



**TECHNICAL COMMITTEE ON WILDLAND FIRE FIGHTING PROTECTIVE
CLOTHING AND EQUIPMENT**

NFPA 1977 FIRST DRAFT

FEBRUARY 5-6, 2019

ORLANDO, FL

AGENDA

Meeting Start Time: 9:00 A.M.

TUESDAY, FEBRUARY 5, 2019

1. Self-introduction of members and guests
2. NFPA Staff Liaison Report – Dave Trebisacci
Creation of First Revisions to NFPA 1977
3. Chairman’s Remarks – George Broyles
4. Approval of Minutes of October 2-3, 2018 meeting, San Antonio (attached)
5. Review of Public Input to NFPA 1977 and creation of First Revisions (attached)
6. NFPA 1877 task group reports
7. Old business
8. New business – Next meeting
9. Adjourn at close of business Wednesday, February 6, 2019.

TECHNICAL COMMITTEE ON
WILDLAND FIRE FIGHTING PROTECTIVE CLOTHING AND EQUIPMENT

NFPA 1977 Pre-First Draft Meeting
NFPA 1877 Draft Development

October 2-3, 2018
San Antonio, TX

MINUTES

Attendees:

George Broyles, Chair	NWCG
Steve Corrado	UL
Vincent Diaz	Atlantic Thread & Supply Company
David Fanning	E. D. Bullard
Bill Haskell	NIOSH NPPTL
David Moore	Glendale FD
Anthony Petrilli	USDA Forest Service
Brian Salvato	Stedfast USA
Rick Swan	IAFF
Dick Weise	LA County
David Trebisacci	NFPA Staff Liaison

Alternates:

Curtis Brown	CalFire
Joel Fassbinder	IAFF
Andrew Kaiser	UL LLC

Guests:

Matt Plunkett	Bullard
Sam Resman	Supply Cache
Jay Tarley	NIOSH NPPTL
Summer Hurd	Green Buffalo
Tom Forth (?)	VF Imagewear
Kirk Owen	Veridian
Jeff Stull	International Personnel Protection
Karen Bengston	CALPIA
Nicole Collins	CALPIA
Scott Eddenfield	CALPIA
Godot Apuzzo	USFS
L. J. Brown	DOI-BLM
Kevin Roche	PSRM
Denise Statham	Bulwark
Charles Dunn	TenCate

1. Chairman George Broyles called the meeting to order at 0900 hrs.
2. The TC provided self-introductions
3. The Minutes of the Technical Committee meeting of August 15-16, 2017 were approved.
4. NFPA Staff Liaison Dave Trebisacci provided the procedures for meetings and the document revision process and timeline for NFPA 1877.
5. The Technical Committee received no Public Comments to NFPA 1977, but created 15 Second Revisions.
6. Bill Haskell provided Correlating Committee notes to be included in the substantiation for several Second Revisions. He also forwarded a presentation being provided by NIOSH/NPPTL in Missoula at the Fire Continuum Conference by a NIOSH Morgantown, WV researcher.
7. Tricia Hock provided a plan to introduce in NFPA 1977 the concept of a test method review to help users to understand test methods.
8. There was no old business discussed.
9. Under new business and presentations:

Korena Hallum & Summer Hurd from Green Buffalow presentation on Nomex issues and sizing specifically for women.

Tony Petrilli discussed previous changes to sizing chart.

A Task Group was formed that will submit PI prior to 1/3/19 on updating sizing charts or otherwise identify appropriate methods to improve fit, functionality for all Nomex.

Task group members:

Rick Swan, Tony Petrilli, Korena Hallam & Summer Hurd (Green Buffalow), Dick Weise, Curtis Brown, Vince Diaz, Karen Bengtson & Nicole Collins (CALPIA).

Potential items for next revision of NFPA 1977 and NFPA 1877:

Rick Swan – will submit a global input to include urban interface firefighting in this document and to change name of document to protective clothing for wildland

firefighting and urban interface firefighting Vince Diaz suggested updating the Origin and Development section of the standard to next edition that gives the history and what the standard means. This can be included in the global change along with the title change. The TC may need to change the document scope.

Rick Swan – 1977 does not have definition of WUI and urban interface firefighting in current edition, definition should be added to 2020 edition.

Currently many definitions in NFPA glossary should coordinate with Karen Lehtonen and then a Public Input can be submitted.

Rick Swan – investigate the potential of adding performance requirements to garments to meet technology and fabrics that currently exist that can improve performance without compromising current performance. Can TC enhance performance requirements and provide higher protection? Increasing RPP to 10, and THL from 450 to 500 in the design and possibility of incorporate multiple materials in a single garment, power stretch panels, etc. This would impact a SCAM document.

Dick Weise - add fire shelter performance and testing requirements to next edition of NFPA 1977. Dick will submit a PI for consideration.

Godot Apuzzo – noted that the wildland helmet current requirement is design restrictive. The fire service is looking at type 1 class G helmet. Develop a baseline to look at heat stress of current helmets, and possibly look at impact studies. NFPA 1951 TC is also studying hard hats, Jeremy Metz, Chair.

Jeff Stull – discussed restricted substances that are prohibited in certain materials. Jeff recommends the TC adopt the OEKO-TEX 100 method of certifying textiles as free of certain Perfluoroalkyl substances (PFAs). OEKO-TEX 100 is a European standard that manufacturers can go to and get certified that their materials meet specific levels of chemicals including specific PFAs. There are four classes. Oeko-tex tests materials and provides certificate of compliance.

Tricia Hock & Brian – Assembling educational materials for annexes; most tables complete still need to know if NFPA or anyone else made progress on hosting videos on various test methods for the public or members. Tables and text are ready and will submit a PI. These will help the end user understand how these products are tested.

Expiration dates for garments, helmets, boots, gloves and maintenance are a topic for NFPA 1877, SCAM document.

Jeff Stull – NFPA 1877 improvement is needed in the area of cleaning and contamination control. Jeff will recommend at CC meeting that the document be held up to address these issues. He noted that NFPA 1851 added requirements and annex material on cleaning and decontamination.

Motion from Rick Swan that 1977 TC support bringing 1877 back to the TC for further review. The TC would support it coming back in 2nd draft, Vince Diaz second. The staff liaison will consult with Standards Administration for its assistance.

10. The next meeting will be an NFPA 1977 First Draft meeting on February 5-6, 2019.

11. The meeting adjourned on October 3, 2018 at 12:20 p.m.



Public Input No. 3-NFPA 1977-2017 [Global Input]

See Attached TIA

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
TIA_1977_16_1_Log_1216.pdf	TIA 1977 16-1, Log 1216	
TIA_1977_16_1_Log_1216.docx	TIA 1977 16-1, Lot 1216 Word	

Statement of Problem and Substantiation for Public Input

Note: A Public Input has been created for the Issued TIA No. 16-1, Log 1216. This TIA was issued on April 6, 2016. Per the NFPA Regs, all issued TIA's must be reconsidered by the Technical Committee for the Next Edition of the Document.

Substantiation.

1. The language as currently written refers to US Commercial Item Descriptions (CID's). These CID's contain design restrictive requirements in the form of thread size, and then relate the thread size to a breaking strength requirement. Any thread size outside of the specified range would be unacceptable. The CID's are tailored to a specific type of thread construction. This forces the manufacturer to use the specified thread type for the compliant element (see table below). This is unnecessarily design restrictive.
2. The performance requirements for the conditioning prior to breaking are not uniform (see table below). This leads to different performance requirements for different thread compositions, and different minimum requirements depending on the end use of the thread. In the case of Garments, Helmets, Work Gloves, Face/Neck Shrouds, and Goggles – the conditioning temperature of 550F exceeds the required melting temperature of 500F.

Specification	Conditioning Temperature	Conditioning Time	NFPA 1977 Element
A-A-50195	500F	15 min	Footwear,
A-A-55195	500F	4 hours	Footwear, Driving Gloves
A-A-55217B	550F	20 min	Garments, Helmets, Work Gloves, Face/Neck Shrouds, Goggles
A-A-55220	None	None	Footwear,

3. The current requirements include a thread elongation requirement. This requirement is in the military CID to account for the forces encountered during the sewing process. This is not a safety issue, and is adding unnecessary testing and cost for no substantiated reason.
4. The helmet thread design requirement requiring all thread to be made of inherently flame-resistant fiber (6.2.13) and the requirement for all thread to have a melt temperature greater than 500F (7.2.1.3) inadvertently deleted the exception for the thread used on the crown straps (NFPA 1977-2011 ed. 7.2.1).
5. The chain saw protector thread design requirement requiring all thread to be made of inherently flame resistant fiber (6.7.4) is contradictory to the thread melt requirement (8.9.5.4.3) of 232C (450F). The design requirement should be removed.
6. All thread melting temperature requirements should be part of the performance requirement (Ch. 7) – not buried in the test method (8.9.5.4.3).
7. There are currently two methods for evaluating thread melting; ASTM D7138, and section 8.9. This can lead to redundant testing of the same thread depending on the use of the thread. Only one method

should be specified.

8. The proposed TIA eliminates the elongation requirement, eliminates the thread size requirement, and replaces the individual military CID's with a uniform breaking strength method and requirement (based on A-A-50195).

Emergency Nature.

NFPA 1977 contains the following conflicts:

- a) Chain saw protector thread is required to be of inherently flame resistant fiber, and requires a melting temperature of 232C. These products are not generally made using inherently flame resistant thread.
- b) Different threads, depending on their end use, are subject to different conditioning requirements, and in the case of face/neck shrouds and goggles, a conditioning temperature of higher than the required melt temperature.

The proposed TIA intends to correct the following circumstances in which the revised NFPA Standard has resulted in an adverse impact of products that was inadvertently overlooked in the total revision process or was without adequate technical (safety) justification for the action:

- a) The standard as currently written is overly design restrictive in that it forces manufacturers to use threads of a certain size and composition.
- b) The standard as currently written forces the redundant testing of thread as there are different requirements based on the end use of the thread.
- c) There is insufficient technical or safety justification for the thread elongation requirement.
- d) The standard as currently written will now require that helmet crown straps be sewn with inherently flame resistant thread. There was no discussion or technical (safety) justification for this action.

Submitter Information Verification

Submitter Full Name: Tc On Fae-Wff

Organization: NFPA

Street Address:

City:

State:

Zip:

Submittal Date: Wed Feb 01 11:17:02 EST 2017

Committee:



Public Input No. 40-NFPA 1977-2018 [Global Input]

Type your content here ...**New Title: Standard on Protective Clothing and Equipment for Wildland Fire Fighting and Urban Interface Fire Fighting**

Statement of Problem and Substantiation for Public Input

Wildland fire fighting has changed and the threat environment as changed. The wildland urban interface or urban interface is not a structure fire requiring NFPA 1971 PPE and it is more than a wildland fire requiring current NFPA 1977 PPE. We know that urban interface fires produce many more toxins than a "normal" wildland fire. Also, the first responders to an urban interface is more than likely a structural firefighter. Many of those structural firefighters and their respective AHJ's should have guidance or possible PPE and this standard should not impede future PPE to be certified to a consensus standard. The proposal is to bring NFPA 1977 into the current threat environment and bring focus on the issues of urban interface fire fighting and the different PPE requirements.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 41-NFPA 1977-2018 [Global Input]	

Submitter Information Verification

Submitter Full Name: Rick Swan
Organization: International Association of Fire Fighters
Street Address:
City:
State:
Zip:
Submittal Date: Thu Oct 25 09:19:25 EDT 2018
Committee: FAE-WFF



Public Input No. 41-NFPA 1977-2018 [Global Input]

Type your content here ...Add the term "urban interface fire fighting" to the currently used term "wildland fire fighting". New term should read "*wildland fire fighting and urban interface fire fighting*".

Add to Chapters 1, 2, 4, 5, 6, 7, 8 and to all of Chapter 3 except for 3.3.75.

Statement of Problem and Substantiation for Public Input

Adding "urban interface fire fighting" to the current term "wildland fire fighting" only adds clarity to the standard on actual duties preformed.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 40-NFPA 1977-2018 [Global Input]	
Public Input No. 42-NFPA 1977-2018 [Section No. 3.3]	

Submitter Information Verification

Submitter Full Name: Rick Swan
Organization: International Association of Fire Fighters
Street Address:
City:
State:
Zip:
Submittal Date: Thu Oct 25 09:49:21 EDT 2018
Committee: FAE-WFF



Public Input No. 50-NFPA 1977-2018 [Global Input]

Update references in Chapter 2 to reflect the current and/or appropriate editions.

Type your content here ...

Statement of Problem and Substantiation for Public Input

Update referenced standards to current and/or appropriate editions.

Submitter Information Verification

Submitter Full Name: Steven Corrado

Organization: UL LLC

Street Address:

City:

State:

Zip:

Submittal Date: Wed Nov 28 10:53:16 EST 2018

Committee: FAE-WFF



Public Input No. 79-NFPA 1977-2019 [Global Input]

Move sizing information provided in Table 6.1.14.3(a) to Annex A as an example of a sizing scheme that may be appropriate for some wildland firefighting organizations. Include in the annex general information about sizing approach depending on the and style of the type of garment and its intended purpose. Describe a means by which individuals can adequately assess where the provided size provides an appropriate level of fit without restricting or impeding movement and for the interface with other items of protective clothing and equipment.

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Statement of Problem and Substantiation for Public Input

While there is permissive language in the standard to provide additional sizes and apply custom sizing, the current standard language in Section 6.1.14 for Size Requirements is design-restrictive and does not account for innovation in garment design or allow for manufacturers to devise sizing that better accommodates the wildland firefighter population. The current sizing system should be relegated to the annex, where it can be one means of achieving sizing compliance. Organizations that desire to use this system can include it in their specifications.

In addition, it is appropriate for information to be provided as part of the standard to allow individual wearers to assess the adequacy of their garment size.

Submitter Information Verification

Submitter Full Name: Jeffrey Stull

Organization: International Personnel Protection, Inc.

Street Address:

City:

State:

Zip:

Submittal Date: Thu Jan 03 15:12:27 EST 2019

Committee:



Public Input No. 81-NFPA 1977-2019 [Global Input]

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Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Public_Input_to_Add_Wildland_Standard_Fire_Shelter_Requirement_to_NFPA_1977.docx		

Statement of Problem and Substantiation for Public Input

Public Inputs for Adding Design, Performance, and Labeling Requirements for Fire Shelters to NFPA 1977

Justification

Fire shelters can be the last line of defense for firefighters trapped in a wildland fire. In spite of the apparent importance of this critical component of protective equipment to firefighter safety, no performance standard currently exists for certifying fire shelters deployed by wildland firefighters in the United States. The availability of such a standard would have several immediate benefits for firefighters. It would ensure a consensus based and widely accessible means for certifying the minimum thermal protective and functional performance of fire shelters and the materials used in the construction of fire shelters. It would provide an open public framework for standardizing the use of the best available laboratory testing technologies for evaluating fire shelter performance. These outcomes would, in turn, promote innovation and improvements in heat resistant materials and shelter designs and test methods available for evaluating fire shelters. By using the NFPA process, it would enable wider input from wildland firefighters and the industrial community that provide fire resistant materials and fire shelter systems. It would give all fire shelter designers and manufacturers a well-defined and vetted performance target for developing new fire shelter products. Clearly, a true performance standard for fire shelters used by wildland firefighters is critically needed and long overdue.

The proposed test methods, design and performance requirements will be built upon the best qualities of the testing system currently used by the U.S. Forest Service (USFS) to select fire shelter designs. The USFS system screens fire shelter prototypes based on a battery of bench and full-scale tests. The performance of candidate fire shelters are benchmarked against the performance of the fire shelter currently qualified by the USFS [1]. The technical aspects of this public comment have also been informed by research conducted by the Center for Research on Textile Protection (T-PACC) at NC State University. NC State recently conducted an extensive three-year research project to develop new fire blocking materials and seam designs, without adding significant weight to the shelter, that exceed the thermal protective performance of the currently used fire shelter in wildland fire burn-overs. This project, funded by the FEMA Assistance to Firefighters Fire Prevention and Safety Grants Program, is among the most comprehensive and well-documented scientifically based research efforts ever attempted to develop improved wildland fire shelter protection. It included basic development of new fire blocking systems and innovative seam designs for shelter constructions. It developed improved bench and full-scale laboratory methods for use in characterizing the thermal protective performance of shelter materials and designs. It validated the enhanced thermal protective performance of the developed fire shelter prototypes in an extensive series of prescribed burns conducted in a variety of locations in the United States. A Project Technical Panel (PTP), including wildland firefighters and subject matter experts in fire shelter technologies, fire shelter testing and standards, and fire shelter utilization from the National Fire Protection Association (NFPA) and the USFS provided invaluable assistance to our research project. A review of this research is provided in the attached presentation made at the 2018 NFPA Conference and Expo [2].

1 Fire Shelters External-New Material Test Protocols 2010, USFS

2. Advances in Wildland Fire Shelter Development and Testing, Mr. John Morton-Aslanis and Dr. Roger Barker, 2018 NFPA Conference and Expo, Las Vegas, Nevada, June 13, 2018

Submitter Information Verification

Proposed Changes to NFPA 1977 to Add Wildland Fire Shelters to NFPA 1977

1.1.1 This standard shall specify the minimum design, performance, testing, and certification requirements for items of wildland fire fighting protective clothing and equipment, including protective garments, protective helmets, protective gloves, protective footwear, protective goggles, and protective chain saw protectors; and for load-carrying equipment and fire shelters.

~~1.1.5 This standard shall not be interpreted as providing criteria for fire shelters for wildland fire entrapment situations.~~

~~1.3.6 This standard shall not apply to fire shelters for use by fire fighters during wildland fire entrapment situations.~~

3.3.X **Fire shelter.** Equipment used to cover a wildland firefighter during a fire entrapment situation only.

3.3.X **Fire shelter package.** The packaging around the Fire shelter that compresses the equipment for ease in carrying.

5.X Fire shelters.

5.X.1 Product Label Requirements.

5.X.1.1 The fire shelter and fire shelter package shall have a product label or labels permanently and conspicuously attached.

5.X.1.2 Configuration of the product label and attachment of the product label shall not interfere with the legibility of any printed portion of the product label.

5.X.1.3 Multiple label pieces shall be permitted in order to carry all statements and information required.

5.X.1.4* 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.

5.X.1.5 All worded portions of the required product label shall be printed at least in English.

5.X.1.6 Symbols and other pictorial graphic representations shall be permitted to be used to supplement or in place of worded statements on the product label(s) where explanations for symbols and pictorial graphic representations are provided in the user information.

5.X.1.7 The following statement shall be printed legibly on the product label, and all letters shall be at least 2.5 mm ($\frac{3}{32}$ in.) high:

**“THIS WILDLAND FIRE SHELTER
MEETS THE REQUIREMENTS OF
NFPA 1977, STANDARD ON PROTECTIVE CLOTHING
AND EQUIPMENT FOR WILDLAND FIRE FIGHTING,
2016 EDITION.**

DO NOT REMOVE THIS LABEL!”

5.X.1.8 At least the following information shall also be printed legibly on the product label, with all letters at least 1.6 mm ($\frac{1}{16}$ in.) high:

- (1) Manufacturer's name, identification, or designation
- (2) Manufacturer's address
- (3) Country of manufacture
- (4) Manufacturer's identification number, lot number, or serial number
- (5) Month and year of manufacture (not coded)
- (6) Model or style name, number, or design
- (7) Size

5.X.2 User Information.

5.X.2.1 The Fire Shelter manufacturer shall provide at least the user information that is specified in 5.X.2.5 with each Fire shelter.

5.X.2.2 The fire shelter manufacturer shall attach the required user information or packaging containing the user information to the fire shelter in such a manner that it is not possible to use the fire shelter without being aware of the availability of the information.

5.X.2.3 The required user information or packaging containing the user information shall be attached to the load-carrying equipment so that a deliberate action is necessary to remove it. The fire shelter manufacturer shall provide notice that the user information is to be removed ONLY by the end user.

5.X.2.4 Symbols and other pictorial graphic representations shall be permitted to be used to supplement or replace worded statements or user information where explanations for symbols and pictorial graphic representations are provided.

5.X.2.5 The load-carrying equipment manufacturer shall provide at least the following instructions and information with each item:

- (1) Pre-use information
 - (a) Safety considerations
 - (b) Limitations of use
 - (c) Fire shelter recommendations and restrictions
 - (d) Sizing requirement
 - (e) Recommended storage practices
 - (d) Warranty information
- (2) Preparation for use
 - (a) Preparing site for deployment
 - (b) Removing fire shelter from packaging
 - (c) Covering oneself independently
 - (e) Any other important instructions
- (3) Inspection frequency and details
- (4) Proper use consistent with NFPA 1500 and 29 CFR 1910.132, "Personal Protective Equipment"
- (5) Retirement and disposal criteria and considerations

Chapter 6 Design requirements

6.X.1 Protective garment items shall have at least the applicable design requirements specified in this section where inspected by the certification organization as specified in Section 4.X.

6.X.2 Fire shelters that are to be held down by the wildland firefighter must have at least 4 inches of material to hold to in locations defined by the manufacture.

6.X.3 Fire shelters must have shake handles to allow rapid removal from packaging and opening of the shelter.

6.X.4 All Thread used to manufacture fire shelter shall be made of inherently flame-resistant fibers.

6.X.5 All fire shelters must be packaged in a way to prevent damage to the shelter and easily be carried by the fire firefighter. The packing volume must not exceed 300 cubic inches.

6.X.6 The shelter and packaging together shall not exceed 6.0 lbs.

6.X.7 Fire shelters must be able to be removed from packaging and cover a firefighter within 60 seconds. This must be done with NFPA 1977 compliant gloves

6.X.8 Fire shelter must come in at least two sizes. One to accommodate an individual's up the maximum pant and shirt sizes defined in Table 6.1.14.3(a)&(b). The second size must accommodate individuals wearing a M Shirt and size 32 pant.

Chapter 7 Performance Requirements

7.X Fire Shelter Performance Requirements.

7.X.1 Fire shelter materials shall be tested for Radiant Protection Performance (RPP) test as specified in Section 8. 2 and shall have an average RPP value of not less than 60

7.X.2 Fire Shelter material composites shall be tested for resistance to tearing as specified in Section 8.6 and shall have a tear strength of not less than TBD N.

7.X.3 Fire shelter materials composites shall be tested for convective/radiant heat protection(TPP) as specified in Section 8.X and shall have an average TPP of not less than 50.

7.X.4 Fire shelter materials shall be individually tested for resistance to flame as specified in Section 8.X (cone flammability test), and have no visible gases, flames or smoke present inside the cone after a period of 30 seconds

7.X.5 Fire shelter composite materials shall be tested for tensile strength as specified in Sections 8.X and shall have a breaking strength of not less than TBD N.

7.X.6 Fire shelter composite materials preconditioned to with heat prior to testing for tensile strength as specified in Sections 8.X and shall have a break strength of not less than TBD N.

