specify each SCBA that is part of the liquid and particulate contaminant protective ensemble. All SCBA specified by the ensemble manufacturer for inclusion in the ensemble shall be certified to Chapters 14 through 18 of this standard.~~

~~6.19.1.5 –~~

~~Liquid and particulate contaminant ensembles shall be designed to accommodate the SCBA specified by the manufacturer for the specific ensemble.~~

(Reserved)

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 02 16:52:37 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-235-NFPA 1970-2022

Statement: Moving these requirements from the ensemble section to the garment section.

At the time the current test method was introduced, there was an urgent need to address firefighter exposure to smoke particulate given concerns for increased rates of cancer among firefighters that may be attributed to direct exposure of skin to smoke particulates and gases as shown in:

(1) T. Fabian et al. (2010). "Firefighter Exposure to Smoke Particulates," Final Report DHS AFG Grant #EMW-2007-FP-02093, Project Number: 08CA31673;

(2) P. S. J. Lees (1995). "Combustion Products and Other Firefighter Exposures." Occup Med: State of the

Art Reviews 10(4): 691-706;

(3) K. M. Kirk, M. Ridgway, Z. Splawinski and M. B. Logan. QFRS (2011). Fire fighter exposures to airborne contaminants during extinguishment of simulated residential room fires. Queensland, Australia: Queensland Fire and Rescue Service (QFRS) Scientific Branch, Research Report 2011-01.

The test was adapted from a similar application of particulate inward leakage used within NFPA 1994 for hazmat material and CBRN protective ensembles. However, there is a larger diversity of ensemble configurations for structural or proximity firefighting protective clothing and equipment that makes the current requirement completely impractical to apply for providing the intended benefit of improved protection from fireground particulate. In addition, the adopted pass/fail criteria create a much more rigorous requirement for firefighter protection than is warranted by known exposure data indicated from recent research. Changes have been made in the applicable chapters on administration, definitions, labeling and information, design requirements, performance requirements, and test methods to transition the optional certification from full ensembles to garments. This specific change allows for a practical application of the criteria for both enhanced particulate and liquid protection of garments to address firefighter exposure to smoke and other fireground hazards. The inward particle leakage performance criteria and test methodology have been adjusted to incorporate quantification of any observed particulate found on the black indicator garment for comparison of those findings with a reasonable level of particulate exposure.



Public Input No. 26-NFPA 1970-2021 [New Section after 6.19.1.5]

6.19.1.6

The manufacturer shall be permitted to specify under garments or other accessory garments worn as part of the ensemble when the specific items are specified to be worn with the ensemble on the product label, are involved in the evaluation of the ensemble for overall liquid integrity and particulate inward leakage, and must be worn in order for the ensemble to function for providing wearer protection from liquid and particulate exposure. The additional under garments or other accessory garments shall be permitted to contribute to the performance of other ensemble requirements in other parts of this standard.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_5_Held.pdf	1971_PI5	

Statement of Problem and Substantiation for Public Input

NOTE: This public input appeared as "Reject but Held" in Public Comment No. 144 of the A2017 Second Draft Report of NFPA 1971 and per the Regs. at 4.4.8.3.1. This additional requirement as part of the optional criteria provides flexibility in the design for how garment elements may be combined with other elements of the ensemble.

Submitter Information Verification

Submitter Full Name: Tc On Fae-Spf
Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 12:28:40 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-304-NFPA 1970-2022

Statement: While principal garments can be designed to limit the inward leakage of liquid and particulate, the use of undergarments or related forms of garments worn underneath the protective ensemble could provide a relatively effective means of contamination control without further encumbering the firefighter. This general philosophy has been applied in the design of certain chemical agent protective clothing in use by the military and certain first response organizations. By making this allowance as part of this standard and specifically requiring that materials used in their construction meet certain performance requirements, i.e., heat resistance and thermal stability (NFPA 1970 [1975]), the use of such garments would safely provide a benefit for minimizing contaminant exposure.



Public Input No. 139-NFPA 1970-2021 [Section No. 6.19.4]

6.19.4 Liquid and Particulate Contaminant Protective Garment Element Design Requirements for Both Ensembles.

6.19.4.1

Liquid and particulate contaminant protective garments shall have at least the applicable design requirements specified in this subsection in addition to the design requirements specified in Section 6.1, Protective Garment Element Design Requirements for Both Ensembles, and Section 6.2, Additional Design Requirements for Structural Fire Fighting Garment Elements or Section 6.3, Additional Design Requirements for Proximity Fire Fighting Garment Elements, where inspected and evaluated by the certification organization as specified in Section 4.4, Inspection and Testing.

6.19.4.1.1*

For the purpose of this requirements, a garment design shall be considered unique based on the following factors:

- (1) Type and orientation of front closure system(s) on coats and trousers
- (2) Type of coat collar, collar closure, and interface with hood
- (3) Type of coat sleeve end and wristlet interface component for creating an interface with protective gloves
- (4) Type of trouser leg construction for creating an interface with protective footwear
- (5) Type of coat and trouser interface and overlap
- (6) Type of interface materials

6.19.4.1.2

Liquid and particulate contaminant protective garments subject to these requirements shall include either a specific set of coats and trousers, or consist of a coverall.

6.19.4.2

Liquid and particulate contaminant protective garments shall be designed and configured to protect at least the wearer's upper and lower torso, arms, and legs, but excluding the hands, feet, and head.

6.19.4.2.1

Liquid and particulate contaminant protective garments shall be permitted to include integrated hoods to protect the wearer's head in conjunction with the SCBA specified by the ensemble manufacturer.

6.19.4.3

All hardware and external fittings shall be free of rough spots, burrs, or sharp edges that could tear primary materials.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
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Submittal Date: Tue Nov 02 16:54:18 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-236-NFPA 1970-2022](#)

Statement: Clarification is being provided as to when liquid and particulate garments are considered unique for the purposes of testing and evaluation.



Public Input No. 141-NFPA 1970-2021 [Section No. 6.19.7]

6.19.7 Liquid and Particulate Contaminant Protective Helmet Elements Design Requirements for Both Ensembles.

6.19.7.1 –

~~Helmet shall have at least the applicable design requirements specified in this subsection where inspected by the certification organization as specified in Section 4.4, Inspection and Testing.~~

6.19.7.2 –

~~Where the liquid and particulate protection is provided by the protective hood and provides an interface with the SCBA specified by the ensemble manufacturer, the manufacturer shall not be required to specify a specific helmet as part of the liquid and particulate contaminant protective ensemble.~~

~~.(Reserved).~~

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
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Zip:
Submittal Date: Tue Nov 02 17:20:37 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-237-NFPA 1970-2022](#)

Statement: Removing these requirements since the performance requirements of liquid and particulate protective ensembles is being moved to garments only.



Public Input No. 142-NFPA 1970-2021 [Section No. 6.19.16]

6.19.16 Liquid and Particulate Contaminant Protective Hood Interface Component Design Requirements for Both Ensembles.

6.19.16.1 –

~~Liquid and particulate contaminant protective hood interface components shall have at least the applicable design requirements specified in this subsection where inspected by the certification organization as specified in Section 4.4, Inspection and Testing.~~

6.19.16.2 –

~~Liquid and particulate contaminant protective hood interface components shall be designed and configured to protect the wearer's head, neck, and face areas, excluding the portion of the face covered by the facepiece of the SCBA specified by the ensemble manufacturer.~~

6.19.16.3 –

~~Liquid and particulate contaminant protective hood interface components shall be permitted to be integrated with the protective garment.~~

(Reserved).

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
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Submittal Date: Tue Nov 02 17:21:44 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-238-NFPA 1970-2022](#)

Statement: Removing these requirements since the performance requirements of liquid and particulate protective ensembles is being moved to garments only.



Public Input No. 181-NFPA 1970-2021 [New Section after 6.19.18]

6.20 Design Requirements for Electrical Circuitry

6.20.1 General.

Structural and proximity firefighting protective ensembles and ensemble elements that contain electrical circuitry shall only utilize circuitry that has been certified, at a minimum, for use in Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 and 2 hazardous locations; and with a temperature class within the range of T3 through T6 inclusive. The suitability shall be demonstrated by being certified as one of the following in accordance with ANSI/UL 913, Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous (Classified) Locations, Sixth Edition, 2002:

- (1) Intrinsically safe apparatus, stand-alone type (i.e. individual pieces of apparatus separately certified for Class I and II, Division 1 and Class III applications, without any external electrical interconnection means, and intended for stand-alone use), or
- (2) Intrinsically safe system (i.e. multiple pieces of intrinsically safe apparatus certified together for Class I and II, Division 1 and Class III applications, with electrical interconnection means, and intended for dedicated system use).

6.20.1.1

Passive electrical circuitry is exempt from this requirement since it does not generate power, and is considered intrinsically safe.

6.20.1.2

The instructions supplied with supplemental devices used to power the passive devices shall include information that requires the device to not be used or stored in the hazardous location.

6.20.2

Electrical circuitry that is certified as part of an intrinsically safe system shall only be interconnected with the other pieces also certified as part of the same intrinsically safe system.

Statement of Problem and Substantiation for Public Input

Electrical equipment is increasingly being used in PPE for tracking, conspicuity, or other automation features. There are currently no requirements within this standard that addresses the safety of those items, in particular, when those items are used within the hazardous location. This proposal is based on work that was done by a task group within the 1981/1982 committees and intends to align the requirements being proposed to those standards.

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 04 11:38:55 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-139-NFPA 1970-2022

Statement: Electrical equipment is increasingly being used in PPE for tracking, conspicuity, or other automation features. There are currently no requirements within this standard that addresses the safety of those items, in particular, when those items are used within the hazardous location. This proposal is based on work that was done by a task group within the 1981/1982 committees.

The option for nonincendive devices (Division 2) is not being recommended for protective clothing within this proposal due to the following differences between the products and their use within 1981/1982 and 1971:

- The elements certified to 1971 are generally assigned to the person that would be wearing the item. If a div

2 option were permitted, the department would be required to assign elements that meet the div 1 requirements in the case that they are required to respond such an event. The products within 1981/1982 are generally not assigned in the same way as the clothing items and this would allow proper selection of the proper product when an event occurs.

- Allowing for a div 2 certification option would require labeling that indicates the level for which the element is certified. In order for the fire fighter to have a div 2 option, they would also be required to have a div 1 option available and then the choice must be made based on the labeling when responding to an event as to which PPE item they need to wear.

At this time, the electrical circuitry being added to the clothing items do not require the higher levels of power that is being requested and utilized within the 1981 and 1982 standards.



Public Input No. 278-NFPA 1970-2021 [New Section after 7.1.1]

CTPP

7.1.X Protective garment elements composite consisting of outer shell, moisture barrier, and thermal barrier shall be tested for thermal insulation while allowing for shrinkage as specified in Section 8.X, Cylinder Thermal Protective Performance (CTPP) Test, and shall have an average CTPP of not less than 30 .

Statement of Problem and Substantiation for Public Input

The current TPP testing method cannot account for the protection reduction caused by shrinkage. In fact, materials that shrink yield a higher TPP value because they get thicker as they shrink and thicker fabrics provide more insulation. In reality, shrinkage does make fabrics thicker but it also moves the fabric closer to the skin. This removes the air layers between the fabric and skin and allows for a higher heat transfer rate. This of course would result in burns occurring quicker.

This test method provides a new TPP sample holder and sensor that allows shrinkage of materials to occur as it would in the field. If a material has a tendency to contract with a flame exposure (TPP level) then the material would shrink up against the sensor yielding higher heat transfer that would produce lower second degree burn times using the stull curve. This method is under development within ASTM (WK75944) and should be approved early next year.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 279-NFPA 1970-2021 [New Section after 7.7.1]	
Public Input No. 281-NFPA 1970-2021 [New Section after 8.10]	

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
Organization: NC State University
Street Address:
City:
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Zip:
Submittal Date: Tue Nov 09 20:54:25 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-168-NFPA 1970-2022](#)

Statement: The current TPP testing method does not account for the protection reduction caused by shrinkage. This test method provides a new TPP sample holder and sensor that allows shrinkage of materials to occur. If a material tends to contract with a flame exposure (TPP level) then the material would shrink up against the sensor yielding higher heat transfer that would produce lower second degree burn times using the stull curve. Further testing will be used to inform the committee during the second draft meeting on the validation of the test method along with other pertinent data that can confirm the proposed performance criterion. The current proposed performance criterion is a placeholder based on the best estimate of the currently available data that would accommodate all tested, certified composites. This test method is being proposed as a supplemental test to the TPP test.

**Public Input No. 189-NFPA 1970-2021 [Section No. 7.1.3.1]****7.1.3.1**

Labels and non-visual/machine readable tags shall meet the performance requirements specified in 7.1.3 only where placed on the exterior of the garment.

Statement of Problem and Substantiation for Public Input

Many fire departments are now using RFID or other machine readable devices to track their PPE. Currently these devices are not specifically covered in the standard. This proposal offers a suggestion for how new requirements would be structured.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 188-NFPA 1970-2021 [New Section after 5.1.7.5]	

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 04 14:18:07 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-140-NFPA 1970-2022

Statement: Many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.



Public Input No. 190-NFPA 1970-2021 [Section No. 7.1.5]

7.1.5

Garment outer shells, moisture barriers, thermal barriers, collar linings, winter liners where provided, DRDs, trim, lettering, and other materials used in garment construction, including, but not limited to, padding, reinforcement, labels, non-visual/machine readable tags, interfacing, binding, hanger loops, emblems, or patches, but excluding elastic and hook and pile fasteners where these items are placed so that they will not directly contact the wearer's body, shall be individually tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test, and shall not melt, separate, or ignite.

Statement of Problem and Substantiation for Public Input

Many fire departments are now using RFID or other machine readable devices to track their PPE. Currently these devices are not specifically covered in the standard. This proposal offers a suggestion for how new requirements would be structured.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 188-NFPA 1970-2021 [<u>New Section after 5.1.7.5</u>]	

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 04 14:18:59 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-141-NFPA 1970-2022

Statement: Many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.

**Public Input No. 195-NFPA 1970-2021 [Section No. 7.1.8]****7.1.8**

All garment hardware, ~~excluding~~ including zippers, ~~but excluding~~ hook and pile fasteners, where placed so that they will not directly contact the wearer's body, shall be individually tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test, and shall not ignite and shall remain functional.

Statement of Problem and Substantiation for Public Input

Clarifying that zippers are included in this requirement. Since zippers do contain textile material, they do not technically meet the definition of hardware. It is current practice to consider them hardware, and therefore this is being updated to make the requirement more clear.

Submitter Information Verification

Submitter Full Name: Amanda Newsom

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Thu Nov 04 14:38:15 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-166-NFPA 1970-2022](#)

Statement: Clarifying that zippers are included in this requirement. Since zippers do contain textile material, they do not technically meet the definition of hardware. It is current practice to consider them hardware, and therefore this is being updated to make the requirement clearer.

**Public Input No. 72-NFPA 1970-2021 [Section No. 7.1.15]****7.1.15***

Garment moisture barrier materials and straight seams shall be tested for resistance to liquid penetration as specified in Section 8.27, Liquid Penetration Resistance Test, and shall show no penetration of the test liquids for at least 1 hour.

Statement of Problem and Substantiation for Public Input

Clarification to be consistent with other standards within the project.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 74-NFPA 1970-2021 [Section No. 7.7.11]	
Public Input No. 76-NFPA 1970-2021 [Section No. 7.10.4]	

Submitter Information Verification

Submitter Full Name: William Fithian
Organization: ASTM/Safety Equipment Institute
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 23 10:49:19 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The reference to straight seams was moved to the test method in Chapter 8 where it is more applicable.



Public Input No. 71-NFPA 1970-2021 [Section No. 7.1.16]

7.1.16

Garment moisture barriers and moisture barrier straight seams shall be tested for resistance to liquid or bloodborne pathogens as specified in Section 8.28, Viral Penetration Resistance Test, and shall allow no penetration of the Phi-X-174 bacteriophage above the test interpretation threshold for at least 1 hour.

Statement of Problem and Substantiation for Public Input

Studies and technical review by other committees within the project demonstrated a need to modify the performance requirements to eliminate false positive test results inherent with this test, that necessitate issuance of nonconformances and the unnecessary quarantining of certified products.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 73-NFPA 1970-2021 [Section No. 7.7.10]	
Public Input No. 75-NFPA 1970-2021 [Section No. 7.10.5]	

Submitter Information Verification

Submitter Full Name: William Fithian
Organization: ASTM/Safety Equipment Institute
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 23 10:44:25 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-154-NFPA 1970-2022](#)

Statement: The threshold revision is intended to aid in more reliable and reproducible test results. Studies and technical review by other committees within the project demonstrated a need to modify the performance requirements to eliminate false positive test results inherent with this test, that necessitate issuance of non-conformances and the unnecessary quarantining of certified products. The reference to straight seams was moved to the test method in Chapter 8 where it is more applicable. The additional "borne" text was also included for consistency with other sections in this document.



Public Input No. 287-NFPA 1970-2021 [Sections 7.1.21, 7.1.22]

Sections 7.1.21, 7.1.22

7.1.21

Where present, DRD materials, seams, splices, and joints shall be tested for material strength as specified in Section 8.58, Drag Rescue Device (DRD) Materials Strength Test, and shall have a minimum tensile strength of 7 kN (1573 lbf).

7.1.22

Garments ~~with the DRD~~ where a DRD installed shall be tested for functionality as specified in Section 8.59, Drag Rescue Device (DRD) Function Test, and shall allow for the manikin to be dragged for a minimum of 2.5 m (98 in.), the DRD shall be deployed within 10 seconds, the SCBA shall not move higher on the torso from the donned position, and the SCBA shall not separate from the manikin.

Statement of Problem and Substantiation for Public Input

While the drag rescue device (DRD) was incorporated as a life-saving feature for protective coat, limited information is available to suggest that its use provides the intended benefits for rapid extraction of a downed firefighter that cannot be achieved by other means. Therefore, it is suggested that the DRD become optional and if absent, the manufacturer provide a warning that the organization establish specific procedures for the rapid extrication of downed firefighters by some other identified means. NFPA 1500 that governs the use of PPE for fire departments currently incorporates language in paragraph 7.2.6 that requires fire department to have a standard operating procedure for rapid extrication of firefighters that may or may not depend on the coat having a DRD. These proposed changes show that the DRD performance requirements are only required where the DRD is present.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 286-NFPA 1970-2021 [Section No. 6.1.9.1]	
Public Input No. 280-NFPA 1970-2021 [Chapter 5]	
Public Input No. 288-NFPA 1970-2021 [Section No. 8.58.1.1]	
Public Input No. 290-NFPA 1970-2021 [Section No. 8.59.1]	

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 21:46:44 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: The fire service still considers having a DRD a mandatory part of the life saving garments to be available when needed. The technical committee is looking at ways to improve the usability and accessibility of the device in further revisions.



Public Input No. 294-NFPA 1970-2021 [Section No. 7.1.23]

7.1.23

Garment moisture barrier materials shall be tested for resistance to light degradation as specified in Section 8.62, Light Degradation Resistance Test, and water shall not appear on the surface of the specimen.

~~Garment moisture barrier materials shall be tested for resistance to light degradation as specified in Section 8.62, Light Degradation Resistance Test, and water shall not appear on the surface of the specimen.~~

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
UV-Light-Test-Public-Input.pdf		

Statement of Problem and Substantiation for Public Input

The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an outer shell. Furthermore, outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test does not address mechanisms of moisture barrier degradation. Please see attachment for further substantiation.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 295-NFPA 1970-2021 [Section No. 8.62]	
Public Input No. 296-NFPA 1970-2021 [Section No. A.8.62.5.2]	

Submitter Information Verification

Submitter Full Name: Derek Urwin
Organization: IAFF
Affiliation: IAFF
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 10 00:36:11 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-191-NFPA 1970-2022](#)

Statement: The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an outer shell. Furthermore, garment outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test further does not address all of the relevant mechanisms of moisture barrier degradation. The impact of UV light on the moisture barrier is being addressed in a separate first revision that accounts for the manner in which garment moisture barriers and other garment materials are actually exposed and accounts for other expected use factors, such as repeated launderings, multiple heat exposures, and flexing, and abrasion from wear and tear.



Public Input No. 322-NFPA 1970-2021 [Section No. 7.1.23]

7.1.23

~~Garment moisture barrier materials shall be tested for resistance to light degradation as specified in Section 8.62 ; Light Degradation Resistance Test, and water shall not appear on the surface of the specimen~~ Replace with an appropriate requirement for a replacement test for the UV Light Degradation Test .

Statement of Problem and Substantiation for Public Input

I've been part of all of the task group and sub task group meetings where this test was, and new tests were, discussed. I understand the desire to remove PFAS from gear and I share that desire. In my own life I have consciously made purchases that reduce my exposure to phthalates, in particular, and other chemicals that are known to be or suspected of being carcinogens, endocrine disruptors, and the like.

As with all decisions, though, there is a balance. There are tradeoffs to be considered and some of the tradeoffs have factors that just aren't known yet.

I submitted this PI in an effort to make sure all tradeoffs are balanced through this process – it's obvious I don't know how to write a test method and I don't have the scientific knowledge to know what test would ensure firefighters can be confident in the durability of their moisture barrier, but I think it's important to create a placeholder in the event that that test is developed over the period of this revision cycle.

I am open to the proposals related to changing conditioning and am also mindful of the risk that we will add tests and cost and lose protection. I do not want to lose the protection of having a test that measures moisture barrier degradation.

At the very least, if we can't have a requirement to remove PFAS from gear AND keep the UV Light Degradation Test, I would ask the committee to preserve requirements to maintain the current level of durability testing for moisture barriers using whatever mechanism is scientifically appropriate and addresses the health and safety concerns of firefighters (firefighters who want a durable moisture barrier have as much value as firefighters who are focused on PFAS removal, in my opinion). My goal is to balance having a durable moisture barrier that does its job with removing PFAS from gear.

The balance, in this instance, is mainly trading one hazard for another (in a very simplistic way). The hazards related to moisture barrier failure are well understood and well documented. A functioning moisture barrier provides primary protection from water and liquids that include some common chemicals and bloodborne pathogens that we know firefighters encounter while performing normal firefighting duties. If a moisture barrier isn't doing its job, those liquids can get to the firefighter's body. A known hazard that is currently accounted for.

The risk of encountering those liquids during normal operations has not gone away and every firefighter should be able to have a certain level of confidence that the moisture barrier is capable of doing what it was built to do.

Obviously, we now have easier access to inspect moisture barriers in the field, and, ideally, those inspections are happening according to current requirements and best practices so that degraded moisture barriers are caught and repaired or replaced. In the cases where inspections aren't happening, or happening as frequently as they should, the risk of unknowingly relying on a degraded moisture barrier is greater. I'm not comfortable adding that risk to any firefighter's job when we've already got something in place that has prevented that.

It has not been proven that (1) removing the UV Light Degradation Test will accomplish removal of PFAS from moisture barriers and, (2) that PFAS-free barriers can't pass the current requirements. This tells me that we do not even know that this test is the commercial holdup.

Beyond that, I have also not seen definitive proof that PFAS from the moisture barrier are even reaching the wearer or that we can even isolate anyone's PFAS absorption to a specific material or consumer good. We're guessing to facilitate commercialization at the risk of losing a durability measure that has proven to be an effective way to ensure durability. It seems backwards to me that anyone who wanted to produce a PFAS-free moisture barrier should not be required to prove durability. And, if PFAS-free moisture barriers can't pass this durability test, why the solution is throwing out the test, not refining it or refining PFAS-free moisture barriers so they are more durable.

If that is truly the balance point, then maybe this test should be balanced against another test (like TPP and THL have to be balanced with each other) so that firefighters get a full picture of the tradeoff.

PFAS are in products we all use every day, I have not seen any information that isolates PFAS from moisture barriers as a source of PFAS in a person's body. Who can say where it came from? From the food that was cooked on a non-stick pan and ingested? From the waterproof jackets, outdoor clothing, footwear, and swimwear most of us wear at one time or another (some with obviously more skin contact than we see with the moisture barrier (which is separated from the wearer by the thermal barrier and, most likely, undergarments and stationwear)). From the carpet and furniture in your house? Or

from all of that burning during a fire, leaving particles on gear that reach apparatus interiors, living areas in the station, personal vehicles, and individual's homes when measures may or may not be taken to limit cross-contamination. We simply do not know.

I understand that UV is not the typical method of degradation in the field but, as we know, lab tests cannot always perfectly mimic field use and care (especially when field use and care is not consistent). What I also understand is that the UV Light Degradation Test has prevented mass moisture barrier failures for 20 years.

I'm not comfortable risking another mass moisture barrier failure without understanding whether or not the UV Light Degradation Test is really the limiting factor for moisture barrier technologies moving to PFAS-free products. And, if it is, understanding the durability of PFAS-free barrier materials. If durability and degradation isn't tested using UV Light, what is the replacement?

Again, without seeing the data, I am not certain that changing conditioning parameters will fully address degradation concerns. I am hopeful. And I hope the additional tests do not add so much cost to certification that we end up throwing the baby out with the bathwater.

I still don't agree that, because a product can't pass a test, we throw out the test. Nor have I seen data that definitively proves this test is preventing PFAS-free barriers from getting certified but, if we can test all barriers for degradation and allow the market to decide where their trade-offs are, I am good with that.

I submit this PI in an effort to allow for a placeholder for a replacement test to the UV Light Degradation Test. I don't have a plan for how that replacement test would be developed, I just know that, for me, that would provide a better assessment of the tradeoffs between having a durable moisture barrier and a PFAS-free moisture barrier.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 321-NFPA 1970-2021 [Section No. 8.62]</u>	This is the performance requirement for the test method in 8.62

Submitter Information Verification

Submitter Full Name: Marni Schmid
Organization: Fortunes Collide Marketing LLC
Affiliation: F.I.E.R.O.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 10 15:33:51 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-191-NFPA 1970-2022

Statement: The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an outer shell. Furthermore, garment outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test further does not address all of the relevant mechanisms of moisture barrier degradation. The impact of UV light on the moisture barrier is being addressed in a separate first revision that accounts for the manner in which garment moisture barriers and other garment materials are actually exposed and accounts for other expected use factors, such as repeated launderings, multiple heat exposures, and flexing, and abrasion from wear and tear.

**Public Input No. 48-NFPA 1970-2021 [Section No. 7.1.24]****7.1.24**

Garment zippers shall be tested for crosswise breaking strength of chain; crosswise breaking strength of separating unit; holding strength of stops, retainers, and separating units; operating force; and slider lock strength requirements of A-A-~~55634A~~ 55634B , *Commercial Item Description, Zippers (Fasteners, Slide, Interlocking)*.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_38_T_McCullough.pdf	1971_PI_38_T.McCullough	

Statement of Problem and Substantiation for Public Input

A-A-55634A has been updated. A-A-55634B is the new version and should be the new referenced document.

Submitter Information Verification

Submitter Full Name: Terrence McCullough
Organization: YKK USA) Inc
Street Address:
City:
State:
Zip:
Submission Date: Thu Aug 19 13:18:46 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-276-NFPA 1970-2022

Statement: This is an update to the most current standard number reference.



Public Input No. 256-NFPA 1970-2021 [New Section after 7.1.27]

7.1.28

Protective garment element composites consisting of outer shell, moisture barrier, and thermal barrier shall be tested for thermal insulation as specified in Section 8.72, Small Scale Flash Fire Exposure Test 1, and shall have an average ERV of not more than 0.300 (30.0%).

Statement of Problem and Substantiation for Public Input

Testing of a variety of currently acceptable turnout gear composites, using the proposed procedures and evaluation techniques outlined in PI-250, suggests that an Energy Ratio Value of not more than 0.300 (30.0%) provides sufficient minimum protection. See substantiating data submitted with PI-250

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]</u>	
<u>Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]</u>	

Submitter Information Verification

Submitter Full Name: Brian Shiels
Organization: ArcWear
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 12:40:53 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-169-NFPA 1970-2022

Statement: This proposed new Performance Requirement is to include bench-scale evaluations of flash fire protective performance of materials used in construction of multilayer garment composites. The TPP test only assess the response of flat samples of composites continuously exposed to flash fire conditions of a combined convective-radiant heat flux of 84 kW/m² until a burn injury criterion is met, failing to account for heat transfer that occurs after the flame exposure ends. The results provide an indicator of how fabrics may perform as full garments. Initial testing of 30 different composites has been conducted. Comparison of these results with the certified TPP results from UL shows that there is little correlation between the results of the two tests, indicating that the flash fire cylinder test provides different information than the TPP test. Further testing, including some inter-laboratory testing, will be used to inform the committee during the second draft meeting on the validation of the test method along with other pertinent data that can confirm the proposed performance criterion. This test method is being proposed as a supplemental test to the TPP test.



Public Input No. 179-NFPA 1970-2021 [New Section after 7.2.2]

Evaporative Resistance Test

7.X.X Garment composites consisting of the outer shell, moisture barrier, and thermal barrier shall be tested for evaporative resistance a specified in X.xx, Evaporative Resistance Test, and shall have an evaporative resistance value no higher than 45 Pa·m²/W

Statement of Problem and Substantiation for Public Input

The inclusion of this test method is supported by data generated from a DHS AFG project¹. In this project a physiological manikin was used to compare ensembles made with a range of THL and evaporative resistance values². Testing was conducted in one mild environment (25C, 65%RH) and two hot environments (35 C, 40% RH, & 40 C, 28% RH). Results indicated that THL was the best predictor of heat stress in mild environments while Evaporative Resistance measurements were a better predictor of heat stress in hotter conditions. Based on these correlations and the fact that firefighters face more heat stress in hotter conditions³ evaporative resistance of composites should be included as a performance requirement within NFPA 1971.

The performance requirements of 45 Pa·m²/W suggestion comes from the data from the project as well. All evaporative resistance values below this value did not show a significantly physiological difference in the 35 C environment.

- 1 Barker R., Developing a new basis for rating the heat strain of firefighter turnout gear. Final report, Federal Emergency Management Agency, Contract No. EMW-2016-FP-00744; 2021.
- 2 Gao H, Deaton S., Barker R., Fang X, Watson K. Relationship between heat loss indexes and physiological indicators of turnout related heat strain in mild and hot environments. International Journal of Occupational Safety and Ergonomics. 2021 Submitted.
- 3 Barker R., Fang X., Deaton S, DenHartog E, Gao H, Tutterow R, Schmid M. Identifying factors that contribute to structural firefighter heat strain in North America. International Journal of Occupational Safety and Ergonomics. 2021 Sep 29 (just-accepted):1-26.

Related Public Inputs for This Document

Related Input

Relationship

Public Input No. 180-NFPA 1970-2021 [New Section after 8.33]
 Public Input No. 209-NFPA 1970-2021 [New Section after A.7.2.2]
 Public Input No. 210-NFPA 1970-2021 [New Section after B.1]

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
Organization: NC State University
Affiliation: Also representing the NFPA 1971 task group evaluating evaporative resistance as a testing requirement
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 13:27:13 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-174-NFPA 1970-2022

Statement: The inclusion of this test method is supported by data generated from a DHS AFG project¹. In this project a physiological manikin was used to compare ensembles made with a range of THL and evaporative resistance values². Testing was conducted in one mild environment (25C, 65%RH) and two hot environments (35 C, 40% RH, & 40 C, 28% RH). Results indicated that THL was the best predictor of heat stress in mild environments while Evaporative Resistance measurements were a better predictor of heat stress in hotter conditions. Based on these correlations and the fact that firefighters face more heat

stress in hotter conditions³ evaporative resistance of composites should be included as a performance requirement within NFPA 1971. The performance requirements of 45 Pa·m²/W suggestion comes from the data from the project as well. All evaporative resistance values below this value did not show a significantly physiological difference in the 35 C environment.

Annex information is provided to support the new Evaporative Resistance Test method.

1 Barker R., Developing a new basis for rating the heat strain of firefighter turnout gear. Final report, Federal Emergency Management Agency, Contract No. EMW-2016-FP-00744; 2021.

2 Gao H, Deaton S., Barker R., Fang X, Watson K. Relationship between heat loss indexes and physiological indicators of turnout related heat strain in mild and hot environments. International Journal of Occupational Safety and Ergonomics. 2021 Submitted.

3 Barker R., Fang X., Deaton S, DenHartog E, Gao H, Tutterow R, Schmid M. Identifying factors that contribute to structural firefighter heat strain in North America. International Journal of Occupational Safety and Ergonomics. 2021 Sep 29 (just-accepted):1-26.



Public Input No. 191-NFPA 1970-2021 [Section No. 7.4.4]

7.4.4

Helmets shall be tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test. The following results shall be considered unacceptable:

- (1) Parts of the complete helmet assembly that do not contact the headform before this test come in contact with the headform as a result of this test
- (2) Distortion of the back of the helmet shell extending more than 40 mm (1½ in.) below the original position of the helmet shell
- (3) Distortion of the front and sides of the helmet shell extending more than 30 mm (1¾ in.) below the original position of the helmet shell
- (4) Separation, melting, or dripping of the retention system, energy absorption system, or ear covers
- (5) Dysfunctional chin strap closure device
- (6) Ignition of any part of the helmet assembly
- (7) Ignition or melting of the product labels and where used, non-visual/machine readable tags
- (8) * Any component of the helmet assembly, including but not limited to supplemental faceshields, extending more than 30 mm (1¾ in.) below the initial lowest point of the helmet shell in the front area, both before and after oven exposure
- (9) Dripping of the faceshield/goggle component

Statement of Problem and Substantiation for Public Input

Many fire departments are now using RFID or other machine readable devices to track their PPE. Currently these devices are not specifically covered in the standard. This proposal offers a suggestion for how new requirements would be structured.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 188-NFPA 1970-2021 [New Section after 5.1.7.5]	

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 04 14:20:12 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-143-NFPA 1970-2022

Statement: Many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.



Public Input No. 291-NFPA 1970-2021 [Section No. 7.4.4]

7.4.4

Helmets shall be tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test. The following results shall be considered unacceptable:

- (1) Parts of the complete helmet assembly that do not contact the headform before this test come in contact with the headform as a result of this test
- (2) Distortion of the back of the helmet shell extending more than 40 mm (1½ in.) below the original position of the helmet shell
- (3) Distortion of the front and sides of the helmet shell extending more than 30 mm (1¾ in.) below the original position of the helmet shell
- (4) Separation, melting, or dripping of the retention system, energy absorption system, or ear covers
- (5) Dysfunctional chin strap closure device
- (6) Ignition of any part of the helmet assembly
- (7) Ignition or melting of the product labels
- (8) * Any component of the helmet assembly, including but not limited to supplemental faceshields, extending more than 30 mm (1¾ in.) below the initial lowest point of the helmet shell in the front area, both before and after oven exposure
- (9) Dripping of the faceshield/goggle component
- (10) The temperature on the top of the headform shall not increase more than 25 degrees as a result of the test.

Statement of Problem and Substantiation for Public Input

The firefighter's brain is a crucial area that will have its cognitive ability lessened as its temperature rises. We currently have no test that measures the helmet's ability to protect the firefighter's brain from increased heat generated during firefighting. As helmet weights decrease as materials become stronger, we need to ensure protection from a thermal increase that would negatively affect the firefighter.

Submitter Information Verification

Submitter Full Name: Jim Reidy
Organization:
Affiliation: Texas State Association of Firefighters
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 22:14:27 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-71-NFPA 1970-2022

Statement: The proposed changes to Section 8.5 broaden the application of the full flame engulfment test to both helmets and gloves for consistency with the way that flame resistance is currently assessed for footwear. For helmets, three different tests are used to evaluate helmet flame resistance using a relatively small Bunsen burner that is used to contact different fixed locations on the helmet requiring multiple evaluations. For gloves, a larger Meker burner is used in a modified form of a vertical flame resistance test to evaluate each unique glove composite.

The indicated changes provide a basis for evaluating each full protective elements under the same flame resistance conditions and have been put into the standard as supplemental tests to the current specified flame resistance procedures to allow a more detailed assessment for how the full engulfment test can be consistently applied for helmets and gloves.

An additional requirement has been added to measure the temperature rise on the top of the headform that

holds the helmet during the flame resistance exposure but no specific criterion has been proposed and it is the expectation of the committee to investigate the utility of the measurement prior to public comment.



Public Input No. 341-NFPA 1970-2021 [Section No. 7.4.5]

7.4.5

Helmets shall be tested for resistance to flame as specified in Section 8.3 8.5 , Flame Resistance Test 2; ~~Procedures A and C, and shall not show any 4, and not have any~~ visible afterflame or glow 5.0 seconds after removal from the test flame- ~~in each test~~ , not have any components melt or drip, and not exhibit any burn through .

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1970_Sec_7.4.5_J.Stull.docx		

Statement of Problem and Substantiation for Public Input

A more effective method for evaluating helmets where the flame could be simultaneously applied to several parts of the helmet would be to adapt the test method currently used for testing full footwear as specified in Section 8.5 to allow for suspending helmets. This would provide for more efficient and relevant testing of full helmets. The utility of the testing has been initially demonstrated.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protec
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 11 18:35:21 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-70-NFPA 1970-2022

Statement: The committee is investigating the application of the full engulfment test, now currently applied to footwear, for with evaluating the flame resistance of whole helmets. This test provides the ability to evaluate complete elements in a manner more representative of use as compared to the current series of tests, which now depends on two to three different tests that utilizes relatively small burners for contacting the helmet at different set locations. In contrast, the proposed test provides a full flame exposure to the top and sides of the helmet. The proposed additional helmet flame resistance requirement is intended to permit further research as to the merits for this test and to allow a determination of which current flame resistance procedures (now Procedure A and C and potentially Procedure D of Section 8.5) can be replaced.

For the reasons above, the proposed removal of Section 8.3, Sections 8.3.5 and 8.3.7 according to Public Input 343, is not being recommended at this time.



Public Input No. 257-NFPA 1970-2021 [New Section after 7.4.16]

7.4.17

Fabric composites used in the construction of helmet ear covers and helmet shrouds shall be tested for thermal insulation as specified in Section 8.72, Small Scale Flash Fire Exposure Test 1, and shall have an average ERV of not more than 0.450 (45%).

Statement of Problem and Substantiation for Public Input

The ERV proposed for garment composites in PI 256 has been adjusted proportionally for helmet ear covers in a manner similar to the comparative TPP value relative to garment composites and helmet ear covers.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]	
Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]	

Submitter Information Verification

Submitter Full Name: Brian Shiels
Organization: ArcWear
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 12:47:25 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: This test does not have applicability to helmet ear covers. They do not fully wrap around the body.



Public Input No. 20-NFPA 1970-2021 [Section No. 7.5.10]

7.5.10 _

Helmet ear covers. Helmets shall be capable of being detached from and reinstalled on the helmet per the manufacturer's instructions within a period of

20 minutes.

20 minutes tested for ease of ear cover removal as specified in 8.76. Ear Cover Removal Test, and shall be removable within 10 minutes.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_11_Held.pdf	1971_PI11	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. 49 of the (A2017) Second Draft Report for NFPA 1971 and per the Regs. at 4.4.8.3.1. There is no associated test method for making this assessment of helmet performance (ease of ear cover removal). The period of 10 minutes is too long considering that if it is too difficult to remove ear covers, then end users are likely to go to the trouble of removing them for cleaning. The removal of a liner from most coat shells generally takes less than 2 minutes. Reinstallation of that lining may take as much as 5 minutes, far shorter than the proposed change here.

Submitter Information Verification

Submitter Full Name: Tc On Fae-Spf

Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment

Street Address:

City:

State:

Zip:

Submittal Date: Mon Aug 16 11:13:11 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-69-NFPA 1970-2022

Statement: With the increasing emphasis on cancer reduction through post fire cleaning and decontamination, the end user who is typically responsible for this post fire process must be able to remove and re-attach the soft goods and ear flaps easily and properly. Recent research shows that some of the textile-based components that come in contact with the wearer's head can be extensively more contaminated than other parts of the ensembles, which could be linked to the fact helmets may not be as frequently cleaned as other elements and it is difficult to remove these items for optimized cleaning. The proposed criterion is intended to establish a reasonable amount of time for the removal and reinstallation of the different helmet soft goods that come in contact with the wearer's head that includes, but is not limited to ear covers, sweatbands, chin straps, nape straps for some helmets. A specific test method has been proposed to provide a systematic way for conducting this evaluation. This requirement does not include suspension soft goods because their improper removal and replacement could adversely affect the physical performance offered by the helmet.

Two of the public inputs (20 and 36) were originally held for further study during the last revision but only addressed the removal of the ear covers. The new changes address a broader range of textile components on the protective helmet. The proposed change further addresses Public Input 289 by providing more detail for how to conduct the evaluation using a standardized set of procedures.



Public Input No. 289-NFPA 1970-2021 [Section No. 7.5.10]

7.5.10

~~Helmet~~ Helmet, ear covers and interior helmet soft goods; including but not limited to forehead pad, helmet suspension system, and ratchet system, shall be capable of being detached from and ~~reinstalled~~ properly reinstalled on the helmet per the manufacturer's instructions within a period of 20 minutes.

Statement of Problem and Substantiation for Public Input

As the emphasis on cleaning the entire ensemble and ensemble elements, Firefighters need to have a user friendly ability to remove and re-attach ear covers and the suspension system (soft goods). Some type of coding system would benefit the end user in re-attachmnet in a proper fashion and timely manner.

Submitter Information Verification

Submitter Full Name: Jim Reidy
Organization:
Affiliation: Texas State Association of Firefighters
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 21:54:29 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-69-NFPA 1970-2022](#)

Statement: With the increasing emphasis on cancer reduction through post fire cleaning and decontamination, the end user who is typically responsible for this post fire process must be able to remove and re-attach the soft goods and ear flaps easily and properly. Recent research shows that some of the textile-based components that come in contact with the wearer's head can be extensively more contaminated than other parts of the ensembles, which could be linked to the fact helmets may not be as frequently cleaned as other elements and it is difficult to remove these items for optimized cleaning. The proposed criterion is intended to establish a reasonable amount of time for the removal and reinstallation of the different helmet soft goods that come in contact with the wearer's head that includes, but is not limited to ear covers, sweatbands, chin straps, nape straps for some helmets. A specific test method has been proposed to provide a systematic way for conducting this evaluation. This requirement does not include suspension soft goods because their improper removal and replacement could adversely affect the physical performance offered by the helmet.

Two of the public inputs (20 and 36) were originally held for further study during the last revision but only addressed the removal of the ear covers. The new changes address a broader range of textile components on the protective helmet. The proposed change further addresses Public Input 289 by providing more detail for how to conduct the evaluation using a standardized set of procedures.



Public Input No. 342-NFPA 1970-2021 [Section No. 7.7]

7.7 Protective Glove Elements Performance Requirements for Both Ensembles.

7.7.1

The glove body composite shall be tested for thermal insulation as specified in Section 8.10, Thermal Protective Performance (TPP) Test, and shall have an average TPP rating of at least 35.0.

7.7.2

The glove interface component composite shall be tested for thermal insulation as specified in Section 8.10, Thermal Protective Performance (TPP) Test, and shall have an average TPP rating of at least 20.0.

7.7.3

Gloves shall be tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test, and shall not melt, separate, or ignite; shall not shrink more than 8 percent in length or width; shall be donnable; and shall be flexible.

7.7.3.1

Hook and pile fasteners on gloves shall be excluded from these requirements where these items are placed such that they will not directly contact the wearer's body.

7.7.3.2

Where hook and pile fasteners are placed on the gloves such that they will directly contact the wearer's body, they shall not melt, separate, or ignite when tested as part of the whole glove.

7.7.4

The glove lining materials of the glove body shall be individually tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test, and shall not melt, separate, or ignite.

7.7.5

Portions of the glove body composite representative of the palm of the glove shall be tested for conductive heat resistance as specified in Section 8.7, Conductive Heat Resistance Test 1, and shall have a second-degree burn time of not less than 10.0 seconds and shall have a pain time of not less than 6.0 seconds.

7.7.6

The glove body composite, including, but not limited to, trim, external labels, and external tags, but excluding hardware, and excluding hook and pile fasteners that do not directly contact the wearer's body, shall be tested for resistance to flame as specified in Section 8.4, Flame Resistance Test 3, and shall not have an average char length of more than 100 mm (4 in.), shall not have an average afterflame of more than 2.0 seconds, shall not melt or drip, and shall not have the amount of consumed materials exceed 5 percent.

7.7.7 –

~~The glove interface component composite, including but not limited to trim, external labels, and external tags, but excluding hardware and hook and pile fasteners that do not directly contact the wearer's body, shall be tested for resistance to flame as specified in Section 8.4, Flame Resistance Test 3, and shall not have an average char length of more than 100 mm (4 in.), shall not have an average afterflame of more than 2.0 seconds, shall not melt or drip, and shall not have the amount of consumed materials exceed 5 percent.~~

7.7.8 –

~~The glove extension composite, including but not limited to trim, external labels, and external tags, but excluding hardware and hook and pile fasteners that do not directly contact the wearer's body, shall be tested for resistance to flame as specified in Section 8.4, Flame Resistance Test 3, and shall not have an average char length of more than 100 mm (4 in.), shall not have an average afterflame of more than 2.0 seconds, shall not melt or drip, and shall not have the amount of consumed materials exceed 5 percent.~~ 8.5, Flame Resistance Test 4, and not have an afterflame of more than 5.0 seconds, not melt or drip, not exhibit any burn-through, and not exhibit melting of the barrier layer.

7.7.9 * _

All sewing thread utilized in the construction of gloves shall be tested for melting resistance as specified in Section 8.11 , Thread Melting Test, and shall not melt at or below 260°C (500°F).

7.7.10 _

The glove body seams shall be tested for resistance to liquid-borne or blood-borne pathogens as specified in Section 8.28 , Viral Penetration Resistance Test, and shall allow no penetration of the Phi-X-174 bacteriophage for at least 1 hour.

7.7.11 * _

Glove body seams shall be tested for resistance to liquid penetration as specified in Section 8.27 , Liquid Penetration Resistance Test, and shall allow no penetration of test liquids for at least 1 hour.

7.7.12 _

The glove body composite shall be tested for resistance to cut as specified in Section 8.21 , Cut Resistance Test, and shall have a distance of blade travel of more than 20 mm (0.8 in.).

7.7.13 _

The glove interface component shall be tested for resistance to cut as specified in Section 8.21 , Cut Resistance Test, and shall have a distance of blade travel of more than 20 mm (0.8 in.).

7.7.14 _

The glove body composite shall be tested for resistance to puncture as specified in Section 8.20 , Puncture Resistance Test, and shall not be punctured under an average applied force of 40 N (8.8 lbf).

7.7.15 * _

Gloves shall be tested for hand function as specified in Section 8.37 , Glove Hand Function Test, and shall have an average percent of bare-handed control not exceeding 220 percent.

7.7.16 _

Knit glove wristlet material(s) shall be tested for material strength as specified in Section 8.13 , Burst Strength Test, and shall have a burst strength of not less than 225 N (51 lbf).

7.7.17 _

Glove body to glove interface component major seams shall be tested for seam strength as specified in Section 8.14 , Seam-Breaking Strength Test, and shall have a burst strength of not less than 182 N (41 lbf).

7.7.18 * _

Gloves shall be tested for resistance to leakage as specified in Section 8.32 , Overall Liquid Integrity Test 1, and shall show no leakage.

7.7.19 * _

Gloves shall be tested for ease of donning as specified in Section 8.36 , Glove Donning Test, and shall have the dry hand donning time not exceed 10 seconds, shall have the wet hand donning time not exceed 30 seconds, shall have no detachment of the inner liner, shall have no detachment of the moisture barrier, and shall allow full insertion of all digits.

7.7.20 _

Gloves shall be tested for retention of the glove liner as specified in Section 8.63 , Liner Retention Test, and shall have no detachment of the inner liner or moisture barrier.

7.7.21 _

Labels shall be tested for durability and legibility as specified in Section 8.41 , Label Durability and Legibility Test 1, shall remain in place, and shall be legible.

7.7.22 _

Gloves shall be tested for grip as specified in Section 8.38 , Grip Test, and shall not have a drop of force of more than 30 percent in any 0.2-second interval.

7.7.23 _

Gloves shall be tested using the torque test as specified in Section 8.68 , Torque Test, and shall have an average percent of bare-handed control not less than 80 percent.

7.7.24 _

Gloves shall be tested for hand function as specified in Section 8.70 , Glove Tool Test, and shall have an average percent of bare-handed control not exceeding 175 percent.

7.7.25 _

The glove body composite at the back of the glove shall be tested for radiant heat resistance as specified in Section 8.67 , Transmitted and Stored Thermal Energy Test, and shall have a second-degree burn time of not less than 130 seconds.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1970_7.7.6_-_7.7.8_J.Stull.docx		

Statement of Problem and Substantiation for Public Input

A more effective method for evaluating gloves would be to adapt the test method currently used for testing full footwear as specified in Section 8.5 to allow for suspending gloves. This would provide for more efficient and relevant testing of single gloves rather than each individual material. The utility of the testing has been initially demonstrated.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protec
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 11 18:39:59 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-89-NFPA 1970-2022

Statement: Two additional tests have been proposed to evaluate full gloves for flame resistance as an alternative to the current composite test based on procedures in Section 8.4. The first additional procedure in 7.7.6.1 uses the flame engulfment test procedures currently in Section 8.5, that have been adapted for evaluating gloves. The second additional procedure uses a new test method that created a 12 second simulated flash fire exposure for whole gloves mount on a handform between multiple burners. Both alternate tests permit the evaluation of full gloves as opposed to requiring the evaluation of each unique composite used in the construction of gloves. The ability of both tests to evaluate full gloves has been demonstration but further refinements in the respective tests may be needed. The committee is further investigating the utility of the two alternative test methods and will determine which tests to proceed with for second revision. If a whole glove test is implemented, it may not be necessary to retain the performance requirement in 7.7.6 and 7.7.7.

For the first draft, the current glove flame resistance test method in Section 8.4 has been retained and proposed changes have been incorporated to clarify the instructions for determining char length.

Also, many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.



Public Input No. 279-NFPA 1970-2021 [New Section after 7.7.1]

7.7.X The glove body composite shall be tested for thermal insulation while allowing for shrinkage as specified in Section 8.X, Cylinder Thermal Protective Performance (CTPP) Test, and shall have an average CTPP of not less than 30 .

Statement of Problem and Substantiation for Public Input

The current TPP testing method cannot account for the protection reduction caused by shrinkage. In fact, materials that shrink yield a higher TPP value because they get thicker as they shrink and thicker fabrics provide more insulation. In reality, shrinkage does make fabrics thicker but it also moves the fabric closer to the skin. This removes the air layers between the fabric and skin and allows for a higher heat transfer rate. This of course would result in burns occurring quicker.

This test method provides a new TPP sample holder and sensor that allows shrinkage of materials to occur as it would in the field. If a material has a tendency to contract with a flame exposure (TPP level) then the material would shirk up against the sensor yielding higher heat transfer that would produce lower second degree burn times using the stull curve. This method is under development within ASTM (WK75944) and should be approved early next year.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 278-NFPA 1970-2021 [New Section after 7.1.1]	Cylinder TPP
Public Input No. 281-NFPA 1970-2021 [New Section after 8.10]	

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
Organization: NC State University
Street Address:
City:
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Submittal Date: Tue Nov 09 20:56:21 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-91-NFPA 1970-2022](#)

Statement: Two additional tests are under consideration for the measurement of glove insulation to account for the reduction in thermal protection caused by shrinkage, which is not measured in TPP testing. It is known that many glove materials composites shrink and yield a higher TPP value because they get thick and create air gaps as they shrink and thicker fabrics with air gaps provide more insulation. In reality, shrinkage does make fabrics thicker but it also moves the fabric closer to the skin. This removes the air layers between the fabric and skin and allows for a higher heat transfer rate. This phenomenon would result in burns occurring quicker.

The first test uses a new TPP sample holder and sensor that allows shrinkage of materials to occur as it would in the field. If a material has a tendency to contract with a flame exposure (TPP level) then the material would shirk up against the sensor yielding higher heat transfer that would produce lower second degree burn times using the Stoll curve.

The second test uses a vertically-mounted hand form for positioning the glove between multiple burners that create a 12-second flame and radiant heat exposure representative of fireground emergency conditions at the same energy level as the TPP tests with the measurement of heat transfer that is reported for as the energy ratio value (ERV) of the transferred heat through the glove to the heat energy incident to the handform without the glove sample.

Both methods are under development within ASTM and are expected to be approved during 2022. The committee intended to investigate both methods further prior to the second draft decision and decide which tests to retain, including the current TPP test as applied to gloves in Section 8.10 and specified as a requirement in 7.7.1. The Committee intends to add supplemental annex language explaining the application

and results from each test method if adopted as part of the second draft.



Public Input No. 331-NFPA 1970-2021 [Section No. 7.7.6]

7.7.6

~~The glove body composite, including, but not limited to, trim, external labels, and external tags, but excluding hardware, and excluding hook and pile fasteners that do not directly contact the wearer's body. Gloves shall be tested for resistance to flame as specified in Section according to 8.4, Flame Resistance Test 3 73, Small Scale Flash Fire Exposure Test 2, and shall not have an average char length of more than 100 mm (4 in.), shall not have an average afterflame afterflame time of more than 2.0 seconds, shall not melt or drip, and shall not have the amount of consumed materials exceed 5 percent.~~

Statement of Problem and Substantiation for Public Input

The proposed Small Scale Flash Fire Exposure Test 2 (whole glove flash fire exposure) provides an opportunity to make more realistic observations of afterflame time and melting/dripping compared to that of the existing glove flammability test. Such observations can be made during the ERV determination test, making testing more streamlined and efficient.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 260-NFPA 1970-2021 [New Section after 8.7.1.7]	proposed test method

Submitter Information Verification

Submitter Full Name: Brian Shiels
Organization: ArcWear
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 10 16:42:44 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-89-NFPA 1970-2022

Statement: Two additional tests have been proposed to evaluate full gloves for flame resistance as an alternative to the current composite test based on procedures in Section 8.4. The first additional procedure in 7.7.6.1 uses the flame engulfment test procedures currently in Section 8.5, that have been adapted for evaluating gloves. The second additional procedure uses a new test method that created a 12 second simulated flash fire exposure for whole gloves mount on a handform between multiple burners. Both alternate tests permit the evaluation of full gloves as opposed to requiring the evaluation of each unique composite used in the construction of gloves. The ability of both tests to evaluate full gloves has been demonstration but further refinements in the respective tests may be needed. The committee is further investigating the utility of the two alternative test methods and will determine which tests to proceed with for second revision. If a whole glove test is implemented, it may not be necessary to retain the performance requirement in 7.7.6 and 7.7.7.

For the first draft, the current glove flame resistance test method in Section 8.4 has been retained and proposed changes have been incorporated to clarify the instructions for determining char length.

Also, many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.



Public Input No. 192-NFPA 1970-2021 [Sections 7.7.6, 7.7.7, 7.7.8]

Sections 7.7.6, 7.7.7, 7.7.8

7.7.6

The glove body composite, including, but not limited to, trim, external labels, external non-visual/machine readable tags, and external tags, but excluding hardware, and excluding hook and pile fasteners that do not directly contact the wearer's body, shall be tested for resistance to flame as specified in Section 8.4, Flame Resistance Test 3, and shall not have an average char length of more than 100 mm (4 in.), shall not have an average afterflame of more than 2.0 seconds, shall not melt or drip, and shall not have the amount of consumed materials exceed 5 percent.

7.7.7

The glove interface component composite, including but not limited to trim, external labels, external non-visual/machine readable tags, and external tags, but excluding hardware and hook and pile fasteners that do not directly contact the wearer's body, shall be tested for resistance to flame as specified in Section 8.4, Flame Resistance Test 3, and shall not have an average char length of more than 100 mm (4 in.), shall not have an average afterflame of more than 2.0 seconds, shall not melt or drip, and shall not have the amount of consumed materials exceed 5 percent.

7.7.8

The glove extension composite, including but not limited to trim, external labels, external non-visual/machine readable tags, and external tags, but excluding hardware and hook and pile fasteners that do not directly contact the wearer's body, shall be tested for resistance to flame as specified in Section 8.4, Flame Resistance Test 3, and shall not have an average char length of more than 100 mm (4 in.), shall not have an average afterflame of more than 2.0 seconds, shall not melt or drip, and shall not have the amount of consumed materials exceed 5 percent.

Statement of Problem and Substantiation for Public Input

Many fire departments are now using RFID or other machine readable devices to track their PPE. Currently these devices are not specifically covered in the standard. This proposal offers a suggestion for how new requirements would be structured.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 188-NFPA 1970-2021 [New Section after 5.1.7.5]	

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 04 14:22:13 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-145-NFPA 1970-2022

Statement: Many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.



Public Input No. 73-NFPA 1970-2021 [Section No. 7.7.10]

7.7.10

The glove body straight seams shall be tested for resistance to liquid-borne or blood-borne pathogens as specified in Section 8.28, Viral Penetration Resistance Test, and shall allow no penetration of the Phi-X-174 bacteriophage above the test interpretation threshold for at least 1 hour.

Statement of Problem and Substantiation for Public Input

Studies and technical review by other committees within the project demonstrated a need to modify the performance requirements to eliminate false positive test results inherent with this test, that necessitate issuance of nonconformances and the unnecessary quarantining of certified products.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 71-NFPA 1970-2021 [Section No. 7.1.16]</u>	Same performance requirement.

Submitter Information Verification

Submitter Full Name: William Fithian
Organization: ASTM/Safety Equipment Institute
Street Address:
City:
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Zip:
Submittal Date: Thu Sep 23 10:54:18 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-155-NFPA 1970-2022

Statement: The threshold revision is intended to aid in more reliable and reproducible test results. Studies and technical review by other committees within the project demonstrated a need to modify the performance requirements to eliminate false positive test results inherent with this test, that necessitate issuance of non-conformances and the unnecessary quarantining of certified products. The reference to straight seams was moved to the test method in Chapter 8 where it is more applicable.

**Public Input No. 74-NFPA 1970-2021 [Section No. 7.7.11]****7.7.11***

Glove body straight seams shall be tested for resistance to liquid penetration as specified in Section 8.27, Liquid Penetration Resistance Test, and shall allow no penetration of test liquids for at least 1 hour.

Statement of Problem and Substantiation for Public Input

Clarification to be consistent with other standards within the project.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 72-NFPA 1970-2021 [Section No. 7.1.15]</u>	Similar performance requirement

Submitter Information Verification

Submitter Full Name: William Fithian
Organization: ASTM/Safety Equipment Institute
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 23 10:56:51 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The reference to straight seams was moved to the test method in Chapter 8 where it is more applicable.



Public Input No. 329-NFPA 1970-2021 [New Section after 7.7.25]

7.7.26

Whole protective gloves shall be tested for thermal insulation as specified in Section 8.73, Small Scale Flash Fire Exposure Test 3, and shall have an average ERV of not more than 0.300 (30.0%).

Statement of Problem and Substantiation for Public Input

Because existing thermal insulation requirements of glove body composites are matched to those of protective garment composites, the proposal here is to match the proposed ERV requirements in PI-256.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 260-NFPA 1970-2021 [New Section after 8.71.7]	Proposed test method

Submitter Information Verification

Submitter Full Name: Brian Shiels
Organization: ArcWear
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 10 16:32:26 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-91-NFPA 1970-2022

Statement: Two additional tests are under consideration for the measurement of glove insulation to account for the reduction in thermal protection caused by shrinkage, which is not measured in TPP testing. It is known that many glove materials composites shrink and yield a higher TPP value because they get thick and create air gaps as they shrink and thinner fabrics with air gaps provide more insulation. In reality, shrinkage does make fabrics thicker but it also moves the fabric closer to the skin. This removes the air layers between the fabric and skin and allows for a higher heat transfer rate. This phenomenon would result in burns occurring quicker.

The first test uses a new TPP sample holder and sensor that allows shrinkage of materials to occur as it would in the field. If a material has a tendency to contract with a flame exposure (TPP level) then the material would shrink up against the sensor yielding higher heat transfer that would produce lower second degree burn times using the Stoll curve.

The second test uses a vertically-mounted hand form for positioning the glove between multiple burners that create a 12-second flame and radiant heat exposure representative of fireground emergency conditions at the same energy level as the TPP tests with the measurement of heat transfer that is reported for as the energy ratio value (ERV) of the transferred heat through the glove to the heat energy incident to the handform without the glove sample.

Both methods are under development within ASTM and are expected to be approved during 2022. The committee intended to investigate both methods further prior to the second draft decision and decide which tests to retain, including the current TPP test as applied to gloves in Section 8.10 and specified as a requirement in 7.7.1. The Committee intends to add supplemental annex language explaining the application and results from each test method if adopted as part of the second draft.



Public Input No. 283-NFPA 1970-2021 [New Section after 7.8.2]

7.8.X Gloves shall be tested for evaporative resistance for whole gloves as specified in X.xx, Evaporative resistance for gloves test, and shall have an evaporative resistance value no higher than 60 Pa·m² /W

Statement of Problem and Substantiation for Public Input

The hands are considered the radiator of the human body. It has a large amount of blood flow and a large surface area for heat to be lost in a small space. They (along with the foot) contain more sweat glands than any other body part. With that I think that it is import to make sure that gloves worn by firefighters are breathable to help with heat stress. To understand if changing the breathability of a glove would change the physiological performance of firefighter we ran a few virtual physiological models. In this model we ran a work/rest cycle for ~2 hours. We also used data from a common fire suit wearing a pair of breathable gloves. Then we simply increased the evaporative resistance of the glove to simulate an impermeable glove to see if it would change the core temperature or the skin temperature. When looking at results in a mild condition (25C, 65%RH) not much difference was seen between a breathable glove and one that was impermeable when looking at whole body outputs such as the core or the mean skin temperature. However, the skin temperature of the hand was about 3oC difference between the breathable glove and the impermeable glove at the end of the simulation. When looking a results in a hotter conditions (35C, 40%RH) we observed a 0.1 oC difference in core temperature and saw a 1.4oC difference in the hand temperature.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 284-NFPA 1970-2021 [New Section after 8.71]</u>	

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
Organization: NC State University
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 21:11:26 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-92-NFPA 1970-2022

Statement: The hands are considered the radiator of the human body. It has a large amount of blood flow and a large surface area for heat to be lost in a small space. They (along with the foot) contain more sweat glands than any other body part. With that I think that it is import to make sure that gloves worn by firefighters are breathable to help with heat stress. To understand if changing the breathability of a glove would change the physiological performance of firefighter we ran a few virtual physiological models. In this model we ran a work/rest cycle for ~2 hours. We also used data from a common fire suit wearing a pair of breathable gloves. Then we simply increased the evaporative resistance of the glove to simulate an impermeable glove to see if it would change the core temperature or the skin temperature. When looking at results in a mild condition (25oC, 65%RH) not much difference was seen between a breathable glove and one that was impermeable when looking at whole body outputs such as the core or the mean skin temperature. However, the skin temperature of the hand was about 3oC difference between the breathable glove and the impermeable glove at the end of the simulation. When looking at results in hotter conditions (35oC, 40%RH), we observed a 0.1oC difference in core temperature and saw a 1.4oC difference in the hand temperature.

