AGENDA

NFPA Technical Committee on Protective Ensembles
for Structural and Proximity Firefighting (FAE-SPF)
NFPA 1970 (1971) Second Draft meeting

Starting Tuesday, February 21st, 2023
10am- 2:00pm eastern
Microsoft Teams meeting

In-person at
Hilton Durham near Duke University
Durham, NC
To join the meeting, please contact ysmith@nfpa.org

1. **Call to order at 10:00am.** Tim Tomlinson.
2. **Introduction of Committee members and guests.** See committee roster attached.
3. **Chair report.** Tim Tomlinson
4. **Staff liaison report.**
5. **Previous meeting minutes.** February 9th, 2023.
6. **Schedule**

Date	Location	Time	Task Group
02/21/2023 (Tuesday)	Microsoft Teams	10am – 2:00pm EST	Gloves, helmets, footwear
02/23/2023 (Thursday)	Microsoft Teams	10am – 2:00pm EST	Test methods/ Design/ Performance
02/28/2023 (Tuesday)	Durham, NC	8am – 5:00pm EST	Design/ Performance
03/01/2023 (Wednesday)	Durham, NC	8am – 5:00pm EST	Restricted substances
03/02/2023 (Thursday)	Durham, NC	8am – 5:00pm EST	Ensembles/ Hoods/ Ch. 4/ Scope
03/03/2023 (Friday)	Durham, NC	8am – 5:00pm EST	Correlation/ Editorial

7. **NFPA 1970 (1971) Second Draft**
    a. **Public comments. See Attached**
    b. **Task group reports.**
        i. Gloves
        ii. Helmets

iii. Footwear
iv. Test methods
v. Design/ Performance
vi. Restricted substances
vii. Ensembles
viii. Hoods
ix. Ch. 4
x. Scope
xi. Correlation
xii. Editorial

c. Presentations.

i. Wednesday, March 1st, 2023: IAFF

d. Second revisions.

8. Other business.

9. Future meetings.

10. Adjourn.

Address List No Phone

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FAE-SPF

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MINUTES

**NFPA Technical Committee on Protective Ensembles
for Structural and Proximity Firefighting (FAE-SPF)
NFPA 1970 (1971) pre-Second Draft meeting**

February 9th, 2023
2 - 4pm eastern

Microsoft Teams meeting

1. **Called to order at 2pm.** Chairman Tim Tomlinson called the meeting to order at 2pm eastern time.
2. **Introduction of Committee members and guests.** Attendees introduced themselves and identified their affiliation.
3. **Chair report.** Tim Tomlinson welcomed attendees.
    a. Update: second draft meetings will start virtually on February 21st and 23rd, 10am -2pm eastern. In-person meetings still begin 8am on February 28th in Durham, NC. Schedule updated.
4. **Staff liaison report.** Chris Farrell provided the Staff report.
    a. Reviewed public comment resolution log. Will send out to task group chairs after the meeting.
5. **Previous meeting minutes.** The meeting minutes from November 29th, 2022, were approved.
6. **NFPA 1970 (1971) pre-Second Draft.**
    a. **Task group reports.** The following task groups reported out to the Committee:
        i. Design/Performance (Lehtonen)
        ii. Restricted substances (Hayden)
        iii. Test methods (Necklaus)
        iv. Ensemble testing (Newsom)
        v. Helmets (Reidy)
        vi. Hoods (Marshall)

vii. Gloves (Weise)
viii. Footwear (Owens)
ix. Correlation (Schmid)
x. Scope (Tutterow)
xi. Editorial (Lehtonen)

b. Presentation. Bryan Ormond, NC State, presented the results of a research project focused on better understanding PFAS in the fire service.

7. Other business.

a. Robert Tutterow announced early bird registration for the 2023 F.I.E.R.O. Fire PPE Symposium closes February 17.

8. Future meetings.

a. Second draft meeting schedule starts Feb. 21st, 2023. Microsoft teams.

9. Adjourned at 4:24pm on Feb. 9th, 2023.

Committee Roster

Committee Members:

x	**Tomlinson, Tim**	Chair	Addison Fire Department
x	**Schmid, Marni**	Secretary (Alternate)	Fire Industry Education Resource
x	**Archibald, Chris**	Principal	Globe Manufacturing Company LLLC.
x	**Berger, George**	Principal	US Marine Corps Installations Command
x	**Cinque, Vince**	Principal	Broward Sheriff Fire Rescue
	Cox, Matthew	Principal	Fairfax County Fire & Rescue Department
x	**Deaton, Anthoney**	Principal	NC State University
x	**Dennison, Tyler**	Principal	L.N. Curtis & Sons
x	**Durby, Tim**	Principal	Prescott Fire Department
x	**Eysser, Christopher**	Principal	Fire Department City of New York
x	**Falkenstein-Smith, Ryan**	Principal	National Institute of Standards and
x	**Fanning, David**	Principal	E. D. Bullard Company
x	**Fesik, Jonathan**	Principal	Fire Industry Repair Maintenance Inc.
x	**Fithian, William**	Principal	ASTM/Safety Equipment Institute (SEI)
	Hamma, Tom	Principal	Heartland Fire & Rescue
x	**Hayden, Earl**	Principal	International Association of Fire Fighters
x	**Herring, Todd**	Principal	Fire-Dex

x	**Lehtonen, Karen**	Principal	LION Group, Inc.
x	**Marshall, Webster**	Principal	Fire Fighter Cancer Foundation
x	**McKenna, Michael**	Principal	Michael McKenna & Associates, LLC
	Necklaus, Gene	Principal	International Association of Fire Chiefs
x	**Newsom, Amanda**	Principal	UL LLC
x	**Ott, Louis**	Principal	Gentex Corporation
	Overbaugh, Ann	Principal	Intertek Testing Services
x	**Owens, Damian**	Principal	Charlotte Fire Department
x	**Ragan, Tom**	Principal	Shelby Specialty Gloves
x	**Reidy, Jim**	Principal	Texas State Association of Fire Fighters
	Robison, R. Wendell	Principal	National Volunteer Fire Council
x	**Shiels, Brian**	Principal	ArcWear
x	**Silvestri, Daniel**	Principal	Verified Independent Services Providers
x	**Stull, Jeffrey**	Principal	International Personnel Protection, Inc.
x	**Tarley, Jay**	Principal	National Institute for Occupational Safety &
x	**Tutterow, Robert**	Principal	Fire Industry Education Resource
	Weise, Dick	Principal	Southern Area Fire Equipment Research
x	**Winer, Harry**	Principal	HIP Consulting LLC
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x	**Colatruglio, Matt**	Alternate	Fire-Dex
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x	**Rihn, John**	Alternate	Globe Manufacturing/Mine Safety
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	Stull, Grace	Alternate	International Personnel Protection, Inc.
x	**Tutor, Robin**	Alternate	UL LLC
	Vaughan, Christopher	Alternate	National Volunteer Fire Council
	Hamilton, William	Nonvoting Member	Occupational Safety & Health
	Levinson, Andrew	Alt. to Nonvoting	Occupational Safety & Health
x	**Farrell, Chris**	Staff Liaison	National Fire Protection Association

Guests:

Doug Dafler	Veridian
Sarah Frey	Phenix Fire Helmets
R. Bryan Ormond	NC State
Joshua Ingram	PBI Performance Products
Chris Gaudette	Orafol
Collin Grove	Cincinnati Fire
Josef Jennings	Bullard
Janeane Leggett	Majestic Fire Apparel
Jennifer Wise	WL Gore
Mike Salvato	Stedfast
Jian Xiang	Dupont
Samantha Lee	WL Gore
Kelly Sisson	Capstone Fire and Safety Management
Joshua Pettaway	DuPont
Stephane Rousse	3M
Tom Martin	Circul-Air Corp.

Travis Temarantz	Wilkes Barre City Firefighters Union
Kira Mok	Northeastern University
John Morton-Aslanis	NC State
Mike Duyck	Hughes Fire
Neil McMillan	IAFF

Total In Attendance: **60**

Public Comment No. 128-NFPA 1970-2023 [Global Input]

I recommend keeping particulate blocking hoods as an option in the NFPA standard, still allowing traditional hoods to be utilized.

Statement of Problem and Substantiation for Public Comment

I recommend keeping particulate blocking hoods as an option in the NFPA standard, still allowing traditional hoods to be utilized.
Being a manufacturer of hoods for over 25 years, we have a diverse customer base.
Fire departments are all different.
They are different in so many ways.
Both outside as well as internal forces make these differences abundant.
There is no single tool, PPE, apparatus, foam, lounge chair, etc that will make all firefighters, and chiefs, and mayors happy – all the time.
There is the variety between fires and responses.
There are the diverse situations that each department are faced with.
Some are structural while others are MVA requiring emergency response.
Which then provokes a thought process…
Is offering just particulate hoods (one single style of hood) the best choice for these vastly different situations?
Sometimes the way you use a garment and the what you wear to respond is more conducive for one style over another (traditional hoods vs particulate hoods).

When it comes to the fire department determining what type of garments to wear, sometimes selections are purpose generated while other times it may be financially driven.

Having both traditional hoods and particulate hoods as an option allows the end user or individual fire department to determine which hood is suitable for each hazardous situation they are presented with.

As a manufacturer we will certainly manufacture in accordance to what the NFPA standard specifies, ensuring that third party testing is conducted to validate the authenticity to the standard.

Related Item

- FR-66

Submitter Information Verification

Submitter Full Name: Jake Leggett
Organization: Majestic Fire Apparel

Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 03 12:40:04 EST 2023
Committee: FAE-SPF

Public Comment No. 129-NFPA 1970-2023 [Global Input]

I am writing in opposition to the proposed change to the NFPA Firefighting PPE standard making Particulate-Blocking Hoods mandatory and not optional.