7.X.7 Fire shelter composites shall be tested for puncture resistance 2 as specified in Section 8.X and shall have a burst strength of not less than TBD N

7.X.8 Fire shelter units (fabricated full scale shelter) shall be tested for seam strength as specified in Sections 8.X and shall have a seam strength of not less than TBD N

7.X.8 Fire shelter units (fabricated full scale shelter) shall be tested for durability as specified in Sections 8.X and shall be free of any holes or tears

7.X.9 Fire shelters shall be tested as a unit against a convective/radiant full scale test. The temperature reading at 2 inches from the floor surface must be less than 150°C and the temperature at 10 inches from the floor surface must be less than 300°C with a 25 second exposure. In addition, the peak CO and CO₂ levels must be below X and X throughout the exposure. The O₂ level must remain above X during the entire exposure. There shall also be no visual observation of flames inside the shelter during the exposure

Chapter 8 Test Methods

8.X Cone Flammability Test –Material Composites

8.X.1 Application

This test shall apply to both woven and non-woven materials in the intended configuration of the shelter design.

8.X.2 Sample Preparation

Samples for conditioning shall be at least 1 m (1 yd) square of material.

All specimens to be tested shall be conditioned as specified in 8.1.1.

8.X.3 Specimens

Specimens shall be 150 mm (6 in.) in diameter.

Multilayer material systems, separable or not, shall be tested in the intended composite construction.

A minimum of 5 specimens shall be tested

8.X.4 Procedure

Specimens shall be tested using the burner assembly specified in CAN/CGSB-4.2 No.27.10-2000, *Flame Resistance – Vertically Oriented Textile Fabric or Fabric Assembly Test*.

Samples shall be cut and formed into a right circular cone. The overlap of material must be fastened using metal staples, so as to produce a seal capable of retaining gases evolved as the specimen is heated.

The sample shall be installed in a restraint device so that the seam formed is opposite the point of application of the burner flame. The location of the burner shall be such that the tip of the flame contacts the sample at a point 30 mm +5 mm below the peak of the cone formed with the sample. The flame shall be applied to the specimen for a period of 30 seconds.

8.X.5 Report

The report shall include observations about the behavior of the material during the exposure. This shall include the presence of smoke, gases, open flame within the cone sample, as well as a description of the condition of the sample, both inside and outside, at the end of the exposure period.

8.X Convective/Radiant Heat Protection-Material Composites

8.X.1 Application. This test method shall apply to fire shelter materials.

8.X.2 Samples.

8.X.2.1 Samples for conditioning shall be in the form of a composite

8.X.2.2 Three samples shall be conditioned as specified in 8.1.1.

8.X.3 Specimens.

8.X.3.1 Specimens for testing shall be taken from the samples for conditioning. Specimens shall not be stitched to hold individual layers together during testing.

8.X.3.2 Specimens for testing shall be representative of each fire shelter composite construction. All variations in composite construction and the order of layering of composite materials shall constitute a new composite and shall be tested separately. Where a composite is identical to another composite except for additional reinforcement layer(s), the composite with no reinforcement layers shall be representative of the composite with reinforcement layer(s). Specimens shall not include seams.

8.X.3.3 Three specimens shall be tested following the conditioning specified in 8.X.2.2.

8.X.4 Apparatus. The test apparatus shall be as specified in ISO 9151, *Clothing for protection against heat and flame — determination of heat transmission on exposure to both flame and radiant heat*.

8.X.5 Procedure. Thermal protective performance testing shall be performed in accordance with ISO 9151, *Clothing for protection against heat and flame — determination of heat transmission on exposure to both flame and radiant heat*, and shall be used with the following modifications:

(1) An exposure heat flux of 84 kW/m² (2.0 cal/cm²s) shall be used.

(2) The spaced configuration shall be used for testing of all material specimens.

8.X.6 Report.

8.X.6.1 The individual test TPP rating of each specimen shall be recorded and reported.

8.X.6.2 The average TPP rating shall be calculated, recorded, and reported.

8.X.6.3 Where a TPP rating is greater than 60, the TPP rating shall be recorded and reported as “>60”

8.X.7 Interpretation.

8.X.7.1 Pass or fail determinations shall be separately based on the average reported TPP rating of all specimens.

Radiant Protective Performance (RPP)

8.2.10 Specific Requirements for Testing Fire Shelter Material-Composites

8.2.10.1 Specimens shall consist of materials from the portion of the fire shelter that is designed to cover the body.

8.2.10.2 Specimens shall not include seams.

8.2.10.3 Specimens shall not be stitched to hold individual layers together.

8.2.10.4 Samples for conditioning shall include fire shelter material that is a minimum of 100 mm × 200 mm, +/- 6 mm (4 in. × 8 in., +/- 1/4 in.).

8.2.9.5 Testing shall be performed as described in 8.2.2 through 8.2.7 with the following modifications:

(1) testing of the fire shelter material will have a radiant heat exposure level of 84 kW/m² (0.5 cal/cm²).

(2) a 0.25 inch spacer will be placed between the sensor and the back of the specimen.

8.X.6 Report.

8.X.6.1 The individual test RPP rating of each specimen shall be recorded and reported.

8.X.6.2 The average RPP rating shall be calculated, recorded, and reported.

8.X.6.3 Where a RPP rating is greater than 60, the RPP rating shall be recorded and reported as “>60”

8.X.7 Interpretation.

8.X.7.1 Pass or fail determinations shall be separately based on the average reported TPP rating of all specimens.

8.X Tensile Strength-Material Composites

8.X.1 Application This test shall apply to both woven and non-woven materials used in fire shelters.

8.X.2 Sample Preparation

Samples for conditioning shall be at least 1 m (1 yd) square of material. All specimens to be tested shall be conditioned as specified in 8.1.1.

8.X.3 Specimens

Specimens shall be 100 mm x 150 mm (4 in. x 6 in.). For multilayered shelter designs, each layer needs to be tested separately. For laminated shelter designs, each laminate layer needs to be tested separately. Additionally, the composite of all layers of the fire shelter shall be tested.

A minimum of five specimens in each of the warp and fill direction shall be tested.

Where the material is isotropic, then ten specimens shall be tested

8.x.4 Procedure

Specimens shall be tested as specified in ASTM D5034-09 *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*.

8.X.5 Report

The tensile strength of an individual specimen shall be the average of the five highest peak loads registered. The tensile strength for each specimen shall be reported to the nearest 1 N (0.2 lbf) of force.

The average tensile strength and standard deviation for warp and fill direction shall be reported

8.X.Tear Strength Test-Material Composites

8.X.1 Application

This test shall apply to both woven and non-woven materials used in fire shelters.

8.X.2 Sample Preparation

Samples for conditioning shall be at least 1 m (1 yd) square of material. All specimens to be tested shall be conditioned as specified in 8.1.1

8.X.3 Specimens

Specimens shall be 100 mm x 150 mm (4 in. x 6 in.). A minimum of five specimens in each of the warp direction and the fill direction shall be tested. For multilayered shelter designs, each layer needs to be tested separately. For laminated shelter designs, each laminate layer needs to be tested separately. Additionally, the composite of all layers of the fire shelter shall be tested. Where the material is isotropic, then ten specimens shall be tested.

8.X.4 Procedure

Specimens shall be tested as specified in ASTM D5587-07ae1 *Standard Test Method for Tearing Strength of Fabrics by Trapezoid Procedure*.

8.X.5 Report

The tear strength of an individual specimen shall be the average of the five highest peak loads registered. The tear strength for each specimen shall be reported to the nearest 1 N (0.2 lbf) of force. Report average tear strength and standard deviation for warp direction and fill direction.

8.X Creased Breaking Strength Test-Material Composites

8.X.1 Application

This test shall apply to both woven and non-woven materials used in fire shelters.

8.X.2 Sample Preparation

Samples for conditioning shall be at least 1 m (1 yd) square of material. All specimens to be tested shall be conditioned as specified in 8.1.1

8.X.3 Specimens

Specimens shall be 100 mm x 150 mm (4 in. x 6 in.). For multilayered shelter designs, each layer needs to be tested separately. For laminated shelter designs, each laminate layer needs to be tested separately. Additionally, the composite of all layers of the fire shelter shall be tested. A minimum of five specimens in each of the warp direction and fill direction shall be tested. Where the material is isotropic, then ten specimens shall be tested.

8.X.4 Procedure

Specimens shall be tested as specified in ASTM D5034-09 *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*. Prior to testing samples shall be folded in half, forming 100 mm x 75 mm (4 in. x 3 in.) rectangle and creased. The spacing between the rollers used for creasing shall be determined using a standard thickness gauge and shall be set to twice the material thickness as determined using ASTM D1777-96 (2002) *Standard Test Method for Thickness of Textile Materials*.

8.X.5 Report

The creased breaking strength of an individual specimen shall be the average of the five highest peak loads registered. The creased breaking strength for each specimen shall be reported to the nearest 1 N (0.2 lbf). Report average creased breaking strength and standard deviation for the warp direction and fill direction.

8.X Elevated Temperature Tensile Strength-Material Composites

8.X.1 Application

This test shall apply to both woven and non-woven materials used in fire shelters.

8.X.2 Sample Preparation

Samples for conditioning shall be at least 1 m (1 yd) square of material. All specimens to be tested shall be conditioned as specified in 8.1.1

8.X.3 Specimens

Specimens shall be 100 mm x 150 mm (4 in. x 6 in.). For multilayered shelter designs, each layer needs to be tested separately. For laminated shelter designs, each laminate layer needs to be tested separately. Additionally, the composite of all layers of the fire shelter shall be tested. A minimum of five specimens in each of the warp direction and the fill direction shall be tested. Where the material is isotropic, then ten specimens shall be tested.

8.X.4 Apparatus

The standard tensile strength test fixture shall be modified to elevate the central 75 mm (3 in.) of the specimen under test to a uniform temperature of 260°C (500°F). The test fixture shall consist of an aluminum enclosure, heated air source, and temperature controller. The heated air source used shall have sufficient capacity to raise the specimen temperature to 260°C within two minutes.

8.X.5 Procedure

Specimens shall be tested as specified in ASTM D5034-09 *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*. Prior to load application the specimen shall be allowed to come to thermal equilibrium at 260°C (500°F), approximately two minutes.

8.X6 Report

The tensile strength of an individual specimen shall be the average of the five highest peak loads registered. The tensile strength for each specimen shall be reported to the nearest 1 N (0.2 lbf) of force. The average tensile strength and standard deviation for the warp direction and fill direction shall be reported.

8.X Puncture Resistance Test –Material Composites

8.X.1 Application

This test shall apply to both woven and non-woven materials used in fire shelters.

8.X.2 Sample Preparation

Samples for conditioning shall be at least 1 m (1 yd) square of material. All specimens to be tested shall be conditioned as specified in 8.1.1

8.X.3 Specimens

Specimens shall be 100 mm (4 in.) diameter. For multilayered shelter designs, each layer needs to be tested separately. For laminated shelter designs, each laminate layer needs to be tested separately. Additionally, the composite of all layers of the fire shelter shall be tested. A minimum of five specimens shall be tested.

8.X.4 Apparatus

Testing machine as described in ASTM D6797 – 07 *Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test.*, except that a ball burst apparatus shall replace the clamp assembly. The polished steel ball specified in Method 5120 shall be replaced with the modified blunt end probe. The blunt end probe shall have a diameter of 9.5 mm (0.375 in) and shall be chamfered at 45° to remove the sharp corner.

8.X.5 Procedure

Specimens shall be tested as specified in ASTM D6797 – 07 *Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test.*

8.X.6 Report

The puncture resistance of an individual specimen shall be the average of the five highest peak loads registered. The burst strength for each specimen shall be reported to the nearest 1 N (0.2 lbf) of force. The average puncture strength and standard deviation shall be reported.

Mullen Burst Strength-Material Composites

8.X.1 Application

This test shall apply to both woven and non-woven materials used in fire shelters.

8.X.2 Sample Preparation

Samples for conditioning shall be at least 1 m (1 yd) square of material. All specimens to be tested shall be conditioned as specified in 8.1.1

8.X.3 Specimens

Specimens shall be 65 mm (2.5 in.) diameter. For multilayered shelter designs, each layer needs to be tested separately. For laminated shelter designs, each laminate layer needs to be tested separately. Additionally, the composite of all layers of the fire shelter shall be tested. A minimum of five specimens shall be tested.

8.X.4 Apparatus

A Mullen Burst Tester shall be used. A motor drive Model A Mullen Burst Tester shall be used. The Burst Tester shall be driven by a motor speed of 1750 rpm and use a Model 305-B Mullen Tester Diaphragm supplied by Mullen Testers. Material with a foil laminate shall be tested with the foil against the diaphragm.

8.X.5 Procedure

The Burst Test shall be tested as specified in ASTM D6797 – 07 *Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test*.

8.X.6 Report

An average of 3 tests across the material width shall be reported.

The burst strength for each specimen shall be reported to the nearest 1 N (0.2 lbf) of force. The lowest value of 3 tests across the material width and standard deviation shall be reported.

8.X Durability-Full Sized Fire Shelter

8.X.1 Application

This test shall apply to full sized fire shelters.

8.X.2 Sample Preparation

Samples shall be left intact within its protective containment bag, if any.

8.X.3 Specimens

A minimum of three shelters shall be tested.

8.X.4 Apparatus

The apparatus used to evaluate the durability shall be capable of repeated compressive loading of a full sized fire shelter to a maximum load of 1115 N (250 lbf) and shall be capable of recording the number of complete cycles. A set of platens shall be firmly affixed to the testing machine and shall apply a uniform load over the surface of the shelter under test. The testing machine used shall be capable of load control and shall have the capability of both maximum and minimum compressive limits.

Load shall be measured with an accuracy of 10N.

8.X.5 Procedure

The shelter under test shall be placed between the testing machine platens and load limits set to minimum compression - 100 N, maximum compression - 1115 N. Cross head speed shall be set to a minimum of 100 inches per minute.

The test shall be complete after the shelter has been subjected to 4000 compressive cycles.

After reaching 4000 cycle the material layers making up the shelter, if any, shall be separated and viewed in front of a light source to accentuate any holes or tears.

8.X.6 Report

The report shall include a description of the shelter before and after testing.

The condition of the shelter after 4000 cycles shall be reported.

The description shall include, but not be limited to, condition of seams and folds, fraying, fiber and thread breakage, cracking or separation of bonded layers or any other condition that reduces the ability of the shelter to provide a barrier to heat and gases.

8.X Seam Strength Test-Full Sized Fire Shelter

8.X Application

This test shall apply to both woven and non-woven materials used in fire shelters.

8.X Sample Preparation

Samples for conditioning shall be at least 1 m (1 yd) square of material.

All specimens to be tested shall be conditioned as specified in 8.1.1

8.X.3 Specimens

Specimens shall be 100 mm x 150 mm (4 in. x 6 in.).

All major seams that connect material layers together, shall be tested. This shall include any attachments (handles, straps, etc.) that are used in the construction of the shelter. A minimum of five specimens for each major seam shall be tested.

Where the material is isotropic, then ten specimens shall be tested.

8.X.4 Procedure

Specimens shall be tested as specified in CAN/CGSB-4.2,

No.32.2-M89 *Breaking Strength of Seams in Woven Fabric*

8.X.5 Report

The breaking strength of an individual specimen shall be the average of the five highest peak loads registered. The breaking strength for each specimen shall be reported to the nearest 1 N (0.2 lbf) of force. The average breaking strength and standard deviation for each major seam and attachment shall be reported.

8.X Elevated Temperature Seam Strength Test

8.X.1 Application

This test shall apply to both woven and non-woven materials used in fire shelters.

8.X.2 Sample Preparation

Samples for conditioning shall be at least 1 m (1 yd) square of material.

All specimens to be tested shall be conditioned as specified in 8.1.1

8.X.3 Specimens

Specimens shall be 100 mm x 200 mm (4 in. x 8 in.). All major seams that connect material layers together, shall be tested. This shall include any attachments (handles, straps, etc.) that are used in the construction of the shelter. A minimum of five specimens in each major seam shall be tested. Where the material is isotropic, then ten specimens shall be tested.

8.X.4 Apparatus

The standard tensile strength test fixture shall be modified to elevate the central 75 mm (3 in.) of the specimen under test to a uniform temperature of 260°C (500°F). The test fixture shall consist of an aluminum enclosure, heated air source, and temperature controller. The heated air source used shall have sufficient capacity to raise the specimen temperature to 260°C within two minutes.

8.X.5 Procedure

Specimens shall be tested as specified in CAN/CGSB-4.2, No. 32.2-M89 *Breaking Strength of Seams in Woven Fabrics*. Prior to load application the specimen shall be allowed to come to thermal equilibrium at 260°C (500°F), approximately two minutes.

8.X.6 Report

The breaking strength of an individual specimen shall be the average of the five highest peak loads registered. The breaking strength for each specimen shall be reported to the nearest 1 N (0.2 lbf) of force. The average breaking strength and standard deviation for each major seam and attachment shall be reported

8.X Convective/Radiant Exposure-Full Scale Shelter

8.X.1 Application

This test shall apply to full sized prototype fire shelters.

8.X.2 Sample Preparation

Samples for conditioning shall be removed from any packing material prior to conditioning. All specimens to be tested shall be conditioned as specified in 8.1.1.

8.x.3 Specimens

A minimum of three shelters shall be tested.

8.x.4 Apparatus

The apparatus used to test full sized shelters shall be capable of producing flame contact over 70% of the shelter surface for at least 30 seconds. The apparatus shall use propane as a fuel and shall have appropriate safety features to prevent the accidental release of fuel.

Burners shall be capable of generating a diffusion flame and shall be arranged to provide a uniform exposure over the surface of the shelter under test.

Equipment suitable for the measurement of the following parameters shall be installed within the shelter under test and recorded during the exposure and for 1 minute following the exposure.

A minimum of 5 burners capable of producing 500,000 BTU/hr each

Burners will produce an air diffused flame yellow/orange in color

Total and radiant heat flux exterior shall be measured at the head of the shelter at a height of 15 inches from the floor with a measured average heat flux of 84 kW/m^2 over the duration of the exposure

The shelter to be tested shall be installed on a suitable internal frame capable of maintaining the shape during the exposure.

Completed testing of M2002 Fire Shelter testing after 25 seconds must show a minimum of $\frac{1}{2}$ of the aluminum outer shell layer removed (Figure 1)

Temperatures shall be measured at a location no more than 6 in. from the intended head end of the shelter at a height of 2 and 10 inches using a bare bead thermocouple with a wire size of 0.005in. at a minimum of 1 sample/second

Total heat Flux measurements shall be taken at three equally spaced locations along the center inside the shelter, 2 inches from the floor

A "dome" with a hole on top shall be placed around the shelter (See Figure 2)

A heavyweight chain can be used to secure the outer edges of the shelter to prevent flames from entering the bottom edge of the shelter (see Figure 3)

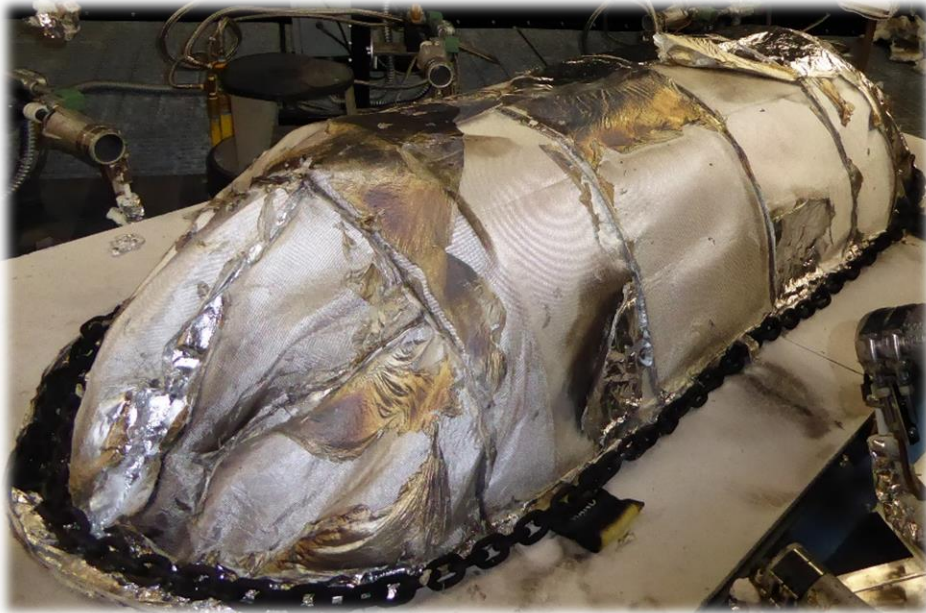


Figure 1: Post Exposure Aluminum outer shell layer removed

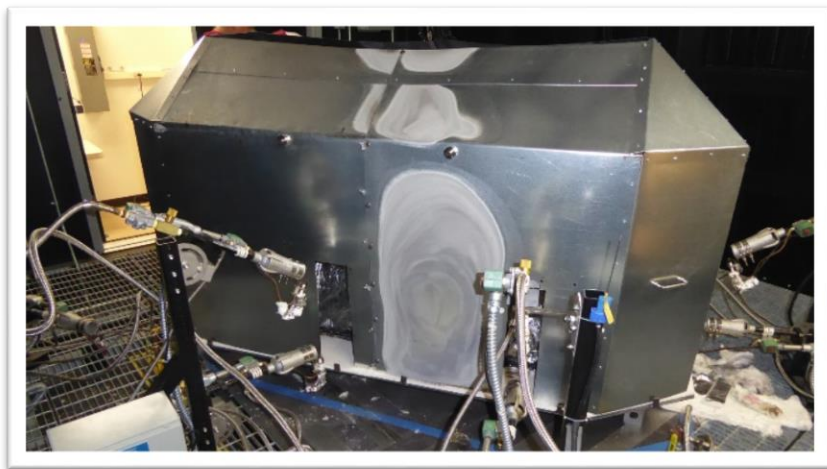


Figure 2 Dome surrounding shelter

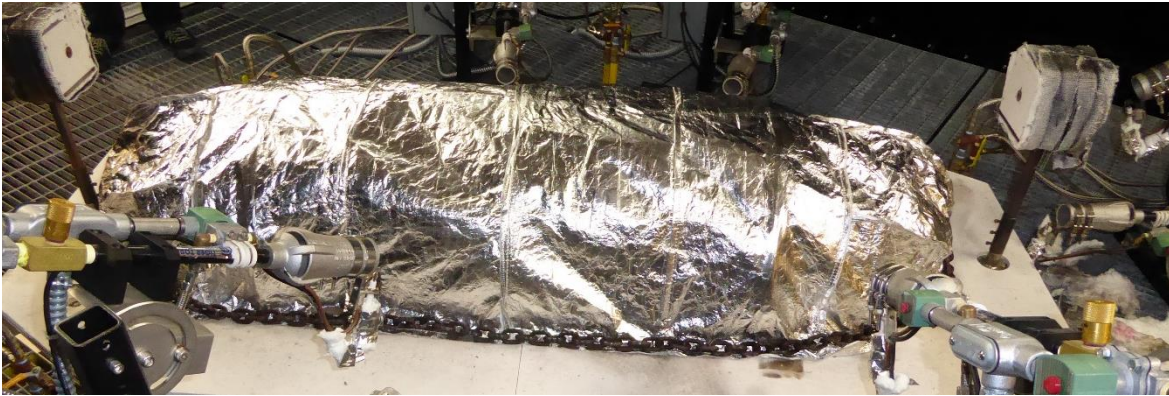


Figure 3: Heavy weight chain securing shelter

8.X.5 Procedure

The shelter to be tested shall be weighed and the starting mass recorded to the nearest 1 g (0.002 lb). The shelter to be tested shall be installed on a suitable internal frame capable of maintaining the shape during the exposure.