**Public Input No. 219-NFPA 1970-2021 [Section No. 7.10.2]****7.10.2**

Footwear, with components in place, shall be tested for resistance to flame as specified in Section 8.5, Flame Resistance Test 4, shall not have an afterflame of more than 5.0 seconds, shall not melt or drip, and shall not exhibit any burn-through.

7.10.2

Footwear components that do not affect the required thermal, physical, or moisture barrier protection of the footwear, do not exceed more than 25% of the exterior surface area of the footwear, and do not touch the wearer's skin shall not have an afterflame of more than 5.0 seconds. Melt, drip, and burn-through shall not be evaluated.

Statement of Problem and Substantiation for Public Input

Adding allowance for small footwear items to melt, drip, and burn-through where they do not pose a risk to the end user by impacting the required level of protection or touch the wearer's skin.

Submitter Information Verification

Submitter Full Name: Amanda Newsom

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Mon Nov 08 09:27:44 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-94-NFPA 1970-2022](#)

Statement: An allowance is added for small footwear items to melt, drip, and burn-through where they do not pose a risk to the end user by impacting the required level of protection or touch the wearer's skin.

**Public Input No. 76-NFPA 1970-2021 [Section No. 7.10.4]****7.10.4**

The footwear upper material composite and footwear straight seams shall be tested for resistance to liquid penetration as specified in Section 8.27, Liquid Penetration Resistance Test, and shall allow no penetration of the test liquids for at least 1 hour.

Statement of Problem and Substantiation for Public Input

Clarification to be consistent with other standards within the project.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 72-NFPA 1970-2021 [Section No. 7.1.15]</u>	Similar performance requirement

Submitter Information Verification

Submitter Full Name: William Fithian
Organization: ASTM/Safety Equipment Institute
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 23 11:01:49 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The reference to straight seams was moved to the test method in Chapter 8 where it is more applicable.



Public Input No. 75-NFPA 1970-2021 [Section No. 7.10.5]

7.10.5

The footwear upper material composite and footwear straight seams shall be tested for resistance to liquid- or blood-borne pathogens as specified in Section 8.28, Viral Penetration Resistance Test, and shall allow no penetration of the Phi-X-174 bacteriophage above the test interpretation threshold for at least 1 hour.

Statement of Problem and Substantiation for Public Input

Studies and technical review by other committees within the project demonstrated a need to modify the performance requirements to eliminate false positive test results inherent with this test, that necessitate issuance of nonconformances and the unnecessary quarantining of certified products.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 71-NFPA 1970-2021 [Section No. 7.1.16]	Similar performance requirement

Submitter Information Verification

Submitter Full Name: William Fithian
Organization: ASTM/Safety Equipment Institute
Street Address:
City:
State:
Zip:
Submittal Date: Thu Sep 23 10:59:32 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-156-NFPA 1970-2022](#)

Statement: The threshold revision is intended to aid in more reliable and reproducible test results. Studies and technical review by other committees within the project demonstrated a need to modify the performance requirements to eliminate false positive test results inherent with this test, that necessitate issuance of non-conformances and the unnecessary quarantining of certified products. The reference to straight seams was moved to the test method in Chapter 8 where it is more applicable.

**Public Input No. 199-NFPA 1970-2021 [Section No. 7.13.3]****7.13.3**

Hood material(s), ~~including labels but~~ excluding hook and pile fasteners and elastic when not placed in direct contact with the body, shall be individually tested for resistance to flame as specified in Section 8.2, Flame Resistance Test 1, and shall not have a char length of more than 100 mm (4 in.) average, shall not have an afterflame of more than 2.0 seconds average, and shall not melt ~~or drip~~ and drip.

7.13.3.1

Hood labels, lettering, and emblems shall be individually tested for resistance to flame as specified in Section 8.2, Flame Resistance Test 1, and shall not have an afterflame of more than 2.0 seconds average, shall not melt and drip, and shall not be totally consumed.

Statement of Problem and Substantiation for Public Input

The observation for melting and dripping is being revised to say "and" instead of "or". This is being revised throughout all the standards in the project as the observation of melting and dripping is less subjective than the observations individually. Also labels, lettering and emblems are being moved to their own paragraph as the char length measurement should not be required on these small specimens.

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Fri Nov 05 14:59:58 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-52-NFPA 1970-2022

Statement: The observation for melting and dripping is being revised to say "and" instead of "or". This is being revised throughout all the standards in the project as the observation of melting and dripping is less subjective than the observations individually. Also labels, lettering and emblems are being moved to their own paragraph as the char length measurement should not be required on these small specimens.

Also, many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.



Public Input No. 193-NFPA 1970-2021 [Sections 7.13.3, 7.13.4, 7.13.5]

Sections 7.13.3, 7.13.4, 7.13.5

7.13.3

Hood material(s), including labels but excluding hook and pile fasteners, non-visual/machine readable tags, and elastic when not placed in direct contact with the body, shall be individually tested for resistance to flame as specified in Section 8.2, Flame Resistance Test 1, and shall not have a char length of more than 100 mm (4 in.) average, shall not have an afterflame of more than 2.0 seconds average, and shall not melt or drip.

7.13.4

Hoods, excluding labels, hook and pile fasteners, non-visual/machine readable tags and elastic, shall be individually tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test, and shall slide freely over the top half of the hood measuring device while in the relaxed state, shall not show any gaps when placed on the lower half of the hood measuring device, and shall not shrink more than 10 percent.

7.13.5

Hoods, including labels but excluding hook and pile fasteners, non-visual/machine readable tags, and elastic when these items are placed where they will not directly contact the wearer's body, shall be individually tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test, and shall not melt, separate, or ignite.

Statement of Problem and Substantiation for Public Input

Many fire departments are now using RFID or other machine readable devices to track their PPE. Currently these devices are not specifically covered in the standard. This proposal offers a suggestion for how new requirements would be structured.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 188-NFPA 1970-2021 [New Section after 5.1.7.5]	

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 04 14:24:12 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-52-NFPA 1970-2022](#)

Statement: The observation for melting and dripping is being revised to say "and" instead of "or". This is being revised throughout all the standards in the project as the observation of melting and dripping is less subjective than the observations individually. Also labels, lettering and emblems are being moved to their own paragraph as the char length measurement should not be required on these small specimens.

Also, many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.

**Public Input No. 200-NFPA 1970-2021 [Section No. 7.13.5]****7.13.5**

~~Hoods, including labels~~ Hoods shall be individually tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test, and shall not melt, separate, or ignite.

7.13.5.1

Components attached to hoods, including labels, lettering, and emblems, but excluding hook and pile fasteners and elastic when these items are placed where they will not directly contact the wearer's body, shall be individually tested for resistance to heat as specified in Section 8.6, Heat and Thermal Shrinkage Resistance Test, and shall not melt, separate, or ignite.

Statement of Problem and Substantiation for Public Input

Adding clarification that the items on the hood such as lettering and emblems shall also meet the heat resistance requirements.

Submitter Information Verification

Submitter Full Name: Amanda Newsom

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Fri Nov 05 15:09:29 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-53-NFPA 1970-2022

Statement: Adding clarification that the items on the hood such as lettering and emblems shall also meet the heat resistance requirements.

Also, many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.



Public Input No. 24-NFPA 1970-2021 [New Section after 7.13.10]

7.13.10

Except where hoods are also certified to the requirements of Section 7.14, knit hood materials shall be tested for air permeability as specified in Section 8.73, Air Permeability Test, and shall have an air permeation of 8.5 m³ /min/m² (50 ft³ /min/ft²).

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_14_Held.pdf	1971_PI14	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. ___ of the (cycle) Second Draft Report for NFPA ___ and per the Regs. at 4.4.8.3.1. The proposed requirements is intended that where manufacturer intend to incorporate a barrier material for purposes of blocking particulate that the optional requirements are applied.

Submitter Information Verification

Submitter Full Name: Tc On Fae-Spf
Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 12:20:27 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: Based on first revisions to make particulate blocking hoods mandatory, this is no longer needed.



Public Input No. 258-NFPA 1970-2021 [New Section after 7.13.10]

7.13.11

Hood composites shall be tested for thermal insulation as specified in Section 8.72, Small Scale Flash Fire Exposure Test 1, and shall have an average ERV of not more than 0.450 (45.0%).

Statement of Problem and Substantiation for Public Input

The ERV proposed for garment composites in PI 256 has been adjusted proportionally for hood composites in a manner similar to the comparative TPP value relative to garment composites and hood composites.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]</u>	
<u>Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]</u>	

Submitter Information Verification

Submitter Full Name: Brian Shiels
Organization: ArcWear
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 13:01:03 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-171-NFPA 1970-2022

Statement: The ERV proposed for garment composites has been adjusted proportionally for hood composites in a manner similar to the comparative TPP value relative to garment composites and hood composites.



Public Input No. 23-NFPA 1970-2021 [New Section after 7.14]

7.14.X Hood composite materials that incorporate a particulate blocking layer shall be tested for transmitted and stored thermal energy as specified in Section 8.71, Transmitted and Stored Thermal Energy, and shall have a predicted time to second degree burn greater than or equal to 100 seconds.

8.71 Transmitted and Stored Thermal Energy Test

8.71.1 Application

8.71.1.1 This test method shall apply to garment sleeve composites containing enhancements as defined in 7.2.4 exterior to the outer shell and particulate blocking hoods.

8.71.1.3 Modifications to this test method for testing particulate blocking hoods shall be specified in

8.71.X

8.71.X Specific requirements for testing particulate blocking hoods

8.71.X.1 Samples.

8.71.X.1.1 Specimens for conditioning shall measure 150 mm x 150 mm +/- 6 mm (6 in. x 6 in. +/- 1/4in.).

8.71.X.1.2 Specimens shall consist of a composite constructed of the layers utilized in the particulate blocking hoods, oriented in the order as worn.

8.71.X.2 Specimens.

8.71.X.2.1 A total of 5 specimens shall be tested.

8.71.X.2.2 The specimens shall be preconditioned by uniformly applying 3.4 grams +/- 0.2 grams of water to the innermost layer of the composite and shall be tested within 2 minutes after preconditioning.

8.71.X.3 Procedure

8.71.X.3.1 Transmitted and stored thermal energy testing shall be conducted in accordance with ASTM F2731, Standard Test Method for Measuring the Transmitted and Stored Thermal Energy in Fire Fighter Protective Clothing Systems, Procedure B, with the following modifications:

_____ (1) Compression of the specimen shall not be required.

_____ (2) The exposure time shall be for a period of 120 seconds, 1/ – 0 seconds or until a time to predicted second degree burn is achieved.

8.71.X.4 Report

8.71.X.4.1 The average time to second degree burn shall be calculated, recorded, and reported. If no burn injury occurs, the time to second degree burn shall be reported as “no burn”.

8.71.X.5 Interpretation

8.71.X.5.1 Pass/fail determination shall be based on the average reported time to second degree burn of all specimens tested.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_13_Held.pdf	1971_PI13	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. 148 of the (A2017) Second Draft Report for NFPA 1971 and per the Regs. at 4.4.8.3.1. If the Total Heat Loss requirement in hoods (7.14.4) is set too high, it could result in the manufacture of lighter and/or thinner hoods which could lead to a drop in thermal insulation, even though it meets the minimum TPP requirement of 20 (7.13.2). The TPP is a flashover exposure and does not represent protection in a sub flash scenario. In some of the work I have been doing with barrier inclusion in hoods with moisture present, I have observed a significant reduction in sub flashover thermal protection when the composite is wet. It is unknown if the drop is meaningful in the field. However, a drop in protection from where current products are performing today is not likely desired. Preventing this could be accomplished by setting a minimum thermal resistance for hoods when dry, and then ensuring that in the wet condition the protection does not drop too significantly from this minimum level. A means for this is provided. Additionally, some firefighters have expressed a concern that too much thermal resistance can reduce situational awareness, so a maximum thermal resistance could be considered as well.

Submitter Information Verification

Submitter Full Name: Tc On Fae-Spf
Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment
Street Address:
City:
State:
Zip:
Submittal Date: Mon Aug 16 12:16:48 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-67-NFPA 1970-2022](#)

Statement: If the Total Heat Loss requirement in hoods (7.14.4) is set too high, it could result in the manufacture of lighter and/or thinner hoods which could lead to a drop in thermal insulation, even though it meets the minimum TPP requirement of 20 (7.13.2). The TPP is a flashover exposure and does not represent protection in a sub flash scenario. In some of the work I have been doing with barrier inclusion in hoods with moisture present, I have observed a significant reduction in sub flashover thermal protection when the composite is wet. It is unknown if the drop is meaningful in the field. However, a drop in protection from where current products are performing today is not likely desired. Preventing this could be accomplished by setting a minimum thermal resistance for hoods when dry, and then ensuring that in the wet condition the protection does not drop too significantly from this minimum level. The proposed test and requirement address a minimum requirement in both dry and wet testing. Future consideration of this requirement could entail reporting the difference in the average test results for both dry and wet conditions and used this difference as part of the interpretation of acceptable performance.

Also, specific changes have been made to certain test methods to provide additional information, which aids in discerning the variability of test results. These changes include the measurement and reporting of specimen thickness and weight as well as the provision of photographs and other information to help document how samples were positioned or specified for testing.



Public Input No. 123-NFPA 1970-2021 [Section No. 7.14]

7.14* Additional Performance Requirements for ~~Optional Structural~~ for Structural Firefighting Protective Hood Interface Components Providing Particulate Protection.

7.14.1

Hood composite materials shall meet all performance criteria specified in Section 7.13, Protective Hood Interface Component Performance Requirements for Both Ensembles.

7.14.2

Hood composite materials that incorporate a particulate blocking layer shall be tested for particulate blocking as specified in Section 8.71, Particulate Blocking Test, and shall have a particulate filtration efficiency of 90 percent or greater for each particle size from 0.1 μm to 1.0 μm .

7.14.3*

Hood composites including a particulate blocking layer shall be tested for evaporative heat transfer as specified in Section 8.33, Total Heat Loss (THL) Test, and shall have a THL of not less than 325 W/m^2 .

Statement of Problem and Substantiation for Public Input

Particulate blocking hoods should be the only acceptable protection for structural hoods. Particulate protection in hoods should be total coverage and should not allow any other hood that does not contain particulate blocking material.

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 02 12:14:26 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-66-NFPA 1970-2022](#)

Statement: Deleting section. See FR 305 for new 7.13.11 and 7.13.12.

The proposed changes make the optional particulate blocking requirements mandatory for all hoods and affects the scope, labeling, design, and performance requirements in NFPA 1971.

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods are being made mandatory.

Further with the increased availability of particulate blocking materials and end products, the fire service should not continue to allow inferior protection from the particulate contaminants on the fire ground: this exposure to fireground soot can be more significantly minimized with the mandated use of particulate blocking hoods. There is sufficient evidence to show that the technology is proven and works with a variety of vendors being able to produce the particulate blocking products and their effectiveness in limiting exposure to particulate as addressed in the following reference:

Richard M. Kesler , Alex Mayer , Kenneth W. Fent , I-Chen Chen , A. Shawn

Deaton , R. Bryan Ormond , Denise L. Smith , Andrea Wilkinson , Steve Kerber & Gavin P. Horn

(2021): Effects of firefighting hood design, laundering and doffing on smoke protection, heat stress

and wearability, Ergonomics, DOI: 10.1080/00140139.2020.1867241

PI numbers 122, 123, 144, 145 all concern the mandatory requirement for particulate hoods.

PI 143 was incorporated into this document as it was decided by the hoods task group that particulate blocking hoods would become mandatory. Eliminating the standard non-particulate hood will provide a higher level of protection from contaminants with the mandatory implementation of particulate protective hoods.

Research has shown that smoke particulates reach the top of the head in fireground exposures for particulate-blocking hoods and beyond the areas of the currently specified areas of the particulate blocking material. It is noted that a significant amount of particulate penetration can occur around the face opening that can compromise protection. Further it is possible that the hood bib can become pulled out from underneath the coat collar and particulate blocking material should be in place for this circumstance. The proposed changes in coverage of the particulate-blocking layer are intended to provide more comprehensive protection to the end user.



Public Input No. 146-NFPA 1970-2021 [Section No. 7.14]

7.

~~7.14 * – Additional Performance Requirements for Optional Structural Firefighting Protective Hood Interface Components Providing Particulate Protection.~~

~~7.14.1 –~~

~~Hood composite materials shall meet all performance criteria specified in Section~~

~~13~~

~~, Protective Hood Interface Component Performance Requirements for Both Ensembles.~~

~~7.14.2.11~~

Hood composite materials that incorporate a particulate blocking layer shall be tested for particulate blocking as specified in Section 8.71, Particulate Blocking Test, and shall have a particulate filtration efficiency of 90 percent or greater for each particle size from 0.1 µm to 1.0 µm.

~~7.14.13.3.12 *~~

Hood composites including a particulate blocking layer shall be tested for evaporative heat transfer as specified in Section 8.33, Total Heat Loss (THL) Test, and shall have a THL of not less than 325 W/m².

Statement of Problem and Substantiation for Public Input

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods should become mandatory. See Public Input 143.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 143-NFPA 1970-2021 [Section No. 4.1.1.2.1]	

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 03:54:31 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-66-NFPA 1970-2022

Statement: Deleting section. See FR 305 for new 7.13.11 and 7.13.12.

The proposed changes make the optional particulate blocking requirements mandatory for all hoods and affects the scope, labeling, design, and performance requirements in NFPA 1971.

Given that hoods are the only item for which there is no mandatory barrier between the firefighter and the outside environment and the fact that both fire gases and smoke particulate readily penetrate the materials used in the construction of regular hoods, the requirements for particulate-blocking hoods are being made mandatory.

Further with the increased availability of particulate blocking materials and end products, the fire service should not continue to allow inferior protection from the particulate contaminants on the fire ground: this exposure to fireground soot can be more significantly minimized with the mandated use of particulate

blocking hoods. There is sufficient evidence to show that the technology is proven and works with a variety of vendors being able to produce the particulate blocking products and their effectiveness in limiting exposure to particulate as addressed in the following reference:

Richard M. Kesler , Alex Mayer , Kenneth W. Fent , I-Chen Chen , A. Shawn

Deaton , R. Bryan Ormond , Denise L. Smith , Andrea Wilkinson , Steve Kerber & Gavin P. Horn

(2021): Effects of firefighting hood design, laundering and doffing on smoke protection, heat stress

and wearability, Ergonomics, DOI: 10.1080/00140139.2020.1867241

PI numbers 122, 123, 144, 145 all concern the mandatory requirement for particulate hoods.

PI 143 was incorporated into this document as it was decided by the hoods task group that particulate blocking hoods would become mandatory. Eliminating the standard non-particulate hood will provide a higher level of protection from contaminants with the mandatory implementation of particulate protective hoods.

Research has shown that smoke particulates reach the top of the head in fireground exposures for particulate-blocking hoods and beyond the areas of the currently specified areas of the particulate blocking material. It is noted that a significant amount of particulate penetration can occur around the face opening that can compromise protection. Further it is possible that the hood bib can become pulled out from underneath the coat collar and particulate blocking material should be in place for this circumstance. The proposed changes in coverage of the particulate-blocking layer are intended to provide more comprehensive protection to the end user.



Public Input No. 259-NFPA 1970-2021 [New Section after 7.16.9]

7.16.10

Protective wristlet interface components shall be tested for thermal insulation as specified in Section 8.72, Small Scale Flash Fire Exposure Test 1, and shall have an average ERV of not more than 0.450 (45.0%).

Statement of Problem and Substantiation for Public Input

The ERV proposed for garment composites in PI 256 has been adjusted proportionally for wristlets in a manner similar to the comparative TPP value relative to garment composites and wristlets.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]</u>	
<u>Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]</u>	

Submitter Information Verification

Submitter Full Name: Brian Shiels
Organization: ArcWear
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 13:09:13 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: The Small Scale Flash Fire Test 1 was proposed with the benefit of showing impact of shrinkage of garments when exposed to heat and flame. The impact of this shrinkage is the loss of insulation air gaps under garment layers. However, wristlet materials are designed to fit tightly against the body. As such, shrinkage would not compromise an insulator air gap since one does not exist by design. Therefore, this test method should not be applicable to wristlet materials.



Public Input No. 235-NFPA 1970-2021 [New Section after 7.20]

7.x Optional Performance Requirements for Vapor Resistant Ensembles

7.x.x Ensemble Integrity Performance Requirements

7.x.x.x Ensembles providing resistance to the ingress of gases or vapors shall be tested for inward vapor leakage in accordance with x.x.x and shall have both a geometric mean local physiological protective dosage factor (*PPDF_l*) value at each passive adsorbent dosimeter (PAD) location for the four ensembles tested of no less than 80 and a geometric mean systemic physiological protective dosage factor (*PPDF_{sys}*) value of no less than 35.

Statement of Problem and Substantiation for Public Input

With cancer now being a major concern for firefighters, attempts to limit exposure to harmful chemicals were added to the NFPA 1971 standard. Most notably particulate blocking hoods and particulate blocking suits are now an option for fire departments to consider when purchasing garments. Study after study has found harmful chemicals within these particles and every attempt should be made to limit and remove them as soon as possible from the skin. However, it is my belief that in a working fire, vapors (not those trapped in a particle) pose more of a risk to firefighters. These free toxic gases are available to transfer through the skin without having to be desorbed, extracted or leached out of a particle. With this thought in mind I have added a optional section that would allow manufactures to produce a vapor resistant (not proof) fire suit to limit the amount of particles and vapor that would come in contact with the skin. At this point there is no solid data to support this concept however, current research being conducted at IFSI will answer this question. Information about the IFSI study can be found below.

Overview

The Illinois Fire Service Institute (IFSI) PPE Interface Project builds off of the UL FSRI-IFSI-NIOSH research conducted during the "Cardiovascular and Chemical Exposure Risks in the Fire Service" project. Through this project led by IFSI, we will study the impact of firefighter personal protective equipment (PPE) interfaces on smoke exposure (gas and particulate) and the generation of heat stress using mannequin and human subject testing. Firefighting PPE is undergoing rapid evolution in an attempt to reduce solid phase smoke exposure. Examples of new approaches include interface control measures on bunker coats and pants and particle blocking hoods. However, studies to determine the effectiveness of these features has largely been limited to laboratory testing and qualitative fluorescent aerosol testing as opposed to full-scale smoke exposure. Furthermore, the ability of these control measures to impact vapor exposure and systemic absorption has not been studied. Simultaneous work to characterize how changes to PPE and increased encapsulation affects heat stress must be conducted to allow firefighters to understand the balance between these risks. The results of this research will be broadly disseminated to the fire service through the development of multiple mechanisms including and online training program.

Goals and Objectives

The goals of this study are to: 1) investigate the gas-phase and solid-phase chemical exposure, with a particular emphasis on known, probable and possible carcinogenic products of combustion and 2) quantify the impacts of various control measures to reduce both the vapor and particulate products of combustion reaching the firefighters' skin and being absorbed into the body while assessing the trade-offs between increased chemical protection and potential impact on heat stress.

To accomplish these goals, the specific aims include:

- 1) Compare protection provided by the different iterations of firefighting PPE –specifically bunker coat, pant and hood - using variations in firefighting PPE that are either currently available or can be rapidly brought to market. For this study, we will initially investigate four PPE conditions that are designed to reduce ensemble element interface vulnerabilities.
- 2) Characterize the additional protection provided by base layers, including long- and short-sleeve and leg base layers.
- 3) Estimate the benefit of rapidly opening up bunker coat during PPE doffing as a simple process to reduce systemic exposure to fireground vapors.
- 4) Quantify the tradeoff between each of the protection measures in aims #1-3 (interface tightening, increased base layer, rapid opening of coats) on firefighter heat strain development.

For now the requirement is set at the NFPA 1990 class three level.

Related Public Inputs for This Document

Related Input

Public Input No. 236-NFPA 1970-2021 [New Section after 8.66]

Relationship

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
Organization: NC State University
Street Address:
City:
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Zip:
Submittal Date: Mon Nov 08 21:23:06 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: The committee agrees that there would be value in having a Man-in-Simulant Test (MIST) evaluation applied to firefighter protective ensembles; however, there are practical difficulties in establishing an optional test for ensembles to be mandatorily applied to ensembles for certification purposes. Moreover, the proposed criteria, even at Class 3 levels as established in NFPA 1990/1994 would require significant encapsulation of the firefighter in order to achieve this proposed performance. Instead, the committee has put the MIST procedures into new Annex H, which prescribes a number of systems level evaluation techniques that can be applied to ensembles on an ad hoc basis by researchers, manufacturers, or end user organizations.



Public Input No. 147-NFPA 1970-2021 [Section No. 7.20.1]

7.20.1 Liquid and Particulate Contaminant Protective Ensemble Performance Requirements for Both Ensembles.

7.20.1.1 –

~~The entire protective ensemble shall be tested for overall particulate inward leakage as specified in Section 8.66 ; Particle Inward Leakage Test, and shall allow no visual particulate inward leakage.~~

7.20.1.2 –

~~The entire CBRN ensemble shall be tested as specified in Section 8.48 , Whole Garment and Ensemble Liquid Penetration Test, and shall show no liquid penetration.~~

(Reserved)

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
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City:
State:
Zip:
Submittal Date: Wed Nov 03 08:06:58 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-239-NFPA 1970-2022

Statement: Moving the optional liquid and particulate protection performance requirements into the garment section instead of the ensemble section.

At the time the current test method was introduced, there was an urgent need to address firefighter exposure to smoke particulate given concerns for increased rates of cancer among firefighters that may be attributed to direct exposure of skin to smoke particulates and gases as shown in:

(1) T. Fabian et al. (2010). "Firefighter Exposure to Smoke Particulates," Final Report DHS AFG Grant #EMW-2007-FP-02093, Project Number: 08CA31673;

(2) P. S. J. Lees (1995). "Combustion Products and Other Firefighter Exposures." Occup Med: State of the Art Reviews 10(4): 691-706;

(3) K. M. Kirk, M. Ridgway, Z. Splawinski and M. B. Logan. QFRS (2011). Fire fighter exposures to airborne contaminants during extinguishment of simulated residential room fires. Queensland, Australia: Queensland Fire and Rescue Service (QFRS) Scientific Branch, Research Report 2011-01.

The test was adapted from a similar application of particulate inward leakage used within NFPA 1994 for hazmat material and CBRN protective ensembles. However, there is a larger diversity of ensemble configurations for structural or proximity firefighting protective clothing and equipment that makes the current requirement completely impractical to apply for providing the intended benefit of improved protection from fireground particulate. In addition, the adopted pass/fail criteria create a much more rigorous requirement for firefighter protection than is warranted by known exposure data indicated from recent research. Changes

have been made in the applicable chapters on administration, definitions, labeling and information, design requirements, performance requirements, and test methods to transition the optional certification from full ensembles to garments. This specific change allows for a practical application of the criteria for both enhanced particulate and liquid protection of garments to address firefighter exposure to smoke and other fireground hazards. The inward particle leakage performance criteria and test methodology have been adjusted to incorporate quantification of any observed particulate found on the black indicator garment for comparison of those findings with a reasonable level of particulate exposure.



Public Input No. 148-NFPA 1970-2021 [Section No. 7.20.4]

7.20.4 Liquid and Particulate Contaminant Protective Garment Element Performance Requirements for Both Ensembles.- (Reserved)

7.20.4.1

Liquid and Particulate Contaminant garments shall meet the performance requirements of this section in addition to meeting the performance requirements as specified in Section 7.1, Protective Garment Elements Performance Requirements for Both Ensembles; and Section 7.2, Additional Requirements for Structural Fire Fighting Protective Garment Elements Only or Section 7.3, Additional Performance Requirements for Proximity Fire Fighting Protective Garment Elements Only.

-

7.20.4.2

The protective garment shall be tested for overall particulate inward leakage with other ensemble elements as specified in Section 8.66, Particle Inward Leakage Test, and shall allow no visual particulate inward leakage on the test subject black indicator garment

7.20.4.3

The protective garments shall be tested as specified in Section 8.48, Whole Garment and Ensemble Liquid Penetration Test, and shall show no liquid penetration

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 08:07:55 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-240-NFPA 1970-2022](#)

Statement: Moving the optional liquid and particulate protection performance requirements into the garment section instead of the ensemble section.

At the time the current test method was introduced, there was an urgent need to address firefighter exposure to smoke particulate given concerns for increased rates of cancer among firefighters that may be attributed to direct exposure of skin to smoke particulates and gases as shown in:

(1) T. Fabian et al. (2010). "Firefighter Exposure to Smoke Particulates," Final Report DHS AFG Grant #EMW-2007-FP-02093, Project Number: 08CA31673;

(2) P. S. J. Lees (1995). "Combustion Products and Other Firefighter Exposures." Occup Med: State of the Art Reviews 10(4): 691-706;

(3) K. M. Kirk, M. Ridgway, Z. Splawinski and M. B. Logan. QFRS (2011). Fire fighter exposures to airborne

contaminants during extinguishment of simulated residential room fires. Queensland, Australia: Queensland Fire and Rescue Service (QFRS) Scientific Branch, Research Report 2011-01.

The test was adapted from a similar application of particulate inward leakage used within NFPA 1994 for hazmat material and CBRN protective ensembles. However, there is a larger diversity of ensemble configurations for structural or proximity firefighting protective clothing and equipment that makes the current requirement completely impractical to apply for providing the intended benefit of improved protection from fireground particulate. In addition, the adopted pass/fail criteria create a much more rigorous requirement for firefighter protection than is warranted by known exposure data indicated from recent research. Changes have been made in the applicable chapters on administration, definitions, labeling and information, design requirements, performance requirements, and test methods to transition the optional certification from full ensembles to garments. This specific change allows for a practical application of the criteria for both enhanced particulate and liquid protection of garments to address firefighter exposure to smoke and other fireground hazards. The inward particle leakage performance criteria and test methodology have been adjusted to incorporate quantification of any observed particulate found on the black indicator garment for comparison of those findings with a reasonable level of particulate exposure.



Public Input No. 37-NFPA 1970-2021 [New Section after 8.1.1.1]

Committee : Correlating Committee directs the Technical Committee on Special Operations Protective

Statement: Clothing and Equipment to consider including systems level testing for the upcoming revision.

As an example, sweating manikin testing could be considered as part of proposed evaluation technique for evaluating the impact of emergency services work clothing elements. The Correlating Committee further directs the Technical Committee on Special Operations Protective Clothing and Equipment to develop criteria for how work clothing elements can be integrated as part of ensemble elements specified in other standards in the project.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1975_PI_1_Held.pdf	1975_PI_1	

Statement of Problem and Substantiation for Public Input

This Public Input appeared as "Reject but Held" in Public Comment No. 5 of the F2018 Second Draft Report for NFPA 1975 and per the Regs. at 4.4.8.3.1. This Public Comment appeared as a Correlating Committee Note in the First Draft Report. NFPA PPE standards are product standards that test the individual PPE product without regard, in many cases, to the respective product compatibility or impact on other complaint products or to the emergency responder. The military has moved towards a process for the "Soldier as a System" to not only address overall design but consider the clothing ensemble with the soldier to be managed as a complete system to make them safer, more effective and efficient. Technology is moving the standards to this capability. Emergency responders must be put at the center of the personal protective equipment process and the standards should be designed for the products emergency responders use, in the as worn condition, where possible. All layers of clothing add and subtract to the performance of the emergency responder and should be accounted for in the standards

Submitter Information Verification

Submitter Full Name: Tc On Fae-Sce
Organization: NFPA 1975 TC on FAE-SCE
Street Address:
City:
State:
Zip:
Submittal Date: Tue Aug 17 08:28:51 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: While the committee finds that there is some merit to the proposal that an NFPA 1975 station/work uniform can, under some circumstances, become part of the overall protection offered by the protective coat and pants, there is a substantial amount of change in the NFPA 1971 requirements that would be necessary to adequately present this option, but more importantly, the proposed changes would offer significant logistical and enforcement problems since firefighters would always be required to wear a particular long-sleeved shirt with full length pants is part of their protective garments. This could be made more difficult by the fact that in warmer climates, many fire departments already permit the use of short sleeved shirts and shorts to be worn underneath protective ensembles. Additionally, approximately 75% of fire departments that rely on the protection provided by NFPA standards are largely or wholly comprised of volunteer firefighters¹. As such, many respond directly from home, primary employment, or other places where their attire would likely not be clothing meeting NFPA 1975. Consideration must be given to ensure garments are constructed to provide the requisite protection to these firefighters. 1 US Fire Department Profile 2018, Evarts and Stein, NFPA 2020. Available at <https://www.nfpa.org/-/media/Files/News-and-Research/Fire-statistics-and-reports/Emergency-responders/osfdprofile.pdf> This approach does warrant further consideration, but the aforementioned challenges, including the logistical arrangements for various types of departments, would need to be carefully addressed before it could be implemented as part of the revised standard.



Public Input No. 155-NFPA 1970-2021 [Section No. 8.1.2]

8.1.2— Top Loading, Washing and Drying Procedure - for Garments, Gloves, Hoods, and Wristlets .

8.1.2.1

Specimens shall be subjected to five cycles of washing and drying in accordance with the procedure specified in Machine Cycle 1, Wash Temperature V, and Drying Procedure Ai of AATCC 135, *Dimensional Changes of Fabrics after Home Laundering*. A 1.82 kg ± 0.1 kg (4.0 lb ± 0.2 lb) load shall be used. A laundry bag shall not be used.

8.1.2.2

Gloves shall be tumble dried for 60 minutes and shall be removed immediately at the end of the drying cycle. At the conclusion of the final drying cycle, the gloves shall be direct dried on a forced-air non-tumble-drying mechanism operated at 10°C ± 5°C (18°F ± 9°F) above current room temperature until dry but for not less than 8 hours.

Statement of Problem and Substantiation for Public Input

There are consistent issues when referencing the products within the title for conditioning procedures. When changes within the testing sections occurs, the product addition or removal is often missed within the conditioning sections. This change intends to remove the need to update the conditioning sections with the product types impacted as the reference is already located within the individual test methods.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 157-NFPA 1970-2021 [Section No. 8.2.3.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 09:55:23 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-119-NFPA 1970-2022

Statement: Laundering conditioning requirements are being updated to reflect several needed changes.

The change to identify top/home laundering machine conditioning versus extractor conditioning.

Removal of the specific elements or items that the procedure covers, this will be reflected in the test methods instead since product addition or removal is often missed in the conditioning sections.

The number of laundering cycles unless otherwise specified by the specific test method is being increased to 30 cycles to reflect the industry trend to launder PPE more frequently.

The top loading method and the extractor method are also changing order in the conditioning section. Extractor will now be 8.1.2 and top loader will now be 8.1.12.



Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]

8.1.12 – Washing and Drying Procedure for Garments, Gloves, and Glove Pouches:

8.1.12.1 –

The complete garment shall be washed with all closures fastened and the garment in its “as-worn” orientation. Garments with separable liners shall not have the liners separated.

8.1.12.2 –

A front-loading washer/extractor shall be used. The capacity shall be between 16 kg (35 lb) and 24.9 kg (55 lb).

8.1.12.3 –

The wash load shall be two-thirds the rated capacity of the washer. If ballast is needed to reach two-thirds capacity, similar material or outer shell material shall be used for garment samples, and 212.6 g/m^2 (7.5 oz/yd^2) woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber ballast shall be used for glove or glove pouch samples.

See attached word document for complete replacement of section 8.1.12.4–

The wash cycle procedure and water levels specified in Table 8.1.12.4(a) and Table 8.1.12.4(b) shall be followed. In addition, the g force shall not exceed 100 g throughout the wash cycle.

Table 8.1.12.4(a) Wash Cycle Procedure for Whole Garments and GBRN Materials

-- Temperature - Operation Time (min) $\pm 3^\circ\text{C}$ $\pm 5^\circ\text{F}$ Water Level Suds using AATCC detergent #1993, 1.0 g/gal water 10 49 120 Low* Drain 1 — — — Carry-over 5 49 120 Low* Drain 1 — — — Rinse 2 38 100 High* Drain 1 — — — Rinse 2 38 100 High* Drain 1 — — — Rinse 2 38 100 High* Drain 1 — — — Extract 5 — — —

*See Table 8.1.12.4(b) for high and low water levels.

Table 8.1.12.4(b) Water Level for Whole Garments, Gloves, and Glove Pouches Operation Wash Cycle Procedure

Low Water Level $\pm 1 \text{ cm}$ ($\frac{3}{8} \text{ in.}$) High Water Level $\pm 1 \text{ cm}$ ($\frac{3}{8} \text{ in.}$) cm in: cm in: 12.7 5.0 25.4 10.0

8.1.12.5 –

Samples shall be dried using a tumble dryer with a stack temperature of 38°C to 49°C (100°F to 120°F) when measured on an empty load 20 minutes into the drying cycle.

8.1.12.6 –

Samples shall be tumbled for 60 minutes and shall be removed immediately at the end of the drying cycle. At the conclusion of the final drying cycle, the garment samples shall be allowed to air dry for at least 48 hours prior to conducting the test and the use of a forced-air dryer operated at ambient temperature, 0°C (0°F) shall be permitted. At the conclusion of the final drying cycle, glove or glove pouch samples shall be dried on a forced-air, non-tumble-drying mechanism operated at 10°C (50°F) above current room temperature until dry but not for less than 8 hours.

8.1.12.7 –

Garments, gloves, and glove pouches shall be washed and dried for a total of five cycles.

Additional Proposed Changes

File Name	Description	Approved
8.1.12_Laundry.docx		

Statement of Problem and Substantiation for Public Input

The front loading washing and drying procedure is being updated to accommodate the following changes:

1. The capacity to be utilized when conditioning samples is being revised to include a calculation for the volume to weight ratio. New washing machines are being manufactured and sold with larger weight capacities while the washer drum size remains the same. By using a volume to weight ratio, laboratories are able to calculate the washer capacity of their machine based on a consistent ratio. The capacity ratio recommended is based on the historical machine weight and volume utilized in other PPE standards.
2. The ballast material is being updated to include materials similar to those materials being tested.
3. The g force maximum is being raised to 125 g which will align the requirement to what has historically been used in the top-loading machines which is believed to be higher than 128 g.
4. The water temperature requirements are being adjusted to align more similarly to the temperatures historically used in top-loading machines.

5. Increase the number of wash cycles to an arbitrary 30 cycles in order to facilitate the discussion around increasing wash cycles. The increased number of wash cycles is needed to better mimic the expected number of launderings for clothing items over their expected service life (6 times per year for 5 years). Consideration should also be placed on gloves as they do not have the same expected service life.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 158-NFPA 1970-2021 [Section No. 8.6.8.3]	
Public Input No. 159-NFPA 1970-2021 [Section No. 8.6.9.3]	
Public Input No. 160-NFPA 1970-2021 [Section No. 8.6.10.3]	
Public Input No. 161-NFPA 1970-2021 [Section No. 8.6.16.2]	
Public Input No. 162-NFPA 1970-2021 [Section No. 8.6.17.3]	
Public Input No. 163-NFPA 1970-2021 [Section No. 8.6.18.2]	
Public Input No. 166-NFPA 1970-2021 [Section No. 8.12.2.2]	
Public Input No. 167-NFPA 1970-2021 [Section No. 8.14.2.2]	
Public Input No. 168-NFPA 1970-2021 [Section No. 8.21.2.2]	
Public Input No. 170-NFPA 1970-2021 [Section No. 8.25.3.2]	
Public Input No. 171-NFPA 1970-2021 [Sections 8.26.2, 8.26.3]	
Public Input No. 172-NFPA 1970-2021 [Section No. 8.27.3.4]	
Public Input No. 173-NFPA 1970-2021 [Section No. 8.28.3.4]	
Public Input No. 174-NFPA 1970-2021 [Section No. 8.50.2.2]	
Public Input No. 175-NFPA 1970-2021 [Section No. 8.51.2.3]	
Public Input No. 176-NFPA 1970-2021 [Section No. 8.62.3]	
Public Input No. 177-NFPA 1970-2021 [Section No. 8.71.3.1]	

Submitter Information Verification

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Submittal Date: Wed Nov 03 09:58:52 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-120-NFPA 1970-2022](#)

Statement: Laundering conditioning requirements are being updated to reflect several needed changes.

The change to identify top/home laundering machine conditioning versus extractor conditioning.

Removal of the specific elements or items that the procedure covers, this will be reflected in the test methods instead since product addition or removal is often missed in the conditioning sections.

The number of laundering cycles unless otherwise specified by the specific test method is being increased to 30 cycles to reflect the industry trend to launder PPE more frequently.

The top loading method and the extractor method are also changing order in the conditioning section. Extractor will now be 8.1.2 and top loader will now be 8.1.12.



Public Input No. 25-NFPA 1970-2021 [New Section after 8.1.18]

NEW FLEXING PROCEDURE FOR BARRIER HOOD PARTICLE RESISTANT LAYER

8.1.18 Flexural Fatigue Procedure for Particle Barrier Layer.

8.1.18.1 Samples shall be subjected to flexural fatigue in accordance with ASTM F 392, *Standard Test Method for Flex Durability of Flexible Barrier Materials*, with the modifications in 8.1.18.2 through 8.1.18.5.

8.1.18.2 Samples shall be flexed at 21° C ± 3°C (70°F ± 5°F) and a relative humidity of 65 percent ± 5 percent.

8.1.18.3 In lieu of flexing conditions A, B, C, d, or E, test samples shall have a flex period of 3000 cycles at 45 cycles/min.

8.1.18.4 The mandrels shall be spaced at a distance of 235 mm ± 6 mm (9 1/4 in. ± 1/4 in.), in the starting position and 83mm (3 1/4 in.) at the closed position.

8.1.18.5 One cycle shall consist of a full flex and twisting action.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_4_Held.pdf	1971_PI4	

Statement of Problem and Substantiation for Public Input

NOTE: This public input appeared as a "Reject but held" in Public Comment No. 104 of the A2017 cycle of the Second Draft Report for NFPA 1971 and per the Regs. at 4.4.8.3.1. The proposed conditioning procedures are intended to provide a basis for evaluating the particle barrier layer of barrier hoods as part of the particulate resistance test.

Submitter Information Verification

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Submittal Date: Mon Aug 16 12:23:27 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-56-NFPA 1970-2022

Statement: The proposed conditioning procedures are intended to provide a basis for evaluating the impact of repeated flexing representative of wearing the hood for several use cycles particulate blocking test as part of the requirements for particulate blocking hoods. This specific conditioning methods has been applied in other standards for similar purposes in assessing the durability of barrier layers.

It is proposed that this conditioning become part of a larger set of particular blocking test pre-conditions.

**Public Input No. 157-NFPA 1970-2021 [Section No. 8.2.3.1]****8.2.3.1**

Specimens shall be tested both before and after being subjected to the procedure specified in 8.1.2 12.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 155-NFPA 1970-2021 [Section No. 8.1.2]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Submittal Date: Wed Nov 03 10:15:00 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.

**Public Input No. 343-NFPA 1970-2021 [Section No. 8.3]****8.3 Flame Resistance Test 2.****8.3.1 Application.**

This test method shall apply to protective helmets.

8.3.2 Samples.

Helmets shall be conditioned as specified in 8.1.3.

8.3.3 Specimens.

Three helmets shall be tested.

8.3.4 Apparatus.**8.3.4.1**

A standard Bunsen burner shall be used.

8.3.4.2

The Bunsen burner shall be fueled by a bottled methane gas, 99 percent pure.

8.3.4.3

A control valve system with a delivery rate designed to furnish gas to the burner under a pressure of $0.035 \text{ kg/cm}^2 \pm 0.003 \text{ kg/cm}^2$ ($\frac{1}{2}$ psi, $+0.1/-0$ psi) at the burner shall be utilized.

8.3.4.4

The barrel of the Bunsen burner shall be $13 \text{ mm} \pm 3 \text{ mm}$ ($\frac{1}{2} \text{ in.} \pm \frac{1}{8} \text{ in.}$) in diameter. A flame spreader shall not be used.

8.3.5 Procedure A.**8.3.5.1**

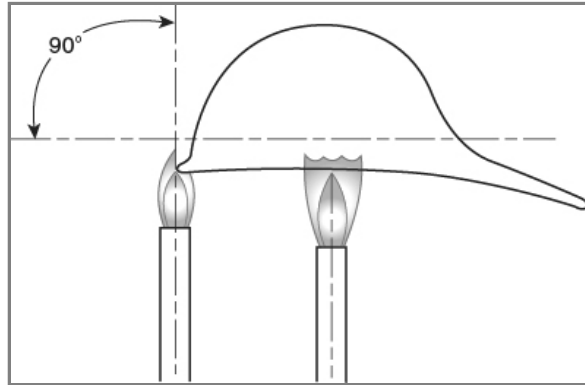
The helmet shall be positioned on the ISO size J headform specified in Figure 8.16.4.1 according to the HPI as described in 8.1.14.

8.3.5.2

The flame of the Bunsen burner shall be adjusted to produce a $50\text{ mm} \pm 1.5\text{ mm}$ ($2\text{ in.} \pm \frac{1}{16}\text{ in.}$) blue flame with an inner cone of $25\text{ mm} \pm 1.5\text{ mm}$ ($1\text{ in.} \pm \frac{1}{16}\text{ in.}$). The temperature of the flame at the tip of the inner cone shall be measured with a K-type thermocouple and shall be $1200^{\circ}\text{C} \pm 100^{\circ}\text{C}$ ($2192^{\circ}\text{F} \pm 180^{\circ}\text{F}$). The tip of the inner cone of the flame shall then be applied to the helmet shell from below the helmet at an angle of 90 degrees to the basic plan, as shown in Figure 8.3.5.2, as follows:

- (1) At the intersection of the front edge of the brim and the midsagittal plane
- (2) At the intersection of each side of the brim and the coronal plane
- (3) At one random location on the edge of the brim to be determined by test laboratory

Figure 8.3.5.2 Test Procedure A:



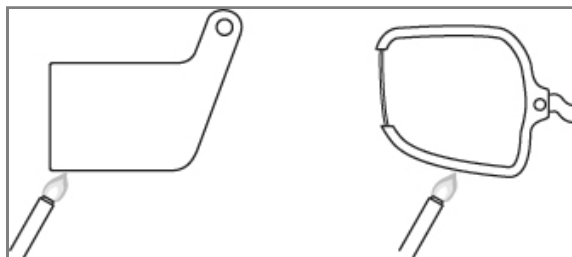
8.3.~~5.3~~

~~The flame shall be applied for 15 seconds, $\pm 1/0$ second. The flame shall then be removed and the duration of the afterflame and afterglow shall be measured, reported, and recorded.~~

~~8.3.~~

6 Procedure B.**8.3.6.1**

Specimens of faceshield/goggle components shall be attached to an appropriate test fixture so that the lower edge of the specimen is exposed. The test setup shall be as shown in Figure 8.3.6.1.

Figure 8.3.6.1 Test Procedure B.**8.3.6.2**

The flame of the Bunsen burner shall be adjusted to produce a $50\text{ mm} \pm 1.5\text{ mm}$ ($2\text{ in.} \pm \frac{1}{16}\text{ in.}$) blue flame with an inner cone of $25\text{ mm} \pm 1.5\text{ mm}$ ($1\text{ in.} \pm \frac{1}{16}\text{ in.}$). The temperature of the flame at the tip of the inner cone shall be measured with a K-type thermocouple and shall be $1200^{\circ}\text{C} \pm 100^{\circ}\text{C}$ ($2192^{\circ}\text{F} \pm 180^{\circ}\text{F}$). The tip of the inner cone of the flame shall then be applied to the outer edge of the specimen at the lowest exposed edge of the specimen. The burner shall be held to the test point of the specimen at an angle of $45\text{ degrees} \pm 10\text{ degrees}$.

8.3.6.3

After 15 seconds, ± 1 second, the flame shall be removed and the duration of the afterflame shall be measured, reported, and recorded.

8.3.**7 Procedure C:****8****8.3.7.1**

The helmet shall be positioned according to the HPI as described in 8.1.13 on the ISO size J headform specified in Figure 8.16.4.1. The helmet shall then be placed under the radiant heat source specified in 8.1.6; while the basic plane of the headform is parallel to the radiant heat source as shown in Figure 8.3.7.1.

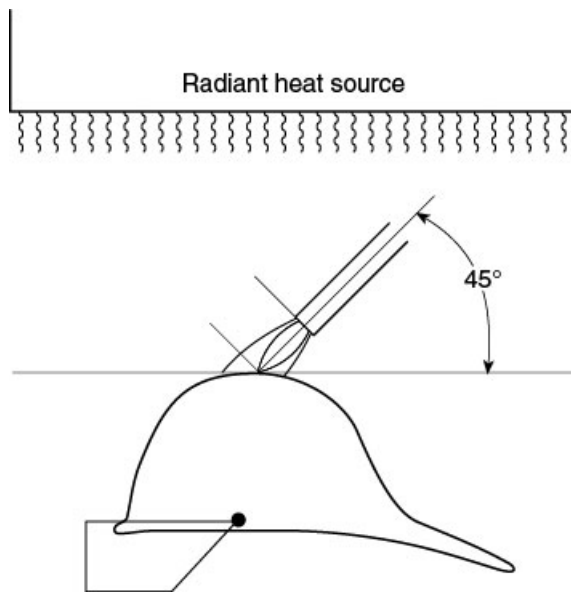
Figure 8.3.7.1 Test

—

8.3.8 Procedure

Procedure

G.

**8.3.7.2 –**

The flame of the Bunsen burner shall be adjusted to produce a 50 mm $\pm$ 1.5 mm (2 in. $\pm$ $\frac{1}{16}$ in.) blue flame with an inner cone of 25 mm $\pm$ 1.5 mm (1 in. $\pm$ $\frac{1}{16}$ in.). The temperature of the flame at the tip of the inner cone shall be measured with a K-type thermocouple and shall be 1200°C $\pm$ 100°C (2192°F $\pm$ 180°F).

8.3.7.3 –

Specimen helmets shall be positioned so that the area to be tested receives a radiant heat flux of 1.0 W/cm² $\pm$ 0.1 W/cm². After 60 seconds, $\pm$ 5/0 seconds, exposure to the radiant flux and without removing the radiant heat source, the tip of the inner cone of the Bunsen burner flame shall be applied against the helmet test area. The application of the flame shall create an angle of 45 degrees $\pm$ 10 degrees, with the plane tangent to the test area at the point of contact.

8.3.7.4 –

After 15 seconds, $\pm$ 1/0 second, the flame shall be removed and the duration of the afterflame and afterglow shall be measured, reported, and recorded.

D.**8.3.8.1**

Specimen helmets with faceshield/goggle component attachment hardware in place shall be positioned according to the HPI as described in 8.1.13 on the ISO size J headform specified in Figure 8.16.4.1.

8.3.8.2

The flame of the Bunsen burner shall be adjusted to produce a 50 mm ± 1.5 mm (2 in. ± 1/16 in.) blue flame with an inner cone of 25 mm ± 1.5 mm (1 in. ± 1/16 in.). The temperature of the flame at the tip of the inner cone shall be measured with a K-type thermocouple and shall be 1200°C ± 100°C (2192°F ± 180°F). The tip of the inner cone of the flame shall then be applied to each faceshield/goggle component attachment hardware location along the helmet brim line from below the brim of the helmet at an angle of 90 degrees to the basic plane.

8.3.8.3

The flame shall be applied for 15 seconds, +1/-0 second. The flame shall then be removed and the duration of the afterflame and afterglow shall be measured, reported, and recorded.

8.3.9 Report.**8.3.9.1**

Afterflame times shall be recorded and reported for each specimen at each flame impingement location.

8.3.9.2

The afterflame times shall be recorded and reported to the nearest 0.2 second.

8.3.10 Interpretation.**8.3.10.1**

Pass/fail performance shall be based on the longest measured afterflame time.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1970_Section_8.3_J.Stull.docx		

Statement of Problem and Substantiation for Public Input

Testing of helmets to Section 8.5 has been proposed to allow a full evaluation of helmets where this Procedures A and C of this test method would no longer be needed.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
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Submittal Date: Thu Nov 11 18:46:36 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-70-NFPA 1970-2022

Statement: The committee is investigating the application of the full engulfment test, now currently applied to footwear, for with evaluating the flame resistance of whole helmets. This test provides the ability to evaluate complete elements in a manner more representative of use as compared to the current series of tests, which now depends on two to three different tests that utilizes relatively small burners for contacting the helmet at different set locations. In contrast, the proposed test provides a full flame exposure to the top and sides of the helmet. The proposed additional helmet flame resistance requirement is intended to permit further research as to the merits for this test and to allow a determination of which current flame resistance procedures (now Procedure A and C and potentially Procedure D of Section 8.5) can be replaced.

For the reasons above, the proposed removal of Section 8.3, Sections 8.3.5 and 8.3.7 according to Public Input 343, is not being recommended at this time.



**Public Input No. 344-NFPA 1970-2021 [Section No. 8.4]****8.4 – Flame Resistance Test 3:****8.4.1 – Application:****8.4.1.1 –**

This test method shall apply to the protective glove body, glove interface components, and glove extension composites:

8.4.1.2 –

Modifications to this test method for evaluation of glove body composites shall be as specified in 8.4.8 :

8.4.1.3 –

Modifications to this test method for evaluation of glove interface components other than wristlet composites shall be as specified in 8.4.9 :

8.4.1.4 –

Modifications to this test method for evaluation of wristlet glove interface components shall be as specified in 8.4.10 :

8.4.1.5 –

Modifications to this test method for evaluation of glove extension composites shall be as specified in 8.4.11 :

8.4.2 – Specimens:

Three specimens shall be tested for each material. Three specimens shall be tested after the conditioning specified in 8.1.3 . Three additional specimens shall be tested after the conditioning specified in 8.1.12 followed by the conditioning specified in 8.1.3 :

8.4.3 – Samples:**8.4.3.1 –**

Samples shall be prepared for each glove body, glove interface component, and glove extension composite:

8.4.3.2 –

Samples shall be conditioned as specified in 8.1.12 and 8.1.3 :

8.4.4 – Apparatus:**8.4.4.1 –**

The test apparatus specified in Method 5905.1, *Flame Resistance of Material; High Heat Flux Flame Contact* , of Federal Test Method Standard 191A, *Textile Test Methods* , shall be used:

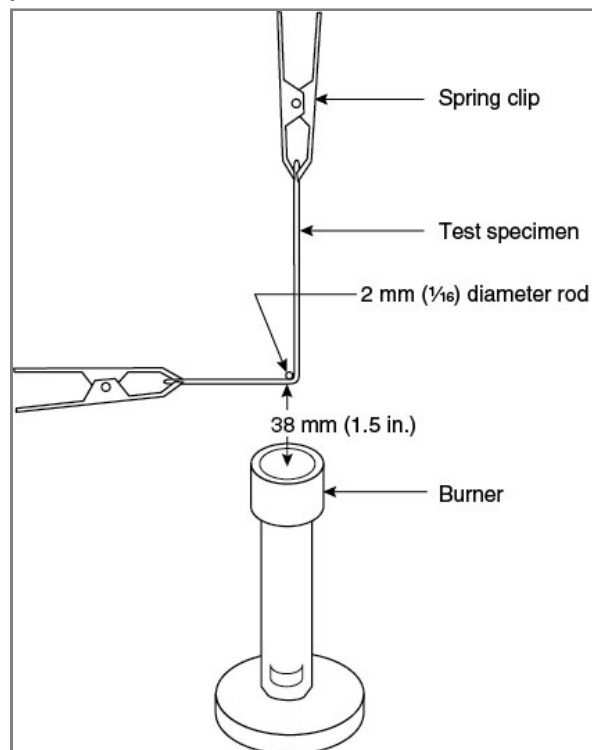
8.4.4.2 –

A freestanding flame height indicator shall be used to assist in adjusting the burner flame height. The indicator shall mark a flame height of 75 mm (3 in.) above the top of the burner:

8.4.4.3 –

A specimen support assembly shall be used that consists of a frame and steel rod of 2 mm ($\frac{1}{16}$ in.) in diameter to support the specimen in an L-shaped position as shown in Figure 8.4.4.3 :

Figure 8.4.4.3 Relationship of Test Material to Burner.

**8.4.4.4 –**

The horizontal portion of the specimen shall be not less than 50 mm (2 in.), and the vertical portion shall be not less than 100 mm (4 in.). The specimen shall be held at each end by spring clips under light tension as shown in Figure 8.4.4.3 :

8.4.5 – Procedure:**8.4.5.1 –**

A balance shall be used to determine the weight of each specimen to the nearest 0.1 g (0.04 oz) before and after testing:

8.4.5.2 –

The burner shall be ignited and the test flame shall be adjusted to a height of 75 mm (3 in.) with the gas on/off valve fully open and the air supply completely and permanently off, as it is important that the flame height be closely controlled. The 75 mm (3 in.) height shall be obtained by adjusting the orifice in the bottom of the burner so that the top of the flame is level with the marked flame height indicator:

8.4.5.3 –

With the specimen mounted in the support assembly, the burner shall be moved so that the middle of the folded corner projects into the flame 38 mm ($1\frac{1}{2}$ in.) as shown in Figure 8.4.4.3 :

8.4.5.4 –

The burner flame shall be applied to the specimen for 12 seconds. After 12 seconds, the burner shall be removed:

8.4.5.5 –

The afterflame time shall be measured as the time, in seconds, to the nearest 0.2 second that the specimen continues to flame after the burner is removed from the flame:

8.4.5.6 –

Each layer of the specimen shall be examined for melting or dripping:

8.4.5.7 –

Each tested sample shall be reconditioned as specified in 8.1.3 and then weighed to the nearest 0.1 g (0.04 oz):

8.4.5.8 –

The specimen then shall be further examined for char length. The char length shall be determined by measuring the length of the tear through the center of the charred area as specified in 8.4.5.8.1 through 8.4.5.8.4 :

8.4.5.8.1 –

The specimen shall be folded lengthwise and creased, by hand, along a line through the highest peak of the charred area.

8.4.5.8.2 –

The hook shall be inserted into a hole punched in the specimen that is 6 mm ($\frac{1}{4}$ in.) in diameter or less. The hole shall be punched out for the hook at one side of the charred area that is 6 mm ($\frac{1}{4}$ in.) from the adjacent outside edge, at the point where the specimen contacted the steel rod, and 6 mm ($\frac{1}{4}$ in.) in from the lower end.

8.4.5.8.3 –

A weight of sufficient size so that the weight and hook together equal the total tearing weight required by Table 8.4.5.8.3 shall be attached to the hook. The total tearing weight for determining charred length shall be based on the weight of the composite specimen and shall be determined from Table 8.4.5.8.3 :

Table 8.4.5.8.3 Determination of Tearing Weight

Specified Weight per Square Yard of Material Before Any Fire-Retardant Treatment or Coating - Total Tearing Weight for Determining Charred Length g/m² oz/yd² - kg lb 68–203 2.0–6.0 0.4 $\frac{1}{4}$ >203–508 >6.0–15.0 0.2 $\frac{1}{2}$ >508–780 >15.0–23.0 0.3 $\frac{3}{4}$ >780 >23.0 0.45 1

8.4.5.8.4 –

A tearing force shall be applied gently to the specimen by grasping the side of the material at the edge of the char opposite the load and raising the specimen and weight clear of the supporting surface. The end of the tear shall be marked off on the edge, and the char length measurement made along the undamaged edge.

8.4.6 – Report:

8.4.6.1 –

The afterflame time and char length shall be recorded and reported for each specimen. The average afterflame time and char length shall also be calculated, recorded, and reported. The afterflame time shall be recorded and reported to the nearest 0.2 second and the char length to the nearest 2.5 mm (0.10 in.).

8.4.6.2 –

The percent consumed shall be calculated using the following formula:

$$\text{Percent consumed} = \frac{W - R}{W} \times 100 \quad [8.4.6.2]$$

where:

W = original conditioned weight

R = conditioned weight 24 hours after testing

8.4.6.2.1 –

The percent consumed shall be recorded and reported for each specimen to the nearest 0.1 percent. The average percent consumed shall be calculated, recorded, and reported to the nearest 0.1 percent.

8.4.6.3 –

Observations of melting or dripping for each specimen shall be recorded and reported.

8.4.7 – Interpretation:

Pass or fail performance shall be based on melting or dripping, the average afterflame time, and the average char length.

8.4.8 – Specific Requirements for Testing Glove Body Composites:

8.4.8.1 –

Samples for conditioning shall be glove body composite pouches as specified in 8.4.8.3 :

8.4.8.2 –

Specimens shall be representative of each glove body composite construction.

8.4.8.3 –

For glove body composites, samples for conditioning shall be in the form of a pouch as described in 8.1.14 :

8.4.8.4 –

After conditioning, the pouch and necessary stitching shall be cut to form 50 mm × 150 mm (2 in. × 6 in.) specimens for testing.