Statement of Problem and Substantiation for Public Comment

I am writing in opposition to the proposed change to the NFPA Firefighting PPE standard making Particulate-Blocking Hoods mandatory and not optional.
As a volunteer firefighter for 35+ years and having worn many brands and style firefighting hoods. I find that the current particulate blocking hoods are very heavy, cumbersome, and noisy. It is like wearing a blanket on my head with the noise level of have a plastic grocery bag.
As you well know, firefighters rely a lot on their senses… Hearing is heavily relied on in firefighting operations. With the noise that is created by the particulate blocking hoods it hinders being able to hear all fireground communications clearly and listening for the victim(s) that you are trying to rescue.
I have seen my brothers and sisters in the fire service wear the particulate blocking hood improperly due to the hinderances. Like any part of the PPE being worn incorrectly, where is it any good if it is not worn appropriately. We need to start with making sure that PPE is properly cared for, maintained, washed, and worn appropriately. If we keep requiring PPE that is cumbersome and not ideal for using/wearing appropriately during ALL firefighting operations it is not doing any good. We are masters at adapting and overcoming situations that are not ideal. Firefighters will adapt by finding a way to overcome the hinderances and that will be by not wearing the hood properly which will in turn expose them to more particulates than wear the traditional knit firefighting hood.
Also coming from the volunteer side, we are unable to afford the cost of issuing a particulate blocking hood for every firefighter. We must rely on fund raising to get the funds needed to continue to serve and protect our community. With the rising cost of everything today there is no way that my department and many other departments can afford to purchase the particulate hoods for every active firefighter and ideally have a second hood available so that the hoods can be properly washed and inspected.
When talking to my brothers and sisters from career departments, they are facing the same budget issues for purchasing PPE. They are seeing budget cuts and the need to shift money in the budget to cover other operating expenses.
As small as these issues may sound to some, they are HUGE on in the outside world and in our fire departments (both volunteer and career).
Let's keep the particulate blocking hood as an option and NOT make it mandatory. I would rather see hoods worn, washed, and maintained correctly than see hoods not worn and maintained appropriately (because the lack of money to purchase enough hoods for everyone and have spares while issued hoods are being cleaned/inspected). In the end, any dirty/contaminated hood is a much bigger issue and more harmful.

Related Item

- FR-66

Submitter Information Verification

Submitter Full Name: Carl Bonser

Organization:	Franklin Twp Vol Fire Co
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Tue Jan 03 13:55:27 EST 2023
Committee:	FAE-SPF

Public Comment No. 132-NFPA 1970-2023 [Global Input]

It is my suggestion and public comment to keep traditional hoods and still offer particulate hoods as an option, not mandatory.

Statement of Problem and Substantiation for Public Comment

It is my suggestion and public comment to keep traditional hoods and still offer particulate hoods as an option.

While I understand the importance and appreciate all the efforts in reducing contaminants / cancer in the fire service with the introduction of particulate hoods …
No one wants to talk about the white elephant in the room, BUDGETS!
Us volunteer departments (which take up much of the demographics of fire stations across the USA) already have limited to NO money in the budget to make up for the difference of traditional hood pricing vs that of a particulate hood.
Many of us purchase our own gloves and hoods, as our fire department budgets are used for other more costly expenses.
Making particulate hoods mandatory could put an economic strain on an already stressed budget both personally and/or professionally.

Let us the firefighters, the ones wearing the product, the ones purchasing personally the product have the choice.
While I understand that traditional hoods may not eliminate the potential for contaminants / cancer in the fire service, however with a good wash your hood program, I do believe the risk could be reduced!
I have not technical backing or substation to my public comment.

PS – I would also suggest making the process of entering a public comment easier as this process is very cumbersome especially when many of us are accessing via a phone and not a physical computer.

Related Item

• FR-66

Submitter Information Verification

Submitter Full Name: Jacqueline Hesley-Bonser
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State:
Zip:
Submittal Date: Tue Jan 03 14:07:31 EST 2023
Committee: FAE-SPF

Public Comment No. 134-NFPA 1970-2023 [Global Input]

If the new NFPA standard makes particulate blocking hoods mandatory, it would greatly put a strain on our department.

Statement of Problem and Substantiation for Public Comment

If the new NFPA standard makes particulate blocking hoods mandatory, it would greatly put a strain on our department. We are a small department with volunteer firefighters and have already been struggling to make ends meet with the decreases in funding and donations. Particulate blocking hoods are in most cases at least double or triple of what the standard knit sock hood costs, as a small department how are we supposed to afford this? Pricing is not the only factor as to why we are against particulate hoods becoming mandatory; we do have a couple firefighters that currently wear particulate hoods and have heard several complaints about them being too noisy. Being able to hear on scene and in a fire is very important and the crackling of the particulate hoods definitely puts a damper on hearing. Therefore, I do not believe the NFPA standard should make particulate blocking hoods mandatory.

Related Item

• FR-66

Submitter Information Verification

Submitter Full Name: Chris Paroby
Organization: Good Intent Fire Company
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 03 14:23:02 EST 2023
Committee: FAE-SPF

Public Comment No. 152-NFPA 1970-2023 [Global Input]

Opposition to Particulate Blocking Hood Changes

Statement of Problem and Substantiation for Public Comment

To Whom it May Concern;

This letter is in opposition to the proposed update to NFPA 1970 in regard to Particulate Blocking Hoods in the Fire Service.

It is in my belief that this change, although having the right intentions, will do more harm than good when it comes to fire companies themselves. According to the NFPA Research; US Fire Department Profile 2020, there are around 65% of all fire companies that are volunteer. Being from rural Pennsylvania in a County that is 100% Volunteer, I can see these proposed changes causing issues when it comes to funding. Most of our small departments rely on fundraising, donations, and grant money to pay for all of our firefighting equipment. However, I do think that some departments investing the extra money into Particulate Blocking Hoods for the more active firemen is a good idea; I also think making this a standard where there is no options is a bad idea. Many departments have Junior Firemen, Probationary Firemen that do not go interior, and they also have those supporting members that are there for scene support. With that being said, those members may not need the Particulate Blocking Hood as much as those that are going interior. I personally have a Particulate Blocking Hood; I love the hood and like having that piece of mind knowing I have slightly more protection than my other hoods on my gear rack. However, I do not find this necessary in the firefighting industry as a mandatory requirement to have these hoods.

Overall, I believe it will make those smaller departments have to pick and choose who they outfit with gear and who will have to be put on a waiting list until they can get the funding to outfit that person. Also, according to US Fire Department Profiles published by NFPA, it says that the combination of Career and Volunteer Firefighters was down four percent in 2020 compared to 2019; this was the lowest number since 1991. Putting this change into play takes away the choices of what departments can buy, which in turn makes departments choose what to do as I stated earlier. In conclusion, I believe that this will push more volunteers away from the fire service. Every person is an asset to his or her community into which they serve; driving that one person away could mean the death of countless civilians when there is not enough help for these departments. I think the ultimate answer to this is to get more information out about Particulate Blocking Hoods and let the departments choose what is best for them and their circumstances.

Related Item

• FR-66

Submitter Information Verification

Submitter Full Name: Jacob Bonser
Organization: Franklin Township Volunteer Fire Company
Street Address:

City:
State:
Zip:
Submittal Date: Tue Jan 03 20:49:50 EST 2023
Committee: FAE-SPF

Public Comment No. 154-NFPA 1970-2023 [Global Input]

I am writing in opposition to the change that is recommended within NFPA to make particulate hoods mandatory (which in essence will remove traditional hoods). I would like the standard to remain as is with traditional hoods remaining in the standard, with the option of a particulate hoods.

Statement of Problem and Substantiation for Public Comment

I am writing in opposition to the change that is recommended within NFPA to make particulate hoods mandatory (which in essence will remove traditional hoods). I would like the standard to remain as is with traditional hoods remaining in the standard, with the option of a particulate hoods.

As a dealer of PPE for the fire service, our #1 priority is safety! Firefighters show up without reservation at our weakest moment, a fire. While my recommendation to keep traditional hoods might contradict our safety priority, my recommendation is based on what our customers want, and what they tell us they need.

Hoods are the most vulnerable piece of PPE. The introduction of particulate hoods to the fire service was circa 2016-2017. And while we understand and appreciate the advancements in protection and technologies used to manufacture particulate hoods, traditional “sock” hoods are by far still the most popular style of hood we sell. There are a variety of reasons why traditional hoods still out sell particulate hoods. Most would say price is a factor, as current particulate blocking hoods can cost 2x-3x that of a traditional hood. Also, there is a stigma that because particulate hoods cost more, that they should last longer (which is not always the case). Comfort. Comfort and safety go hand in hand. We all can relate, if something is not comfortable to wear, you are just counting down the minutes until you can take it off, or it will not be worn at all! Feedback regarding the comfort of particulate hoods has not always been favorable. Many are not fond of the (for lack of better description) the plastic bag feeling when wearing particulate hoods. Many have concerns with limited hearing while wearing particulate hoods. Others feel that particulate hoods are too hot (adding stress to an already physiologically challenged firefighter). Several voice concerns with laundering of particulate hoods and concerns with how clean are particulate hoods after they have been laundered. We receive more complaints and concerns on particulate hoods then we do for traditional hoods. So going back, particulate hoods have been around awhile, with manufacturer’s knowing the insufficiencies of particulate hoods (and fabrics), since they have been launched, yet no one has come up with the ”magic hood” that suffices all. Hence my recommendation to keep traditional hoods in the standard.