The shelter should be exposed to flame for a minimum of 25 seconds or until the temperature at breathing level (50 mm above the floor) reaches 150°C,

Visual observations from inside are recorded with a video camera in a protected enclosure.

The composition of the atmosphere within the shelter shall be measured using a real time analyzer suitable for the measurement of oxygen, carbon dioxide, carbon monoxide and hydrocarbons.

Samples shall be drawn during the exposure at a level of 2 in. above the floor at the intended head end of the shelter. The equipment shall have the following resolution: Oxygen 0.1%, Carbon Dioxide 0.1%, Carbon Monoxide 10 ppm

For one replication the concentration of HCL and HCN shall be measured during the test

After exposure and cool down, external observations of the condition of the shelter shall be made and recorded.

8.X.6 Report:

Temperature at 2 in level after end of exposure (°C)

Temperature at 10 in. level after end of exposure (°C)

Peak concentration of CO and CO₂, HCL and HCN (acceptable levels tbd)

Minimum O₂ level (acceptable levels tbd)

Time of visual interior shelter degradation (sec)

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Public Input No. 84-NFPA 1977-2019 [Global Input]

Remove the digit circumference and length information provided in Tables 6.3.5.2(a) through (e) leaving the whole hand circumference and length information as part of revised tables.

Statement of Problem and Substantiation for Public Input

The current detail in the glove hand sizes provided in paragraph 6.3.5.2 is not up to date and is not used by industry. The critical information in these tables are the hand circumference and hand length. Overall sizing requirements for gloves should be reexamined.

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Public Input No. 85-NFPA 1977-2019 [Global Input]

Standardize the product listing information to be specified in paragraph 4.1.5.

Statement of Problem and Substantiation for Public Input

Current listing information is not consistent between certification organizations. A specific list of information disclosures for the listing should be specified in the standard rather than letting the manufacturers dictate the content of these listings and making the information more useful to end users viewing certification listings.

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2.3 Other Publications.

2.3.1 AATCC Publications.

American Association of Textile Chemists and Colorists, ~~P.O. Box 12215~~ 1 Davis Drive ,
Research Triangle Park, NC 27709, www.aatcc.org.

AATCC 135, *Dimensional Changes of Fabrics After Home Laundering*, ~~2004~~ 2018 .

2.3.2 Aerospace Industries Association Publications.

Aerospace Industries Association, ~~400 Wilson~~ 1000 Wilson Blvd., Suite 1700, Arlington, VA
22209-3928, www.aia-aerospace.org.

NASM 27980, *Fastener, Snap, Style 2* (Regular Wire Spring Clamp Type), ~~1998~~ 2015 .

2.3.3 ANSI/ISEA Publications.

American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036,
www.ansi.org.

ANSI/ISEA Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices*,
~~2010~~ 2015 .

ANSI/ISEA Z89.1, *Industrial Head Protection*, 2014.

2.3.4 ASTM Publications.

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

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, 2011 **201 6** .

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

ASTM D1424, *Standard Test Method for the Tear Resistance of Woven Fabrics by Falling Pendulum (Elmendorf-Type) Apparatus*, 2013 **20 09, editorial change 1, 2015** .

ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, 2011a **201 7, reapproved 2018** .

ASTM D1776/**D1776M** , *Standard Practice for Conditioning Textiles for Testing*, 2008e1 **20 16** .

ASTM D2256/D2256M, *Tensile Properties of Yarns by the Single-Strand Method*, **2010, reapproved 2015** .

ASTM D3787, *Standard Test Method for Bursting Strength of Textiles — Constant-Rate-of-Traverse (CRT) Ball Burst Test*, 2011 **201 6** .

ASTM D4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Tester Method)*, 2012e1 **2012 , reapproved 2016** .

ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*, 2013b **201 5** .

ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, 2008 **20 16** .

ASTM E809, *Standard Test Method for Measuring Photometric Characteristics of Retroreflectors*, **20 08, reapproved 2013** .

ASTM E810, *Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting Utilizing the Coplanar Geometry*, **20 03, reapproved 2013** .

ASTM F1060, *Standard Test Method for Thermal Protective Performance of Materials for Protective Clothing for Hot Surface Contact*, 2008 **20 1 8** .

ASTM F1342/F1342M, *Standard Test Method for Protective Clothing Material Resistance to Puncture*, 2013e1 **2005, editorial change 1, 2013** .

ASTM F1414, *Standard Test Method for Measurement of Cut Resistance to Chain Saw in Lower Body (Legs) Protective Clothing*, 2013 **201 5** .

ASTM F1790/**F1790M** , ~~Standard Test Method~~ *Method for Measuring Cut Resistance of Materials Used in Protective Clothing* , 2005 **With CPP Test Equipment** , **20 1 5** .

ASTM F1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, 2011 **201 7** .

ASTM F1897, *Standard Specification for Leg Protection for Chain Saw Users*, 2014.

ASTM F1939, *Standard Test Method for Radiant Heat Resistance of Flame Resistant Clothing Materials with Continuous Heating*, 2008 **20 15** .

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

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 **201 7** .

2.3.5 EN Publications.

European **British Standard Institution**, BSI, Customer Service, 389 Chiswick High Road, London, W4 4AL, U.K, www.bsigroup.com/en/.

BS EN 471 ISO 20471, *High Visibility Warning Clothing for Professional Use - Visibility - Clothing - Test Methods and Requirements*, 2004, A1:2008, **2013**, **amendment 1, 2016**. (**Supersedes EN 471**)

2.3.6 ISO Publications.

International Organization for Standardization, 4 **Central Secretariat**, ~~ch. de la Voie-Grèuse~~ **Chemin de Blandonnet 8**, **CP** 56, CH-1211 Geneva 20 **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 62, *General requirements for bodies operating assessment and certification/registration of quality systems*, 2008. (**Superseded by ISO/IEC 17021-1**)

ISO 65, *General requirements for bodies operating product certification systems*, 1996. (**Superseded by ISO/IEC 17065**)

ISO 4649, *Rubber vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*, ~~2010~~ **2017**.

ISO 9001, *Quality management systems — requirements*, ~~2008~~ **2015**.

ISO/IEC 17011, *General requirements - R requirements for accreditation bodies accrediting conformity assessment bodies*, ~~2004~~ **2017**.

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

ISO /IEC 17025, *General requirements for the competence of testing and calibration laboratories*, ~~2005~~ **2017**.

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**, **Technical corrigendum 1, 2004**.

2.3.7 U.S. Government Publications – Code of Federal Regulations.

U.S. Government Publishing Office, **732 North Capitol Street NW, Washington**, **DC** - 20402, **20401-0001**, www.access.gpo.gov/nara/cfr/cfr-table-search.html

Title 29, Code of Federal Regulations, Part 1910.132, “Personal Protective Equipment,” 2009.

2.3.8 U.S. Government Publications – Military Specifications and Commercial Item Descriptions.

DLA Document Production Service Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

Commercial Item Description A-A-55126B, *Fastener Tapes, Hook and Loop, Synthetic*, 7 September 2006.

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

Military Specification MIL-DTL-10884H, *Fastener, Snap*, 20 July 2005.

2.3.9 Other Publications.

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

Statement of Problem and Substantiation for Public Input

Referenced current SDO contact information and national consensus standard editions.

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Public Input No. 64-NFPA 1977-2018 [Section No. 2.3.4]

2.3.4 ASTM Publications.

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

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

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

ASTM D1424, *Standard Test Method for the Tear Resistance of Woven Fabrics by Falling Pendulum (Elmendorf-Type) Apparatus*, 2013.

ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, 2011a.

ASTM D1776, *Standard Practice for Conditioning Textiles for Testing*, 2008e1.

ASTM D2256/D2256M, *Tensile Properties of Yarns by the Single-Strand Method*, 2015.

ASTM D3787, *Standard Test Method for Bursting Strength of Textiles — Constant-Rate-of-Traverse (CRT) Ball Burst Test*, 2011.

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

ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*, ~~2013~~ 2015.

ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, 2008.

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

ASTM E810, *Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting Utilizing the Coplanar Geometry*, 2013.

ASTM F1060, *Standard Test Method for Thermal Protective Performance of Materials for Protective Clothing for Hot Surface Contact*, ~~2008~~ 2018.

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

ASTM F1414, *Standard Test Method for Measurement of Cut Resistance to Chain Saw in Lower Body (Legs) Protective Clothing*, 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 F1897, *Standard Specification for Leg Protection for Chain Saw Users*, 2014.

ASTM F1939, *Standard Test Method for Radiant Heat Resistance of Flame Resistant Clothing Materials with Continuous Heating*, ~~2008~~ 2015.

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

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.

Statement of Problem and Substantiation for Public Input

updates dates of some standards associated with flammability or heat resistance

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Public Input No. 42-NFPA 1977-2018 [Section No. 3.3]

3.3* General Definitions.

3.3.1 Brim.

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

3.3.2 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.

3.3.3 Certification Organization.

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

3.3.4 Chain Saw Protectors.

See 3.3.77.

3.3.5 Char.

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

3.3.6 Chin Strap.

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

3.3.7 Cold Weather Outerwear.

See 3.3.80.

3.3.8 Compliance/Compliant.

Meeting or exceeding all applicable requirements of this standard.

3.3.9 Component.

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

3.3.10 Composite.

The layer or layers of materials or components.

3.3.11 Drip.

To run or fall in drops or blobs.

3.3.12 Ease.

The size requirements and tolerance of garments that allows good fit and do not inhibit the natural body movements or the performance of job-related tasks.

3.3.13 Face/Neck Shroud.

See 3.3.82.

3.3.14 Flame Resistance (protective apparel).

The property of a material whereby combustion is prevented, terminated, or inhibited following application of a flaming or non-flaming 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 3.3.29.)

3.3.15 Fluorescence.

A process by which radiant flux of certain wavelengths is absorbed and reradiated non-thermally in other, usually longer, wavelengths.

3.3.16 Follow-Up Program.

The sampling, inspections, 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.

3.3.17 Footwear.

See 3.3.83.

3.3.18 Footwear Upper.

That portion of the footwear element above the sole, heel, and insole.

3.3.19 Garment.

See 3.3.84, Wildland Fire Fighting Protective Garments.

3.3.20 Glove Body.

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

3.3.21 Gloves.

See 3.3.81.

3.3.22 Goggle Clip.

The component of the helmet that retains the strap of the goggle or headlamp.

3.3.23* Goggles.

See 3.3.85.

3.3.24* Gusset.

The relatively flexible material in protective footwear that joins the upper quarter and the tongue to provide expansion when donned.

3.3.25 Hardware.

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

3.3.26 Headform.

A device that simulates the configuration of the human head.

3.3.27 Heel Breast.

The forward face of the footwear heel.

3.3.28 Helmet.

See 3.3.86.

3.3.29 Inherent Flame Resistance.

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

3.3.30 Insole.

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

3.3.31 Interlining.

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

3.3.32 Jacket.

See 3.3.87.

3.3.33 Lining.

Any material that is used to cover or partially cover the inside surface area of a protective garment.

3.3.34 Load-Carrying Equipment.

See 3.3.78.

3.3.35 Lower Torso.

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

3.3.36 Manufacturer.

The entity that directs and controls 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.

3.3.37 Melt.

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

3.3.38 Nape Device.

A component used to aid in helmet retention.

3.3.39 Neck Shroud.

See 3.3.82.

3.3.40 One-Piece Garment.

See 3.3.88.

3.3.41 Peak.

The part of the helmet extending forward over the wearer's forehead.

3.3.42* Product Label.

A marking provided by the manufacturer for each compliant product containing compliance statements, certification statements, manufacturer and model information, or similar data.

3.3.43 Protective Clothing and Equipment.

See 3.3.79.

3.3.44 Protective Cold Weather Outerwear.

See 3.3.80.

3.3.45 Protective Driving Gloves.

See 3.3.81.

3.3.46 Protective Face/Neck Shroud.

See 3.3.82.

3.3.47 Protective Footwear.

See 3.3.83.

3.3.48 Protective Garments.

See 3.3.84.

3.3.49 Protective Goggles.

See 3.3.85.

3.3.50 Protective Helmet.

See 3.3.86.

3.3.51 Protective Jacket.

See 3.3.87.

3.3.52 Protective One-Piece Garment.

See 3.3.88.

3.3.53 Protective Shirt.

See 3.3.89.

3.3.54 Protective Trousers.

See 3.3.90.

3.3.55 Protective Work Gloves.

See 3.3.91.

3.3.56 Proximity Fire Fighting.

Specialized fire-fighting operations that can include the activities of rescue, fire suppression, and property conservation at incidents involving fires producing very high levels of radiant heat as well as conductive and convective heat.

3.3.57 Radiant Protective Performance (RPP).

A numerical value indicating the resistance of materials to a radiant heat exposure.

3.3.58 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.

3.3.59 Sample.

(1) The ensemble, element, item, component, or composite that is conditioned for testing. (See also 3.3.65, Specimen.) (2) Ensembles, elements, items, or components that are randomly selected from the manufacturer's production line, from the manufacturer's inventory, or from the open market.

3.3.60 Seams.**3.3.60.1*** Major Seam.

Seam assemblies where rupture exposes the wearer to immediate danger.

3.3.60.2* Minor Seam.

Remaining seam assemblies that are not classified as major seams.

3.3.60.3 Seam Assembly.

The structure obtained when materials are joined by means of a seam.

3.3.61 Separate/Separation.

A material response evidenced by splitting or delaminating.

3.3.62 Shank.

The component of footwear that provides additional support to the instep.

3.3.63 Shirt.

See 3.3.89.

3.3.64 Shroud.

See 3.3.82.

3.3.65 Specimen.

The conditioned ensemble, element, item, or component that is tested. Specimens are taken from samples. (See also 3.3.59.)

3.3.66 Structural Fire Fighting.

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.

3.3.67* Tex.

A direct yarn size system that identifies the weight in grams for 1000 meters of yarn.

3.3.68 Textile Fabric.

A planar structure consisting of yarns or fibers.

3.3.69 Thermal Protective Performance (TPP).

A numerical value indicating the resistance of materials to a convective and radiant heat exposure.

3.3.70* 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.

3.3.71 Top Line.

The top edge of protective footwear that includes the tongue, gusset, quarter, collar, and shaft.

3.3.72 Trim.

See 3.3.75.

3.3.73 Trousers.

See 3.3.90.

3.3.74 Upper Torso.

The area of the body trunk above the waist and extending to the shoulder, excluding the arms, wrists, and hands.

New 3.3. xx Urban Interface Fire Fighting .

Activities of fire suppression and property conservation within areas of housing and other structures/improvements that are either intermingled or abut vegetation or forest.

3.3. 75 Visibility Markings.

Retroreflective and fluorescent conspicuity enhancements. Retroreflective enhancements improve night time conspicuity, and fluorescent enhancements improve day time conspicuity.

3.3.76 Wildland Fire Fighting.

The activities of fire suppression and property conservation in woodlands, forests, grasslands, brush, prairies, and other such vegetation, or any combination of vegetation, that is involved in a fire situation but is not within buildings or structures.

3.3.77 Wildland Fire Fighting Chain Saw Protectors.

The items of protective equipment that provide protection to the legs, or to the lower torso and legs, excluding the ankles and feet.

3.3.78 Wildland Fire Fighting Load-Carrying Equipment.

The item of equipment worn by the wildland fire fighter to facilitate the carrying of gear.

3.3.79* Wildland Fire Fighting Protective Clothing and Equipment.

Items of compliant protective clothing and equipment products that provide protection from some risks, but not all risks, of emergency incident operations.

3.3.80 Wildland Fire Fighting Protective Cold Weather Outerwear.

Items of protective clothing that provide protection to the upper or lower torso, arms, and legs to provide insulation for warmth of the wearer during cold weather.

3.3.81 Wildland Fire Fighting Protective Driving Gloves.

The items of protective clothing that provide protection to the hands and wrists, and dexterity and grip to the hands that is critical to operating fire fighting vehicles and special equipment during wildland fire fighting operations.

3.3.82 Wildland Fire Fighting Protective Face/Neck Shroud.

Items of protective clothing that provide protection to the face and neck area.

3.3.83 Wildland Fire Fighting Protective Footwear.

Items of protective clothing that provide protection to the foot, ankle, and lower leg.

3.3.84* Wildland Fire Fighting Protective Garments.

Items of protective clothing that provide protection to the wearer's upper or lower torso, excluding the hands, face, and feet.

3.3.85* Wildland Fire Fighting Protective Goggle.

The items of protective equipment that provide protection to the eyes and a portion of the face.

3.3.86 Wildland Fire Fighting Protective Helmet.

Items of protective equipment that provide protection to the head.

3.3.87 Wildland Fire Fighting Protective Jacket.

The protective outer garment item that provides protection to the upper torso and arms, excluding the hands and head.

3.3.88 Wildland Fire Fighting Protective One-Piece Garment.

The single-piece protective garment item that provides protection to the upper and lower torso, arms, and legs, excluding the head, hands, and feet.

3.3.89 Wildland Fire Fighting Protective Shirt.

A protective garment item that provides protection to the upper torso and arms, excluding the head and hands.

3.3.90 Wildland Fire Fighting Protective Trousers.

The protective garment items that provide protection to the lower torso and legs, excluding the feet.

3.3.91 Wildland Fire Fighting Protective Work Gloves.

The items of protective clothing that provide protection to the hands and wrists while directly engaged in wildland fire fighting operations.

New 3.3. xx Wildland/Urban Interface (WUI).

The line or zone where structures and other development meet or intermingle with undeveloped wildland or vegetative fuels and the area within or adjacent to private and public property where mitigation actions can prevent damage or loss from wildfire.

New 3.3.xx Wildland/Urban Interface Fire Fighting.

See new 3.3.xx Urban Interface Fire Fighting.

3.3.92 Winter Liner.

An optional component layer that provides added insulation against cold.

Statement of Problem and Substantiation for Public Input

The definition for "Wildland/Urban Interface (WUI)" is from NFPA 1710.

"Urban Interface Fire Fighting" and "Wildland/Urban Interface Fire Fighting" are important to bring the standard into the current environment in which fire fighters face potential exposure.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 41-NFPA 1977-2018 [Global Input]</u>	

Submitter Information Verification

Submitter Full Name: Rick Swan
Organization: International Association of Fire Fighters
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Zip:
Submittal Date: Thu Oct 25 10:14:15 EDT 2018
Committee: FAE-WFF



Public Input No. 57-NFPA 1977-2018 [New Section after 3.3.36]

Manufacturing Facility.

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

Statement of Problem and Substantiation for Public Input

The use of the term manufacturer is inconsistent throughout the document.

In previous revisions of the standard, the definition for manufacturer was expanded to include all entities that require ISO 9001 registration. However, this expanded definition was not appropriate for the remaining uses of the term manufacturer within the document. Therefore, a more succinct definition for manufacturer is proposed while 4.5.3 was expanded to clarify which entities are required to have ISO 9001.

Also the current term manufacturer is used to describe the warrantee/liability function as well as the actual assembly function. This can lead to confusion and misinterpretation of the requirements in chapter 4. Therefore a new definition of manufacturing facility was added to distinguish between the terms manufacturer and manufacturing facility and to distinguish between these two functions.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 56-NFPA 1977-2018 [Section No. 3.3.36]</u>	
<u>Public Input No. 59-NFPA 1977-2018 [Section No. 4.2.9 [Excluding any Sub-Sections]]</u>	
<u>Public Input No. 60-NFPA 1977-2018 [Section No. 4.2.9.1]</u>	

Submitter Information Verification

Submitter Full Name: Steven Corrado
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Submittal Date: Wed Dec 19 08:39:58 EST 2018
Committee: FAE-WFF



Public Input No. 56-NFPA 1977-2018 [Section No. 3.3.36]

3.3.36 Manufacturer.

The entity that ~~directs and controls 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.~~

Statement of Problem and Substantiation for Public Input

The use of the term manufacturer is inconsistent throughout the document.

In previous revisions of the standard, the definition for manufacturer was expanded to include all entities that require ISO 9001 registration. However, this expanded definition was not appropriate for the remaining uses of the term manufacturer within the document. Therefore, a more succinct definition for manufacturer is proposed while 4.5.3 was expanded to clarify which entities are required to have ISO 9001.

Also the current term manufacturer is used to describe the warrantee/liability function as well as the actual assembly function. This can lead to confusion and misinterpretation of the requirements in chapter 4. Therefore a new definition of manufacturing facility was added to distinguish between the terms manufacturer and manufacturing facility and to distinguish between these two functions.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 57-NFPA 1977-2018 [New Section after 3.3.36]</u>	
<u>Public Input No. 58-NFPA 1977-2018 [Section No. 3.3.59]</u>	
<u>Public Input No. 61-NFPA 1977-2018 [Section No. 4.5.3 [Excluding any Sub-Sections]]</u>	

Submitter Information Verification

Submitter Full Name: Steven Corrado
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Submittal Date: Wed Dec 19 08:36:13 EST 2018
Committee: FAE-WFF



Public Input No. 58-NFPA 1977-2018 [Section No. 3.3.59]

3.3.59 Sample.

(1) The ensemble, element, item, component, or composite that is conditioned for testing. (See also 3.3.65, Specimen.) (2) Ensembles, elements, items, or components that are randomly selected from the ~~manufacturer manufacturing facility's production~~ production line, from the manufacturer's or manufacturing facility's inventory, or from the open market.

Statement of Problem and Substantiation for Public Input

Adding definition to be consist with other documents in the project and to allow for the consistent application of requirements.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 56-NFPA 1977-2018 [Section No. 3.3.36]</u>	

Submitter Information Verification

Submitter Full Name: Steven Corrado
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Submittal Date: Wed Dec 19 08:45:36 EST 2018
Committee: FAE-WFF



Public Input No. 59-NFPA 1977-2018 [Section No. 4.2.9 [Excluding any Sub-Sections]]

The certification organization shall have a follow-up inspection program of the ~~manufacturer's~~ 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~~ 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.X.

Statement of Problem and Substantiation for Public Input

The use of the term manufacturer is inconsistent throughout the document.

In previous revisions of the standard, the definition for manufacturer was expanded to include all entities that require ISO 9001 registration. However, this expanded definition was not appropriate for the remaining uses of the term manufacturer within the document. Therefore, a more succinct definition for manufacturer is proposed while 4.5.3 was expanded to clarify which entities are required to have ISO 9001.

Also the current term manufacturer is used to describe the warrantee/liability function as well as the actual assembly function. This can lead to confusion and misinterpretation of the requirements in chapter 4. Therefore a new definition of manufacturing facility was added to distinguish between the terms manufacturer and manufacturing facility and to distinguish between these two functions.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 57-NFPA 1977-2018 [New Section after 3.3.36]</u>	

Submitter Information Verification

Submitter Full Name: Steven Corrado
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Submittal Date: Wed Dec 19 08:49:09 EST 2018
Committee: FAE-WFF



Public Input No. 60-NFPA 1977-2018 [Section No. 4.2.9.1]

4.2.9.1

As part of the follow-up inspection program, the certification organization shall select sample compliant product at random from ~~the manufacturer's~~ the manufacturing facility's production line, from the ~~manufacturer's~~ manufacturer's or manufacturing facility's in-house stock, or from the open market.

Statement of Problem and Substantiation for Public Input

The use of the term manufacturer is inconsistent throughout the document.

In previous revisions of the standard, the definition for manufacturer was expanded to include all entities that require ISO 9001 registration. However, this expanded definition was not appropriate for the remaining uses of the term manufacturer within the document. Therefore, a more succinct definition for manufacturer is proposed while 4.5.3 was expanded to clarify which entities are required to have ISO 9001.