8.4.9 – Specific Requirements for Testing Protective Glove Interface Components Other than Wristlet Composites:

8.4.9.1 –

Samples for conditioning shall be glove interface component composite swatches as specified in 8.4.9.3 :

8.4.9.2 –

Specimens shall be representative of the glove interface component composite construction:

8.4.9.3 –

For glove interface component composites, samples for conditioning shall be in the form of a pouch as described in 8.1.14 :

8.4.9.4 –

After conditioning, the necessary stitching shall be cut to form 50 mm × 150 mm (2 in. × 6 in.) specimens for testing:

8.4.10 – Specific Requirements for Testing Protective Wristlet Glove Interface Components:

8.4.10.1 –

Samples for conditioning shall be wristlet glove interface component composite swatches as specified in 8.4.10.3 :

8.4.10.2 –

Specimens shall be representative of the wristlet glove interface component composite construction:

8.4.10.3 –

For wristlet glove interface component composites, samples for conditioning shall include wristlet material. Three specimens shall be tested after the conditioning specified in 8.1.3 . Three additional specimens shall be tested after the conditioning specified in 8.1.2 followed by the conditioning specified in 8.1.3 :

8.4.10.4 –

After conditioning, the material shall be cut to form 50 mm × 150 mm (2 in. × 6 in.) specimens for testing. Specimens shall not include seams where multiple layers are involved:

8.4.11 – Specific Requirements for Testing Protective Glove Extension Composites:

8.4.11.1 –

Samples for conditioning shall be glove extension composite swatches as specified in 8.4.11.3 :

8.4.11.2 –

Specimens shall be representative of the glove extension composite construction:

8.4.11.3 –

For glove extension composites, samples for conditioning shall be in the form of a pouch as described in 8.1.14 :

8.4.11.4 –

After conditioning, the necessary stitching shall be cut to form 50 mm × 150 mm (2 in. × 6 in.) specimens for testing:

Statement of Problem and Substantiation for Public Input

Testing of gloves to Section 8.5 has been proposed to allow a full evaluation of gloves where this test method would no longer be needed.

Submitter Information Verification

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State:

Zip:

Submittal Date: Thu Nov 11 19:00:17 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-90-NFPA 1970-2022

Statement: Two additional tests have been proposed to evaluate full gloves for flame resistance as an alternative to the current composite test based on procedures in Section 8.4. The first additional procedure in 7.7.6.1 uses the flame engulfment test procedures currently in Section 8.5, that have been adapted for evaluating gloves. The second additional procedure uses a new test method that created a 12 second simulated flash fire exposure for whole gloves mount on a handform between multiple burners. Both alternate tests permit the evaluation of full gloves as opposed to requiring the evaluation of each unique composite used in the construction of gloves. The ability of both tests to evaluate full gloves has been demonstration but further refinements in the respective tests may be needed. The committee is further investigating the utility of the two alternative test methods and will determine which tests to proceed with for second revision. If a whole glove test is implemented, it may not be necessary to retain the performance requirement in 7.7.6 and 7.7.7.

For the first draft, the current glove flame resistance test method in Section 8.4 has been retained and proposed changes have been incorporated to clarify the instructions for determining char length.



Public Input No. 220-NFPA 1970-2021 [Sections 8.4.5.8.2, 8.4.5.8.3, 8.4.5.8.4]

Sections 8.4.5.8.2, 8.4.5.8.3, 8.4.5.8.4

8.4.5.8.2

The hook shall be inserted into a hole punched in the specimen that is 6 mm (¼ in.) in diameter or less. The hole shall be punched out for the hook at one side of the charred area that is 6 mm (¼ in.) from the adjacent outside edge, at the point where the specimen contacted the steel rod, and 6 mm (¼ in.) ~~in from the lower end~~ away from the point where the specimen contacted the steel rod in the 4 inch long direction, as shown in Figure 8.4.5.2.

Insert Figure

8.4.5.8.3

A weight of sufficient size so that the weight and hook together equal the total tearing weight required by Table 8.4.5.8.3 shall be attached to the hook. The total tearing weight for determining charred length shall be based on the weight of the composite specimen and shall be determined from Table 8.4.5.8.3.

Table 8.4.5.8.3 Determination of Tearing Weight

<u>Specified Weight per Square Yard of Material Before Any Fire-Retardant Treatment or Coating</u>		<u>Total Tearing Weight for Determining Charred Length</u>	
<u>g/m²</u>	<u>oz/yd²</u>	<u>kg</u>	<u>lb</u>
68–203	2.0–6.0	0.1	¼
>203–508	>6.0–15.0	0.2	½
>508–780	>15.0–23.0	0.3	¾
>780	>23.0	0.45	1

8.4.5.8.4

A tearing force shall be applied gently to the specimen by grasping the side of the material at the edge of the char opposite the load as shown in Figure 8.4.5.2 and raising the specimen and weight clear of the supporting surface. The end of the tear shall be marked off on the edge, and the char length measurement made along the undamaged edge.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Figure_8.4.5.8.2.png		

Statement of Problem and Substantiation for Public Input

These changes clarify instructions for determining char length.

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
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Submission Date: Mon Nov 08 09:30:17 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-90-NFPA 1970-2022

Statement: Two additional tests have been proposed to evaluate full gloves for flame resistance as an alternative to the current composite test based on procedures in Section 8.4. The first additional procedure in 7.7.6.1 uses the flame engulfment test procedures currently in Section 8.5, that have been adapted for evaluating gloves. The second additional procedure uses a new test method that created a 12 second simulated flash fire

exposure for whole gloves mount on a handform between multiple burners. Both alternate tests permit the evaluation of full gloves as opposed to requiring the evaluation of each unique composite used in the construction of gloves. The ability of both tests to evaluate full gloves has been demonstrated but further refinements in the respective tests may be needed. The committee is further investigating the utility of the two alternative test methods and will determine which tests to proceed with for second revision. If a whole glove test is implemented, it may not be necessary to retain the performance requirement in 7.7.6 and 7.7.7.

For the first draft, the current glove flame resistance test method in Section 8.4 has been retained and proposed changes have been incorporated to clarify the instructions for determining char length.

**Public Input No. 345-NFPA 1970-2021 [Section No. 8.5]****8.5 Flame Resistance Test 4.****8.5.1 Application.****8.5.1.1**

This test method shall apply to protective helmets, protective gloves, and protective footwear.

8.5.1.2

Modifications to this test method for evaluating protective helmets shall be as specified in 8.5.8.

8.5.1.3

Modifications to this test method for evaluating protective gloves shall be as specified in 8.5.9.

8.5.1.4

Modifications to this test method for evaluating protective footwear shall be as specified in 8.5.10.

8.5.2 Samples.**8.5.2.1**

Samples shall be complete ~~footwear~~ helmets, gloves, and footwear.

8.5.2.2

~~Samples~~ Helmet and footwear samples shall be conditioned as specified in 8.1.3.

8.5.2.3

Glove samples shall be conditioned as specified in 8.12.

8.5.3 Specimens.

Three complete footwear items shall be tested.

8.5.4 Apparatus.**8.5.4.1**

The test apparatus shall consist of a fuel pan, movable shutter(s), specimen holder, n-heptane, ignition source, and timing device.

8.5.4.1.1

The fuel pan shall be 305 mm × 457 mm × 63.5 mm (12 in. × 18 in. × 2.5 in.).

8.5.4.1.2

The movable shutter(s) shall be located at a height of 255 mm ± 13 mm (10 in. ± ½ in.) above the surface of the water and n-heptane fluid as measured before ignition. The shutter(s) shall be of a size sufficient to cover the surface area of the fuel pan and shall be capable of being fully retracted or fully extended within 1 second.

8.5.4.1.3

The specimen holder shall be capable of suspending the specimen over the flame in a manner such that the holder does not impede the flames.

8.5.4.1.4

The stopwatch or other device shall measure the burning time to the nearest 0.1 second.

8.5.5 Procedure.**8.5.5.1**

The test shall be conducted in a draft-free area.

8.5.5.2

The fuel pan shall be level.

8.5.5.3

Water shall be placed in the fuel pan to a height of 13 mm (½ in.).

8.5.5.4

400 to 500 mL of n-heptane shall be added to the fuel pan such that it will burn freely for 1.5 to 2.0 minutes.

8.5.5.5

The specimen shall be mounted in the appropriate specimen holder ~~as follows: The toe shall be at an angle of 7.5 degrees $\pm$ 2.5 degrees, above the heel.~~

- ~~• The height of the lowest edge of the specimen shall be 305 mm $\pm$ 25 mm (12 in. $\pm$ 1 in.) from the surface of the water and n-heptane fluid as measured before ignition.~~
- ~~• The heel-toe axis of the specimen shall be parallel with the 457 mm (18 in.) side of the fuel pan.~~

8.5.5.6

With the shutter retracted, the n-heptane shall be ignited using a suitable ignition source.

8.5.5.6.1

Where paper or other material is used to ignite the n-heptane, it shall not be left in the fuel pan, where it can disturb the flame pattern.

8.5.5.7

The n-heptane shall burn freely for 1 minute, $\pm$ 5 seconds.

8.5.5.8

The shutter(s) shall be positioned above the flame.

8.5.5.9

The specimen shall be positioned above the shutter(s) over the approximate center of the flame area.

8.5.5.10

The shutter(s) shall be retracted and specimen flame exposure shall commence not longer than 1 minute, 15 seconds from ignition.

8.5.5.11

The specimen shall be exposed to the flame for 12 seconds $\pm$ 0.2 second.

8.5.5.12

Following flame exposure, the shutter(s) shall be repositioned above the flame.

8.5.5.13

The afterflame time shall be measured as the time, in seconds, to the nearest 0.1 second that the specimen continues to flame after the shutter is repositioned over the flame.

8.5.5.14

Following the flame exposure, the specimen shall be visually examined for melting, dripping, and burn-through.

8.5.6 Report.**8.5.6.1**

The afterflame time shall be recorded and reported for each specimen. The average afterflame time shall be calculated and reported. The afterflame time shall be recorded and reported to the nearest 0.2 second.

8.5.6.2

Observations of melting, dripping, or burn-through for each specimen shall be recorded and reported.

8.5.7 Interpretation.

Pass or fail performance shall be based on the average afterflame time and any observed melting, dripping, or burn-through.

8.5.8 Specific Requirements for Testing Protective Helmets**8.5.8.1**

Helmet samples shall include all individual components necessary for the certification of the helmet.

8.5.8.2

Where different eye and face protection are used, each helmet and eye/face protection component interface shall be separately evaluated.

8.5.8.3

The specimen holder for the helmet shall be an inverted flame resistant, non-conductive ISO Size J headform on which the helmet is placed at the manufacturer-specified HPI and with the lowest point of the helmet at 305 mm $\pm$ 25 mm (12 in. $\pm$ 1 in.) from the surface of the water and n-heptane fluid as measured before ignition.

8.5.9 Specific Requirements for Testing Protective Gloves**8.5.9.1**

Glove samples shall include complete gloves.

8.5.9.2

Where gloves had different interface area components, each glove configuration shall be separately tested.

8.5.9.3

The specimen holder for the helmet shall be an inverted flame resistant, non-conductive handform that holds the glove in a vertical position, fingers down, at 305 mm $\pm$ 25 mm (12 in. $\pm$ 1 in.) from the tip of the lowest finger to the surface of the water and n-heptane fluid as measured before ignition.

8.5.10 Specific Requirements for Testing Protective Footwear.**8.5.10**

Footwear samples shall include complete footwear with all elements closed or secured.

8.5.10

The specific holder for footwear shall provide the following mounting and positioning of the specimen:

- (1) The toe shall be at an angle of 7.5 degrees $\pm$ 2.5 degrees, above the heel.
- (2) The height of the lowest edge of the specimen shall be 305 mm $\pm$ 25 mm (12 in. $\pm$ 1 in.) from the surface of the water and n-heptane fluid as measured before ignition.
- (3) The heel-toe axis of the specimen shall be parallel with the 457 mm (18 in.) side of the fuel pan.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
PI345_1970_Section_8.5_J.Stull.docx		

Statement of Problem and Substantiation for Public Input

For the application of this test for helmets and gloves, specific modification are needed to permit testing of these additional products.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
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Street Address:
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Submittal Date: Thu Nov 11 19:02:00 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-71-NFPA 1970-2022

Statement: The proposed changes to Section 8.5 broaden the application of the full flame engulfment test to both helmets and gloves for consistency with the way that flame resistance is currently assessed for footwear. For helmets, three different tests are used to evaluate helmet flame resistance using a relatively small Bunsen burner that is used to contact different fixed locations on the helmet requiring multiple evaluations. For gloves, a larger Meker burner is used in a modified form of a vertical flame resistance test to evaluate each unique glove composite.

The indicated changes provide a basis for evaluating each full protective elements under the same flame resistance conditions and have been put into the standard as supplemental tests to the current specified flame resistance procedures to allow a more detailed assessment for how the full engulfment test can be consistently applied for helmets and gloves.

An additional requirement has been added to measure the temperature rise on the top of the headform that holds the helmet during the flame resistance exposure but no specific criterion has been proposed and it is the expectation of the committee to investigate the utility of the measurement prior to public comment.

**Public Input No. 158-NFPA 1970-2021 [Section No. 8.6.8.3]****8.6.8.3**

Specimens shall be tested both before and after being subjected to the procedure specified in 8.1.2 12 .

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
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Submittal Date: Wed Nov 03 10:29:16 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.

**Public Input No. 159-NFPA 1970-2021 [Section No. 8.6.9.3]****8.6.9.3**

Specimens shall be tested with the sealed seam oriented vertically and shall be tested both before and after being subjected to the procedure specified in 8.1.2 12.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
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Submittal Date: Wed Nov 03 10:29:59 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.

**Public Input No. 160-NFPA 1970-2021 [Section No. 8.6.10.3]****8.6.10.3**

Specimens shall be tested both before and after being subjected to the procedure specified in 8.1.2 12 .

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
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Submittal Date: Wed Nov 03 10:30:35 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.



Public Input No. 94-NFPA 1970-2021 [Sections 8.6.13.2, 8.6.13.3, 8.6.13.4]

Sections 8.6.13.2, 8.6.13.3, 8.6.13.4

8.6.13.2

The glove specimen dimensions shall be measured. The glove shall be made smooth and flattened in both directions to provide the most accurate measurement. A rigid ruler shall be used for the measurements. The length measurement of the glove specimen shall be from the tip of the middle finger to the end of the glove body on the palm side. The width measurement of the glove specimen shall be the width measurement on the palm side 25 mm (1 in.) below the base of the fingers.

8.6.13.3

The gloves shall then be conditioned as specified in 8.1.12.

8.6.13.4

The glove body shall then be filled with nominal 4 mm ($\frac{1}{8}$ in.) sized perforated soda-lime or borosilicate glass beads

in the body of the glove and borosilicate glass rods in the fingers

in the following manner:

- (1) A total of 50 mL of beads shall be evenly distributed into each of the fingers resulting in approximately 10 mL of beads in each of the five digits. A Borosilicate glass rod composite measuring 12.7mm in diameter and 5cm in length shall be placed in each of the five digits.
- (2)* A lightweight bag constructed of 170 g/m² (5.0 oz/yd²) or less heat-resistant material and measuring 120.5 mm (4.75 in.) high by 183.0 mm (7.20 in.) wide, shall be filled with 375 mL of beads. The bag shall be sewn on all four sides with heat-resistant thread to keep the beads from spilling out. The bag filled with beads shall be placed inside the body of the glove.
- (3) The glass beads shall be at a temperature of 21°C ± 3°C (71°F ± 5°F).
- (4) The opening of the glove shall be clamped together, and the specimen shall be suspended by the clamp in the oven so that the entire glove is not less than 50 mm (2 in.) from any oven surface and not less than 150 mm (6 in.) from any other specimen, and airflow is parallel to the plane of the material. Testing a wristlet glove you may remove the wristlet to aid in the clamping of the glove.
- (5) One to three glove specimens shall be placed in the test oven at one time.
- (6) The glove specimens shall be suspended such that each specimen is the same distance from the airflow source so that no glove sample is blocking the airflow to other glove samples.

Statement of Problem and Substantiation for Public Input

A sub task group was formed to review HTS test method which included the laboratories. We clarified in greater detail how the gloves were to be measured. Also there was a problem in placing glass beads in the fingers and we agreed to replace them with glass rods which should add consistency in the testing. In testing a wristlet glove the labs are now allowed to remove the wristlet if that aids in the closing of the glove.

Submitter Information Verification

Submitter Full Name: Harry Winer

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Submittal Date: Fri Oct 29 10:01:40 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-84-NFPA 1970-2022

Statement: The committee agrees with the recommendations from the task group that was formed to review heat and

thermal shrinkage test method, which included the two laboratories performing the majority of this testing. The laboratory representatives clarified in greater detail how the gloves should be measured. The proposed changes also addresses the problem observed in placing glass beads in the fingers and it was agreed to replace the glass beads with glass rods for improved consistency in the testing. In addition, another proposed change permits the removing most of the wristlets from glove samples having wristlets if that aids in the closing of the glove for the purpose of performing the test but is subject to certain caveats.



Public Input No. 221-NFPA 1970-2021 [Section No. 8.6.14.13]

8.6.14.13

After flexing, the footwear specimen shall be marked with a water height line on the exterior at a height of 75 mm (3 in.) below the height of the boot as defined in 6.10.3.1 but no lower than ~~230~~ 225 mm (~~9 in~~ 8.86 in.) where measured up from the center of the insole at the heel. The measurement shall be made on the interior and transferred to the exterior. Plain white paper toweling shall be placed inside the footwear specimen such that the paper toweling intimately contacts all areas inside the footwear specimen to at least the water height line. The footwear specimen shall then be placed in a container that allows its immersion in tap water, treated with a dye and a surfactant that achieves a surface tension of 35 dynes/cm $\pm$ 5 dynes/cm, to the water height line.

Statement of Problem and Substantiation for Public Input

Editorial. Correcting a rounding error from last edition. The required height of the boot per 6.10.3.3 is 250 mm (9.84 in.). The intention is for the boot height to be approximately 10 inches and the waterline to be approximately 1 inch below to allow for splash, wicking, etc. Having the waterline be 25 mm below the boot height aligns with the calculations and rounding in NFPA 1951-2020, NFPA 1990-2022, and NFPA 1999-2018. This is a very slight relaxation in the requirement so this should not create compliance issues with currently certified products.

Submitter Information Verification

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Submittal Date: Mon Nov 08 09:38:17 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: Modifications were made to this test method thus making the editorial modification unnecessary.

**Public Input No. 161-NFPA 1970-2021 [Section No. 8.6.16.2]****8.6.16.2**

Hoods shall be tested both before and after the conditioning specified in 8.1.2 12 .

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Submittal Date: Wed Nov 03 10:33:04 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.

**Public Input No. 162-NFPA 1970-2021 [Section No. 8.6.17.3]****8.6.17.3**

Specimens shall be tested both before and after being subjected to the procedure specified in 8.1.2 12 .

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

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Submittal Date: Wed Nov 03 10:33:44 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.

**Public Input No. 163-NFPA 1970-2021 [Section No. 8.6.18.2]****8.6.18.2**

Specimens shall be tested both before and after being subjected to the procedure specified in 8.1.2 12 .

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Street Address:
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Submittal Date: Wed Nov 03 10:34:31 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.



Public Input No. 281-NFPA 1970-2021 [New Section after 8.10]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
CTPP_sub.docx	Cylinder TPP	

Statement of Problem and Substantiation for Public Input

The current TPP testing method cannot account for the protection reduction caused by shrinkage. In fact, materials that shrink yield a higher TPP value because they get thicker as they shrink and thicker fabrics provide more insulation. In reality, shrinkage does make fabrics thicker but it also moves the fabric closer to the skin. This removes the air layers between the fabric and skin and allows for a higher heat transfer rate. This of course would result in burns occurring quicker.

This test method provides a new TPP sample holder and sensor that allows shrinkage of materials to occur as it would in the field. If a material has a tendency to contract with a flame exposure (TPP level) then the material would shrink up against the sensor yielding higher heat transfer that would produce lower second degree burn times using the stull curve. This method is under development within ASTM (WK75944) and should be approved early next year.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 278-NFPA 1970-2021 [New Section after 7.1.1]	cylinder TPP
Public Input No. 279-NFPA 1970-2021 [New Section after 7.7.1]	Cylinder TPP

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
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Street Address:
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Zip:
Submittal Date: Tue Nov 09 21:00:13 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-167-NFPA 1970-2022](#)

Statement: The current TPP testing method cannot account for the protection reduction caused by shrinkage. In fact, materials that shrink yield a higher TPP value because they get thicker as they shrink and thicker fabrics provide more insulation. In reality, shrinkage does make fabrics thicker but it also moves the fabric closer to the skin. This removes the air layers between the fabric and skin and allows for a higher heat transfer rate. This of course would result in burns occurring quicker. This test method provides a new TPP sample holder and sensor that allows shrinkage of materials to occur as it would in the field. If a material has a tendency to contract with a flame exposure (TPP level) then the material would shrink up against the sensor yielding higher heat transfer that would produce lower second degree burn times using the stull curve. This method is under development within ASTM (WK75944) and should be approved early this year.

**Public Input No. 183-NFPA 1970-2021 [Section No. 8.10.3.2]****8.10.3.2**

Specimens shall be tested ~~both before and after conditioning~~ the conditioning as specified in 8.1.2 ~~and then conditioning as specified in 8.1.3.~~

Statement of Problem and Substantiation for Public Input

This test has been performed for many years and there is a substantial amount of data to support that the materials tested after laundry conditioning will perform better than the materials that are in the "as-received" state. The one exception where this might not be true is when testing gloves, and in particular, glove composites that include leather. However, also through testing, it has been determined that when leather materials are tested, they often shrink which can create an air pocket between the sensor and the leather being tested. This means that the result can be falsely higher just due to the test method. This proposal is being submitted in order to facilitate discussion.

Submitter Information Verification

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Submittal Date: Thu Nov 04 12:12:57 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-86-NFPA 1970-2022

Statement: This test has been performed for many years and there is a substantial amount of data to support that the materials tested after laundry conditioning will perform better than the materials that are in the "as-received" state. The one exception where this might not be true is when testing gloves, and in particular, glove composites that include leather. However, also through testing, it has been determined that when leather materials are tested, they often shrink which can create an air pocket between the sensor and the leather being tested. This means that the result can be falsely higher just due to the test method. This proposed change has been made to facilitate discussion during the public comment period.

**Public Input No. 69-NFPA 1970-2021 [Section No. 8.11.4.1]****8.11.4.1**

The melting temperature of specimens shall be determined in accordance with ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, using Procedure 1 or Procedure 2.

Statement of Problem and Substantiation for Public Input

For the purposes of determining thread melt, either Procedure 1 or Procedure 2 should be acceptable. In previous editions of this standard, the thread melt test method was more consistent with Procedure 2. Additionally, Procedure 2 is consistent with the thread melt test utilized in related performance standards within the project.

Submitter Information Verification

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Submittal Date: Thu Sep 23 10:20:52 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-173-NFPA 1970-2022

Statement: For the purposes of determining thread melt, either Procedure 1 or Procedure 2 should be acceptable. In previous editions of this standard, the thread melt test method was more consistent with Procedure 2. Additionally, Procedure 2 is consistent with the thread melt test utilized in related performance standards within the project.

**Public Input No. 166-NFPA 1970-2021 [Section No. 8.12.2.2]****8.12.2.2**

Samples shall be tested both before and after being conditioned as specified in 8.1.2 12.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
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Submittal Date: Wed Nov 03 10:49:10 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-123-NFPA 1970-2022

Statement: Adding additional conditioning requirements prior to tear testing for increased durability challenges.

**Public Input No. 167-NFPA 1970-2021 [Section No. 8.14.2.2]****8.14.2.2**

Samples shall be submitted for testing after being subjected to the procedure specified in 8.1.2 12.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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City:
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Submittal Date: Wed Nov 03 10:50:03 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.

**Public Input No. 196-NFPA 1970-2021 [Sections 8.14.3.2.1, 8.14.3.2.2, 8.14.3.2.3, 8.14.3.2.4]****Sections 8.14.3.2.1, 8.14.3.2.2, 8.14.3.2.3, 8.14.3.2.4****8.14.3.2.1**

Where two pieces of woven clothing item fabric are joined, the woven fabric seam specimen shall be prepared as specified in ~~8.2.4.2~~ 10.3 of ASTM D1683, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, and shall use the same thread, seam type, and stitch type as used in the finished clothing item.

8.14.3.2.2

Where two pieces of knit or stretch woven clothing item fabric are joined, the knit fabric seam specimen shall be prepared as specified in 7.2.2 of ASTM D3940, *Standard Test Method for Bursting Strength (Load) and Elongation of Sewn Seams of Knit or Woven Stretch Textile Fabrics*, using the same thread, seam type, and stitch type as used in the finished clothing item.

8.14.3.2.3

Specimens of clothing item seam assemblies constructed from other than woven or knit textiles shall be tested as specified in 8.14.3.2.1.

8.14.3.2.4

Where a piece of woven clothing item fabric and a knit or stretch woven fabric are joined, the seam specimen shall be prepared as specified in ~~8.2.4.2~~ 10.3 of ASTM D1683, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, and shall use the same thread, seam type, and stitch type as used in the finished clothing item.

Statement of Problem and Substantiation for Public Input

The ASTM standard has been updated and the previous reference no longer exists. This proposal updates the reference according to the latest edition of the standard.

Submitter Information Verification

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Submittal Date: Thu Nov 04 14:43:37 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-113-NFPA 1970-2022

Statement: ASTM D1683 has been updated and the previous reference no longer exists. This change updates the reference to the correct section in the latest edition of the standard.

**Public Input No. 168-NFPA 1970-2021 [Section No. 8.21.2.2]****8.21.2.2**

Glove wristlet interface components shall be conditioned as specified in 8.1.2 12 .

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
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Submittal Date: Wed Nov 03 10:50:47 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.

**Public Input No. 169-NFPA 1970-2021 [Section No. 8.24.4]****8.24.4** Procedure.**8.24.4.1**

Specimens shall be tested using five cycles of Machine Cycle 1, Wash Temperature V, and Drying Procedure Ai of AATCC 135, Test Method for Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics.

8.24.4.2

A 1.8 kg $\pm$ 0.1 kg (4.0 lb $\pm$ 0.2 lb), load shall be used. A laundry bag shall not be used.

8.24.4.3

Laundry water hardness shall not exceed 25 ppm.

8.24.4.4

Specimen marking and measurements shall be conducted in accordance with the procedure specified in AATCC 135, Test Method for Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics After Home Laundering.

8.24.4.5

Knit specimens shall be pulled to original dimensions and shall be allowed to relax for 1 minute prior to measurement.

Statement of Problem and Substantiation for Public Input

Updating the standard title to the latest version of the standard as referenced in Chapter 2.

Submitter Information Verification

Submitter Full Name: Amanda Newsom

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Submittal Date: Wed Nov 03 10:51:38 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-114-NFPA 1970-2022](#)

Statement: Performance requirements are being changed to measure results after laundering in an extractor versus the home style top laundering machine. The specimens however should still be marked and measured per the AATCC standard, therefore the reference is being updated to reflect the current title.

**Public Input No. 170-NFPA 1970-2021 [Section No. 8.25.3.2]****8.25.3.2**

Specimens shall be tested after being subjected to the procedure specified in 8.1.2 12.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
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Submittal Date: Wed Nov 03 10:55:41 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-126-NFPA 1970-2022

Statement: Adding additional conditioning requirements prior to glove puncture resistance testing for increased durability challenges.



Public Input No. 67-NFPA 1970-2021 [Section No. 8.25.4]

8.25.4 Apparatus.

The test apparatus shall be as specified in AATCC ~~42~~ 22-2017e, Test Method for Water Resistance Repellency: Impact Penetration Test Spray, with the following modifications:

- (1) A metal roller approximately 115 mm (4½ in.) long and weighing 1 kg (2½ lb) shall be used.
- (2) Metal embroidery hoops, measuring 150 mm to 180 mm (6 in. to 7 in.) in diameter shall be used for mounting the specimen.

Statement of Problem and Substantiation for Public Input

I suspect that from the 1971-2000 edition to the 1971-2007 edition, the Water Absorption Resistance Test section was mistakenly changed to an incorrect equivalent test method and test equipment reference. This change has evidently persisted through to the 1971-2018 edition. Notwithstanding that, I believe this should be changed.

NFPA 1971-2000

6-26.4 Procedure.

6-26.4.1 Specimens shall be tested in accordance with Method 5504, Water Resistance or Coated Cloth; Spray Absorption Method, of Federal Test Method Standard 191A, Textile Test Methods. The normal outer surface shall be exposed to the water spray.

NFPA 1971-2007

8.26.4 Apparatus. The test apparatus shall be as specified in AATCC 42, Test Method for Water Resistance: Impact Penetration Test, with the following modifications:

- (1) A metal roller approximately 115 mm (4Y2 in.) long and weighing 1 kg (2Y2lb) shall be used.
- (2) Metal embroidery hoops, measuring 150 mm to 180 mm (6 in. to 7 in.) in diameter shall be used for mounting the specimen.

NFPA 1971-2000 6-26.4.1, references the test method, and therefore the equipment, used for Fed TM Std 5504. This is the same equipment that is used for AATCC 22 Spray Test. This equipment makes use of an embroidery hoop and has a fitting for mounting such a hoop.

NFPA 1971-2007 8.26.4 references the AATCC 42 equipment which does not have any way to mount an embroidery hoop with fabric affixed within it, however the procedure specifies testing the fabric in an embroidery hoop.

Submitter Information Verification

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Submittal Date: Wed Sep 22 17:50:25 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-279-NFPA 1970-2022

Statement: It is noted that the method for which the sample is attached to the test surface was not clear in the existing language. However, simply changing the AATCC method would change the rest of the test equipment, and not just the specimen mounting method. The proposed language is being added to clarify how the sample specimen is mounted using the embroidery hoop while maintaining the rest of the equipment specifications in AATCC 42.

**Public Input No. 66-NFPA 1970-2021 [Section No. 8.25.5.5]****8.25.5.5**

The following operations shall then be executed as rapidly as possible:

- (1) The specimen shall be removed from the hoops and placed between sheets of blotting paper on a flat horizontal surface. The metal roller shall be rolled quickly forward and back one time over the paper without application of any pressure other than the weight of the roller.
- (2) A square 100 mm × 100 mm (4 in. × 4 in.) shall be cut out of the center of the wet portion of the specimen and weighed to the nearest 0.05 g. This weight shall be designated as the “wet weight.” Not more than 30 seconds shall elapse between the time the water has ceased flowing through the spray nozzle and the start of the weighing.
- (3) The same 100 mm (4 in.) square shall be conditioned as specified in ~~6.8~~ 6.1.3 until it has dried and reached moisture equilibrium with the surrounding standard atmosphere for textiles. Following this conditioning it shall be reweighed. This weight shall be designated as the “dry weight.”

Statement of Problem and Substantiation for Public Input

NFPA 1971 2018 Section 8.25.5.5 (3) should be corrected from ‘...conditioned as specified in 6.1.3...’ to ‘...conditioned as specified in 8.1.3...’.

(6.1.3 does not even refer to a conditioning method while 8.1.3 does.)

Submitter Information Verification

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Submittal Date: Wed Sep 22 17:44:28 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-115-NFPA 1970-2022](#)

Statement: Correction of reference from 6.1.3 to 8.1.3.



Public Input No. 171-NFPA 1970-2021 [Sections 8.26.2, 8.26.3]

Sections 8.26.2, 8.26.3

8.26.2 Samples.

8.26.2.1

Samples for conditioning shall be at least 1 m (1 yd) square.

8.26.2.2

Samples for the conditioning specified in 8.1.5 shall be 150 mm (6 in.) squares cut from a sample subjected to the procedures specified in 8.1.2 12 and 8.1.3.

8.26.3 Specimens.

8.26.3.1

A minimum of five specimens of moisture barrier material shall be tested for each sequence of conditioning.

8.26.3.2

Specimens shall be tested after being subjected to the procedure specified in 8.1.3.

8.26.3.3

Specimens shall also be tested after conditioning as specified in 8.1.2 12, followed by 8.1.3, followed by 8.1.5.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Zip:
Submittal Date: Wed Nov 03 10:56:25 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-127-NFPA 1970-2022

Statement: Adding additional conditioning requirements prior to glove puncture resistance testing for increased durability challenges.



Public Input No. 205-NFPA 1970-2021 [Section No. 8.26.4.1]

8.26.4.1

Specimens shall be tested at 172 kPa (25 psi) in accordance with ~~Method 5512, Water Resistance of Coated Cloth; High Range, Hydrostatic Pressure Method~~, of Federal Test Method Standard 191A, ~~Textile Test Methods~~ ASTM D 751, Hydrostatic Resistance, Procedure A.

Statement of Problem and Substantiation for Public Input

FED STD 191 A has been inactive since June 1990. The ASTM D 751 method utilizes the same equipment and performs the same test.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 206-NFPA 1970-2021 [Section No. 8.26.4.3]</u>	

Submitter Information Verification

Submitter Full Name: Michael Salvato
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City:
State:
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Submittal Date: Fri Nov 05 15:53:08 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-116-NFPA 1970-2022

Statement: Federal Test Method Standard 191A has not been inactive since June 1990. The test method in ASTM D751 Method A, utilizes the same equipment and performs the same test.



Public Input No. 206-NFPA 1970-2021 [Section No. 8.26.4.3]

8.26.4.3

~~There shall be no placement of a restraining cloth over the test specimen during the hydrostatic exposure. A taffeta fabric restraint, conforming to Type III, Class 1 of MIL-C-21852 shall be placed across the back of the sample (on top of the sample) during testing. No area of the taffeta restraint may be used more than once.~~

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
US5650225_Gore_Patent_describing_TAFFETA_Restraint.pdf	Patents and MIL-SPEC demonstrate that it is common to use a restraint to prevent specimen 'bulging/ballooning'. The intent is to measure hydrostatic leakage through the barrier not peak shear stress or tensile strength as the specimen deforms during pressurization	
MIL_C_44187C_Spec_with_taffeta_used.pdf	Patents and MIL-SPEC demonstrate that it is common to use a restraint to prevent specimen 'bulging/ballooning'. The intent is to measure hydrostatic leakage through the barrier not peak shear stress or tensile strength as the specimen deforms during pressurization	
US5026591_Gore_PU_Patent.pdf	Patents and MIL-SPEC demonstrate that it is common to use a restraint to prevent specimen 'bulging/ballooning'. The intent is to measure hydrostatic leakage through the barrier not peak shear stress or tensile strength as the specimen deforms during pressurization	
US5480455_Gore_Patent_that_shows_TAFFETA_Restraint.pdf	Patents and MIL-SPEC demonstrate that it is common to use a restraint to prevent specimen 'bulging/ballooning'. The intent is to measure hydrostatic leakage through the barrier not peak shear stress or tensile strength as the specimen deforms during pressurization	

Statement of Problem and Substantiation for Public Input

The theory behind this test is that it represents the worst case of a person kneeling or sitting in a puddle of water. The test is to ensure that the resulting hydrostatic pressure does not penetrate the barrier sample and cause water leakage into the garment. The performance criteria of 25-psi is a 'worst case' hydrostatic pressure calculated as a 200-lb person, kneeling on one knee to form a 3"x3" area where pressure could be applied.

The allowance of a taffeta restraint better represents the barrier material property as worn by end-users. When the barriers is exposed in the field to a hydrostatic pressure due to a wearer kneeling, sitting or placing pressure on the material in water, there will always be the person's body acting as a restraint. In all likelihood and for the purposes of this standard there will also be other clothing items worn between the person's body and the moisture barrier.

The restraint ensures that this method test only the hydrostatic property of the barrier. When many barriers are tested in this method without a restraint they expand and 'balloon' under the pressure as it builds to 10-psi. While the specimen 'balloons', the pressure does not build under it. The mode of failure for these barriers is not due to hydrostatic resistance. Instead it is due to an unrealistic tensile load that occurs due to the stretching barrier. Often the mode of failure occurs due to the excessive shear stress that develops in the adhesive bonds between the barrier material and textile. For this

reason, this method, without a restraint is also design limiting as new barrier materials are investigated for PFAS-free moisture barriers.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 205-NFPA 1970-2021 [Section No. 8.26.4.1]	modification is suitable for either Hydrostatic test method

Submitter Information Verification

Submitter Full Name: Michael Salvato
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Submittal Date: Fri Nov 05 15:57:59 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-177-NFPA 1970-2022

Statement: The committee considered the concerns from the submitter that the current requirement for evaluating an unrestrained moisture barrier sample could prevent the use of moisture barriers based on alternative material technologies.

An investigation of the reasons for including the water penetration (hydrostatic) resistance test identified that the original requirement was part of the first edition of NFPA 1971 promulgated in 1975 using FTMS 191A,5512, "Water resistance of coated cloth: high range, hydrostatic pressure method." The requirement and method remained unchanged until 1986 when the 25 psi water resistance requirement was applied to samples that were both pristine and subjected to 5 home laundering cycles. In the 1991 edition, a water permeability test requirement using a test pressure of 1 psi with a different test method (based on FTMS 191A,5516 – "Water resistance of coated cloth; water permeability; hydrostatic pressure method") was added for the evaluation of the moisture barrier water penetration in addition to the subject test. For the 1997 edition, the same two hydrostatic tests remained in the standard but were supplemented with newly developed criteria and test methods for moisture barrier liquid and viral penetration resistance. The low pressure (1 psi) hydrostatic test was removed in the 2000 edition of NFPA 1971 because it was believed that the liquid and viral penetration resistance tests provided a suitable assessment of moisture barrier water and liquid penetration qualities, but the high pressure hydrostatic test was retained because it was considered to provide an evaluation of the coating and lamination quality of the moisture barrier for maintaining its barrier performance.

In the 2007 edition of NFPA 1971, the barrier and hydrostatic requirements stayed the same, but two additional provisions were added to the hydrostatic test method, which included the clarification of the specimen orientation and the prohibition for using a fabric restraint in evaluating the specimen. According to the records for the revision of the 2007 edition, public comments were submitted to reflect current testing practice for the conduct of the test method (see page 63 of: <https://www.nfpa.org/assets/files/AboutTheCodes/1971/1971-A2006-ROC.pdf>). In 2013, the specific language on the specimen orientation was further clarified to how it currently appears in successive editions of the standard based on a public comment that appears on page 110 at:

https://www.nfpa.org/Assets/files/AboutTheCodes/1971/1971_F2011_FAE-SPF_ROC_ballot.pdf

The committee has also undertaken changes in the standard to better assess the continued performance of the moisture barrier in terms of its ability to maintain appropriate integrity and barrier qualities. One such change is to introduce a range of conditioning steps applied before testing that include repeated laundering, heat exposures, UV light exposure, and flexing/abrasion applied to samples in composite form (See First Revision 122 that introduces new section 8.1.22). This new sequence of conditioning steps is designed to more realistically subject composite samples to the types of environmental exposures that would be expected from use on the fireground and were incorporated into the water penetration resistance test through First Revision 127. Nevertheless, the proposed changes will likely affect material performance in yet to be determined ways and thus warrant a more thorough investigation on the specific test method approach and criteria to match end user expectations for moisture barrier service life and performance.

An annex section has been added to paragraph A.8.26.4.3 to provide the reasons for prohibiting the use of a fabric restraint, but indicate that its use is a matter of continuing investigation. This investigation will take place as part of the process between the conclusion of first draft revisions and the preparation of the second

draft.



Public Input No. 222-NFPA 1970-2021 [Section No. 8.27.3.2]

8.27.3.2

Glove specimens shall be tested after being subjected to the following conditioning:

- (1) Specimens shall first be subjected to the procedure specified in 8.1.44 12.
- (2) Specimens shall then be conditioned as specified in 8.1.3.
- (3) Specimens shall then be conditioned as specified in 8.1.5.
- (4) Specimens shall then be conditioned as specified in 8.1.3.

Statement of Problem and Substantiation for Public Input

Editorial. Correcting reference to glove laundering method instead of glove flexing method.

Submitter Information Verification

Submitter Full Name: Amanda Newsom

Organization: UL LLC

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City:

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Submittal Date: Mon Nov 08 09:40:16 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-128-NFPA 1970-2022](#)

Statement: The extractor laundering conditioning method is being moved to Section 8.1.2. Therefore, this section needs to be revised to reflect the extractor conditioning method.



Public Input No. 172-NFPA 1970-2021 [Section No. 8.27.3.4]

8.27.3.4

Moisture barrier materials and moisture barrier seam specimens shall be tested after being twice subjected to the following conditioning:

- (1) Specimens shall first be subjected to the procedure specified in 8.1.2 12 .
- (2) Specimens shall then be conditioned as specified in 8.1.3.
- (3) Specimens shall then be conditioned as specified in 8.1.5.
- (4) Specimens shall then be conditioned at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$) and at a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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City:
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Submittal Date: Wed Nov 03 10:59:09 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.

**Public Input No. 223-NFPA 1970-2021 [Section No. 8.28.3.2]****8.28.3.2**

Glove specimens shall be tested after being subjected to the following conditioning:

- (1) Specimens shall first be subjected to the procedure specified in 8.1.44 12.
- (2) Specimens shall then be conditioned as specified in 8.1.3.
- (3) Specimens shall then be conditioned as specified in 8.1.5.
- (4) Specimens shall then be conditioned as specified in 8.1.3.

Statement of Problem and Substantiation for Public Input

Editorial. Correcting reference to glove laundering method instead of glove flexing method.

Submitter Information Verification

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Zip:

Submittal Date: Mon Nov 08 09:41:26 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-129-NFPA 1970-2022](#)

Statement: The extractor laundering conditioning method is being moved to Section 8.1.2. Therefore, this section needs to be revised to reflect the extractor conditioning method.



Public Input No. 173-NFPA 1970-2021 [Section No. 8.28.3.4]

8.28.3.4

Moisture barrier material and moisture barrier seam specimens shall be tested after being twice subjected to the following conditioning:

- (1) Specimens shall first be subjected to the procedure specified in 8.1.2 12 .
- (2) Specimens shall then be conditioned as specified in 8.1.3.
- (3) Specimens shall then be conditioned as specified in 8.1.5.
- (4) Specimens shall then be conditioned at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$) and at a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 11:00:00 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.



Public Input No. 201-NFPA 1970-2021 [Section No. 8.28.5]

8.28.5 Report.

8.28.5.1 The pass or fail performance for each specimen shall be recorded and reported.

8.28.5.2 The assay titer in PFU/mL of Phi-X174 shall be recorded and reported.

Statement of Problem and Substantiation for Public Input

Often the bacteriophage testing results in false failures due to minor cross contamination from the test cell or leakage at the seals. Modifying the Reporting paragraph to include an assay titer of the Phi-X174 will allow for a more consistent Interpretation of the results and should significantly reduce the amount of retesting and randomly failing specimens for no apparent reason.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 203-NFPA 1970-2021 [Section No. 8.28.6]</u>	

Submitter Information Verification

Submitter Full Name: Michael Salvato
Organization: Stedfast USA
Street Address:
City:
State:
Zip:
Submittal Date: Fri Nov 05 15:17:53 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-162-NFPA 1970-2022

Statement: Often the bacteriophage testing results in false failures due to minor cross contamination from the test cell or leakage at the seals. Modifying the Reporting paragraph to include an assay titer of the Phi-X174 will allow for a more consistent Interpretation of the results and should significantly reduce the amount of retesting and randomly failing specimens for no apparent reason.



Public Input No. 203-NFPA 1970-2021 [Section No. 8.28.6]

8.28.6 Interpretation.

~~A failure of any specimen against any virus constitutes failure of the material~~

Specimens shall exhibit no more than 10 PFU/ml of Phi-X174 in the assay titer to pass the test .

Statement of Problem and Substantiation for Public Input

Often the bacteriophage testing results in false failures due to minor cross contamination from the test cell or leakage at the seals. Modifying the Interpretation paragraph to include a specified assay titer of the Phi-X174 will allow for a more consistent Interpretation of the results and should significantly reduce the amount of retesting and randomly failing specimens for no apparent reason.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 201-NFPA 1970-2021 [Section No. 8.28.5]</u>	adding assay titer and performance value for assay titer

Submitter Information Verification

Submitter Full Name: Michael Salvato
Organization: Stedfast USA
Street Address:
City:
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Submittal Date: Fri Nov 05 15:32:05 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-163-NFPA 1970-2022

Statement: Revised language needed to be consistent with other standards within the project. This test is highly sensitive to false positive failures. A few of the reasons include: 1. Inadequacy of the test cell to properly seal and prevent possible wicking of the contaminant on certain materials. 2. The multiple transfers required to prepare, expose and analyze samples and results. 3. The inability to detect whether or not cross contamination or residual contaminants exist throughout the entire testing process Through historical data, when PFU counts have no more than 10, the resolution to that failure is typically a simple retest with no modification to the product. This leads the labs and manufacturers to conduct multiple rounds of expensive testing due to a false failure that is inherent to the test method. When actual failure occurs, the PFU counts are substantially higher and generally too numerous to count. For perspective, the test consists of exposing specimens to over a million PFUs. Having <10 show up at the end of the test is considered to be contamination and not an indication of material performance or safety.



Public Input No. 77-NFPA 1970-2021 [Section No. 8.28.6]

8.28.6 Interpretation.

Specimens shall exhibit no more than 10 PFU/mL of Phi-X174 in the assay titer to pass the test. A failure of any specimen against any virus constitutes failure of the material.

Statement of Problem and Substantiation for Public Input

Revised language needed to be consistent with other standards within the project. This test is highly sensitive to false positive failures. A few of the reasons include: 1. Inadequacy of the test cell to properly seal and prevent possible wicking of the contaminant on certain materials. 2. The multiple transfers required to prepare, expose and analyze samples and results. 3. The inability to detect whether or not cross contamination or residual contaminants exist throughout the entire testing process Through historical data, when PFU counts have no more than 10, the resolution to that failure is typically a simple retest with no modification to the product. This leads the labs and manufacturers to conduct multiple rounds of expensive testing due to a false failure that is inherent to the test method. When actual failure occurs, the PFU counts are substantially higher and generally too numerous to count. For perspective, the test consists of exposing specimens to over a million PFUs. Having <10 show up at the end of the test is considered to be contamination and not an indication of material performance or safety.

Submitter Information Verification

Submitter Full Name: William Fithian
Organization: ASTM/Safety Equipment Institute
Street Address:
City:
State:
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Submittal Date: Thu Sep 23 11:05:10 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-163-NFPA 1970-2022

Statement: Revised language needed to be consistent with other standards within the project. This test is highly sensitive to false positive failures. A few of the reasons include: 1. Inadequacy of the test cell to properly seal and prevent possible wicking of the contaminant on certain materials. 2. The multiple transfers required to prepare, expose and analyze samples and results. 3. The inability to detect whether or not cross contamination or residual contaminants exist throughout the entire testing process Through historical data, when PFU counts have no more than 10, the resolution to that failure is typically a simple retest with no modification to the product. This leads the labs and manufacturers to conduct multiple rounds of expensive testing due to a false failure that is inherent to the test method. When actual failure occurs, the PFU counts are substantially higher and generally too numerous to count. For perspective, the test consists of exposing specimens to over a million PFUs. Having <10 show up at the end of the test is considered to be contamination and not an indication of material performance or safety.



Public Input No. 180-NFPA 1970-2021 [New Section after 8.33]

Evaporative Resistance Test Method

8.xx Evaporative Resistance Test .

8.xx.1 Application.

8.xx.1.1 This test method shall apply to structural fire fighting protective garment elements component composites.

8.xx.2 Samples. Samples shall be conditioned at a temperature of 35 °C +/- 2 °C and a relative humidity of 40% +/- 5% for at least 4 hours.

8.xx.2.1 The minimum sample size shall be 51 cm X 51 cm (20 in. X 20in.).

8.xx.3 Specimens.

8.xx.3.1 Evaporative resistance testing shall be conducted on at least three specimens.

8.xx.3.2 Specimens shall consist of all layers in the structural fire fighting protective garment composite, arranged in the order and orientation as worn.

8.xx.4 Apparatus.

8.xx.4.1 The test apparatus shall be as specified in ASTM F1868, Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate.

8.xx.4.2 The dimensions for the sweating guarded hot plate shall be a 25.4 cm (10 in.) test plate with a 12.7 cm (5 in.) guard surrounding the test plate.

8.xx.5 Procedure. Testing shall be conducted in accordance with ASTM F1868, Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate, using part B, with the following modifications:

- (1) The specimen shall be placed on the test plate with the side normally facing the human body toward the test plate.
- (2) For multiple layers, the layers shall be arranged in the order and orientation as worn.
- (3) Each layer shall be smoothed by hand to eliminate wrinkles or bubbles in each layer and, if necessary, the edges shall be secured.
- (4) Once the test is started, no further adjustments to the specimen shall be made.

8.xx.6 Report.

8.xx.6.1 The average intrinsic evaporative resistance of the sample shall be reported and recorded in units of Pa·m² /W.

8.xx.7 Interpretation.

8.xx.7.1 Pass or fail determination shall be based on the average reported evaporative resistance measurements of all specimens tested.

8.xx.7.2 If an individual result from any test set varies more than +/- 10 percent from the average result, the results from the test set shall be discarded and another set of specimens shall be tested.

Statement of Problem and Substantiation for Public Input

The inclusion of this test method is supported by data generated from a DHS AFG project¹. In this project a physiological manikin was used to compare ensembles made with a range of THL and evaporative resistance values². Testing was conducted in one mild environment (25C, 65%RH) and two hot environments (35 C, 40% RH, & 40 C, 28% RH). Results indicated that THL was the best predictor of heat stress in mild environments while Evaporative Resistance measurements were a better predictor of heat stress in hotter conditions. Based on these correlations and the fact that firefighters face more heat stress in hotter conditions³ evaporative resistance of composites should be included as a performance requirement within NFPA 1971.

¹ Barker R., Developing a new basis for rating the heat strain of firefighter turnout gear. Final report, Federal Emergency Management Agency, Contract No. EMW-2016-FP-00744; 2021.

² Gao H, Deaton S., Barker R., Fang X, Watson K. Relationship between heat loss indexes and physiological indicators of turnout related heat strain in mild and hot environments. International Journal of Occupational Safety and

Ergonomics. 2021 Submitted.

3 Barker R., Fang X., Deaton S, DenHartog E, Gao H, Tutterow R, Schmid M. Identifying factors that contribute to structural firefighter heat strain in North America. International Journal of Occupational Safety and Ergonomics. 2021 Sep 29 (just-accepted):1-26.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 179-NFPA 1970-2021 [New Section after 7.2.2]	Method for the requirement
Public Input No. 209-NFPA 1970-2021 [New Section after A.7.2.2]	
Public Input No. 210-NFPA 1970-2021 [New Section after B.1]	

Submitter Information Verification

Submitter Full Name: Anthony Deaton
Organization: NC State University
Affiliation: Also representing the NFPA 1971 task group evaluating evaporative resistance as a testing requirement
Street Address:
City:
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Zip:
Submittal Date: Wed Nov 03 14:20:04 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-175-NFPA 1970-2022](#)

Statement: The inclusion of this test method is supported by data generated from a DHS AFG project¹. In this project a physiological manikin was used to compare ensembles made with a range of THL and evaporative resistance values². Testing was conducted in one mild environment (25C, 65%RH) and two hot environments (35 C, 40% RH, & 40 C, 28% RH). Results indicated that THL was the best predictor of heat stress in mild environments while Evaporative Resistance measurements were a better predictor of heat stress in hotter conditions. Based on these correlations and the fact that firefighters face more heat stress in hotter conditions³ evaporative resistance of composites should be included as a performance requirement within NFPA 1971. The performance requirements of 45 Pa·m²/W suggestion comes from the data from the project as well. All evaporative resistance values below this value did not show a significantly physiological difference in the 35 C environment.

Annex information is provided to support the new Evaporative Resistance Test method.

Since evaporative resistances are additive—which is not true for heat loss—an option exists to reduce the total amount of testing. The optional test sequence provided in this comment delineated an alternative method to testing every combination of outer shell, moisture barrier, or thermal barrier for evaporative resistance testing. As an example, if all the permutations of 15 outer shells, 6 moisture barriers, and 15 thermal barriers were considered, a total of 1350 composites (excluding replicates) would need to be tested, the same amount that would be required for THL testing. With this optional test sequence, this could be reduced to 105 evaporative resistance tests (excluding replicates). Proof of concept for this methodology has been demonstrated based on four composites using a range of outer shell, moisture barrier, and thermal barrier technologies. Based on the figures below, the optional test sequence based on measuring moisture barrier and thermal liner layers with a control fabric and adding back the intended outer shell layer to calculate the evaporative resistance appears to provide accurate estimate of absolute evaporative resistance of composite. The methodology could be applied to the initial and/or re-certification processes.

1 Barker R., Developing a new basis for rating the heat strain of firefighter turnout gear. Final report, Federal Emergency Management Agency, Contract No. EMW-2016-FP-00744; 2021.

2 Gao H, Deaton S., Barker R., Fang X, Watson K. Relationship between heat loss indexes and physiological indicators of turnout related heat strain in mild and hot environments. International Journal of Occupational Safety and Ergonomics. 2021 Submitted.

3 Barker R., Fang X., Deaton S, DenHartog E, Gao H, Tutterow R, Schmid M. Identifying factors that contribute to structural firefighter heat strain in North America. International Journal of Occupational Safety and Ergonomics. 2021 Sep 29 (just-accepted):1-26.



Public Input No. 268-NFPA 1970-2021 [New Section after 8.33]

TITLE OF NEW CONTENT

Type your content here ...Specimens shall be tested both before and after conditioning as specified in 8.1.2 and then conditioning as specified in 8.1.3.

Statement of Problem and Substantiation for Public Input

The current standard only tests the THL of a new composite. The TPP is tested both new and after 5 washes. The end user would benefit knowing what the THL drops to after having the composite tested after 5 washes. Fire departments interested in selecting new PPE would greatly appreciate this information when choosing new bunker gear..

Submitter Information Verification

Submitter Full Name: Dennis Chavez

Organization: San Antonio Fire Department

Street Address:

City:

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Zip:

Submittal Date: Tue Nov 09 14:58:34 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-176-NFPA 1970-2022

Statement: The committee agrees with the submitter to allow comparison for how laundering may affect garment composite THL values; however, the impact of laundering would best be evaluated in whole garment THL testing covered in Annex H, which uses full garments on a sweating manikin test apparatus. This information in addition to the other reasons for why THL testing is not conducted on washed composite samples was instead included as additional statements in the already existing Annex section for the THL performance requirement.

The use of THL in the NFPA standards is about helping reduce heat stress and not about how garments feel or how they are perceived in the field. Therefore the reference for 20 to 25 W/m² difference is not relevant. Instead, the referenced paper indicates that a difference of 60 to 70 W/m² was the minimum amount needed for a detectable change in performance. Modeling efforts are underway to determine the ability to discriminate physiological differences for the current range of compliant garment composites.



Public Input No. 269-NFPA 1970-2021 [Section No. 8.34.4.1]

8.34.4.1

An ISO-size J headform conforming to the nominal dimensions in Figure 8-16 _ **The chin strap elongation test fixture shall consist of rigid material of sufficient thickness to facilitate firm attachment of the helmet assembly while attached to the chinstrap tensile testing machined specified in 8.35 .4.1 - shall be used .**

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Sec_8_34_4_1_NFPA_1971_Revision_-_First_Draft_MSA_Comment.docx		

Statement of Problem and Substantiation for Public Input

Substantiation:

Requirement 7.4.7 and corresponding test method 8.34 Retention System Test are intended to evaluate the helmet chinstrap's elongation and its resistance to breaking or stretching under applied force. However, the current test procedure is prone to variability in set-up and testmanship, especially when certain types of 3-point or 4-point chinstraps are evaluated.

One advantage to 3-point and 4-point chinstraps is that they can improve helmet retention while optimizing fitment for diverse firefighter anthropometrics. 2-point chinstraps are typically in-line with the helmet center-of-gravity and are located close the firefighter's ears as a result. The current test method favors this attachment location. By moving the front chinstrap connection forward and adding rear nape straps, 3-point and 4-point chinstraps can offer firefighters equivalent or even improved helmet security while also improving ear fitment.

However, based on the current 8.34 test procedure, certain types of 3-point and 4-point chinstraps tend to cause forward helmet rotation during testing, making results more unpredictable and unreliable. This rotation doesn't represent helmet behavior during actual use and contributes significantly to test variability. In more extreme cases, it can prevent chinstraps with a better anthropometric fit from being offered with NFPA certification. As a potential solution, A8.34.5.4 suggests testing with a brace that allows vertical movement of the helmet but prevents horizontal plane rotation. However, implementation of this suggestion could be inconsistent and pose additional burden on test labs because such a brace must be helmet specific.

For reference, the inconsistency caused by helmet rotation has been noted for other similar chinstrap elongation tests like EN12492:2012 through inter-laboratory comparison studies. (see attached doc for supporting photographic information)

An alternative test method is proposed which (1) retains the intent to evaluate chinstrap elongation and resistance to breaking or stretching under applied force, while (2) reduces test variability.

In this alternative method, chinstrap assemblies will be tested for elongation and resistance to breaking or stretching using a fixture very similar to the Shell Retention Test. With this new method, the chinstrap loading and 20 mm elongation requirement are unchanged, but questions about the effects of helmet rotation and whether the helmet should be braced eliminated. Effectively, the chinstrap assembly is mounted on a steel plate fixture and tested for strength and elongation in a more repeatable controlled fashion. Additionally, limiting the vertical deflection from the shell and suspension is not a departure from the test intent today, since deflection measured at the top of the helmet shell is subtracted from the total system elongation.

Finally, section 7.4.9 Shell Retention Test will continue to be used to assess the strength of retention system attachments, including that of the chinstrap.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 270-NFPA 1970-2021 [Section No. 8.34.5.3]	
Public Input No. 271-NFPA 1970-2021 [Section No. 8.34.5.6]	

Submitter Information Verification

Submitter Full Name: John Rihn
Organization: Globe Manufacturing/Mine Safety

Street Address:**City:****State:****Zip:****Submittal Date:** Tue Nov 09 16:35:29 EST 2021**Committee:** FAE-SPF**Committee Statement****Resolution:** FR-74-NFPA 1970-2022

Statement: Requirement 7.4.7 and corresponding test method 8.34 Retention System Test are intended to evaluate the helmet chinstrap's elongation and its resistance to breaking or stretching under applied force. However, the current test procedure is prone to variability in set-up and testmanship, especially when certain types of 3-point or 4-point chinstraps are evaluated.

One advantage to 3-point and 4-point chinstraps is that they can improve helmet retention while optimizing fitment for diverse firefighter anthropometrics. 2-point chinstraps are typically in-line with the helmet center-of-gravity and are located close the firefighter's ears as a result. The current test method favors this attachment location. By moving the front chinstrap connection forward and adding rear nape straps, 3-point and 4-point chinstraps can offer firefighters equivalent or even improved helmet security while also improving ear fitment.

However, based on the current 8.34 test procedure, certain types of 3-point and 4-point chinstraps tend to cause forward helmet rotation during testing, making results more unpredictable and unreliable. This rotation doesn't represent helmet behavior during actual use and contributes significantly to test variability. In more extreme cases, it can prevent chinstraps with a better anthropometric fit from being offered with NFPA certification. As a potential solution, A.8.34.5.4 suggests testing with a brace that allows vertical movement of the helmet but prevents horizontal plane rotation. However, implementation of this suggestion could be inconsistent and pose additional burden on test labs because such a brace must be helmet specific.

For reference, the inconsistency caused by helmet rotation has been noted for other similar chinstrap elongation tests like EN12492:2012 through inter-laboratory comparison studies.

An alternative test method is proposed which (1) retains the intent to evaluate chinstrap elongation and resistance to breaking or stretching under applied force, while (2) reduces test variability. In this alternative method, chinstrap assemblies will be tested for elongation and resistance to breaking or stretching using a fixture very similar to the Shell Retention Test. With this new method, the chinstrap loading and 20 mm elongation requirement are unchanged, but questions about the effects of helmet rotation and whether the helmet should be braced eliminated. Effectively, the chinstrap assembly is mounted on a steel plate fixture and tested for strength and elongation in a more repeatable controlled fashion. Additionally, limiting the vertical deflection from the shell and suspension is not a departure from the test intent today, since deflection measured at the top of the helmet shell is subtracted from the total system elongation.

Finally, section 7.4.9, Shell Retention Test, will continue to be used to assess the strength of retention system attachments, including that of the chinstrap.



Public Input No. 270-NFPA 1970-2021 [Section No. 8.34.5.3]

8.34.5.3

~~The headform. The test fixture~~ and mechanical chin structure shall be positioned so that the vertical straight line distance between the bottom of the rollers and the ~~crown of the headform is 210 mm~~ helmet reference plane is 110 mm $\pm$ 10 mm (8 $\frac{5}{16}$ in. $\pm$ $\frac{3}{8}$ in.), the chinstrap shall be passed around the rollers, and the helmet shall be ~~secured to the headform~~ positioned and secured in a fixture so that the helmet's reference plane is horizontal and so that the helmet rotation is prevented during the test. The chin strap shall be adjusted and preloaded to 45 N $\pm$ 5 N (10 lbf $\pm$ 1 lbf). ~~The distance between the top position of the helmet and the bottom of the rollers shall be rollers shall~~ measured and recorded to the nearest 0.5 mm (1/64 in.).

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Sec_8_34_4_1_NFPA_1971_Revision_-_First_Draft_MSA_Comment.docx		

Statement of Problem and Substantiation for Public Input

Substantiation:

Requirement 7.4.7 and corresponding test method 8.34 Retention System Test are intended to evaluate the helmet chinstrap's elongation and its resistance to breaking or stretching under applied force. However, the current test procedure is prone to variability in set-up and testmanship, especially when certain types of 3-point or 4-point chinstraps are evaluated.

One advantage to 3-point and 4-point chinstraps is that they can improve helmet retention while optimizing fitment for diverse firefighter anthropometrics. 2-point chinstraps are typically in-line with the helmet center-of-gravity and are located close the firefighter's ears as a result. The current test method favors this attachment location. By moving the front chinstrap connection forward and adding rear nape straps, 3-point and 4-point chinstraps can offer firefighters equivalent or even improved helmet security while also improving ear fitment.

However, based on the current 8.34 test procedure, certain types of 3-point and 4-point chinstraps tend to cause forward helmet rotation during testing, making results more unpredictable and unreliable. This rotation doesn't represent helmet behavior during actual use and contributes significantly to test variability. In more extreme cases, it can prevent chinstraps with a better anthropometric fit from being offered with NFPA certification. As a potential solution, A8.34.5.4 suggests testing with a brace that allows vertical movement of the helmet but prevents horizontal plane rotation. However, implementation of this suggestion could be inconsistent and pose additional burden on test labs because such a brace must be helmet specific.

For reference, the inconsistency caused by helmet rotation has been noted for other similar chinstrap elongation tests like EN12492:2012 through inter-laboratory comparison studies.

An alternative test method is proposed which (1) retains the intent to evaluate chinstrap elongation and resistance to breaking or stretching under applied force, while (2) reduces test variability.