The NFPA Standard should serve as a “guide” on what fire departments should buy. If the NFPA standard enforces and declares mandatory particulate hoods and not allowing traditional hoods (which traditional hoods have been around for years and years) then they, NFPA is deciding for the fire department

Related Item

- FR-66

Submitter Information Verification

Submitter Full Name: TOM MCCOY
Organization: FireCraft Safety Products
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 08:17:52 EST 2023
Committee: FAE-SPF

Public Comment No. 164-NFPA 1970-2023 [Global Input]

Public Comment on NFPA PPE standard to make particulate blocking hoods mandatory.

Statement of Problem and Substantiation for Public Comment

Being from a small rural volunteer fire department we rely on fundraising and donations to buy equipment and operate. By changing the current standard to make particulate blocking hoods mandatory instead of optional would put a large financial burden on most departments. The particulate blocking hoods are 3 to 4 times more expensive than a standard hood.
Not all our firefighters are interior firefighters and not having the option to buy a standard hood for the support and exterior firefighter would make it that we would have to choose who gets a hood. Currently we have the option to purchase the particulate hoods for the active interior firefighters and a standard hood for exterior firefighters and other support personnel.
We are also fortunate to have a Junior Firefighter program in our department and we have several junior members. These are young men and women who are limited to what they can do when the alarm sounds for help. They are not interior firefighters; they are still learning and are a big part in our department, community, and the future of the department. Right now, we have the option to issue the junior members a standard hood but if the standard changes to require particulate hoods we will not have that option and would face the issue of not being able to fully outfit our members.
Volunteers are hard to come by and not being able to give every firefighter a hood might cause some not to give to their community and you know one person can make a difference in how and emergency is handled.
The demographics of departments differ, especially in the rural areas of our country. We tend to wear many “hats,” so to speak. For example, our department runs mostly alarms and motor vehicle accidents…We have very little working fire calls. A neighboring community sees far more terrain rescue and alarm calls than working fire calls while another neighboring community sees mostly alarms, motor vehicle accidents and wildland fires. So, the ability to have an option on which hoods to purchase would be the best for not only our department but all departments.

Related Item

• FR-66

Submitter Information Verification

Submitter Full Name: Walter Kroboth
Organization: Parryville Volunteer Fire Co
Street Address:
City:
State:
Zip:

Submittal Date: Wed Jan 04 10:44:43 EST 2023
Committee: FAE-SPF

Public Comment No. 183-NFPA 1970-2023 [Global Input]

I am making a Public Comment expressing my opposition of making particulate hoods mandatory in the new NFPA Standard.

Statement of Problem and Substantiation for Public Comment

I am making a Public Comment expressing my opposition of making particulate hoods mandatory in the new NFPA Standard.

As a dealer of firefighting equipment and PPE I am writing to ask NFPA to reconsider making particulate blocking hoods mandatory for the fire service.

We sell both the traditional firefighting hoods and the particulate blocking firefighting hoods. However, in our experience, the only departments that are financially able to purchase particulate blocking hoods are those that have received grants to do so. The typical fire department (which includes many volunteer fire departments) cannot afford particulate hoods, as particulate hoods are 2 – 3 times more expensive than the traditional knit hood. Which just adds to the overall cost to outfit a firefighter, which is already expensive.

Another concern is contamination, cross-contamination, how to clean a particulate hood, and how clean does a particulate hood get. As with any PPE, once the item becomes contaminated in a fire, there should be concern with the cleaning as to not cross-contaminate. When you review how garments (gear) are laundered, the outer shell and the liner are separated and washed separately (washing outer garments with outer garments, while liners are washed with liners). Washing the outer shell and the lining separate helps reduce cross-contamination. This is not possible with a particulate hood, as particulate hoods do not have individual liners that can be separated. How can we reduce or prevent cross-contamination of any contaminate if we cannot separate these layers, and we are talking about an item that goes on the head – next to your face on your neck which are high risk areas? We could recommend that heavily contaminated hoods be separated from those that may be less soiled to help reduce contamination during laundering. But aren't firefighters already doing enough without having to sort through and determine what is heavily contaminated and what is less, and making piles of laundry accordingly? It has been my experience that firefighting gear is already not washed and maintained as it should be. Maybe the focus should be on cleaning gear, making sure gear is laundered, having back up clean gear (always be ready).

I am asking, on behalf of my company and the fire departments that I serve, for the NFPA to please keep traditional hoods in the standard while offering particulate blocking hoods as an option (by not making particulate hoods mandatory).

Related Item

- FR-66

Submitter Information Verification

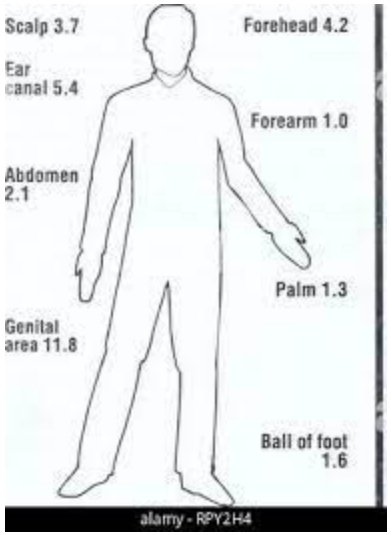
Submitter Full Name: Russell Campbell
Organization: Macs Fire Safety
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 11:46:09 EST 2023
Committee: FAE-SPF

Public Comment No. 20-NFPA 1970-2022 [Global Input]

Type your content here ...In regards to sect 7.18.4.4 describing a particulate blocking "suit" and having this "suit" extend the full length of the arm from shoulder to wrist and extending the full length of the leg from waist to ankle. This idea of a full body suit is not practical or safe. I would suggest that the garments be a combination of short sleeve and shorts. Both top and bottom could be worn as station wear thus always ready to protect the fire fighter. The sleeves should have a elastic sleeve and elastic leg.

Please note the below illustration showing Dermal Monitoring and Absorbing. this shows that the genitals fare and away the most vulnerable area of absorption over 11x greater than the forearm.

In addition all the testing should be similar to the ff hood.



Thank You,

Mark Monson

St. Paul Fire Dept.

Additional Proposed Changes

File Name	Description	Approved

.1665542687861 Public Comment on 1971

Statement of Problem and Substantiation for Public Comment

ype your content here ...In regards to sect 7.18.4.4 describing a particulate blocking "suit" and having this "suit" extend the full length of the arm from shoulder to wrist and extending the full length of the leg from waist to ankle. This idea of a full body suit is not practical or safe. I would suggest that the garments be a combination of short sleeve and shorts. Both top and bottom could be worn as station wear thus always ready to protect the fire fighter. The sleeves should have a elastic sleeve and elastic leg.

Please note the below illustration showing Dermal Monitoring and Absorbing. this shows that the genitals fare and away the most vulnerable area of absorption over 11x greater than the forearm.

In addition all the testing should be similar to the ff hood.

Thank You,

Mark Monson

St. Paul Fire Dept.

Related Item

• Particulate blocking under garments

Submitter Information Verification

Submitter Full Name: Mark Monson
Organization: City Of Savage
Street Address:
City:
State:
Zip:
Submittal Date: Tue Oct 11 22:21:14 EDT 2022
Committee: FAE-SPF

Public Comment No. 210-NFPA 1970-2023 [Global Input]

Dear Committee Members,

As President of Wilkes-Barre City Fire Fighters Union IAFF Local 104 and former chair of our local's cancer prevention committee, I feel it is imperative to submit public comment on the 2nd Draft of consolidated NFPA 1970.

Cancer is killing fire service members at a highly alarming rate. There are countless stories of firefighters, some as young as 24 and 25 years old, being diagnosed with occupational cancer, ultimately being buried by their family, friends, and coworkers. It has to stop. You hold the power to facilitate changes that will remove the toxins and carcinogens in our turnout gear.

We, the end users of turnout gear, ask you to advocate for our health and longevity. Do the right thing, and help stop killing our brothers and sisters.

My general substantiation for the comments/revisions submitted is that cancer is now the number one killer of firefighters and is the largest risk to the fire service. 348 of 469 members honored during the IAFF Fallen Fire Fighter Memorial died of occupational cancer. Known carcinogens and toxins must be removed from turnout gear.

Respectfully submitted,

Travis Temarantz

President | Wilkes-Barre City Fire Fighters Union

IAFF Local # 104

Statement of Problem and Substantiation for Public Comment

My general substantiation for the comments/revisions submitted is that cancer is now the number one killer of firefighters and is the largest risk to the fire service. 348 of 469 members honored during the IAFF Fallen Fire Fighter Memorial died of occupational cancer. Known carcinogens and toxins must be removed from turnout gear.

Related Item

• TIA 1594 on NFPA 1971, Public Comments submitted by me on 2nd draft items

Submitter Information Verification

Submitter Full Name: Travis Temarantz
Organization: Wilkes Barre City Firefighters Union IAFF Local 104
Affiliation: Representing General Members and Cancer Prevention Committee

Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 14:27:29 EST 2023
Committee: FAE-SPF

Public Comment No. 211-NFPA 1970-2023 [Global Input]

Restore the standard title names following referenced sections where deleted by editorial in the first draft.
Examples 8.1.5, 8.1.16, 8.1.24, and so on.

Statement of Problem and Substantiation for Public Comment

The Section titles have been removed by NFPA editorial in sections that were modified during the first revision. The consolidated standard is challenging enough in terms of proper references, removing the title of the referenced section creates more confusion, particularly since it is done sporadically and not consistently throughout the document. The section titles make it easier to understand what is being required in paragraphs versus having to navigate away from what you are reading to see the referenced section.