Also the current term manufacturer is used to describe the warrantee/liability function as well as the actual assembly function. This can lead to confusion and misinterpretation of the requirements in chapter 4. Therefore a new definition of manufacturing facility was added to distinguish between the terms manufacturer and manufacturing facility and to distinguish between these two functions.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 57-NFPA 1977-2018 [New Section after 3.3.36]</u>	

Submitter Information Verification

Submitter Full Name: Steven Corrado
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Submittal Date: Wed Dec 19 08:50:51 EST 2018
Committee: FAE-WFF



Public Input No. 61-NFPA 1977-2018 [Section No. 4.5.3 [Excluding any Sub-Sections]]

~~The manufacturer shall-~~

All of the following entities shall either be registered to ISO 9001, *Quality management systems*

=

requirements

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

Statement of Problem and Substantiation for Public Input

The use of the term manufacturer is inconsistent throughout the document.

In previous revisions of the standard, the definition for manufacturer was expanded to include all entities that require ISO 9001 registration. However, this expanded definition was not appropriate for the remaining uses of the term manufacturer within the document. Therefore, a more succinct definition for manufacturer is proposed while 4.5.3 was expanded to clarify which entities are required to have ISO 9001.

Also the current term manufacturer is used to describe the warrantee/liability function as well as the actual assembly function. This can lead to confusion and misinterpretation of the requirements in chapter 4. Therefore a new definition of manufacturing facility was added to distinguish between the terms manufacturer and manufacturing facility and to distinguish between these two functions.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 56-NFPA 1977-2018 [Section No. 3.3.36]</u>	
<u>Public Input No. 62-NFPA 1977-2018 [Section No. 4.5.4]</u>	

Submitter Information Verification

Submitter Full Name: Steven Corrado
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Committee: FAE-WFF



Public Input No. 62-NFPA 1977-2018 [Section No. 4.5.4]

4.5.4 * –

~~Any entity that meets the definition of manufacturer as specified in Section 3.3, and therefore is considered to be the “manufacturer,” but does not manufacture or assemble the compliant product, shall meet the requirements specified in Section 4.5.~~

Statement of Problem and Substantiation for Public Input

Section is redundant if PI 61 is accepted. Now covered under 4.5.3.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 61-NFPA 1977-2018 [Section No. 4.5.3 [Excluding any Sub-Sections]]</u>	
<u>Public Input No. 63-NFPA 1977-2018 [Section No. A.4.5.4]</u>	

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Committee: FAE-WFF



Public Input No. 8-NFPA 1977-2017 [Section No. 5.1.1.4]

5.1.1.4*

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 (3/32 in.) high. The label, symbol, or identifying mark shall be at least 6 mm (1/4 in.) in height and shall be placed in a conspicuous location.

Statement of Problem and Substantiation for Public Input

All clothing and equipment label lettering height requirements were reviewed by a Correlating Committee task group. Based on the findings, the lettering heights in these proposals are being proposed project wide.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

Organization: Lion Group Inc

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Submittal Date: Fri Jun 23 12:53:57 EDT 2017

Committee:



Public Input No. 9-NFPA 1977-2017 [Section No. 5.2.1.4]

5.2.1.4*

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 (3/32 in.) high. The label, symbol, or identifying mark shall be at least 6 mm (1/4 in.) in height and shall be placed in a conspicuous location.

Statement of Problem and Substantiation for Public Input

All clothing and equipment label lettering height requirements were reviewed by a Correlating Committee task group. Based on the findings, the lettering heights in these proposals are being proposed project wide.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Fri Jun 23 13:00:01 EDT 2017
Committee:



Public Input No. 10-NFPA 1977-2017 [Section No. 5.3.1.4]

5.3.1.4*

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 (3/32 in.) high. The label, symbol, or identifying mark shall be at least 6 mm (1/4 in.) in height and shall be placed in a conspicuous location.

Statement of Problem and Substantiation for Public Input

All clothing and equipment label lettering height requirements were reviewed by a Correlating Committee task group. Based on the findings, the lettering heights in these proposals are being proposed project wide.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

Organization: Lion Group Inc

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Submittal Date: Fri Jun 23 13:02:19 EDT 2017

Committee:



Public Input No. 11-NFPA 1977-2017 [Section No. 5.4.1.4]

5.4.1.4*

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 (3/32 in.) high. The label, symbol, or identifying mark shall be at least 6 mm (1/4 in.) in height and shall be placed in a conspicuous location.

Statement of Problem and Substantiation for Public Input

All clothing and equipment label lettering height requirements were reviewed by a Correlating Committee task group. Based on the findings, the lettering heights in these proposals are being proposed project wide.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

Organization: Lion Group Inc

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Submittal Date: Fri Jun 23 13:04:14 EDT 2017

Committee:



Public Input No. 12-NFPA 1977-2017 [Section No. 5.5.1.4]

5.5.1.4*

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 (3/32 in.) high. The label, symbol, or identifying mark shall be at least 6 mm (1/4 in.) in height and shall be placed in a conspicuous location.

Statement of Problem and Substantiation for Public Input

All clothing and equipment label lettering height requirements were reviewed by a Correlating Committee task group. Based on the findings, the lettering heights in these proposals are being proposed project wide.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

Organization: Lion Group Inc

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Submittal Date: Fri Jun 23 13:06:11 EDT 2017

Committee:



Public Input No. 13-NFPA 1977-2017 [Section No. 5.6.1.4]

5.6.1.4*

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 (3/32 in.) high. The label, symbol, or identifying mark shall be at least 6 mm (1/4 in.) in height and shall be placed in a conspicuous location.

Statement of Problem and Substantiation for Public Input

All clothing and equipment label lettering height requirements were reviewed by a Correlating Committee task group. Based on the findings, the lettering heights in these proposals are being proposed project wide.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

Organization: Lion Group Inc

Street Address:

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State:

Zip:

Submittal Date: Fri Jun 23 13:08:00 EDT 2017

Committee:



Public Input No. 14-NFPA 1977-2017 [Section No. 5.7.1.4]

5.7.1.4*

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 (3/32 in.) high. The label, symbol, or identifying mark shall be at least 6 mm (1/4 in.) in height and shall be placed in a conspicuous location.

Statement of Problem and Substantiation for Public Input

All clothing and equipment label lettering height requirements were reviewed by a Correlating Committee task group. Based on the findings, the lettering heights in these proposals are being proposed project wide.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

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Submittal Date: Fri Jun 23 13:09:44 EDT 2017

Committee:



Public Input No. 15-NFPA 1977-2017 [Section No. 5.8.1.4]

5.8.1.4*

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 (3/32 in.) high. The label, symbol, or identifying mark shall be at least 6 mm (1/4 in.) in height and shall be placed in a conspicuous location.

Statement of Problem and Substantiation for Public Input

All clothing and equipment label lettering height requirements were reviewed by a Correlating Committee task group. Based on the findings, the lettering heights in these proposals are being proposed project wide.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Fri Jun 23 13:11:24 EDT 2017
Committee:



Public Input No. 16-NFPA 1977-2017 [Section No. 5.9.1.4]

5.9.1.4*

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 (3/32 in.) high. The label, symbol, or identifying mark shall be at least 6 mm (1/4 in.) in height and shall be placed in a conspicuous location.

Statement of Problem and Substantiation for Public Input

All clothing and equipment label lettering height requirements were reviewed by a Correlating Committee task group. Based on the findings, the lettering heights in these proposals are being proposed project wide.

Submitter Information Verification

Submitter Full Name: Karen Lehtonen

Organization: Lion Group Inc

Street Address:

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Zip:

Submittal Date: Fri Jun 23 13:12:47 EDT 2017

Committee:



Public Input No. 17-NFPA 1977-2017 [Section No. 6.1.14.3]

A large, empty rectangular box with a thin border, intended for public input or comments.

6.1.14.3

Manufacturers shall produce garments in accordance with the minimum sizing requirements indicated in Table 6.1.14.3(a), Table 6.1.14.3(b), Table 6.1.14.3(c), and Table 6.1.14.3(d).

Table 6.1.14.3(a) Minimum Sizing Requirements for Protective Upper Torso Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>						<u>Amount of Change†</u>
	<u>XS</u>	<u>S</u>	<u>M</u>	<u>L</u>	<u>XL</u>	<u>2XL</u>	
Collar length (A)	14 ³ / ₄	15 ³ / ₄	16 ³ / ₄	17 ³ / ₄	18 ³ / ₄	19 ³ / ₄	1
Collar width (B)	3	3	3	3	3	3	0
Front length (C)	24 ³ / ₄	25 ³ / ₄	26 ³ / ₄	27 ³ / ₄	28 ³ / ₄	29 ³ / ₄	1
Back length (D)	28	29	30	31	32	33	1
Sleeve length (E)	30 ¹ / ₂	31 ¹ / ₂	32 ¹ / ₂	33 ¹ / ₂	34 ¹ / ₂	35 ¹ / ₂	1
Sleeve cuff circumference (F)	12	12 1/2	13	13 1/2	14	14 1/2	1/2
Chest circumference (G)	39	43	47	51	55	59	4
Waist circumference (H)	33	37	41	45	49	53	4
Bottom circumference (I)	38	42	46	50	54	58	4

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(a).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(b) Minimum Sizing Requirements for Men's Lower Torso Protective Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>26</u>	<u>28</u>	<u>30</u>	<u>32</u>	<u>34</u>	<u>36</u>	<u>38</u>	<u>40</u>	
Waist circumference (A)	26	28	30	32	34	36	38	40	2
Seat circumference (B)	37	39	41	43	45	47	49	51	2
Thigh circumference (C)	25	26	27	28	29	30	31	32	1
Knee circumference (D)	17 ¹ / ₂	18 ¹ / ₄	19	19 ³ / ₄	20 ¹ / ₂	21 ¹ / ₄	22	22 ³ / ₄	3/4
Leg cuff circumference (E)	15 ¹ / ₂	16	16 ¹ / ₂	17	17 ¹ / ₂	18	18 ¹ / ₂	19	1/2
Front rise (F)	9 ⁷ / ₈	10 ³ / ₁₆	10 ¹ / ₂	10 ¹³ / ₁₆	11 ¹ / ₈	11 ⁷ / ₁₆	11 ³ / ₄	12 ¹ / ₁₆	5/16
Back rise (G)	15 ³ / ₈	15 ¹¹ / ₁₆	16	16 ⁵ / ₁₆	16 ⁵ / ₈	16 ¹⁵ / ₁₆	17 ¹ / ₄	17 ⁹ / ₁₆	5/16
Inseam length (H)	Cut to order or provided in 1 in. increments between 28 and 36 in.								-

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(c) Minimum Sizing Requirements for Women's Lower Torso Protective Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>23</u>	<u>25</u>	<u>27</u>	<u>29</u>	<u>31</u>	<u>33</u>	<u>35</u>	<u>37</u>	
Waist circumference (A)	23	25	27	29	31	33	35	37	2

Dimension Measured*	Garment Size								Amount of Change†
	23	25	27	29	31	33	35	37	
Seat circumference (B)	37	39	41	43	45	47	49	51	2
Thigh circumference (C)	25	26	27	28	29	30	31	32	1
Knee circumference (D)	17½	18¼	19	19¾	20½	21¼	22	22¾	¾
Leg cuff circumference (E)	15½	16	16½	17	17½	18	18½	19	½
Front rise (F)	9 8 7/8	10 9 3/16	10 9 1/2	10 9 13/16	11 10 1/8	11 10 7/16	11 10 3/4	12 11 1/16	5/16
Back rise (G)	14 14 11/16	15 15 1/16	15 15 5/16	16 15 5/8	16 15 5/8	16 15 15/16	17 16 1/4	17 16 9/16	5/16
Inseam length (H)	Cut to order or provided in 1 in. increments between 28 and 36 in.								-

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(d) Minimum Sizing Requirements for Protective One-Piece Garments (in.)

Dimension Measured*	Garment Size					Amount of Change†
	XS	S	M	L	XL	
Collar length (A)	14¾	15¾	16¾	17¾	18¾	1
Collar width (B)	3	3	3	3	3	0
Sleeve length (C)	30½	31½	32½	33½	34½	1
Sleeve cuff circumference (D)	12½	13	13½	14	14½	½
Chest circumference (E)	32	36	40	44	48	4
Seat circumference (F)	37	41	45	49	53	4
Thigh circumference (G)	25	27	29	31	33	2
Knee circumference (H)	17½	19	20½	22	23½	1½
Leg cuff circumference (I)	17½	18½	19½	20½	21½	1
Vertical circumference (J)	-	-	-	-	-	-
S (short size)	—	—	69	71½	74	—
R (regular size)	63½	63½	71	73½	76	—
T (tall size)	65½	65½	73	75½	78	—
Height range	-	-	-	-	-	-
S (short size)	—	—	64–67	—	—	—
R (regular size)	63–66	—	67½–72	—	—	—
T (tall size)	66½–69	—	72½–75	—	—	—

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(c).

†The amount of change between two consecutive garment sizes for the dimension measured.

Statement of Problem and Substantiation for Public Input

By reducing the minimum size requirements of the front and back rise on Women's Lower Torso Protective Garments, manufacturers will be able to supply women wildland firefighters with a better fitting garment. CrewBoss has received numerous requests from women firefighters to develop a pant that fits their body types. The most common criticism of the currently available certified pants is that the rise is too long which results in comfort and mobility issues. CrewBoss had collected end user feedback to substantiate this claim and has conducted wear trials of prototype pants to determine the appropriate revision. From our findings, it has been determined that reducing the current front and back rise minimum measurements by 1" each will resolve these issues.

Submitter Information Verification

Submitter Full Name: Jeff Yee

Organization: CrewBoss / Western Shelter Systems

Street Address:

City:

State:

Zip:

Submittal Date: Wed Aug 16 12:24:58 EDT 2017

Committee:



Public Input No. 29-NFPA 1977-2018 [Section No. 6.1.14.3]

6.1.14.3

Manufacturers shall produce garments in accordance with the minimum sizing requirements indicated in Table 6.1.14.3(a), Table 6.1.14.3(b), Table 6.1.14.3(c), and Table 6.1.14.3(d).

Table 6.1.14.3(a) Minimum Sizing Requirements for Protective Upper Torso Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>						<u>Amount of Change†</u>
	<u>XS</u>	<u>S</u>	<u>M</u>	<u>L</u>	<u>XL</u>	<u>2XL</u>	
Collar length (A)	14 ³ / ₄	15 ³ / ₄	16 ³ / ₄	17 ³ / ₄	18 ³ / ₄	19 ³ / ₄	1
Collar width (B)	3	3	3	3	3	3	0
Front length (C)	24 ³ / ₄	25 ³ / ₄	26 ³ / ₄	27 ³ / ₄	28 ³ / ₄	29 ³ / ₄	1
Back length (D)	28	29	30	31	32	33	1
Sleeve length (E)	30 ¹ / ₂	31 ¹ / ₂	32 ¹ / ₂	33 ¹ / ₂	34 ¹ / ₂	35 ¹ / ₂	1
Sleeve cuff circumference (F)	12	12 ¹ / ₂	13	13 ¹ / ₂	14	14 ¹ / ₂	¹ / ₂
Chest circumference (G)	39	43	47	51	55	59	4
Waist circumference (H)	33	37	41	45	49	53	4
Bottom circumference (I)	38	42	46	50	54	58	4

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(a).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(b) Minimum Sizing Requirements for Men's Lower Torso Protective Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>26</u>	<u>28</u>	<u>30</u>	<u>32</u>	<u>34</u>	<u>36</u>	<u>38</u>	<u>40</u>	
Waist circumference (A)	26	28	30	32	34	36	38	40	2
Seat circumference (B)	37	39	41	43	45	47	49	51	2
Thigh circumference (C)	25	26	27	28	29	30	31	32	1
Knee circumference (D)	17 ¹ / ₂	18 ¹ / ₄	19	19 ³ / ₄	20 ¹ / ₂	21 ¹ / ₄	22	22 ³ / ₄	³ / ₄
Leg cuff circumference (E)	15 ¹ / ₂	16	16 ¹ / ₂	17	17 ¹ / ₂	18	18 ¹ / ₂	19	¹ / ₂
Front rise (F)	9 ⁷ / ₈	10 ³ / ₁₆	10 ¹ / ₂	10 ¹³ / ₁₆	11 ¹ / ₈	11 ⁷ / ₁₆	11 ³ / ₄	12 ¹ / ₁₆	⁵ / ₁₆
Back rise (G)	15 ³ / ₈	15 ¹¹ / ₁₆	16	16 ⁵ / ₁₆	16 ⁵ / ₈	16 ¹⁵ / ₁₆	17 ¹ / ₄	17 ⁹ / ₁₆	⁵ / ₁₆
Inseam length (H)	Cut to order or provided in 1 in. increments between 28 and 36 in.								

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(c) Minimum Sizing Requirements for Women's Lower Torso Protective Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>23</u>	<u>25</u>	<u>27</u>	<u>29</u>	<u>31</u>	<u>33</u>	<u>35</u>	<u>37</u>	
Waist circumference (A)	23	25	27	29	31	33	35	37	2
Seat circumference (B)	37	39	41	43	45	47	49	51	2

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>23</u>	<u>25</u>	<u>27</u>	<u>29</u>	<u>31</u>	<u>33</u>	<u>35</u>	<u>37</u>	
Thigh circumference (C)	25	26	27	28	29	30	31	32	1
Knee circumference (D)	17½	18¼	19	19¾	20½	21¼	22	22¾	¾
Leg cuff circumference (E)	15½	16	16½	17	17½	18	18½	19	½
Front rise (F)	9⅞	10¾	10½	10¾	11⅞	11¾	11¾	12¼	⅝
Back rise (G)	15¾	15¾	16	16⅝	16⅝	16¾	17¼	17¾	⅝
Inseam length (H)	Cut to order or provided in 1 in. increments between 28 and 36 in.								

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(d) Minimum Sizing Requirements for Protective One-Piece Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>					<u>Amount of Change†</u>
	<u>XS</u>	<u>S</u>	<u>M</u>	<u>L</u>	<u>XL</u>	
Collar length (A)	14¾	15¾	16¾	17¾	18¾	1
Collar width (B)	3	3	3	3	3	0
Sleeve length (C)	30½	31½	32½	33½	34½	1
Sleeve cuff circumference (D)	12½	13	13½	14	14½	½
Chest circumference (E)	32	36	40	44	48	4
Seat circumference (F)	37	41	45	49	53	4
Thigh circumference (G)	25	27	29	31	33	2
Knee circumference (H)	17½	19	20½	22	23½	1½
Leg cuff circumference (I)	17½	18½	19½	20½	21½	1
Vertical circumference (J)						
S (short size)	—	—	69	71½	74	—
R (regular size)	63½	63½	71	73½	76	—
T (tall size)	65½	65½	73	75½	78	—
Height range						
S (short size)	—	—	64–67	—	—	—
R (regular size)	63–66	—	67½–72	—	—	—
T (tall size)	66½–69	—	72½–75	—	—	—

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(c).

†The amount of change between two consecutive garment sizes for the dimension measured.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA.docx	Written comments on NFPA women's sizing and ease specifications	

Statement of Problem and Substantiation for Public Input

Countless women, myself included, have had to “make do” with ill-fitting Nomex pants. Many women in wildland fire are being told “just make it work” or worse “suck it up.” We wouldn’t tell someone to “make it work” or “suck it up” with an ill-fitting flight helmet. Men’s fit, women’s NFPA 1977 fit, and even what are classified as “Unisex” pants are notorious for the crotch hanging down which causes chafing and often results in women having to free up a hand to pull the pants up while scrambling over logs and rocks, while having to climb up on engines or other trucks, etc. It’s not just the size of the waist or inseam but the overall cut and fit that are problematic. The only women’s specific wildland nomex pants being made do meet NFPA 1977 specs because they were manufactured based on real women’s bodies. Many women find these pants much more comfortable and professional looking, however we cannot use USFS funds to purchase pants that are not NFPA 1977 compliant.

Many women are buying non-compliant Nomex pants, from Cascade and others, out of their own pocket because we cannot use federal funds on non-compliant pants. One young woman asked “If I got hurt and they found out I wasn’t wearing NFPA 1977 compliant pants would the government withhold benefits from me or my family?” That is a real concern, and I cannot assure this woman that the answer would be “no.” Other women are saying things like “Isn’t this just the most fitting thing ever for women in fire? We don’t just have to deal with all the other BS, but it is literally not legal for us to buy and wear PPE that fits us. I can’t think of a better subtle way to keep women out (of fire) than that.” Don’t we want ALL of our wildland firefighters to have the best gear and to feel they’re worthy of that?

Submitter Information Verification

Submitter Full Name: Riva Duncan
Organization: US Forest Service
Affiliation: Umpqua National Forest, Roseburg BLM, Coos Bay BLM (Oregon)
Street Address:
City:
State:
Zip:
Submittal Date: Fri Apr 27 17:02:50 EDT 2018
Committee:



Public Input No. 32-NFPA 1977-2018 [Section No. 6.1.14.3]

6.1.14.3

Manufacturers shall produce garments in accordance with the minimum sizing requirements indicated in Table 6.1.14.3(a), Table 6.1.14.3(b), Table 6.1.14.3(c), and Table 6.1.14.3(d).

Table 6.1.14.3(a) Minimum Sizing Requirements for Protective Upper Torso Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>						<u>Amount of Change†</u>
	<u>XS</u>	<u>S</u>	<u>M</u>	<u>L</u>	<u>XL</u>	<u>2XL</u>	
Collar length (A)	14 ³ / ₄	15 ³ / ₄	16 ³ / ₄	17 ³ / ₄	18 ³ / ₄	19 ³ / ₄	1
Collar width (B)	3	3	3	3	3	3	0
Front length (C)	24 ³ / ₄	25 ³ / ₄	26 ³ / ₄	27 ³ / ₄	28 ³ / ₄	29 ³ / ₄	1
Back length (D)	28	29	30	31	32	33	1
Sleeve length (E)	30 ¹ / ₂	31 ¹ / ₂	32 ¹ / ₂	33 ¹ / ₂	34 ¹ / ₂	35 ¹ / ₂	1
Sleeve cuff circumference (F)	12	12 ¹ / ₂	13	13 ¹ / ₂	14	14 ¹ / ₂	¹ / ₂
Chest circumference (G)	39	43	47	51	55	59	4
Waist circumference (H)	33	37	41	45	49	53	4
Bottom circumference (I)	38	42	46	50	54	58	4

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(a).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(b) Minimum Sizing Requirements for Men's Lower Torso Protective Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>26</u>	<u>28</u>	<u>30</u>	<u>32</u>	<u>34</u>	<u>36</u>	<u>38</u>	<u>40</u>	
Waist circumference (A)	26	28	30	32	34	36	38	40	2
Seat circumference (B)	37	39	41	43	45	47	49	51	2
Thigh circumference (C)	25	26	27	28	29	30	31	32	1
Knee circumference (D)	17 ¹ / ₂	18 ¹ / ₄	19	19 ³ / ₄	20 ¹ / ₂	21 ¹ / ₄	22	22 ³ / ₄	³ / ₄
Leg cuff circumference (E)	15 ¹ / ₂	16	16 ¹ / ₂	17	17 ¹ / ₂	18	18 ¹ / ₂	19	¹ / ₂
Front rise (F)	9 ⁷ / ₈	10 ³ / ₁₆	10 ¹ / ₂	10 ¹³ / ₁₆	11 ¹ / ₈	11 ⁷ / ₁₆	11 ³ / ₄	12 ¹ / ₁₆	⁵ / ₁₆
Back rise (G)	15 ³ / ₈	15 ¹¹ / ₁₆	16	16 ⁵ / ₁₆	16 ⁵ / ₈	16 ¹⁵ / ₁₆	17 ¹ / ₄	17 ⁹ / ₁₆	⁵ / ₁₆
Inseam length (H)	Cut to order or provided in 1 in. increments between 28 and 36 in.								