In this alternative method, chinstrap assemblies will be tested for elongation and resistance to breaking or stretching using a fixture very similar to the Shell Retention Test. With this new method, the chinstrap loading and 20 mm elongation requirement are unchanged, but questions about the effects of helmet rotation and whether the helmet should be braced eliminated. Effectively, the chinstrap assembly is mounted on a steel plate fixture and tested for strength and elongation in a more repeatable controlled fashion. Additionally, limiting the vertical deflection from the shell and suspension is not a departure from the test intent today, since deflection measured at the top of the helmet shell is subtracted from the total system elongation.

Finally, section 7.4.9 Shell Retention Test will continue to be used to assess the strength of retention system attachments, including that of the chinstrap.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 269-NFPA 1970-2021 [Section No. 8.34.4.1]	Test method to 8.34.4.1
Public Input No. 271-NFPA 1970-2021 [Section No. 8.34.5.6]	

Submitter Information Verification

Submitter Full Name: John Rihn
Organization: Globe Manufacturing/Mine Safety
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 16:44:28 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-75-NFPA 1970-2022

Statement: Requirement 7.4.7 and corresponding test method 8.34 Retention System Test are intended to evaluate the helmet chinstrap's elongation and its resistance to breaking or stretching under applied force. However, the current test procedure is prone to variability in set-up and testmanship, especially when certain types of 3-point or 4-point chinstraps are evaluated.

One advantage to 3-point and 4-point chinstraps is that they can improve helmet retention while optimizing fitment for diverse firefighter anthropometrics. 2-point chinstraps are typically in-line with the helmet center-of-gravity and are located close the firefighter's ears as a result. The current test method favors this attachment location. By moving the front chinstrap connection forward and adding rear nape straps, 3-point and 4-point chinstraps can offer firefighters equivalent or even improved helmet security while also improving ear fitment.

However, based on the current 8.34 test procedure, certain types of 3-point and 4-point chinstraps tend to cause forward helmet rotation during testing, making results more unpredictable and unreliable. This rotation doesn't represent helmet behavior during actual use and contributes significantly to test variability. In more extreme cases, it can prevent chinstraps with a better anthropometric fit from being offered with NFPA certification. As a potential solution, A.8.34.5.4 suggests testing with a brace that allows vertical movement of the helmet but prevents horizontal plane rotation. However, implementation of this suggestion could be inconsistent and pose additional burden on test labs because such a brace must be helmet specific.

For reference, the inconsistency caused by helmet rotation has been noted for other similar chinstrap elongation tests like EN12492:2012 through inter-laboratory comparison studies.

An alternative test method is proposed which (1) retains the intent to evaluate chinstrap elongation and resistance to breaking or stretching under applied force, while (2) reduces test variability. In this alternative method, chinstrap assemblies will be tested for elongation and resistance to breaking or stretching using a fixture very similar to the Shell Retention Test. With this new method, the chinstrap loading and 20 mm elongation requirement are unchanged, but questions about the effects of helmet rotation and whether the helmet should be braced eliminated. Effectively, the chinstrap assembly is mounted on a steel plate fixture and tested for strength and elongation in a more repeatable controlled fashion. Additionally, limiting the vertical deflection from the shell and suspension is not a departure from the test intent today, since deflection measured at the top of the helmet shell is subtracted from the total system elongation.

Finally, section 7.4.9, Shell Retention Test, will continue to be used to assess the strength of retention system attachments, including that of the chinstrap.



Public Input No. 271-NFPA 1970-2021 [Section No. 8.34.5.6]

8.34.5.6

The ~~distance between the top of the helmet and the bottom of the rollers~~ roller's position shall be measured and recorded again after the force has been maintained at 445 N (100 lbf) for 60 seconds, +15/-0 seconds. The difference between the second measurement and the first shall be the retention system elongation.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Sec_8_34_4_1_NFPA_1971_Revision_-_First_Draft_MSA_Comment.docx		

Statement of Problem and Substantiation for Public Input

Substantiation:

Requirement 7.4.7 and corresponding test method 8.34 Retention System Test are intended to evaluate the helmet chinstrap's elongation and its resistance to breaking or stretching under applied force. However, the current test procedure is prone to variability in set-up and testmanship, especially when certain types of 3-point or 4-point chinstraps are evaluated.

One advantage to 3-point and 4-point chinstraps is that they can improve helmet retention while optimizing fitment for diverse firefighter anthropometrics. 2-point chinstraps are typically in-line with the helmet center-of-gravity and are located close the firefighter's ears as a result. The current test method favors this attachment location. By moving the front chinstrap connection forward and adding rear nape straps, 3-point and 4-point chinstraps can offer firefighters equivalent or even improved helmet security while also improving ear fitment.

However, based on the current 8.34 test procedure, certain types of 3-point and 4-point chinstraps tend to cause forward helmet rotation during testing, making results more unpredictable and unreliable. This rotation doesn't represent helmet behavior during actual use and contributes significantly to test variability. In more extreme cases, it can prevent chinstraps with a better anthropometric fit from being offered with NFPA certification. As a potential solution, A8.34.5.4 suggests testing with a brace that allows vertical movement of the helmet but prevents horizontal plane rotation. However, implementation of this suggestion could be inconsistent and pose additional burden on test labs because such a brace must be helmet specific.

For reference, the inconsistency caused by helmet rotation has been noted for other similar chinstrap elongation tests like EN12492:2012 through inter-laboratory comparison studies.

An alternative test method is proposed which (1) retains the intent to evaluate chinstrap elongation and resistance to breaking or stretching under applied force, while (2) reduces test variability.

In this alternative method, chinstrap assemblies will be tested for elongation and resistance to breaking or stretching using a fixture very similar to the Shell Retention Test. With this new method, the chinstrap loading and 20 mm elongation requirement are unchanged, but questions about the effects of helmet rotation and whether the helmet should be braced eliminated. Effectively, the chinstrap assembly is mounted on a steel plate fixture and tested for strength and elongation in a more repeatable controlled fashion. Additionally, limiting the vertical deflection from the shell and suspension is not a departure from the test intent today, since deflection measured at the top of the helmet shell is subtracted from the total system elongation.

Finally, section 7.4.9 Shell Retention Test will continue to be used to assess the strength of retention system attachments, including that of the chinstrap.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 269-NFPA 1970-2021 [Section No. 8.34.4.1]	Test method to 8.34.4.1
Public Input No. 270-NFPA 1970-2021 [Section No. 8.34.5.3]	Test method to 8.34.4.1

Submitter Information Verification

Submitter Full Name: John Rihn
Organization: Globe Manufacturing/Mine Safety
Street Address:

City:
State:
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Submittal Date: Tue Nov 09 16:54:01 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-76-NFPA 1970-2022

Statement: Requirement 7.4.7 and corresponding test method 8.34 Retention System Test are intended to evaluate the helmet chinstrap's elongation and its resistance to breaking or stretching under applied force. However, the current test procedure is prone to variability in set-up and testmanship, especially when certain types of 3-point or 4-point chinstraps are evaluated.

One advantage to 3-point and 4-point chinstraps is that they can improve helmet retention while optimizing fitment for diverse firefighter anthropometrics. 2-point chinstraps are typically in-line with the helmet center-of-gravity and are located close the firefighter's ears as a result. The current test method favors this attachment location. By moving the front chinstrap connection forward and adding rear nape straps, 3-point and 4-point chinstraps can offer firefighters equivalent or even improved helmet security while also improving ear fitment.

However, based on the current 8.34 test procedure, certain types of 3-point and 4-point chinstraps tend to cause forward helmet rotation during testing, making results more unpredictable and unreliable. This rotation doesn't represent helmet behavior during actual use and contributes significantly to test variability. In more extreme cases, it can prevent chinstraps with a better anthropometric fit from being offered with NFPA certification. As a potential solution, A.8.34.5.4 suggests testing with a brace that allows vertical movement of the helmet but prevents horizontal plane rotation. However, implementation of this suggestion could be inconsistent and pose additional burden on test labs because such a brace must be helmet specific.

For reference, the inconsistency caused by helmet rotation has been noted for other similar chinstrap elongation tests like EN12492:2012 through inter-laboratory comparison studies.

An alternative test method is proposed which (1) retains the intent to evaluate chinstrap elongation and resistance to breaking or stretching under applied force, while (2) reduces test variability. In this alternative method, chinstrap assemblies will be tested for elongation and resistance to breaking or stretching using a fixture very similar to the Shell Retention Test. With this new method, the chinstrap loading and 20 mm elongation requirement are unchanged, but questions about the effects of helmet rotation and whether the helmet should be braced eliminated. Effectively, the chinstrap assembly is mounted on a steel plate fixture and tested for strength and elongation in a more repeatable controlled fashion. Additionally, limiting the vertical deflection from the shell and suspension is not a departure from the test intent today, since deflection measured at the top of the helmet shell is subtracted from the total system elongation.

Finally, section 7.4.9, Shell Retention Test, will continue to be used to assess the strength of retention system attachments, including that of the chinstrap.



Public Input No. 149-NFPA 1970-2021 [Section No. 8.48.1]

8.48.1 Application.

8.48.1.1

This test method shall apply to protective garments, protective coats with an integrated garment-glove interface, protective trousers with integrated booties, ~~and entire ensembles~~ protective garments with integrated hoods, and protective garments that are being evaluated for the optional liquid and particulate contaminant protection.

8.48.1.2

Modifications to this test method for testing protective coats and protective coats with an integrated garment-glove interface shall be as specified in 8.48.9.

8.48.1.3

Modifications to this test method for testing protective trousers and protective trousers with integrated booties shall be as specified in 8.48.10.

8.48.1.4

Modifications to this test method for testing protective coat and trouser sets or protective coveralls shall be as specified in 8.48.11.

8.48.1.5

Modifications to this test method for testing proximity firefighting ensemble garment elements shall be as specified in 8.48.12.

8.48.1.6

Modifications to this test method for testing ~~entire ensembles~~ garments for optional liquid and particulate contaminant protection shall be as specified in 8.48.13.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 08:13:01 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-241-NFPA 1970-2022](#)

Statement: In order to align the testing requirements with the changes being introduced to the performance requirements, these updates are necessary in order to clarify that the evaluation needs to be made utilizing garment specimens instead of full ensembles.

**Public Input No. 150-NFPA 1970-2021 [Section No. 8.48.3.1]****8.48.3.1**

A minimum of three specimens shall be tested. Specimens shall consist of individual coats, trousers, ~~or~~ coverall elements; or sets of coats and trousers elements ~~, or entire ensembles~~ for liquid and particulate contaminant protection. Each element shall have in place all layers that are required for the element to be compliant.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
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Submittal Date: Wed Nov 03 08:15:20 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-242-NFPA 1970-2022

Statement: In order to align the testing requirements with the changes being introduced to the performance requirements, these updates are necessary in order to clarify that the evaluation needs to be made utilizing garment specimens instead of full ensembles.



Public Input No. 151-NFPA 1970-2021 [Section No. 8.48.13]

8.48.13 Specific Requirements for Testing ~~Ensembles~~ Garments for Optional Liquid and Particulate Contaminant Protection.

8.48.13.1

Specimens for testing shall consist of liquid and particulate contaminant ~~protective ensembles, including the garment, helmet, glove, and footwear elements, and the SCBA specified for the ensemble by the ensemble manufacturer. The hood interface component shall also be tested where the hood is not part of the liquid and particulate contaminant protective ensemble garment elements.~~

8.48.13.2

A total of three different ~~ensemble~~ specimens shall be evaluated.

8.48.13.3

Garment, ~~glove, and hood~~ elements shall be conditioned as specified in 8.1.11.

8.48.13.4

~~Where the ensemble garment element does not include booties, footwear shall be conditioned by flexing for 100,000 cycles in accordance with Appendix B of FIA 1209, *Whole Shoe Flex*, with the following modifications:~~

- (1) ~~Water shall not be used.~~
- (2) ~~The flex speed shall be 60 cycles per minute, $\pm$ 2 cycles per minute.~~

8.48.13.4.1 –

~~Alternative flexing equipment shall be permitted to be used when the flexing equipment meets the following parameters:~~

- (1) ~~Provides the angle of flex as described in FIA 1209.~~
- (2) ~~Capable of a flex speed of 60 cycles per minute, $\pm$ 2 cycles per minute.~~
- (3) ~~Provides a means of securing the footwear during flexing.~~

8.48.13.5 –

~~The liquid-absorptive garment shall be a hooded coverall. The upper torso liquid-absorptive garment shall cover the upper torso and arms of the manikin from the middle of the manikin's neck, down to the manikin's waistline, and down to the manikin's wrist crease. The lower torso liquid-absorptive garment shall cover the legs of the manikin from the manikin's waistline down to the manikin's ankles. The garment or garments shall be made of fabric meeting the requirements specified in ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*. The liquid-absorptive garment shall not interfere with the correct wearing of the ensemble. In addition to the liquid-absorptive garment, the manikin's hands shall be covered with suitably sized, 100 percent cotton gloves and the manikin's feet covered with suitably sized, 100 percent cotton socks.~~

8.48.13.4.1

Where the coat consists of an attached hood, the upper torso indicator garment shall also incorporate a hood.

8.48.13.6

Specimens provided in 8.48.13.1 shall be donned on the manikin in accordance with garment manufacturer's specifications.

8.48.13.7

~~The taping, blockage, coverage, or provision of absorbent toweling of or to any part of any interface or element on the ensemble shall not be permitted.~~

~~8.48.13.8~~ –

~~The~~ manikin with ensemble in place shall be evaluated using Procedure A as specified in ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, with the following modifications:

(1) Procedure A shall be used.

(2) If the garment does not have an integrated hood, a plastic bag shall be applied over the manikin head without the protective helmet as specified in 8.48.13.1.

(3) If the garment does have an integrated hood, it is permitted to apply duct tape to the interface between the SCBA-facepiece and the particulate blocking hood while still using the helmet as part of the test specimen.

(4) The suited manikin shall be exposed to the liquid spray for 2.5 minutes in each of the four manikin orientations for a total of ~~20~~ 10 minutes.

-

~~8.48.13.9~~ – *

Following the test, the portions of the liquid-absorptive garment, inner cotton gloves, and inner cotton socks worn on the manikin that are underneath the garments being evaluated shall be inspected to determine evidence of liquid leakage.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
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Submittal Date: Wed Nov 03 08:16:35 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-243-NFPA 1970-2022

Statement: In order to align the testing requirements with the changes being introduced to the performance requirements, these updates are necessary in order to clarify that the evaluation needs to be made utilizing garment specimens instead of full ensembles.

**Public Input No. 174-NFPA 1970-2021 [Section No. 8.50.2.2]****8.50.2.2**

Samples shall be conditioned to the procedure specified in 8.1.2 12 at 10 cycles.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Street Address:
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Submittal Date: Wed Nov 03 11:01:20 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.

**Public Input No. 175-NFPA 1970-2021 [Section No. 8.51.2.3]****8.51.2.3**

All samples shall first be conditioned as specified in 8.1.2 12 .

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]</u>	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Zip:
Submittal Date: Wed Nov 03 11:02:04 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.



Public Input No. 288-NFPA 1970-2021 [Section No. 8.58.1.1]

8.58.1.1

This test shall apply to DRD materials and DRD seams, splices, and joints, where a DRD is installed in the protective coat or coverall .

Statement of Problem and Substantiation for Public Input

While the drag rescue device (DRD) was incorporated as a life-saving feature for protective coat, limited information is available to suggest that its use provides the intended benefits for rapid extraction of a downed firefighter that cannot be achieved by other means. Therefore, it is suggested that the DRD become optional and if absent, the manufacturer provide a warning that the organization establish specific procedures for the rapid extrication of downed firefighters by some other identified means. NFPA 1500 that governs the use of PPE for fire departments currently incorporates language in paragraph 7.2.6 that requires fire department to have a standard operating procedure for rapid extrication of firefighters that may or may not depend on the coat having a DRD. This proposed change shows that the DRD test method applies only where a DRD is present.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 287-NFPA 1970-2021 [Sections 7.1.21, 7.1.22]	
Public Input No. 286-NFPA 1970-2021 [Section No. 6.1.9.1]	
Public Input No. 280-NFPA 1970-2021 [Chapter 5]	
Public Input No. 290-NFPA 1970-2021 [Section No. 8.59.1]	

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
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Zip:
Submittal Date: Tue Nov 09 21:52:26 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: The fire service still considers having a DRD a mandatory part of the life saving garments to be available when needed. The technical committee is looking at ways to improve the usability and accessibility of the device in further revisions.

**Public Input No. 292-NFPA 1970-2021 [Section No. 8.59]****8.59 Drag Rescue Device (DRD) Function Test.****8.59.1 Application.**

This test shall apply to DRD installed in protective coats and protective coverall elements.

8.59.2 Samples.**8.59.2.1**

Samples shall consist of complete protective coats or protective coveralls with DRD installed.

8.59.2.2

Samples shall be conditioned as specified in 8.1.3.

8.59.3 Specimens.**8.59.3.1**

Specimens for testing shall be complete coat or complete coverall garment elements with DRD.

8.59.3.2

A minimum of three specimens shall be tested for each garment element type.

8.59.3.3

Each specimen shall have all garment layers in place.

8.59.4 Apparatus.**8.59.4.1**

One pair of protective gloves, one SCBA mask, and one flashlight shall be provided.

8.59.4.1.1 (NEW)

Flashlight shall be certified as compliant for use in structural fire fighting environments.

8.59.4.1.2 (NEW)

SCBA mask shall be certified as compliant for use in structural fire fighting environments

8.59.4.1.1

The gloves shall be certified as compliant with this standard and shall be properly sized to fit the test technician.

8.59.4.1.2

For structural firefighting ensembles, the protective gloves shall be structural firefighting gloves.

8.59.4.1.3

For proximity firefighting ensembles, the protective gloves shall be proximity firefighting gloves.

8.59.4.2

One IAFF "Rescue Randy" Model 1475 manikin or equivalent, shall be provided as the test manikin.

8.59.4.3

One open-circuit SCBA shall be provided.

8.59.4.3.1

The SCBA shall be certified as compliant with Chapters 14 through 18 of this standard.

8.59.4.3.2

The SCBA shall be equipped with an empty 60-minute rated breathing air cylinder.

8.59.5 Procedure.**8.59.5.1**

The DRD shall be inspected to insure correct installation within the garment element in accordance with manufacturer's instructions.

8.59.5.2

The DRD shall be in the secured, nondeployed, position.

8.59.5.3

The size of the specimen shall properly fit the manikin by conforming to the dimensions of the manikin chest circumference in accordance with the manufacturer's sizing system.

8.59.5.4

The test specimen shall be donned on the test manikin in accordance with the manufacturer's instructions for proper wearing, and shall be tested with an SCBA.

8.59.5.5

The SCBA shall be donned in accordance with the SCBA manufacturer's instructions over the specimen.

8.59.5.6

The test manikin shall be placed on its side on a concrete surface.

8.59.5.7

With the test manikin in position, the test technician shall don the gloves specified in 8.59.4.1. The test technician shall also operate in low or no light using only a handheld flashlight as well as wear an SCBA mask to ensure close resemblance to the limitations of the user in a field use situation with regards to sight, dexterity, and spatial awareness.

8.59.5.8

The test technician shall deploy the DRD according to the manufacturer's instructions.

8.59.5.9

Deployment time shall be measured beginning when the test technician touches the manikin and shall stop when the dragging motion begins.

8.59.5.10

The test technician shall drag the manikin in a straight line using the DRD, in accordance with the manufacturer's instructions, for a distance of 2.5 m, +0.5/-0 m (8 ft, +1½/-0 ft).

8.59.5.11

The deployment of the DRD and the dragging of the manikin shall be observed to determine if the SCBA is dislodged from the "as donned position."

8.59.6 Report.**8.59.6.1**

The deployment time of the DRD shall be recorded and reported.

8.59.6.2

The ability to drag the manikin the required distance shall be recorded and reported.

8.59.6.3

Change in the position of the SCBA during either the deployment of the DRD or the dragging of the manikin shall be recorded and reported.

8.59.7 Interpretation.**8.59.7.1**

The inability to deploy the device in 10 seconds or less, or the inability to drag the manikin 2.5 m (8 ft) shall constitute failing performance.

8.59.7.2

Failure of one or more specimens shall constitute failing performance.

Statement of Problem and Substantiation for Public Input

The DRD shall be more closely assessed for use as it relates to the limitations of the firefighters who may be required to deploy this device in a life saving event. The test and evaluation of success for the DRD should take into account the limits placed on visual acuity, dexterity, and spatial awareness as it relates to the types of situations and extreme stress that these devices will be utilized for life saving efforts.

Related Public Inputs for This Document

Related Input

Relationship

[Public Input No. 293-NFPA 1970-2021 \[Section No. 6.1.9.1\]](#)

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
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Zip:
Submittal Date: Tue Nov 09 22:34:14 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-118-NFPA 1970-2022](#)

Statement: In order to make the DRD functionality test more realistic additional parameters are being added to the test method to reduce visibility to better evaluate DRD strap accessibility. Additional work is needed to improve the conditions of realism and ensure repeatability of the test. The Committee will work with the fire service to get additional input on prospective changes to the test.



Public Input No. 290-NFPA 1970-2021 [Section No. 8.59.1]

8.59.1 Application.

This test shall apply to DRD installed in protective coats and protective coverall elements, where present .

Statement of Problem and Substantiation for Public Input

While the drag rescue device (DRD) was incorporated as a life-saving feature for protective coat, limited information is available to suggest that its use provides the intended benefits for rapid extraction of a downed firefighter that cannot be achieved by other means. Therefore, it is suggested that the DRD become optional and if absent, the manufacturer provide a warning that the organization establish specific procedures for the rapid extrication of downed firefighters by some other identified means. NFPA 1500 that governs the use of PPE for fire departments currently incorporates language in paragraph 7.2.6 that requires fire department to have a standard operating procedure for rapid extrication of firefighters that may or may not depend on the coat having a DRD. This proposed change shows that the DRD test method applies only where a DRD is present.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 288-NFPA 1970-2021 [Section No. 8.58.1.1]	
Public Input No. 287-NFPA 1970-2021 [Sections 7.1.21, 7.1.22]	
Public Input No. 286-NFPA 1970-2021 [Section No. 6.1.9.1]	
Public Input No. 280-NFPA 1970-2021 [Chapter 5]	

Submitter Information Verification

Submitter Full Name: Webster Marshall
Organization: Fire Fighter Cancer Foundation
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 09 21:54:56 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: The fire service still considers having a DRD a mandatory part of the life saving garments to be available when needed. The technical committee is looking at ways to improve the usability and accessibility of the device in further revisions.

**Public Input No. 207-NFPA 1970-2021 [Section No. 8.62]****8.62 Light Degradation Resistance Test.****8.62.1 Application.**

This test method shall apply to moisture barrier materials.

8.62.2 Samples.**8.62.2.1**

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber, the moisture barrier, a layer of 3.8 oz $\pm$ 0.3 oz, aramid needle punched nonwoven, quilted to a 3.4 oz $\pm$ 0.2 oz, aramid woven plain weave thermal barrier material, and another layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber. The four-layer composite sample shall be stitched around the entire periphery.

8.62.2.2

Where the layer intended to be the moisture barrier is configured of a composite that includes outer shell, moisture barrier, or thermal barrier combinations, the samples to be conditioned shall be constructed using those materials.

8.62.2.3

The moisture barrier layer shall be removed from the four-layer composite samples after all conditioning has been completed and shall become the moisture barrier specimen.

8.62.2.4

Where the moisture barrier is configured as indicated in 8.62.2.2, specimens shall be permitted to be a composite of layers provided that the layer intended to be the moisture barrier will face the light source in the test apparatus and provided that the specimen was conditioned according to 8.62.2.2.

8.62.3 Sample Preparation.

Sample composites shall be subjected to two cycles of the following conditioning:

- (1) The sample shall first be subjected to the procedure specified in 8.1.2.
- (2) The sample shall then be conditioned as specified in 8.1.3.
- (3) The sample shall then be conditioned as specified in 8.1.5.
- (4) The sample shall then be conditioned at a temperature of 21°C $\pm$ 3°C (70°F $\pm$ 5°F), and a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

8.62.4 Specimen Preparation.**8.62.4.1**

The moisture barrier material will be removed from the conditioned sample composite and be cut into specimens at least 150 mm (6 in.) square.

8.62.4.2

A minimum of four specimens shall be tested.

8.62.5 Procedure.**8.62.5.1**

Light resistance testing shall be conducted in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles.

8.62.5.2*

For each specimen, a piece of cardstock shall be cut in equal dimensions to the specimen. The specimen shall be stapled to the cardstock at each corner with the film side of the specimen away from the cardstock. The cardstock-backed specimen shall be clipped into the test apparatus, insuring clips do not contact the specimen, and the film side of the specimen is oriented toward the light source.

8.62.5.3

Specimens shall be subjected to 40 hours of continuous light exposure.

8.62.5.4

Specimens shall be removed from the test apparatus and conditioned in a dark environment at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent, for at least 4 hours.

8.62.5.5

Specimens shall be tested in accordance with ASTM D751, *Standard Methods for Testing Coated Fabrics, Hydrostatic Resistance*, Procedure B – Rising Column Water Method, Procedure 2, Sections 46–49, with the following modifications:

- (1) Alternative test apparatus shall be permitted provided that the exposed area of the specimen is at least 108 mm ($4\frac{1}{4}$ in.) in diameter and the pressure can be applied uniformly over the exposure period at a precision of ± 0.1 kPa (± 0.2 psi).
- (2) The applied pressure shall be 13.8 kPa (2 psi) for an exposure period of 1 minute.
- (3) Restraining materials shall not be used.
- (4) Failing performance shall be if any water appears on the surface of the specimen during the exposure period as discerned by a person with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.) with standard room illumination.

8.62.5.5.1

The moisture barrier specimen shall be placed in the apparatus with the film side facing away from the water source.

8.62.6 Reports.

The pass or fail performance for each specimen shall be recorded and reported.

8.62.7 Interpretation.

One or more test failures of any specimen shall constitute failure of material.

Statement of Problem and Substantiation for Public Input

Removing the UV Light test would give firefighters the opportunity to choose PPE that is free from PFAS.

Submitter Information Verification

Submitter Full Name: James Burneka

Organization: Firefighter Cancer Consultants

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Submittal Date: Sat Nov 06 09:13:49 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-192-NFPA 1970-2022](#)

Statement: The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an outer shell. Furthermore, garment outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test further does not address all of the relevant mechanisms of moisture barrier degradation. The impact of UV light on the moisture barrier is being addressed in a separate first revision that accounts for the manner in which garment moisture barriers and other garment materials are actually exposed and accounts for other expected use factors, such as repeated launderings, multiple heat exposures, and flexing, and abrasion from wear and tear.

**Public Input No. 227-NFPA 1970-2021 [Section No. 8.62]****8.62 Light Degradation Resistance Test. ----- REMOVE ----- REMOVE THE FALICIOUS XENON LIGHT TEST COMPLETELY -----****8.62.1 Application.**

This test method shall apply to moisture barrier materials.

8.62.2 Samples.**8.62.2.1**

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber, the moisture barrier, a layer of 3.8 oz $\pm$ 0.3 oz, aramid needle punched nonwoven, quilted to a 3.4 oz $\pm$ 0.2 oz, aramid woven plain weave thermal barrier material, and another layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber. The four-layer composite sample shall be stitched around the entire periphery.

8.62.2.2

Where the layer intended to be the moisture barrier is configured of a composite that includes outer shell, moisture barrier, or thermal barrier combinations, the samples to be conditioned shall be constructed using those materials.

8.62.2.3

The moisture barrier layer shall be removed from the four-layer composite samples after all conditioning has been completed and shall become the moisture barrier specimen.

8.62.2.4

Where the moisture barrier is configured as indicated in 8.62.2.2, specimens shall be permitted to be a composite of layers provided that the layer intended to be the moisture barrier will face the light source in the test apparatus and provided that the specimen was conditioned according to 8.62.2.2.

8.62.3 Sample Preparation.

Sample composites shall be subjected to two cycles of the following conditioning:

- (1) The sample shall first be subjected to the procedure specified in 8.1.2.
- (2) The sample shall then be conditioned as specified in 8.1.3.
- (3) The sample shall then be conditioned as specified in 8.1.5.
- (4) The sample shall then be conditioned at a temperature of 21°C $\pm$ 3°C (70°F $\pm$ 5°F), and a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

8.62.4 Specimen Preparation.**8.62.4.1**

The moisture barrier material will be removed from the conditioned sample composite and be cut into specimens at least 150 mm (6 in.) square.

8.62.4.2

A minimum of four specimens shall be tested.

8.62.5 Procedure.**8.62.5.1**

Light resistance testing shall be conducted in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles.

8.62.5.2*

For each specimen, a piece of cardstock shall be cut in equal dimensions to the specimen. The specimen shall be stapled to the cardstock at each corner with the film side of the specimen away from the cardstock. The cardstock-backed specimen shall be clipped into the test apparatus, insuring clips do not contact the specimen, and the film side of the specimen is oriented toward the light source.

8.62.5.3

Specimens shall be subjected to 40 hours of continuous light exposure.

8.62.5.4

Specimens shall be removed from the test apparatus and conditioned in a dark environment at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent, for at least 4 hours.

8.62.5.5

Specimens shall be tested in accordance with ASTM D751, *Standard Methods for Testing Coated Fabrics, Hydrostatic Resistance*, Procedure B – Rising Column Water Method, Procedure 2, Sections 46–49, with the following modifications:

- (1) Alternative test apparatus shall be permitted provided that the exposed area of the specimen is at least 108 mm (4¼ in.) in diameter and the pressure can be applied uniformly over the exposure period at a precision of ± 0.1 kPa (± 0.2 psi).
- (2) The applied pressure shall be 13.8 kPa (2 psi) for an exposure period of 1 minute.
- (3) Restraining materials shall not be used.
- (4) Failing performance shall be if any water appears on the surface of the specimen during the exposure period as discerned by a person with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.) with standard room illumination.

8.62.5.5.1

The moisture barrier specimen shall be placed in the apparatus with the film side facing away from the water source.

8.62.6 Reports.

The pass or fail performance for each specimen shall be recorded and reported.

8.62.7 Interpretation.

One or more test failures of any specimen shall constitute failure of material.

Statement of Problem and Substantiation for Public Input

It is remarkable to me that in 2015 after I found the 1999 Safety Alert for the BreathTex Moisture Barrier that was precisely what led to the exposure of what we now call the greatest deception ever. And here, after five years of memos, emails, calls, NFPA neutrality statements, and NFPA 'task groups' that are silent lurking rooms for industry, after national awareness brought to light by the first study ever of PFAS used in 'turnout gear' - orchestrated by two outsiders, a fire wife, and a nuclear physicist, a study that should have been done years ago by your organization but would never be done due to DuPont in every arm of your veins, we find ourselves here still seeking to put firefighter health and safety before 'unforeseen circumstances'.

After having the scientific community weigh in, over 170 public comments, the most highly respected PPE person in the land; Jeff Stull speaking for the IAFF, and the public opinion clearly in favor of firefighters who 'merely want the freedom to choose' weather they wear PTFE or not, the NFPA in it's heavily weighted industry driven machine, has opted to deny the firefighters their will. Which heightens the awareness that the NFPA has become merely a front group for FEMSA and ACC.

Remove the Fallacious Xenon Light Degradation Test in its entirety.

I look forward to our next round -
Diane Cotter

Submitter Information Verification

Submitter Full Name: Diane Cotter

Organization: [Not Specified]

Street Address:

City:

State:

Zip:

Submittal Date: Mon Nov 08 15:43:21 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-192-NFPA 1970-2022

Statement: The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the

middle layer, beneath an outer shell. Furthermore, garment outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test further does not address all of the relevant mechanisms of moisture barrier degradation. The impact of UV light on the moisture barrier is being addressed in a separate first revision that accounts for the manner in which garment moisture barriers and other garment materials are actually exposed and accounts for other expected use factors, such as repeated launderings, multiple heat exposures, and flexing, and abrasion from wear and tear.

**Public Input No. 295-NFPA 1970-2021 [Section No. 8.62]****8.62 Light Degradation Resistance Test.****8.62.1 Application.**

This test method shall apply to moisture barrier materials.

8.62.2 Samples.**8.62.2.1**

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber, the moisture barrier, a layer of 3.8 oz $\pm$ 0.3 oz, aramid needle punched nonwoven, quilted to a 3.4 oz $\pm$ 0.2 oz, aramid woven plain weave thermal barrier material, and another layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber. The four-layer composite sample shall be stitched around the entire periphery.

8.62.2.2

Where the layer intended to be the moisture barrier is configured of a composite that includes outer shell, moisture barrier, or thermal barrier combinations, the samples to be conditioned shall be constructed using those materials.

8.62.2.3

The moisture barrier layer shall be removed from the four-layer composite samples after all conditioning has been completed and shall become the moisture barrier specimen.

8.62.2.4

Where the moisture barrier is configured as indicated in 8.62.2.2, specimens shall be permitted to be a composite of layers provided that the layer intended to be the moisture barrier will face the light source in the test apparatus and provided that the specimen was conditioned according to 8.62.2.2.

8.62.3 Sample Preparation.

Sample composites shall be subjected to two cycles of the following conditioning:

- (1) The sample shall first be subjected to the procedure specified in 8.1.2.
- (2) The sample shall then be conditioned as specified in 8.1.3.
- (3) The sample shall then be conditioned as specified in 8.1.5.
- (4) The sample shall then be conditioned at a temperature of 21°C $\pm$ 3°C (70°F $\pm$ 5°F), and a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

8.62.4 Specimen Preparation.**8.62.4.1**

The moisture barrier material will be removed from the conditioned sample composite and be cut into specimens at least 150 mm (6 in.) square.

8.62.4.2

A minimum of four specimens shall be tested.

8.62.5 Procedure.**8.62.5.1**

Light resistance testing shall be conducted in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles.

8.62.5.2*

For each specimen, a piece of cardstock shall be cut in equal dimensions to the specimen. The specimen shall be stapled to the cardstock at each corner with the film side of the specimen away from the cardstock. The cardstock-backed specimen shall be clipped into the test apparatus, insuring clips do not contact the specimen, and the film side of the specimen is oriented toward the light source.

8.62.5.3

Specimens shall be subjected to 40 hours of continuous light exposure.

8.62.5.4

Specimens shall be removed from the test apparatus and conditioned in a dark environment at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent, for at least 4 hours.

8.62.5.5

Specimens shall be tested in accordance with ASTM D751, *Standard Methods for Testing Coated Fabrics, Hydrostatic Resistance*, Procedure B – Rising Column Water Method, Procedure 2, Sections 46–49, with the following modifications:

- (1) Alternative test apparatus shall be permitted provided that the exposed area of the specimen is at least 108 mm ($4\frac{1}{4}$ in.) in diameter and the pressure can be applied uniformly over the exposure period at a precision of ± 0.1 kPa (± 0.2 psi).
- (2) The applied pressure shall be 13.8 kPa (2 psi) for an exposure period of 1 minute.
- (3) Restraining materials shall not be used.
- (4) Failing performance shall be if any water appears on the surface of the specimen during the exposure period as discerned by a person with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.) with standard room illumination.

8.62.5.5.1

The moisture barrier specimen shall be placed in the apparatus with the film side facing away from the water source.

8.62.6 Reports.

The pass or fail performance for each specimen shall be recorded and reported.

8.62.7 Interpretation.

One or more test failures of any specimen shall constitute failure of material.

8.62 Light Degradation Resistance Test:

8.62.1 Application:

This test method shall apply to moisture barrier materials:

8.62.2 Samples:

8.62.2.1

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber, the moisture barrier, a layer of 3.8 oz $\pm$ 0.3 oz, aramid needle punched nonwoven, quilted to a 3.4 oz $\pm$ 0.2 oz, aramid woven plain weave thermal barrier material, and another layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber. The four-layer composite sample shall be stitched around the entire periphery:

8.62.2.2

Where the layer intended to be the moisture barrier is configured of a composite that includes outer shell, moisture barrier, or thermal barrier combinations, the samples to be conditioned shall be constructed using those materials:

8.62.2.3

The moisture barrier layer shall be removed from the four-layer composite samples after all conditioning has been completed and shall become the moisture barrier specimen:

8.62.2.4

Where the moisture barrier is configured as indicated in [8.62.2.2](#), specimens shall be permitted to be a composite of layers provided that the layer intended to be the moisture barrier will face the light source in the test apparatus and provided that the specimen was conditioned according to [8.62.2.2](#):

8.62.3 Sample Preparation:

Sample composites shall be subjected to two cycles of the following conditioning:

- (1) The sample shall first be subjected to the procedure specified in [8.1.2](#):
- (2) The sample shall then be conditioned as specified in [8.1.3](#):
- (3) The sample shall then be conditioned as specified in [8.1.5](#):
- (4) The sample shall then be conditioned at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours:

8.62.4 Specimen Preparation:

8.62.4.1

The moisture barrier material will be removed from the conditioned sample composite and be cut into specimens at least 150 mm (6 in.) square:

8.62.4.2

A minimum of four specimens shall be tested:

8.62.5 Procedure:

8.62.5.1

Light resistance testing shall be conducted in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles:

8.62.5.2

For each specimen, a piece of cardstock shall be cut in equal dimensions to the specimen. The specimen shall be stapled to the cardstock at each corner with the film side of the specimen away from the cardstock. The cardstock-backed specimen shall be clipped into the test apparatus, insuring clips do not contact the specimen, and the film side of the specimen is oriented toward the light source:

8.62.5.3

Specimens shall be subjected to 40 hours of continuous light exposure:

8.62.5.4

Specimens shall be removed from the test apparatus and conditioned in a dark environment at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent, for at least 4 hours.

8.62.5.5

Specimens shall be tested in accordance with ASTM D751, *Standard Methods for Testing Coated Fabrics, Hydrostatic Resistance*, Procedure B—Rising Column Water Method, Procedure 2, Sections 46–49, with the following modifications:

(1) Alternative test apparatus shall be permitted provided that the exposed area of the specimen is at least 108 mm ($4\frac{1}{4}$ in.) in diameter and the pressure can be applied uniformly over the exposure period at a precision of ± 0.1 kPa (± 0.2 psi).

(2) The applied pressure shall be 13.8 kPa (2 psi) for an exposure period of 1 minute.

(3) Restraining materials shall not be used.

(4) Failing performance shall be if any water appears on the surface of the specimen during the exposure period as discerned by a person with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.) with standard room illumination.

8.62.5.5.1

The moisture barrier specimen shall be placed in the apparatus with the film side facing away from the water source.

8.62.6 Reports

The pass or fail performance for each specimen shall be recorded and reported.

8.62.7 Interpretation

One or more test failures of any specimen shall constitute failure of material.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
UV-Light-Test-Public-Input.pdf		

Statement of Problem and Substantiation for Public Input

The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an outer shell. Furthermore, outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test does not address mechanisms of moisture barrier degradation. Please see attachment for further substantiation.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 294-NFPA 1970-2021 [Section No. 7.1.23]	
Public Input No. 296-NFPA 1970-2021 [Section No. A.8.62.5.2]	

Submitter Information Verification

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Submittal Date: Wed Nov 10 00:43:21 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-192-NFPA 1970-2022

Statement: The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an outer shell. Furthermore, garment outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test further does not address all of the relevant mechanisms of moisture barrier degradation. The impact of UV light on the moisture barrier is being addressed in a separate first revision that accounts for the manner in which garment moisture barriers and other garment materials are actually exposed and accounts for other expected use factors, such as repeated launderings, multiple heat exposures, and flexing, and abrasion from wear and tear.



Public Input No. 299-NFPA 1970-2021 [Section No. 8.62]

8.62 – Light Degradation Resistance Test:

8.62.1 – Application:

This test method shall apply to moisture barrier materials.

8.62.2 – Samples:

8.62.2.1 –

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber, the moisture barrier, a layer of 3.8 oz $\pm$ 0.3 oz, aramid needle punched nonwoven, quilted to a 3.4 oz $\pm$ 0.2 oz, aramid woven plain weave thermal barrier material, and another layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber. The four-layer composite sample shall be stitched around the entire periphery.

8.62.2.2 –

Where the layer intended to be the moisture barrier is configured of a composite that includes outer shell, moisture barrier, or thermal barrier combinations, the samples to be conditioned shall be constructed using those materials.

8.62.2.3 –

The moisture barrier layer shall be removed from the four-layer composite samples after all conditioning has been completed and shall become the moisture barrier specimen.

8.62.2.4 –

Where the moisture barrier is configured as indicated in 8.62.2.2, specimens shall be permitted to be a composite of layers provided that the layer intended to be the moisture barrier will face the light source in the test apparatus and provided that the specimen was conditioned according to 8.62.2.2.

8.62.3 – Sample Preparation:

Sample composites shall be subjected to two cycles of the following conditioning:

- (1) The sample shall first be subjected to the procedure specified in 8.1.2.
- (2) The sample shall then be conditioned as specified in 8.1.3.
- (3) The sample shall then be conditioned as specified in 8.1.5.
- (4) The sample shall then be conditioned at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

8.62.4 – Specimen Preparation:

8.62.4.1 –

The moisture barrier material will be removed from the conditioned sample composite and be cut into specimens at least 150 mm (6 in.) square.

8.62.4.2 –

A minimum of four specimens shall be tested.

8.62.5 – Procedure:

8.62.5.1 –

Light resistance testing shall be conducted in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles.

8.62.5.2 * –

For each specimen, a piece of cardstock shall be cut in equal dimensions to the specimen. The specimen shall be stapled to the cardstock at each corner with the film side of the specimen away from the cardstock. The cardstock-backed specimen shall be clipped into the test apparatus, insuring clips do not contact the specimen, and the film side of the specimen is oriented toward the light source.

8.62.5.3 –

Specimens shall be subjected to 40 hours of continuous light exposure.

8.62.5.4 –

~~Specimens shall be removed from the test apparatus and conditioned in a dark environment at a temperature of 21°C ± 3°C (70°F ± 5°F), and a relative humidity of 65 percent ± 5 percent, for at least 4 hours.~~

8.62.5.5 –

~~Specimens shall be tested in accordance with ASTM D751, *Standard Methods for Testing Coated Fabrics; Hydrostatic Resistance*, Procedure B – Rising Column Water Method, Procedure 2, Sections 46–49, with the following modifications:~~

- ~~(1) Alternative test apparatus shall be permitted provided that the exposed area of the specimen is at least 108 mm (4 ¹/₄ in.) in diameter and the pressure can be applied uniformly over the exposure period at a precision of ± 0.1 kPa (± 0.2 psi).~~
- ~~(2) The applied pressure shall be 13.8 kPa (2 psi) for an exposure period of 1 minute.~~
- ~~(3) Restraining materials shall not be used.~~
- ~~(4) Failing performance shall be if any water appears on the surface of the specimen during the exposure period as discerned by a person with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.) with standard room illumination.~~

8.62.5.5.1 –

~~The moisture barrier specimen shall be placed in the apparatus with the film side facing away from the water source.~~

8.62.6 – Reports:

~~The pass or fail performance for each specimen shall be recorded and reported.~~

8.62.7 – Interpretation:

~~One or more test failures of any specimen shall constitute failure of material.~~

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Public_Input_Remove_UV_Light_Test_Requirement_and_Test_Method_NFPA_1971_consolidated_1970.pdf	The UV light degradation test in NFPA 1971 was based on research that does not support its inclusion in NFPA 1971 and its application is scientifically illogical. The 2002 Addendum also does not support the use of the UV light degradation test in NFPA 1971.	

Statement of Problem and Substantiation for Public Input

The research conducted in 2000 and 2002 does not justify the impetus for NFPA Standard 1971's UV Light Degradation Test for moisture barriers. The experiments conducted did not answer the questions posed and did not result in statistically significant results. In fact, during a NFPA meeting on June 21, 2021 with Dr. Elizabeth Easter, the University of Kentucky professor who proposed the UV light degradation test based on her students' research, said she was unsure as to whether the 2000-2002 test were run on the same layering of turnout gear that exists today, and said materials used in turnout gear may have changed in the past two decades, and these tests would be "very difficult" to replicate. Given that

the research upon which the UV light degradation test was based does not support its implementation, the 20 years that have elapsed, and advances in materials and textile science, together with the current information regarding the dangers of PFAS and their ability to be dermally absorbed, it is critical that the Technical Committee consider deleting the UV light degradation test.

There are other ways to address concerns for UV light exposure that are more relevant to the types of exposure that occur for firefighter protective clothing.

The unintended consequence of this test, which is again, unsupported by science, is an increased and unnecessary firefighter exposure to PFAS chemicals known to be carcinogens and EDCs.

The current UV Light Degradation Test inhibits innovation and the opportunity for superior Moisture Barrier alternatives to come to market, mandating 50 year old technology (ePTFE) in firefighter ensembles. This is contrary to NFPA Statement of General Principles 2.(c) found in their 2021 Standards Directory.

NFPA's Guide for the Conduct of Participants in the NFPA Standards Development Process Sec. 3.3 states; TC/CC members are expected to and should base all advocacy, voting, and other standards development activities on sound technical and scientific bases and should act in the interest of fire safety and NFPA's other purposes and goals. As such to act in accordance with NFPA policies the removal of the UV Light Degradation Resistance Test is necessary to maintain integrity in the NFPA process.

Current Policy limits promoting a single product. The current UV Light Degradation Resistance Test in effect does just that, by being so restrictive only ePTFE can achieve certification.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 300-NFPA 1970-2021 [Global Input]</u>	

Submitter Information Verification

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Submittal Date: Wed Nov 10 07:14:38 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-192-NFPA 1970-2022

Statement: The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an outer shell. Furthermore, garment outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test further does not address all of the relevant mechanisms of moisture barrier degradation. The impact of UV light on the moisture barrier is being addressed in a separate first revision that accounts for the manner in which garment moisture barriers and other garment materials are actually exposed and accounts for other expected use factors, such as repeated launderings, multiple heat exposures, and flexing, and abrasion from wear and tear.



Public Input No. 316-NFPA 1970-2021 [Section No. 8.62]

8.62 – Light Degradation Resistance Test:

8.62.1 – Application:

This test method shall apply to moisture barrier materials.

8.62.2 – Samples:

8.62.2.1 –

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber, the moisture barrier, a layer of 3.8 oz $\pm$ 0.3 oz, aramid needle punched nonwoven, quilted to a 3.4 oz $\pm$ 0.2 oz, aramid woven plain weave thermal barrier material, and another layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber. The four-layer composite sample shall be stitched around the entire periphery.

8.62.2.2 –

Where the layer intended to be the moisture barrier is configured of a composite that includes outer shell, moisture barrier, or thermal barrier combinations, the samples to be conditioned shall be constructed using those materials.

8.62.2.3 –

The moisture barrier layer shall be removed from the four-layer composite samples after all conditioning has been completed and shall become the moisture barrier specimen.

8.62.2.4 –

Where the moisture barrier is configured as indicated in 8.62.2.2, specimens shall be permitted to be a composite of layers provided that the layer intended to be the moisture barrier will face the light source in the test apparatus and provided that the specimen was conditioned according to 8.62.2.2.

8.62.3 – Sample Preparation:

Sample composites shall be subjected to two cycles of the following conditioning:

- (1) The sample shall first be subjected to the procedure specified in 8.1.2.
- (2) The sample shall then be conditioned as specified in 8.1.3.
- (3) The sample shall then be conditioned as specified in 8.1.5.
- (4) The sample shall then be conditioned at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

8.62.4 – Specimen Preparation:

8.62.4.1 –

The moisture barrier material will be removed from the conditioned sample composite and be cut into specimens at least 150 mm (6 in.) square.

8.62.4.2 –

A minimum of four specimens shall be tested.

8.62.5 – Procedure:

8.62.5.1 –

Light resistance testing shall be conducted in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles.

8.62.5.2 * –

For each specimen, a piece of cardstock shall be cut in equal dimensions to the specimen. The specimen shall be stapled to the cardstock at each corner with the film side of the specimen away from the cardstock. The cardstock-backed specimen shall be clipped into the test apparatus, insuring clips do not contact the specimen, and the film side of the specimen is oriented toward the light source.

8.62.5.3 –

Specimens shall be subjected to 40 hours of continuous light exposure.

8.62.5.4 –

~~Specimens shall be removed from the test apparatus and conditioned in a dark environment at a temperature of 21°C ± 3°C (70°F ± 5°F), and a relative humidity of 65 percent ± 5 percent, for at least 4 hours.~~

8.62.5.5 –

~~Specimens shall be tested in accordance with ASTM D751, *Standard Methods for Testing Coated Fabrics; Hydrostatic Resistance*, Procedure B – Rising Column Water Method, Procedure 2, Sections 46–49, with the following modifications:~~

- ~~(1) Alternative test apparatus shall be permitted provided that the exposed area of the specimen is at least 108 mm (4 ¹/₄ in.) in diameter and the pressure can be applied uniformly over the exposure period at a precision of ± 0.1 kPa (± 0.2 psi).~~
- ~~(2) The applied pressure shall be 13.8 kPa (2 psi) for an exposure period of 1 minute.~~
- ~~(3) Restraining materials shall not be used.~~
- ~~(4) Failing performance shall be if any water appears on the surface of the specimen during the exposure period as discerned by a person with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.) with standard room illumination.~~

8.62.5.5.1 –

~~The moisture barrier specimen shall be placed in the apparatus with the film side facing away from the water source.~~

8.62.6 – Reports:

~~The pass or fail performance for each specimen shall be recorded and reported.~~

8.62.7 – Interpretation:

~~One or more test failures of any specimen shall constitute failure of material.~~

Statement of Problem and Substantiation for Public Input

The UV light degradation test in NFPA 1971 was based on research that does not support its inclusion in NFPA 1971 and its application is scientifically illogical. The unintended consequence of keeping this test in the standard maintains ePTFE/PFAS exposures to firefighters, contributing to line of duty cancers - the number one cause of LODD in the fire service as of 2019.

The current UV Light Degradation Test also inhibits innovation and the opportunity for superior Moisture Barrier alternatives to come to market, mandating 50 year old technology (ePTFE) in firefighter ensembles. This is contrary to NFPA Statement of General Principles 2.(c) found in their 2021 Standards Directory.

NFPA's Guide for the Conduct of Participants in the NFPA Standards Development Process Sec. 3.3 states; TC/CC members are expected to and should base all advocacy, voting, and other standards development activities on sound technical and scientific bases and should act in the interest of fire safety and NFPA's other purposes and goals. As such to act in accordance with NFPA policies the removal of the UV Light Degradation Resistance Test is necessary to maintain integrity in the NFPA process.

Current Policy limits promoting a single product. The current UV Light Degradation Resistance Test in effect does just that, by being so restrictive only ePTFE can achieve certification.

Submitter Information Verification

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Submittal Date: Wed Nov 10 13:52:29 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-192-NFPA 1970-2022](#)

Statement: The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an outer shell. Furthermore, garment outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test further does not address all of the relevant mechanisms of moisture barrier degradation. The impact of UV light on the moisture barrier is being addressed in a separate first revision that accounts for the manner in which garment moisture barriers and other garment materials are actually exposed and accounts for other expected use factors, such as repeated launderings, multiple heat exposures, and flexing, and abrasion from wear and tear.



Public Input No. 321-NFPA 1970-2021 [Section No. 8.62]

8.62– Light Degradation Resistance Test.

8.62.1 – Application:

This test method shall apply to moisture barrier materials.

8.62.2 – Samples:

8.62.2.1 –

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber, the moisture barrier, a layer of 3.8 oz $\pm$ 0.3 oz, aramid needle punched nonwoven, quilted to a 3.4 oz $\pm$ 0.2 oz, aramid woven plain weave thermal barrier material, and another layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber. The four-layer composite sample shall be stitched around the entire periphery.

8.62.2.2 –

Where the layer intended to be the moisture barrier is configured of a composite that includes outer shell, moisture barrier, or thermal barrier combinations, the samples to be conditioned shall be constructed using those materials.

8.62.2.3 –

The moisture barrier layer shall be removed from the four-layer composite samples after all conditioning has been completed and shall become the moisture barrier specimen.

8.62.2.4 –

Where the moisture barrier is configured as indicated in 8.62.2.2, specimens shall be permitted to be a composite of layers provided that the layer intended to be the moisture barrier will face the light source in the test apparatus and provided that the specimen was conditioned according to 8.62.2.2.

8.62.3 – Sample Preparation:

Sample composites shall be subjected to two cycles of the following conditioning:

- (1) The sample shall first be subjected to the procedure specified in 8.1.2.
- (2) The sample shall then be conditioned as specified in 8.1.3.
- (3) The sample shall then be conditioned as specified in 8.1.5.
- (4) The sample shall then be conditioned at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

8.62.4 – Specimen Preparation:

8.62.4.1 –

The moisture barrier material will be removed from the conditioned sample composite and be cut into specimens at least 150 mm (6 in.) square.

8.62.4.2 –

A minimum of four specimens shall be tested.

8.62.5 – Procedure:

8.62.5.1 –

Light resistance testing shall be conducted in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles.

8.62.5.2 * –

For each specimen, a piece of cardstock shall be cut in equal dimensions to the specimen. The specimen shall be stapled to the cardstock at each corner with the film side of the specimen away from the cardstock. The cardstock-backed specimen shall be clipped into the test apparatus, insuring clips do not contact the specimen, and the film side of the specimen is oriented toward the light source.

8.62.5.3 –

Specimens shall be subjected to 40 hours of continuous light exposure.

8.62.5.4 –

~~Specimens shall be removed from the test apparatus and conditioned in a dark environment at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent, for at least 4 hours.~~

8.62.5.5 –

~~Specimens shall be tested in accordance with ASTM D751, *Standard Methods for Testing Coated Fabrics; Hydrostatic Resistance*, Procedure B – Rising Column Water Method, Procedure 2, Sections 46–49, with the following modifications:~~

- ~~(1) Alternative test apparatus shall be permitted provided that the exposed area of the specimen is at least 108 mm ($4\frac{1}{4}$ in.) in diameter and the pressure can be applied uniformly over the exposure period at a precision of ± 0.1 kPa (± 0.2 psi).~~
- ~~(2) The applied pressure shall be 13.8 kPa (2 psi) for an exposure period of 1 minute.~~
- ~~(3) Restraining materials shall not be used.~~
- ~~(4) Failing performance shall be if any water appears on the surface of the specimen during the exposure period as discerned by a person with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.) with standard room illumination.~~

8.62.5.5.1 –

~~The moisture barrier specimen shall be placed in the apparatus with the film side facing away from the water source.~~

8.62.6 – Reports:

~~The pass or fail performance for each specimen shall be recorded and reported.~~

8.62.7 – Interpretation:

~~One or more test failures of any specimen shall constitute failure of material~~

Replace with a scientifically appropriate moisture barrier degradation test.

Statement of Problem and Substantiation for Public Input

I've been part of all of the task group and sub task group meetings where this test was, and new tests were, discussed. I understand the desire to remove PFAS from gear and I share that desire. In my own life I have consciously made purchases that reduce my exposure to phthalates, in particular, and other chemicals that are known to be or suspected of being carcinogens, endocrine disruptors, and the like.

As with all decisions, though, there is a balance. There are tradeoffs to be considered and some of the tradeoffs have factors that just aren't known yet.

I submitted this PI in an effort to make sure all tradeoffs are balanced through this process – it's obvious I don't know how to write a test method and I don't have the scientific knowledge to know what test would ensure firefighters can be confident in the durability of their moisture barrier, but I think it's important to create a placeholder in the event that that test is developed over the period of this revision cycle.

I am open to the proposals related to changing conditioning and am also mindful of the risk that we will add tests and cost and lose protection. I do not want to lose the protection of having a test that measures moisture barrier degradation.

At the very least, if we can't have a requirement to remove PFAS from gear AND keep the UV Light Degradation Test, I would ask the committee to preserve requirements to maintain the current level of durability testing for moisture barriers using whatever mechanism is scientifically appropriate and addresses the health and safety concerns of firefighters (firefighters who want a durable moisture barrier have as much value as firefighters who are focused on PFAS removal, in my opinion). My goal is to balance having a durable moisture barrier that does its job with removing PFAS from gear.

The balance, in this instance, is mainly trading one hazard for another (in a very simplistic way). The hazards related to moisture barrier failure are well understood and well documented. A functioning moisture barrier provides primary protection from water and liquids that include some common chemicals and bloodborne pathogens that we know firefighters encounter while performing normal firefighting duties. If a moisture barrier isn't doing its job, those liquids can get to the firefighter's body. A known hazard that is currently accounted for.

The risk of encountering those liquids during normal operations has not gone away and every firefighter should be able to have a certain level of confidence that the moisture barrier is capable of doing what it was built to do.

Obviously, we now have easier access to inspect moisture barriers in the field, and, ideally, those inspections are happening according to current requirements and best practices so that degraded moisture barriers are caught and repaired or replaced. In the cases where inspections aren't happening, or happening as frequently as they should, the risk

of unknowingly relying on a degraded moisture barrier is greater. I'm not comfortable adding that risk to any firefighter's job when we've already got something in place that has prevented that.

It has not been proven that (1) removing the UV Light Degradation Test will accomplish removal of PFAS from moisture barriers and, (2) that PFAS-free barriers can't pass the current requirements. This tells me that we do not even know that this test is the commercial holdup.

Beyond that, I have also not seen definitive proof that PFAS from the moisture barrier are even reaching the wearer or that we can even isolate anyone's PFAS absorption to a specific material or consumer good. We're guessing to facilitate commercialization at the risk of losing a durability measure that has proven to be an effective way to ensure durability. It seems backwards to me that anyone who wanted to produce a PFAS-free moisture barrier should not be required to prove durability. And, if PFAS-free moisture barriers can't pass this durability test, why the solution is throwing out the test, not refining it or refining PFAS-free moisture barriers so they are more durable. If that is truly the balance point, then maybe this test should be balanced against another test (like TPP and THL have to be balanced with each other) so that firefighters get a full picture of the tradeoff.

PFAS are in products we all use every day, I have not seen any information that isolates PFAS from moisture barriers as a source of PFAS in a person's body. Who can say where it came from? From the food that was cooked on a non-stick pan and ingested? From the waterproof jackets, outdoor clothing, footwear, and swimwear most of us wear at one time or another (some with obviously more skin contact than we see with the moisture barrier (which is separated from the wearer by the thermal barrier and, most likely, undergarments and stationwear)). From the carpet and furniture in your house? Or from all of that burning during a fire, leaving particles on gear that reach apparatus interiors, living areas in the station, personal vehicles, and individual's homes when measures may or may not be taken to limit cross-contamination. We simply do not know.

I understand that UV is not the typical method of degradation in the field but, as we know, lab tests cannot always perfectly mimic field use and care (especially when field use and care is not consistent). What I also understand is that the UV Light Degradation Test has prevented mass moisture barrier failures for 20 years.

I'm not comfortable risking another mass moisture barrier failure without understanding whether or not the UV Light Degradation Test is really the limiting factor for moisture barrier technologies moving to PFAS-free products. And, if it is, understanding the durability of PFAS-free barrier materials. If durability and degradation isn't tested using UV Light, what is the replacement?

Again, without seeing the data, I am not certain that changing conditioning parameters will fully address degradation concerns. I am hopeful. And I hope the additional tests do not add so much cost to certification that we end up throwing the baby out with the bathwater.

I still don't agree that, because a product can't pass a test, we throw out the test. Nor have I seen data that definitively proves this test is preventing PFAS-free barriers from getting certified but, if we can test all barriers for degradation and allow the market to decide where their trade-offs are, I am good with that.

I submit this PI in an effort to allow for a placeholder for a replacement test to the UV Light Degradation Test. I don't have a plan for how that replacement test would be developed, I just know that, for me, that would provide a better assessment of the tradeoffs between having a durable moisture barrier and a PFAS-free moisture barrier.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 322-NFPA 1970-2021 [Section No. 7.1.23]	

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Submission Date: Wed Nov 10 15:30:41 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-192-NFPA 1970-2022](#)

Statement: The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the

middle layer, beneath an outer shell. Furthermore, garment outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test further does not address all of the relevant mechanisms of moisture barrier degradation. The impact of UV light on the moisture barrier is being addressed in a separate first revision that accounts for the manner in which garment moisture barriers and other garment materials are actually exposed and accounts for other expected use factors, such as repeated launderings, multiple heat exposures, and flexing, and abrasion from wear and tear.



Public Input No. 327-NFPA 1970-2021 [Section No. 8.62]

8.62 – Light Degradation Resistance Test:

8.62.1 – Application:

This test method shall apply to moisture barrier materials.

8.62.2 – Samples:

8.62.2.1 –

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber, the moisture barrier, a layer of 3.8 oz $\pm$ 0.3 oz, aramid needle punched nonwoven, quilted to a 3.4 oz $\pm$ 0.2 oz, aramid woven plain weave thermal barrier material, and another layer of 7.5 oz woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber. The four-layer composite sample shall be stitched around the entire periphery.

8.62.2.2 –

Where the layer intended to be the moisture barrier is configured of a composite that includes outer shell, moisture barrier, or thermal barrier combinations, the samples to be conditioned shall be constructed using those materials.

8.62.2.3 –

The moisture barrier layer shall be removed from the four-layer composite samples after all conditioning has been completed and shall become the moisture barrier specimen.

8.62.2.4 –

Where the moisture barrier is configured as indicated in 8.62.2.2, specimens shall be permitted to be a composite of layers provided that the layer intended to be the moisture barrier will face the light source in the test apparatus and provided that the specimen was conditioned according to 8.62.2.2.

8.62.3 – Sample Preparation:

Sample composites shall be subjected to two cycles of the following conditioning:

- (1) The sample shall first be subjected to the procedure specified in 8.1.2.
- (2) The sample shall then be conditioned as specified in 8.1.3.
- (3) The sample shall then be conditioned as specified in 8.1.5.
- (4) The sample shall then be conditioned at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

8.62.4 – Specimen Preparation:

8.62.4.1 –

The moisture barrier material will be removed from the conditioned sample composite and be cut into specimens at least 150 mm (6 in.) square.

8.62.4.2 –

A minimum of four specimens shall be tested.

8.62.5 – Procedure:

8.62.5.1 –

Light resistance testing shall be conducted in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, using Cycle 8 Exposure Conditions. Both inner and outer filters shall be borosilicate. Exposure duration shall not include dark cycles.