Related Item

• FR276

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 14:28:05 EST 2023
Committee: FAE-SPF

Public Comment No. 232-NFPA 1970-2023 [Global Input]

Chapter 9 Test Methods (NFPA 1971)

Reorganze test methods by category and make titles of test methods more consistent as shown in attachment

...

Additional Proposed Changes

File Name	Description	Approved
Stull_NFPA_1970_PC232_Proposed_Organization_of_Test_Methods.docx	Reorganization and retitling of test methods	

Statement of Problem and Substantiation for Public Comment

When NFPA 1971, 1972, 1973 and 1974 were consolidated into a single standard for the 2000 edition of NFPA 1971, the format for the test methods was harmonized and test methods were logically ordered in a way where like test methods appears in the same part of the Chapter. In successive revisions of NFPA 1971 as new test methods were added or deleted, this order has not been maintained. The creation of categories of test method where the current and new test methods are placed in categories related to the type of test method will assist regaining this reorganization and help keep related methods in the same part of the standard.

In addition, since NFPA has abandoned using the titles as part of the test methods, it is now more important that several test methods be retitled to reflect their actual use.

Related Item

• Global public input

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 17:01:51 EST 2023

Committee: FAE-SPF

Public Comment No. 233-NFPA 1970-2023 [Global Input]

Revise Sections in Chapter 7, 8, and 9 that address restricted substances

1. Update Restricted Substance Requirements in First Revision 223 (Section 8.20) to reflect status of limits available in January 2023

2. Upate test methodology for measuring restricted substances in First Revision 222 (Section 9.83) to include further details on any test methodology needed to carry out assessments.

3. Further review specified materials and components for evaluation of restricted substances as addressed for each element in Chapter 7. Consider limiting requirement to only major components and those components that make contact with unprotected skin.

4. Consider paring down list provdied in Section 8.20 to those restricted substances of greatest current concern for fire gear, including chlorophenols, formaldehyde, heavy metals, per- and polyfluoroakyl substances, phthalates, and UV absorbers/stablizers.

5. Add information to annex to better explain process and correspondence with industry practices and likelihood of changes in restrictions.

Statement of Problem and Substantiation for Public Comment

Additional refinements are needed to bring test method and criteria to latest understanding of applied restricted substance requirements.

Related Item

• FR222 and 223

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 17:09:59 EST 2023
Committee: FAE-SPF

Public Comment No. 234-NFPA 1970-2023 [Global Input]

Address Basis of PFAS-Free for Structural Firefighting Protective Elements

In paragraph 6.4.13, apply a standardized total organic fluorine test for each major material and component in the respective element as the basis of being able to make this claim, along with providing a new section in Chapter 9 for the test method that has a defined limit of quantification.

Statement of Problem and Substantiation for Public Comment

A more definitive and verifiable way is needed for basis a PFAS-Free claim. The use of a test method for total organic fluorine though not perfect is the next best means for achieving this type of demonstrated claim. Consult ASTM Subcommittee F15.81, which is working on this developing a guide for measurement of PFAS in consumer products.

Related Item

• FR215

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 17:32:51 EST 2023
Committee: FAE-SPF

Public Comment No. 236-NFPA 1970-2023 [Global Input]

Provide Improvements to Cleaning Efficiency Reporting in Chapters 6, 8, and 9

1. Update test methodology for measurement of cleaning efficiency in Section 9.81 by removing references from NFPA 1851.

2. Limit clearning efficiency measurements to garment shell and liner materials, whole hoods, and removable helmet ear cover and suspension over materials.

3. Precondition material for a limite number of wash cycles (10).

4. Apply cleaning efficiency measurements for reporting purposes only.

.

Statement of Problem and Substantiation for Public Comment

Some streamlining of the procedures are being applied to make the testing more repeatable and easier to execute. The testing is being limited to those components where the procedures have been demonstrated to provide discriminatory results.

Related Item

• FR205

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 17:41:19 EST 2023
Committee: FAE-SPF

Public Comment No. 237-NFPA 1970-2023 [Global Input]

Adapt the multienvironmental exposure conditioning in 9.1.22 to address field observed premature excessive wear and damage of outer shell fabrics considering a combination of UV light exposure, heat, and laundering.

Statement of Problem and Substantiation for Public Comment

Observed significant wear and tear of some products in the field resulting in early service life of some gear reported by multiple sources demands attention to identifying protocols that will better predict service life of gear for meeting fire service expectations.

Related Item

- FR122

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 17:54:42 EST 2023
Committee: FAE-SPF

Public Comment No. 238-NFPA 1970-2023 [Global Input]

Improve Use Information for Structural Firefighting Protective Ensembles

1. Include requirement to reference NFPA 1851.

2. Break down cleaning procedures to preliminary exposure reduction, advanced cleaning, specialized cleaning, disinfection, and sanitization

3. Dictate that statements must be included that indicate dangers or hazards of contaminated gear.

4. Provide more definitive information on associated safety practices and hygiene wihen using gear.

Statement of Problem and Substantiation for Public Comment

A greater linkage must be provided between NFPA 1851, most recently revised in 2020 and the new edition of the NFPA 1971 user information requirements to be met by manufacturers.

Related Item

• FR112

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 18:01:53 EST 2023
Committee: FAE-SPF

Public Comment No. 239-NFPA 1970-2023 [Global Input]

Introduce PFAS methodology provided by NIST

Establish PFAS measurement approach based on information provided by NIST presentation made to Hazardous Substances Task Group on 16 November.

Statement of Problem and Substantiation for Public Comment

Substantial research was undertaken by the National Institute on Standards and Technology to develop and validate methods that can be applied to turnout clothing materials. This methodology should be basis of the test method provided in NFPA 1971 for the measurement of PFAS in materials.

Related Item

- FR222

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 18:09:11 EST 2023
Committee: FAE-SPF

Public Comment No. 240-NFPA 1970-2023 [Global Input]

Chapter 9 test Methods (for NFPA 1971)

Where possible, provide additional reporting details to describe how test is performed, particularly with the requirement for photographs or diagrams to depict positions of products for full testing where variations in test practice can occur.

Statement of Problem and Substantiation for Public Comment

Some test imprecision occurs as the result of not documenting how products are testing one each occasion, primarily in the evaluation of full products. Additional test documentation helps in ensuring that testing is carried out in a consistent way.

Related Item

• Prior public input

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protectino, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 18:14:39 EST 2023
Committee: FAE-SPF

Public Comment No. 171-NFPA 1970-2023 [Section No. 1.2.3]

~~1.2.3~~ ~~*~~ –

~~This standard shall address optional, nonmandatory testing for full structural and proximity firefighting protective ensembles in different areas of overall systems performance as addressed in Annex~~ ~~H~~ .

Statement of Problem and Substantiation for Public Comment

See Public Comment 169 which proposes to remove Annex G
N.B. this text should have referred to Annex G, not H. This was a typo in the first revision.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 169-NFPA 1970-2023 [Chapter G]	
Public Comment No. 172-NFPA 1970-2023 [Section No. A.1.2.3]	

Related Item

• Annex G

Submitter Information Verification

Submitter Full Name: Marcus Berney-Smith
Organization: Draeger Safety Ltd. UK
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 11:03:23 EST 2023
Committee: FAE-SPF

Public Comment No. 178-NFPA 1970-2023 [Section No. 1.2.3]

1.2.3*

This standard shall address optional, nonmandatory testing for full structural and proximity firefighting protective ensembles in different areas of overall systems performance as addressed in Annex ~~H~~ G .

Statement of Problem and Substantiation for Public Comment

Section 1.2.3 references Annex H, but the correct reference should be Annex G.

See also Public Comment No. 166.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 166-NFPA 1970-2023 [Chapter G]	

Related Item

- First Revision No. 232-NFPA 1970-2022

Submitter Information Verification

Submitter Full Name: Robert Sell
Organization: Draeger, Inc.
Affiliation: Draeger, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 11:32:46 EST 2023
Committee: FAE-SPF

Public Comment No. 78-NFPA 1970-2022 [Section No. 1.2.3]

1.2.3*

This standard shall address optional, nonmandatory testing for full structural and proximity firefighting protective ensembles in different areas of overall systems performance as addressed in Annex ~~H~~ G .

Statement of Problem and Substantiation for Public Comment

Editorial Correction. The correct Annex to reference is Annex G.

Related Item

- FR232

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Dec 28 12:27:26 EST 2022
Committee: FAE-SPF

Public Comment No. 62-NFPA 1970-2022 [Section No. 1.3]

1.3* Application.

This standard shall be applied as follows:

(1) Chapters 1 through 4, 5 through 9 , and Annexes A, B, and H constitute the 2024 edition of NFPA 1971.

(2) Chapters 1 through ~~3~~ 4 , 10 through 14, and Annexes A, C, and H constitute the 2024 edition of NFPA 1975.

(3) Chapters 1 through ~~3~~ 4 , 15 through 19, and Annexes A, D, and H constitute the 2024 edition of NFPA 1981.

(4) Chapters 1 through ~~3~~ 4 , 20 through 24, and Annexes A, E, F, and H constitute the 2024 edition of NFPA 1982.

Statement of Problem and Substantiation for Public Comment

Chapter 4 currently covers the general certification requirements for all 4 documents within NFPA 1970 but previously, Chapter 4 only appeared to cover the certification requirements for NFPA 1971. The Chapter 4 covering NFPA 1971 has since been deleted and there is now a separate chapter within the NFPA 1971 (Sections 5 - 9). There appear to be some inconsistencies which contradicts the current Chapter 4.1.1 as compared to section 1.3.