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(c) Minimum Sizing Requirements for Women's Lower Torso Protective Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>23</u>	<u>25</u>	<u>27</u>	<u>29</u>	<u>31</u>	<u>33</u>	<u>35</u>	<u>37</u>	
Waist circumference (A)	23	25	27	29	31	33	35	37	2
Seat circumference (B)	37	39	41	43	45	47	49	51	2

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>23</u>	<u>25</u>	<u>27</u>	<u>29</u>	<u>31</u>	<u>33</u>	<u>35</u>	<u>37</u>	
Thigh circumference (C)	25	26	27	28	29	30	31	32	1
Knee circumference (D)	17½	18¼	19	19¾	20½	21¼	22	22¾	¾
Leg cuff circumference (E)	15½	16	16½	17	17½	18	18½	19	½
Front rise (F)	9⅞	10¾	10½	10¾	11⅞	11¾	11¾	12¼	⅕
Back rise (G)	15 ⅜	15 ⅞	16	16 ⅞	16 ⅞	16 ⅞	17¼	17 ⅞	⅕
Inseam length (H)	Cut to order or provided in 1 in. increments between 28 and 36 in.								

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(d) Minimum Sizing Requirements for Protective One-Piece Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>					<u>Amount of Change†</u>
	<u>XS</u>	<u>S</u>	<u>M</u>	<u>L</u>	<u>XL</u>	
Collar length (A)	14¾	15¾	16¾	17¾	18¾	1
Collar width (B)	3	3	3	3	3	0
Sleeve length (C)	30½	31½	32½	33½	34½	1
Sleeve cuff circumference (D)	12½	13	13½	14	14½	½
Chest circumference (E)	32	36	40	44	48	4
Seat circumference (F)	37	41	45	49	53	4
Thigh circumference (G)	25	27	29	31	33	2
Knee circumference (H)	17½	19	20½	22	23½	1½
Leg cuff circumference (I)	17½	18½	19½	20½	21½	1
Vertical circumference (J)						
S (short size)	—	—	69	71½	74	—
R (regular size)	63½	63½	71	73½	76	—
T (tall size)	65½	65½	73	75½	78	—
Height range						
S (short size)	—	—	64–67	—	—	—
R (regular size)	63–66	—	67½–72	—	—	—
T (tall size)	66½–69	—	72½–75	—	—	—

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(c).

†The amount of change between two consecutive garment sizes for the dimension measured.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA-Feedback_Skelly.docx	Feedback for Women's sizing metrics.	

Statement of Problem and Substantiation for Public Input

Women's specific sizing is necessary because the current specifications provide safety and comfort hazards for women in both structure and wildland fire. Industry has been responding to this need, but because NFPA's standards do not acknowledge women's specific sizing, they may not be officially adopted by federal agencies.

Splitting the current standards into Men's and Women's sizing will allow for official adoption and is simply the right thing to do. Attached are a number of examples of women's size charts to assist in this effort.

Submitter Information Verification

Submitter Full Name: Dana Skelly

Organization: [Not Specified]USDA Forest Service

Street Address:

City:

State:

Zip:

Submittal Date: Sat Apr 28 11:49:22 EDT 2018

Committee:

April 28, 2018

Dear NFPA PPE Standards Team,

We need two sets of sizing measurements, one for men and one for women. I've provided no edits here because what you have in place are the men's.

There is a wealth of information on line regarding the importance of sizing that is gender appropriate. This has been a continuing issue for women in both wildland and structure fire. This is the perfect opportunity for NFPA to modernize and acknowledge this need by providing sizing for both men and women's frames.

For women's sizings, I've included a few options from a variety of retailer's websites below. Please let me know how to continue to support you in making this imperative improvement.

Yours in Service,

Dana Skelly
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TAILORED (*inch*)

	XS		S		M		L		XL		
SIZE	0	2	4	6	8	10	12	14	16	18	20
BACK LENGTH	25	25 1/4	25 1/2	25 3/4	26	26 1/4	26 1/2	26 3/4	27	27 1/4	27 1/2
BUST	35 1/2	36 1/2	37 1/2	38 1/2	39 1/2	40 1/2	42	43 1/2	45	47	49
SWEEP	38	39	40	41	42	43	44 1/2	46	47 1/2	49 1/2	51 1/2

WOMEN'S																					
size	xx-small		x-small		small		medium		large		x-large	1X		2X		3X		4X		5X	
	00	0	2	4	6	8	10	12	14	16	18	16W	18W	20W	22W	24W	26W	28W	30W	32W	34W
bust/ chest	31	32	33	34	35	36	37	38½	40	42	44	44	46	48	50	52	54	56	58	60	62
arm (petite)	26½	27¼	27½	28	28½	28¾	29½	29½	29¾	30¼	30¾	30¼	30¾	31	31¼	31½	31¾	32	32½	32¾	32¾
arm (regular)	28½	29¼	29½	30	30½	30¾	31½	31½	31¾	32¼	32¾	31¼	32½	32½	32¾	33½	33¾	33½	33¾	33¾	33¾
arm (tall)	29½	30¼	30½	31	31½	31¾	32½	32½	32¾	33¼	33¾	--	--	--	--	--	--	--	--	--	--
waist	24½-25½	25½-26½	26½-27½	27½-28½	28½-29½	29½-30½	30½-31½	32-33	33½-34½	35½-36½	37-38½	38-39	40-41	42-43	44-45	46-47	48-49	50½-51½	53½-54½	55½-56½	58-59
hip	34	35	36	37	38	39	40	41½	43	44½	46½	46	48	50	52	54	56	58	60	62	64

Size	XS	S	M	L	XL				
	4	6	8	10	12	14	16	18	20
Bust	34	35	36	37	38 ^{1/2}	40	41 ^{1/2}	43 ^{1/2}	45 ^{1/2}
Natural Waist	26 ^{1/2}	27 ^{1/2}	28 ^{1/2}	29 ^{1/2}	31	32 ^{1/2}	34	36	38
Hips	36 ^{1/2}	37 ^{1/2}	38 ^{1/2}	39 ^{1/2}	41	42 ^{1/2}	44	46	48
Regular Sleeve	30	30 ^{3/8}	30 ^{3/4}	31 ^{1/8}	31 ^{1/2}	31 ^{7/8}	32 ^{1/4}	32 ^{5/8}	33

Size Chart - Women - Tops & Shirts

Sizes 00-18

Size	XXS 00	XXS 0	XS 2	XS 4	S 6	S 8	M 10	M 12	L 14
Bust	31	32	33	34	35	36	37	38 ^{1/2}	40
Regular Arm Length	29 ^{1/4}	29 ^{1/2}	29 ^{7/8}	30 ^{1/8}	30 ^{1/2}	30 ^{3/4}	31	31 ^{3/8}	31 ^{5/8}
Petite Arm Length	27 ^{3/4}	28	28 ^{3/8}	28 ^{5/8}	29	29 ^{1/4}	29 ^{1/2}	29 ^{7/8}	30 ^{1/4}
Tall Arm Length	30 ^{1/4}	30 ^{1/2}	30 ^{7/8}	31 ^{1/8}	31 ^{1/2}	31 ^{3/4}	32	32 ^{3/8}	32 ^{5/8}

Size Chart - Women - Pants & Shorts

Inches | [Centimeters](#)

Sizes 00-18

Size	XXS 00	XXS 0	XS 2	XS 4	S 6	S 8	M 10	M 12	L 14	L 16	XL 18
Waist	24 ^{1/2} - 25 ^{1/2}	25 ^{1/2} - 26 ^{1/2}	26 ^{1/2} - 27 ^{1/2}	27 ^{1/2} - 28 ^{1/2}	28 ^{1/2} - 29 ^{1/2}	29 ^{1/2} - 30 ^{1/2}	30 ^{1/2} - 31 ^{1/2}	32 - 33	33 ^{1/2} - 34 ^{1/2}	35 - 36 ^{1/2}	37 - 38 ^{1/2}
Hips	34	35	36	37	38	39	40	41 ^{1/2}	43	44 ^{1/2}	46 ^{1/2}
Regular Rise	25	25 ^{1/2}	26	26 ^{1/2}	27	27 ^{1/2}	28	28 ^{3/4}	29 ^{1/2}	30 ^{1/4}	31
Petite Rise	24	24 ^{1/2}	25	25 ^{1/2}	26	26 ^{1/2}	27	27 ^{3/4}	28 ^{1/2}	29 ^{1/4}	30
Tall Rise	26	26 ^{1/2}	27	27 ^{1/2}	28	28 ^{1/2}	29	29 ^{3/4}	30 ^{1/2}	31 ^{1/4}	32



Public Input No. 33-NFPA 1977-2018 [Section No. 6.1.14.3]

A large, empty rectangular frame, likely intended for a drawing or image, but currently blank.

6.1.14.3

Manufacturers shall produce garments in accordance with the minimum sizing requirements indicated in Table 6.1.14.3(a), Table 6.1.14.3(b), Table 6.1.14.3(c), and Table 6.1.14.3(d).

Table 6.1.14.3(a) Minimum Sizing Requirements for Protective Upper Torso Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>						<u>Amount of Change†</u>
	<u>XS</u>	<u>S</u>	<u>M</u>	<u>L</u>	<u>XL</u>	<u>2XL</u>	
Collar length (A)	14 ³ / ₄	15 ³ / ₄	16 ³ / ₄	17 ³ / ₄	18 ³ / ₄	19 ³ / ₄	1
Collar width (B)	3	3	3	3	3	3	0
Front length (C)	24 ³ / ₄	25 ³ / ₄	26 ³ / ₄	27 ³ / ₄	28 ³ / ₄	29 ³ / ₄	1
Back length (D)	28	29	30	31	32	33	1
Sleeve length (E)	30 ¹ / ₂	31 ¹ / ₂	32 ¹ / ₂	33 ¹ / ₂	34 ¹ / ₂	35 ¹ / ₂	1
Sleeve cuff circumference (F)	12	12 1/2	13	13 1/2	14	14 1/2	1/2
Chest circumference (G)	39	43	47	51	55	59	4
Waist circumference (H)	33	37	41	45	49	53	4
Bottom circumference (I)	38	42	46	50	54	58	4

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(a).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(b) Minimum Sizing Requirements for Men’s Lower Torso Protective Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>26</u>	<u>28</u>	<u>30</u>	<u>32</u>	<u>34</u>	<u>36</u>	<u>38</u>	<u>40</u>	
Waist circumference (A)	26	28	30	32	34	36	38	40	2
Seat circumference (B)	37	39	41	43	45	47	49	51	2
Thigh circumference (C)	25	26	27	28	29	30	31	32	1
Knee circumference (D)	17 ¹ / ₂	18 ¹ / ₄	19	19 ³ / ₄	20 ¹ / ₂	21 ¹ / ₄	22	22 ³ / ₄	3/4
Leg cuff circumference (E)	15 ¹ / ₂	16	16 ¹ / ₂	17	17 ¹ / ₂	18	18 ¹ / ₂	19	1/2
Front rise (F)	9 ⁷ / ₈	10 ³ / ₁₆	10 ¹ / ₂	10 ¹³ / ₁₆	11 ¹ / ₈	11 ⁷ / ₁₆	11 ³ / ₄	12 ¹ / ₁₆	5/16
Back rise (G)	15 ³ / ₈	15 ¹¹ / ₁₆	16	16 ⁵ / ₁₆	16 ⁵ / ₈	16 ¹⁵ / ₁₆	17 ¹ / ₄	17 ⁹ / ₁₆	5/16
Inseam length (H)	Cut to order or provided in 1 in. increments between 28 and 36 in.								-

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(c) Minimum Sizing Requirements for Women’s Lower Torso Protective Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>
	<u>26</u>	<u>28</u>	<u>30</u>	<u>32</u>	<u>34</u>	<u>36</u>	<u>38</u>	<u>40</u>	
= These should be even #'s as well. =									

<u>Dimension Measured*</u>	<u>Garment Size</u>								<u>Amount of Change†</u>	- <u>These should be even #'s as well.</u>
	<u>23</u>	<u>25</u>	<u>27</u>	<u>29</u>	<u>31</u>	<u>33</u>	<u>35</u>	<u>37</u>		
Waist circumference (A)	23	25	27	29	31	33	35	37	2	
Seat circumference (B)	37	39	41	43	45	47	49	51	2	
Thigh circumference (C)	25	26	27	28	29	30	31	32	1	
Knee circumference (D)	17½	18¼	19	19¾	20½	21¼	22	22¾	¾	
Leg cuff circumference (E)	15½	16	16½	17	17½	18	18½	19	½	
Front rise (F) * <u>This too much. 9 1/2 for size 29 /31is an appropriate fit</u>	9¾	10¾	10½	10¾	11½	11¾	11¾	12¼	5/16	
Back rise (G) * <u>This also need to be modified to match front rise.</u>	15 3/8	15¾	16	16¾	16¾	16¾	17¼	17¾	5/16	
Inseam length (H)	Cut to order or provided in 1 in. increments between 28 and 36 in.								-	

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(d) Minimum Sizing Requirements for Protective One-Piece Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>					<u>Amount of Change†</u>
	<u>XS</u>	<u>S</u>	<u>M</u>	<u>L</u>	<u>XL</u>	
Collar length (A)	14¾	15¾	16¾	17¾	18¾	1
Collar width (B)	3	3	3	3	3	0
Sleeve length (C)	30½	31½	32½	33½	34½	1
Sleeve cuff circumference (D)	12½	13	13½	14	14½	½
Chest circumference (E)	32	36	40	44	48	4
Seat circumference (F)	37	41	45	49	53	4
Thigh circumference (G)	25	27	29	31	33	2
Knee circumference (H)	17½	19	20½	22	23½	1½
Leg cuff circumference (I)	17½	18½	19½	20½	21½	1
Vertical circumference (J)	-	-	-	-	-	-
S (short size)	—	—	69	71½	74	—
R (regular size)	63½	63½	71	73½	76	—
T (tall size)	65½	65½	73	75½	78	—
Height range	-	-	-	-	-	-
S (short size)	—	—	64–67	—	—	—
R (regular size)	63–66	—	67½–72	—	—	—
T (tall size)	66½–69	—	72½–75	—	—	—

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(c).

†The amount of change between two consecutive garment sizes for the dimension measured.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA.docx	Statement to NFPA re: Women's garments	

Statement of Problem and Substantiation for Public Input

The standard sizing of fire pants does not serve many of the women firefighters. I would like to request NFPA update its women's sizing and ease specifications. If the function and material of the garment meets safety and performance standards, sizing should be customizable. Furthermore, if sizing and poor fit is an issue for the wearer, then safety and performance standards cannot be met, and NFPA has failed its customers.

Submitter Information Verification

Submitter Full Name: Ashley Garrison
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Apr 30 08:43:22 EDT 2018
Committee:

RE: NFPA Women's Protective Clothing Specifications
Table 6.1.14.3c and 6.1.14.3(e)

I would like to request NFPA update its women's sizing and ease specifications. If the function and material of the garment meets safety and performance standards, sizing should be customizable. Furthermore, if sizing and poor fit is an issue for the wearer, then safety and performance standards cannot be met, and NFPA has failed its customers.

As a woman, the primary fit failure is the front/back rise along with waist size. The current standard produces a pant with a 'baggy crotch' that is uncomfortable and hinders movement, especially when traveling off-trail.

There are many brands that make job specific clothing for women that fit properly, as well as several fire equipment companies making better fitting women's pants.

I believe NFPA can develop new standards that meet safety and ease considerations AND are more akin to standard sizing and comfort for women.

Thank you.

Ashley Garrison

Forester

Colorado State Forest Service

Woodland Park, CO



Public Input No. 66-NFPA 1977-2019 [Section No. 6.1.14.3]

A large, empty rectangular box with a thin border, intended for public input or comments.

6.1.14.3

Manufacturers shall produce garments in accordance with the minimum sizing requirements indicated in Table 6.1.14.3(a), Table 6.1.14.3(b), Table 6.1.14.3(c), and Table 6.1.14.3(d), and Table 6.1.14.3(e).

Table 6.1.14.3(a) Minimum Sizing Requirements for Women's Protective Upper Torso Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>						
	<u>Regular</u>	<u>Petite</u>	<u>± Tall</u>				
	<u>XS - XL</u>	<u>M - XS - XL</u>	<u>XS - XL</u>	<u>±XL</u>	<u>Amount of Change†</u>		
Collar length - Chest (A)	14 3/4	15 3/4	16 3/4	17 3/4	18 3/4	19 3/4	1
Collar width (B)	3	3	3	3	3	3	0
Front length (C)	24 3/4	25 3/4	26 3/4	27 3/4	28 3/4	29 3/4	1
Back length (D)	28	29	30	31	32	33	1
Sleeve length (E)	30 1/2	31 1/2	32 1/2	33 1/2	34 1/2	35 1/2	1
Sleeve cuff circumference (F)	12	12 1/2	13	13 1/2	14	14 1/2	1/2
Chest circumference (G)	39	43	47	51	55	59	4
Waist circumference (H)	33	37	41	45	49	53	4
Bottom circumference (I)	38	42	46	50	54	58	4

Note: To convert measurements to millimeters, multiply by 25.4.

17 - 26.5	17 - 26.5	17 - 26.5	
Sleeve (B)	21.5 - 29	20.5 - 26	24 - 29
Waist (C)	16 - 25.5	16 - 25.5	16 - 25.5
Total Length (D)	25.5 - 32.5	24 - 31	27 - 34

Note: FLAT measurements in INCHES (shirt measurements NOT body measurements).

*Each company will determine their own grade rules to determine their brands ideal fit.

*Letters in parentheses refer to Figure 6.1.14.7(a).

Table 6.1.14.3(b) Minimum Sizing Requirements for Men's Upper Torso Protective Garments (in.)

<u>Dimension Measured*</u>	<u>Garment Size</u>		
	<u>Regular</u>	<u>Short</u>	<u>Tall</u>
	<u>XS - XL</u>	<u>XS - XL</u>	<u>XS - XL</u>
Chest (A)	15.5 - 27.5	15.5 - 27.5	15.5 - 27.5
Sleeve (B)	22 - 29	20 - 27	24 - 31
Waist (C)	13.5 - 25.5	13.5 - 25.5	13.5 - 25.5
Total Length (D)	24 - 34	22 - 32	26 - 36

Note: FLAT measurements in INCHES (shirt measurements NOT body measurements).

*Each company will determine their own grade rules to determine their brands ideal fit.

*Letters in parentheses refer to Figure 6.1.14.7(a).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(c)

b

c) Minimum Sizing Requirements for

Men's

Women's Lower Torso Protective Garments (in.)

-

Garment Size

-

Dimension Measured*

26

Regular

28

XS - XL

30

Petite

32

XS - XL

34

Tall

36 38 40 Amount of Change† Waist circumference

Note: To convert measurements to millimeters, multiply by 25.4.

XS - XL

Waist (A)

26 28 30 32 34 36 38 40 2 Seat circumference (B) 37 39 41 43 45 47 49 51 2 Thigh circumference (C) 25 26 27 28 29 30 31 32 1 Knee circumference (D) 17 ¹/₂ 18 ¹/₄ 19 19 ³/₄ 20 ¹/₂ 21 ¹/₄ 22 22 ³/₄ ³/₄ Leg cuff circumference (E) 15 ¹/₂ 16 16 ¹/₂ 17 17 ¹/₂ 18 18 ¹/₂ 19 ¹/₂ Front rise (F) 9 ⁷/₈ 10 ³/₁₆ 10 ¹/₂ 10 ¹³/₁₆ 11 ¹/₈ 11 ⁷/₁₆ 11 ³/₄ 12 ¹/₁₆ ⁵/₁₆ Back rise (G) 15 ³/₈ 15 ¹¹/₁₆ 16 16 ⁵/₁₆ 16 ⁵/₈ 16 ¹⁵/₁₆ 17 ¹/₄ 17 ⁹/₁₆ ⁵/₁₆ Inseam length (H) Cut to order or provided in 1 in. increments between 28 and 36 in. -

12.5—20.5	12—20	12.5—20.5	
Seat (B)	17—26	17—26	17—26
Thigh (C)	8.75—16.5	8.5—16	8.75—16.5
Inseam (D)	28—34	26—32	32—34

Note: FLAT measurements in INCHES (pant measurements NOT body measurements)

*Each company will determine their own grade rules to determine their brands ideal fit.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3{

e

d) Minimum Sizing Requirements for Women's

Men's Lower Torso Protective Garments (in.)

-

Garment Size			
-			
Dimension Measured*			
23			
Regular			
25			
XS-XL			
27			
Short			
29			
XS-XL			
34			
Tall			

33 35 37 Amount of Change† Waist circumference

Note: To convert measurements to millimeters, multiply by 25.4.

XS-XL			
-------	--	--	--

Waist (A)

23 25 27 29 31 33 35 37 2 Seat circumference (B) 37 39 41 43 45 47 49 51 2 Thigh circumference (C) 25 26 27 28 29 30 31 32 1 Knee circumference (D) 17 1/2 18 1/4 19 3/4 20 1/2 21 1/4 22 3/4 23 3/4 Leg cuff circumference (E) 15 1/2 16 1/2 17 1/2 18 1/2 19 1/2 Front rise (F) 9 7/8 10 3/16 10 1/2 10 13/16 11 1/8 11 7/16 11 3/4 12 1/16 5/16 Back rise (G) 15 3/8 15 11/16 16 5/16 16 5/8 16 15/16 17 1/4 17 9/16 5/16 Inseam length (H) Cut to order or provided in 1 in. increments between 28 and 36 in. -

10-22	10-22	10-22	
Seat (B)	17-30	17-30	17-30
Thigh (C)	9-16	9-16	9-16

Inseam (D) 28—36 26—34 30—38

Note: FLAT measurements in INCHES (pant measurements NOT body measurements)

*Each company will determine their own grade rules to determine their brands ideal fit.

*Letters in parentheses refer to Figure 6.1.14.7(b).

†The amount of change between two consecutive garment sizes for the dimension measured.

Table 6.1.14.3(

d

e) Minimum Sizing Requirements for Protective One Piece Garments (in.)