8.62.5.2 * –

For each specimen, a piece of cardstock shall be cut in equal dimensions to the specimen. The specimen shall be stapled to the cardstock at each corner with the film side of the specimen away from the cardstock. The cardstock-backed specimen shall be clipped into the test apparatus, insuring clips do not contact the specimen, and the film side of the specimen is oriented toward the light source.

8.62.5.3 –

Specimens shall be subjected to 40 hours of continuous light exposure.

8.62.5.4 –

Specimens shall be removed from the test apparatus and conditioned in a dark environment at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent, for at least 4 hours.

8.62.5.5 –

Specimens shall be tested in accordance with ASTM D751, *Standard Methods for Testing Coated Fabrics; Hydrostatic Resistance*, Procedure B – Rising Column Water Method, Procedure 2, Sections 46–49, with the following modifications:

- (1) Alternative test apparatus shall be permitted provided that the exposed area of the specimen is at least 108 mm ($4\frac{1}{4}$ in.) in diameter and the pressure can be applied uniformly over the exposure period at a precision of ± 0.1 kPa (± 0.2 psi).
- (2) The applied pressure shall be 13.8 kPa (2 psi) for an exposure period of 1 minute.
- (3) Restraining materials shall not be used.
- (4) Failing performance shall be if any water appears on the surface of the specimen during the exposure period as discerned by a person with 20/20 vision, or vision corrected to 20/20, at a nominal distance of 305 mm (12 in.) with standard room illumination.

8.62.5.5.1 –

The moisture barrier specimen shall be placed in the apparatus with the film side facing away from the water source.

8.62.6 – Reports.

The pass or fail performance for each specimen shall be recorded and reported.

8.62.7 – Interpretation.

One or more test failures of any specimen shall constitute failure of material.

Statement of Problem and Substantiation for Public Input

Of these nine single-layer moisture barriers, three (samples E, F and L) contained PTFE, a PFAS polymer. However, as shown in Figure 2[9], below, the PTFE moisture barriers also failed after the abrasion and UV light tests, similar to non-PTFE moisture barriers. This result demonstrates that the use of PTFE based moisture barriers does not prevent degradation from occurring and that the UV light degradation test does not address the mechanism of previously observed moisture barrier failure.

Furthermore, UV light was not examined as a possible sole cause of moisture barrier degradation in the Thesis. Specifically, it states: “[t]he analysis of the data was (sic) used to determine if UV light exposure and abrasion had a significant effect on the failure of the moisture barrier and whether the test can be replicated to predict future failures” (emphasis added).[10] The premise of this approach is flawed. In order to determine whether UV light is the cause of moisture barrier degradation, it must be tested independently of abrasion. In order to determine which factor is responsible for the failure of moisture barriers, or whether there is a compounding effect of both UV light and abrasion, tests should have been run separately on UV light, abrasion, both together, and in reverse order. Instead, each sample was subjected to “flexing treatment prior to each 20-hour increment” of UV light exposure.[11] In fact, the author concedes that one of the “limitations” of the study was that “flexing was conducted on all single layer moisture barriers ... which did not allow for a comparison of unflexed single layer moisture barriers.”[12] This methodology makes it impossible to distinguish the effect of UV light from the effect of abrasion as it relates to mechanisms of failure in moisture barriers.

The statistics conducted on the data were not reported in the Thesis, and the analysis was not sufficient. First, there is no information as to whether data was tested for normality prior to running “multivariate statistical analysis.”[13] Second, the proper statistical analysis is a Failure Time Model, which was not conducted. Finally, and most importantly, the author concedes that “[t]he multivariate statistical test used to analyze the resulting data from the instrumental and natural sunlight exposure did not show significant results (emphasis added).”[14] If the statistical analysis did not produce significant results, then no conclusions can be drawn about UV light and its role in moisture barrier degradation. Despite this, it was concluded that “UV light did contribute to failure of the moisture barrier of fire fighter’s turnout gear.”[15] This conclusion, given the limitations of the study and the limited statistical analyses, is not scientifically valid. Furthermore, the subsequent adoption of the UV light test for moisture barriers in NFPA Standard 1971 was based upon this invalid conclusion and fails to address the mechanism of past moisture barrier failures. As a result NFPA Standard 1971 fails to adequately protect fire fighters by relying upon the UV light test.

Of equal concern is the lack of scientific logic in subjecting moisture barriers to a UV light test when outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to such a test.[16]

The 2002 Addendum also does not support the use of the UV light degradation test in NFPA 1971

In 2002, an Addendum to the Thesis entitled "Evaluation of Moisture Barriers for Fire Fighting Turnout Gear Assessment of Product Failure and Test Method Development Predicting Failure Models" (hereinafter the "Addendum").[17] The Addendum was done based on the same methodology of the Thesis, and was also considered "quasi-experimental," with no randomization.[18] Moreover, the variability of the data collected was so extreme that the author stated there were nine data points whose "validity was questionable." [19] Dixon's Analysis of Extreme Values was used to "throw out" two data points.[20] However, similar to the Thesis, no statistics are included and no test for normality of data is referenced. Dixon's Test for Outliers must be conducted on normally distributed data; therefore the exclusion of data points was not appropriate. Finally, the researcher found that moisture barriers manufactured with PTFE (a PFAS polymer) failed in a similar manner to non-PTFE moisture barriers.[21]

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Submittal Date: Wed Nov 10 16:06:44 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-192-NFPA 1970-2022](#)

Statement: The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an outer shell. Furthermore, garment outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test further does not address all of the relevant mechanisms of moisture barrier degradation. The impact of UV light on the moisture barrier is being addressed in a separate first revision that accounts for the manner in which garment moisture barriers and other garment materials are actually exposed and accounts for other expected use factors, such as repeated launderings, multiple heat exposures, and flexing, and abrasion from wear and tear.



Public Input No. 176-NFPA 1970-2021 [Section No. 8.62.3]

8.62.3 Sample Preparation.

Sample composites shall be subjected to two cycles of the following conditioning:

- (1) The sample shall first be subjected to the procedure specified in 8.1.2 12.
- (2) The sample shall then be conditioned as specified in 8.1.3.
- (3) The sample shall then be conditioned as specified in 8.1.5.
- (4) The sample shall then be conditioned at a temperature of $21^{\circ}\text{C} \pm 3^{\circ}\text{C}$ ($70^{\circ}\text{F} \pm 5^{\circ}\text{F}$), and a relative humidity of 65 percent $\pm$ 5 percent for at least 4 hours.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]	

Submitter Information Verification

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Submittal Date: Wed Nov 03 11:02:45 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: The laundering conditioning throughout the standard is being transitioned to utilize the extractor method which will be renumbered to 8.1.2. Therefore, the updates to references being made in these inputs are not needed.



Public Input No. 95-NFPA 1970-2021 [Sections 8.63.4, 8.63.5, 8.63.6, 8.63.7]

Sections 8.63.4, 8.63.5, 8.63.6, 8.63.7

8.63.4

Apparatus:

Liner retention shall be evaluated with the use of locking forceps and a force measuring gauge.

8.63.5

Procedure:

8.63:

5

The locking forceps shall be attached to the inner liner of the digit to be tested ensuring that an unattached liner or the outer shell is not grabbed.

4.1

—

Test subjects shall be selected so that their hand dimensions are as close as possible to the middle of the range for hand length and hand circumference for size 70W (wide) and size 76W (wide) gloves specified in Figure 6.7.6.1.

8.63:

5

The hook of the force gauge shall be looped around the locking bridge of the forceps

4.2

—

The test subject's hand shall then be completely submerged in room temperature water $[21^{\circ}\text{C} \pm 3^{\circ}\text{C}]$ $(70^{\circ}\text{F} \pm 5^{\circ}\text{F})$ for 10 seconds before donning the glove each time.

8.63:

5

4.3

—

The

digit of the

glove

shell shall be gripped ensuring that the inner liner is not impeded.

shall be donned in accordance with the Manufacturer's donning procedure. The test subject shall don one glove at a time.

8.63:

5

4.4

—

The

force gauge

glove shall

be pulled until $25\text{ N} (5\frac{1}{2}\text{ lbf})$ registers on the dial and then released

then be removed by grasping the fingertip of the middle finger and pulling the hand out of the glove.

8.63:

5

Each digit shall be inspected for indication of detachment of inner liner and/or moisture barrier.

4.5

—

Where the glove cannot be donned because of detachment of the inner liner or moisture barrier, the trial for that glove shall be stopped. If any fingers cannot be fully inserted into the glove, the trial for that glove shall be stopped.

~~8.63:~~~~6~~~~5 – Report:~~~~Results shall be recorded and reported as pass or fail.~~~~8.63:~~~~7~~~~6 – Interpretation:~~~~8.63:~~~~7~~~~6 :~~~~4~~~~Failure of~~~~4~~~~Any detachment of the inner liner and/or moisture barrier shall constitute failing performance.~~~~8.63.6.2 -~~~~Failure of either size shall constitute failure of the test.~~~~8.63.6.3~~~~Any glove digits that do not allow full insertion shall constitute failing performance.~~~~8.63.6.4~~~~Failure of any digit of any glove shall constitute failure.~~~~8.63:~~~~7~~~~6 :~~~~2~~~~5 -~~~~Glove shall be permitted to be cut open to verify detachment.~~

Statement of Problem and Substantiation for Public Input

A sub task group was formed with the labs to review the comment on the use of the forceps. It was concluded that the use of the forceps was not relevant today. When the forceps test was placed in the std. their was only one method of attaching liners (finger tip tabs) today their are many methods of attachments including total bonding. Therefore where and what do you grip for each method of attachment. It was also stated that gloves do not fail the forceps test, they fail prior to the forceps. The failures occur after the gloves are laundered. So the group added a test subject donning and doffing the glove after it is laundered to replace the forceps.

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Submittal Date: Fri Oct 29 10:32:49 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-85-NFPA 1970-2022

Statement: The committee agrees with the findings of the task group that was formed with the labs to review and comment on the use of the forceps as part of the glove liner retention test. It was concluded that the use of the forceps was no longer relevant. When this test was placed in the standard, there was only one method of

attaching liners using fingertip tabs. Currently, there are many methods of attaching the liner including direct bonding. Therefore, the ability to judge how to grip the forceps in the gloves will vary with each method of attachment and is subject to inconsistency based on laboratory's judgement of placing the forceps. It was also stated by the laboratories conducting this test that gloves do not fail based on the forceps, but rather the liners detach or become inverted during the laundering process prior to the use of the forceps. Therefore, a recommendation was made to use a test subject donning and doffing the glove with wet hands after it has been laundered multiple times and completely remove the step of using the forceps to pull the liner.

The committee is also switching this test to the washer/extractor laundering procedures specified in the new conditioning technique that appears in Section 8.1.12 and has further specified the application of 5 wash cycles. The committee further intends to investigate these conditions to determine suitability prior to public comment.



Public Input No. 236-NFPA 1970-2021 [New Section after 8.66]

8.x.x Man-in-Simulant Test (MIST).

8.x.2.1 Application.

This test shall apply to complete turnout ensembles.

8.x.2.2 Samples.

8.x.2.2.1

Samples for conditioning shall be complete ensembles and shall include the respirator.

8.x.2.3

Samples shall be conditioned as specified in 8.1.2.

8.x.2.3 Specimens.

8.x.2.3.1

The specimen shall be a complete ensemble with gloves and footwear and shall include the respirator.

8.x.2.3.2

Where the ensemble utilizes the respirator facepiece as the ensemble visor, the ensemble shall be tested with each type or model of the respirator specified by the manufacturer.

8.x.2.3.3

Where the respirator is completely encapsulated by the ensemble, the ensemble shall be tested with a respirator specified by the manufacturer.

8.x.2.3.4

A minimum of four specimens shall be tested. The specimens shall represent a minimum of two different ensemble sizes.

8.x.2.3.5

Where the ensemble has multiple types of external fittings, each type of external fitting shall be present on each specimen at the time of testing.

8.x.2.3.6

Specimens shall be provided to fit or be adjustable to fit the selected test subjects in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

8.x.2.3.7*

None of the ensembles or components of the ensemble to be tested shall have been previously subjected to MIST testing unless it can be demonstrated that the ensemble or components are free of contamination.

8.x.2.3.8

Underclothing and socks shall be permitted to be reused, provided they have been laundered with a detergent that has been demonstrated not to cause interference with the analytical method.

8.x.2.3.9

Where socks are used as part of the protective ensemble, it shall be permitted that testing be performed on only one representative outer boot style for the evaluation of the ensemble.

8.x.2.4 Apparatus.

8.x.2.4.1 Test Facility.

8.x.2.4.1.1

The test facility shall include areas for dressing, a first stage undressing area adjacent and accessible to the chamber, and a second stage undressing area adjacent and accessible to the first stage undressing area.

8.x.2.4.1.2

The test shall be conducted in a test chamber with a minimum volume of sufficient dimensions to permit free movement of the test subject(s) when fully dressed in the ensemble and for the test subject(s) to carry out the physical exercise routine specified in 8.2.2.5.8.

8.x.2.4.1.3

More than one test subject shall be permitted in the chamber at the same time, provided they can complete all tasks completely in the appropriate time period and that they have an unobstructed direct path to the wind stream.

8.x.2.4.1.4

The test chamber shall have a temperature of 25°C, ± 2°C, relative humidity of 55 percent, ± 10 percent, and a nominal wind speed of 0.9 to 2.2 m/sec (2 to 5 mph). The average wind speed shall be 1.6 m/sec, ± 0.2 m/sec (3.5 mph, ± 0.5 mph).

8.x.2.4.2 Test Chemical and Analytical Equipment.

8.x.2.4.2.1

The test simulant shall be methyl salicylate (MeS; C₈H₈O₃) CAS #119-36-8, more commonly known as oil of wintergreen. The MeS minimum purity shall be 95 percent. Vapor doses shall be measured using passive adsorbent dosimeters (PADs).

8.x.2.4.2.2*

The standard concentration of MeS in the vapor chamber shall be 150 mg/m³, ± 10 mg/m³, as measured by a **real-time infrared analysis** of the chamber air or other validated real-time analytical technique.

8.x.2.4.2.3

Readings shall be taken every 60 seconds to verify compliance with the concentration requirement, and an air sample shall be taken at least every 10 minutes for validation of readings.

8.x.2.4.2.4

Every step shall be taken to avoid generation of liquid aerosol.

8.x.2.4.2.5

The sensitivity of the analytical technique used for the measurement of MeS in the PADs shall provide a detection limit of 30 ng MeS per PAD. The analytical technique shall have an upper limit of quantification of 50,000 ng.

8.x.2.4.3*Passive Adsorbent Dosimeters (PADs).

The test shall be conducted using PADs that affix directly to the skin of test subjects and that have the following characteristics:

- (1) The PADs shall be a foil packet, which contains an adsorbent material covered by a high-density polyethylene film that acts as a pseudo-skin barrier.
- (2)* The high-sensitivity polyethylene film shall have an uptake rate of approximately 2.0 cm/min.

8.x.2.4.4 Test Subjects.

8.x.2.4.4.1

All test subjects shall be medically and physically suitable to perform these tests without danger to themselves. A medical certificate for each test subject shall have been issued within 12 months prior to testing.

8.x.2.4.4.2

Test subjects shall be familiar with the use of chemical-protective ensembles and with the selected CBRN SCBA.

8.x.2.5 Procedure.

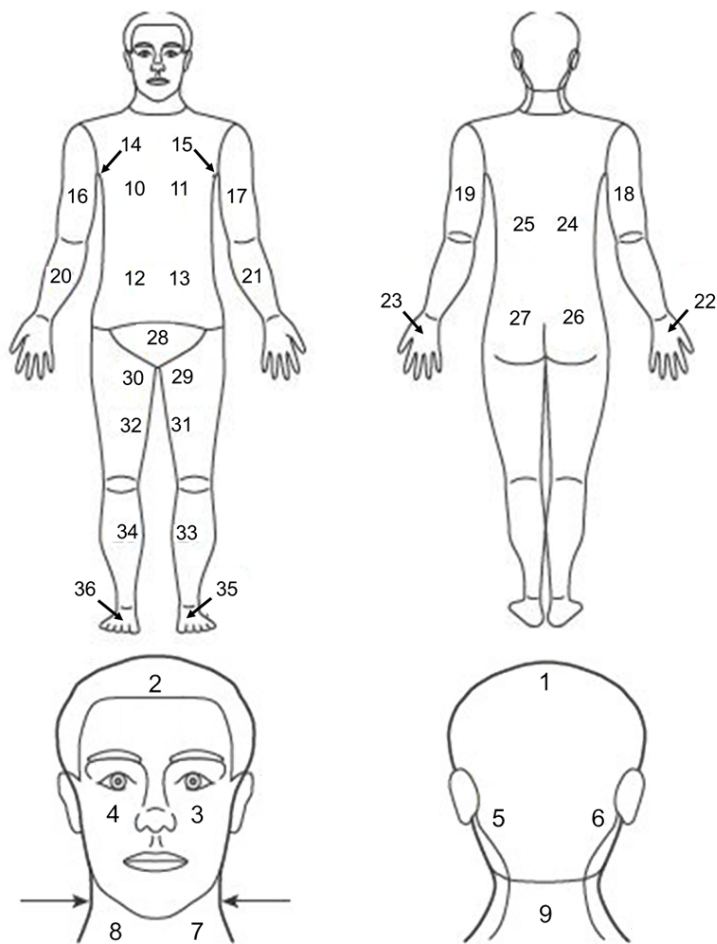
8.x.2.5.1

Test subjects shall have followed pretrial procedures that include proper hydration and avoiding personal hygiene products that could contain MeS.

8.x.2.5.2

PADs shall be placed on test subjects at the body region locations shown in Figure 8.2.5.2.

FIGURE 8.x.2.5.2 Locations of PADs on Test Subjects.



- 1: scalp (SCA)

2: forehead (F)

3: cheek (LC)

4: cheek (RC)

5: behind left ear (LE)

6: behind right ear (RE)

7: neck left (LN)

8: neck right (NR)

9: nape (NA)

10: right upper chest (RUC)

11: left upper chest (LUC)

12: right lower abdomen (RLA)

13: left lower abdomen (LLA)

14: right armpit (RA)

15: left armpit (LA)

16: right inner upper arm (RIU)

17: right inner upper arm (RIU)

18: right outer upper arm (ROU)
- 19: left outer upper arm (LOU)

20: right forearm (RFA)

21: left forearm (LFA)

22: right hand (RH)

23: left hand (LH)

24: right middle back (RMB)

25: left middle back (LMB)

26: right lower back/buttock (RLB)

27: left lower back/buttock (LLB)

28: groin (GR)

29: left crotch (LC)

30: right crotch (RC)

31: left inner thigh (LIT)

32: right inner thigh (RIT)

33: left inner shin (LIS)

34: right inner shin (RIS)

35: left foot (LF)

36: right foot (RF)

Table 8.x.2.7.2.1 Site-Specific OSED by PAD Location

8.x.2.5.2.1

All PADs shall be applied in a clean dressing area by personnel who have followed pretrial procedures to minimize contamination. Test subjects shall also follow pretrial procedures to minimize contamination.

8.x.2.5.2.2

Cheek PADs shall be located entirely within the respirator facepiece, and all other PADs shall be located entirely outside the seal of the respirator facepiece.

8.x.2.5.3

Three additional PADs shall be used to conduct background sampling and for quality control during the trial. These PADs shall be located in the dressing area, the stage 1 undress area, and the stage 2 undress area.

8.x.2.5.4

The test subject shall don the protective ensemble and respirator in accordance with the manufacturer's instructions in an area located away from the test chamber. The test subject shall wear clothing under the CBRN protective ensemble as specified by the manufacturer. If no undergarments are specified or required by the manufacturer as part of the certified ensemble, the test subject shall wear a short-sleeve cotton shirt and shorts or underwear.

8.x.2.5.5

After sealing the ensemble, the test subject shall enter the test chamber, and the test chamber shall be sealed.

8.x.2.5.6

The test duration will be 30 minutes in the chamber with a 5-minute decontamination period.

8.x.2.5.7

The start of the test, in which the test subject enters the MIST chamber, shall be initiated within 60 minutes after removal of the ensemble from the conditioning environment.

8.x.2.5.8 Physical Exercise Routine.

8.x.2.5.8.1

Once the chamber concentration has been established, the test subject(s) shall perform the following physical activity protocol and the chamber concentration shall remain within acceptable limits during the exercise protocol:

(1) Drag 70 kg (154 lb) human dummy using both hands a distance of 10 m (33 ft) over a 15-second period. Stop and rest for 15 seconds. Repeat exercise twice.

(2) Duck squat, pivot right, pivot left, stand. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(3) Stand erect. With arms at sides, bend body to left and return, bend body forward and return, bend body to right and return. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(4) Stand erect. Extend arms overhead in the lateral direction, then bend elbows. Extend arms overhead in the frontal direction, then bend elbows. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(5) Stand erect. Extend arms perpendicular to the sides of torso. Twist torso left and return, twist torso right and return. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(6) Stand erect. Reach arms across chest completely to opposite sides. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(7) Climb two steps of the ladder and touch the ceiling with one hand (use alternate hands each time). Climb down, squat, and touch the floor with both hands. Repeat exercise three times within 1 minute.

(8) Crawl in place for 1 minute. Rotate orientation 90 degrees to wind stream every 15 seconds.

(9) Sit on stool (facing wind) and slowly turn head from side to side between extreme positions on each side. Pause momentarily at east extreme position and inhale. Repeat the exercise for 1 minute.

(10) Sit on stool (back to wind) and slowly move head up and down. Pause momentarily at each extreme position and inhale. Repeat the exercise for 1 minute.

8.x.2.5.8.2

Physical activities and rest periods shall be performed in a chamber location that provides an unobstructed exposure of the protective ensemble to the required wind stream.

8.x.2.5.8.3

Each physical activity and rest cycle shall be 10 minutes. The cycle of exercise and rest shall be completed a total of three times, for a total chamber exposure of 30 minutes. Each exercise cycle shall consist of eight 1-minute activities followed by a 2-minute rest (sitting) period.

8.x.2.5.8.4

The test subject shall begin the first repetition of each activity facing the wind stream and shall rotate 90 degrees between each repetition until the time period for that exercise has ended.

8.x.2.5.8.5

All physical activities shall be a full range of motion and performed at a moderate speed.

8.x.2.5.9 Decontamination and Doffing.

8.x.2.5.9.1

After completion of the 30-minute MIST exposure, the test subjects shall move to a decontamination area, where they shall remain for at least 5 minutes. This area shall be well ventilated to assist in off gassing of the outside of the ensemble.

8.x.2.5.9.2

In the decontamination area, all exposed ensemble surfaces, including such items as the respirator, boots, gloves, and helmets, shall be washed with a liquid soap solution.

8.x.2.5.9.2.1

If the garment is designed for wet decontamination, it shall be washed with the liquid soap solution as well.

8.x.2.5.9.2.2

Alternative decontamination methods, such as an air wash, shall be permitted if the selected decontamination method can be demonstrated to remove MeS to levels that do not result in contamination of the test subjects during the doffing of the protective ensemble.

8.x.2.5.9.3

The decontaminated test subject shall move to the first stage undressing room where all remaining items of clothing, except for underclothes, shall be doffed. The undress process shall not exceed 5 minutes.

8.x.2.5.9.4

As soon as the garment is unsealed and the PADs on the test subject's body are exposed to the ambient atmosphere in the first stage undressing room, three fresh PADs shall be placed near the test subject to detect background MeS concentrations.

8.x.2.5.9.5

As soon as all items of clothing, except the underwear, are removed, the decontaminated test subject shall proceed to the second stage undressing room and the background PADs shall be collected and handled as specified in 8.2.2.5.9.7. The exposure time for the first stage undressing room background PADs shall be recorded.

8.x.2.5.9.6

When the test subject enters the second stage undressing room, three additional PADs shall be placed near the test subject and the exposure PADs shall be removed from the test subject's body. Both the second stage undressing room background PADs and the exposure PADs taken off the test subject's body shall be handled as specified in 8.2.2.5.9.7. The exposure time for the second stage undressing room PADs shall be recorded.

8.x.2.5.9.7

Where an adhesive is used on the back of the PADs, each PAD shall be backed with aluminum foil, placed in individual sealed glass vials with a nonadsorbent lid liner, and shall remain at room temperature of 25°C, ± 3°C (77°F, ± 5°F) for 30 minutes, ± 5 minutes, immediately after exposure.

8.x.2.6 PAD Qualification and Analysis.

8.x.2.6.1

The uptake rate for each lot of PADs shall be determined in accordance with 8.2.2.6.2 using a minimum of seven PADs selected randomly from the lot.

8.x.2.6.2*Measurement of PAD Uptake Rate.

8.x.2.6.2.1

PAD uptake rate shall be measured by exposing PADs in a small-scale chamber under the following conditions:

- (1) The concentration of MeS shall be 1 mg/m³, ± 0.5 mg/m³.
- (2) The temperature shall be 35°C, ± 2°C (94°F, ± 4°F).
- (3) The relative humidity shall be 55 percent, ± 20 percent.
- (4) The flow of MeS in the humidified air or nitrogen shall be at a rate of 1 cm/sec, ± 0.2 cm/sec over the PAD.
- (5) The exposure shall be conducted for a period of 30 minutes, +1/–0 minutes.

8.x.2.6.2.2

The PAD uptake rate shall be calculated in accordance with the procedures provided in 8.2.2.6.4. The average of all PAD uptake rates shall be calculated and used in the calculation of MeS dosage on the test subject PADs.

8.x.2.6.3

After their initial 30 minutes at room temperature, the PADs shall be subjected to one of the following handling and analysis procedures:

- (1) The PADs shall be stored at a cold temperature sufficient to prevent the migration of MeS from the adhesive until extraction or analysis.
- (2) The PADS shall be extracted within 4 hours.
- (3) The adsorbent shall be removed and thermally desorbed within 4 hours.

8.x.2.6.3.1

The determination of a sufficiently low temperature that prevents migration of the MeS from the adhesive shall be made by exposing 12 PADs simultaneously in the test chamber in a vertical position at a concentration of 100 mg/m³ of MeS for 30 minutes, +5 minutes, –0 minutes. After this exposure, the PADs shall be covered in foil and each placed in a sealed container and stored at 25°C, ± 3°C (77°F, ± 5°F) for 30 minutes, ± 5 minutes. Four of these PADs shall be packed in dry ice for 24 hours, four placed in the proposed cold storage temperature for 24 hours, and four extracted or analyzed within 4 hours. The average mass absorbed on the four PADs stored at the proposed storage temperature shall equal with 95 percent confidence the average mass absorbed on four PADs stored for 24 hours in dry ice and the four PADs analyzed immediately after exposure.

8.x.2.6.3.2

Where liquid extraction of the PADs samples is performed, the liquid extracts shall be stored at 0°C to 4°C (32°F to 39°F) for up to 14 days following their exposure before analysis.

8.x.2.6.4

The actual MeS vapor exposure concentration and the actual time of exposure shall be used to determine the uptake rate from the following equation:

[8.2.2.6.4]

$$U = m / Act$$

where:

u = the uptake rate in cm/min

m = the total mass of MeS measured on the PAD in mg

A = the average active area of the PAD in cm²

Ct = the exposure vapor dosage in mg/min/cm³

8.x.2.6.5

The range of the analytical technique shall be sufficient to measure the expected range of MeS dosage on the test subject PADs.

8.x.2.6.5.1

When liquid extraction is used as the analytical technique, the calibration curve used for determining the equipment response to MeS shall be established using at least 4 MeS concentration standards accounting for the proper density of

the extraction solvent.

8.x.2.6.6

For the test results to be considered valid for a given ensemble, no more than one PAD from each of the body region locations tested (i.e., no more than one PAD out of all replicates for any particular region) shall be permitted to be lost to analysis.

8.x.2.7 Calculations.

8.x.2.7.1

The dosage measured by each PAD ($C_{t_{inside,i}}$) shall be determined using the average uptake rate determined for the PAD lot used in the evaluation of a specific ensemble using the following equation:

[8.x.2.7.1]

$$C_{t_{inside,i}} = m_i / u_{avg} A$$

where:

$C_{t_{inside,i}}$ = the MeS vapor dosage at the specific PAD in mg/min/cm³

m_i = the total mass of MeS measured on the specific PAD in mg

u_{avg} = the average uptake of the PAD lot in cm/min

A = the average active area of the PA in cm²

8.x.2.7.1.1

The protection factor at each PAD location shall be calculated using the following equation:

[8.x.2.7.1.1]

$$PF_i = C_{t_{outside}} / C_{t_{inside,i}}$$

where the $C_{t_{outside}}$ shall be determined from the measured chamber vapor dosage of the individual trial over the entire exposure. The value for $C_{t_{outside}}$ shall be the average of the chamber MeS concentration readings taken during the course of the test subject exposure period.

8.x.2.7.1.2

Where the measured total mass of MeS for a given PAD falls below 30 ng, the value of 30 ng shall be used for that specific PAD.

8.x.2.7.2

All results for each PAD location shall be expressed in terms of the local physiological protective dosage factor (PPDF) value and shall be calculated according to the following equation:

[8.x.2.7.2]

$$Local\ PPDF_i = (OSED_i / 25) * PF$$

where:

OSED = onset of symptoms exposure dosages

PF = protection factor

8.x.2.7.2.1*

The site-specific onset of symptoms exposure dosages (OSED) for each PAD shall be based on ECT10 values for mustard blistering/ulceration according to Table 8.2.2.7.2.1.

Table 8.x.2.7.2.1 Site-Specific OSED by PAD Location

<u>Body Region</u>	<u>PAD Location</u>	<u>OSED (mg•min•m⁻³)</u>
<u>Head/neck</u>	<u>1, 2, 3, 4, 5, 6, 7, 8, 9</u>	<u>100</u>

<u>Body Region</u>	<u>PAD Location</u>	<u>OSED (mg•min•m⁻³)</u>
<u>Torso/buttocks (excluding perineum)</u>	<u>10, 11, 12, 13, 24, 25, 26, 27, 28</u>	<u>100</u>
<u>Arm/hand</u>	<u>14, 15, 16, 17, 18, 19, 20, 21, 22, 23</u>	<u>50</u>
<u>Leg/foot</u>	<u>31, 32, 33, 34, 35, 36</u>	<u>100</u>
<u>Perineum</u>	<u>29, 30</u>	<u>25</u>

8.x.2.7.2.2

The average local PPDF values at each PAD location for all specimens tested shall be calculated.

8.x.2.7.3

A systemic PPDF shall also be calculated from the PAD data. The systemic protection analysis shall use the systemic weighting body region hazard analysis values from the Defense Research Establishment Suffield Report and National Research Council Report to calculate the systemic physiological protective dosage factor for each ensemble test (PPDF_{sys}). The PPDF_{sys} for each specimen is calculated as follows, where each of the terms is calculated using the information in Table 8.2.2.7.3.

[8.x.2.7.3]

$$PPDF_{sys} = \sum_i (dz_i / ED_{50i}) / \sum_i (dz_i / ED_{50i} * PF_i)$$

Table 8.x.2.7.3 ED_{50i} Values by PAD and Body Location

<u>Body Region <i>i</i> for BRHA Model</u>	<u>PADs Mapped to This Region (Average Dosage from Each PAD, Then Calculate PF_{<i>i</i>})</u>	<u>Area of Body Region (<i>dz_i</i> , cm²)</u>	<u>ED_{50i} for Severe Effects (VX) for Body Region (mg/Individual)</u>
<u>Scalp</u>	<u>1, 2</u>	<u>350</u>	<u>0.76</u>
<u>Ears</u>	<u>5, 6</u>	<u>50</u>	<u>0.46</u>
<u>Face, cheeks, and neck</u>	<u>3, 4, 7, 8</u>	<u>300</u>	<u>0.48</u>
<u>Chin and neck</u>	<u>7, 8</u>	<u>200</u>	<u>0.36</u>
<u>Nape</u>	<u>9</u>	<u>100</u>	<u>1.72</u>
<u>Chest/Abdomen</u>	<u>10, 11, 12, 13</u>	<u>2858</u>	<u>2.23</u>
<u>Back</u>	<u>24, 25, 26, 27</u>	<u>2540</u>	<u>2.65</u>
<u>Axillae</u>	<u>14, 15</u>	<u>200</u>	<u>2.07</u>
<u>Upper arm medial</u>	<u>16, 17</u>	<u>488</u>	<u>2.8</u>
<u>Upper arm lateral</u>	<u>18, 19</u>	<u>706</u>	<u>6.57</u>
<u>Elbow fold</u>	<u>16, 17, 18, 19, 20, 21</u>	<u>50</u>	<u>2.09</u>
<u>Elbow</u>	<u>16, 17, 18, 19, 20, 21</u>	<u>50</u>	<u>2.25</u>
<u>Forearm extensor</u>	<u>20, 21</u>	<u>487</u>	<u>2.8</u>
<u>Forearm flexor</u>	<u>20, 21</u>	<u>706</u>	<u>6.57</u>
<u>Hands dorsum</u>	<u>22, 23</u>	<u>200</u>	<u>2.91</u>
<u>Hands palmar</u>	<u>22, 23</u>	<u>200</u>	<u>9.24</u>
<u>Buttocks</u>	<u>26, 27</u>	<u>953</u>	<u>4.26</u>
<u>Groin</u>	<u>28</u>	<u>300</u>	<u>1.22</u>
<u>Scrotum</u>	<u>29, 30</u>	<u>200</u>	<u>0.11</u>
<u>Thigh anterior</u>	<u>31, 32</u>	<u>2845</u>	<u>6.57</u>

<u>Body Region i for BRHA Model</u>	<u>PADs Mapped to This Region (Average Dosage from Each PAD, Then Calculate PF i.)</u>	<u>Area of Body Region (dZ_i , cm^2)</u>	<u>ED 50 i for Severe Effects (VX) for Body Region (mg/Individual)</u>
<u>Thigh posterior</u>	<u>31, 32</u>	<u>1422</u>	<u>4.26</u>
<u>Knee</u>	<u>31, 32, 33, 34</u>	<u>200</u>	<u>7.14</u>
<u>Popliteal space (back of knees)</u>	<u>31, 32, 33, 34</u>	<u>100</u>	<u>2.09</u>
<u>Shins</u>	<u>33, 34</u>	<u>1897</u>	<u>6.57</u>
<u>Calves</u>	<u>33, 34</u>	<u>948</u>	<u>2.8</u>
<u>Feet dorsum</u>	<u>35, 36</u>	<u>500</u>	<u>6.6</u>
<u>Feet plantar</u>	<u>35, 36</u>	<u>300</u>	<u>7.14</u>

8.x.2.7.3.1

The average PPDFsys for all specimens tested shall be calculated.

8.x.2.7.3.2*

The protection factor PFi used in the calculation of PPDFsys shall be the average PF of all PADs in a specific body region.

8.x.2.8 Report.**8.x.2.8.1**

The individual specimen and average local PPDFi values for each PAD location shall be recorded and reported.

8.x.2.8.2

The PPDFsys value for each specimen and the average PPDFsys value for the ensemble tested shall be recorded and reported.

8.x.2.8.3

A spreadsheet shall be prepared that shows all test measurements and calculations, including at least the following:

- (1) The MeS vapor exposure concentration for PAD lot qualification
- (2) The exposure time used for PAD lot qualification
- (3) The measured MeS mass on each PAD used for PAD lot qualification
- (4) Each individual and the average PAD uptake rate
- (5) The measured MeS mass on each PAD used in the dressing room, stage 1 undressing room, and stage 2 undressing room
- (6) The measured MeS mass on each PAD placed on the test subject
- (7) The calculated vapor dosage for each PAD placed on the test subject

8.x.2.9 Interpretation.

The average local PPDFi values at each PAD location and the average PPDFsys value shall be used to determine pass or fail performance.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Mist_sub.docx	MIST	

Statement of Problem and Substantiation for Public Input

With cancer now being a major concern for firefighters, attempts to limit exposure to harmful chemicals were added to the NFPA 1971 standard. Most notably particulate blocking hoods and particulate blocking suits are now an option for fire departments to consider when purchasing garments. Study after study has found harmful chemicals within these particles

and every attempt should be made to limit and remove them as soon as possible from the skin. However, it is my belief that in a working fire, vapors (not those trapped in a particle) pose more of a risk to firefighters. These free toxic gases are available to transfer through the skin without having to be desorbed, extracted or leached out of a particle. With this thought in mind I have added an optional section that would allow manufactures to produce a vapor resistant (not proof) fire suit to limit the amount of particles and vapor that would come in contact with the skin. At this point there is no solid data to support this concept however, current research being conducted at IFSI will answer this question. Information about the IFSI study can be found below.

Overview

The Illinois Fire Service Institute (IFSI) PPE Interface Project builds off of the UL FSRI-IFSI-NIOSH research conducted during the "Cardiovascular and Chemical Exposure Risks in the Fire Service" project. Through this project led by IFSI, we will study the impact of firefighter personal protective equipment (PPE) interfaces on smoke exposure (gas and particulate) and the generation of heat stress using mannequin and human subject testing. Firefighting PPE is undergoing rapid evolution in an attempt to reduce solid phase smoke exposure. Examples of new approaches include interface control measures on bunker coats and pants and particle blocking hoods. However, studies to determine the effectiveness of these features has largely been limited to laboratory testing and qualitative fluorescent aerosol testing as opposed to full-scale smoke exposure. Furthermore, the ability of these control measures to impact vapor exposure and systemic absorption has not been studied. Simultaneous work to characterize how changes to PPE and increased encapsulation affects heat stress must be conducted to allow firefighters to understand the balance between these risks. The results of this research will be broadly disseminated to the fire service through the development of multiple mechanisms including and online training program.

Goals and Objectives

The goals of this study are to: 1) investigate the gas-phase and solid-phase chemical exposure, with a particular emphasis on known, probable and possible carcinogenic products of combustion and 2) quantify the impacts of various control measures to reduce both the vapor and particulate products of combustion reaching the firefighters' skin and being absorbed into the body while assessing the trade-offs between increased chemical protection and potential impact on heat stress.

To accomplish these goals, the specific aims include:

- 1) Compare protection provided by the different iterations of firefighting PPE –specifically bunker coat, pant and hood - using variations in firefighting PPE that are either currently available or can be rapidly brought to market. For this study, we will initially investigate four PPE conditions that are designed to reduce ensemble element interface vulnerabilities.
- 2) Characterize the additional protection provided by base layers, including long- and short-sleeve and leg base layers.
- 3) Estimate the benefit of rapidly opening up bunker coat during PPE doffing as a simple process to reduce systemic exposure to fireground vapors.
- 4) Quantify the tradeoff between each of the protection measures in aims #1-3 (interface tightening, increased base layer, rapid opening of coats) on firefighter heat strain development.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 235-NFPA 1970-2021 [New Section after 7.20]	

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
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Submittal Date: Mon Nov 08 21:35:11 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-233-NFPA 1970-2022

Statement: The fire service is increasingly becoming aware that the different elements of clothing and equipment that make up their ensembles lack compatibilities and provide varying levels of performance. While NFPA standards address the specific design, performance, and testing requirements of the individual elements, there is the absence of full ensemble evaluations for assessing performance, function, and comfort for ensembles when integrated. This responsibility falls to individual fire departments and organizations but there are only a handful of test standardized test methods and few criteria to address how full ensembles should be designed, particularly for structural firefighting. In addition, the increasing use of electronics as part of protective ensembles has a significant impact on the end user in terms of their utility and should be addressed in the absence of specific standards.

With cancer now being a major concern for firefighters, attempts to limit exposure to harmful chemicals were added to the NFPA 1971 standard. Most notably particulate blocking hoods and particulate blocking suits are now an option for fire departments to consider when purchasing garments. Study after study has found harmful chemicals within these particles and every attempt should be made to limit and remove them as soon as possible from the skin. However, it is indicated in a working fire, vapors (not those trapped in a particle) pose more of a risk to firefighters. These free toxic gases are available to transfer through the skin without having to be desorbed, extracted or leached out of a particle.

The MIST test that was separately proposed as an optional performance requirement is being placed in this annex as a way for it to be applied.

**Public Input No. 153-NFPA 1970-2021 [Section No. 8.66]****8.66 Particle Inward Leakage Test.****8.66.1 Application.**

This test shall apply to liquid and particulate protective ~~ensembles~~ garments .

8.66.2 Samples.**8.66.2.1**

~~Samples shall consist of liquid and particulate protective ensembles, including the ensemble garment, helmet, glove, and footwear elements, and the SCBA specified for the ensemble by the ensemble manufacturer. The hood interface component shall also be tested where the hood is not part of the liquid and particulate protective ensemble garment elements.~~

8.66.2.2 –

~~The ensemble shall be tested with each style of the SCBA specified by the manufacturer garments combined with the following elements, specified by the manufacturer, for the purposes of testing a full ensemble:~~

- ~~(1) A specific protective helmet certified to the fire fighting protective helmet requirements of this standard.~~
- ~~(2) A specific pair of protective gloves certified to the fire fighting protective glove requirements of this standard where the glove is of a gauntlet style and the glove length measured from the tip of the longest glove finger to the edge of the gauntlet is no longer than 305 mm (12 in.).~~
- ~~(3) A specific pair of protective footwear certified to the fire fighting protective footwear requirements of this standard where the height of the footwear as measured from the sole wear surface is no higher than 406 mm (16 in.).~~
- ~~(4) A specific particulate-blocking hood certified to the fire fighting requirements in this standard including the additional design and performance requirements for optional fire fighting protective hood interface requirements for providing particulate protection.~~
- ~~(5) An SCBA certified to 2019 edition of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services .~~

8.66.2.

3

2 _**Garment**~~, glove, and hood~~elements shall be conditioned as specified in 8.1.

44

12 .

8.66.2.

4-

~~Where the ensemble garment element does not include attached booties, the footwear shall be conditioned by flexing for 100,000 cycles in accordance with Appendix B of FIA 1209, *Whole Shoe Flex*, with the following modifications:~~

- ~~(1) Water shall not be used.~~
- ~~(2) The flex speed shall be 60 cycles/min $\pm$ 2 cycles/min.~~
- ~~(3) Alternative flexing equipment shall be permitted to be used when the flexing equipment meets the following parameters:~~
 - ~~(4) The alternative flexing equipment shall be capable of providing the angle of flex as described in FIA 1209.~~
 - ~~(5) The alternative flexing equipment shall be capable of a flex speed of 60 cycles/min $\pm$ 2 cycles/min.~~
 - ~~(6) The alternative flexing equipment shall provide a means of securing the footwear during flexing.~~

8.66.2.5 -**3 _**

Samples shall be conditioned at 21°C $\pm$ 6°C (70°F $\pm$ 11°F) and 50 percent $\pm$ 30 percent relative humidity for at least 4 hours.

8.66.3 _ Specimens.**8.66.3.1 _**

Specimens for testing shall consist of the garment

~~, helmet, glove,~~andfootwearthe elements

~~, and the respirator specified for the ensemble by the ensemble manufacturer. The hood interface component shall also be tested where the hood is not part of the liquid and particulate protective ensemble garment elements.~~

specified in 8.66.2.1.**8.66.3.2 _**

A minimum of three specimens shall be tested using different test subjects .

8.66.3.3 _

Specimens shall

Specimen garments, helmets, gloves, footwear, hoods, and SCBA-facepieces shall be provided to fit or be adjustable to fit the selected test subjects in accordance with the manufacturer's sizing provisions that are specific to each

ensembleelement of the ensemble .

8.66.3.4 _

None

The ensemble elements of the ensembles or components of the

ensemble to be tested shall not have been previously subjected to particle inward leakage testing unless it can be demonstrated that the ensemble or components are free of contamination.

8.66. 3.5

For the purpose of isolating the garment, the use of duct tape to tape the hood interface component to the SCBA facepiece shall be permitted for garments that do not include an integrated hood.

8.66. 4 _ Apparatus.**8.66.4.1 _**

The test shall be conducted in a chamber large enough to conduct testing on at least one test subject.

8.66.4.2 _

The test chamber shall have a system capable of providing a stable, uniform airflow directed at the test subject.

8.66.4.3 _

The test chamber shall prevent significant aerosol contact with any areas of the facility not intended as exposure areas, to prevent contamination.

8.66.4.4 _

The test chamber shall have an aerosol generator capable of maintaining the aerosol mass concentration as specified in the procedure.

8.66.4.5 _

The challenge aerosol shall be a combination of amorphous silica, 50 percent by weight; tetraethylene glycol, 42 percent by weight; uranine, 6 percent by weight; and Tinopal™, 2 percent by weight.

8.66.4.6 _

Test subjects shall wear a suitably-sized, close-fitting, one- or multiple piece full-body garment made of black synthetic material that is sized to the individual test subject. The bodysuit must be clean and free of visible lint, to the extent practicable, prior to donning the candidate garment ensemble.

8.66.4. 6.1

This garment shall be referred to as the black indicator garment.

8.66.4.6.2

The arms of the respective black indicator garment shall extend down the test subject's arms to the wrist crease and the legs of the respective black indicator garment shall extend down to the test subject's ankles.

8.66.4.6.3

For garments without an integrated hood, the black indicator garment shall extend at least to base of the test subject's neck, but is permitted to go higher.

8.66.4.6.4

For garments with integrated hoods, the top part of the black indicator garment shall include a hood that covers the test subject's head with the exception of the face area to allow for the uninhibited wearing of the selected SCBA-facepiece.

8.66.4.6.5

The full-body garment must be clean and free of visible lint, to the extent practicable, prior to donning the candidate garment ensemble.

8.66.4. 7 _

Visual inspection of the test participant

subject, while wearing the black indicator garment, shall be performed under illumination by black light in a dark room after doffing the candidate garments. Inspection shall be performed while the test participant is fully illuminated by black light with a wavelength of 365 nm.

8.66.4.8 * _

A separate handheld black light with a wavelength of 365 nm and an intensity of 1200 $\mu\text{W}/\text{cm}^2$ at 380 nm shall be used to inspect areas where the presence of fluorescent particles could be unclear.

8.66.4.9 _

A 35 mm camera or digital equivalent with the appropriate capabilities and settings for taking photographs under UV light shall be provided for documenting the visual condition of the test subject before and after exposure to the aerosol.

8.66.4.10 _

The test facility shall have separate garment storage, donning, doffing, and control room areas to prevent contamination.

8.66.4.11 _

All test subjects shall have a medical doctor's certificate that substantiates that they are medically and physically suitable to perform these tests without danger to themselves. The medical certificate shall have been issued within 12 months prior to testing.

8.66.4.12 _

Test subjects shall be familiar with the use of structural firefighting protective clothing and equipment and with the selected respirator.

8.66.5 _ Procedure.**8.66.5.1 _**

The test chamber shall be stabilized with the following conditions:

- (1) Average wind speed shall be 47 m/sec $\pm$ 0.89 m/sec (10.0 mph $\pm$ 2 mph) at the fan outlet airflow station.
- (2) Temperature shall be 21°C $\pm$ 6°C (70°F $\pm$ 5°F).
- (3) Relative humidity shall be 45 percent $\pm$ 15 percent.
- (4) Average aerosol concentration shall be 160 mg/m³, $\pm$ 25/-0 mg/m³.
- (5) Aerosol aerodynamic mass median diameter shall be 2.5 μ m $\pm$ 0.5 μ m.

8.66.5.2 _

The test subject shall don black indicator garments that cover the wearer's torso, arms, hands, legs, ankles, and head excluding the face. The indicator garments shall provide a dark uniform appearance under black light illumination.

8.66.5.3 * _

At least 10 specific areas of the black indicator garment shall be masked with a suitable tape or masking product that will remain in place during testing and not affect the appearance of the indicator garment under black light illumination.

8.66.5.3.1 _

At least 10 masked areas, with minimum dimensions of 25 mm $\times$ 50 mm (1 in. $\times$ 2 in.) shall be distributed over the indicator garment.

8.66.5.4 _

The test subject shall don the protective ensemble and respirator in accordance with the manufacturer's instructions in a clean area separate from the test chamber.

8.66.5.5 _

Once the test chamber has reached the conditions stated in 8.66.5.1, the test subject will enter the chamber and be properly positioned in the wind.

8.66.5.6 _

The 30-minute test period begins when the test subject is positioned in the wind.

8.66.5.7 _

During the 30-minute test period, the test subject shall perform the three stationary exercises as specified in Table C.2 of Test Operations Procedure (TOP) 10-2-022, *Chemical Vapor and Aerosol System-Level Testing of Chemical/Biological Protection Suits*.

8.66.5.8 _

At the conclusion of the 30-minute test period, the test subject shall exit the test chamber and enter the doffing area.

8.66.5.9 _

The test subject shall then be assisted to doff the ensemble to prevent contact of the outside surface of the ensemble with the subject's skin or indicator garment.

8.66.5.9.1

If accidental contact occurs, the specific location shall be noted, and the test shall be repeated or the specific affected area shall not be considered when interpreting whether or not the garment passes or fails.

8.66.5.10 _

After doffing, the masked areas shall be unmasked on the black indicator garment and the test subject shall be examined under black light in the viewing area for evidence of particulate inward leakage that appears on the black indicator garment .

8.66.5.10.1

For coats without an integrated hood, only the upper portion of the black indicator garment up to the base of the neck shall be examined.

8.66.5.11 _

Photographs shall be taken of the test subject under black with the following minimum positions:

- (1) Front, right, back, and left side of test subject's neck and head
- (2) Front, right, back, and left side of test subject's upper torso
- (3) Front, right, back, and left side of test subject's lower torso

8.66.5.12 * _

A separate black light shall be used to inspect any areas where the presence of fluorescent particles might be unclear.

8.66.5.12.1 _

The exposure of the test subject under the black light shall be bracketed in f-stop settings on the camera to provide photographs with varying contrast to permit documentation of any observed fluorescence.

8.66.5.13

Specific areas of known fluorescent that are not attributed to other sources, e.g., lint, cross-contamination during doffing, or residual detergent on the witness garment shall be documented on a chart showing their specific location that is included as part of the report.

8.66.5.13.1

For the purpose of inspection of the black indicator garment for protective garment sets that are without an integrated hood, areas to be inspected include the test subject's arms down to the wrist crease, test subject's legs down to the ankle area, and to the top of the test subject's neck.

8.66.5.14

Where fluorescence on the black indicator garment is observed or suspected, those specific areas shall be sampled for particle contamination using the procedures established in 8.66.6.

8.66.5.15 _

The laboratory shall be permitted, but is not required, to further sample any areas that are suspect for particle contamination using the procedures established in 8.66.

5

6.

7.

These procedures, when used, shall be employed for documentation purposes only and shall not be used for interpreting compliance with the performance requirement.

8.66.6 _ Sampling and Analysis of Black Indicator Garment.

8.66.6.1 _

The test subject's black indicator garment shall be sampled to recover aerosol

any particular contamination that has been deposited

: This garmentAll

and appears visible during the black light examination using the following procedures:

(1) The number of areas sampled shall be limited to up to five areas that appear to show the greatest level of fluorescence when examined under the black light.

(2) One sample shall be taken from an area that shows no fluorescence during the examination under UV light and shall serve as a baseline level for testing.

(3) Garment -rinse sampling shall be performed by pressing a tube against the portion of the black indicator garment to be sampled and adding 20 mL of 0.01 N sodium hydroxide (NaOH).

(4). The solution shall be washed over the black indicator garment for approximately 10 seconds, then pipetted into a clean container.

8.66.6.2 –

(5) All samples shall be labeled appropriately before they are analyzed.

8.66.6.3 –

For

(6) For each of the black indicator garment-rinse samples, approximately 5 mL of each of the samples shall be analyzed in a fluorometer to determine the mass of aerosol that is present in the sample.

(7). The results shall be recorded and verified to identify and eliminate any errors in reading or recording the data.

(8) Test results shall be reported in µg/cm2 at each sampling location .

8. 66.7 _

After each trial, upon completion of the garment-rinse sampling and black light photography, the test subject shall return to a locker room and shower.

8.66.8 _ Report.

The report shall consist of the following elements:

- (1) Photographic records documenting the test ensemble and results consisting of the following:
 - (2) The identification and design details of the specific protective garment being evaluated.
 - (3) The identification of the specific elements by manufacturer, style or model number, and size evaluated as part of the full test ensemble, including the protective helmet, protective gloves, protective footwear, particulate-blocking hood, and self-contained breathing apparatus.
 - (4) A photograph of the front head-to-toe view of the test subject in the full test ensemble immediately before entering the aerosol chamber. Additional photographs of the test subject in the ensemble showing design details shall be included as warranted.
 - (5) Black light photographs of the test subject after doffing.

~~These photographs shall cover all body locations with the test subjects wearing shorts, and, for female test subjects, a sports bra.~~

- (1)
 - (a) ~~-~~
 - (b) If the post-exposure photographs show no aerosol deposits and show only
~~a black garment in a dark room~~
- (1)
 - (a) the black indicator garment free of observed fluorescence , the following statement shall be permitted in lieu of post-exposure photographs: "No visible aerosol deposits were revealed in the photographs."
- (2) The test conditions, including the following:
 - (3) The challenge aerosol mass concentration averaged for the duration of the test
 - (4) The average wind speed, temperature, and relative humidity for the test
 - (5) Date of test and test operator
- (6) Specific observations for the location of any deposited aerosol on the test subject's indicator garments as noted during visual observation under a black light
- (7) Any notable observations by the test operators, especially
~~system~~
 - (1) ensemble interface, openings, mask breaches, or poor
~~fits~~
 - (1) fit of any ensemble elements.
 - (2) Any supplemental test data sampling and analysis of the black indicator garments provided for documentation purposes only.

8.66.9 _ Interpretation.

~~Any~~

8.66.9.1

The absence of any evidence of particulate inward leakage on any test subject's indicator garment as determined by visual inspection under a black light shall constitute

~~failure:~~

passing performance.

8.66.9.2

Where the measurement of the surface concentrations of fluorescent particles are made, the specific surface concentration at each location shall be reported and be used to determine passing or failing performance.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

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Submittal Date: Wed Nov 03 08:30:53 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-244-NFPA 1970-2022

Statement: In order to align the testing requirements with the changes being introduced to the performance requirements, these updates are necessary in order to clarify that the evaluation needs to be made utilizing garment specimens instead of full ensembles.

Multiple revisions were made to the test method that are intended to improve the repeatability of the test. The addition of surrogate items was included since this method requires the use of an ensemble for the purposes of testing, but the performance criteria only evaluates the garments.

Further investigation of alternative test methods or procedures is necessary. While these revisions are aimed to improve the reliability of the test method available today, it is not an economic test method that can be performed easily and is readily available.

**Public Input No. 246-NFPA 1970-2021 [Section No. 8.70.4.1]****8.70.4.1**

Glove tool testing shall be evaluated with the use of the following apparatus:

- (1) A hand tool vertical test apparatus consisting of one horizontal board with one vertical board attached in the middle of the horizontal board. The vertical board shall have holes drilled 50 mm (2 in.) apart in a "T"-shaped fashion with a row of three holes and a row of one hole directly under and in the center of the top row.
- (2) Four- ~~19 mm (2.5 in.) coarse thread~~ M12-1.75 x 60 mm bolts with nuts and two washers
- (3) $\frac{3}{8}$ in. drive deep-well 19 mm ~~(2.5 in.)~~ socket
- (4) 19 mm ~~(2.5 in.)~~ box-end wrench
- (5) $\frac{3}{8}$ in. drive torque wrench

Statement of Problem and Substantiation for Public Input

This change provides consistent metric language to the Glove Tool Test bolts.

Submitter Information Verification

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Submittal Date: Tue Nov 09 07:40:27 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-87-NFPA 1970-2022

Statement: This change provides consistent metric language for the Glove Tool Test bolts.



Public Input No. 272-NFPA 1970-2021 [New Section after 8.71]

Optional Test Sequence to Reduce Total Number of Composites Tested

(comment includes performance criteria, test method and annex material)

7.2.XX . Garment composites shall be tested for evaporative resistance as specified in Section 8.XX – Evaporative Resistance

Test and shall have an average evaporative resistance of less than or equal to $40 \text{ m}^2 \text{ Pa/W}$.

7.2.XX.1 . Certain garment composites shall be permitted to be excluded from direct testing for evaporative resistance and instead calculated when testing is conducted by sequence of testing as specified in 8.XX.X.

8.XX.1 Application.

8.XX.1.1 . This test method shall apply to structural fire fighting protective garment element composites.

8.XX.1.2* Modifications to this test method for providing a sequence of testing to reduce the number of garment composites tested shall be as specified in 8.XX.X.

8.XX.8* Specific Requirements for the Sequence of Testing to Reduce the Number of Garment Composites Tested.

8.XX.8.1 . The control fabric shall be a layer of 7.5 oz/yd^2 woven 93 percent meta-aramid, 5 percent para-aramid, and 2 percent antistat fiber.

8.XX.8.2 . The control fabric shall be individually tested (by itself) in accordance with 8.XX.5.

8.XX.8.3 . The evaporative resistance of the control fabric shall be recorded and referred to as “Result A”.

8.XX.8.4 . The moisture barrier layer(s) and thermal barrier layer(s) for a specific garment composite shall be tested in conjunction with the control fabric in accordance with 8.XX.5 with all layers arranged in the order and orientation as worn.

8.XX.8.5 . The evaporative resistance of the control fabric with moisture barrier layer and thermal barrier layer shall be recorded and referred to as “Result B”.

8.XX.8.5.1 . If a specific moisture barrier layer(s) and thermal barrier layer(s) combination has been previously tested, it is not necessary to perform steps 8.XX.8.2 through 8.XX.8.4.

8.XX.8.6 . The outer shell layer for a specific composite shall be individually tested in accordance with 8.XX.5.

8.XX.8.7 . The evaporative resistance of the outer shell fabric shall be recorded and referred to as “Result C”.

8.XX.8.7.1 . If a specific outer shell has been previously tested, it is not necessary to perform step 8.XX.8.6.

8.XX.8.8 . The difference, “Difference D”, between the control fabric evaporative resistance of “Result A” and the garment composite evaporative resistance “Result B” shall be calculated according to the following equation:

$$\text{Difference D} = \text{Result B} - \text{Result A}$$

8.XX.8.9 . The sum, “Sum E”, of the garment outer shell evaporative resistance “Result C” and calculated moisture barrier layer/thermal barrier layer combination evaporative resistance of “Difference D” shall be calculated according to the following equation:

$$\text{Sum E} = \text{Result C} + \text{Difference D}$$

8.XX.8.10 The individual replicate evaporative resistances, in $\text{m}^2 \text{ Pa/W}$, shall be calculated, recorded and reported along with the identification of the specific layers:

- _____ (1) For “Result A”: recorded and reported
- _____ (2) For “Result B”: recorded and reported
- _____ (3) For “Result C”: recorded and reported
- _____ (4) For “Difference D”: calculated, recorded and reported
- _____ (5) For “Sum E”: calculated, recorded and reported

8.XX.8.11* The average evaporative resistance, in $\text{m}^2 \text{ Pa/W}$, for the garment outer shell “Result C”, combination of moisture barrier layer and thermal barrier layer “Difference D” and calculated garment composite “Sum E” shall be calculated, recorded and reported.

8.XX.8.12 . Using this approach, the pass or fail determination shall be based on the average calculated and reported evaporative resistance for the garment composite, “Sum E” of all specimens tested.

A.8.XX.1.2 . Because evaporative resistances are additive—which is not true for heat loss—it is possible to reduce the total amount of testing required by testing the outer shells and liners (moisture barrier and thermal barriers) separately and

adding the two components (shells and liners) together to determine the evaporative resistance of the composite.

A.8.XX.8 . See A.8.XX.1.2.

A.8.XX.8.11 Once a specific outer shell has been evaluated for its evaporative resistance, (i.e. . 8.XX.8.7), that value, “Result C”, does not need to be re-tested in the future. If future composites utilize the same specific outer shell, its previously determined value, “Result C”, can be used in the calculation of the composite’s evaporative resistance as described in 8.XX.8.7. The same logic applies in the case of the specific moisture barrier and thermal barrier combination as calculated as “Difference D” (i.e. 8.XX.8.8). For example (refer to Table A.8.XX.11),

(1) a composite (1) is comprised of an outer shell (OS1) and a moisture barrier/thermal barrier combination (L1). Using the optional test sequence, its evaporative resistance (Sum E1) is calculated.

(2) a second composite (2) comprised of a different outer shell (OS2) and the same moisture barrier/thermal barrier combination (L1) above. Rather than repeat steps 8.XX.8.2 through 8.XX.8.5 to determine A and B, the value of D calculated for L1 is used to calculate Sum E2 along with the evaporative resistance of OS2 as per 8.XX.8.9.

(3) a third composite (3) is comprised of OS1 and a different moisture barrier/thermal barrier combination (L2). Rather than repeat the testing of OS1, its previously determined evaporative resistance, is used in the calculation of evaporative resistance.

<u>Composite ID</u>	<u>Outer Shell</u>	<u>Moisture Barrier/Thermal Barrier Combination</u>	<u>Does the Result C for the given outer shell exist?</u>	<u>Do Results A and B for a given moisture barrier/thermal barrier combination exist?</u>	<u>Calculation of D</u>	<u>Calculation of E</u>
<u>1</u>	<u>OS1</u>	<u>TL1</u>	<u>No, Test C1</u>	<u>No, Test A1, B1</u>	<u>D1 = B1 – A1</u>	<u>E1 = C1+D1</u>
<u>2</u>	<u>OS2</u>	<u>TL1</u>	<u>No, Test C2</u>	<u>Yes, A1, B1</u>	<u>D1</u>	<u>E2 = C2 + D1</u>
<u>3</u>	<u>OS1</u>	<u>TL2</u>	<u>Yes, C1</u>	<u>No, Test A2, B2</u>	<u>D2 = B2-A2</u>	<u>E3 = C1 + D2</u>

Table A.8.75.11

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
optional_test_sequence_-_NFPA_1970.docx		

Statement of Problem and Substantiation for Public Input

Substantiation for Optional Ret Test Sequence:

Since evaporative resistances are additive—which is not true for heat loss—an option exists to reduce the total amount of testing. The optional test sequence provided in this comment delineated an alternative method to testing every combination of outer shell, moisture barrier, or thermal barrier for evaporative resistance testing. As an example, if all the permutations of 15 outer shells, 6 moisture barriers, and 15 thermal barriers were considered, a total of 1350 composites (excluding replicates) would need to be tested, the same amount that would be required for THL testing. With this optional test sequence, this could be reduced to 105 evaporative resistance tests (excluding replicates).