Related Item

• PI No. 214-NFPA 1970-2024

Submitter Information Verification

Submitter Full Name: Robert Sell
Organization: Draeger, Inc.
Affiliation: Draeger, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Mon Dec 26 12:28:55 EST 2022
Committee: FAE-SPF

Public Comment No. 130-NFPA 1970-2023 [Chapter 2]

UPDATE CHAPTER 2 REFERENCES TO CURRENT TITLES AND EDITIONS

Chapter 2 Referenced Publications

2.1 General.

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

2.2 NFPA Publications.

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

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, 2021 edition.

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

NFPA 1802, *Standard on Two-Way, Portable RF Voice Communications Devices for Use by Emergency Services Personnel in the Hazard Zone*, 2021 edition.

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

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

NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*, 2020 edition.

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

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

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

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

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

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2019 edition.

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

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

NFPA 2500, *Standards for Operations and Training for Technical Search and Rescue Incidents and Life Safety Rope and Equipment for Emergency Services*, 2022 edition.

2.3 Other Publications.

2.3.1 AATCC Publications.

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

AATCC 15, *Colorfastness to Perspiration*, 2021.

AATCC TM35, *Test Method for Water Resistance: Rain Test*, 2018e2.

AATCC TM42, *Test Method for Water Resistance: Impact Penetration Test*, 2017e.

AATCC TM61, *Test Method for Colorfastness to Laundering: Accelerated*, 2013; reaffirmed 2020.

AATCC TM70, *Test Method for Water Repellency — Tumble Jar Dynamic Absorption Test*, 2015; reaffirmed 2020.

AATCC TM135, *Test Method for Dimensional Changes of Fabrics after Home Laundering*, 2018.

AATCC TM158, *Test Method for Dimensional Changes on Dry-Cleaning in Perchloroethylene: Machine Method*, 2016e.

2.3.2 AFPS Publications.

German Product Safety Committee (Ausschuss für Produktsicherheit, AfPS), Federal Institute for Occupational Safety and Health (BAuA), Postbox 17 02 02, D-44061 Dortmund, Germany.

AfPS GS 2019, *Testing and assessment of Polycyclic Aromatic Hydrocarbons (PAHs) in the awarding of GS Marks – Specification pursuant to Article 21 (1) No. 3 of the Product Safety Act (ProdSG)*, 2019.

2.3.3 ANSI Publications.

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

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

ANSI/ASA S1.13, *Measurement of Sound Pressure Levels in Air*, 2020.

ANSI/ASA S3.2, *American National Standard Method for Measuring the Intelligibility of Speech over Communication Systems*, 2020.

2.3.4 ASME Publications.

American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME B46.1, *Surface Texture (Surface Roughness, Waviness & Lay)*, 2019.

ASME Y14.38, *Abbreviations and Acronyms for Use in Product Definition and Related Documents*, 2019.

ASME Y14.5, *Dimensioning and Tolerancing*, 2018.

2.3.5* ASTM Publications.

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

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

ASTM B16/B16M, *Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines*, 2019.

ASTM B117, *Standard Practice for Operating Salt Spray (Fog) Apparatus*, 2019.

ASTM B152/B152M, *Specification for Copper Sheet, Strip Plate, and Rolled Bar*, 2019.

ASTM D471, *Standard Test Method for Rubber Property—Effect of Liquids*, 2016a (2021).

ASTM D737, *Standard Test Method for Air Permeability of Textile Fabrics*, 2018.

ASTM D751, *Standard Test Methods for Coated Fabrics*, 2019.

ASTM D1003, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*, 2021.

ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, 2017 (2018).

ASTM D1776/D1776M, *Standard Practice for Conditioning and Testing Textiles*, 2020.

ASTM D1777, *Standard Test Method for Thickness of Textile Materials*, 1996 (2019).

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

ASTM D3359, *Standard Test Methods for Rating Adhesion by Tape Test,* 2017.

ASTM D3776/D3776M, *Standard Test Methods for Mass Per Unit Area (Weight) of Fabric*, 2020.

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

ASTM D4157, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Oscillatory Cylinder Method)*, 2013 (2017).

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

ASTM D5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*, 2021.

ASTM D5169, *Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners*, 1998 (2021).

ASTM D5170, *Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners*, 1998 (2021).

ASTM D5587, *Standard Test Method for the Tearing Strength of Fabrics by Trapezoid Procedure*, 2015 (2019).

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

ASTM D6775, *Standard Test Method for Breaking Strength and Elongation of Textile Webbing, Tape and Braided Material*, 2013 (2017).

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

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

ASTM D8041/D8041M, *Standard Test Method for Whole Boot Breathability (MVTR)*, 2016.

ASTM E162, *Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source*, 2021.

ASTM E809, *Standard Practice for Measuring Photometric Characteristics of Retroreflectors*, 2021.

ASTM E991, *Standard Practice for Color Measurement of Fluorescent Specimens Using the One-Monochromator Method*, 2021.

ASTM E1164, *Standard Practice for Obtaining Spectrometric Data for Object-Color Evaluation*, 2012 (2017)e1.

ASTM E2152, *Standard Practice for Computing the Colors of Fluorescent Objects from Bispectral Photometric Data*, 2012 (2017).

ASTM E2153, *Standard Practice for Obtaining Bispectral Photometric Data for Evaluation of Fluorescent Color*, 2001 (2017).

ASTM F392/F392M, *Standard Practice for Conditioning Flexible Barrier Materials for Flex Durability*, 2011 (2015).

ASTM F903, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Liquids*, 2018.

ASTM F1060, *Standard Test Method for Evaluation of Conductive and Compressive Heat Resistance (CCHR)*, 2018.

ASTM F1215, *Test Method for Determining the Initial Efficiency of a Flatsheet Filter Medium in an Airflow Using Latex Spheres,* 1998.

ASTM F1342/F1342M, *Standard Test Method for Protective Clothing Material Resistance to Puncture*, 2022.

ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, 2022.

ASTM F1671/F1671M, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X-174 Bacteriophage Penetration as a Test System*, 2022.

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*, 2017.

ASTM F1939, *Standard Test Method for Radiant Heat Resistance of Flame Resistant Clothing Materials with Continuous Heating*, 2015 (2020).

ASTM F2010/F2010M, *Standard Test Method for Evaluation of Glove Effects on Wearer Finger Dexterity Using a Modified Pegboard Test*, 2018.

ASTM F2299/F2299M, *Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres*, 2003 (2017).

ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin*, 2016.

ASTM F2412, *Standard Test Methods for Foot Protection*, 2018a.

ASTM F2413, *Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear*, 2018.

ASTM F2700, *Standard Test Method for Unsteady-State Heat Transfer Evaluation of Flame-Resistant Materials for Clothing with Continuous Heating*, 2008 (2020).

ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy of Firefighter Protective Clothing Systems*, 2018.

ASTM F2894, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, 2021.

ASTM F2913, *Standard Test Method for Measuring the Coefficient of Friction for Evaluation of Slip Performance of Footwear and Test Surfaces/Flooring Using a Whole Shoe Tester*, 2019.

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

ASTM F3426, *Standard Test Method for Measuring the Thermal Insulation of Clothing Items Using Heated Manikin Body Form*, 2020.

ASTM G155, *Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials*, 2021.

ASTM WK70964, *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Clothing Materials for Protection Against Fire Simulations (Cylinder Method)*.

ASTM WK76082, *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Gloves for Protection Against Fire Simulations (Hand Form Method)*.

2.3.6 CENELEC Publications.

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

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

2.3.7 CIE Publications.

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

ISO/CIE 10526, *CIE standard illuminants for colorimitry*, 2007.

2.3.8 CPSC Publications.

Consumer Product Safety Commission, Directorate for Laboratory Sciences, Division of Chemistry, 5 Research Place, Rockville, MD 20850.

CPSC-CH-C1001-09.4, *Standard Operating Procedure for Determination of Phthalates*, January 17, 2018.

CPSC-CH-E1002-08.3, *Standard Operating Procedure for Determining Total Lead (Pb) in Nonmetal Children's Products*, Revision November 15, 2012.

2.3.9 CSA Group Publications.

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

CSA Z195, *Protective Footwear*, 2014.

2.3.10 DIN Publications.

Deutsches Institut für Normung e.V. (German Institute for Standardization), Am DIN-Platz, Burggrafenstraße 6, 10787 Berlin.

DIN 50009, *Textiles – Determination of tetrachlorophenol-, trichlorophenol-, dichlorophenol-, monochlorophenol-isomers and pentachlorophenol content*, 2021.

DIN 54231, *Textiles – Detection of disperse dyestuffs*, 2005.

2.3.11 EBU Publications.

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

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

2.3.12 EN Publications.

European Committee for Standardization, Rue de la Loi 200, 1049 Bruxelles, Belgium.

EN 16711-2, *Textiles – Determination of metal content – Part 2: Determination of metals extracted by acidic artificial perspiration solution*, 2016.

EN 17131, *Textiles and textile products – Determination of Dimethylformamide (DMF), method using gas chromatography*, 2013.

EN 17137, *Textiles – Determination of the content of compounds based on chlorobenzenes and chlorotoluenes*, 2018.

EN 62321-6, *Determination of certain substances in electrotechnical products – Part 6: Polybrominated biphenyls and polybrominated diphenyl ethers in polymers by gas chromatography-mass spectrometry (GC-MS)*, 2015.

2.3.13 FIA Publications.

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

FIA 1209, *Whole Shoe Flex*, 1984.

2.3.14 IEC Publications.

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

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

2.3.15 ISEA Publications.

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

ANSI/ISEA 107, *American National Standard for High-Visibility Safety Apparel*, 2020.

ANSI/ISEA Z87.1, *American National Standard for Occupational and Educational Personal Eye and Face Protection Devices*, 2020.