Dimension Measured*	Garment Size					Amount of Change†
	XS	S	M	L	XL	
Collar length (A)	14 ³ / ₄	15 ³ / ₄	16 ³ / ₄	17 ³ / ₄	18 ³ / ₄	1
Collar width (B)	3	3	3	3	3	0
Sleeve length (C)	30 ¹ / ₂	31 ¹ / ₂	32 ¹ / ₂	33 ¹ / ₂	34 ¹ / ₂	1
Sleeve cuff circumference (D)	12 ¹ / ₂	13	13 ¹ / ₂	14	14 ¹ / ₂	¹ / ₂
Chest circumference (E)	32	36	40	44	48	4
Seat circumference (F)	37	41	45	49	53	4
Thigh circumference (G)	25	27	29	31	33	2
Knee circumference (H)	17 ¹ / ₂	19	20 ¹ / ₂	22	23 ¹ / ₂	1 ¹ / ₂
Leg cuff circumference (I)	17 ¹ / ₂	18 ¹ / ₂	19 ¹ / ₂	20 ¹ / ₂	21 ¹ / ₂	1
Vertical circumference (J)	-	-	-	-	-	-
-S (short size)	—	—	69	71 ¹ / ₂	74	—
-R (regular size)	63 ¹ / ₂	63 ¹ / ₂	71	73 ¹ / ₂	76	—
-T (tall size)	65 ¹ / ₂	65 ¹ / ₂	73	75 ¹ / ₂	78	—
Height range	-	-	-	-	-	-
-S (short size)	—	—	64—67	—	—	—
-R (regular size)	63—66	—	67 ¹ / ₂ —72	—	—	—
-T (tall size)	66 ¹ / ₂ —69	—	72 ¹ / ₂ —75	—	—	—

Note: To convert measurements to millimeters, multiply by 25.4.

*Letters in parentheses refer to Figure 6.1.14.7(c).

†The amount of change between two consecutive garment sizes for the dimension measured.

Additional Proposed Changes

File Name	Description	Approved
Public_Input_Charts.xlsx	Green Buffalo suggested upper and lower torso protective garment size guide for women and men.	

Statement of Problem and Substantiation for Public Input

In NFPA 1977-2016, Table 6.1.14.3(a), Table 6.1.14.3(b), and Table 6.1.14.3(c), the minimum size requirements put limitations on garments. The combination of the minimum sizing requirements and the amount of ease requirements (Table 6.1.14.6) make the garments a hinderance to the end user in most cases. The tables cause significant fit issues for men and women required to wear said garments when

the appropriate measurements are not sufficient for the human body to function in the environment that these garments are required to be worn in. These garments should be designed more ergonomically so firefighters are able to perform their jobs with more ease and comfort while still being protected.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 73-NFPA 1977-2019 [Section No. 6.1.14.7]</u>	

Submitter Information Verification

Submitter Full Name: Korena Hallam
Organization: Green Buffalow
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 02 10:39:49 EST 2019
Committee: FAE-WFF

Table 6.1.14.3(a) Minimum Sizing Requirements for Women's Protective Upper Torso Garments (in.)			
	Garment Size		
Dimension Measured	Regular XS - XL	Petite XS -XL	Tall XS - XL
Chest (A)	17 - 26.5	17 - 26.5	17 - 26.5
Sleeve (B)	21.5 - 29	20.5 - 26	24 - 29
Waist (C)	16 - 25.5	16 - 25.5	16 - 25.5
Total Length (D)	25.5 - 32.5	24 - 31	27 - 34

Note: FLAT measurements in INCHES (shirt measurements NOT body measurements)
*Each company will determine their own grade rules to determine their brands ideal fit
*Letters in parentheses refer to Figure 6.1.14.7(a)

Table 6.1.14.3(b) Minimum Sizing Requirements for Men's Protective Upper Torso Garments (in.)			
	Garment Size		
Dimension Measured	Regular XS - XL	Short XS -XL	Tall XS - XL
Chest (A)	15.5 - 27.5	15.5 - 27.5	15.5 - 27.5
Sleeve (B)	22 - 29	20 - 27	24 - 31
Waist (C)	13.5 -25.5	13.5 - 25.5	13.5 - 25.5
Total Length (D)	24 - 34	22 - 32	26 - 36

Note: FLAT measurements in INCHES (shirt measurements NOT body measurements)
*Each company will determine their own grade rules to determine their brands ideal fit
*Letters in parentheses refer to Figure 6.1.14.7(a)

Table 6.1.14.3(c) Minimum Sizing Requirements for Women's Protective Lower Torso Garments (in.)	
	Garment Size

Dimension Measured	Regular XS - XL	Petite XS -XL	Tall XS - XL
Waist (A)	12.5 - 20.5	20 - 20	12.5 - 20.5
Seat (B)	17 - 26	17 - 26	17 - 26
Thigh (C)	8.75 - 16.5	8.5 - 16.5	8.75 - 16.5
Inseam (D)	28 - 34	26 - 32	32 - 34

Note: FLAT measurements in INCHES (pant measurements NOT body measurements)

*Each company will determine their own grade rules to determine their brands ideal fit

*Letters in parentheses refer to Figure 6.1.14.7(b)

Table 6.1.14.3(d) Minimum Sizing Requirements for Men's Protective Lower Torso Garments (in.)

Dimension Measured	Garment Size		
	Regular XS - XL	Short XS -XL	Tall XS - XL
Waist (A)	10 - 22	10 - 22	10 - 22
Seat (B)	17 - 30	17 - 30	17 - 30
Thigh (C)	9 - 16	9 - 16	9 - 16
Inseam (D)	28 - 36	26 - 34	30 - 38

Note: FLAT measurements in INCHES (pant measurements NOT body measurements)

*Each company will determine their own grade rules to determine their brands ideal fit

*Letters in parentheses refer to Figure 6.1.14.7(b)



Public Input No. 31-NFPA 1977-2018 [Section No. 6.1.14.6]

6.1.14.6

Garments shall be permitted to be custom made, provided that the individual is measured for all dimensions cited in the sizing tables and that the garment provides the minimum ease specified in Table 6.1.14.6.

Table 6.1.14.6 Ease

Dimension	Amount of Ease (in.)	
	Men's Garments	Women's Garments
Upper torso garment		
Neck circumference	+1	+1
Chest circumference	+6	+6
Hip circumference	+6	+6
Bottom circumference	+6	+6
Cuff circumference	+6	+6
Amount of front and back length extending below top of hip line	+6	+6
Lower torso garment		
Waist circumference	+1	+1
Seat circumference	+6	+7
Thigh circumference	+6	+6
Knee circumference	+6	+6
Bottom circumference	+11	+11
Rise (front and back)	+6	+11
One-piece garment		
Neck circumference	+1	+1
Chest circumference	+6	+6
Cuff circumference	+6	+6
Seat circumference	+6	+7
Thigh circumference	+6	+6
Knee circumference	+6	+6
Bottom circumference	+11	+11
Vertical circumference	+10	+10

Note: To convert measurements to millimeters, multiply by 25.4.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Women_s_Wildland_Firefighter_Nomex_Shirts.doc	Women need approved Nomex wildland shirts and pants	

Statement of Problem and Substantiation for Public Input

Women would have safety gear that fits correctly so that we can work safely and efficiently. No more shirts that hang almost to our knees, no more chafing due to extra-long rise in pants. Nomex that fits

without rubbing sores are needed. We long to do our jobs well without sores, chafing and gapping shirts, please help. Thank you.

Submitter Information Verification

Submitter Full Name: Linda Chappell

Organization: USDA Forest Service

Affiliation: Women in Wildland Fire across the nation

Street Address:

City:

State:

Zip:

Submittal Date: Fri Apr 27 23:07:28 EDT 2018

Committee:



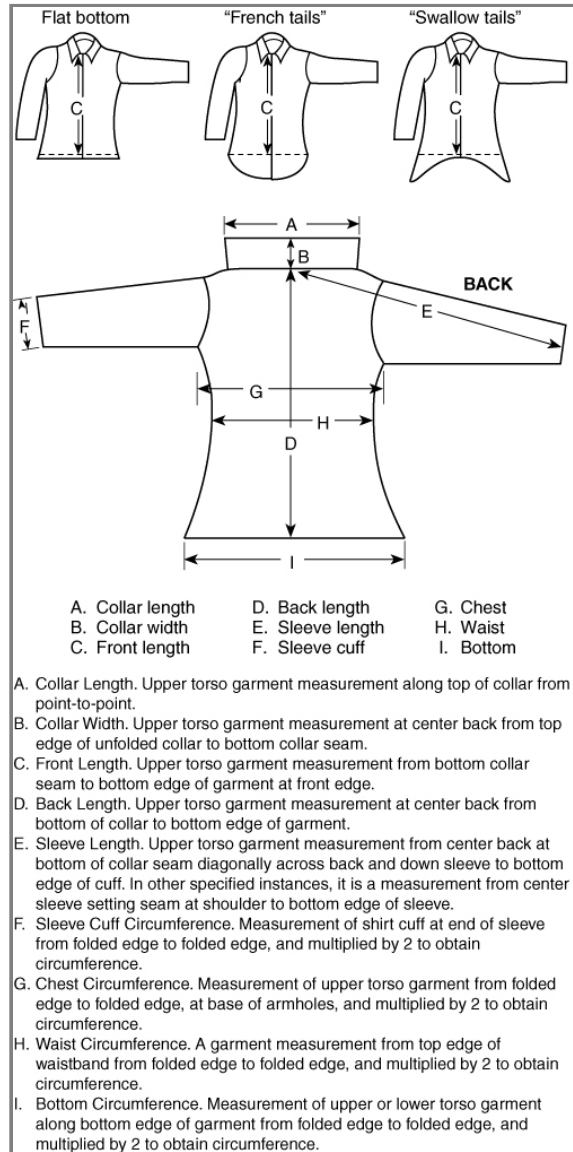
Public Input No. 73-NFPA 1977-2019 [Section No. 6.1.14.7]

A large, empty rectangular box with a thin border, intended for public input or comments.

6.1.14.7

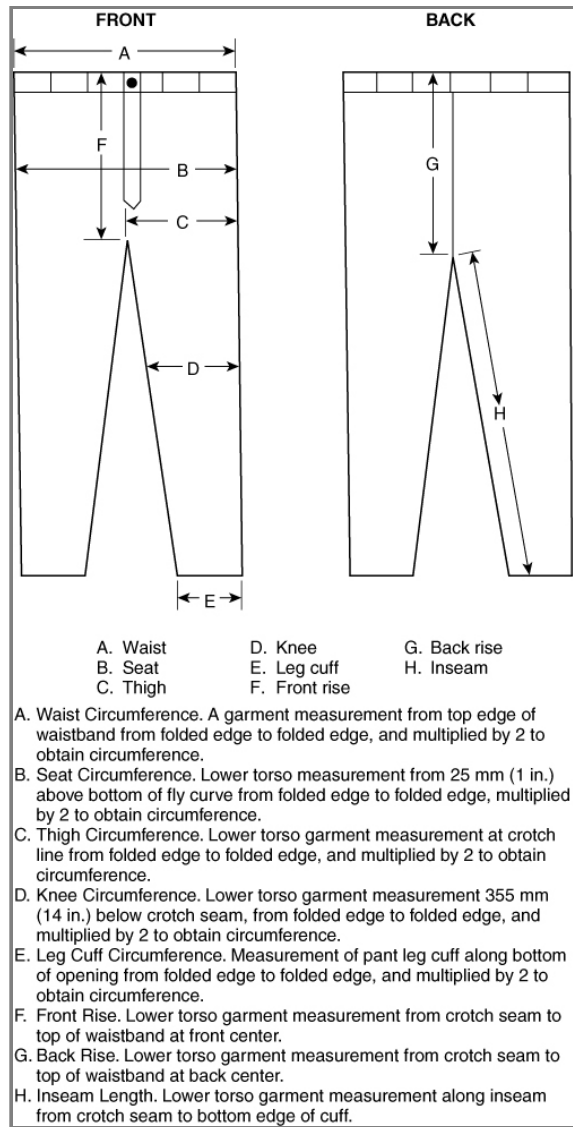
Garments shall be closed, laid flat, smoothed, and gently stretched when measured as defined in Section 3.3 and as specified in Section 6.1 and in Figure 6.1.14.7(a) through Figure 6.1.14.7(c).

Figure 6.1.14.7(a) Upper Torso Measurements [to be used with Table 6.1.14.3(a) and Table 6.1.14.3(b)].



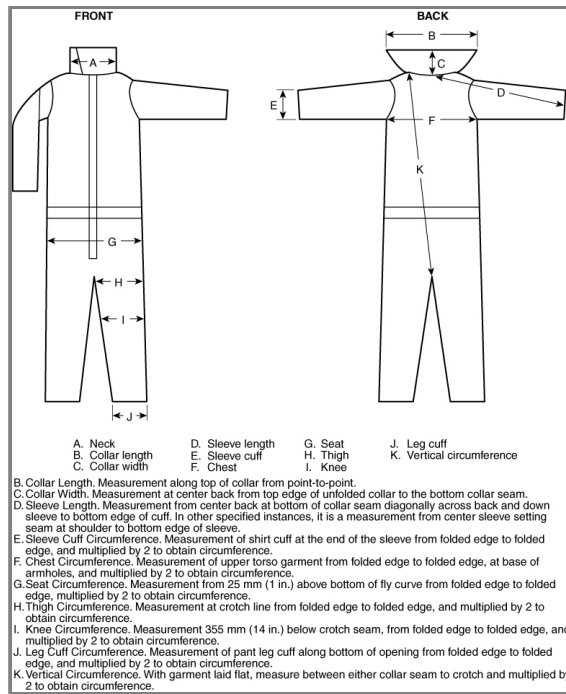
IMAGES WOULD NOT FORMAT; UPLOADED

Figure 6.1.14.7(b) Lower Torso Measurements [to be used with Table 6.1.14.3(b c) and Table 6.1.14.3(e d)].



IMAGES WOULD NOT FORMAT; UPLOADED

Figure 6.1.14.7(c) One-Piece Garment Torso Measurements [to be used with Table 6.1.14.3(d)].



Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
NFPA_Suggested_Figure_6.1.14.7.xlsx	Green Buffalo suggested Figure 6.1.14.7(a) and Figure 6.1.14.7(b)	

Statement of Problem and Substantiation for Public Input

In NFPA 1977-2016, Table 6.1.14.3(a), Table 6.1.14.3(b), and Table 6.1.14.3(c), the minimum size requirements put limitations on garments. The combination of the minimum sizing requirements and the amount of ease requirements (Table 6.1.14.6) make the garments a hinderance to the end user in most cases. The tables cause significant fit issues for men and women required to wear said garments when the appropriate measurements are not sufficient for the human body to function in the environment that these garments are required to be worn in. These garments should be designed more ergonomically so firefighters are able to perform their jobs with more ease and comfort while still being protected.

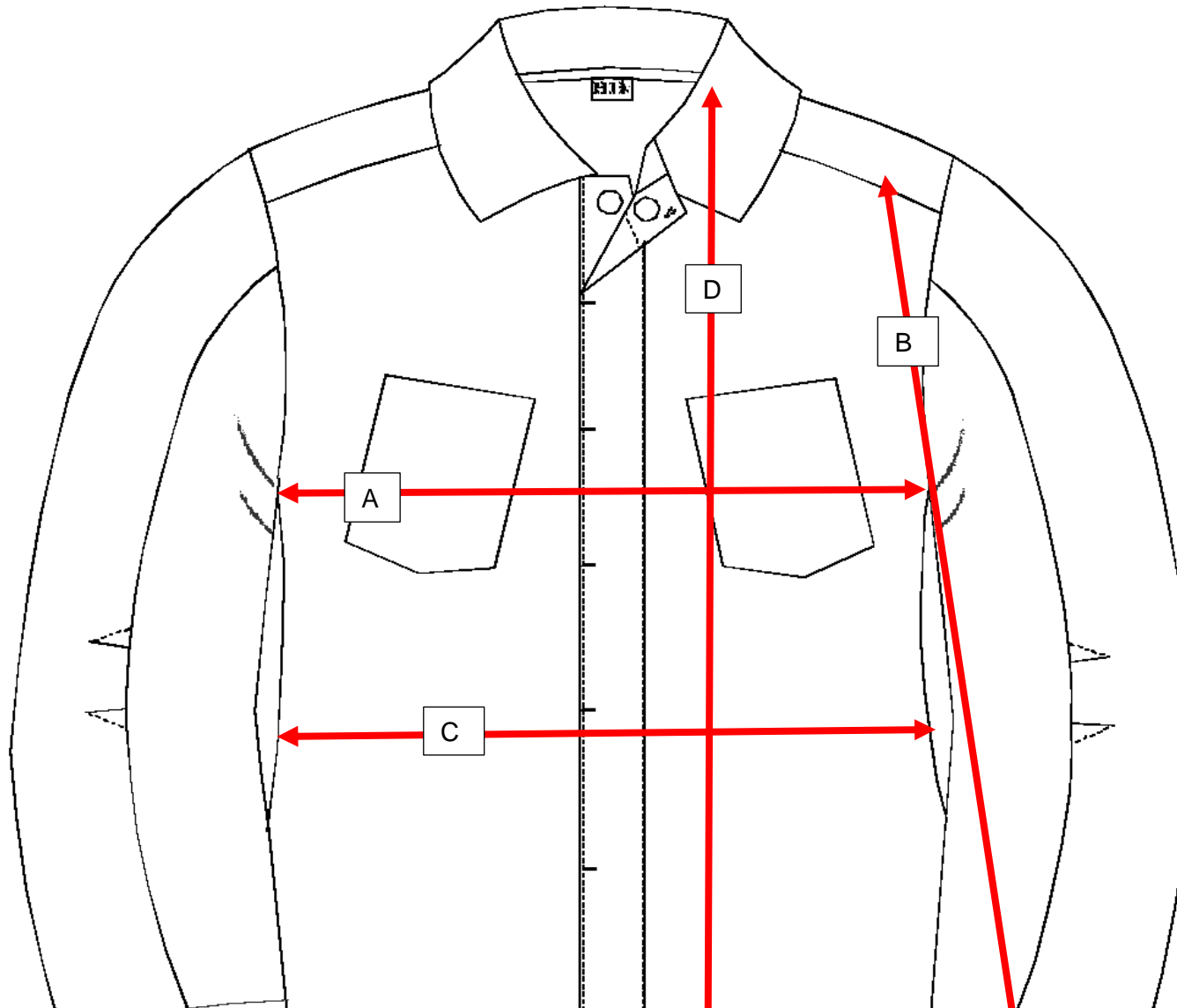
Related Public Inputs for This Document

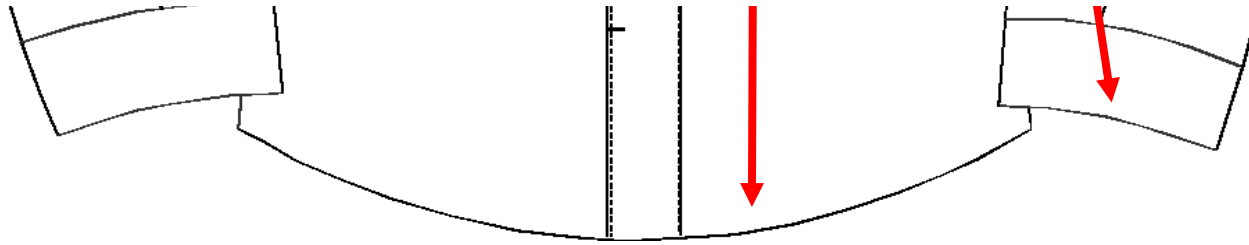
<u>Related Input</u>	<u>Relationship</u>
Public Input No. 66-NFPA 1977-2019 [Section No. 6.1.14.3]	

Submitter Information Verification

Submitter Full Name: Korena Hallam
Organization: Green Buffalo
Street Address:
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Zip:
Submittal Date: Thu Jan 03 11:48:32 EST 2019
Committee: FAE-WFF

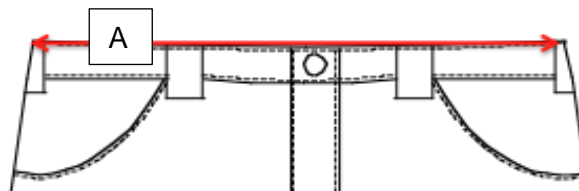
Figure 6.1.14.7(a) Upper Torso Measurements [to be used with Table 6.1.14.3(a)(b)]

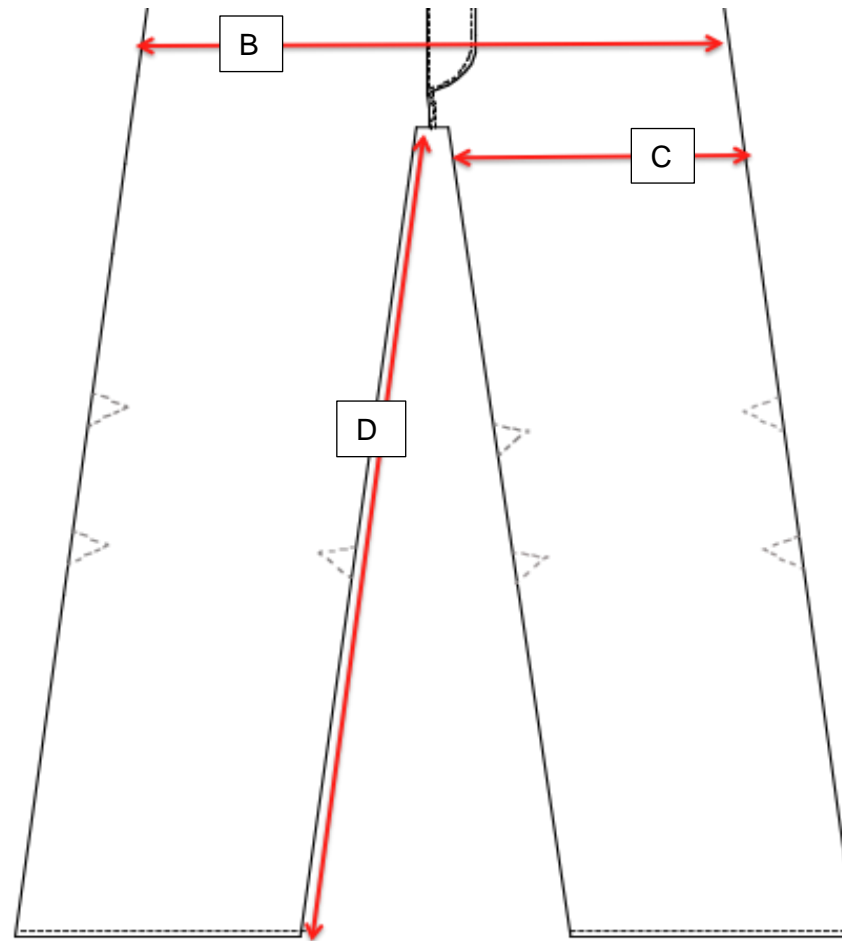




- A. Chest Circumference. Measurement of upper torso garment from folded edge to folded edge, at base of armholes and multiplied by 2 to obtain circumference.
- B. Sleeve Length. Measurement from midpoint of shoulder diagonally down sleeve to bottom edge of cuff.
- C. Waist Circumference. A garment measurement from top edge of waistband from folded edge to folded edge, and multiplied by 2 to obtain circumference.
- D. Total Length. Upper torso garment measurement from high point shoulder at base of collar to bottom edge of garment.

Figure 6.1.14.7(b) Lower Torso Measurements [to be used with Table 6.1.14.3(c)(d)]





- A. Waist Circumference. A garment measurement from top edge of waistband from folded edge to folded edge and multiplied by 2 to obtain circumference.
- B. Seat Circumference. Lower torso measurement from 1 inch above bottom of fly curve from folded edge to folded edge, and multiplied by 2 to obtain circumference.
- C. Thigh Circumference. Lower torso garment measurement from 2 inches below the bottom of the crotch

C. Thigh circumference. Lower torso garment measurement from 2 inches below the bottom of the crotch from folded edge to folded edge, and multiplied by 2 to obtain circumference.