Proof of concept for this methodology has been demonstrated based on four composites using a range of outer shell, moisture barrier, and thermal barrier technologies. Based on the figures below, the optional test sequence based on measuring moisture barrier and thermal liner layers with a control fabric and adding back the intended outer shell layer to calculate the evaporative resistance appears to provide accurate estimate of absolute evaporative resistance of composite. The methodology could be applied to the initial and/or re-certification processes.

Submitter Information Verification

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Zip:
Submittal Date: Tue Nov 09 19:17:07 EST 2021

Committee: FAE-SPF

Committee Statement

Resolution: FR-175-NFPA 1970-2022

Statement: The inclusion of this test method is supported by data generated from a DHS AFG project¹. In this project a physiological manikin was used to compare ensembles made with a range of THL and evaporative resistance values². Testing was conducted in one mild environment (25C, 65%RH) and two hot environments (35 C, 40% RH, & 40 C, 28% RH). Results indicated that THL was the best predictor of heat stress in mild environments while Evaporative Resistance measurements were a better predictor of heat stress in hotter conditions. Based on these correlations and the fact that firefighters face more heat stress in hotter conditions³ evaporative resistance of composites should be included as a performance requirement within NFPA 1971. The performance requirements of 45 Pa·m²/W suggestion comes from the data from the project as well. All evaporative resistance values below this value did not show a significantly physiological difference in the 35 C environment.

Annex information is provided to support the new Evaporative Resistance Test method.

Since evaporative resistances are additive—which is not true for heat loss—an option exists to reduce the total amount of testing. The optional test sequence provided in this comment delineated an alternative method to testing every combination of outer shell, moisture barrier, or thermal barrier for evaporative resistance testing. As an example, if all the permutations of 15 outer shells, 6 moisture barriers, and 15 thermal barriers were considered, a total of 1350 composites (excluding replicates) would need to be tested, the same amount that would be required for THL testing. With this optional test sequence, this could be reduced to 105 evaporative resistance tests (excluding replicates). Proof of concept for this methodology has been demonstrated based on four composites using a range of outer shell, moisture barrier, and thermal barrier technologies. Based on the figures below, the optional test sequence based on measuring moisture barrier and thermal liner layers with a control fabric and adding back the intended outer shell layer to calculate the evaporative resistance appears to provide accurate estimate of absolute evaporative resistance of composite. The methodology could be applied to the initial and/or re-certification processes.

1 Barker R., Developing a new basis for rating the heat strain of firefighter turnout gear. Final report, Federal Emergency Management Agency, Contract No. EMW-2016-FP-00744; 2021.

2 Gao H, Deaton S., Barker R., Fang X, Watson K. Relationship between heat loss indexes and physiological indicators of turnout related heat strain in mild and hot environments. International Journal of Occupational Safety and Ergonomics. 2021 Submitted.

3 Barker R., Fang X., Deaton S, DenHartog E, Gao H, Tutterow R, Schmid M. Identifying factors that contribute to structural firefighter heat strain in North America. International Journal of Occupational Safety and Ergonomics. 2021 Sep 29 (just-accepted):1-26.



Public Input No. 284-NFPA 1970-2021 [New Section after 8.71]

8.xx Evaporative Resistance for Gloves Test .

8.xx.1 Application.

8.xx.1.1 This test method shall apply to structural fire fighting protective glove.

8.xx.2 Samples. Samples shall be conditioned at a temperature of 35 °C +/- 2 °C and a relative humidity of 40% +/- 5% for at least 4 hours.

8.xx.3 Specimens.

8.xx.3.1 Evaporative resistance testing shall be conducted on at least three specimens.

8.xx.3.2 Specimens shall be provided to fit or be adjustable to fit the thermal manikin hand in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

8.xx.4 Apparatus.

8.xx.4.1 The test apparatus shall be as specified in ASTM F3426, Standard Test Method for Thermal Insulation of Clothing Items Using Heated Manikin Body Forms, Option 2.

8.xx.4.2 The hand form must also have the ability to simulate sweat such that it would keep the hand form saturated with water.

8.xx.5 Procedure. Testing shall followed the Procedures identified in ASTM F2370, Standard Test Method for Measuring the Evaporative Resistance of Clothing using a Sweating manikin, with the following modifications:

(1) Instead of a full sized manikin only use the hand manikin specified in 8.xx.4.

(2) Use a 1 m/s wind flow to measure the evaporative resistance

(3) The calculation for the parallel evaporative resistance value for the hand should only include the fingers, thumb, palm and the back to the hand. The wrist area shall not be included in the calculation.

8.xx.6 Report.

8.xx.6.1 The average intrinsic evaporative resistance of the sample shall be reported and recorded in units of Pa·m² /W.

8.xx.7 Interpretation.

8.xx.7.1 Pass or fail determination shall be based on the average reported evaporative resistance measurements of all specimens tested.

8.xx.7.2 If an individual result from any test set varies more than +/- 10 percent from the average result, the results from the test set shall be discarded and another set of specimens shall be tested.

Statement of Problem and Substantiation for Public Input

The hands are considered the radiator of the human body. It has a large amount of blood flow and a large surface area for heat to be lost in a small space. They (along with the foot) contain more sweat glands than any other body part. With that I think that it is import to make sure that gloves worn by firefighters are breathable to help with heat stress.

To understand if changing the breathability of a glove would change the physiological performance of firefighter we ran a few virtual physiological models. In this model we ran a work/rest cycle for ~2 hours. We also used data from a common fire suit wearing a pair of breathable gloves. Then we simply increased the evaporative resistance of the glove to simulate an impermeable glove to see if it would change the core temperature or the skin temperature.

When looking at results in a mild condition (25C, 65%RH) not much difference was seen between a breathable glove and one that was impermeable when looking at whole body outputs such as the core or the mean skin temperature. However, the skin temperature of the hand was about 3oC difference between the breathable glove and the impermeable glove at the end of the simulation.

When looking a results in a hotter conditions (35C, 40%RH) we observed a 0.1 oC difference in core temperature and saw a 1.4oC difference in the hand temperature.

Related Public Inputs for This Document

Related Input

Relationship

[Public Input No. 283-NFPA 1970-2021 \[New Section after 7.8.2\]](#)

evp. resistance for gloves

Submitter Information Verification

Submitter Full Name: Anthoney Deaton**Organization:** NC State University**Street Address:****City:****State:****Zip:****Submittal Date:** Tue Nov 09 21:16:37 EST 2021**Committee:** FAE-SPF

Committee Statement

Resolution: [FR-93-NFPA 1970-2022](#)

Statement: The hands are considered the radiator of the human body. It has a large amount of blood flow and a large surface area for heat to be lost in a small space. They (along with the foot) contain more sweat glands than any other body part. With that I think that it is import to make sure that gloves worn by firefighters are breathable to help with heat stress. To understand if changing the breathability of a glove would change the physiological performance of firefighter we ran a few virtual physiological models. In this model we ran a work/rest cycle for ~2 hours. We also used data from a common fire suit wearing a pair of breathable gloves. Then we simply increased the evaporative resistance of the glove to simulate an impermeable glove to see if it would change the core temperature or the skin temperature. When looking at results in a mild condition (25oC, 65%RH) not much difference was seen between a breathable glove and one that was impermeable when looking at whole body outputs such as the core or the mean skin temperature. However, the skin temperature of the hand was about 3oC difference between the breathable glove and the impermeable glove at the end of the simulation. When looking at results in hotter conditions (35oC, 40%RH) we observed a 0.1oC difference in core temperature and saw a 1.4oC difference in the hand temperature.



Public Input No. 32-NFPA 1970-2021 [Section No. 8.71.2.3]

8.71.2.3*

A reference sample shall be

prepared

prepared that consists of a

composite

composite constructed using two layers of 8.49.

0 oz

0 oz./yd² ± 0.41.

0 oz

0 oz./yd²,

100 percent meta-aramid

100 percent

meta-aramid

meta-aramid, 1 × 1 rib knit with a stitch count of 37 courses/in. ± 2 courses/in. and 21 wales/in. ± 2 wales per in.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_46_TIA.pdf	NFPA 1971 TIA Log No. 1404	
1971_TIA_Log_1404_PI_32.pdf	1971_TIA_Log1404	

Statement of Problem and Substantiation for Public Input

This Public Input originates from TIA 18-3, Log No. 1404 issued on December 7, 2018 and per the Regs. shall be brought before the Committee for consideration for the next edition. During the development of this test method and subsequent validation procedure, the knit material referenced in this paragraph was purchased to verify the validity of the procedure. When the material was purchased, a product information sheet was submitted and those specifications were added to the standard for material selection. After reviewing the product for use in certification testing, it was determined that the weight specification provided does not match the weight of the material when measured in accordance with ASTM D3776. UL reviewed the weight procedure used by the manufacturer, and how it is used to develop the product information sheet and it was determined that the manufacturer weighs an entire roll of the material and then calculates what the average weight would be in oz/yd². Since this is not the practice of this industry or in accordance with an established laboratory practice, it is being suggested that the tolerance required be adjusted to conform with the values generated during validation of the material. The nominal weight and range chosen is intended to allow for either method for measurement and allows for the material to comply with the standard. See below for the various methods for which the material was measured at UL and none of the results are within tolerance. All measurements were taken from the exact same roll as the samples that were used during the development of this test method during the last revision of NFPA 1971 and therefore this difference in procedure was overlooked. Reference Knit for Particulate Blocking Test NFPA 1971-2018 Dimensions 7" x 7" Set (1 or 2) Set 1 Mass (grams) 9.93 oz/yd² 9.27 7" x 7" Set 2 10.10 9.42 15" x 15" Set 1 46.32 9.41 15" x 15" Set 2 45.98 9.34 8-2.7" Circles Set 1 9.45 9.45 8-2.7" Circles Set 2 9.49 9.49 Average 9.40

Submitter Information Verification

Submitter Full Name: TC on FAE-SPF
Organization: NFPA TC on FAE-SPF
Street Address:
City:
State:
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Submittal Date: Mon Aug 16 12:55:44 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-306-NFPA 1970-2022

Statement: As currently written, there is only one source of testing for performing this test, which is relatively expensive and sometime difficult to access. Research conducted by NC State under a DHS AFG Research Grant specifically on hoods has shown that hood materials with very low air permeability performed on hood composites per ASTM F737 will provide passing results for particulate blocking efficiency (see attached figure of plot for air permeability versus particulate blocking efficiency [PBE]). Further, the same research has shown that the modifications specified for F2299, which make the testing exclusive to a single laboratory, do not provide any specific differentiation of the appropriate performing particulate blocking hoods when ASTM F737 is used as a screening test and that seams can be a significant source of particle penetration through the particulate-blocking hood. The proposed changes: (1) remove certain modification of the ASTM F2299, including the modified test configuration. (2) add the performance of air permeability testing according to ASTM D737 as a means for screening materials on the need for evaluation for the measurement of particulate blocking efficiency; materials or seams with an air permeability below 25 CFM do not need to be tested. (3) specify the evaluation of seam samples representative of hood construction.

Other proposed changes to the test method include:

- Testing of both flat material and seams (seams have not been previously subjected to testing).
- A corrected description of the reference material.
- Changes to the conditioning procedures that now include a total of 4 heat exposures, 24 laundering cycles, 1 set of aggressive flexing procedures using a technique specified in other barrier product standards, and exposure to UV light, where the specific exposure levels are yet to be defined.
- The laundering procedures have been changed to a washer/extractor-based method since the top-loading method and equipment for washing material is no longer available.

The entirety of the proposed changes are intended to provide a more rigorous evaluation of protective hoods with particulate blocking capabilities that more realistically addresses the field performance of these products and their intended service life.



Public Input No. 177-NFPA 1970-2021 [Section No. 8.71.3.1]

8.71.3.1

Particulate-blocking-layer composite specimens shall be tested both before and after being twice subjected to the following conditioning:

- (1) Specimens shall be first subjected twice to the procedure specified in 8.1.2 12 .
- (2) Specimens shall then be conditioned as specified in 8.1.3.
- (3) Specimens shall then be conditioned as specified in 8.1.5.

Statement of Problem and Substantiation for Public Input

It has been well known for some time that top-loading machines that have been historically used to condition samples are becoming obsolete. The laboratories are no longer able to source new machines, and the parts that are needed to repair them are becoming scarce. This change is being submitted to change the laundering conditioning to be performed in the front loader/extractor instead of the top-loading machine. This change will provide much more availability for washing machines, more closely align the conditioning procedure to that used within 1851 and the fire station, and also minimizes the reduction in conditioning severity made by this change (coupled with the changes to the washing procedure (see PI 156).

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 156-NFPA 1970-2021 [Section No. 8.1.12]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Wed Nov 03 11:04:00 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-306-NFPA 1970-2022](#)

Statement: As currently written, there is only one source of testing for performing this test, which is relatively expensive and sometime difficult to access. Research conducted by NC State under a DHS AFG Research Grant specifically on hoods has shown that hood materials with very low air permeability performed on hood composites per ASTM F737 will provide passing results for particulate blocking efficiency (see attached figure of plot for air permeability versus particulate blocking efficiency [PBE]). Further, the same research has shown that the modifications specified for F2299, which make the testing exclusive to a single laboratory, do not provide any specific differentiation of the appropriate performing particulate blocking hoods when ASTM F737 is used as a screening test and that seams can be a significant source of particle penetration through the particulate-blocking hood. The proposed changes: (1) remove certain modification of the ASTM F2299, including the modified test configuration. (2) add the performance of air permeability testing according to ASTM D737 as a means for screening materials on the need for evaluation for the measurement of particulate blocking efficiency; materials or seams with an air permeability below 25 CFM do not need to be tested. (3) specify the evaluation of seam samples representative of hood construction.

Other proposed changes to the test method include:

- Testing of both flat material and seams (seams have not been previously subjected to testing).
- A corrected description of the reference material.
- Changes to the conditioning procedures that now include a total of 4 heat exposures, 24 laundering cycles,

1 set of aggressive flexing procedures using a technique specified in other barrier product standards, and exposure to UV light, where the specific exposure levels are yet to be defined.

- The laundering procedures have been changed to a washer/extractor-based method since the top-loading method and equipment for washing material is no longer available.

The entirety of the proposed changes are intended to provide a more rigorous evaluation of protective hoods with particulate blocking capabilities that more realistically addresses the field performance of these products and their intended service life.



Public Input No. 204-NFPA 1970-2021 [Sections 8.71.5, 8.71.6, 8.71.7]

Sections 8.71.5, 8.71.6, 8.71.7

8.71.5 Procedure.

8.71.5.1

Specimens shall be tested in accordance with ASTM F2299/F2299M, *Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres*, with the following modifications:

- (1) A reference specimen as specified in 8.71.3 shall be tested prior to the commencement of a series of testing or when the test equipment is modified or repaired.
- (2) The normal outer surface of the particulate-blocking layer shall be mounted such that it faces the upstream side as oriented in the hood.
- (3) If the airflow is met with the specimen in place, the upstream and downstream aerosol counts shall be recorded for a minimum of 5 counts at each particle range using a 1 minute sampling time.
- (4) If the downstream count is less than 100, the sampling time shall be extended until 100 counts are obtained but not longer than 5 minutes.
- (5) If the airflow is not met, the needle valve shall be closed and the OPC exhaust shall be recirculated into the downstream side to maintain a pressure drop of 249 Pa (1 in. H₂O column) across the specimen.
- (6) The material specimen cross section diameter shall be 60 mm (2.36 in.).

8.71.5.2*

The latex sphere sizes used in testing shall range from 0.1 µm to 1.0 µm and shall be created using at least eight different known particle sizes from 0.1 µm to 1.0 µm.

8.71.5.3

The required airflow shall be 1.7 L/min ± 0.1 L/min in 8.71.5.1(3)

8.71.5.4

The efficiency for each specimen shall be calculated for each sequence for conditioning using the following equation:

$$\% \text{Efficiency} = \eta = [1 - (\text{downstream counts} / \text{upstream counts})] * 100 \quad [8.71.5.4]$$

8.71.5.5

~~For each test condition, the~~ The average efficiency for each specimen- particle size shall be calculated for each test condition .

8.71.6 Report.

8.71.6.1

The final measurement ~~airflow and the pressure (ΔP) shall~~ airflow shall be recorded and reported in L/min- ~~and in Pa (in. H₂O column) , respectively~~ for each specimen.

8.71.6.2

The upstream and downstream particulate counts shall be recorded and reported ~~from 0.1 µ to 1.0 µ~~ for each particle size.

8.71.6.3

The average percent efficiency ~~shall~~ for each particle size per test condition shall be recorded and reported.

8.71.7 Interpretation.

The lowest average percent efficiency in either test condition for each particle size shall be used to determine ~~pass or fail performance~~ pass or fail performance .

Statement of Problem and Substantiation for Public Input

Adding the specimen cross section diameter specification since this will impact testing results. Using a different diameter will impact the face velocity, which will impact the product performance. The diameter being specified will provide a face velocity of 1 cm/sec which is what has been used historically.

Also adding clarification on how to report and interpret the results. The previous language was ambiguous and did not match the performance requirement outlined in chapter 7,

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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City:
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Zip:
Submittal Date: Fri Nov 05 15:45:10 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-306-NFPA 1970-2022](#)

Statement: As currently written, there is only one source of testing for performing this test, which is relatively expensive and sometime difficult to access. Research conducted by NC State under a DHS AFG Research Grant specifically on hoods has shown that hood materials with very low air permeability performed on hood composites per ASTM F737 will provide passing results for particulate blocking efficiency (see attached figure of plot for air permeability versus particulate blocking efficiency [PBE]). Further, the same research has shown that the modifications specified for F2299, which make the testing exclusive to a single laboratory, do not provide any specific differentiation of the appropriate performing particulate blocking hoods when ASTM F737 is used as a screening test and that seams can be a significant source of particle penetration through the particulate-blocking hood. The proposed changes: (1) remove certain modification of the ASTM F2299, including the modified test configuration. (2) add the performance of air permeability testing according to ASTM D737 as a means for screening materials on the need for evaluation for the measurement of particulate blocking efficiency; materials or seams with an air permeability below 25 CFM do not need to be tested. (3) specify the evaluation of seam samples representative of hood construction.

Other proposed changes to the test method include:

- Testing of both flat material and seams (seams have not been previously subjected to testing).
- A corrected description of the reference material.
- Changes to the conditioning procedures that now include a total of 4 heat exposures, 24 laundering cycles, 1 set of aggressive flexing procedures using a technique specified in other barrier product standards, and exposure to UV light, where the specific exposure levels are yet to be defined.
- The laundering procedures have been changed to a washer/extractor-based method since the top-loading method and equipment for washing material is no longer available.

The entirety of the proposed changes are intended to provide a more rigorous evaluation of protective hoods with particulate blocking capabilities that more realistically addresses the field performance of these products and their intended service life.



Public Input No. 250-NFPA 1970-2021 [New Section after 8.71.7]

8.72 Small Scale Flash Fire Exposure Test 1

8.72.1 Application

8.72.1.1 This test method shall apply to multilayer protective garment composites, wristlets, helmet ear covers, shrouds, and hoods, including single layer knit hoods that are worn in contact with the skin.

8.72.2 Specimens

8.72.2.1 Three specimens shall be tested.

8.72.2.2 Single layer specimens shall be 310mm +/- 5mm x 375mm +/-5mm.

8.72.2.2.1 For multilayer protective garment composite specimens, the inner most layer shall be 310mm +/- 5mm x 375mm +/-5mm. Subsequent layers shall increase in the longest direction by 6mm

8.72.2.3 Specimens shall consist of all layers used in the construction of the garment, excluding any areas with special reinforcements.

8.72.2.4* Specimens consisting of multiple layers shall be fastened together and shall be constructed so that the outermost layer receives all initial direct flame contact.

A8.72.2.4 One method for fastening the layers together is to overlap the ends of the longest dimension by 12.5 mm and staple along the overlapped area.

8.72.2.5 Gently fold the ends of the specimen so to not crease the fabric and fasten them together so that the surface that will be worn next to the skin comprises the inside of the cylindrical specimen, overlapping the ends no greater than 13 mm (0.5 in.) to form a cylindrical sleeve that is 310 mm $\pm$ 5 mm (12 1/4 in. $\pm$ 1/4 in) tall and has an interior circumference of 360 mm $\pm$ 5 mm (14 1/4 in. $\pm$ 1/4 in).

8.72.3 Sample Preparation

8.72.3 Specimens shall be tested both before and after conditioning as specified in 8.1.2 and then conditioning as specified in 8.1.3

8.72.4 Apparatus

8.72.4.1 The test apparatus shall be as specified in ASTM WK70964., *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Clothing Materials for Protection Against Fire Simulations (Cylinder Method)*.

8.72.4.2 The measurement apparatus configuration consists of a vertically aligned instrumented cylinder, specimen holder assembly, fuel and fuel delivery system, data acquisition hardware, and data analysis software programs. A diagram of a representative test apparatus appears in **INSERT FIGURE FOR GENERAL ARRANGEMENT OF APPARATUS.**

8.72.4.2.1 A vertically aligned instrumented cylinder measuring 310 mm tall and 102mm in diameter shall be used.

8.72.4.2.2 The cylinder surface shall be constructed of thermally stable, nonmetallic materials which will not contribute fuel to the combustion process. The resulting cylinder shall be compatible with cleaning by damp cloth or compatible cleaning liquid and not be damaged by moisture, high humidity or cleaning liquid.

8.72.4.2.3 Copper calorimeter thermal energy sensors shall be used. Each sensor shall have the capacity to measure the incident heat flux over a range from 0.0 to 165 kW/m² (0.0 to 4.0 cal/s·cm²). This range permits the use of the sensors to set the exposure level by directly exposing the instrumented cylinder to the controlled fire in a test without the test specimen and have the capability to measure the heat transfer to the cylinder when covered with a test specimen.

8.72.4.2.4 The sensors shall be constructed of a material with known thermal and physical characteristics that shall be used to indicate the time varying heat flux received by the sensors. The minimum response time for the thermal energy sensor-data acquisition system shall be < 0.2 s.

8.72.4.2.5 Fifteen thermal energy sensors shall be used. The sensors shall be uniformly distributed about the cylinder configured as six alternating columns of two and three sensors spaced 60° apart (see Fig. X) has been found effective. The representative surface area for each sensor shall be defined by a polygon projected onto the cylinder surface passing through the midpoints of lines drawn between each sensor. **INSERT FIGURE FOR DETAILS OF SENSOR PLACEMENT**

ABOUT CYLINDER

8.72.4.2.6 A provision is necessary to secure the specimen and maintain even spacing between the test specimen and the instrumented cylinder, and especially necessary for test specimens that are unable to support their own weight and maintain a uniform cylindrical shape. Spacing is established by a lower spacer ring and two upper spacer disks, and the specimen is secured to a flame-resistant pin cushion. **INSERT FIGURE FOR DETAILS OF SPECIMEN MOUNTING AND RETENTION.**

8.72.4.2.7 A flat disk of flame-resistant, thermally stable, nonmetallic materials which will not contribute fuel to the combustion process shall be used. The material must allow pins to easily pass through it, while holding the pins steady throughout the fire exposure. A carbon felt with 6.4 mm (1/4 in.) thickness has found effective.

8.72.4.3 The apparatus shall be equipped with fuel supply, delivery, and burner systems to provide reproducible fire exposures.

8.72.4.3.1 The propane fuel source shall be Liquefied Petroleum (LP) Gas meeting the HD-5 specification in ASTM D1835.

8.72.4.4 A system of piping, a pressure regulator, valves, and pressure sensors shall be provided to safely deliver gaseous propane to the pilot/exposure burners. The delivery system shall be sufficient to provide an average heat flux of at least 84 kW/m^2 , $\pm 4.2 \text{ kW/m}^2$ ($2.0 \text{ cal/s}\cdot\text{cm}^2$, $\pm 0.1 \text{ cal/s}\cdot\text{cm}^2$) for an exposure time of at least 8 s, and up to 20 s. The fuel delivery system shall be controlled to provide known exposure duration within ± 0.1 s of the set exposure time and the remaining gas between the last valve and the burner shall not exceed 220 cm^3 . The remaining excess gas in the line, after the valve closure, shall not continue to flame more than 0.1 seconds at the burner.

8.72.4.5 The burner system shall consist of eight exposure burners arranged in four evenly spaced burner towers with two exposure burners each.

8.72.4.5.1 Cylindrical burners with 23 mm inside diameter, 50 mm length, 1.9 mm gas orifices, and an operating pressure of 15-20 psi have been found to deliver suitable flame exposure.

8.72.4.5.2 The four burner towers (see Fig. X) shall be distributed at 90-degree intervals around the cylinder. The distance to the cylinder, vertical position, and directional aim of each burner shall be adjustable to yield the exposure level and uniformity described in 8.72.5.3, 8.72.5.3.1, 8.72.5.3.2, and 8.72.5.3.3 (**INSERT FIGURE FOR BURNER DETAIL**).

8.72.4.5.3 A standing pilot flame ignition system shall be used. The ignition system shall not interfere with the flame exposure pattern. The ignition system shall be interlocked to the burner gas supply valves to prevent premature or erroneous opening of these valves. Any electrical magnetic field generated by the ignition system shall be small enough so as not to interfere with the quality of the data acquisition and recording process.

8.72.4.6 A system shall be provided with the capability of acquiring and storing the results of the measurement from each sensor at least ten times per second for the data acquisition period.

8.72.4.6.1 The accuracy of the measurement system shall be less than ± 2.0 °C (± 3.6 °F) for temperature measurements. The minimum resolution of the measurement system shall be 0.01 °C (± 0.018 °F).

8.72.4.7 The software shall log the output from the thermal energy sensors in identifiable files for the preset time at or above the minimum specified data acquisition rate.

8.72.4.7.1 The software shall convert the recorded thermal sensor outputs into a measured heat flux using a method appropriate for the thermal energy sensor design. This shall include accounting for the heat losses from the surface and sides of the sensor, as appropriate.

8.72.4.7.2 The incident heat flux at each sample point for each thermal energy sensor shall be calculated using the calibration characteristics determined in 8.72.5.2.3. These values shall be stored for use in calculating the average incident heat flux and its standard deviation for nude exposures as required in 8.72.5.3.

8.72.4.7.3 Using the absorption characteristics of the thermal energy sensors, calculate and store the absorbed heat flux for each sensor for each sample point.

8.72.4.7.4 In addition to monitoring and controlling the operation of the fire, data acquisition systems, and carrying out the incident heat flux and absorbed heat flux, the computer software shall be used to prepare some of the materials for the report, sensors calibrations, etc.

8.72.5 Calibration

8.72.5.1 Calibration shall be performed in accordance with ASTM WK70964, *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Clothing Materials for Protection Against Fire Simulations (Cylinder Method)*.

8.72.5.2 Calibration

8.72.5.2.1 The thermal energy sensors are calibrated using energy sources of known characteristics. Pure radiant and combined convection and radiation sources have been found effective. A traceable calibration heat flux reference sensor shall be used when setting the energy levels for these calibrations. Each thermal energy sensor shall be calibrated before the required flame exposure conditions for specimen testing are set.

8.72.5.2.2 The reference heat flux sensor shall be calibrated against a suitable NIST (or other recognized standards body) traceable reference with an accuracy of $\pm 5\%$. Commonly used calibration methods for reference sensors do not typically cover the range up to 84 kW/m^2 . Sensors shall be calibrated to at least 40 kW/m^2 , and must demonstrate linearity over this range to extrapolate up to 84 kW/m^2 .

8.72.5.2.3 Using the calibration energy source, expose each sensor over the range of 3 to 100 kW/m^2 (0.07 to $2.5 \text{ cal/s}\cdot\text{cm}^2$). It is recommended that a minimum of two different heat flux levels be used for this calibration, one representative of nude exposure conditions and the other representative of conditions under a test specimen. Measure the heat fluxes produced by the calibration energy source with the reference heat flux sensor.

8.72.5.2.4 Generate a calibration function such that each thermal energy sensor calculates heat flux to within 5 % of the reference heat flux sensor at all calibration points.

8.72.5.2.5 Calibrate each sensor prior to commissioning a new cylinder, and at least once annually thereafter or whenever a sensor is repaired or replaced, and whenever the results appear to have shifted or to differ from the expected values.

8.7.5.3 Using the procedure described in 8.72.6, expose the nude cylinder to the test fire for 4 s. Confirm that the average calculated incident heat flux is $84 \text{ kW/m}^2 \pm 5\%$ and its standard deviation of the average heat flux values is not greater than 10 kW/m^2 ($0.24 \text{ cal/s}\cdot\text{cm}^2$) using the procedure in 8.72.5.3.2. If the calculated average heat flux or standard deviation is not within these specifications, determine the cause and correct before proceeding with specimen testing.

8.72.5.3.1 Exposing a nude cylinder for more than 4 s has the potential to result in surface temperatures high enough to cause deterioration of the shell of the cylinder and sensors.

8.72.5.3.2 The average value of all sensors shall be determined, taking into account the sensor calibrations and characteristics. The average heat flux value reported is the average of the averages for each of the sensors for the steady region of the exposure duration.

8.72.5.3.2.1 The averaging interval for the nude exposure of any duration shall be determined as starting to include the first datapoint where the average heat flux value across all sensors is $\geq 60 \text{ kW/m}^2$ and ending to include the last datapoint where the average heat flux across all sensors is $\geq 60 \text{ kW/m}^2$.

8.72.5.3.3 The incident heat flux values calculated for each sensor shall be used to calculate the cumulative incident thermal energy for the cylinder. The cumulative incident thermal energy of the cylinder shall be stored in a file for future use in determining the energy ratio value.

8.72.5.3.3.1 Cumulative incident thermal energy shall include the entire test period of exposure time plus extended data acquisition time. For nude exposures, the extended data acquisition time shall be at least 20 s.

8.72.5.3.4 Expose the nude cylinder to the flames before testing a set of specimens and repeat the nude exposure at the conclusion of the testing of the set.

8.72.5.3.4.1 Additionally, the cumulative incident thermal energy of the cylinder shall be measured and recorded at the conclusion of the test set. This cumulative incident thermal energy file shall be averaged with the pre-test cumulative incident thermal energy file for future use in determining the energy ratio value.

8.72.5.3.5 The duration of the fire exposure shall be controlled by the internal clock of the computer control system. The measured duration of the exposure shall be the specified value $\pm 0.1 \text{ s}$ or $\pm 5\%$, whichever is smaller.

8.72.5.3.6 The average heat flux calculated in 8.72.5.3.2 shall be the specified test condition $\pm 5\%$. If not, adjust the fuel flow rate by modifying the gas pressure or flow at the burner heads. Repeat the calibration run(s) until the specified value is obtained. Repeat nude calibrations shall only be conducted when the average temperature of all sensors is less than 34°C (93°F) and no single sensor temperature exceeds 38°C (100°F) to eliminate the effect of any elevated internal temperature or temperature gradients on the calculation of the heat flux.

8.72.5.3.7 Cool the sensors after an exposure with a jet of air (or contact with a cold surface) to an average temperature of $32 \pm 2^\circ\text{C}$ ($90 \pm 4^\circ\text{F}$) with no single sensor exceeding 38°C (100°F). A measurement shall not proceed until the sensor temperatures have stabilized (less than 1°C temperature change for a 1 min duration).

8.72.6 Procedure

8.72.6.1 The results from three test specimen exposures are required for determination of an energy ratio value.

8.72.6.2 Place the specimen around the instrumented cylinder so that the overlapped specimen ends (seam) are not covering any sensors. Fasten the specimen to the sample holder by inserting pins through the fabric specimen and into the pin cushion. A minimum of four pins, spaced at approximately 90-degree intervals shall be used to mount the specimen.

8.72.6.3 An exposure time of 10 s shall be selected.

8.72.6.4 A minimum data acquisition time of 120 s shall be used.

8.72.6.4.1 If the amount of transmitted energy is not constant for the last ten seconds of acquisition time, increase the acquisition time to achieve this requirement.

8.72.6.5 Light the pilot flames and confirm that all the pilot flames on the burners are lit.

8.72.6.6 Initiate the test exposure by pressing the appropriate computer or remote key. The computer program will start the data acquisition, open the burner gas supply solenoid valves for the time of the exposure, and stop the data acquisition at the end of the specified time.

8.72.6.7 Collect the data from all installed thermal energy sensors. Note that data collection during and after the fire exposure shall be done in a still air environment with the fume hood shielded or turned off.

8.72.6.8 Repeat 8.72.6.2 through 8.72.6.7 until all specimens have been exposed. Before starting the next exposure, ensure that the average temperature of all the sensors is $32 \pm 2^\circ\text{C}$ ($90 \pm 4^\circ\text{F}$) and no single sensor exceeds 38°C (100°F).

8.72.7 Calculation of Results

8.72.7.1 The energy ratio value is calculated using

$$ERV = \frac{Q_{transferred}}{Q_{incident} \times \frac{t_{test}}{t_{cal}}}$$

ERV = $Q_{transferred} / (Q_{incident} \times t_{test} / t_{cal})$

Where

$Q_{transferred}$ = the cumulative thermal energy calculated transferred through the subject material in a material test run,

$Q_{incident}$ = the averaged cumulative incident thermal energy calculated during the last heat flux calibration before testing a sample set and during the first heat flux calibration after testing a sample set,

t_{cal} = the average exposure duration, in seconds, of the heat flux calibrations used to determine $Q_{incident}$ (maximum 4 s),

t_{test} = the exposure duration, in seconds, of the material test run.

8.72.7.1.1 Take the average of three individual specimen test energy ratio values and report this value as the sample average energy ratio value.

8.72.8 Report

8.72.8.1 The individual test ERV of each specimen shall be recorded and reported.

8.72.8.2 The average ERV shall be calculated and reported

8.72.9 Interpretation

8.72.9.1 Pass or fail determinations shall be based on the average reported ERV of all specimens tested.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Substantiating_data_for_NFPA_1970_Pi-250.docx	Substantiating data for NFPA 1970 PI-250	

Statement of Problem and Substantiation for Public Input

This proposed new Test Method allows for repeatable bench-scale evaluations of flash fire protective performance of materials used in construction of multilayer protective garment composites, wristlets, helmet ear covers, shrouds, and hoods, including single layer knit hoods that are worn in contact with the skin. The TPP test only assess the response of flat samples of composites continuously exposed to flash fire conditions of a combined convective-radiant heat flux of 84 kW/m² until a burn injury criterion is met, failing to account for heat transfer that occurs after the flame exposure ends. The proposed apparatus consists of an instrumented cylinder form with multiple thermal energy sensors that are exposed to an average heat flux of 84 kW/m², which is the same average heat flux as the TPP test, for 10 seconds. Data acquisition software calculates the total accumulated energy that passes through the material specimens as measured by the sensors and presents the data in an easily readable report. The results provide a more reliable indicator of how fabrics may perform as full garments. Initial testing of 30 different composites has been conducted by a test lab with the results attached. Comparison of these results with the certified TPP results from UL shows that there is little correlation between the results of the two tests, indicating that the flash fire cylinder test provides different information than the TPP test. Further testing, including some inter-laboratory testing, will be used to inform the committee during the second draft meeting on the validation of the test method along with other pertinent data that can confirm the proposed performance criterion. The current proposed performance criterion is a placeholder based on the best estimate of the currently available data that would accommodate all tested, certified composites. This test method is being proposed as a supplemental test to the TPP test. The equipment for this test method has been commercialized and is available at multiple test laboratories. Furthermore, this test method is the subject of an ASTM work item that is currently in the balloting process where it can be possible to cite a fully approved test method at the time that the revision process is completed.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 256-NFPA 1970-2021 [New Section after 7.1.27]	performance requirement
Public Input No. 257-NFPA 1970-2021 [New Section after 7.4.16]	performance requirement
Public Input No. 258-NFPA 1970-2021 [New Section after 7.13.10]	performance requirement
Public Input No. 259-NFPA 1970-2021 [New Section after 7.16.9]	performance requirement
Public Input No. 255-NFPA 1970-2021 [Section No. 2.3.3]	referenced document
Public Input No. 255-NFPA 1970-2021 [Section No. 2.3.3]	
Public Input No. 256-NFPA 1970-2021 [New Section after 7.1.27]	
Public Input No. 257-NFPA 1970-2021 [New Section after 7.4.16]	
Public Input No. 258-NFPA 1970-2021 [New Section after 7.13.10]	
Public Input No. 259-NFPA 1970-2021 [New Section after 7.16.9]	
Public Input No. 260-NFPA 1970-2021 [New Section after 8.71.7]	

Submitter Information Verification

Submitter Full Name: Brian Shiels
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Zip:
Submittal Date: Tue Nov 09 09:08:14 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-170-NFPA 1970-2022](#)

Statement: This proposed new test method allows for repeatable bench-scale evaluations of flash fire protective performance of materials used in construction of multilayer garment and hood composites. The TPP test only assess the response of flat samples of composites continuously exposed to flash fire conditions of a combined convective-radiant heat flux of 84 kW/m² until a burn injury criterion is met, failing to account for

heat transfer that occurs after the flame exposure ends. The proposed apparatus consists of an instrumented cylinder form with multiple thermal energy sensors that are exposed to an average heat flux of 84 kW/m², which is the same average heat flux as the TPP test, for 10 seconds. Data acquisition software calculates the total accumulated energy that passes through the material specimens as measured by the sensors and presents the data in an easily readable report. The results provide a more reliable indicator of how fabrics may perform as full garments. Initial testing of 30 different composites has been conducted by a test lab with the results attached. Comparison of these results with the certified TPP results from UL shows that there is little correlation between the results of the two tests, indicating that the flash fire cylinder test provides different information than the TPP test. Further testing, including some inter-laboratory testing, will be used to inform the committee during the second draft meeting on the validation of the test method along with other pertinent data that can confirm the proposed performance criterion. The current proposed performance criterion is a placeholder based on the best estimate of the currently available data that would accommodate all tested, certified composites. This test method is being proposed as a supplemental test to the TPP test. The equipment for this test method has been commercialized and is available at multiple test laboratories. Furthermore, this test method is the subject of an ASTM work item that is currently in the balloting process where it can be possible to cite a fully approved test method at the time that the revision process is completed.



Public Input No. 260-NFPA 1970-2021 [New Section after 8.71.7]

8.73 Small Scale Flash Fire Exposure Test 2

8.73.1 Application

8.73.1.1 This test method shall apply to protective gloves

8.73.2 Specimens

8.73.2.1 Five whole protective gloves shall be tested.

8.73.2.2 Samples for conditioning shall be whole gloves sized to fit a hand having a circumference of 232-272 mm and having a hand length of 186-196 mm.

8.73.3 Sample Preparation

8.73.3.1 Specimens shall be tested both before and after conditioning as specified in 8.1.12 and then conditioned as specified in 8.1.3.

8.73.4 Apparatus

8.73.4.1 The test apparatus shall be that specified in ASTM WK76082, *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Gloves for Protection Against Fire Simulations (Hand Form Method)*.

8.73.4.2 The measurement apparatus configuration consists of a vertically aligned instrumented hand form, fuel and fuel delivery system, data acquisition hardware, and data analysis software programs. A diagram of a representative test apparatus appears in Figure X. (INSERT FIGURE FOR GENERAL ARRANGEMENT OF APPARATUS).

8.73.4.2.1 A vertically aligned hand form measuring approximately 365 mm (14.5 in.) tall, having a hand circumference of 232-272 mm (7.79-9.13 in.), and having a hand length of 186-196 mm (6.96-7.32 in.) shall be used.

8.73.4.2.2 The hand form surface shall be constructed of thermally stable, nonmetallic materials which will not contribute fuel to the combustion process. The resulting hand form shall be compatible with cleaning by damp cloth or compatible cleaning liquid and not be damaged by moisture, high humidity or cleaning liquid.

8.73.4.2.3 Copper calorimeter thermal energy sensors shall be used. Each sensor shall have the capacity to measure the incident heat flux over a range from 0.0 to 165 kW/m² (0.0 to 4.0 cal/s·cm²). This range permits the use of the sensors to set the exposure level by directly exposing the instrumented hand form to the controlled fire in a test without the test specimen and have the capability to measure the heat transfer to the hand form when covered with a glove specimen.

8.73.4.2.4 The sensors shall be constructed of a material with known thermal and physical characteristics that shall be used to indicate the time varying heat flux received by the sensors. The minimum response time for the thermal energy sensor-data acquisition system shall be ≤ 0.2 s.

8.73.4.2.5 Ten thermal energy sensors shall be used. The sensors shall be uniformly distributed about the hand form, excluding the fingers.

8.73.4.2.5.1 Uniform distribution shall be achieved by distributing three thermal energy sensors on the palm, three thermal energy sensors on the back of the hand, and four thermal energy sensors on the wrist/forearm. The representative surface area for each sensor shall be defined by a polygon projected onto the hand form surface passing through the midpoints of lines drawn between each sensor. (INSERT FIGURE FOR DETAILS OF SENSOR PLACEMENT ABOUT HAND FORM).

8.73.4.3 The apparatus shall be equipped with fuel supply, delivery, and burner systems to provide reproducible fire exposures.

8.73.4.3.1 The propane fuel source shall be Liquefied Petroleum (LP) Gas meeting the HD-5 specification in ASTM D1835.

8.73.4.4 A system of piping, a pressure regulator, valves, and pressure sensors shall be provided to safely deliver gaseous propane to the pilot/exposure burners. The delivery system shall be sufficient to provide an average heat flux of at least 84 kW/m² ± 4.2 kW/m² (2.0 cal/s·cm² ± 0.1 cal/s·cm²) for an exposure time of at least 8 s, and up to 20 s. The fuel delivery system shall be controlled to provide known exposure duration within ±0.1 s of the set exposure time and the remaining gas between the last valve and the burner shall not exceed 220 cm³. The remaining excess gas in the line, after the valve closure, shall not continue to flame more than 0.1 seconds at the burner.

8.73.4.5 The burner system shall consist of eight exposure burners arranged in four evenly spaced burner towers with two exposure burners each.

8.73.4.5.1 Cylindrical burners with 23 mm inside diameter, 50 mm length, 1.9 mm gas orifices, and an operating pressure of 15-20 psi have been found to deliver suitable flame exposure.

8.73.4.5.2 The four burner towers shall be distributed at 90-degree intervals around the hand form. The distance to the hand form, vertical position, and directional aim of each burner shall be adjustable to yield the exposure level and uniformity described in 8.73.5.3, 8.73.5.3.1, 8.73.5.3.2, and 8.73.5.3.3 (INSERT FIGURE OF BURNER DETAIL).

8.73.4.5.3 A standing pilot flame ignition system shall be used. The ignition system shall not interfere with the flame exposure pattern. The ignition system shall be interlocked to the burner gas supply valves to prevent premature or erroneous opening of these valves. Any electrical magnetic field generated by the ignition system shall be small enough so as not to interfere with the quality of the data acquisition and recording process.

8.73.4.6 A system shall be provided with the capability of acquiring and storing the results of the measurement from each sensor at least ten times per second for the data acquisition period.

8.73.4.6.1 The accuracy of the measurement system shall be less than $\pm 2.0^{\circ}\text{C}$ ($\pm 3.6^{\circ}\text{F}$) for temperature measurements.

8.73.4.7 The software shall log the output from the thermal energy sensors in identifiable files for the preset time at or above the minimum specified data acquisition rate.

8.73.4.7.1 The software shall convert the recorded thermal sensor outputs into a measured heat flux using a method appropriate for the thermal energy sensor design. This shall include accounting for the heat losses from the surface and sides of the sensor, as appropriate.

8.73.4.7.2 The incident heat flux at each sample point for each thermal energy sensor shall be calculated using the calibration characteristics determined in 8.73.5.2.3. These values shall be stored for use in calculating the average incident heat flux and its standard deviation for nude exposures as required in 9.3

8.73.4.7.3 Using the absorption characteristics of the thermal energy sensors, calculate and store the absorbed heat flux for each sensor for each sample point.

8.73.4.7.4 In addition to monitoring and controlling the operation of the fire, data acquisition systems, and carrying out the incident heat flux and absorbed heat flux, the computer software shall be used to prepare some of the materials for the report, sensors calibrations, etc.

8.73.5 Calibration

8.73.5.1 Calibration shall be performed in accordance with ASTM WK 76082, *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Gloves for Protection Against Fire Simulations (Hand Form Method)*.

8.73.5.2 Calibration

8.73.5.2.1 The thermal energy sensors are calibrated using energy sources of known characteristics. Pure radiant and combined convection and radiation sources have been found effective. A traceable calibration heat flux reference sensor shall be used when setting the energy levels for these calibrations. Each thermal energy sensor shall be calibrated before the required flame exposure conditions for specimen testing are set.

8.73.5.2.2 The reference heat flux sensor shall be calibrated against a suitable NIST (or other recognized standards body) traceable reference with an accuracy of $\pm 5\%$. Commonly used calibration methods for reference sensors do not typically cover the range up to 84 kW/m^2 . Sensors shall be calibrated to at least 40 kW/m^2 , and must demonstrate linearity over this range to extrapolate up to 84 kW/m^2 .

8.73.5.2.3 Using the calibration energy source, expose each sensor over the range of 3 to 100 kW/m^2 (0.07 to $2.5\text{ cal/s}\cdot\text{cm}^2$). It is recommended that a minimum of two different heat flux levels be used for this calibration, one representative of nude exposure conditions and the other representative of conditions under a test specimen. Measure the heat fluxes produced by the calibration energy source with the reference heat flux sensor.

8.73.5.2.4 Generate a calibration function such that each thermal energy sensor calculates heat flux to within 5 % of the reference heat flux sensor at all calibration points.

8.73.5.2.5 Calibrate each sensor prior to commissioning a new instrumented hand form, and at least once annually thereafter or whenever a sensor is repaired or replaced, and whenever the results appear to have shifted or to differ from the expected values.

8.73.5.3 Using the procedure described in 8.73.6, expose the nude hand form to the test fire for 4 s or for the test duration, if less than 4 s. Confirm that the average calculated incident heat flux is $84\text{ kW/m}^2 \pm 5\%$ and its standard deviation of the average heat flux values is not greater than 10 kW/m^2 ($0.24\text{ cal/s}\cdot\text{cm}^2$) using the procedure in 8.73.5.3.2. If the calculated average heat flux or standard deviation is not within these specifications, determine the cause and correct before proceeding with specimen testing.

8.73.5.3.1 Exposing a nude hand form for more than 4 s has the potential to result in surface temperatures high enough to cause deterioration of the shell of the hand form and sensors.

8.73.5.3.2 The average value of all sensors shall be determined, taking into account the sensor calibrations and characteristics. The average heat flux value reported is the average of the averages for each of the sensors for the steady region of the exposure duration.

8.73.5.3.2.1 The averaging interval for the nude exposure of any duration shall be determined as starting to include the first datapoint where the average heat flux value across all sensors is $\geq 60 \text{ kW/m}^2$ and ending to include the last datapoint where the average heat flux across all sensors is $\geq 60 \text{ kW/m}^2$.

8.73.5.3.3 The incident heat flux values calculated for each sensor shall be used to calculate the cumulative incident thermal energy for the hand form. The cumulative incident thermal energy of the hand form shall be stored in a file for future use in determining the energy ratio value.

8.73.5.3.3.1 Cumulative incident thermal energy shall include the entire test period of exposure time plus extended data acquisition time. For nude exposures, the extended data acquisition time shall be at least 20 s. For specimen exposures, the extended data acquisition time shall be at least 120 s.

8.73.5.3.4 Expose the nude hand form to the flames before testing a set of specimens and repeat the nude exposure at the conclusion of the testing of the set.

8.73.5.3.4.1 Additionally, the cumulative incident thermal energy of the hand form shall be measured and recorded at the conclusion of the test set. This cumulative incident thermal energy file shall be averaged with the pre-test cumulative incident thermal energy file for future use in determining the energy ratio value.

8.73.5.3.5 The duration of the fire exposure shall be controlled by the internal clock of the computer control system. The measured duration of the exposure shall be the specified value $\pm 0.1 \text{ s}$ or $\pm 5 \%$, whichever is smaller.

8.73.5.3.6 The average heat flux calculated in 8.73.5.3.2 shall be the specified test condition $\pm 5 \%$. If not, adjust the fuel flow rate by modifying the gas pressure or flow at the burner heads. Repeat the calibration run(s) until the specified value is obtained. Repeat nude calibrations shall only be conducted when the average temperature of all sensors is less than 34°C (93°F) and no single sensor temperature exceeds 38°C (100°F) to eliminate the effect of any elevated internal temperature or temperature gradients on the calculation of the heat flux.

8.73.5.3.7 Cool the sensors after an exposure with a jet of air (or contact with a cold surface) to an average temperature of $32 \pm 2^\circ\text{C}$ ($90 \pm 4^\circ\text{F}$) with no single sensor exceeding 38°C (100°F). A measurement shall not proceed until the sensor temperatures have stabilized (less than 1°C temperature change for a 1 min duration).

8.73.6 Procedure

8.73.6.1 The results from three glove specimen exposures are required for determination of an energy ratio value.

8.73.6.2 Place the specimen onto the instrumented hand form so that the glove specimen is pulled fully down onto the hand form with each digit of the hand form occupying one digit of the glove specimen.

8.73.6.3 An exposure time of 10 s shall be selected.

8.73.6.4 A minimum data acquisition time of 120 s shall be used.

8.73.6.5 Light the pilot flames and confirm that all the pilot flames on the burners are lit.

8.73.6.6 Initiate the test exposure by pressing the appropriate computer or remote key. The computer program will start the data acquisition, open the burner gas supply solenoid valves for the time of the exposure, and stop the data acquisition at the end of the specified time.

8.73.6.7 Collect the data from all installed thermal energy sensors. Note that data collection during and after the fire exposure shall be done in a still air environment with the fume hood shielded or turned off.

8.73.6.8 Observe and record any afterflame time, melting, and dripping.

8.73.6.9 Repeat 8.73.6.2 through 8.73.6.8 until all specimens have been exposed. Before starting the next exposure, ensure that the average temperature of all the sensors is $32 \pm 2^\circ\text{C}$ ($90 \pm 4^\circ\text{F}$) and no single sensor exceeds 38°C (100°F).

8.73.7 Calculation of Results

8.73.7.1 The energy ratio value is calculated using

$$ERV = \frac{Q_{transferred}}{Q_{incident} \times \frac{t_{test}}{t_{cal}}}$$

ERV = $\frac{Q_{transferred}}{Q_{incident} \times \frac{t_{test}}{t_{cal}}}$

Where

$Q_{transferred}$ = the cumulative thermal energy calculated transferred through the subject material in a material test run,

$Q_{incident}$ = the averaged cumulative incident thermal energy calculated during the last heat flux calibration before testing a sample set and during the first heat flux calibration after testing a sample set,

t_{cal} = the average exposure duration, in seconds, of the heat flux calibrations used to determine $Q_{incident}$ (maximum 4 s),

t_{test} = the exposure duration, in seconds, of the material test run.

8.73.7.1.1 Take the average of three individual specimen test energy ratio values and report this value as the sample average energy ratio value.

8.73.8 Report

8.73.8.1 The individual test ERV of each specimen shall be recorded and reported.

8.73.8.2 The average ERV shall be calculated and reported

8.73.8.3 Observations of afterflame time, melting, and dripping shall be reported.

8.73.9 Interpretation

8.73.9.1 Pass or fail determinations shall be based on the average reported ERV of all specimens tested.

8.73.9.2 Pass or fail determinations shall be based on the average reported afterflame time of all specimens tested.

8.73.9.3 Pass or fail determinations shall be based on individual specimen observations of melting and dripping.

Statement of Problem and Substantiation for Public Input

This proposed new Test Method allows for repeatable bench-scale evaluations of flash fire protective performance of protective gloves, as a whole as-sold glove. The TPP test only assess the response of flat samples of composites continuously exposed to flash fire conditions of a combined convective-radiant heat flux of 84 kW/m² until a burn injury criterion is met, failing to account for heat transfer that occurs after the flame exposure ends. The proposed apparatus consists of an instrumented hand form with multiple thermal energy sensors that are exposed to an average heat flux of 84 kW/m², which is the same average heat flux as the TPP test, for 10 seconds. Data acquisition software calculates the total accumulated energy that passes through the material specimens as measured by the sensors and presents the data in an easily readable report. The results provide a more reliable indicator of how fabrics may perform as whole gloves. Initial pass/fail criteria was matched to that of garment composites based on the current equal TPP requirements. Further testing, including some inter-laboratory testing, will be used to inform the committee during the second draft meeting on the validation of the test method along with other pertinent data that can confirm the proposed performance criterion. The current proposed performance criterion is a placeholder based on the best estimate.. This test method is being proposed as a supplemental test to the TPP test. The equipment for this test method has been commercialized and is available at multiple test laboratories. Furthermore, this test method is the subject of an ASTM work item that is currently in the balloting process where it can be possible to cite a fully approved test method at the time that the revision process is completed.

Related Public Inputs for This Document

Related Input
Public Input No. 250-NFPA 1970-2021
[New Section after 8.71.7]
Public Input No. 329-NFPA 1970-2021
[New Section after 7.7.25]
Public Input No. 331-NFPA 1970-2021
[Section No. 7.7.6]

Relationship
 PI-250 is the Test Method used for garment materials, whereas this PI is a test method specific to gloves.

Submitter Information Verification

Submitter Full Name: Brian Shiels
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Submittal Date: Tue Nov 09 13:16:40 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-172-NFPA 1970-2022](#)

Statement: This proposed new Test Method allows for repeatable bench-scale evaluations of flash fire protective performance of protective gloves, as a whole as-sold glove. The TPP test only assess the response of flat samples of composites continuously exposed to flash fire conditions of a combined convective-radiant heat flux of 84 kW/m² until a burn injury criterion is met, failing to account for heat transfer that occurs after the flame exposure ends. The proposed apparatus consists of an instrumented hand form with multiple thermal energy sensors that are exposed to an average heat flux of 84 kW/m², which is the same average heat flux as the TPP test, for 10 seconds. Data acquisition software calculates the total accumulated energy that passes through the material specimens as measured by the sensors and presents the data in an easily readable report. The results provide a more reliable indicator of how fabrics may perform as whole gloves. Initial pass/fail criteria was matched to that of garment composites based on the current equal TPP requirements. Further testing, including some inter-laboratory testing, will be used to inform the committee during the second draft meeting on the validation of the test method along with other pertinent data that can confirm the proposed performance criterion. This test method is being proposed as a supplemental test to the TPP test. The equipment for this test method has been commercialized and is available at multiple test laboratories. Furthermore, this test method is the subject of an ASTM work item that is currently in the balloting process where it can be possible to cite a fully approved test method at the time that the revision process is completed.



Public Input No. 36-NFPA 1970-2021 [New Section after 8.71.7]

8.76 Helmet Ear Cover Removal Test.

8.76.1 Application. This test method shall apply to protective helmets used for structural firefighting.

8.76.2 Samples.

8.76.2.1 Samples for conditioning shall be whole helmets with ear covers attached.

8.76.2.2 Samples shall be conditioned as specified in 8.1.3

8.76.3 Specimens.

8.76.3.1 A minimum of 3 complete helmets shall be tested.

8.76.3.2 Each unique means for mounting ear covers, where different, shall be tested.

8.76.4 Procedure.

8.76.4.1 A different test operator shall perform each separate test.

8.76.4.2 Each test operator shall be provided the manufacturer instructions for the removal of the ear covers, any required tools dictated by the manufacturer, and a flat table with chair.

8.76.4.3 The test operators shall be permitted to acquaint themselves with the manufacturer instructions and practice in the removal and reattachment of the helmet ear covers until they believe they are competence in performing this action.

8.76.4.4 After the test operator has met the condition specified in 8.76.4.3, a completely assembled helmet with ear covers shall be provided to the test operator and the test operator shall be timed for the length that is needed to full remove the ear covers completely from the helmet.

8.76.5 Report. The individual ear cover removal times shall be reported and recorded. An average ear cover removal time shall be calculated.

8.76.6 Interpretation. Pass/fail performance shall be based on the average ear cover removal time.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_12_Held.pdf	1971_PI12	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. 50 of the (A2017) Second Draft Report for NFPA 1971 and per the Regs. at 4.4.8.3.1. There is no associated test method for making this assessment of helmet performance (ease of ear cover removal). The proposed method provides details for the consistent execution of the test.

Submitter Information Verification

Submitter Full Name: Tc On Fae-Spf

Organization: NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment

Street Address:

City:

State:

Zip:**Submittal Date:** Tue Aug 17 08:18:49 EDT 2021**Committee:** FAE-SPF**Committee Statement****Resolution:** FR-82-NFPA 1970-2022

Statement: With the increasing emphasis on cancer reduction through post fire cleaning and decontamination, the end user who is typically responsible for this post fire process must be able to remove and re-attach the soft goods and ear flaps easily and properly. Recent research shows that some of the textile-based components that come in contact with the wearer's head can be extensively more contaminated than other parts of the ensembles, which could be linked to the fact helmets may not be as frequently cleaned as other elements and it is difficult to remove these items for optimized cleaning. The proposed criterion is intended to establish a reasonable amount of time for the removal and reinstallation of the different helmet soft goods that come in contact with the wearer's head that includes, but is not limited to ear covers, sweatbands, chin straps, nape straps for some helmets. A specific test method has been proposed to provide a systematic way for conducting this evaluation. This requirement does not include suspension soft goods because their improper removal and replacement could adversely affect the physical performance offered by the helmet.

Two of the public inputs (20 and 36) were originally held for further study during the last revision but only addressed the removal of the ear covers. The new changes address a broader range of textile components on the protective helmet. The proposed change further addresses Public Input 289 by providing more detail for how to conduct the evaluation using a standardized set of procedures.



A.3.3.10 Bitragion Coronal Arc.

Figure A.3.3.10 Bitragion Coronal Arc.

A.3.3.11 Bitragion Inion Arc.

Figure A.3.3.11 Bitrignon Inion Arc.



<https://submittals.nfpa.org/TerraViewWeb/ViewerPage.jsp>

Submitter Information Verification**Submitter Full Name:** Karen Lehtonen**Organization:** LION Group, Inc.**Street Address:****City:****State:****Zip:****Submittal Date:** Tue Nov 09 09:54:14 EST 2021**Committee:** FAE-SPF**Committee Statement****Resolution:** [FR-295-NFPA 1970-2022](#)**Statement:** These changes are being made so that the document has the correct images.



Public Input No. 276-NFPA 1970-2021 [Sections A.3.3.10, A.3.3.11, A.3.3.22, A.3.3.34, A.3.3.37, ...]

Sections

A.3.3.10, A.3.3.11, A.3.3.22, A.3.3.34, A.3.3.37, A.3.3.39, A.3.3.51, A.3.3.57, A.3.3.60, A.3.3.64, A.3.3.67, A.3.3.78, A

A.3.3.10

1

Bitracion Coronal Arc.



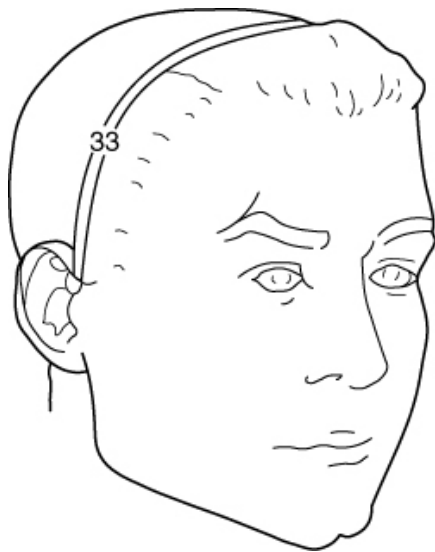
See Figure A.3.3.10 .

~~Figure A~~

Figure A .3.3.

40 Bitragon

10 Bitragion Coronal Arc.

[illegible]

Abstract

Figure 1

A.3.3.11

1

Bitragion Inion Arc.



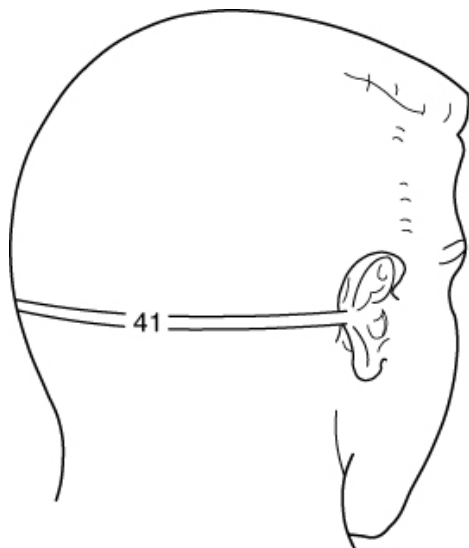
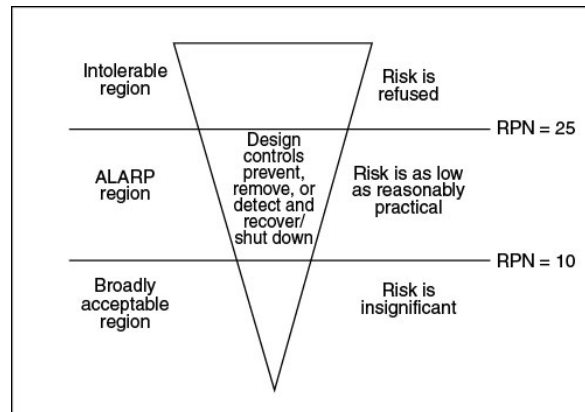
For test purposes, the bitrignon arc is identified as Datum Plane 10. See [Figure A.3.3.11](#).

[Figure A](#)

Figure A.3.3.

[11 Bitrignon](#)

11 Bitrignon Inion Arc.



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A.3.3.22

-

CBRN Terrorism Agents.

- [🔗](#)

Chemical terrorism agents include solid, liquid, and gaseous chemical warfare agents and toxic industrial chemicals. Chemical warfare agents include, but are not limited to, GB (sarin), GD (soman), HD (sulfur mustard), VX, and specific toxic industrial chemicals. Many toxic industrial chemicals, for example chlorine and ammonia, are identified as chemical terrorism agents because of their availability and the degree of injury they could inflict.

Biological agents are bacteria, viruses, or the toxins derived from biological material. Biological particles can be dispersed as aerosols and liquid-borne pathogens. Airborne biological agents could be dispersed in the form of liquid aerosols or solid aerosols (i.e., a powder of bacterial spores). Liquid-borne pathogens could be potentially encountered during a terrorism incident as a result of deliberate disposal or from body fluids released by victims of other weapons (i.e., explosives, firearms).