2.3.16 ISO Publications.

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

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

ISO 3071, *Textiles – Determination of pH of aqueous extract*, 2020.

ISO 4045, *Leather – Chemical tests – Determination of pH and difference figure*, 2018.

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

ISO 6401, *Plastics – Poly (vinyl chloride) – Determination of residual vinyl chloride monomer – Gas chromatographic method*, 2008.

ISO 6530, *Protective clothing – Protection against liquid chemicals – Test method for resistance of materials to penetration by liquids*, 2005.

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

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

ISO 14184-1, *Textiles – Determination of formaldehyde – Part 1: Free and hydrolyzed formaldehyde (water extraction method)*, 2011.

ISO 14362-1, *Textiles — Methods for determination of certain aromatic amines derived from azo colorants — Part 1: Detection of the use of certain azo colorants accessible with and without extracting the fibres,* 2017.

ISO 14389, *Textiles – Determination of phthalate content – Tetrahydrofuran method*, 2014.

ISO 16186, *Footwear – Critical substances potentially present in footwear and footwear components – Determination of dimethyl fumarate (DMFU)*, 2021.

ISO 16900-5, *Respiratory protective devices – Methods of test and test equipment – Part 5: Breathing machine, metabolic simulator, RPD headforms and torso, tools and verification tools*, 2016.

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

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

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

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

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

ISO 17072-1, *Leather – Chemical determination of metal content – Part 1; Extractable metals*, 2019.

ISO 17075-1, *Leather – Chemical determination of chromium (VI) content in leather – Part 1: Colorimetric method*, 2017.

ISO 17075-2, *Leather – Chemical determination of chromium (VI) content in leather – Part 2: Chromatographic method*, 2017.

ISO 17226-1, *Leather – Chemical determination of formaldehyde content – Part 1: Method using high-performance liquid chromatography,* 2021.

ISO 17226-2, *Leather – Chemical determination of formaldehyde content – Part 2: Method using colorimetric analysis*, 2018.

ISO 17234-1, *Leather — Chemical tests for the determination of certain azo colourants in dyed leathers — Part 1: Determination of certain aromatic amines derived from azo colourants,* 2020.

ISO 17234-2, *Leather — Chemical tests for the determination of certain azo colorants in dyed leathers — Part 2: Determination of 4-aminoazobenzene,* 2011.

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

ISO 17493, *Clothing and equipment for protection against heat — Test method for convective heat resistance using a hot air circulating oven*, 2016.

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

ISO 17881-1, *Textiles – Determination of certain flame retardants – Part 1: Brominated flame Retardants*, 2016.

ISO 17881-2, *Textiles – Determination of certain flame retardants – Part 2: Phosphorus flame retardants*, 2016.

ISO 18218, *Leather – Determination of ethoxylated alkylphenols – Part 1: Direct method*, 2015.

ISO 18219-1, *Leather – Determination of chlorinated hydrocarbons in leather – Part 1: Chromatographic method for short-chain chlorinated paraffins (SCCPs)*, 2021.

ISO 18219-2, *Leather – Determination of chlorinated hydrocarbons in leather – Part 2: Chromatographic method for middle-chain chlorinated paraffins (MCCPs)*, 2021.

ISO 18254-1, *Textiles – Method for the detection and determination of alkylphenol ethoxylates (APEO) – Part 1: Method using HPLC-MS*, 2016.

ISO 19577, *Footwear – Critical substances potentially present in footwear and footwear components – Determination of Nitrosamines*, 2019.

ISO 21084, *Textiles – Method for determination of alkylphenols (AP)*, 2019.

ISO 22818, *Textiles – Determination of short-chain chlorinated paraffins (SCCP) and middle-chain chlorinated paraffins (MCCP in textile products out of different matrices by use of gas chromatography negative ion chemical ionization mass spectrometry (GC-NCI-MS)*, 2021.

ISO 23702, *Leather – Organic fluorine – Part 1: Determination of the non-volatile compound content by extraction method using liquid chromatography/tandem mass spectrometry detector (LC-MS/MS),* 2018.

ISO/TS 16179, *Footwear – Critical substances potentially present in footwear and footwear components – Determination of organotin compounds in footwear materials*, 2012.

ISO/TS 16189, *Footwear – Critical substances potentially present in footwear and footwear components – Test method to quantitatively determine dimethylformamide in footwear materials*, 2013.

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

2.3.17 PIA Publications.

Parachute Industry Association, 6499 S Kings Ranch Road #6-12, Gold Canyon, AZ 85118.

PIA-C-419, *Cloth, duck, unbleached, plied-yarns, army and numbered, Revision B*, March 13, 2011.

2.3.18 SAE Publications.

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

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

2.3.19 UL Publications.

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

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

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

2.3.20 US Department of Defense Publications.

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

A-A-55126C, *Commercial Item Description, Fastener Tapes, Hook and Loop, Synthetic*, December 21, 2016.

A-A-55634CB, *Commercial Item Description, Zippers (Fasteners, Slide, Interlocking)*, October 30, 2019.

2.3.21 US Government Publications.

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

Statement of Standard for NIOSH CBRN SCBA Testing, 2002.

Title 29, Code of Federal Regulations, Part 7, Subpart C.

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

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

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

NIOSH Firefighter Anthropometric Data Base (https://www.cdc.gov/niosh/data/datasets/rd-1007-2015-0/default.html).

2.3.22 Other Publications.

EPA SW-846 Test Method 1311, *Toxicity Characteristic Leaching Procedure*, 1992.

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

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

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

2.4 References for Extracts in Mandatory Sections.

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

Statement of Problem and Substantiation for Public Comment

Update Chapter 2 references to current titles and editions at time of second revision. A proposed track changes document will be provided at the time of addressing public comments.

Related Item

• FR280

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Tue Jan 03 13:58:28 EST 2023
Committee: FAE-SPF

Public Comment No. 235-NFPA 1970-2023 [New Section after 2.1]

TITLE OF NEW CONTENT

Type your content here ...

Additional Proposed Changes

File Name	Description	Approved
PUBLIC_COMMENT_SUBMISSION_.docx	DECLARATION OF NO CONFLICT OF INTEREST, DECLARATION OF NO ADVERSE HEALTH EFFECTS TO PERSONS OR ENVIRONMENT.	

Statement of Problem and Substantiation for Public Comment

In previous years, some manufacturers of turnout gear and AFFF have known of adverse health effects of 'forever chemicals' and have gone to extreme lengths to omit this knowledge. It is time for NFPA to address actions of Manufacturers with declarations of 'no conflict of interest' and 'no adverse health effects' with use of their products.

Related Item

- xenon light test

Submitter Information Verification

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Public Comment No. 2-NFPA 1970-2022 [Section No. 2.3.3]

2.3.3 ~~ANSI~~ ASA Publications.

~~American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.~~

~~ANSI/~~

Acoustical Society of America, 1305 Walt Whitman Road Suite 110, Melville, NY 11747-4300.

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

~~ANSI/~~

ASA S1.13, *Measurement of Sound Pressure Levels in Air* , 2020.

~~ANSI/~~

ASA S3.2,

~~American National Standard~~

Method for Measuring the Intelligibility of Speech over Communication Systems , 2020.

Statement of Problem and Substantiation for Public Comment

(Submitted on behalf of the FAE-ELS HazLoc Harmonization Task Group)
There are other referenced ANSI standards besides ASA standards under other SDO headings (such as ANSI/UL 913 and ANSI/UL 121201).

Related Item

• FR-280

Submitter Information Verification

Submitter Full Name: Paul Kelly
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Submittal Date: Thu Sep 08 22:20:25 EDT 2022

Committee: FAE-SPF

Public Comment No. 3-NFPA 1970-2022 [Section No. 2.3.19]

2.3.19 UL Publications.

~~Underwriters Laboratories Inc.~~ UL Standards & Engagement (ULSE) , 333 Pfingsten Road, Northbrook, IL 60062-2096.

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

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

Statement of Problem and Substantiation for Public Comment

(Submitted on behalf of the FAE-ELS HazLoc Harmonization Task Group)
Updated the new UL Standards organization name and editted the title and edition designations for ANSI/UL 913 and ANSI/UL 121201.

Related Item

• FR-280

Submitter Information Verification

Submitter Full Name: Paul Kelly
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Submittal Date: Thu Sep 08 22:35:24 EDT 2022
Committee: FAE-SPF

Public Comment No. 4-NFPA 1970-2022 [New Section after 3.3.129]

3.3.130 Passive Electrical Circuitry

Electrical circuitry that is part of ensembles and apparel and that has no integral power source, relying on a supplemental device to energize the circuitry. An example of such circuitry is a passive radio-frequency identification (RFID) tag.

Statement of Problem and Substantiation for Public Comment

(Submitted on behalf of the FAE-ELS/FAE-SCE HazLoc Harmonization Task Group)
Definition supports new electrical circuitry design requirements for ensembles and apparel.

Related Item

• FR-139 • FR-44

Submitter Information Verification

Submitter Full Name: Paul Kelly
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Submittal Date: Thu Sep 08 22:48:39 EDT 2022
Committee: FAE-SPF

Public Comment No. 151-NFPA 1970-2023 [Section No. 3.3.135]

3.3.135 PFAS.

An abbreviation for perfluoroalkyl and polyfluoroalkyl substances, which are a class of organic chemicals containing at least one fully fluorinated carbon atom; PFAS shall be tested for using a total organic fluorine (TOF) test .

Statement of Problem and Substantiation for Public Comment

Since PFAS are a class of more than 10,000 chemicals, and we can only test for roughly 70 of these, you need to specify how you will determine the presence of PFAS. Using the Total Organic Fluorine (TOF) test is one way to ensure that all PFAS are accounted for.