D. Inseam. Lower torso garment measurement along inseam from base of the crotch seam to bottom edge of cuff.



Public Input No. 72-NFPA 1977-2019 [New Section after 7.1]

7.1. Additional Performance Requirement for Optional Urban Interface Protection . . .

7.1. .1 Garment textile fabrics that incorporate a particulate blocking layer shall be tested for particulate blocking as specified in Section 8. , 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.

7.1. .2 Garment textile fabrics that incorporate (other performance identified as necessary for providing Urban Interface Protection) shall be tested for (specified properties - TBD) as specified in Section 8. , and shall have (specified minimum performance requirement - TBD).

Statement of Problem and Substantiation for Public Input

Wildland Fire Fighters are exposed to smoke particles and particulates from combustion materials in the same manner as Structural Fire Fighters, possibly with even greater concentrations and frequency. The current textile-only garments for Wildland FF offer little protection against these potentially carcinogenic particles. Adding an option for incorporating Particulate Blocking performance to Wildland garment materials would provide guidance and established requirements to organizations seeking to provide this additional protection to members.

Wildland FF are also frequently encountering structure fires, vehicle fires and other hazards that need to be addressed as part of suppressing the wildland fire. Encountering these non-Wildland fire hazards while wearing NFPA 1977 certified Wildland Gear can expose Wildland FF to hazards and risks that the currently certified 1977 gear provides little or no protection against. The additional hazards may include common chemicals and other threats found on the Urban Interface fire ground or common chemicals or hazards currently identified as part of current Wildland FF tactics. The committee could establish a minimal list of anticipated hazards based on experiences and establish the necessary criteria for this optional material.

The intent would provide additional protection against hazards without causing additional heat stress. The addition of barrier materials may also need to be controlled by incorporating design requirements in Chapter 6 to limit the placement of chemical protective barriers if they do not meet the THL requirements of this standard.

Submitter Information Verification

Submitter Full Name: Michael Salvato

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Submission Date: Wed Jan 02 12:11:33 EST 2019

Committee: FAE-WFF



Public Input No. 43-NFPA 1977-2018 [Section No. 7.1.1]

7.1.1

Garment textile fabrics shall be tested for radiant protective performance as specified in Section 8.2 and shall have an average RPP value of not less than ~~7~~ 10 .

Statement of Problem and Substantiation for Public Input

NFPA 1977 is 25 years old and this performance requirement has not be modified since the first edition. During recent testing and research, fabric manufactures have been able to increase the Radiant Protective Performance (RPP) protective qualities and still provide a better Thermal Heat Loss value that currently exists. There are current fabrics available that meet this value and after 25 years it is time to apply the science and research into Wildland PPE and place these improvements into the standard. While the current value is a minimum, it is incumbent upon standards to provide the best minimum values available for the protection of firefighters.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 46-NFPA 1977-2018 [Section No. 7.5.1]</u>	

Submitter Information Verification

Submitter Full Name: Rick Swan
Organization: International Association of Fire Fighters
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City:
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Submittal Date: Thu Oct 25 10:31:46 EDT 2018
Committee: FAE-WFF



Public Input No. 77-NFPA 1977-2019 [New Section after 7.1.6]

Evaporative Resistance

7.1.X Garment composite, excluding cold weather outerwear garments and excluding winter liners where provided, shall be tested for evaporative resistance as specified in Section 8.X and shall have a Ret value of less than 20.

Statement of Problem and Substantiation for Public Input

Several NFPA documents have adopted or are considering evaporative resistance (Ret) for addressing heat strain with firefighters. THL should be more of a predictor of heat strain in moderate environments while it's thought that Ret would be a better predictor of heat stain in hotter environments as it removes the effects of conduction.

Some of the benefits of Ret have been observed in structural gear through a physiological study. In NFPA 1994 it was shown that a garbage bag (with no breathability) could pass the THL requirement which lead to the adoption of Ret into their standard. It is unclear if Ret will provide any benefit to the wildland firefighter community. Nevertheless, I would like for the committee to consider it for more study.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 78-NFPA 1977-2019 [New Section after 8.5]</u>	

Submitter Information Verification

Submitter Full Name: Anthony Deaton
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Submittal Date: Thu Jan 03 14:11:15 EST 2019
Committee: FAE-WFF



Public Input No. 82-NFPA 1977-2019 [Section No. 7.1.6]

7.1.6*

~~Garment composite A wildland garment , excluding cold weather outerwear garments and excluding winter liners where provided, shall be tested for evaporative heat transfer as specified in Section 8.5 and shall have a total heat loss of not less than 450 W/m² .~~

~~7.1.6.1 * –~~

~~Where the total surface area of all reinforcements exceeds the values in Table 7.1.6.1 , the reinforcement composites shall be tested for evaporative heat transfer as specified in Section 8.5~~

~~Garment heat loss as specified in Section 8.X and shall have a total~~

~~heat loss of not less than~~

~~450 W~~

~~XXX W /m²~~

~~All pockets (with the exception of the front waist pockets as indicated in A.7.1.6.1) shall be included in the calculation of the surface area of reinforcement.~~

~~Table 7.1.6.1 Total Surface Area of All Reinforcements~~

~~Type of Garment Garment Size Surface Area (in. ²) Protective upper XS 625 torso garment S 687 - M 752 - L 820 - XL 893 - 2XL 966 Men's lower torso- 26 534 protective garment 28 556 - 30 577 - 32 599 - 34 624 - 36 643 - 38 665 - 40 688 Women's lower- 23 534 torso protective- 25 556 garment 27 577 - 29 599 - 31 624 - 33 643 - 35 665 - 37 688 Protective XS 1070 one-piece garment S 1166 - M 1264 - L 1365 - XL 1470 - 2XL 1580~~

~~Note: To convert measurements to mm² , multiply by 645.16.~~

Statement of Problem and Substantiation for Public Input

Inputs to Public Comment on NFPA 1977

Justification (Sweating Manikin Test Method)

To reduce heat strain to wildland firefighters, NFPA 1977 currently requires a Total Heat Loss (THL) of no less than 450 w/m². This requirement is measured using a guarded sweating hot plate test method (ASTM F1868). Since the sweating plate test method can only measure the insulation and breathability of flat swatches of fabric materials, it cannot assess the effects of garment air layers and reinforcements (pockets, trim, closures, etc.) used in the construction of wildland firefighter protective clothing. Research conducted by NC State has shown that the THL of fabric materials tested by the standard significantly over-predicts the THL of the actual wildland firefighter garments [1]. To compensate for this shortcoming, and to prevent manufacturers from making a double layer product and only testing the outer shell material, the standard requires that “when the total surface area of the reinforcement exceeds values in Table 7.1.6.1, the THL of each reinforcement section must be measured using the guarded sweating hot plate test method. Therefore, we propose that, in addition to measuring the THL of a garment fabric materials, a performance requirement be added that is based on measuring the THL of the test garment using a standard sweating manikin test method (ASTM F2370). This would eliminate the need to estimate the surface covered by reinforcements, and provide a more accurate assessment of the predicted heat strain contributed by the garment, as worn by the firefighter. Sweating manikin tests are routinely conducted to assess the thermal insulation and breathability of protective clothing ensembles.

1. Barker, Roger, "Balancing Thermal Comfort and Radiant Heat Protection in Wildland Firefighter Clothing", AATCC 2018 International Conference, Greenville, South Carolina, March 6-8, 2018.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 83-NFPA 1977-2019 [Section No. 8.5]</u>	

Submitter Information Verification

Submitter Full Name: Anthony Deaton
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Submittal Date: Thu Jan 03 16:14:00 EST 2019
Committee: FAE-WFF



Public Input No. 44-NFPA 1977-2018 [Section No. 7.1.6 [Excluding any Sub-Sections]]

Garment composite, excluding cold weather outerwear garments and excluding winter liners where provided, shall be tested for evaporative heat transfer as specified in Section 8.5 and shall have a total heat loss of not less than ~~450 W~~ 550 W /m².

Statement of Problem and Substantiation for Public Input

NFPA 1977 is 25 years old and this performance requirement has not been modified. During recent testing and research, fabric manufactures have been able to increase the Thermal Heat Loss (THL) value protective qualities and still provide a higher RPP value. There are current fabrics available that meet this value and after 25 years it is time to apply the science and research into Wildland PPE and place these improvements into the standard. While the current value is a minimum, it is incumbent upon standards to provide the best minimum values available for the protection of firefighters.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 45-NFPA 1977-2018 [Section No. 7.1.6.1]</u>	

Submitter Information Verification

Submitter Full Name: Rick Swan
Organization: International Association of Fire Fighters
Street Address:
City:
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Zip:
Submittal Date: Thu Oct 25 10:49:24 EDT 2018
Committee: FAE-WFF



Public Input No. 74-NFPA 1977-2019 [Section No. 7.1.6 [Excluding any Sub-Sections]]

Garment composite, excluding cold weather outerwear garments and excluding winter liners where provided, shall be tested for conductive and evaporative heat transfer as specified in Section 8.5 and shall have a total heat loss of not less than 450 W/m².

Statement of Problem and Substantiation for Public Input

This correction addresses the both forms of heat transfer measured in total heat loss testing.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 75-NFPA 1977-2019 [Section No. 7.1.6.1]</u>	

Submitter Information Verification

Submitter Full Name: Anthony Deaton
Organization: NC State University
Street Address:
City:
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Zip:
Submittal Date: Thu Jan 03 13:36:41 EST 2019
Committee: FAE-WFF



Public Input No. 45-NFPA 1977-2018 [Section No. 7.1.6.1]

7.1.6.1*

Where the total surface area of all reinforcements exceeds the values in Table 7.1.6.1, the reinforcement composites shall be tested for evaporative heat transfer as specified in Section 8.5 and shall have a total heat loss of not less than ~~450 W~~ 550 W /m². All pockets (with the exception of the front waist pockets as indicated in A.7.1.6.1) shall be included in the calculation of the surface area of reinforcement.

Table 7.1.6.1 Total Surface Area of All Reinforcements

<u>Type of Garment</u>	<u>Garment Size</u>	<u>Surface Area (in.²)</u>	
Protective upper torso garment	XS	625	
	S	687	
		M	752
		L	820
		XL	893
		2XL	966
Men's lower torso protective garment	26	534	
	28	556	
		30	577
		32	599
		34	621
		36	643
		38	665
		40	688
Women's lower torso protective garment	23	534	
	25	556	
	27	577	
		29	599
		31	621
		33	643
		35	665
		37	688
Protective one-piece garment	XS	1070	
	S	1166	
		M	1264
		L	1365
		XL	1470
		2XL	1580

Note: To convert measurements to mm², multiply by 645.16.

Statement of Problem and Substantiation for Public Input

NFPA 1977 is 25 years old and this performance requirement has not be modified. During recent testing and research, fabric manufactures have been able to increase the Thermal Heat Loss (THL) value protective qualities and still provide a higher RPP value. There are current fabrics available that meet

this value and after 25 years it is time to apply the science and research into Wildland PPE and place these improvements into the standard. While the current value is a minimum, it is incumbent upon standards to provide the best minimum values available for the protection of firefighters.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 44-NFPA 1977-2018 [Section No. 7.1.6 [Excluding any Sub-Sections]]</u>	

Submitter Information Verification

Submitter Full Name: Rick Swan
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Street Address:
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Zip:
Submittal Date: Thu Oct 25 10:56:05 EDT 2018
Committee: FAE-WFF



Public Input No. 75-NFPA 1977-2019 [Section No. 7.1.6.1]

A large, empty rectangular box with a thin border, intended for public input or comments.

7.1.6.1*

Where the total surface area of all reinforcements exceeds the values in Table 7.1.6.1, the reinforcement composites shall be tested for conductive and evaporative heat transfer as specified in Section 8.5 and shall have a total heat loss of not less than 450 W/m². All pockets (with the exception of the front waist pockets as indicated in A.7.1.6.1) shall be included in the calculation of the surface area of reinforcement.

Table 7.1.6.1 Total Surface Area of All Reinforcements

<u>Type of Garment</u>	<u>Garment Size</u>	<u>Surface Area (in. ²)</u>	
<u>Protective upper torso garment</u>	<u>XS</u>	<u>625</u>	
	<u>S</u>	<u>687</u>	
-			
	<u>M</u>	<u>752</u>	
-			
	<u>L</u>	<u>820</u>	
-			
	<u>XL</u>	<u>893</u>	
-			
		<u>2XL</u>	<u>966</u>
<u>Men's lower torso protective garment</u>		<u>26</u>	<u>534</u>
		<u>28</u>	<u>556</u>
-			
	<u>30</u>	<u>577</u>	
-			
	<u>32</u>	<u>599</u>	
-			
	<u>34</u>	<u>621</u>	
-			
	<u>36</u>	<u>643</u>	
-			
	<u>38</u>	<u>665</u>	
-			
		<u>40</u>	<u>688</u>
<u>Women's lower torso protective garment</u>		<u>23</u>	<u>534</u>
		<u>25</u>	<u>556</u>
		<u>27</u>	<u>577</u>
-			
	<u>29</u>	<u>599</u>	
-			
	<u>31</u>	<u>621</u>	
-			
	<u>33</u>	<u>643</u>	
-			
	<u>35</u>	<u>665</u>	
-			
		<u>37</u>	<u>688</u>
<u>Protective one-piece garment</u>	<u>XS</u>	<u>1070</u>	
	<u>S</u>	<u>1166</u>	
-			

<u>M</u>	<u>1264</u>
-	
<u>L</u>	<u>1365</u>
-	
<u>XL</u>	<u>1470</u>
-	
<u>2XL</u>	<u>1580</u>

Note: To convert measurements to mm², multiply by 645.16.

Statement of Problem and Substantiation for Public Input

Correction addresses both forms of heat transfer that occurs in total heat loss testing

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 74-NFPA 1977-2019 [Section No. 7.1.6 [Excluding any Sub-Sections]]</u>	address the same issue

Submitter Information Verification

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Submittal Date: Thu Jan 03 13:41:18 EST 2019
Committee: FAE-WFF



Public Input No. 4-NFPA 1977-2017 [Section No. 7.1.9.1]

7.1.9.1

Woven garment seam assemblies and seam assemblies that contain at least one woven material shall demonstrate a sewn seam strength equal to or greater than 315 N (70 lbf) force for major seams and 225 N (50 lbf) force for minor seams and shall only demonstrate failure of the stitching along the stitchline when stressed during testing .

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Public_Comment_6.pdf	1977_Hold_PC6	
Public_Comment_6.docx	1977_Hold_PC6	

Statement of Problem and Substantiation for Public Input

Note: This Public Input appeared as a "Reject but Hold" in Public Comment No. 6 of the F2015 cycle Second Draft Report for NFPA 1977 and per the Regs. at 4.4.8.3.1.

Substantiation:

Data that is readily available and well known show that a properly designed seam construction, using the correct tex size of sewing thread, and the proper number of stitches per inch can meet the seam strength performance requirements for both "major" seams and "minor" seams so that only failure of the stitching will occur along the stitchline when stressed during testing.

Any member of a manufacturer's staff; designer, product specialists, production engineer, and quality control personnel - who has learned these formulas, (to be found on following page), and their interpretation, can easily calculate and approximate point of failure when fabric sections are sewn together.

Submitter Information Verification

Submitter Full Name: TC ON FAE-WFF
Organization: NFPA
Street Address:
City:
State:
Zip:
Submittal Date: Wed Feb 01 12:57:17 EST 2017
Committee:



Public Input No. 5-NFPA 1977-2017 [Section No. 7.1.9.3]

7.1.9.3

~~Where the fabric strength is less than the required seam strength specified in 7.1.9.1, providing the fabric fails without failure of the seam below the applicable forces specified in 7.1.9.1, the seam breaking strength shall be considered acceptable.~~ Fabrics which cannot be used to build sewn seam constructions that meet both the major seam strength performance of 315n (70lbf) and the minor seam strength performance requirement of 225N (50lbf) and demonstrate a seam failure, only along the stitchline, shall not be used for the manufacture of garments.

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Public_Comment_10.pdf	1977_PC10_Hold	
Public_Comment_10.docx	1977_PC10_Hold Word	

Statement of Problem and Substantiation for Public Input

NOTE: This Public Input appeared as "Reject but Hold" in Public Comment No. 10 of the F2015 Second Draft Report for NFPA 1977 and per the Regs. at 4.4.8.3.1.

Substantiation:

Failure along the stitchline enables garment to be repaired. Fabric failure requires that garment needs to be replaced.

As shown in 7.1.9.1 the different elements that are used to calculate the estimated seam strength can also be useful factors in making a determination about fabric suitability.

Submitter Information Verification

Submitter Full Name: TC ON FAE-WFF
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Street Address:
City:
State:
Zip:
Submittal Date: Wed Feb 01 15:14:34 EST 2017
Committee:



Public Input No. 46-NFPA 1977-2018 [Section No. 7.5.1]

7.5.1

Protective face/neck shroud textile fabrics shall be tested for radiant protective performance as specified in Section 8.2 and shall have an average RPP value of not less than 7 10 .

Statement of Problem and Substantiation for Public Input

NFPA 1977 is 25 years old and this performance requirement has not been modified. During recent testing and research, fabric manufactures have been able to increase the Radiant Protective Performance (RPP) protective qualities and still provide a better Thermal Heat Loss value. There are current fabrics available that meet this value and after 25 years it is time to apply the science and research into Wildland PPE and place these improvements into the standard. While the current value is a minimum, it is incumbent upon standards to provide the best minimum values available for the protection of firefighters.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 43-NFPA 1977-2018 [Section No. 7.1.1]</u>	

Submitter Information Verification

Submitter Full Name: Rick Swan
Organization: International Association of Fire Fighters
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City:
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Zip:
Submittal Date: Thu Oct 25 10:58:48 EDT 2018
Committee: FAE-WFF



Public Input No. 6-NFPA 1977-2017 [Section No. 7.5.8.2]

7.5.8.2

~~Where the fabric strength is less than the required seam strength specified in 7.5.8.1 , providing the fabric fails without failure of the seam below the force specified in 7.5.8.1 , the seam breaking strength shall be considered acceptable.~~

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Public_Comment_15.pdf	1977_PC15_Hold	
Public_Comment_15.docx	1977_PC15_Hold Word	

Statement of Problem and Substantiation for Public Input

Note: This Public Input appeared as "Reject but Hold" in Public Comment No. 15 of the F2015 Second Draft Report for NFPA 1977 and per the Regs. at 4.4.8.3.1.

Substantiation:

See Section 7.1.9.1 and Section 7.1.9.3

Submitter Information Verification

Submitter Full Name: TC ON FAE-WFF

Organization: NFPA

Street Address:

City:

State:

Zip:

Submittal Date: Wed Feb 01 15:26:20 EST 2017

Committee:



Public Input No. 71-NFPA 1977-2019 [Sections 7.9.1, 7.9.2]

Sections

7.9.1

~~, 7.9.2 7.9.4~~

–

Load-carrying equipment shall be tested for resistance to heat as specified in Section 8.4 and shall not melt, drip, separate, or ignite.

7.9.2 –

~~Load-carrying equipment hardware and closure systems shall be tested for resistance to heat as specified in Section 8.4 ; shall not melt, drip, separate, or ignite; hardware and closure systems that release the item from the “as worn” position shall remain functional; and fire shelter attachment hardware shall remain functional~~

All hardware items shall remain functional .

Statement of Problem and Substantiation for Public Input

This revision clarifies and aligns the requirements with chapter 8. It also simplifies the requirements for hardware functionality in chapter 7.

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Public Input No. 55-NFPA 1977-2018 [Section No. 8.1.3.1]

8.1.3.1

Samples shall be conditioned by exposing them to the procedure specified in 8.4.6 with the following modifications:

- (1) The oven test temperature in 8.4.6 shall be stabilized as follows, and the test exposure time shall be as follows:
 - (a) For load carrying equipment visibility markings, the temperature shall be 140°C, +6°/-0°C (285°F, +10°/-0°F), and the test exposure shall be 10 minutes, +15/-0 seconds.
 - (b) For thread utilized in garments, helmets, gloves, footwear, and face/neck shrouds, the temperature shall be 260°C, +6°/-0°C (500°F, +10°/-0°F), and the test exposure shall be 15 minutes, +15/-0 seconds.
 - (c) For helmet visibility markings, the temperature shall be 177°C, +6°/-0°C (350°F, +10°/-0°F), and the test exposure shall be 5 minutes, +15/-0 seconds.
- (2) The test exposure time shall begin when the test thermocouple reading has stabilized at the required test exposure temperature.
- (3) The requirements of 8.4.5 and 8.4.6 shall be disregarded.

Statement of Problem and Substantiation for Public Input

Clarifies the conditioning procedure for the helmet visibility markings.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 53-NFPA 1977-2018 [Section No. 8.16.4.3.2]</u>	

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Public Input No. 80-NFPA 1977-2019 [Section No. 8.2]

8.2 Radiant Protective Performance (RPP) Test.

8.2.1 Application.

8.2.1.1

This test method shall apply to protective garment and face/neck shroud materials.

8.2.1.2

Modifications to this test method for testing garment materials shall be as specified in 8.2.8.

8.2.1.3

Modifications to this test method for testing face/neck shroud materials shall be as specified in 8.2.9.

8.2.2 Samples.

8.2.2.1

Samples for conditioning shall be as specified in 8.2.8 for garment materials and in 8.2.9.1 for protective face/neck shroud materials.

8.2.2.2

Samples shall be tested before and after five laundering cycles as specified in 8.1.2, then preconditioned as specified in 8.1.1.

8.2.3 Specimens.

8.2.3.1

Specimens shall measure 400 mm × 200 mm, ±6 mm (4 in 6 in . × 8 in 6 in ., ±¼ in.) with the long dimension in the warp or wale direction and shall consist of all layers representative of the clothing item to be tested .

8.2.3.2

Testing shall be conducted on three specimens.

8.2.4 Apparatus.

8.2.4.1

The test apparatus specified in ~~ASTM F1939~~ ASTM F2731 , *Standard Test Method for Radiant Heat Resistance of Flame Resistant Clothing Materials with Continuous Heating Measuring the Transmitted and Stored Energy of Firefighter protective Clothing System* , shall be used with the following modifications: ~~The vertically oriented radiant heat source shall consist of a bank of five 500-W infrared, tubular, quartz lamps having a 125 mm (5 in .) lighted length and a mean overall length of 225 mm (8 ¾ in.).~~

- ~~The control of the radiant heat source shall be permitted to be a variable transformer.~~
- ~~The means for affixing the sample holder shall be permitted to be by any means that achieve the required specimen positioning in the test apparatus.~~
- ~~No additional materials (e.g., a protective screen) shall be placed between the radiant lamps and the sample.~~

8.2.5 Procedure.

8.2.5.1

Radiant protective performance (RPP) testing shall be performed in accordance with ASTM F4939 F2731, *Standard Test Method for Radiant Heat Resistance of Flame Resistant Clothing Materials with Continuous Heating*, at a radiant heat exposure level of 21 kW/m^2 (0.5 cal/cm^2).

8.2.5.2 –

A modification for the warm-up period for the radiant lamp to 60 seconds, $\pm 5/0$ seconds shall be used *Measuring the Transmitted and Stored Energy of Firefighter protective Clothing System*, with the following modifications:

(a) Testing will be conducted at the 7.1 kW/m².

(b) no moisture preconditioning will occur on the fabrics

(c) The RPP value will be calculated by multiplying the measured calibration heat flux and the predicted time to 2nd degree burn.