CBRN also includes radiological particulates dispersed as aerosols but not for radiological gases or vapors. Airborne particulates have the ability to emit alpha- and beta-particles and ionizing radiation from the decay of unstable isotopes.

A.3.3.

[34](#)

35 Combination SCBA/SAR.- 

Combination SCBA/SARs consist of the following:

An SCBA certified as compliant with Chapters 14 through 18 of this standard and having a minimum rated service life of 30 minutes

A connection for the attachment of an air line that provides a continuous supply of breathing air that is independent of the SCBA breathing air supply.

The definition does not include SARs that are used in conjunction with escape self-contained breathing apparatus (ESCBA) where the ESCBA provide less than a minimum rated service life of 30 minutes. For the purpose of this standard, combination SCBA/SARs are encompassed by the terms self-contained breathing apparatus and SCBA.

A.3.3.~~37~~**38 Component.**- 

Components include items required for the design and construction of the product and are evaluated and may be tested as a part of the whole product.

A.3.3.~~39~~**40 Compressed Breathing Air.**- 

The quality of the compressed breathing air used in open-circuit SCBA has a direct effect on the performance of the equipment. It is therefore imperative that breathing air consistent with the design criteria established in this standard is used to ensure that the SCBA will continue to meet the performance criteria contained in this standard. It has been established through years of experience that breathing air that meets the requirements of NFPA 1989, which specifies a maximum moisture content of 24 ppm or drier [i.e., a dew point of -54°C (-65°F) or lower] and a maximum particulate level of 5 mg/m³ air, will meet the needs of both emergency services personnel and the SCBA. (See also 18.1.3.3.).

3.3.41 Contamination

Ensembles and ensemble elements can be exposed to products of combustion and other hazardous materials in several ways through contact with gases/vapors, liquids, or particulates. A fire in which the fire fighter wears SCBA and is exposed to fire smoke, other particulates, and fire gases represents a common source of contamination.

The extent and persistency of the contamination in the ensemble or ensemble element will vary with the type of contaminant, the length of the contamination period, and the means by which the ensemble or ensemble elements are contaminated. In general, contamination that is persistent represents the greatest concern since these forms of contaminants might remain in the clothing for extended periods of time and provide continued exposure to the fire fighter.

Examples of common contaminants found in fires include, but are not limited to, the following:

- (1) Heavy inorganic metals (e.g., arsenic, antimony, cadmium, chromium, mercury).
- (2) Semi-volatile organic compounds, including but not limited to, the following:
 - (a) Polynuclear aromatic hydrocarbons (PAHs) (e.g., anthracene, chrysene, fluoranthene, naphthalene, pyrene).
 - (b) Phthalate plasticizers [e.g., benzyl butyl phthalate (BPP), bis(2-ethylhexyl) phthalate (DEHP), dimethyl phthalate]
 - (c) Polybrominated diphenyl ether flame retardants (PBDEs) [e.g., pentabromodiphenyl ether (BDE 99), hexabromodiphenyl ether (BDE 153)]
 - (d) Polychlorinated biphenyls (PCBs) (e.g., 2,2,3,3,4,4,5,5-Octachlorobiphenyl)
 - (e) Substituted phenols (e.g., 2-methylphenol and pentachlorophenol)

(3

~~51~~ Emblems: - 

Hazardous particulates (e.g., soot, asbestos, silica, lead dust)

In contrast, many volatile organic chemicals such as formaldehyde and benzene, while hazardous, easily evaporate unless bound in the materials used in the element. In addition, carbon particles that make up the majority of smoke actually absorb and hold many products of combustion, resulting in persistent contamination.

Certain materials, components, or portions of an ensemble element or ensemble might be more susceptible to contamination. For example, the textile fabric components of a protective helmet might be more easily contaminated than the hard surface of the helmet shell.

A.3.3.49 Drag Rescue Device.

The drag rescue device (DRD) is intended solely to assist in pulling or dragging an incapacitated fire fighter and is not intended for vertical rescue operations where the victim fire fighter would be raised or lowered.

A.3.3.55 Emblems.

Users are cautioned that patches or emblems might contribute to burn injury. Emblems or patches used on work apparel are not included in the test requirements of this standard. In particular, users are cautioned about using large emblems or patches on work apparel because these items are not required to be tested under Chapters 9 through 13 of this standard for heat or flame resistance or stored energy.

A.3.3.

~~57~~

61 Entry Firefighting.

- 

Examples of fires that commonly produce extreme levels of convective, conductive, and radiant heat and could result in incidents incorporating entry firefighting operations include, but are not limited to, bulk flammable liquid fires, bulk flammable gas fires, bulk flammable metals, and aircraft fires. Highly specialized thermal protection is necessary for persons involved in such extraordinarily specialized operations due to the scope of these operations and because direct entry into flames is made. Usually these operations are exterior operations as in outside of structures. Entry firefighting is *not* structural firefighting.

A.3.3.

~~60~~

64 Faceshield.

- 

The faceshield is not intended as primary eye protection.

A.3.3.

~~64~~

68 Flame Resistance.

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Flame resistance can be an inherent property of the textile material, or it can be imparted by specific treatment.

A.3.3.

~~67~~

71 Footwear.

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See Figure A.3.3.

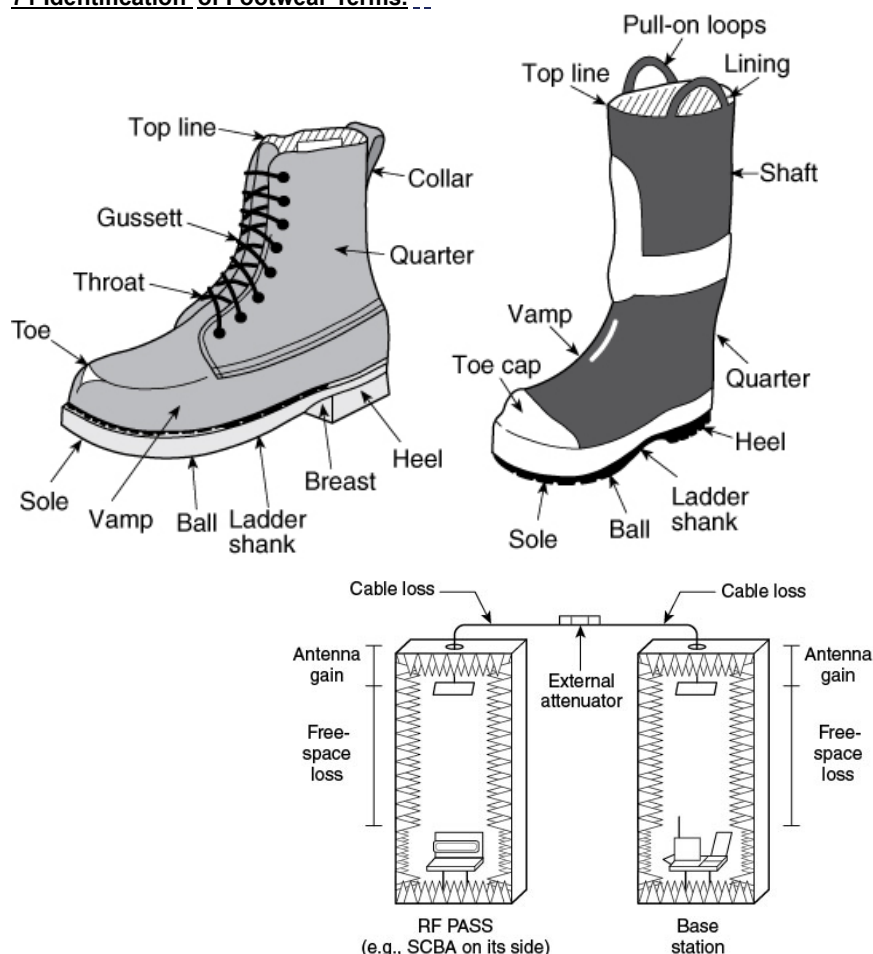
~~67~~

~~71~~

Figure A

Figure A.3.3.

~~67 Identification~~

71 Identification of Footwear Terms...**A.3.3:**~~78~~**82 Gusset:**

The gusset generally lacks some layers used in the construction of the footwear upper or might include different layers for the purpose of being flexible. The gusset is not observable from the front of the footwear when the footwear is donned or faced up.

A.3.3:~~115~~**85 Hazardous Materials**

Hazardous materials are any solid, particulate, liquid, gas, aerosol, or mixture thereof that can cause harm to the human body through respiration, ingestion, skin absorption, injection, or contact.

A.3.3.121 NIOSH Certified:

An SCBA being "NIOSH certified" is only one part of the certification process to Chapters ~~14~~ through ~~18~~ of this standard. SCBA that are only NIOSH certified are not compliant with Chapters ~~14~~ through ~~18~~ and should not be construed as having certification as compliant with NFPA 1970 (previously NFPA 1981). See Section ~~14.2~~ for further details. For the NIOSH certification to remain in effect, the SCBA must be used and maintained in the "as approved" condition.

NIOSH certification is conducted in accordance with the requirements of 42 CFR 84, Subpart H.

A.3.3:~~119~~**125 Particulate Blocking Layer:**

- 

For the purpose of this standard, the particulate blocking layer is intended to inhibit the passage of smoke particles through the protective clothing element or interface device. The combination of the particulate blocking layer and other layers associated with the element or interface device might also contribute to this function.

A.3.3:

~~120~~

126- Particulates:

- 

There are at least seven forms of particulate matter, as follows:

Aerosol: - A dispersion of solid or liquid particles of microscopic size in a gaseous medium such as smoke, fog, or mist.

Dust: - A term loosely applied to solid particles predominantly larger than colloidal and capable of temporary suspension in air or other gases. Derivation from larger masses through the application of physical force is usually implied.

Fog: - A term loosely applied to visible aerosols in which the dispersed phase is liquid. Formation by condensation is implied.

Fume: - Solid particles generated at condensation from the gaseous state, generally after volatilization from melted substances and often accompanied by a chemical reaction such as oxidation. Popular usage sometimes includes any type of contaminant.

Mist: - A term loosely applied to dispersion of liquid particles, many of which are large enough to be individually visible without visual aid.

Smog: - A word derived from the words smoke and fog and applied to extensive atmospheric contamination by aerosols arising from a combination of natural and human-made sources.

Smoke: - Small gasborne particles resulting from incomplete combustion and consisting predominantly of carbon and other combustible materials.

A.3.3:

~~131~~

137- Product Label:

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The product label is not the certification organization's label, symbol, or identifying mark; however, the certification organization's label, symbol, or identifying mark can be attached to it or be part of the product label.

A.3.3:

~~143~~

149- Proximity Firefighting:

- 

Examples of fires that commonly produce high levels of radiant heat, as well as convective and conductive heat, and could result in incidents incorporating proximity firefighting operations include, but are not limited to, bulk flammable liquid fires, bulk flammable gas fires, bulk flammable metal fires, and aircraft fires. These operations usually are exterior operations but might be combined with interior operations. Proximity firefighting is not structural firefighting but might be combined with structural firefighting operations. Proximity firefighting also is not entry firefighting. The firefighting activities differ from "entry firefighting" as proximity firefighting does not include direct entry of firefighters into flames. Proximity operations are performed close to the actual fire where the high levels of radiant heat as well as the convective and conductive heat would overcome the thermal protection provided by structural firefighting protective ensembles and the proximity firefighting protective ensembles provide enhanced protection from these thermal exposures. After the fire and heat have been controlled at a proximity firefighting incident, entry into structures or enclosures by firefighters protected by proximity firefighting protective ensembles could be made where the incident requires additional operations for control of the incident.

A.3.3:

~~155~~

161- Radiological Particulate Terrorism Agents:

- 

Chapters 4 through 8 of this standard only provides partial protection from certain radiation sources. By their nature, these ensembles provide protection from alpha-particles, and the element materials and distance will significantly attenuate beta-particles. These ensembles do not provide any protection from ionizing radiation, such as gamma- and x-rays, other than to keep the actual radiological particulate from direct skin contact.

A.3.3:

~~472~~

~~478.4~~

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Major A Seam:

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Each TC can identify the various layers in the annex if so desired.

A.3.3:

~~474~~

180 Self-Contained Breathing Apparatus (SCBA):

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For the purposes of Chapters 14 through 18 of this standard, where the term is used without a qualifier, it indicates only open-circuit self-contained breathing apparatus or combination SCBA/SARs. ~~[See also 3.3.4, Atmosphere-Supplying Respirator; 3.3:~~

~~34~~

~~35, Combination SCBA/SAR; and 3.3:~~

~~496~~

~~202, Supplied Air Respirator (SAR).]~~

A.3.3:

~~488~~

194 Structural Firefighting Protective Ensemble:

— 

Structural firefighting protective ensembles include, but are not limited to, garments, helmets, hoods, gloves, and footwear.

A.3.3:

~~496~~

202 Supplied Air Respirator (SAR):

— 

For the purposes of Chapters 14 through 18 of this standard, combination SCBA/SARs are encompassed by the terms *self-contained breathing apparatus* and *SCBA*.

A.3.3:

~~204~~

211 Tongue:

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The tongue might or might not be made of the same composite as the footwear upper. The tongue might be of a similar material composite as the footwear gusset.

A.3.3:

~~213~~

220 Upper:

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See Figure A.3.3:

~~67~~

71 -

~~A.3.3.~~~~245~~~~222~~ **Visibility Markings:**- 

~~Retroreflective enhancements improve night-time conspicuity, and fluorescent enhancements improve day-time conspicuity.~~

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA_1970_PI_A.3_CLEAN.docx	This is a clean copy of the proposed annex for all definitions-related items (3.3.x), everything is numbered to tie to the legislative text and figures have been updated with correct figures.	

Statement of Problem and Substantiation for Public Input

For annex items related to definitions (3.3.x), many had to be renumbered to tie to PI 276 and every figure had to be replaced with correct figures. Annex items were added for new definitions with annex items and specific references within annex items were also updated to tie to PI 276.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 274-NFPA 1970-2021 [Section No. 3.3]</u>	274 is the primary except for correcting images, those have to be done regardless of the status of PI 274

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Committee: FAE-SPF

Committee Statement

Resolution: FR-295-NFPA 1970-2022

Statement: These changes are being made so that the document has the correct images.

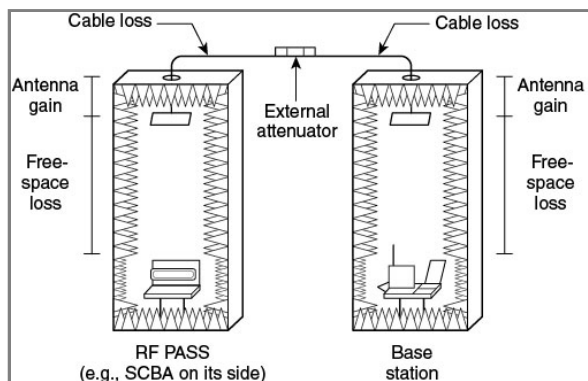


Public Input No. 252-NFPA 1970-2021 [Section No. A.3.3.67]

A.3.3.67 Footwear.

See Figure A.3.3.67.

Figure A.3.3.67 Identification of Footwear Terms.



Statement of Problem and Substantiation for Public Input

Replace figure with correct figure for definition in NFPA 1971, 2018 ed

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Committee Statement

Resolution: [FR-296-NFPA 1970-2022](#)

Statement: These changes are being made so that the document has the correct images.



Public Input No. 12-NFPA 1970-2021 [New Section after A.3.3.78]

A.3.3.81 Hazardous (Classified) Locations (HazLoc).

A Hazardous (Classified) Location is a location in which an explosive gas atmosphere or explosive dust atmosphere may exist. Electrical equipment used where such atmospheres may exist needs to be protected against the risk of explosion from energy or thermal ignition sources. Within this standard, intrinsic safety (IS) and nonincendive (NI) are protection concepts associated with the rating of equipment for operation in potentially explosive atmospheres. IS and NI ratings take into account the nature of the explosive atmosphere encountered — Class I being explosive gas atmospheres and Class II being explosive dust atmospheres — and the frequency or interval of the presence of such explosive atmospheres (i.e., continuously, intermittently, or abnormally). The frequency or interval of the presence of the explosive atmosphere determines the proper Division (e.g., Division 1 or Division 2) or Zone (e.g., Zone 0, Zone 1, or Zone 2) classifications that are applied to a particular IS or NI rating. To determine the appropriate IS or NI rating for SCBA and PASS devices, the AHJ identifies the expected explosive atmospheres likely to be encountered and the expected frequency or interval of the presence of such expected explosive atmospheres.

Statement of Problem and Substantiation for Public Input

(Submitted on behalf of the FAE-ELS HazLoc Harmonization Task Group)

Explanatory material is being proposed in this PI to address the new HazLoc-related definitions and to address why Division 2 NI requirements are being proposed in addition to the existing Division 1 IS requirements. This explanatory material aligns with those included in NFPA 1802 for RF/RSM devices.

Submitter Information Verification

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 Committee: FAE-SPF

Committee Statement

Resolution: FR-281-NFPA 1970-2022

Statement: Addition of HazLoc-related definitions that address UL 913-based intrinsic safety terms and UL 121201-related nonincendive terms to reflect the inclusion of UL 913 and UL 121201 as HazLoc-related certification options.

These definitions align with those include in NFPA 1802 for RF/RSM devices, and are structured in a tiered approach that provides all HazLoc definitions together to minimize the repeating of text and to facilitate better understanding.

Also, addition of definitions for the electrical parameter designations (i.e. Uo, Io, Co, Lo on the power sources and Ui, Ii, Ci, Li on the power receivers) from Table 16.1.8.2.2.2 (Table 6.22.2.1.2 from UL 1802). These definitions are based on the industry definitions from UL 121201, with modifications to correlate to the terms used in Table 16.1.8.2.2.2 (Table 6.22.2.1.2 from UL 1802).

Explanatory material is added to address the new HazLoc-related definitions and to address why Division 2 NI requirements are being proposed in addition to the existing Division 1 IS requirements. This explanatory material aligns with those included in NFPA 1802 for RF/RSM devices.



Public Input No. 184-NFPA 1970-2021 [Sections

A.4.1.1, A.4.1.1.3, A.4.1.1.5, A.4.1.2, A.4.1.2.3, ...]

Sections

A.4.1.1, A.4.1.1.3, A.4.1.1.5, A.4.1.2, A.4.1.2.3, A.4.1.3.2, A.4.1.3.8, A.4.2.4, A.4.3.1, A.4.3.5, A.4.3.6, A.4.3.7.1, A.4.5.2(b), A.4.5.2(2), A.4.6.3, A.4.6.4, A.4.7.2, A.4.7.11, A.4.7.13

A.4.1.1 — [🔗](#)

Organizations responsible for specialized functions including, but not limited to, wildland firefighting, proximity firefighting, and other specialized firefighting, emergency medical service, special operations, and hazardous materials response should use appropriate protective clothing and protective equipment specifically designed for those activities:

A.4.1.1.3 — [🔗](#)

While separate requirements are specified for structural firefighting and proximity firefighting protective elements, the optional liquid and particulate contaminant protection requirements apply to ensembles only. Individual elements cannot be separately certified to the optional liquid and particulate contaminant protection criteria in this standard. Only complete ensembles, in which all necessary elements are specified to achieve the stated performance requirements, can be certified to the optional liquid and particulate contaminant protection criteria in this standard.

The optional liquid and particulate contaminant protection criteria are intended to address protection of firefighters against fireground liquids and smoke particulates that carry chemical and other hazardous contaminants. Individual ensemble element requirements for protective garments, gloves, and footwear currently specify the use of a moisture barrier and/or liquid protection requirements; however, the entire ensemble is not evaluated for liquid penetration resistance performance. In particular, interfaces between individual elements are susceptible to inward leakage of liquids that can only be determined when the entire ensemble as configured by the organization is evaluated. Similarly, there are no requirements for particulate penetration resistance of ensemble elements or the overall ensemble. Ensemble elements that incorporate moisture barriers will limit particulate penetration; however, the interfaces between elements will readily permit inward penetration of particulate from smoke and other sources at the fire scene. Standard protective hood interface components have no barrier material and allow the passage of particles through the hood materials to the firefighter's head and neck that are not covered by the SCBA facepiece.

The optional liquid and particulate contaminant protection criteria are not intended to protect against all hazardous substance exposures, but rather minimize firefighter exposures to routine liquids, including hot, cold, or contaminated water and the bulk of particulates generated at the fire scene. Some liquids and particulate might still pass through the clothing depending on the nature of the exposure, including the exposure time and conditions. Moreover, hazardous vapors or gases could still also penetrate individual ensemble elements or interfaces leading to exposures. Ensembles that are certified to the optional liquid and particulate contaminant protection criteria are not hazardous materials protective ensembles and should not be used in place of these specialized ensembles.

Organizations responsible for first responders should use protective ensembles and protective clothing specifically designed for those hazardous materials emergencies and should use ensembles that are certified to the following standards, as appropriate:

- (1) NFPA 994
- (2) NFPA 992
- (3) NFPA 994

Specific criteria for CBRN protective ensembles previously addressed in the 2007 and 2013 editions of NFPA 1971 were moved to NFPA 994. NFPA 994 establishes requirements for chemical/biological protection as part of the Class 2 requirements. The 2012 edition of NFPA 994 specified criteria for single-use CBRN protective ensembles; however, the 2018 edition includes CBRN protection criteria for both single and multiple-use protective ensembles.

A.4.1.1.5 —

Fire and emergency response organizations are cautioned that accessories are not a part of the certified product but could be attached to the certified product by a means not engineered, manufactured, or authorized by the manufacturer.

Fire and emergency response organizations are cautioned that if the accessory or its means of attachment causes the structural integrity of the certified product to be compromised, the certified product might not comply with the standard for which it was designed, manufactured, and marketed. Additionally, if the accessory or its attachment means are not designed and manufactured from materials suitable for the hazardous environments of emergency incidents, the failure of the accessory or its attachment means could cause injury to the emergency responder.

Because the aftermarket for certified product accessories is so broad, fire and emergency response organizations are advised to contact both the manufacturer of the accessory and the manufacturer of the certified product and verify that the accessory and its means of attachment are suitable for use in the intended emergency response environment. Fire and emergency response organizations should seek and receive written documentation from both the accessory manufacturer and the manufacturer of the certified product to validate the following information:

- (1) The accessory for a certified product, and its attachment method, will not degrade the designed protection or performance of the certified product below the requirements of the product standard to which it was designed, manufactured, tested, and certified.
- (2) The accessory, when properly attached to the certified product, shall not interfere with the operation or function of the certified product, or with the operation or function of any of the certified product's component parts.

Users are also cautioned that the means of attachment of the accessory that fail to attach the accessory safely and securely to the certified product can cause the accessory to be inadvertently dislodged from the certified product and create a risk to the wearer or other personnel in the vicinity.

A.4.1.2 —

This standard is not designed to be utilized as a purchase specification. It is prepared, as far as practicable, with regard to required performance, avoiding restriction of design wherever possible. Purchasers should specify departmental requirements for items such as color, markings, closures, pockets, and patterns, or other features related to specific elements or ensembles. Tests specified in this standard should not be deemed as defining or establishing performance levels for protection from all structural or proximity firefighting environments.

A.4.1.2.3 —

The testing requirements in Chapter 8 of this standard are not intended to establish the limitations of the working environment for firefighting but are intended to establish material performance. Users should be advised that when a continual increase of heat is felt through the protective ensemble, the protective ensemble could be nearing its maximum capability and injury could be imminent.

Users should be advised that if unusual conditions prevail, or if there are signs of abuse or mutilation of the protective ensemble or any element or component thereof, or if modifications or replacements are made or accessories are added without authorization of the protective ensemble element manufacturer, the margin of protection might be reduced.

Users should be advised that the protective properties in new structural firefighting protective ensemble elements, as required by this standard, can diminish as the product is worn and ages.

A.4.1.3.2 —

Specific design and performance criteria are established in Chapters 4 through 8 of this standard to demonstrate limited protection against liquid and particulate contaminant hazards to reduce the amount of contamination that passes through the ensemble onto the firefighter's skin and to reduce the contamination that might remain in the ensemble elements as the result of the exposure. Full-scale tests are used to evaluate the resistance of complete ensembles to penetration of liquids and particulates.

A.4.1.3.8 —

See A.4.1.1.5 :

~~A.4.2.4~~ —

~~NFPA, from time to time, has received complaints that certain items of fire and emergency services protective clothing or protective equipment might be carrying labels falsely identifying them as compliant with an NFPA standard.~~

NFPA advises those purchasing protective ensembles or protective ensemble elements to be aware of the following:

For protective ensembles or protective ensemble elements to meet the requirements of Chapters 4 through 8 of NFPA 1970 they must be certified by an independent third-party certification organization. In addition, the item must carry the label, symbol, or other identifying mark of that certification organization.

A protective ensemble or element that does not bear the mark of an independent third-party certification organization is not compliant with Chapters 4 through 8 of NFPA 1970 even if the product label states that the protective ensemble or element is compliant.

For further information about certification and product labeling, Chapters 4 and 5 of NFPA 1970 should be referenced. Also, the definitions for *Certification/Certified*, *Labeled*, and *Listed* in Chapter 3 should be reviewed.

Third-party certification is an important means of ensuring the quality of fire and emergency services protective clothing and equipment. To be certain that an item is properly certified, labeled, and listed, the NFPA recommends that prospective purchasers require appropriate evidence of certification for the specific product and model from the manufacturer before purchasing. Prospective purchasers also should contact the certification organizations and request copies of the certification organization's list of certified products to the appropriate NFPA standard. This listing is a requirement of third-party certification by this standard and is a service performed by the certification organization.

All NFPA standards on fire and emergency services protective clothing and equipment require that the item be certified by an independent third-party certification organization and, as with NFPA 1970 protective ensembles or protective ensemble elements, all items of fire and emergency services protective clothing and equipment must carry the label, symbol, or other identifying mark of that certification organization.

Any item of protective clothing or protective equipment covered by an NFPA standard that does not bear the mark of an independent third-party certification organization is not compliant with the appropriate NFPA standard even if the product label states that the item is compliant.

A.4.3.1 —

The certification organization should have a sufficient breadth of interest and activity so that the loss or award of a specific business contract would not be a determining factor in the financial well-being of the agency.

A.4.3.5 —

The contractual provisions covering certification programs should contain clauses advising the manufacturer that, if requirements change, the product should be brought into compliance with the new requirements by a stated effective date through a compliance review program involving all currently listed products.

Without these clauses, certifiers would not be able to move quickly to protect their name, marks, or reputation. A product safety certification program would be deficient without these contractual provisions and the administrative means to back them up.

A.4.3.6 —

~~Investigative procedures are important elements of an effective and meaningful product safety certification program. A preliminary review should be carried out on products submitted to the agency before any major testing is undertaken.~~

~~A.4.3.7.1~~ —

~~For further information and guidance on recall programs, see 29 CFR 7. Subpart C.~~

A.4.3.9 —

Such factory inspections should include, in most instances, witnessing of production tests. With certain products, the certification organization inspectors should select samples from the production line and submit them to the main laboratory for countercheck testing. With other products, it might be desirable to purchase samples in the open market for test purposes.

~~A.4.4.4~~ —

Table A.4.4.4(a) through Table A.4.4.4(k) are provided as a quick reference for conditioning and testing of elements and cannot be relied on as requirements.

~~Table A.4.4.4(a) Testing Structural Firefighting Garments~~

Test Section	Number	Test Material or Component	- Conditioning	Garments Composite	Outer-Shell Moisture Barrier Thermal Barrier Winter Liner Labels Other Materials Thread Seams Hardware Trim - Washing/Drying ^a	Room Temp. ^b	Convective Heat ^c	Flame resistance	8.2	- X X X X - X - - - X - X X - Heat thermal resistance	8.6	- X X X X X - - X X - X - TPP	8.10	- X - - - - - X - Thread melting	8.11	- - - - - X - - - - - X - Tear resistance	8.12	- X X X - - - X X - Seam strength	8.14	- - - - - X - X - Cleaning shrinkage	
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resistance 8-24 --- X X X X ----- X --- Water absorption resistance 8-25 --- X ----- X --- Water penetration
 resistance 8-26 --- X ----- X X X Liquid penetration resistance 8-27 --- X ----- X --- X X X Viral penetration
 resistance 8-28 --- X ----- X --- X X X Corrosion resistance 8-29 ----- X --- X --- Total heat
 loss 8-33 - X ----- X --- Label durability 8-41 ----- X ----- Trim
 retroreflectivity 8-45 ----- X --- X X Trim fluorescence 8-45 ----- X --- X --- Overall liquid
 penetration 8-48 X ----- X --- Breaking
 strength 8-50 - X ----- GCHR 8-51 - X ----- X X --- Light degradation
 resistance 8-62 --- X ----- X X X DRD function 8-59 X ----- DRD material
 strength 8-58 ----- X - X -----

^a See 8.1.2.

^b See 8.1.3.

^c See 8.1.5.

Table A.4.4.4(b) Conditioning and Testing of Structural Firefighting Helmets

Test Section Number Specimen Numbers Room Temperature ^a Wet ^b Low Temperature ^c Radiant ^d Convective
 Heat ^e Washing/Drying ^f Helmet, faceshield, and goggle flame test 8-2 & 8-3 1 ----- Heat
 resistance 8-6 2 ----- Retention 8-34 1 ----- Suspension retention 8-35 1 ----- Shell
 retention 8-43 13 ----- Electrical resistance 8-30 4 ----- Faceshield, goggle luminous
 transmittance 8-44 6 ----- Faceshield, goggle impact resistance 8-17 3 4 9 - 13 - Top impact 8-15 3 4 9 7 11 - Label
 legibility 8-42 2 4 9 7 --- Impact acceleration 8-16 5 6 10 8 --- Penetration 8-19 3 4 9 14 12 - Faceshield, goggle lens
 abrasion resistance 8-22 8 ----- Hardware corrosion 8-29 3 ----- Trim retroreflectivity and
 fluorescence 8-45 X ----- Thread heat resistance 8-11 X ----- Ear cover, chin strap flame
 resistance 8-2 X ----- X Ear cover, chin strap heat resistance 8-6 X ----- X Ear cover TPP 8-10 X -----

^a See 8.1.3.

^b See 8.1.7.

^c See 8.1.4.

^d See 8.1.6.

^e See 8.1.5.

^f See 8.1.2.

Table A.4.4.4(c) Testing Structural Firefighting Gloves

Test Section Number Test Material or Component - Test Conditioning Whole Glove Glove Composite Glove
 Gauntlet Glove Wristlet Thread Hardware - Room Temp ^a Washing/Drying ^b Convective
 Heat ^c Wet ^d Flex ^e TPP 8-10 - X X X --- X X --- Heat and thermal shrinkage
 resistance 8-6 X ----- X X --- X Conductive heat resistance test 1 8-7 - X ----- X X - X - Flame resistance test
 3 8-4 - X X X --- X X --- Thread melting 8-11 --- X --- X --- Viral penetration
 resistance 8-28 - X ----- X X X --- Liquid penetration resistance 8-27 - X ----- X X X --- Cut
 resistance 8-21 - X X X --- X X --- Puncture resistance test 1 8-20 - X ----- X --- X --- Glove hand
 function 8-37 X ----- X --- Burst strength 8-13 --- X --- X --- Seam breaking
 strength 8-14 --- X X --- X --- Overall liquid integrity test 1 8-32 X ----- X X --- Glove donning
 test 8-36 ----- X --- Liner retention test 8-63 X ----- X --- Label durability and legibility test
 1 8-41 X ----- X - X --- Grip 8-38 X ----- X - X --- Corrosion resistance 8-29 ----- X - X ---

^a See 8.1.3.

^b See 8.1.2.

^c See 8.1.5.

^d See 8.1.8.

^e See 8.1.10.

Table A.4.4.4(d) Testing Structural Firefighting Footwear

Test Section Number Test Material or Component - Test Conditioning Whole Footwear Footwear
 Composite Footwear Sole Footwear Toe Section Footwear Moisture Barrier Footwear Moisture Barrier
 Seam Thread Labels - Room Temp ^a Convective Heat ^b Wet ^c Radiant heat resistance test
 1 8-9 X ----- X - X Conductive heat resistance test 1 8-7 X ----- X --- Conductive heat resistance test
 2 8-8 X ----- X --- Flame resistance test 4 8-5 X ----- X --- Thread melting test 8-11 ----- X --- X --- Liquid
 penetration resistance 8-27 ----- X X --- X X --- Viral penetration resistance 8-28 ----- X X --- X X --- Puncture resistance
 test 8-20 X X X ----- X --- Cut resistance 8-21 - X ----- X --- Slip resistance 8-40 X ----- X --- Abrasion
 resistance 8-23 --- X ----- X --- Electrical insulation test 2 8-31 X ----- X --- Ladder shank
 bend 8-39 X ----- X --- Eyelet and stud post attachment 8-49 X ----- X --- Corrosion
 resistance 8-29 X ----- X --- Label durability and legibility 8-41 ----- X - X X --- Overall liquid integrity test

2 8.70 X-----X-- Heat and thermal shrinkage resistance test 8.6 X-----X-- Puncture resistance device
flex test 8.20 X-----X--

vi ~~See 8.1.3.~~

~~b See 8.1.5.~~

^e ~~See 8.1.9.~~

~~Table A.4.4.4(e) Testing Structural Firefighting Interfaces~~

Test Section Number	Test Material or Component	- Conditioning Hood	Hood Material or Composite	Hood Seam Hood Thread Wristlet Material or Composite Wristlet Seam Wristlet Thread - Washing/Drying ^a	Room Temperature ^b	Flame resistance 8-4	X	--X--XX	Heat/thermal resistance 8-6	X--X--XX	TPP 8-10	X--X--XX	Thread melting strength 8-13	X--X--XX	Seam strength 8-14	X--X--XX	Cleaning shrinkage 8-24	X---X---X-
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❖ ~~See 8.1.2.~~

~~b See 8.1.3.~~

~~Table A.4.4.4(f) Testing Proximity Firefighting Garments~~

[illegible]

	Materials	Thread	Seams	Hardware	Trim	- Washing/Drying ^a	Room Temp ^b	Convective Heat ^c	Flame
resistance	8.2	--X	X	X	X	-X--X-X-	Heat/thermal		
resistance	8.6	--X	X	X	X	X-X-X-TPP	8.10 -X-----X-	Thread melting	8.11-----X-----X-Tear
resistance	8.12	--X	X	X	X	--X-X-	Seam strength	8.14-----X--X-	Cleaning shrinkage
resistance	8.24	--X	X	X	X	--X-X-	Water absorption resistance	8.25 -X-----X-	Water penetration
resistance	8.26	--X				--X-X-X	Liquid penetration resistance	8.27--X-----X--X-X-X	Viral penetration
resistance	8.28	--X				--X-X-X-X	Corrosion resistance	8.29-----X--X-	Total heat
loss	8.33	-X				--X-X-	Label durability	8.41-----X-----Overall liquid	
penetration	8.48	X				--X-X-	Breaking		
strength	8.50	-X				--CCHR	8.51 -X-----X-X-	Light degradation	
resistance	8.62					--X-X-X	DRD function test	8.59-----DRD material strength	
test	8.58					--Radiant heat resistance test	2 8.61--X-----X-	Wet	
flex	8.54	-X				--X-X-	Adhesion after wet flex	8.55 -X-----X-	Flex at low
temperature	8.56	-X				--X-X-	Resistance to high temperature blocking	8.57--X-----X-	

❖ ~~See 8.1.2.~~

~~b See 8-1-3~~

^e ~~See 8.1.5.~~

~~Table A.4.4.4(g) Conditioning and Testing of Proximity Firefighting Helmet~~

Test Section Number Specimen Numbers Room Temperature ^a Wet ^b Low Temperature ^c Radiant ^d Convective Heat ^e Washing/Drying ^f Helmet, faceshield flame test 8:3 1----- Heat resistance 8:6 2----- Retention 8:34 1----- Suspension retention 8:36 1----- Shell retention 8:43 13----- Electrical resistance 8:30 4----- Faceshield luminous transmittance 8:44 6----- Faceshield impact resistance 8:17 3 4 9 - 13- Faceshield radiant reflective test 8:52 15----- Top impact 8:15 3 4 9 7 41- Label legibility 8:42 2 4 9 7-- Impact acceleration 8:16 5 6 10 8-- Penetration 8:19 3 4 9 14 12- Radiant heat transmittance test 8:52 15----- Hardware corrosion 8:29 3----- Trim retroreflectivity 8:45 X----- Thread heat resistance 8:11 X----- Shroud, cover, chin strap flame resistance 8:2 X----- X Shroud, cover, chin strap heat resistance 8:6 X----- X Shroud TPP 8:10 X----- Shroud, cover radiant reflective test 8:52 X----- Shroud, cover wet flex test 8:54 X----- Shroud, cover flex at low temperature 8:56 X----- Shroud, cover high temperature blocking 8:57 X----- Shroud, cover tear resistance 8:12 X----- X Shroud, moisture barrier water penetration 8:26 X--- X X Shroud, moisture barrier liquid penetration 8:27 X--- X X Shroud, moisture barrier viral penetration 8:28 X--- X X

❖ ~~See 8.1.3.~~

b ~~See 8.1.7.~~

^e ~~See 8.1.4.~~

d ~~See 8.1.6.~~

^e ~~See 8.1.5.~~

^f ~~See 8.1.2.~~

~~Table A.4.4.4(h) Testing Proximity Gloves~~

Test Test Material or Component - Test Conditioning Section Number Whole Glove Glove Composite Glove Outer Shell Material Glove Gauntlet Glove Wristlet Thread Hardware - Room Temp ^a Washing/Drying ^b Convective Heat ^c Wet ^d Flex ^e TPP 8-10 - X - X X - - X X - - Heat and thermal shrinkage resistance 8-6 X - - - - - X X - - X Conductive heat resistance test 1 8-7 - X - - - - - X X - X - Flame resistance test 3 8-4 - X - X X - - X X - - Thread melting 8-11 - - - - - X - X - - Viral penetration resistance 8-28 - X - - - - - X X X - - Liquid penetration resistance 8-27 - X - - - - - Cut resistance 8-21 - X - X X - - X X - - Puncture resistance test 1 8-20 - X - - - - - X - X - Glove hand function 8-37 X - - - - - X - - Burst strength 8-13 - - - - - X - - X - - Seam breaking strength 8-14 - - - - - X X - - X - - Overall liquid integrity test 1 8-33 X - - - - - X X - - Glove donning test 8-37 X - - - - - X - - Liner retention test 8-63 X - - - - - X - - Label durability and legibility test 1 8-41 X - - - - - X - X - Radiant heat resistance test 2 8-61 - - X - - - - - X - - Wet flex 8-54 - - X - - - - - X - - Adhesion after wet flex 8-55 - - X - - - - - X - - Flex at low temperature 8-56 - - X - - - - - X - - Resistance to high temperature blocking 8-57 - - X - - - - - X - - Grip test 8-38 X - - - - - X - X - Corrosion resistance 8-29 - - - - - X - X - -

^a -See 8.1.3.

^b -See 8.1.2.

^c -See 8.1.5.

^d -See 8.1.8.

^e -See 8.1.10.

Table A.4.4.4(i) Testing Proximity Firefighting Footwear

Test Section Number Test Material or Component - Test Conditioning Whole Footwear Footwear Composite Footwear Sole Footwear Toe Section Footwear Moisture Barrier Footwear Moisture Barrier Seam Thread Labels - Room Temp ^a Convective Heat ^b Wet ^c Radiant heat resistance test 2 8-61 X - - - - - X - X Conductive heat resistance test 3 8-60 X - - - - - X - - Conductive heat resistance test 2 8-8 X - - - - - X - - Flame resistance test 4 8-5 X - - - - - X - - Thread melting test 8-11 - - - - - X - X - Liquid penetration resistance 8-27 - - - - - X X - - X X - Viral penetration resistance 8-28 - - - - - X X - - X X - Puncture resistance test 8-20 X X - - - - - X - - Cut resistance 8-21 - X - - - - - X - - Slip resistance 8-40 X - - - - - X - - Abrasion resistance 8-23 - - X - - - - - X - - Electrical insulation test 2 8-31 X - - - - - X - - Impact and compression 8-18 - - X - - - - - X - - Ladder shank bend 8-39 X - - - - - X - - Eyelet and stud post attachment 8-49 X - - - - - X - - Corrosion resistance 8-29 X - - - - - X - - Label durability and legibility 8-41 - - - - - X - X - Overall liquid integrity test 2 8-70 X - - - - - X - - Heat and thermal shrinkage resistance test 8-6 X - - - - - X - - Puncture resistance device flex test 8-19 X - - - - - X - -

^a -See 8.1.3.

^b -See 8.1.5.

^c -See 8.1.9.

Table A.4.4.4(j) Testing Proximity Firefighting Interfaces

Test Section Number Test Material or Composite - Conditioning Wristlet Material or Composite Wristlet Seams Wristlet Thread - Washing/Drying ^a Room Temperature ^b Flame resistance 8-2 X - - X X Thermal shrinkage resistance 8-6 X - - X X Heat resistance 8-6 X - - X X TPP 8-10 X - - - - X Thread melting 8-11 - - X - - X Burst strength 8-13 X - - - - X X Seam strength 8-14 - X - - X X Cleaning shrinkage 8-24 X - - - - X -

^a -See 8.1.2.

^b -See 8.1.3.

Table A.4.4.4(k) Optional CBRN Protective Ensemble Test Matrix

- MIST Overall Liquid Penetration Chemical Permeation Resistance Burst Strength Puncture Propagation Tear (PPT) Resistance Cold Temperature Performance Cut Resistance Puncture Resistance Abrasion Resistance Test Material or Component* 8-66 8-48 8-67 8-13 8-68 8-69 8-22 8-20 8-70 Overall ensemble X X - - - - - CBRN barrier layer - - X - - - - External CBRN barrier layer (garment) - - X X X - - External CBRN barrier layer (glove) - - - - - X X - External CBRN barrier layer (footwear) - - - - - X X X

*Each ensemble element must meet the requirements for both ensemble and the respective ensemble as a prerequisite for applying the CBRN protection option.

A.4.4.4.1 —

The order of testing is from left to right in Table A.4.4.4(b). Where there is more than one environmental condition for a specific test, the order of environmental conditioning for that test is from top to bottom in Table A.4.4.4(b).

A.4.4.4.2 —

The order of testing is from left to right in Table A.4.4.4(g). Where there is more than one environmental condition for a specific test, the order of environmental conditioning for that test is from top to bottom in Table A.4.4.4(g) :

A.4.5.1(2)(b) —

An example of a nonquantitative result would be pass or fail for melting and dripping.

A.4.5.2(2) —

An example of a nonquantitative result would be pass or fail for melting and dripping.

A.4.6.3 —

In September 2015, a revised edition of ISO 9001, *Quality management systems — Requirements*, was issued. Both the 2008 and 2015 editions of ISO 9001 are being referenced in this edition of NFPA 1970 to allow manufacturers a sufficient amount of time to transition registration of their quality management systems to the newer edition.

A.4.6.4 —

Subcontractors should be considered to be, but not be limited to, a person or persons, or a company, firm, corporation, partnership, or other organization having an agreement with or under contract with the compliant product manufacturer to supply or assemble the compliant product or portions of the compliant product.

A.4.7.2 —

By definition, a hazard might involve a condition that can be imminently dangerous to the end-user. With this thought in mind, the investigation should be started immediately and completed in as timely a manner as is appropriate considering the particulars of the hazard being investigated.

A.4.7.11 —

The determination of the appropriate corrective action for the certification organization to initiate should take into consideration the severity of the product hazard and its potential consequences to the safety and health of end users. The scope of testing and evaluation should consider, among other things, testing to the requirements of the standard to which the product was listed as compliant, the age of the product, the type of use and conditions to which the compliant product has been exposed, care and maintenance that has been provided, the use of expertise on technical matters outside the certification organization's area of competence, and product hazards caused by circumstances not anticipated by the requirements of the applicable standard. As a guideline for determining which is more appropriate, a safety alert or a product recall, the following product hazard characteristics are provided, which are based on 42 CFR 84, Subpart E, §84.41:

- (1) *Critical*: A product hazard that judgment and experience indicate is likely to result in a condition immediately hazardous to life or health (IHLH) for individuals using or depending on the compliant product. If an IHLH condition occurs, the user will sustain, or will be *likely* to sustain, an injury of a severity that could result in loss of life, or result in significant bodily injury or loss of bodily function, either immediately or at some point in the future.
- (2) *Major A*: A product hazard, other than *Critical* that is likely to result in failure to the degree that the compliant product does not provide any protection or reduces protection, *and is not detectable to the user*. The phrase *reduced protection* means the failure of specific protective design(s) or feature(s) that results in degradation of protection in advance of reasonable life expectancy to the point that continued use of the product is *likely* to cause physical harm to the user, or where continued degradation could lead to IHLH conditions.
- (3) *Major B*: A product hazard, other than *Critical* or *Major A*, that is likely to result in reduced protection and is detectable to the user. The phrase *reduced protection* means the failure of specific protective design(s) or feature(s) that results in degradation of protection in advance of reasonable life expectancy to the point that continued use of the product is *likely* to cause physical harm to the user, or where continued degradation could lead to IHLH conditions.
- (4) *Minor*: A product hazard, other than *Critical*, *Major A*, or *Major B*, that is not likely to materially reduce the usability of the compliant product for its intended purpose or a product hazard that is a departure from the established applicable standard and has little bearing on the effective use or operation of the compliant product for its intended purpose.

Where the facts are conclusive, based on characteristics of the hazard classified as indicated previously, the certification organization should consider initiating the following corrective actions with the authorized and responsible parties:

- (1) *Critical* product hazard characteristics: product recall
- (2) *Major A* product hazard characteristics: product recall or safety alert, depending on the nature of the specific product hazard
- (3) *Major B* product hazard characteristics: safety alert or no action, depending on the nature of the specific product hazard
- (4) *Minor* product hazard characteristic: no action

A.4.7.13 —

Reports, proposals, and proposed TIAs should be addressed to the technical committee that is responsible for the applicable standard and be sent in care of Standards Administration, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

Revise according to the word document attached.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1970-proposed_annex_4.docx		

Statement of Problem and Substantiation for Public Input

As part of the task group for consolidation, this proposal is being submitted to align the annex items as it relates to the revision of each standard's "chapter 4".

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 185-NFPA 1970-2021 [Sections A.9.2.8, A.9.3.1, A.9.3.5, A.9.3.6, A.9.3.7.1, A.9...]	
Public Input No. 186-NFPA 1970-2021 [Sections A.14.3.1, A.14.3.5, A.14.3.6, A.14.3.9, A.14.4, A....]	
Public Input No. 187-NFPA 1970-2021 [Sections A.19.1.1.1, A.19.1.1.2, A.19.1.1.3, A.19.1.2.2, A....]	

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Submittal Date: Thu Nov 04 13:16:03 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-298-NFPA 1970-2022](#)

Statement: Moving 1971 specific info to new chapter 5 annex material as part of the consolidation and updating references. End users sometimes have difficulties navigating certification listing websites for identifying compliant products. The listed name provided by the certification organization should correspond to the name used by the manufacturer, at least as found on the product label, such as the required model or other identification.

Adding new certification requirements for recognized components to identify testing requirements related to restricted substances. Also, wanted to add a five-year window for which data can be accepted toward a new certification. Adding separate requirements for component supplier quality assurance so ISO 9001 is optional, which is aligned with current practice (for example, NFPA 2112).

The delay between the effective date of the newly issued standard and the actual publication of that standard continues to exceed what is reasonable for the certification organizations to complete all testing required. Over the years, the "gap" was typically between 1 to 3 months. More recently, some standards are being published up to 6 months from issuance. This "gap" causes issue because the certification organizations are not able to issue certifications to the "old" edition after the effective date, and they are also not able to issue certifications to the "new" standard because the finished standard is unavailable. In the case where a standard is published 6 months after issuance, the COs are only given 6 months to test and update all certifications. This is impossible to do, especially where the testing program is as extensive as the one in this standard. This proposal adds 6 months to the previously allowed 12 months so that if the standard is published months after the effective date, the COs still have the ability to complete the necessary testing and file updates.

Moving 1971 specific annex info to new chapter 5 as part of the consolidation. Updating references.

Removing annex item that addresses the update to ISO 9001 as this is no longer applicable.



Public Input No. 126-NFPA 1970-2021 [Section No. A.4.1.1.3]

A.4.1.1.3

~~While separate requirements are specified for structural firefighting and proximity firefighting protective elements, the optional liquid and particulate contaminant protection requirements apply to ensembles only. Individual elements cannot be separately certified to the optional liquid and particulate contaminant protection criteria in this standard. Only complete ensembles, in which all necessary elements are specified to achieve the stated performance requirements, can be certified to the optional liquid and particulate contaminant protection criteria in this standard.~~

The optional liquid and particulate contaminant protection criteria are intended to address protection of firefighters against fireground liquids and smoke particulates that carry chemical and other hazardous contaminants. ~~Individual ensemble element~~ Individual requirements for protective garments, gloves, and footwear currently specify the use of a moisture barrier and/or liquid protection requirements; however, the entire ensemble is not evaluated for liquid penetration resistance performance. In particular, interfaces between individual elements are susceptible to inward leakage of liquids that can only be determined when the entire ensemble as configured by the organization is evaluated. Similarly, there are no requirements for particulate penetration resistance of ensemble elements or the overall ensemble with the exception of protective hoods that are also certified for optional particulate barrier protection. Ensemble elements that incorporate moisture barriers will limit particulate penetration; however, the interfaces between elements will readily permit inward penetration of particulate from smoke and other sources at the fire scene. Standard protective hood interface components have no barrier material and allow the passage of particles through the hood materials to the firefighter's head and neck that are not covered by the SCBA facepiece.

New requirements for optional liquid particulate contaminant protection are only applied to protective garments because of the difficulty of evaluating every conceivable combination of the different ensemble elements in addition to available self-contained breathing apparatus (SCBA) facepieces. This approach can be justified on the basis of fact that protective garments provide the principal integration function for the majority of the ensemble, particularly as applied to interfaces with gloves, footwear, and hood while also addressing the coat to trousers overlap and the closures provided in both coats and trousers. Specific performance testing still involves ensembles; however, the manufacturer of the protective garments selects the other elements of the ensemble to be tested and is required to report which elements are used in this testing.

The optional liquid and particulate contaminant protection criteria are not intended to protect against all hazardous substance exposures, but rather minimize firefighter exposures to routine liquids, including hot, cold, or contaminated water and the bulk of particulates generated at the fire scene. Some liquids and particulate might still pass through the clothing depending on the nature of the exposure, including the exposure time and conditions. Moreover, hazardous vapors or gases could still also penetrate individual ensemble elements or interfaces leading to exposures. ~~Ensembles~~ Garments that are certified to the optional liquid and particulate contaminant protection criteria are not hazardous materials protective ~~ensembles~~ garments and should not be used in place of these specialized ensembles.

Organizations responsible for hazardous materials ~~first responders~~ response should use protective ensembles and protective clothing specifically designed for those hazardous materials emergencies and should use ensembles that are certified to the following standards, as appropriate:

- (1) NFPA 1991
- (2) NFPA 1992
- (3) NFPA 1994

Specific criteria for CBRN protective ensembles previously addressed in the 2007 and 2013 editions of NFPA 1971 were moved to NFPA 1994. NFPA 1994 establishes requirements for chemical/biological protection as part of the Class 2 requirements. The 2012 edition of NFPA 1994 specified criteria for single-use CBRN protective ensembles; however, the 2018 edition includes CBRN protection criteria for both single- and multiple-use protective ensembles.

Statement of Problem and Substantiation for Public Input

Adding explanation for the change to garment certification instead of ensembles. See PI 125

Related Public Inputs for This Document

Related Input
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]

Relationship

Submitter Information Verification

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Submittal Date: Tue Nov 02 15:22:07 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-299-NFPA 1970-2022](#)

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 198-NFPA 1970-2021 [Section No. A.4.1.1.3]

A.4.1.1.3

While separate requirements are specified for structural firefighting and proximity firefighting protective elements, the optional liquid and particulate contaminant protection requirements apply to ensembles only. Individual elements cannot be separately certified to the optional liquid and particulate contaminant protection criteria in this standard. Only complete ensembles, in which all necessary elements are specified to achieve the stated performance requirements, can be certified to the optional liquid and particulate contaminant protection criteria in this standard.

The optional liquid and particulate contaminant protection criteria are intended to address protection of firefighters against fireground liquids and smoke particulates that carry chemical and other hazardous contaminants. Individual ensemble element requirements for protective garments, gloves, and footwear currently specify the use of a moisture barrier and/or liquid protection requirements; however, the entire ensemble is not evaluated for liquid penetration resistance performance. In particular, interfaces between individual elements are susceptible to inward leakage of liquids that can only be determined when the entire ensemble as configured by the organization is evaluated. Similarly, there are no requirements for particulate penetration resistance of ensemble elements or the overall ensemble. Ensemble elements that incorporate moisture barriers will limit particulate penetration; however, the interfaces between elements will readily permit inward penetration of particulate from smoke and other sources at the fire scene. Standard protective hood interface components have no barrier material and allow the passage of particles through the hood materials to the firefighter's head and neck that are not covered by the SCBA facepiece.

The optional liquid and particulate contaminant protection criteria are not intended to protect against all hazardous substance exposures, but rather minimize firefighter exposures to routine liquids, including hot, cold, or contaminated water and the bulk of particulates generated at the fire scene. Some liquids and particulate might still pass through the clothing depending on the nature of the exposure, including the exposure time and conditions. Moreover, hazardous vapors or gases could still also penetrate individual ensemble elements or interfaces leading to exposures. Ensembles that are certified to the optional liquid and particulate contaminant protection criteria are not hazardous materials protective ensembles and should not be used in place of these specialized ensembles.

Organizations responsible for first responders should use protective ensembles and protective clothing specifically designed for those hazardous materials emergencies and should use ensembles that are certified to the following standards, as appropriate:

- (1) NFPA 1991
- (2) NFPA 1992
- (3) NFPA 1994
- (4) NFPA 1990

Specific criteria for CBRN protective ensembles previously addressed in the 2007 and 2013 editions of NFPA 1971 were moved to NFPA 1994. NFPA 1994 establishes requirements for chemical/biological protection as part of the Class 2 requirements. The 2012 edition of NFPA 1994 specified criteria for single-use CBRN protective ensembles; however, the 2018 edition includes CBRN protection criteria for both single- and multiple-use protective ensembles. The NFPA 1994 requirements referenced are now contained within NFPA 1990.

Statement of Problem and Substantiation for Public Input

The haz mat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.

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Submittal Date: Thu Nov 04 15:41:06 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-299-NFPA 1970-2022](#)

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 130-NFPA 1970-2021 [Section No. A.4.1.3.2]

A.4.1.3.2



Specific design and performance criteria are established in Chapters 4 through 8 of this standard to demonstrate limited protection against liquid and particulate contaminant hazards to reduce the amount of contamination that passes through the ~~ensemble garment~~ onto the firefighter's skin and to reduce the contamination that might remain in the ~~ensemble garment~~ elements as the result of the exposure. Full-scale tests are used to evaluate the resistance of complete ensembles to penetration of liquids and particulates but are not certified as an ensemble as only the areas underneath the garment are evaluated.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

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Committee: FAE-SPF

Committee Statement

Resolution: [FR-299-NFPA 1970-2022](#)

Statement: Moving 1971 specific information from chapter 4 into a new chapter 5 as part of the consolidation.

For the implementation of requirements to address restricted substances, it is important that these requirements be applied at the component level. To this end, new certification procedures are proposed to specifically address components, which can also be applied more formally as part of the certification process for other requirements. These requirements should be adopted for all products covered under the NFPA 1970 consolidation.

Based on the work performed by the ensemble task group, the requirements for optional liquid and particulate ensembles are being changed to the certification of garments only.

Firefighters routinely wear structural PPE for non-structural incidents and for overhaul when better NFPA compliant forms of PPE are available. A change in the scope and purpose is one way to encourage the use of more appropriate PPE for the hazards encountered.

Also adding the statement that there are optional requirements for particulate hoods since this was inadvertently omitted previously

Some form of analysis should be required for a manufacturer that submits samples for testing and gets failing results. This analysis should be documented where it could be a change in the product, a fault of the test method, or some other identified cause. Manufacturers should not be permitted to simply keep submitting new samples until they receive pass results. This requirement should be harmonized across all products covered by NFPA 1970.

Adding annex material to support the change in scope as submitted in PI13 and PI15.

Adding explanation for the change to garment certification instead of ensembles for particulate protection.

The hazmat standards referenced in this section are now contained in NFPA 1990 which is being added for reference. The reference to NFPA 1991, 1992 and 1994 remains as historical perspective.



Public Input No. 194-NFPA 1970-2021 [New Section after A.5.1.7.5]

A.5.1.8 Non-Visual/Machine readable tags include but are not limited to RFID tags, blue tooth, data chips, etc. These tags are typically scannable and provide specific data when scanned similar to a bar code. The intent of permitting these supplemental tags is to allow for additional methods of tracking element use, laundering, etc while also assuring a level of performance if included within an element.

Statement of Problem and Substantiation for Public Input

A.5.1.8 Non-Visual/Machine readable tags include but are not limited to RFID tags, blue tooth, data chips, etc. These tags are typically scannable and provide specific data when scanned similar to a bar code. The intent of permitting these supplemental tags is to allow for additional methods of tracking element use, laundering, etc while also assuring a level of performance if included within an element.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 188-NFPA 1970-2021 [New Section after 5.1.7.5]</u>	

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Thu Nov 04 14:26:03 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-138-NFPA 1970-2022

Statement: Many organizations are using RFID or other machine readable devices to track PPE. Currently there are not requirements in this standard for such devices. These requirements outline the minimum requirements.



Public Input No. 111-NFPA 1970-2021 [New Section after A.5.3.4]

A.5.4.1

Packaging containing the user information can consist of printed materials or instructions to access the information digitally.

Statement of Problem and Substantiation for Public Input

Adding recommended language to clarify the use of digital access of the information. This language is utilized in other standards within this project to describe the process currently used in the field.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 110-NFPA 1970-2021 [Section No. 5.4.2]	

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
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City:
State:
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Submittal Date: Mon Nov 01 14:49:49 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-112-NFPA 1970-2022

Statement: This addition is to provide additional annex material to clarify that user instructions can be delivered in various formats. This language is utilized in other standards within this project to describe the process currently used.



Public Input No. 137-NFPA 1970-2021 [New Section after A.5.4.4]

A.5.4.8(3)

The purpose of the information is primarily to document those other elements of the ensemble that were used for qualifying the protective garment(s) to the optional liquid and particulate contaminant protection requirements of this standard. This information does not imply that other individual elements used in testing as indicated by the manufacturer meet any specific requirements for liquid and particulate protection. Additionally, this information does not convey that the specific ensemble tested is certified as an "ensemble" meeting the optional liquid and particulate contaminant protection requirements as this standard does not cover ensemble certification.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
State:
Zip:
Submittal Date: Tue Nov 02 16:49:02 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-234-NFPA 1970-2022

Statement: Revising the labeling required as it relates to the certification of garments instead of ensembles for the optional liquid and particulate protection.



Public Input No. 22-NFPA 1970-2021 [Section No. A.6.5.2]

A.6.5:

2-

2-:



Many helmet designs expose the faceshield/goggle component(s) to abrasion, heat, flame, and particulate contamination. Purchasers might wish to specify a means of protecting the component(s). This could include, but not be limited to, faceshield/goggle components that retract inside the helmet, and coverings for the component(s) that are inherently resistant to the

firefighting

fire fighting; environment. Fire departments should consider the health risks associated with contaminated goggles coming in direct contact with the wearer's face. Goggles do not have to be attached to the helmet.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_10_Held.pdf	1971_PI10	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. ___ of the (cycle) Second Draft Report for NFPA ___ and per the Regs. at 4.4.8.3.1. If faceshields and/or goggles are not externally mounted to the helmet, there is no need for this explanation. NFPA 1500, Standard on Fire Department Occupational Safety and Health Program (2013 revision) chapter 7.18 is the section on Face and Eye Protection states the following: 7.18.1 Primary eye protection appropriate for a given specific hazard shall be provided for and used by members exposed to that specific hazard. 7.18.1.1* Primary eye protection shall meet the requirements of ANZI Z87.1 Practice for Occupational and Educational Eye and Face Protection. 7.18.1.2 Face protection shall be in addition to primary eye protection unless SCBA is being used. 7.18.1.3 The helmet faceshield alone shall not be considered and shall not be used as primary eye protection. 7.18.2 The full facepiece of SCBA shall constitute face and eye protection when worn. 7.18.2.1 SCBA that has a face-mounted regulator that when disconnected provides a direct path for flying objects to strike the face or eyes shall have the regulator attached in order to be considered face and eye protection. 7.18.3 When operating in the hazardous area at an emergency scene without the full facepiece of respiratory protection being worn, members shall wear primary eye protection that is designed to protect the member's eyes from the expected hazard. Eye and face protection should be considered as "stand alone" elements or omitted completely from this standard. This issue as proposed during the public input period and the TC did not accept the language to remove externally eye and face protection from helmets. The substantiation stated "...The TG concluded that removing the faceshield or goggles or both from the standard at this time would be a step backwards. During structural fire fighting the SCBA facepiece provides eye protection but during other routine operations the faceshield or goggles or both will provide better eye protection for the fire fighter when properly worn". And, "We were unable to locate any data that shows fire fighter injuries would be reduced if the faceshield or goggles or both were removed from the helmet." Of course, there is no data that shows injuries would be reduced. There is no database that captures this type information. The existing design requirements add unnecessary weight to the helmet and creates a top-heavy helmets. There have been lawsuits filed about the "bobblehead" effect of existing helmets. More importantly, the current design allows for the faceshield and goggles or both, to be exposed to the toxic fire environment and abrasion. Few, if any, faceshields, goggles, "flip-downs" or any combination thereof, currently mounted and in-service on helmets are clean and abrasion free enough to provide the fire fighter good visibility when deployed. Cancer awareness and prevention is paramount in any fire fighter health discussion. Yet, NFPA 1971 currently allows for goggles that can have a face seal that, by design, come in direct contact with the contaminated helmet when stowed, and then placed directly against the fire fighter's face when deployed. Minimizing all these health and safety issues is clearly NOT a step backwards. It is a step forward.