Related Item

- FR

Submitter Information Verification

Submitter Full Name: Kyla Bennett
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City:
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Submittal Date: Tue Jan 03 17:12:51 EST 2023
Committee: FAE-SPF

Public Comment No. 116-NFPA 1970-2023 [Section No. 4.1.7]

4.1.7

The certification organization shall not issue any new certifications based on the following standards on or after the NFPA effective date of the ~~2023~~ 2024 edition of NFPA 1970:

(1) 2018 edition of NFPA 1971

(2) 2019 edition of NFPA 1975

(3) ~~2018~~ 2019 edition of NFPA 1981

(4) 2018 edition of NFPA 1982

Statement of Problem and Substantiation for Public Comment

NFPA lists the next edition of 1970 as 2024.
NFPA 1981 has a cover of 2019 but label requirement of 2018 edition?

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 117-NFPA 1970-2023 [Section No. 4.1.8]	
Public Comment No. 118-NFPA 1970-2023 [Sections 4.1.8, 4.1.9]	

Related Item

• FR-298-NFPA 1970-2022

Submitter Information Verification

Submitter Full Name: John Morris
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City:
State:
Zip:
Submittal Date: Mon Jan 02 12:21:42 EST 2023

Committee: FAE-SPF

Public Comment No. 117-NFPA 1970-2023 [Section No. 4.1.8]

4.1.8

The certification organization shall not permit any manufacturer to continue to label any products that are certified as compliant with the 2018 edition of NFPA 1971, the 2019 edition of NFPA 1975, the 2019 (2018) edition of NFPA 1981, or the 2018 edition of NFPA 1982 on the effective date of the ~~2023~~ 2024 edition of NFPA 1970, plus 18 months.

Statement of Problem and Substantiation for Public Comment

Correction of dates to match revision cycle

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 116-NFPA 1970-2023 [Section No. 4.1.7]	

Related Item

- FR-298-NFPA 1970-2022

Submitter Information Verification

Submitter Full Name: John Morris
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Zip:
Submittal Date: Mon Jan 02 12:32:12 EST 2023
Committee: FAE-SPF

Public Comment No. 140-NFPA 1970-2023 [Section No. 4.1.8]

4.1.8

The certification organization shall not permit any manufacturer to continue to label any products that are certified as compliant with the 2018 edition of NFPA 1971, the 2019 edition of NFPA 1975, the 2018 edition of NFPA 1981, or the 2018 edition of NFPA 1982 on the effective date of the 2023 edition of NFPA 1970~~, plus 18 months~~ .

Statement of Problem and Substantiation for Public Comment

I have deleted the "plus 18 months," because 18 months is too long to wait for this. It is known that PFAS is linked with cancer, and we cannot delay removal of PFAS from turnout gear.

Related Item

• FR

Submitter Information Verification

Submitter Full Name: Kyla Bennett
Organization: PEER
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City:
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Submittal Date: Tue Jan 03 16:49:34 EST 2023
Committee: FAE-SPF

Public Comment No. 187-NFPA 1970-2023 [Section No. 4.1.8]

4.1.8

The certification organization shall not permit any manufacturer to continue to label any products that are certified as compliant with the 2018 edition of NFPA 1971, the 2019 edition of NFPA 1975, the 2018 edition of NFPA 1981, or the 2018 edition of NFPA 1982 on the effective date of the 2023 edition of NFPA 1970~~, plus 18 months~~ .

Statement of Problem and Substantiation for Public Comment

As end users of turnout gear, we are fighting to have gear free of carcinogens and toxins. Many revisions of NFPA 1970 to 1971 were made to remove those very toxins and carcinogens, providing us with safer turnout gear. The 18-month compliance in this chapter, simply put, will allow manufacturers to continue to produce gear that Is aiding in the killing of our brothers and sisters. Compliance needs to happen as soon as possible, not well over a year later. 18-months is a completely unacceptable timeline for those that wear turnout gear to be provided a safer alternative.

Related Item

• 4.1.9

Submitter Information Verification

Submitter Full Name: Travis Temarantz
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Affiliation: Wilkes-Barre City Firefighters Union IAFF Local 104
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City:
State:
Zip:
Submittal Date: Wed Jan 04 12:42:53 EST 2023
Committee: FAE-SPF

Public Comment No. 38-NFPA 1970-2022 [Section No. 4.1.8]

4.1.8

The certification organization shall not permit any manufacturer to continue to label any products that are certified as compliant with the 2018 edition of NFPA 1971, the 2019 edition of NFPA 1975, the 2018 edition of NFPA 1981, or the 2018 edition of NFPA 1982 on the effective date of the 2023 edition of NFPA 1970~~, plus 18 months~~ .

Statement of Problem and Substantiation for Public Comment

The substantive revisions from NFPA 1971 to NFPA 1970 has been done to identify and eliminate hazardous chemicals contained within structural firefighting ensembles. The extension for compliance by manufacturers with a maximum transitional period of 18 months goes against the mission of NFPA, which is to “save lives and reduce loss with information, knowledge and passion”, and serves as an unreasonable length of time for end-users to wait for safer forms of PPE. In addition, 18 months has not been authorized in past editions of NFPA 1971, and there is no valid explanation for this allowance.

Related Item

• 4.1.9

Submitter Information Verification

Submitter Full Name: Neil McMillan
Organization: IAFF
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 22 05:23:53 EST 2022
Committee: FAE-SPF

Public Comment No. 118-NFPA 1970-2023 [Sections 4.1.8, 4.1.9]

Sections 4.1.8, 4.1.9

4.1.8

The certification organization shall not permit any manufacturer to continue to label any products that are certified as compliant with the 2018 edition of NFPA 1971, the 2019 edition of NFPA 1975, the 2019 (2018) edition of NFPA 1981, or the 2018 edition of NFPA 1982 on the effective date of the ~~2023~~ 2024 edition of NFPA 1970, plus 18 months.

4.1.9

The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2018 edition of NFPA 1971, the 2019 edition of NFPA 1975, the 2019 (2018) edition of NFPA 1981, or the 2018 edition of NFPA 1982 from all products that are under the control of the manufacturer on the effective date of the ~~2023~~ 2024 edition of NFPA 1970, plus 18 months, and the certification organization shall verify that this action is taken.

Statement of Problem and Substantiation for Public Comment

Correction of dates to match revision cycles

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 116-NFPA 1970-2023 [Section No. 4.1.7]	

Related Item

- FR-298-NFPA 1970-2022

Submitter Information Verification

Submitter Full Name: John Morris
Organization: 3M Company
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jan 02 12:35:40 EST 2023

Committee: FAE-SPF

Public Comment No. 141-NFPA 1970-2023 [Section No. 4.1.9]

4.1.9

The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2018 edition of NFPA 1971, the 2019 edition of NFPA 1975, the 2018 edition of NFPA 1981, or the 2018 edition of NFPA 1982 from all products that are under the control of the manufacturer on the effective date of the 2023 edition of NFPA 1970, ~~plus 18 months, and~~ and the certification organization shall verify that this action is taken.

Statement of Problem and Substantiation for Public Comment

As stated previously, 18 months is too long to wait.

Related Item

• FR

Submitter Information Verification

Submitter Full Name: Kyla Bennett
Organization: PEER
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 03 16:50:37 EST 2023
Committee: FAE-SPF

Public Comment No. 192-NFPA 1970-2023 [Section No. 4.1.9]

4.1.9

The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2018 edition of NFPA 1971, the 2019 edition of NFPA 1975, the 2018 edition of NFPA 1981, or the 2018 edition of NFPA 1982 from all products that are under the control of the manufacturer on the effective date of the 2023 edition of NFPA 1970, ~~plus 18 months,~~ and the certification organization shall verify that this action is taken.

Statement of Problem and Substantiation for Public Comment

As end users of turnout gear, we are fighting to have gear free of carcinogens and toxins. Many revisions of NFPA 1970 to 1971 were made to remove those very toxins and carcinogens, providing us with safer turnout gear. Simply put, the 18-month compliance in this chapter will allow manufacturers to continue producing gear that Is aiding in the killing of our brothers and sisters. Compliance needs to happen as soon as possible, not over a year later. 18 months is a completely unacceptable timeline for those that wear turnout gear to be provided a safer alternative.

Related Item

• 4.1.8

Submitter Information Verification

Submitter Full Name: Travis Temarantz
Organization: Wilkes-Barre City Firefighters Union IAFF Local 104
Affiliation: Representing Membership and Cancer Prevention Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 13:01:09 EST 2023
Committee: FAE-SPF

Public Comment No. 39-NFPA 1970-2022 [Section No. 4.1.9]

4.1.9

The certification organization shall require manufacturers to remove all certification labels and product labels indicating compliance with the 2018 edition of NFPA 1971, the 2019 edition of NFPA 1975, the 2018 edition of NFPA 1981, or the 2018 edition of NFPA 1982 from all products that are under the control of the manufacturer on the effective date of the 2023 edition of NFPA 1970 ~~, plus 18 months,~~ and the certification organization shall verify that this action is taken.

Statement of Problem and Substantiation for Public Comment

The substantive revisions from NFPA 1971 to NFPA 1970 has been done to identify and eliminate hazardous chemicals contained within structural firefighting ensembles. The extension for compliance by manufacturers with a maximum transitional period of 18 months goes against the mission of NFPA, which is to “save lives and reduce loss with information, knowledge and passion”, and serves as an unreasonable length of time for end-users to wait for safer forms of PPE. In addition, 18 months has not been authorized in past editions of NFPA 1971, and there is no valid explanation for this allowance.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 43-NFPA 1970-2022 [Section No. 4.7.10]	

Related Item

- 4.1.8

Submitter Information Verification

Submitter Full Name: Neil McMillan
Organization: IAFF
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 22 05:29:52 EST 2022
Committee: FAE-SPF

Public Comment No. 225-NFPA 1970-2023 [New Section after 4.3.4]

TITLE OF NEW CONTENT

For the design requirements, one representative sample of each model from one or the others of the manufacturing facilities of a single manufacturer can be tested.