8.2.6 Report.

8.2.6.1

The individual test RPP rating of each specimen shall be recorded and reported.

8.2.6.2

The average RPP rating shall be calculated, recorded, and reported.

8.2.6.3

If an RPP rating is greater than 60, it shall be recorded and reported as ">60."

8.2.7 Interpretation.

8.2.7.1

Pass or fail determinations shall be based on the average reported RPP rating of all specimens tested.

8.2.7.2

If an individual result from any test set varies more than ± 8 percent from the average result, the results from that test set shall be discarded and another set of specimens shall be tested.

8.2.8 Specific Requirements for Testing Garment Materials.

8.2.8.1

Specimens shall consist of all layers used in the construction of the garment, excluding any areas with special reinforcements. Specimens shall not include seams. Specimens shall not be stitched to hold individual layers together.

8.2.8.2

Samples for conditioning shall be at least 1 m (1 yd) square of each material.

8.2.8.3

Testing shall be performed as described in 8.2.2 through 8.2.7.

8.2.9 Specific Requirements for Testing Protective Face/Neck Shroud Materials.

8.2.9.1

Specimens shall consist of materials from the portion of the face/neck shroud that covers the neck and facial area.

8.2.9.2

Specimens shall not include seams.

8.2.9.3

Specimens shall not be stitched to hold individual layers together.

8.2.9.4

Samples for conditioning shall include face/neck shroud material that is a minimum of ~~400 mm × 200 mm, ±6 mm (4 in 6 in . × 8 in 6 in ., ±¼ in.)~~ with the long dimension in the warp or wale direction.

8.2.9.5

Testing shall be performed as described in 8.2.2 through 8.2.7.

Statement of Problem and Substantiation for Public Input

Justification for changing the RPP Test Method

The RPP apparatus and test method (ASTM F1939) have remained relatively unchanged for decades and were originally developed to replicate high intensity (84 kW/m²), short duration (< 10 seconds) heat exposures, specifically for structural firefighting clothing. Wildland Firefighters, through NFPA 1977 [2], have adopted a lower level of heat exposure of 21 kW/m², for their single layer coverall materials. Though 21 kW/m² is one quarter of the exposure flux of the original RPP test, recent research has shown that this may still be significantly too high to represent realistic working conditions for daily wildland firefighting. The findings from independent studies show that the upper range of heat flux experienced by wildland firefighters in the field ranges from approximately 6.3-8.6 kW/m², which is significantly less than the 21 kW/m² currently used by the RPP test method in the current NFPA 1977 Standard [3-9]. A project conducted by the California Department of Forestry and Fire Protection (CAL FIRE) defined a "Reasonable Maximum Exposure" (RME) for wildland firefighting to be equivalent to 7.1 kW/m² [3]. At the same time, the currently used Radiant Protective Performance (RPP) test method (ASTM F1939) possesses inherent limitations that greatly affect the results of the test the lower radiant flux exposures encountered by wildland firefighters [10]. The test apparatus and methodology were originally developed for the evaluation of protection gained by aluminized fabrics for proximity firefighting, which is high intensity, shorter duration testing. We are proposing to measure RPP using the ASTM F 2731 test method; a bench-scale testing platform that uses water cooled thermal sensor technology and an advanced skin burn injury model to provide a more accurate prediction for burn injuries resulting from the transmission of radiant heat in exposures that more accurately simulates wildland firefighter field exposures. NC State has conducted extensive research comparing the ASTM F1939 and ASTM F 2731 test methods showing that the ASTM F 2731 test method is repeatable and can differentiate fabrics of differing weights [10].

- [1] American Society for Testing and Materials, "ASTM F1939-08 Standard Test Method for Radiant Heat Resistance of Flame Resistant Clothing Materials with Continuous Heating," 2008.
- [2] National Fire Protection Association, "NFPA 1977: Standard on Protective Clothing and Equipment for Wildland Fire Fighting," 2011.
- [3] California Department of Forestry and Fire Prevention (CAL FIRE), "Wildland Fire Fighting Hazard & Risk Assessment Draft Report," 2010.
- [4] J. D. Cohen. Relating flame radiation to home ignition using modeling and experimental crown fires. Canadian Journal of Forest Research 34(8), pp. 1616-1626. 2004. DOI: 10.1139/X04-049.
- [5] B.W. Butler and J.D. Cohen, "Firefighter Safety Zones: How Big is Big Enough?" Fire Management Notes, Vol. 58 (1), pp/ 13-16.
- [6] G. Budd, J. Brotherhood, A. Hendrie, S. Jeffery, F. Beasley, B. Costin, W. Zhien, M. Baker, B. Hoschke, B. Holcombe, N. Cheney and M. Dawson, "Project Aquarius 4. Experimental bushfires, suppression procedures, and measurements," International Journal of Wildland Fire, vol. 7, pp. 99, 1997.
- [7] P. K. Raj. Field tests on human tolerance to (LNG) fire radiant heat exposure, and attenuation effects of clothing and other objects. J. Hazard. Mater. 157(2-3), pp. 247-259. 2008. . DOI: <http://dx.doi.org/prox.lib.ncsu.edu/10.1016/j.jhazmat.2007.12.114>.
- [8] A. Sullivan, P. Ellis and I. Knight, "A Review of Radiant Heat Flux Models Used in Bushfire Applications," International Journal of Wildland Fire, vol. 12, pp. 101, 2003.
- [9] D. Packham and A. Pompe, "Radiation Temperatures of Forest Fires," Australian Forest Research, vol. 5, pp. 1-8, 1971.
- [10] Watson, K., Hummel, A. and Barker, R., "Comparison of Two Methods for Evaluating the Radiant Protective Performance of Wildland Firefighter Protective Clothing", ASTM Special Technical Publication (STP) 10th Vol., ASTM International, West Conshochan, PA, 2015.

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Public Input No. 65-NFPA 1977-2019 [Sections 8.3.1, 8.3.2]

~~Sections 8.3.1, 8.3.2~~

~~8.3.4~~

~~_ Application.~~

~~8.3.1.1~~

~~This test method shall apply to protective garment and face/neck shroud ~~textiles~~ materials .~~

~~8.3.1.2~~

~~Modifications to this test method for testing woven textile materials shall be as specified in 8.3.9.~~

~~8.3.1.3~~

~~Modifications to this test method for testing knit textile materials shall be as specified in 8.3.10.~~

~~8.3.1.4~~

~~Modifications to this test method for testing nonwoven textile materials shall be as specified in 8.3.11.~~

~~8.3.1.5~~

~~Modifications to this test method for testing visibility marking materials shall be as specified in 8.3.12.~~

~~8.3.1.6~~

~~Modifications to this test method for testing lettering, including transfer film, shall be as specified in 8.3.13.~~

~~8.3.1.7~~

~~Modifications to this test method for testing small specimens not meeting the specimen size requirements of 8.3.2.1 shall be as specified in 8.3.14.~~

~~8.3.1.8~~

~~Modifications to this test method for testing padding and reinforcements shall be as specified in 8.3.15.~~

~~8.3.2~~ Samples.

~~8.3.2.1~~

~~Samples for conditioning shall be as specified in 8.3.9 for woven textile materials, in 8.3.11 for nonwoven textile materials, in 8.3.12 for visibility marking materials, in 8.3.13 for lettering, including transfer film, in 8.3.14 for small materials.~~

~~8.3.2.2~~

~~Samples shall be conditioned as specified in 8.1.1.~~

~~8.3.2.3~~ –

~~Visibility markings, lettering, and small materials shall be tested both before and after being subjected to five laundry cycles as specified in 8.1.2 .~~

~~8.3.2.4~~

~~Each individual layer of multilayer material systems or composites shall be tested separately.~~

Statement of Problem and Substantiation for Public Input

Clarifies that this test method applies to more items than textile materials. Also removes redundant preconditioning requirements for small items.

Adding modifications for the preconditioning requirements for padding and reinforcement materials since these items are identified in chapter 7 as needing testing, but the preconditioning requirements for these materials is unclear.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 67-NFPA 1977-2019 [Section No. 8.3.4]</u>	
<u>Public Input No. 70-NFPA 1977-2019 [New Section after 8.3.14.3]</u>	

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Public Input No. 67-NFPA 1977-2019 [Section No. 8.3.4]

8.3.4 Sample Preparation.

8.3.4.1

Specimens of garment textile fabrics and face/neck shroud textile fabrics shall be tested both before and after being subjected to 100 laundering cycles as specified in 8.1.2.

8.3.4.2

Specimens of visibility markings, lettering, padding, reinforcement and small materials shall be tested both before and after being subjected to five laundering cycles as specified in 8.1.2.

8.3.4.3

All specimens to be tested shall be conditioned as specified in 8.1.1.

Statement of Problem and Substantiation for Public Input

Padding and reinforcements were identified in chapter 7 as an item to be tested, but the preconditioning requirements were not provided. This adds clarification to those requirements.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 65-NFPA 1977-2019 [Sections 8.3.1, 8.3.2]</u>	

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Public Input No. 70-NFPA 1977-2019 [New Section after 8.3.14.3]

8.3.15

Specific requirements for testing padding and reinforcement materials.

8.3.15.1 Five specimens shall be tested.

8.3.15.2 Samples for conditioning shall be at least 1 m (1 yd) square of each material.

8.3.15.3 Testing shall be performed as described in 8.3.2 through 8.3.8.

Statement of Problem and Substantiation for Public Input

Paddings and reinforcement are not directional so requirements are being added which allow the testing to be performed without identifying a direction. This information supports PIs 65 and 67.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 65-NFPA 1977-2019 [Sections 8.3.1, 8.3.2]</u>	

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Public Input No. 7-NFPA 1977-2017 [Section No. 8.4.12.6]

8.4.12.6

The length of the brim or peak shall be the shortest distance from each point to the center of the radius on the top side of the brim or peak where they intersect the dome of the helmet. These distances shall be measured and recorded as the original lengths.

PLEASE ADD FIGURE DESCRIBING THE HORIZONTAL AND VERTICAL MEASUREMENTS

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
Public_Comment_28.pdf	1977_PC28_Hold	
Public_Comment_28.docx	1977_PC28_Hold Word	

Statement of Problem and Substantiation for Public Input

Note: This Public Input appeared as "Reject but Hold" in Public Comment No. 28 of the F2015 Second Draft Report for NFPA 1977 and per the Regs. at 4.4.8.3.1.

Substantiation:

A figure would be extremely beneficial to ensure this process is carried out in a consistent manner.
Related Item

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Public Input No. 52-NFPA 1977-2018 [Section No. 8.4.13]

8.4.13 Specific Requirements for Testing Protective Gloves.

8.4.13.1

Specimens shall include complete gloves with labels.

8.4.13.2

Specimen gloves shall be ~~in size small and size large.~~

8.4.13.3

Specimen gloves shall be preconditioned as specified in 8.1.1. Specimen gloves shall then be placed in a circulating air oven for not less than 4 hours at 49°C, +2°/-0°C (120°F, +5°/-0°F).

8.4.13.4

The glove body shall then be filled with ~~4 mm (3/16 - nominal 4 mm (1/8 in.) sized perforated soda-lime or borosilicate glass beads , with care taken to tightly pack the glass beads into the fingers of the glove and into the glove body.~~

~~8.4.13.~~

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.

(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).

NEW A.8.4.13.4(2) A cotton muslin fabric has been found to be a suitable material for the construction of the lightweight bag to hold the beads.

8.4.13.5

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 or other specimen and airflow is parallel to the plane of the material. One to three glove specimens shall be placed in the test oven at one time. 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.

8.4.13.6

The test oven shall be heated and the test thermocouple stabilized at 204°C, +6°/-0°C (400°F, +10°/-0°F) for a minimum of 30 seconds.

8.4.13.7

After 5 minutes, +15/-0 seconds, oven exposure at 204°C, +6°/-0°C (400°F, +10°/-0°F), the sample gloves shall be removed and allowed to cool for a minimum of 2 minutes.

8.4.13.8

An assessment of the glove donnability and flexibility shall be made after the heat exposure by having a test subject whose hand dimensions are appropriate for wearing the glove put the glove on and attempt to clutch the hands into a fist five times.

8.4.13.9

The dimensions of the glove specimen shall also be measured to determine pass/fail.

8.4.13.9.1

Glove measurements shall be made following preconditioning and after the oven heat exposure specified in 8.4.13.6.

8.4.13.9.2

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.

8.4.13.9.3

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.

8.4.13.10

The percent change in the width and length dimensions of each specimen shall be calculated. Results shall be reported as the average of all three specimens in each dimension.

8.4.13.11

Testing shall be performed as described in 8.4.2 through 8.4.8.

Statement of Problem and Substantiation for Public Input

Revised test method to align with NFPA 1971 to increase consistency in the preparation of the glove specimens for testing. This alleviates the problem of "overstuffing" the gloves to inhibit shrinkage.

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Public Input No. 78-NFPA 1977-2019 [New Section after 8.5]

Evaporative resistance Test (Ret)

8.X Evaporative resistance test.

8.X.1 Application.

8.X.1.1 This test method shall apply to protective garment composites and reinforcement composites but shall not apply to cold weather outerwear composites.

8.X.1.2 Modifications to this test method for testing reinforcement composites shall be as specified in 8.5.8.

8.X.2 Samples.

8.X.2.1 Samples shall consist of all the layers of the protective garment composite, with the exception of winter liner, arranged in the order and orientation they are worn.

8.X.2.2 Samples shall be conditioned for five laundering cycles as specified in 8.1.2, then conditioned at a temperature of 35°C +/-7°C (77°F +/- 12.6°F) and a relative humidity of 40 percent +/- 5 percent for at least 4 hours.

8.X.3 Specimens.

8.X.3.1 Specimens for testing shall be the same as samples for conditioning.

8.X.3.2 Testing shall be conducted on a minimum of three specimens.

8.X.4 Apparatus.

8.X.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.X.5 Procedure.

8.X.5.1 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.

8.X.6 Report.

8.X.6.1 The evaporative resistance (*Ret*) of the sample shall be calculated, recorded, and reported.

8.X.7 Interpretation.

8.X.7.1 Pass or fail determination shall be based on the average evaporative resistance (Ret) measurement of all specimens tested.

Statement of Problem and Substantiation for Public Input

Several NFPA documents have adopted or are considering evaporative resistance (Ret) for addressing heat strain with firefighters. THL should be more of a predictor of heat strain in moderate environments while it's thought that Ret would be a better predictor of heat stain in hotter environments as it removes the effects of conduction.

Some of the benefits of Ret have been observed in structural gear through a physiological study. In NFPA 1994 it was shown that a garbage bag (with no breathability) could pass the THL requirement which lead to the adoption of Ret into their standard. It is unclear if Ret will provide any benefit to the wildland firefighter community. Nevertheless, I would like for the committee to consider it for more study.

Related Public Inputs for This Document

Related Input
Public Input No. 77-NFPA 1977-2019 [New Section after 7.1.6]

Relationship
Ret testing

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Public Input No. 83-NFPA 1977-2019 [Section No. 8.5]

8.5 Total Heat Loss Test.

8.5.1 Application.

8.5.1.1

This test method shall apply to ~~protective garment composites and reinforcement composites~~ wildland garments with all specified reinforcements, but shall not apply to cold weather outerwear composites.

~~8.5.1.2~~

~~Modifications to this test method for testing reinforcement composites shall be as specified in 8.5.8.~~

~~8.5.2~~ – Samples.

8.5.2.1

~~Samples~~ The garment shall consist of all the layers of the protective garment composite, with the exception of winter liner, arranged in the order and orientation they are worn.

8.5.2.2

Samples shall be conditioned for five laundering cycles as specified in 8.1.2, then conditioned at a temperature of 25°C ±7°C (77°F ±12.6°F) and a relative humidity of 65 percent ±5 percent for at least 4 hours.

8.5.3 Specimens.

8.5.3.1

Specimens for testing shall be the same as samples for conditioning.

8.5.3.2

Testing shall be conducted on a minimum of three specimens.

8.5.4 Apparatus.

8.5.4.1

The test apparatus shall be as specified in ~~ASTM F1868~~ in ASTM F2370, *Standard Test Method for ~~Thermal and Measuring the~~ Evaporative Resistance of Clothing ~~Materials~~ Using a Sweating Hot Plate- Manikin*

8.5.5 Procedure.

8.5.5.1

Testing shall be conducted in accordance with ASTM

F1868

F2370, *Standard Test Method for*

~~Thermal and~~

Measuring the Evaporative Resistance of Clothing

~~Materials~~

Using a Sweating

~~Hot Plate, using Part C.~~

~~8.5.6~~ – Report.

8.5.6.1 –

The average intrinsic thermal resistance (R_{ef}) of the sample shall be calculated, recorded, and reported.

Manikin with the following modifications:

(a) The environmental temperature shall be set to 25 °C +/- 0.5 °C

(b) The sweating rate should be set to 200 g/ml/hr

(c) Rather than calculating the evaporative resistance of the suit, do a parallel calculation of the heat flux for the manikin system

8.5.6.2 –

The average apparent intrinsic evaporative resistance (AR_{ef}) of the sample shall be calculated, recorded, and reported

Report

8.5.6.3 –

The

1 The average total heat

loss (Q_t) of the sample

flux required to keep the manikin at 35°C wearing the garment shall be calculated, recorded, and reported.

8.5.7 – Interpretation.**8.5.7.1–**

Pass

Pass or fail determination shall be based on the average reported

total

garment heat loss measurement of all specimens tested.

8.5.8 – Specific Testing Requirements for Reinforcement Composites.**8.5.8.1 –**

~~Determination of the total surface area of reinforcement shall not include the waist band, fly, pants cuff, front waist pockets, belt loops, collar, front placket, sleeve cuff, seams, hook and loop, and hems.~~

8.5.8.2 –

~~Determination of the total surface area shall include reinforcement layers and add-ons such as visibility markings, padding, extra pockets, names, organization identification, and heraldry.~~

Statement of Problem and Substantiation for Public Input

Inputs to Public Comment on NFPA 1977

Justification (Sweating Manikin Test Method)

To reduce heat strain to wildland firefighters, NFPA 1977 currently requires a Total Heat Loss (THL) of no less than 450 w/m². This requirement is measured using a guarded sweating hot plate test method (ASTM F1868). Since the sweating plate test method can only measure the insulation and breathability of flat swatches of fabric materials, it cannot assess the effects of garment air layers and reinforcements (pockets, trim, closures, etc.) used in the construction of wildland firefighter protective clothing. Research conducted by NC State has shown that the THL of fabric materials tested by the standard significantly over-predicts the THL of the actual wildland firefighter garments [1]. To compensate for this shortcoming, and to prevent manufacturers from making a double layer product and only testing the outer shell material, the standard requires that “when the total surface area of the reinforcement exceeds values in Table 7.1.6.1, the THL of each reinforcement section must be measured using the guarded sweating hot plate test method. Therefore, we propose that, in addition to measuring the THL of a garment fabric materials, a performance requirement be added that is based on measuring the THL of

the test garment using a standard sweating manikin test method (ASTM F2370). This would eliminate the need to estimate the surface covered by reinforcements, and provide a more accurate assessment of the predicted heat strain contributed by the garment, as worn by the firefighter. Sweating manikin tests are routinely conducted to assess the thermal insulation and breathability of protective clothing ensembles.

1. Barker, Roger, "Balancing Thermal Comfort and Radiant Heat Protection in Wildland Firefighter Clothing", AATCC 2018 International Conference, Greenville, South Carolina, March 6-8, 2018.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 82-NFPA 1977-2019 [Section No. 7.1.6]</u>	

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Committee: FAE-WFF



Public Input No. 76-NFPA 1977-2019 [Sections 8.5.5, 8.5.6]

Sections 8.5.5, 8.5.6

8.5.5 Procedure.

8.5.5.1

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 C -

8.5.6 – Report:

8.5.6.1 –

The average intrinsic thermal resistance (R_{ef}) of the sample shall be calculated, recorded, and reported, with the following modification:

- (a) all testing will be conducted at 2 m/s
- (b) Only conduct evaporative resistance testing.
- (c) Only report the heat flux required to keep the plate at 35oC

8.5.6.2 –

The average apparent intrinsic evaporative resistance (AR_{ef}) of the sample shall be calculated, recorded, and reported

Report

8.5.6.3 1

The average total heat loss (Q_t) of the sample shall be calculated, heat flux required to keep the samples at 35C shall be recorded, and reported.

Statement of Problem and Substantiation for Public Input

It is unclear why we conduct two tests (thermal and apparent evaporative resistance measurements) to calculate a THL value. A heat loss value can be measured directly by measuring the power requirement to keep the plate at 35 C when conducting an apparent evaporative resistance test in a 25oC environment with a 2 m/s wind flow.

I would like for the committee to consider this change to reduce testing costs

Submitter Information Verification

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Submission Date: Thu Jan 03 13:48:36 EST 2019
Committee: FAE-WFF



Public Input No. 54-NFPA 1977-2018 [Section No. 8.16.4.2.1]

8.16.4.2.1

Specimens of load carrying equipment and helmet visibility markings shall be tested for retroreflectivity when wet as specified in Annex C of EN 471, *High Visibility Warning Clothing for Professional Use. Test Methods and Requirements*, at a rate of 109 mm/hr (4 1/4 in./hr).

Statement of Problem and Substantiation for Public Input

Clarifies what products are to be subjected to this test method.

Submitter Information Verification

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Submittal Date: Mon Dec 17 16:05:47 EST 2018

Committee: FAE-WFF



Public Input No. 53-NFPA 1977-2018 [Section No. 8.16.4.3.2]

8.16.4.3.2

Specimens of visibility markings used on helmets shall be tested for ~~retroreflectivity only after the convective heat exposure~~ retroreflectivity after a convective heat exposure of 177C, +6, -0 (350F, +10, -0) for 5 minutes as specified in ~~8.4.1.42.3~~

Statement of Problem and Substantiation for Public Input

Clarifying requirements for the testing of helmet visibility trim.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 55-NFPA 1977-2018 [Section No. 8.1.3.1]</u>	

Submitter Information Verification

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Submittal Date: Mon Dec 17 15:57:59 EST 2018
Committee: FAE-WFF



Public Input No. 51-NFPA 1977-2018 [Section No. 8.30.2.2]

8.30.2.2

Samples shall be conditioned as specified in ~~8.1.4~~ - ASTM F1414 Section 10.

Statement of Problem and Substantiation for Public Input

Correlating the conditioning requirements of the chain saw chaps with the ASTM test method. The current edition of NFPA 1977 requires only As Received testing. The ASTM method requires As Received and After Laundering. This will harmonize the requirements.

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Submittal Date: Wed Nov 28 10:57:48 EST 2018

Committee: FAE-WFF



Public Input No. 63-NFPA 1977-2018 [Section No. A.4.5.4]

A.4.5.4 —

~~For example, such a situation can exist when a product is wholly manufactured and assembled by one or more entities for a separate entity that, in turn, puts its name and label on the product, a practice known as “private labeling,” and markets and sells the product as its own.~~

Statement of Problem and Substantiation for Public Input

Section no longer needed if PI62 is accepted.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 62-NFPA 1977-2018 [Section No. 4.5.4]</u>	

Submitter Information Verification

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Submittal Date: Wed Dec 19 09:00:13 EST 2018
Committee: FAE-WFF

7. Old business
8. New business – Next meeting
9. Adjourn at close of business Wednesday, February 6, 2019.