Submitter Information Verification

Submitter Full Name:	Tc On Fae-Spf
Organization:	NFPA 1971 TC on Structural and Proximity Fire Fighting Protective Clothing and Equipment

Street Address:**City:****State:****Zip:****Submittal Date:** Mon Aug 16 11:42:58 EDT 2021**Committee:** FAE-SPF**Committee Statement**

Resolution: The removal of and changes to the faceshield and goggles design/ performance from the helmet requirements would result in a decrease in safety to the firefighters.

**Public Input No. 140-NFPA 1970-2021 [New Section after A.6.16.2]****A.6.19.4.1.1**

Design features including the placement of reinforcement materials, trim, and pockets are not considered unique for this requirement. Differences in terms of garment outer shells, moisture barriers, thermal barriers, reinforcement materials, trim, and other construction materials are not considered unique for this requirement.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]</u>	

Submitter Information Verification**Submitter Full Name:** Amanda Newsom**Organization:** UL LLC**Street Address:****City:****State:****Zip:****Submittal Date:** Tue Nov 02 17:18:15 EDT 2021**Committee:** FAE-SPF**Committee Statement****Resolution:** FR-236-NFPA 1970-2022

Statement: Clarification is being provided as to when liquid and particulate garments are considered unique for the purposes of testing and evaluation.



Public Input No. 209-NFPA 1970-2021 [New Section after A.7.2.2]

A.x.x.x Evaporative Resistance is a performance requirement for evaporative heat transfer in a hot condition. It measures how well the garment's base composite (outer shell, moisture barrier, and thermal barrier) allows moisture vapor to evaporate from the testing surface thereby allowing evaporative cooling to take place.

This test ignores the insulation component of heat loss and only measures the evaporative resistance in a hot/humid environment (35 °C, 40% RH). Insulation is not considered because in stressful conditions (where the air temperature is equal to or greater than skin temperature) heat cannot be lost by conduction but can be gained from the outside environment. The measurement of evaporative resistance is also necessary outside of the THL testing conditions (25 °C, 65% RH) as research by Gao et al. has shown that membranes perform similarly in this mild condition but the performance changes significantly as the testing environmental temperature increases

It should be noted that the differences in evaporative resistance that would result in any difference in physiological performance are dependent on how hard a person would be working and the environment in which they are working.

- (1) Gao H, Deaton S, Fang X, Watson K, DenHartog EA, Barker R. Effects of environmental temperature and humidity on evaporative heat loss through firefighter suit materials made with semi-permeable and microporous moisture barriers. Textile Research Journal. 2021 Jul 22:00405175211026537.

Statement of Problem and Substantiation for Public Input

This is additional information to support the new evaporative resistance test method added as a public input.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 180-NFPA 1970-2021 [New Section after 8.33]	Evaporative Resistance
Public Input No. 179-NFPA 1970-2021 [New Section after 7.2.2]	Evaporative Resistance
Public Input No. 210-NFPA 1970-2021 [New Section after B.1]	

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
Organization: NC State University
Street Address:
City:
State:
Zip:
Submittal Date: Sun Nov 07 12:43:10 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-175-NFPA 1970-2022](#)

Statement: The inclusion of this test method is supported by data generated from a DHS AFG project¹. In this project a physiological manikin was used to compare ensembles made with a range of THL and evaporative resistance values². Testing was conducted in one mild environment (25C, 65%RH) and two hot environments (35 C, 40% RH, & 40 C, 28% RH). Results indicated that THL was the best predictor of heat stress in mild environments while Evaporative Resistance measurements were a better predictor of heat stress in hotter conditions. Based on these correlations and the fact that firefighters face more heat stress in hotter conditions³ evaporative resistance of composites should be included as a performance requirement within NFPA 1971. The performance requirements of 45 Pa·m²/W suggestion comes from the data from the project as well. All evaporative resistance values below this value did not show a significantly physiological difference in the 35 C environment.

Annex information is provided to support the new Evaporative Resistance Test method.

Since evaporative resistances are additive—which is not true for heat loss—an option exists to reduce the

total amount of testing. The optional test sequence provided in this comment delineated an alternative method to testing every combination of outer shell, moisture barrier, or thermal barrier for evaporative resistance testing. As an example, if all the permutations of 15 outer shells, 6 moisture barriers, and 15 thermal barriers were considered, a total of 1350 composites (excluding replicates) would need to be tested, the same amount that would be required for THL testing. With this optional test sequence, this could be reduced to 105 evaporative resistance tests (excluding replicates). Proof of concept for this methodology has been demonstrated based on four composites using a range of outer shell, moisture barrier, and thermal barrier technologies. Based on the figures below, the optional test sequence based on measuring moisture barrier and thermal liner layers with a control fabric and adding back the intended outer shell layer to calculate the evaporative resistance appears to provide accurate estimate of absolute evaporative resistance of composite. The methodology could be applied to the initial and/or re-certification processes.

1 Barker R., Developing a new basis for rating the heat strain of firefighter turnout gear. Final report, Federal Emergency Management Agency, Contract No. EMW-2016-FP-00744; 2021.

2 Gao H, Deaton S., Barker R., Fang X, Watson K. Relationship between heat loss indexes and physiological indicators of turnout related heat strain in mild and hot environments. International Journal of Occupational Safety and Ergonomics. 2021 Submitted.

3 Barker R., Fang X., Deaton S, DenHartog E, Gao H, Tutterow R, Schmid M. Identifying factors that contribute to structural firefighter heat strain in North America. International Journal of Occupational Safety and Ergonomics. 2021 Sep 29 (just-accepted):1-26.



Public Input No. 211-NFPA 1970-2021 [Section No. A.7.2.2]

A.7.2.2

Total heat loss (THL) is a performance requirement for evaporative heat transfer. It measures how well the garment composite (outer shell, moisture barrier, and thermal barrier) allows heat and moisture vapor to transfer away from the wearer, thus helping to reduce heat stress.

The test consists of two parts. Part 1, "dry heat," is the insulation factor. Part 2, "wet heat," is the heat lost as moisture vapor passes through the composite. The test takes both of these parts into consideration, thus the term "total heat loss."

The test plate (sweating hot plate) represents sweating skin and the way in which sweating skin evaporates heat. The plate is heated to 35°C (95°F) (approximately skin temperature), and the test chamber temp is controlled at 25°C (77°F). The composite is placed on the plate as it is worn, with the face cloth of the thermal barrier on the plate and the outer shell on the top or outermost layer. Moisture is delivered to the plate to simulate sweating. The test measures the amount of electricity (W/m^2) required to maintain the plate at a constant temperature. If more heat is escaping through the composite, more electricity is required to maintain the plate at a constant temperature. Higher THL ratings indicate better performance.

THL test results have some inherent variability. In recognition of this variability, each THL test consists of three specimens. The THL rating is based on the average THL results of the three specimens. If an individual test result for one specimen varies from the average of the three specimens by more than 10 percent plus or minus, the results from that test set are discarded.

~~It should be noted that small differences in THL might be difficult for firefighters to distinguish in the field. It might take 20 to 25 W/m^2 or more, depending on the individual and the conditions, to be felt by the wearer.~~

The study the committee used to justify the implementation of the THL testing and for basing the current requirement is J. O. Stull and R. M. Duffy, "Field Evaluation of Protective Clothing Effects on Fire Fighter Physiology: Predictive Capability of the Total Heat Loss Test," *Performance of Protective Clothing: Issues and Priorities for the 21st Century*, Seventh Volume, ASTM STP 1386, C. N. Nelson and N. W. Henry, Eds., American Society for Testing and Materials, West Conshohocken, PA, 2000, pp. 481–503.

Statement of Problem and Substantiation for Public Input

The use of THL in the NFPA standards is about helping reduce heat stress and not about how garments feel or how they are perceived in the field. I'm also not sure where this reference for 20 to 25 W/m^2 comes from as I cannot find this information in the referenced paper. The paper does mention that 60 to 70 W/m^2 was the minimum amount needed for a detectable change in performance.

Related Public Inputs for This Document

Related Input	Relationship
Public Input No. 124-NFPA 1970-2021 [Section No. B.2]	THL

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
Organization: NC State University
Street Address:
City:
State:
Zip:
Submittal Date: Sun Nov 07 14:25:54 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-176-NFPA 1970-2022](#)

Statement: The committee agrees with the submitter to allow comparison for how laundering may affect garment composite THL values; however, the impact of laundering would best be evaluated in whole garment THL testing covered in Annex H, which uses full garments on a sweating manikin test apparatus. This information in addition to the other reasons for why THL testing is not conducted on washed composite samples was

instead included as additional statements in the already existing Annex section for the THL performance requirement.

The use of THL in the NFPA standards is about helping reduce heat stress and not about how garments feel or how they are perceived in the field. Therefore the reference for 20 to 25 W/m² difference is not relevant. Instead, the referenced paper indicates that a difference of 60 to 70 W/m² was the minimum amount needed for a detectable change in performance. Modeling efforts are underway to determine the ability to discriminate physiological differences for the current range of compliant garment composites.



Public Input No. 152-NFPA 1970-2021 [New Section after A.8.48.7]

A.8.48.13.9

For the purpose of inspection, inspection of the liquid-absorptive garment for protective garment sets that are without an integrated hood include the manikin arms out to the wrist crease, manikin legs down to the ankle area, and to the base of the manikin's neck. When an integrated hood is utilized, the inspection area also includes the liquid-absorptive hood.

Statement of Problem and Substantiation for Public Input

As part of the work performed by the ensemble task group, the requirements for liquid and particulate ensembles are being update to indicate the certification of garments. See PI125 for the full substantiation

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 125-NFPA 1970-2021 [Section No. 1.1.1]	

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
Street Address:
City:
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Zip:
Submittal Date: Wed Nov 03 08:29:13 EDT 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-243-NFPA 1970-2022

Statement: In order to align the testing requirements with the changes being introduced to the performance requirements, these updates are necessary in order to clarify that the evaluation needs to be made utilizing garment specimens instead of full ensembles.



Public Input No. 296-NFPA 1970-2021 [Section No. A.8.62.5.2]

A.8.62.5.2

A readily available white cardstock material of 1.29 mm (0.05 in.) thickness is suitable for use as a backing material to keep the material flat and unaffected by the air currents created in the test apparatus.

~~A.8.62.5.2~~

~~A readily available white cardstock material of 1.29 mm (0.05 in.) thickness is suitable for use as a backing material to keep the material flat and unaffected by the air currents created in the test apparatus.~~

~~Remove row from Annex B.~~

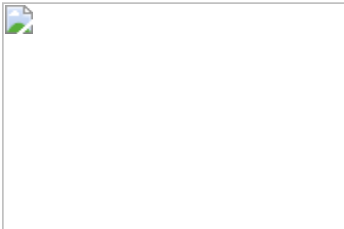
~~7.1.23 Light Degradation Resistance Test (moisture barrier)~~

~~This test is performed in accordance with ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, on moisture barrier materials. Samples are conditioned for laundry and heat in specially made pockets comprised of two layers of outer shell and one layer of thermal barrier.~~

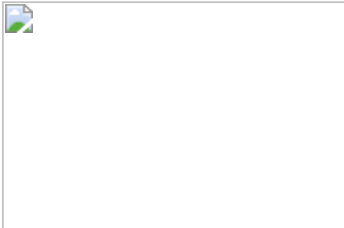
~~After conditioning, the specimens are exposed to continuous light for 40 hours using a xenon apparatus, then conditioned in a dark, temperature-controlled room. The specimens are then tested by applying pressure with water for 1 minute in accordance with ASTM D751, *Standard Test Methods for Coated Fabrics*.~~

~~The Light Degradation Resistance Test is used to measure how much the moisture barrier degrades as a result of excessive light exposure, and the performance requirement sets a minimum exposure limit.~~

~~Often, the moisture barrier is the first part of the ensemble to fail, especially if it has been exposed to prolonged sunlight or artificial light. This test is a measure of the durability of the moisture barrier.~~



~~**Exterior of Xenon Apparatus:**~~



~~**Interior of Xenon Apparatus in Use:**~~

Additional Proposed Changes

File Name	Description	Approved
UV-Light-Test-Public-Input.pdf		

Statement of Problem and Substantiation for Public Input

The UV light degradation test is applied to stand alone moisture barriers. This is not representative of the three layer ensemble that comprises structural fire fighting turnout gear, where the moisture barrier is the middle layer, beneath an

outer shell. Furthermore, outer shell materials manufactured using meta and para-aramid and polybenzimidazole based fabrics that do degrade under UV light are not subject to a UV light degradation test. The UV light degradation test does not address mechanisms of moisture barrier degradation. Please see attachment for further substantiation.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 294-NFPA 1970-2021 [Section No. 7.1.23]	
Public Input No. 295-NFPA 1970-2021 [Section No. 8.62]	

Submitter Information Verification

Submitter Full Name: Derek Urwin
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Submittal Date: Wed Nov 10 00:47:55 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-259-NFPA 1970-2022](#)
Statement: Updating the annex to reflect changes made during the revision process.



Public Input No. 210-NFPA 1970-2021 [New Section after B.1]

7.X.X. Evaporative Resistance test

This test is performed in accordance with ASTM F1886, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate, Part B*, on samples of the garments base composite (outer shell, moisture barrier, and thermal barrier) conditioned in the testing environment in the order and orientation as it is worn. Specimens are placed on a sweating hot plate and heat loss due to evaporation is measured and used to calculate the evaporative resistance value.

The Evaporative Resistance test is used to evaluate the amount of heat that can be transferred out of the garment composite via sweat evaporation from the wearer's skin through the garment to a hot and humid environment. The test does not account for other materials attached to the base garment composite such as trim, pockets, reinforcements, labels, and other accessories. These additional layers can easily negate any advantages gained from a composite with a low evaporative resistance. In addition this test cannot measure the effect of sunlight on the gear where darker colors and dirty gear have shown to have lower performance.

Lower values indicate better performance and a better ability to lose heat in a hot environment. However, appropriate Evaporative Resistance values for your department must be considered with THL and TPP values. (See A.7.2.2 and A.7.X.X for more detail.)

Statement of Problem and Substantiation for Public Input

This input supplies a test method description and test method application to the Annex

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 179-NFPA 1970-2021 [New Section after 7.2.2]	Evaporative Resistance
Public Input No. 180-NFPA 1970-2021 [New Section after 8.33]	Evaporative Resistance
Public Input No. 209-NFPA 1970-2021 [New Section after A.7.2.2]	Evaporative Resistance

Submitter Information Verification

Submitter Full Name: Anthoney Deaton
Organization: NC State University
Street Address:
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Zip:
Submittal Date: Sun Nov 07 12:53:45 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: [FR-259-NFPA 1970-2022](#)

Statement: Updating the annex to reflect changes made during the revision process.



Public Input No. 124-NFPA 1970-2021 [Section No. B.2]

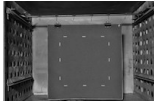
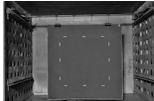
B.2 Garments.

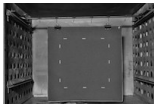
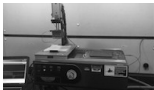
Table B.2 is intended to serve as an abbreviated guide to specified tests that apply to garments, including the outer shell, the moisture barrier, the thermal barrier, garment hardware, and materials used in the construction of the garment. These tests evaluate whether or not the garment meets the minimum performance requirements of the 2018 edition of NFPA 1971. They do not guarantee the safety of the firefighter or ensure the firefighter will not experience injury while wearing the garment.

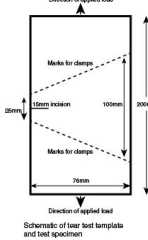
Table B.2 Garments

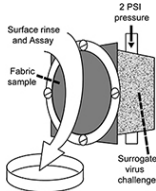
Test Method	Test Method Description	Test Method Application
7.1.1 Thermal Protective Performance (TPP) Test	This test is performed in accordance with ISO 17492, <i>Clothing for protection against heat and flame — Determination of heat transmission on exposure to both flame and radiant heat</i> , on three specimens/samples of the three-layer garment composite, which are tested both as received and after conditioning with five laundering cycles. Specimens comprise the outer shell, thermal liner, and moisture barrier and are layered and tested in the order in which they are worn. The outer shell exterior is exposed to both radiant and convective heat sources.	The Thermal Protective Performance (TPP) test is used to measure the insulating performance of the three-layer system by evaluating how quickly heat is transferred from the outside of the garment to the inside.
	TPP Test Apparatus.	-
	TPP Test Being Run.	-
-	-	Under the given test conditions, which simulate severe flashover conditions, the TPP rating divided in half indicates the approximate number of seconds until a firefighter would receive a second-degree burn.
-	-	This is the primary test to measure the garment's ability to protect the firefighter from severe heat and flame. The higher the number, the higher the protection from heat (under the specific test conditions), and, in general, the higher the heat stress on the firefighter. Firefighters should always consider the TPP rating as it relates to the Total Heat Loss (THL) rating.
-	-	The rate of temperature rise is recorded and compared to the known skin response to heat; the recorded time is multiplied by the heat exposure energy to determine the Thermal Protective Performance (TPP) rating.
-	-	The TPP rating of the garment must be at least 35.

Test Method	Test Method Description	Test Method Application
7.1.2 Whole Garment and Ensemble Liquid Penetration Test (Shower Test)	This test is performed in accordance with ASTM F1359/F1359M, <i>Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin</i> , on a full garment set (coat and pants) or coveralls. The whole garment is placed on a manikin dressed in a water-absorptive layer and exposed to 2.5 minutes of liquid spray from four different orientations for a total of 10 minutes. After removal of the garment, the water-absorptive layer is examined for evidence of moisture penetration.	The Shower Test is used to evaluate how well the seams and closures of the garment, under controlled test conditions, resist inward leakage of liquids from exterior sources. Note: The Shower Test is the <i>only</i> test performed on assembled garments — coats and pants.
7.1.3 Flame Resistance Test 1	This test is performed in accordance with ASTM D6413/D6413M, <i>Standard Test Method for Flame Resistance of Textiles (Vertical Test)</i> , as received and after conditioning with five laundering cycles on garment components (hook and pile, elastic, and labels can be excluded from the test depending on their location in the garment).	The Flame Resistance Test 1 is used to evaluate the material, under controlled test conditions, for its ability to self-extinguish after the flame is removed. The char length of the material after exposure to flame is also measured.
	Test Apparatus in Ready Position.	-
	Flame Test Being Performed.	-
-	-	Each separable layer of multilayer composites is tested individually. The specimen is suspended over a flame for 12 seconds to determine how easily the material ignites. Ease of ignition and charring characteristics are observed and recorded. Materials cannot char more than 100 mm (4 in.), cannot show afterflame 2 seconds after removal of the test flame, and cannot melt. This is the primary test to establish the flame-resistant properties of the materials used in garment construction.
7.1.4 Heat and Thermal Shrinkage Resistance Test (shrinkage)	This test is performed as received and after conditioning with five laundering cycles. Outer shells, moisture barriers, thermal barriers, collar linings, and winter liners (where provided) are tested individually. Fabric samples are marked and measured before exposure to 5 minutes of heat in a 260°C (500°F) oven.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate the materials for shrinkage after exposure to high temperatures. Excessive shrinkage could compromise the firefighter's mobility and impact the insulating qualities of the garment. Post-exposure measurements are taken and averaged, and no more than 10 percent shrinkage is permitted.
7.1.5 Heat and Thermal Shrinkage Resistance Test (melting, separation, ignition)	This test is performed as received and after conditioning with five laundering cycles on garment components, except for hook and loop and elastic, when placed where they will not contact the firefighter's body. Samples are suspended in a 260°C (500°F) oven for 5 minutes.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to determine whether or not components used to construct protective garments will melt, separate, or easily ignite.

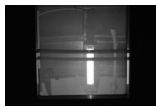
<u>Test Method</u>	<u>Test Method Description</u>	<u>Test Method Application</u>
-	-	Garment components cannot melt, drip, separate, or ignite.
The test conditions are not intended to simulate actual fireground exposures but rather serve as a means to establish a minimum level of thermal stability for the materials used in the construction of protective clothing elements.		
	Oven Exterior.	-
	Oven Interior.	-
7.1.6 Heat and Thermal Shrinkage Resistance Test (moisture barrier seams)	This test is performed as received and after conditioning with 5 laundering cycles on all moisture barrier seams. Samples are prepped and exposed to 5 minutes of heat in a 260°C (500°F) oven. Observations are limited to seam material ignition and dripping.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate the ability of the moisture barrier seams to resist dripping or ignition.
	Oven Exterior.	-
	Oven Interior.	-
7.1.7 Heat and Thermal Shrinkage Resistance Test (outer shells and collar linings/char)	This test is performed as received and after conditioning outer shells and collar linings with five laundering cycles to identify charring when specimens are exposed to 5 minutes of heat in a 260°C (500°F) oven. Specimens cannot char.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate whether or not the outer surfaces of the garment will char and/or break open, exposing interior layers. Charring and breaking open compromise the thermal and physical protection of the garments, which, in turn, increases the risk of firefighter burns and injuries.
	Oven Exterior.	-
	Oven Interior.	-
7.1.8 Heat and Thermal Shrinkage Resistance Test (hardware)	This test is performed on hardware, excluding hook and pile, when they do not contact a firefighter's body. Performance of the specimens is observed after exposure to 5 minutes of heat in a 260°C (500°F) oven.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the ability of the hardware to remain functional and resist ignition when exposed to heat. This test eliminates the use of hardware on garments that will not withstand exposure to a certain level of heat.

<u>Test Method</u>	<u>Test Method Description</u>	<u>Test Method Application</u>
	Oven Exterior.	-
	Oven Interior.	-
7.1.9 Conductive and Compressive Heat Resistance (CCHR) Test	This test is performed on composites from the shoulder and knee areas with all layers placed in the same order as they are constructed. Sample sizes are representative of the knee and shoulder area and must be provided for each composite combination used by the garment manufacturer. Samples are tested in both the wet and dry condition under applied pressure.	The Conductive and Compressive Heat Resistance (CCHR) Test is used to evaluate the properties of the garment shoulder and knee areas, which are more likely to become compressed; thermal insulation is reduced under compression. The requirement sets a minimum number of seconds until the firefighter would receive a second-degree burn when these areas are under compression.
	Conductive and Compressive Heat Resistance (CCHR) Test Machine in the Ready State.	-
	Conductive and Compressive Heat Resistance (CCHR) Test Machine in Operation.	-
7.1.10 Thread Melting Test	This test is performed in accordance with ASTM D7138, <i>Standard Test Method to Determine Melting Temperature of Synthetic Fibers</i> , on the three different specimens of sewing thread used in the construction of the garment as received.	The Thread Melting Test is used to evaluate the thread used in the construction of the garment to determine whether it has at least the same heat resistance as the fabric used in the garment's construction. The temperature at which the thread melts or decomposes is recorded, and if it melts below 260°C (500°F), it fails.
7.1.11 Tear Resistance Test (outer shells and collar linings)	This test is performed in accordance with ASTM D5587, <i>Standard Test Method for the Tearing of Fabrics by Trapezoid Procedure</i> , on outer shells and collar linings (tested individually) as received and after conditioning with five laundering cycles. The test measures the force (in pounds) needed to continue a pre-existing tear. Opposite ends of an intentionally notched, trapezoidal-shaped specimen are gripped in a machine and pulled apart until the specimen tears completely.	The Tear Resistance Test is used for this requirement to measure the ability of the outer shell fabric and collar linings to resist further tearing when a small tear occurs. Fabric tears further expose the firefighter to the products of combustion. It also is a test of the strength and durability of the fabric. Firefighting occurs in a harsh environment that includes many hazards that might tear a garment.
	Sample Marked and Pre-cut for Test.	-
	Test Being Performed.	-

Test Method	Test Method Description	Test Method Application
7.1.12 Tear Resistance Test (moisture barriers, thermal barriers)	This test is performed in accordance with ASTM D5587 on moisture barriers, thermal barriers, and winter liners as received and after conditioning with five laundering cycles. The test measures the force (in pounds) needed to continue a pre-existing tear. Opposite ends of an intentionally notched, trapezoidal-shaped specimen are gripped in a machine and pulled apart until the specimen tears completely.	The Tear Resistance Test is used for this requirement to measure the ability of the thermal barrier materials and the moisture barrier to resist further tearing when a small tear occurs, which further exposes the firefighter to the products of combustion.
	Diagram of Trapezoidal Tear Test.	-
7.1.13 Seam-Breaking Strength Test	This test is performed in accordance with ASTM D1683/D1683M, <i>Standard Test Method for Failure in Sewn Seams of Woven Fabrics</i>, on all garment seam assemblies. Samples are tested after conditioning. Opposite ends of a 50 mm × 200 mm (2 in. × 8 in.) specimen with the seam bisecting the length are gripped in a machine and pulled apart until the specimen breaks.	The Seam-Breaking Strength Test is used to evaluate the strength of garment seams under stress. The test demonstrates the durability of the seam as an indicator of physical performance when subjected to repeated wearer movement, such as bending and stretching.
	Seam Breaking Strength Test.	-
7.1.14 Water Penetration Resistance Test (moisture barriers)	This test is performed on specimens of garment moisture barriers as received and after conditioning. A circular portion of the moisture barrier is clamped down in a hydrostatic tester and exposed to high water pressure from underneath. The specimen is then examined for water penetration.	The Water Penetration Resistance Test is used to evaluate the ability of moisture barrier materials to keep water from getting through the barrier. The test demonstrates the capacity of the moisture barrier to keep the firefighter dry from external pressurized water.
7.1.15 Liquid Penetration Resistance Test (moisture barrier and barrier seams)	This test is performed in accordance with ASTM F903, <i>Standard Test Method for Failure in Sewn Seams of Woven Fabrics</i>, on moisture barrier fabric and seams for the garment, shroud, footwear, bootie, and glove. Specimens are conditioned for laundry and heat in specially made pockets comprised of two layers of outer shell and a layer of thermal.	The Liquid Penetration Resistance Test is used to evaluate whether or not the garment's moisture barrier and seams resist penetration of liquids meant to be representative of those commonly encountered on the fireground. After conditioning specimens are placed in a test cell where the normal outer surface of the material is exposed to aqueous film-forming foam, battery acid, surrogate gasoline, fire-resistant hydraulic fluid, swimming pool chlorine, and automobile antifreeze fluid; each liquid is tested separately on an individual specimen. After 1 hour of exposure, each sample is evaluated. No liquid can penetrate any sample.

Test Method	Test Method Description	Test Method Application
7.1.16 Viral Penetration Resistance Test (moisture barrier and barrier seams)	This test is performed in accordance with ASTM F1671/F1671M, <i>Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X-174 Bacteriophage Penetration as a Test System</i> , on moisture barrier fabric and seams. Samples are conditioned for laundry and heat in specially made pockets comprised of two layers of outer shell and a layer of thermal barrier.	The Viral Penetration Resistance Test is used to evaluate the ability of the garment's moisture barrier fabric and seams to keep blood-borne pathogens from coming in contact with the firefighter. After conditioning, the specimens are then placed in a test cell where the film side is exposed to surrogate virus in a liquid solution and is evaluated for passage of virus after 1 hour. Any evidence of virus passage through the barrier fabric or seam as determined using a microbiological technique constitutes failure.
 Diagram of Viral Penetration Test for Moisture Barrier and Seams.		
7.1.17 Cleaning Shrinkage Resistance Test (moisture barriers, winter liners, collar liners) (see also 7.2.4)	This test is performed on three conditioned specimens of garment moisture barriers, winter liners (when provided), and collar liners, each tested individually.	The Cleaning Shrinkage Resistance Test is used to evaluate how much garment materials shrink after repeated laundering; shrinkage could decrease the firefighter's mobility. This requirement allows no more than a 5 percent change in the width and length dimensions after five wash and dry cycles in accordance with AATCC 135, <i>Dimensional Changes in Automatic Home Laundering of Woven and Knit Fabrics</i> .
7.1.18 Water Absorption Resistance Test (resistance to water absorption)	This test applies to the garment outer shells and collar lining. The conditioned specimens, tested individually, are mounted on an apparatus specified in AATCC 42, <i>Test Method for Water Resistance: Impact Penetration Test</i> , and exposed to a constant flow of water to determine the level of water absorption.	The Water Absorption Resistance Test is used to determine how much water the outer shell absorbs. The requirement limits how much water can be absorbed — absorbed liquid adds weight, which increases firefighter fatigue and decreases firefighter mobility.
7.1.19 Corrosion Resistance Test	This test is performed in accordance with ASTM B117, <i>Test Method for Water Resistance: Impact Penetration Test</i> , to measure corrosion. Metal hardware is exposed to a saline solution spray for 20 hours following which base metal can show only slight surface corrosion and the hardware must remain functional.	The Corrosion Resistance Test is used to evaluate whether hardware will (1) corrode and (2) remain functional after extended exposure to salt spray.

Test Method	Test Method Description	Test Method Application
		Hardware failure can result in loss of thermal and physical protection for the firefighter.
7.1.20 Label Durability and Legibility Test 1	This test is performed on garment labels attached to sample fabric. Garment label specimens are exposed to 10 laundry cycles in accordance with AATCC 135 and then subjected to abrasion in accordance with ASTM D4966, <i>Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Test Method)</i> .	The Label Durability and Legibility Test is used to evaluate whether or not the label stays in place and is legible after exposure to multiple launderings, abrasion, and convective heat. The presence and legibility of labels is important for garment identification and tracking.
7.1.21 Drag Rescue Device (DRD) Materials Strength Test	This test is performed in accordance with ASTM D6775, <i>Standard Test Method for Breaking Strength and Elongation of Textile Webbing, Tape and Braided Material</i> , to measure the breaking strength of DRD materials, seams, splices, and joints. Specimens are conditioned then elongated to the point of breaking. The pounds of force needed to break each specimen is recorded and used to calculate the average breaking strength of the specimens.	The Drag Rescue Device (DRD) Materials Strength Test is used to evaluate the strength of the DRD materials, seams, splices, and joints to determine whether the specimens can withstand the force of dragging a downed firefighter.
7.1.22 Drag Rescue Device (DRD) Function Test	This test is used to evaluate DRD functionality as it is installed in the coat or coverall. The garments and DRD, after conditioning at room temperature, are placed on a manikin with an SCBA. The DRD is deployed, and the manikin is dragged for a specified distance.	The DRD Function Test is used to assess the ease of deploying and using the DRD to remove a downed firefighter. The deployment time is recorded and reported, the ability to drag the manikin the required distance is recorded and reported, and any change in the position of the SCBA during deployment or dragging is recorded and reported. Ten seconds is the maximum amount of time permitted to deploy the DRD. For the DRD to pass the test, the SCBA can neither move higher on the torso than when initially donned nor become separated from the manikin during the test.
7.1.23 Light Degradation Resistance Test (moisture barrier)	This test is performed in accordance with ASTM G155, <i>Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials</i> , on moisture barrier materials. Samples are conditioned for laundry and heat in specially made pockets comprised of two layers of outer shell and one layer of thermal barrier.	The Light Degradation Resistance Test is used to measure how much the moisture barrier degrades as a result of excessive light exposure, and the performance requirement sets a minimum exposure limit. After conditioning, the specimens are exposed to continuous light for 40 hours using a xenon apparatus, then conditioned in a dark, temperature-controlled room. The specimens are then tested by applying pressure with water for 1 minute in accordance with ASTM D751, <i>Standard Test Methods for Coated Fabrics</i>. Often, the moisture barrier is the first part of the ensemble to fail, especially if it has been exposed to prolonged sunlight or artificial light. This test is a measure of the durability of the moisture barrier.

<u>Test Method</u>	<u>Test Method Description</u>	<u>Test Method Application</u>
	Exterior of Xenon Apparatus.	-
	Interior of Xenon Apparatus in Use.	-
7.1.24 Zipper Strength Test	This test is used to evaluate zippers for crosswise breaking strength of the chain and of the separating unit. They are also tested for holding strength of stops, retainers, and separating units and for operating force and slider lock strength.	The Zipper Strength Test is used to assess the durability and functionality of zippers after repeated use.
7.1.25 Fastener Tape Strength Test (breaking)	This test is performed after three launderings in accordance with ASTM D5034, <i>Standard Test Method for Breaking Strength and Elongation of Textile Fabrics</i> , and is based on the requirements of A-A-55126B, <i>Commercial Item Description, Fastener Tapes, Hook and Loop, Synthetic</i> . It is used to evaluate the breaking strength of hook and pile tape by separately pulling the hook and pile tapes in the jaws of a tensile testing machine until the tape breaks. The force used at the breaking point is recorded as the breaking strength.	The Fastener Tape Strength Test is used for this requirement to assess the overall strength of tapes used in hook and pile fasteners. The material must meet or exceed industry-established requirements based on the composition and width of the tape.
7.1.26 Fastener Tape Strength Test (shear)	This test is performed after three launderings in accordance with ASTM D5169, <i>Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners</i> , and is based on the requirements of A-A-55126B. It is used to evaluate the shear strength of the hook and pile tape by measuring the force required to separate hook tape overlapping pile tape when pulled between two jaws of a tensile testing machine. Testing is performed after the tapes have been repeatedly attached and detached. The maximum measured force is reported as the shear strength.	The Fastener Tape Strength Test is used for this requirement to assess the durability and functionality of the hook and pile to not separate after repeated use.
7.1.27 Fastener Tape Strength Test (peel)	This test is performed after three launderings in accordance with ASTM D5170, <i>Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners</i> , and is based on the requirements of A-A-55126B. It is used to evaluate the peel strength of the hook and pile tape. In the test, hook tape is sealed over an equal length of pile tape and the end of the two tapes are separated half their length. The two open ends of tape are attached to the jaws of a tensile testing machine and pulled to measure the force required to completely separate the two tapes. This testing is performed after the tapes have been repeatedly sealed and resealed several times.	The Fastener Tape Strength Test is used for this requirement to assess the durability and functionality of the hook and pile to stay sealed after repeated use.

Test Method	Test Method Description	Test Method Application
7.2.2 Total Heat Loss (THL) Test	This test is performed in accordance with ASTM F1868, <i>Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate, Part C</i>, on samples of the garment composite (outer shell, moisture barrier, and thermal barrier) conditioned at room temperature 25 oC, 65%RH, arranged in the order and orientation as it is worn. Specimens are placed on a sweating hot plate to evaluate heat transfer under wet conditions and thermal resistance under dry conditions. These values are combined in an equation to provide predict a total heat loss value in 25 oC, 65%RH environment with a 2 m/s wind flow.	The Total Heat Loss (THL) Test is used to evaluate the amount of heat that can be transferred out of the garment composite via both sweat evaporation from the wearer's skin and conduction through the garment to the outside environment into a mild environment. The test does not account for other materials attached to the base garment composite such as trim, pockets, and other layers. Higher values indicate better performance in mild environments, and more heat loss. - However, appropriate THL values for your department must be considered with TPP, TPP and Evaporative Resistance values. (See A.7.2.2 and A.7.X.X for more detail.) <u>Additions to the garment can negate benefits provided by a high THL composite. In addition this test cannot measure the effect of sunlight on the gear where darker colors and dirty gear have shown to have lower performance.</u>
7.2.3 Retroreflectivity and Fluorescence Test (garment trim)	The conditioned garment trim is tested for both retroreflectivity and fluorescence. The coefficient of retroreflection is tested in accordance with ASTM E809, <i>Standard Practice for Measuring Photometric Characteristics of Retroreflectors</i>. Once retroreflection is determined, the specimen is evaluated for fluorescence. The colorimetric properties are measured in accordance with ASTM E991, <i>Standard Practice for Color Measurement of Fluorescent Specimens</i>. Retroreflection/retroreflectivity is the reflection of light in which the reflected rays are preferentially returned in the direction close to the opposite of the direction of the incident rays, with the property being maintained over wide variations of the direction of the incident rays.	The Retroreflectivity and Fluorescence Test is used to evaluate how well samples of retroreflective and fluorescent material retain their retroreflectivity and fluorescence. The standard has requirements for retroreflectivity and fluorescence to enhance nighttime/low light visibility (retroreflection) and daytime visibility (fluorescence). The visibility of a firefighter is crucial during both interior and exterior operations. In addition, almost all emergency incidents begin in a roadway (apparatus placement), and many emergency incidents are roadway-related. For firefighter safety, it is important that garments have effective retroreflectivity and fluorescence for conspicuity (visibility). Fluorescence is the process by which radiant flux of certain wavelengths is absorbed and reradiated nonthermally in other, usually longer, wavelengths.
7.2.4 Cleaning Shrinkage Resistance Test (outer shell, moisture barrier, thermal barrier, winter liner, wristlet, bootie) (see also 7.1.17)	This test, performed in accordance with AATCC 135 measures the percent of change in the width and length dimensions after five wash and dry cycles. Tests are performed on three specimens of the conditioned garment outer shell, moisture barrier, thermal barrier, winter liner, wristlet, bootie material where present, and protective hoods. Each material and each separable layer of a composite material is tested separately.	The Cleaning Shrinkage Resistance Test is used to measure how much fabrics shrink after cleaning; they will not pass if they shrink more than 5 percent. Excessive shrinkage could compromise the firefighter's mobility and impact the insulating qualities of the garment.

<u>Test Method</u>	<u>Test Method Description</u>	<u>Test Method Application</u>
7.2.5 Breaking Strength Test (outer shell and collar lining)	This test is performed in accordance with ASTM D6775 on the garment outer shell and collar lining materials (individually) after conditioning. Five specimens from the sample, in the warp and fill direction, are elongated to the point of breaking.	The Breaking Strength Test is used to evaluate the garment's outer shell and collar lining strength for material robustness so it remains intact in rugged fireground environments. Material breakage can compromise the thermal and physical protection features of the garments, which increases the risk of firefighter burns and injuries.
	Apparatus Ready for Test.	-
	Sample Fabric upon Completion of Test.	-
7.2.6 Transmitted and Stored Thermal Energy Test (enhanced composites related to sleeves)	This test is performed in accordance with ASTM F2731, <i>Standard Test Method for Measuring the Transmitted and Stored Energy in Fire Fighter Protective Clothing Systems</i> , on conditioned garment sleeve composites containing enhancements; enhancements include, but are not limited to, trim, emblems, flags, reinforcements, and so forth. The test is run on a base composite with the enhancement attached, following wet conditioning of the samples.	The Transmitted and Stored Thermal Energy Test is used to evaluate the ability of the garment composite enhancements to store and then transfer heat through the composite and enhancement to the skin. The test is used to evaluate the potential for burn injury when the composite is compressed, during a lower heat, longer time exposure. The test is intended to ensure that there is a level of protection to the firefighter to help prevent a burn injury when the garment does not indicate evidence of thermal exposure.

Statement of Problem and Substantiation for Public Input

This public input fixes a few errors in this section and adds additional language to clarify the benefits and limitations of THL

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 211-NFPA 1970-2021 [Section No. A.7.2.2]	

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Committee Statement

Resolution: [FR-259-NFPA 1970-2022](#)

Statement: Updating the annex to reflect changes made during the revision process.





Public Input No. 197-NFPA 1970-2021 [Chapter G]

Annex G Informational References

G.1 Referenced Publications.

The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

G.1.1 NFPA Publications.

National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, ~~2018~~ 2021 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, ~~2014~~ 2020 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program*, ~~2015~~ 2022 edition.

NFPA 1851, *Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, ~~2014~~ 2020 edition.

NFPA 1852, *Standard on Selection, Care, and Maintenance of Open-Circuit Self-Contained Breathing Apparatus (SCBA)*, ~~2013~~ 2019 edition.

NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*, ~~2013~~ 2020 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2007 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2013 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2020 edition.

NFPA 1973, *Gloves for Structural Fire Fighting*, 1993 edition (withdrawn).

NFPA 1975, *Standard on Emergency Services Work ~~Clothing Elements~~ Apparel*, ~~2014~~ 2019 edition.

NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Fire Fighting*, ~~2016~~ 2022 edition and Urban Interface Fire Fighting, 2022 edition.

NFPA 1989, *Standard on Breathing Air Quality for Emergency Services Respiratory Protection*, ~~2013~~ 2019 edition.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2016 edition.

NFPA 1992, *Standard on Liquid Splash-Protective Ensembles and Clothing for Hazardous Materials Emergencies*, 2018 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*, 2012 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2018 edition.

NFPA 1990, *Standard for Protective Ensembles for Hazardous Materials and CBRN Operations*, 2022 Edition.

NFPA 1999, *Standard on Protective Clothing and Ensembles for Emergency Medical Operations*, 2018 edition.

NFPA 5000®, *Building Construction and Safety Code*®, ~~2018~~ 2021 edition.

G.1.2 Other Publications.

G.1.2.1 AATCC Publications.

American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle, NC 27709.

AATCC 42, *Water Resistance: Impact Penetration Test*, 2013.

AATCC 135, *Dimensional Changes of Fabrics After Home Laundering*, 2004.

AATCC TM135, *Test Method for Dimensional Changes of Fabrics after Home Laundering*, 2018

AATCC 158, *Dimensional Changes on Dry-Cleaning in Perchloroethylene: Machine Method*, ~~2016~~ 2016e.

G.1.2.2 ANSI Publications.

American National Standards Institute, Inc., 25 West 43rd Street, 4th floor, New York, NY 10036.

ANSI Z88.2, *Practices for Respiratory Protection*, 2015.

ANSI Z88.6, *Respiratory Protection — Respirator Use — Physical Qualifications for Personnel*, 2006.

ANSI Z88.10, *Respirator Fit Test Methods*, 2010.

G.1.2.3 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM B16/B16M, *Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines*, 2010, ~~reapproved 2015~~ 2019.

ASTM B117, *Test Method for Water Resistance: Impact Penetration Test*, ~~2016~~ 2019.

ASTM D751, *Standard Test Methods for Coated Fabrics*, ~~2011~~ 2019.

ASTM D1003, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*, ~~2013~~ 2021.

ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, ~~2011a~~ 2017 (2018).

ASTM ~~D1683/D1683M~~, *Standard Test Method for Failure in Sewn Seams of Woven Apparel Fabrics*, 2016. ASTM D1776/D1776M, *Standard Practice for Conditioning and Testing Textiles*, ~~2016~~ 2020.

ASTM D4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Test Method)*, ~~2012e1~~ 2012 (2016).

ASTM D5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*, ~~2013~~ 2021.

ASTM D5169, *Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners*, ~~2015 1998~~ (2021).

ASTM D5170, *Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners*, ~~2015 1998~~ (2021).

ASTM D5587, *Standard Test Method for the Tearing Strength of Fabrics by Trapezoid Procedure*, 2015 (2019).

ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*, 2015.

ASTM D6775, *Standard Test Method for Breaking Strength and Elongation of Textile Webbing, Tape and Braided Material*, 2013 (2017).

ASTM D6797, *Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test*, 2015.

ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, 2016.

ASTM E809, *Standard Practice for Measuring Photometric Characteristics of Retroreflectors*, ~~2013~~ 2021.

ASTM E991, *Standard Practice for Color Measurement of Fluorescent Specimens Using the One-Monochromator Method*, ~~2011~~ 2021.

ASTM F903, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Liquids*, ~~2010~~ 2018.

ASTM F1060, *Standard Test Method for ~~Thermal Protective Performance of Materials for Protective Clothing for Hot Surface Contact~~*, ~~2008~~ Conductive and Compressive Heat Resistance 2018.

ASTM F1342/F1342M, *Standard Test Method for Protective Clothing Material Resistance to Puncture*, 2005 (2013; e1) e1.

ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, ~~2016~~ 2016a.

ASTM F1671/F1671M, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X-174 Bacteriophage Penetration as a Test System*, 2013.

ASTM F1731, *Standard Practice for Body Measurements and Sizing of Fire and Rescue Services Uniforms and Other Thermal Hazard Protective Clothing*, ~~2013~~ 2021.

ASTM F1790, *Test Methods for Measuring Cut Resistance of Materials Used in Protective Clothing*, 2005.

ASTM F1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, ~~2014~~ 2017.

ASTM F2010/F2010M, *Standard Test Method for Evaluation of Glove Effects on Wearer ~~Hand~~ Finger Dexterity Using a Modified Pegboard Test*, ~~2010~~ 2018.

ASTM F2299/F2299M, *Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres*, ~~2010~~ 2003 (2017).

ASTM F2412, *Standard Test Methods for Foot Protection*, ~~2011~~ 2018a.

ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy ~~in Fire-Fighter Protective of Firefighter Protective~~ Clothing Systems*, ~~2011~~ 2018.

ASTM F2894, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, ~~2014~~ 2021.

ASTM F2913, *Standard Test Method for Measuring the Coefficient of Friction for Evaluation of Slip Performance of Footwear and Test Surfaces/Flooring Using a Whole Shoe Tester*, ~~2011~~ 2019.

ASTM G155, *Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials*, 2013.

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Footwear Industries of America, 1420 K Street, NW, Suite 600, Washington, DC 20005.

FIA 1209, *Whole Shoe Flex*, 1984.

G.1.2.6 ISEA Publications.

International Safety Equipment Association, 1901 North Moore Street, Arlington, VA 22209-1762.

ANSI/ISEA 107, *American National Standard for High-Visibility Safety Apparel- and Accessories*, ~~2015~~ 2020.

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ISO Guide 27, *Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity*, 1983.

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JEDEC, 3103 North 10th Street, Suite 240-S, Arlington, VA 22201-2107.

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Remley, K.A., M.R. Souryal, W.F. Young, D.G. Kuester, D.R. Novotny, and J.R. Guerrieri, "Interference Tests for 900 MHz Frequency-Hopping Public-Safety Wireless Devices," *IEEE Electromagnetic Compatibility Society Symposium Digest*, August 2011.

Souryal, M.R., D.R. Novotny, D.G. Kuester, J.R. Guerrieri, and K.A. Remley, "Impact of RF Interference Between a Passive RFID System and a Frequency Hopping Communications System in the 900 MHz ISM Band," *IEEE Electromagnetic Compatibility Society Symposium Digest*, July 2010, pp. 495-500.

G.3 References for Extracts in Informational Sections.

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Statement of Problem and Substantiation for Public Input

Updating standard editions and titles. Additional revisions will be needed at or following first revision based on changes made by TC's during first revision. Particularly to those in the Annex.

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Submittal Date: Thu Nov 04 15:02:50 EDT 2021

Committee: FAE-SPF

Committee Statement

Resolution: [FR-273-NFPA 1970-2022](#)

Statement: The referenced publications have been updated to reflect publications added or removed during the revision process as well as publications that have been revised by other organizations.

**Public Input No. 49-NFPA 1970-2021 [Section No. G.1.2.12]****G.1.2.12** US Department of Defense Publications.

Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.

A-A-55126B, *Commercial Item Description, Fastener Tapes, Hook and Loop, Synthetic*, 2006.

A-A-55634B, *Commercial Item Description, Zippers (Fasteners, Slide Interlocking, 10 May 2018.*

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
1971_PI_39_T_McCullough.pdf	1971_PI_396_T.McCullough	

Statement of Problem and Substantiation for Public Input

A-A-55634B is missing from Annex C. Referenced in 7.1.24, performance requirements for garment zippers.

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Committee Statement

Resolution: The referenced standard should not be included in Annex G, it is only referenced in the main body of the standard. Annex G is for referenced publications in Annex A.



Public Input No. 339-NFPA 1970-2021 [New Section after G.3]

New Annex H

Annex H

Systems Based Testing for Ensemble Performance, Integration, and Interoperability

H.1 Preamble

This annex provides several test methods that can be applied to evaluate the performance, integration, and interoperability of full ensembles or groupings of protective clothing and equipment that can be used for structural or proximity fire fighting. These test methods are optional and non-mandatory but can be applied by research institutions, manufacturers, and end users for evaluating different combinations of elements. Specific test procedures are provided in several different areas of evaluation that include a general overview and intended use of the test procedures, equipment requirements, test procedures, reportable results, and recommended approach for interpreting test results. In some cases, references are made to already existing standardized test methods.

H.2 Full Ensemble Thermal Testing

H.2.1 Full Ensemble Flash Fire test

H.2.1.1 Overview and intended use . This test method provides a means to evaluate the protective ensemble as a whole to a flame engulfment or flash over simulation. Second and third degree burn prediction are provided for an exposure with the exception of the hands and feet. In addition, valuable information on the after flame and durability of the materials can be assessed after the exposure. Provided that the entire ensemble is tested it will provide a single test that evaluates the thermal performance of each component of an ensemble.

H.2.1.2 Samples.

H.2.1.2.1 Samples shall consist of at least the bunker pants and coat for evaluation. However, it is recommended that the helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how ensemble performs as a whole.

H.2.1.2.2 At a minimum a t-shirt and briefs should be worn under the protective ensemble. A station uniform may also be tested under the protective garment but will not represent the worst case scenario unless the station uniform is required to be worn at all times, day or night.

H.2.1.2.3 The ensemble should be tested in as received state.

H.2.1.2.4 Samples shall be conditioned at 21°C ±2°C (70°F ± 4°F) and 65 percent ± 10 percent relative humidity for at least 4 hours.

H.2.1.3 Specimens.

H.2.1.3.1 A minimum of three specimens shall be tested.

H.2.1.3.2 Specimens shall be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

H.2.1.3.2 . 1 If required to dress, ensemble elements may be cut to dress on the manikin. The cut should then be reattached after dressing

H.2.1.4 Apparatus.

H.2.1.4.1 The apparatus shall be as specified in ASTM F1930, *Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin*.

H.2.1.5 Procedure.

H.2.1.5.1 Dress the manikin in the protective ensemble to be tested.

H.2.1.5.2 Expose the manikin for 12 seconds and record data for a minimum of 120 seconds after the exposure is over.

H.2.1.5.3 After the exposure, do the following in addition to requirements within ASTM F1930.

- _____ (1) Record any instances of breakopen in the all the layers of clothing
- _____ (2) Record any melting
- _____ (3) Check to make sure the SCBA can still be used and no leaks occur

(4) Verify that the mask can still be seen through.

H.2.1.6 Report. The report shall include the burn injury prediction and all other requirements outlined in ASTM F1930. In addition, information detailed in H.2.1.5.3 shall be also be reported

H.3 Full Ensemble Physiological Testing

H.3.1 Predicted Ensemble Physiological Impact Test

H.3.1.1 Overview and intended use. This test method provides a consistent means to evaluate protective ensembles for heat stress in firefighters. Predicted core body temperature, mean skin temperature, sweating totals, and cardiac outputs predictions are provided.

H.3.1.2 Samples.

H.3.1.2.1 Samples shall consist of at least the bunker pants and coat for evaluation. It is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

H.3.1.2.2 At a minimum a t-shirt and briefs should be worn under the protective ensemble. **H.3.1.2.3** The ensemble should be washed and dried before being tested.

H.3.1.2.4 Samples shall be conditioned in the testing environment for at least 4 hours.

H.3.1.3 Specimens.

H.3.1.3.1 A minimum of three specimens shall be tested.

H.3.1.3.2 Specimens shall be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

H.3.1.3.2.1 If required to dress, ensemble elements may be cut to dress on the manikin. The cut should then be reattached after dressing

H.3.1.4 Apparatus.

H.3.1.4.1 The apparatus shall be as specified in section 5 of ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin*.

H.3.1.4.2 The manikin must also be coupled with a physiological model that reads inputs on the testing environment and the heat flow into the manikin system. With collected data and input data on work rates the software controls the manikin's skin temperature and sweat rate and provides physiological predictions every second.

H.3.1.5 Procedure.

H.3.1.5.1 Dress manikin in the protective ensemble to be tested outside the test chamber.

H.3.1.5.2 Set test chamber to desired testing temperature.

H.3.1.5.3 Once set point temperatures have been obtain start model and move manikin into the test chamber.

H.3.1.5.4 Run system for a maximum of 2.5 hours. If predicted core temperature reaches above 39.5 C then testing can stop.

H.3.1.6 Report. The report shall include the plots for the predicted core body temperature, mean skin temperature, sweat total and cardiac output.

H.3.2 Measured Ensemble Heat Loss Test

H.3.2.1 Overview and intended use. This test method provides a consistent means to evaluate protective ensembles for measured heat loss.

H.3.2.2 Samples.

H.3.2.2.1 Samples shall consist of at least the bunker pants and coat for evaluation. It is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

H.3.2.2.2 At a minimum a t-shirt and briefs should be worn under the protective ensemble. **H.3.2.2.3** The ensemble should be washed and dried before being tested.

H.3.2.2.4 Samples shall be conditioned in the testing environment for at least 4 hours.

H.3.2.3 Specimens.

H.3.2.3.1 A minimum of three specimens shall be tested.

H.3.2.3.2 Specimens shall be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

H.3.2.3.2 . 1 If required to dress, ensemble elements may be cut to dress on the manikin. The cut should then be reattached after dressing

H.3.2.4 . Apparatus.

H.3.2.4.1 The apparatus shall be as specified in section 5 of ASTM F2370., *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin.*

H.3.2.5 . Procedure.

H.3.2.5.1 Dress manikin in the protective ensemble to be tested outside the test chamber.

H.3.2.5.2 Follow the procedures in ASTM F2370 with the following exceptions

- (1) Chamber Temperature should be set at 25C, 65%RH
- (2) Wind flow should be set at 2 m/s
- (3) Once a steady state has been achieved, record the heat flux at each body section and calculate the overall heat flux with the parallel method

H.3.2.6 . Report. The report shall include the heat flux values for each body section of the manikin and the overall heat flux loss from the manikin.

H.3.2 . Measured Ensemble Evaporative Resistance Test

H.3.2.1 . Overview and intended use . This test method provides a consistent means to evaluate protective ensembles for measured Evaporative Resistance of an firefighter ensemble.

H.3.2.2 . Samples.

H.3.2.2.1 Samples shall consist of at least the bunker pants and coat for evaluation. It is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

H.3.2.2.2 At a minimum a t-shirt and briefs should be worn under the protective ensemble. **H.3.2.2.3** The ensemble should be washed and dried before being tested.

H.3.2.2.4 Samples shall be conditioned in the testing environment for at least 4 hours.

H.3.2.3 . Specimens.

H.3.2.3.1 A minimum of three specimens shall be tested.

H.3.2.3.2 Specimens shall be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

H.3.2.3.2 . 1 If required to dress, ensemble elements may be cut to dress on the manikin. The cut should then be reattached after dressing

H.3.2.4 . Apparatus.

H.3.2.4.1 The apparatus shall be as specified in ASTM F2370., *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin.*

H.3.2.5 . Procedure.

H.3.2.5.1 Dress manikin in the protective ensemble to be tested outside the test chamber.

H.3.2.5.2 Follow the procedures in ASTM F2370 with the following exceptions

- (1) Wind flow should be set at 1 m/s

H.3.2.6 . Report. The report shall include the evaporative resistance for each body section of the manikin and the overall evaporative resistance from the manikin.

H.4 Full Ensemble Integrity Testing

H.4.1 Outward Particle Leakage test

H.4.1.1 . Overview and intended use . This test method provides a means to evaluate a protective ensemble performance against particle infiltration by examining how well it prevents the escape visible particles. This is a simple method that gives a visual assessment of performance by particles escaping the protective ensemble. This method is not standardized and is only designed to subjectively evaluate how well a suit will resist infiltration of particles by examining where and the quantity of particles that can exit the ensemble

H.4.1.2 . Samples.

H.4.1.2.1 Samples shall consist of at least the bunker pants and coat for evaluation. However, it is recommended that the helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how ensemble performs as a whole.

H.4.1.2.2 At a minimum a t-shirt and briefs should be worn under the protective ensemble

H.4.1.3 Specimens.

H.4.1.3.1 A minimum of three specimens shall be tested.

H.4.1.3.2 Specimens shall be provided to fit or be adjustable to fit the mannequin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

H.4.1.3.2 . 1 If required to dress, ensemble elements may be cut to dress on the manikin. The cut should then be reattached after dressing

H.4.1.4 Apparatus.

H.4.1.4.1 The apparatus shall be a display manikin with movable joints for ease of dressing.

H.4.1.4.2 A commercial grade theatrical smoke machine shall be used to generate the particles. **H.4.1.4.2.1** The smoke generator should be attached to a holding box with a volume of at least 170 liters to provide better control and delivery of the smoke into the manikin. This box will also have tubing exiting the box to provide particles to the manikin. A total of six exit ports should be delivered to the chest and arms, 4 to the legs, and 1 for the head

H.4.1.5 Procedure.

H.4.1.5.1 Attach the smoke delivery tubes to the manikin.

H.4.1.5.1.1 The six tubes for the chest and arms should have the tubing placed on the following locations: upper chest, waist, lower back, between the shoulder blades, and one on each of the lower forearms.

H.4.1.5.1.2 The four tubes for the leg should be placed on the manikin in the following locations: Groin, buttocks, lower left and right shin.

H.4.1.5.1.3 The tube for the head should be placed on the back of the head.

H.4.1.5.2 Dress the manikin in the protective ensemble to be tested.

H.4.1.5.3 Place the dressed manikin in front of a black background to provide better assessment of smoke exiting the system

H.4.1.5.4 Turn on smoke generator and allow particles to flow through tubing. Once smoke is flowing measure the time it takes for particles to be visually seen coming from the ensemble. Take notes on all the places smoke is exiting and subjectively rate the amount of visible smoke.

H.4.1.5.5 If comparing suits pictures should be taken

H.4.1.5.6 If smoke exiting the suit is too excessive, isolate smoke flow to one section of the body at a time and make notes on each section.

H.4.1.6 Report. The report shall provide the time for leakage to occur and a notes on where smoke was coming from and how much was exiting the suit.

H.5 Full Ensemble Functionality Testing

H.5.1 Fit/Function test

H.5.1.1 Overview and intended use . This test method provides a means to evaluate the protective ensemble as a whole to a task-oriented routine to judge the comfort, fit, and function. Times required to complete tasks and ratings based on each task are collected and reported.

H.5.1.2 Samples.

H.5.1.2.1 Samples shall consist of at least the bunker pants and coat for evaluation. However, it is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

H.5.1.2.2 At a minimum a t-shirt and briefs should be worn under the protective ensemble. **H.5.1.2.3** The ensemble should be tested in as received state as it represents the worst case condition.

H.5.1.2.4 Samples shall be conditioned at 21°C ± 6°C (70°F ± 11°F) and 50 percent ± 30 percent relative humidity for at least 4 hours.

H.5.1.3 Specimens.

H.5.1.3.1 A minimum of eight specimens shall be tested.

H.5.1.3.2 Specimens shall be provided to fit or be adjustable to fit the test subject in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

H.5.1.4 Apparatus.

H.5.1.4.1 The testing apparatuses shall be as specified in ASTM F1154, *Standard Practice for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components*.

H.5.1.5 Procedure.

H.5.1.5.1 Dress subjects in the protective ensemble to be tested.

H.5.1.5.2 Follow procedures outlined in ASTM F1154, Option A and Option B.

H.5.1.6 Report. The report shall include the time required to complete the tasks and the subjective rating on the difficulty of completing said task as defined in ASTM F1154.

H.5.2 Range of Motion test

H.5.2.1 Overview and intended use. This test method provides a means to evaluate the restriction caused by a protective ensemble on the wearer.

H.5.2.2 Samples.

H.5.2.2.1 Samples shall consist of at least the bunker pants and coat for evaluation. However, it is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

H.5.2.2.2 At a minimum a t-shirt and briefs should be worn under the protective ensemble. **H.5.2.2.3** The ensemble should be tested in as received state as it represents the worst case condition.

H.5.2.2.4 Samples shall be conditioned at 21°C ± 6°C (70°F ± 11°F) and 50 percent ± 30 percent relative humidity for at least 4 hours.

H.5.2.3 Specimens.

H.5.2.3.1 A minimum of eight specimens shall be tested.

H.5.2.3.2 Specimens shall be provided to fit or be adjustable to fit the human subjects in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

H.5.2.4 Apparatus.

H.5.2.4.1 The apparatus shall be as specified in ASTM F3031, *Standard Practice for Range of Motion Evaluation of First Responder's Protective Ensembles*.

H.5.2.5 Procedure.

H.5.2.5.1 Dress subjects in the protective ensemble to be tested.

H.5.2.5.2 Follow procedures outlined in ASTM F3031 and record the maximum range of motion for each exercise.

H.5.2.6 Report. The report shall include the average range of motion and subjective ratings along with all other reporting requirements specified in ASTM F3031.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Systems_Level_Testing_Outline_New_Annex_H_A_Deaton.docx	1970_New Annex H_A.Deaton	

Statement of Problem and Substantiation for Public Input

The fire service is increasingly becoming aware that the different elements of clothing and equipment that make up their ensembles lack compatibilities and provide varying levels of performance. While NFPA standards address the specific design, performance, and testing requirements of the individual elements, there is the absence of full ensemble evaluations for assessing performance, function, and comfort for ensembles when integrated. This responsibility falls to individual fire departments and organizations but there are only a handful of test standardized test methods and few criteria to address how full ensembles should be designed, particularly for structural firefighting. In addition, the increasing use of electronics as part of protective ensembles has a significant impact on the end user in terms of their utility and should be addressed in the absence of specific standards. Related Public Input 212

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State:
Zip:
Submittal Date: Thu Nov 11 17:51:57 EST 2021
Committee: FAE-SPF

Committee Statement

Resolution: FR-233-NFPA 1970-2022

Statement: The fire service is increasingly becoming aware that the different elements of clothing and equipment that make up their ensembles lack compatibilities and provide varying levels of performance. While NFPA standards address the specific design, performance, and testing requirements of the individual elements, there is the absence of full ensemble evaluations for assessing performance, function, and comfort for ensembles when integrated. This responsibility falls to individual fire departments and organizations but there are only a handful of test standardized test methods and few criteria to address how full ensembles should be designed, particularly for structural firefighting. In addition, the increasing use of electronics as part of protective ensembles has a significant impact on the end user in terms of their utility and should be addressed in the absence of specific standards.

With cancer now being a major concern for firefighters, attempts to limit exposure to harmful chemicals were added to the NFPA 1971 standard. Most notably particulate blocking hoods and particulate blocking suits are now an option for fire departments to consider when purchasing garments. Study after study has found harmful chemicals within these particles and every attempt should be made to limit and remove them as soon as possible from the skin. However, it is indicated in a working fire, vapors (not those trapped in a particle) pose more of a risk to firefighters. These free toxic gases are available to transfer through the skin without having to be desorbed, extracted or leached out of a particle.

The MIST test that was separately proposed as an optional performance requirement is being placed in this annex as a way for it to be applied.