Statement of Problem and Substantiation for Public Comment

For the same model from a single manufacturer but produced in more than one manufacturing facility using the same quality assurance procedures, the sampling level for the design requirement could be specified as one representative model from one of the manufacturing facilities. A sample for each model produced in the different manufacturing facilities will be identical (same pattern, same design, same sizing…).

Related Item

•

Submitter Information Verification

Submitter Full Name: Karine Martin
Organization: Innotex
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 16:13:40 EST 2023
Committee: FAE-SPF

Public Comment No. 193-NFPA 1970-2023 [Section No. 4.3.4]

4.3.4

Sampling levels for testing and inspection shall be established by the certification organization ~~and the manufacturer~~ to ensure a reasonable and acceptable reliability at a reasonable and acceptable confidence level that products certified to this standard are compliant, unless such sampling levels are specified herein.

Statement of Problem and Substantiation for Public Comment

The purpose of the certification agency is to "save lives." Allowing the developer or manufacturer to set sampling levels allows for bias and the possibility for end users to question the integrity of these set standards. The only agent that should set levels is the agency developed to set standards, not the manufacturers. This Is ultimately a reason the NFPA was developed which is to hold manufacturers to save standards that save lives.

Related Item

• TIA 1594 on NFPA Standard 1971

Submitter Information Verification

Submitter Full Name: Travis Temarantz
Organization: Wilkes-Barre City Firefighters Union IAFF Local 104
Affiliation: Representing General Membership and Cancer Prevention Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 13:04:21 EST 2023
Committee: FAE-SPF

Public Comment No. 40-NFPA 1970-2022 [Section No. 4.3.4]

4.3.4

Sampling levels for testing and inspection shall be established by the certification ~~organization and the manufacturer to~~ organization to ensure a reasonable and acceptable reliability at a reasonable and acceptable confidence level that products certified to this standard are compliant, unless such sampling levels are specified herein.

Statement of Problem and Substantiation for Public Comment

Bias is present if manufacturers are included in establishing sampling levels, inspection and reasonableness regarding the confidence that "certified" products are compliant.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- NFPA 1971 TIA 1594

Submitter Information Verification

Submitter Full Name: Neil McMillan
Organization: IAFF
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 22 05:34:06 EST 2022
Committee: FAE-SPF

Public Comment No. 63-NFPA 1970-2022 [Section No. 4.3.9]

4.3.9

Inspection and evaluation by the certification organization for determining compliance of recognized components per the requirements specified in NFPA 1971 sections 7.1.14, 7.4.9, 7.7.6, 7.10.10, and 7.13.7 shall be permitted to consist of a review of any available test data provided by the component supplier.

4.3.9.1

Data submitted by the component supplier shall be evaluated against the requirements in NFPA 1971 Table 7.21 to determine compliance of the recognized component being evaluated.

4.3.9.2

This evaluation is required for initial certification only, or if there is a change to the materials used in the recognized component.

4.3.9.3

The data submitted by the component supplier for the purposes of demonstrating compliance to these requirements must not be greater than five years from the initial certification date of that component to this standard.

4.3.9.4

The test data submitted by the component supplier for demonstrating compliance with the requirements in NFPA 1971 sections 7.1.14, 7.4.9, 7.7.6, 7.10.10, and 7.13.7 generated by a testing laboratory shall be accredited to ISO 17025, *General requirements for the competence of testing and calibration laboratories.*

4.3.9.5

Any test data that is required to demonstrate compliance with NFPA 1971 sections 7.1.14, 7.4.9, 7.7.6, 7.10.10, and 7.13.7 that is not submitted by the component supplier shall be subjected to the requirements as outlined in those sections.

Statement of Problem and Substantiation for Public Comment

Section 4.3.9 along with the sub-sections appear in the general "Certification" section and covers some specific requirements pertaining to NFPA 1971. I believe it is out-of-place in Chapter 4 where all documents are covered in a generic manner. I would suggest to at least make reference to NFPA 1971 to distinguish section 4.3.9 and sub-sections as only for use in the inspection and evaluation for NFPA 1971 compliant products.

Section 4.3.9 could also be completely removed and inserted into Chapter 5.

Related Item

• First Revision No. 300-NFPA 1970-2022

Submitter Information Verification

Submitter Full Name: Robert Sell
Organization: Draeger, Inc.
Affiliation: Draeger, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Dec 27 11:43:20 EST 2022
Committee: FAE-SPF

Public Comment No. 142-NFPA 1970-2023 [Section No. 4.3.9.2]

4.3.9.2

This evaluation is required for initial certification only, or if there is a change to the materials or any after-market coatings used in the recognized component.

Statement of Problem and Substantiation for Public Comment

Some PFAS are added as after market coatings/finishes; therefore, this should be added.

Related Item

• FR

Submitter Information Verification

Submitter Full Name: Kyla Bennett
Organization: PEER
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 03 16:51:42 EST 2023
Committee: FAE-SPF

Public Comment No. 195-NFPA 1970-2023 [Section No. 4.3.9.2]

4.3.9.2

This evaluation is required for initial certification only, or if there is a change to the ~~materials used~~ products,coatings and/or finishes used in the recognized component.

Statement of Problem and Substantiation for Public Comment

"Materials" are not defined in Chapter 3 - Definitions. Without definition, there will be different interpretations of what "material" means. Because of this, a revision to the term "material," is needed which would leave no room for interpretation as to what "materials" are in the gear-making process.

Related Item

• Chapter 3 - Definitions

Submitter Information Verification

Submitter Full Name: Travis Temarantz
Organization: Wilkes-Barre City Firefighters Union
Affiliation: Representing General Membership and Cancer Prevention Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 13:11:38 EST 2023
Committee: FAE-SPF

Public Comment No. 41-NFPA 1970-2022 [Section No. 4.3.9.2]

4.3.9.2

This evaluation is required for initial certification only, or if there is a change to the materials ~~used~~ , finishes, and/or coatings used in the recognized component.

Statement of Problem and Substantiation for Public Comment

Due to the term “materials” as being absent from those listed in Chapter 3 – Definitions. It is incumbent that all constituents known to presently and/or historically contain hazardous chemicals be are included in “material” evaluation.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- Chapter 3 - Definitions

Submitter Information Verification

Submitter Full Name: Neil McMillan
Organization: IAFF
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 22 05:39:09 EST 2022
Committee: FAE-SPF

Public Comment No. 143-NFPA 1970-2023 [Section No. 4.7.9]

4.7.9

Where the facts indicating a need for corrective action are ~~conclusive and the~~ based on the best available, impartial science, and the manufacturer has exhausted all appeal rights, the certification organization shall initiate corrective action immediately, provided there is a manufacturer to be held responsible for such action.

Statement of Problem and Substantiation for Public Comment

"Conclusive" science does not ensure impartiality. I substituted the words "best available" and "impartial" to ensure that the science is sound and unbiased.

Related Item

• FR

Submitter Information Verification

Submitter Full Name: Kyla Bennett
Organization: PEER
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 03 16:53:10 EST 2023
Committee: FAE-SPF

Public Comment No. 197-NFPA 1970-2023 [Section No. 4.7.9]

4.7.9

Where the facts indicating a need for corrective action are ~~conclusive and~~ scientifically evaluated. supported and peer reviewed, and the manufacturer has exhausted all appeal rights, the certification organization shall initiate corrective action immediately, provided there is a manufacturer to be held responsible for such action.

Statement of Problem and Substantiation for Public Comment

Science can be supported with evidence and testing and be proven true or false. It is never "conclusive" by definition. A characteristic of pseudoscience is that it is proven true beyond a reasonable doubt and is typically not peer-reviewed. The changes proposed are necessary that testing becomes backed by science and not pseudoscience in the interest of protecting lives. Without a definition of "conclusive" in Chapter 3: Definitions, there is no set limit for what is "conclusive."

Related Item

• Chapter 3: Definitions

Submitter Information Verification

Submitter Full Name: Travis Temarantz
Organization: Wilkes-Barre City Firefighters Union IAFF Local 104
Affiliation: Representing general membership and Cancer Prevention Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 13:20:40 EST 2023
Committee: FAE-SPF

Public Comment No. 42-NFPA 1970-2022 [Section No. 4.7.9]

4.7.9

Where the facts indicating a need for corrective action are ~~conclusive and~~ scientifically supported and the manufacturer has exhausted all appeal rights, the certification organization shall initiate corrective action immediately, provided there is a manufacturer to be held responsible for such action.

Statement of Problem and Substantiation for Public Comment

"Conclusive" is a term that is excluded from Chapter 3 – Definitions, therefore the Marriam-Webster's Collegiate Dictionary, 11th edition's illustration is too restrictive to the purpose of this Chapter. Conclusive facts is a threshold which is too high when considering the Precautionary Principle, and the risk to end-users. Facts based in evidence which is scientifically sound, is a reasonable benchmark for corrective action.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 44-NFPA 1970-2022 [Section No. 4.7.11]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- Chapter 3 Definitions

Submitter Information Verification

Submitter Full Name: Neil McMillan
Organization: IAFF
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 22 05:41:17 EST 2022
Committee: FAE-SPF

Public Comment No. 144-NFPA 1970-2023 [Section No. 4.7.10]

4.7.10

Where the facts are ~~conclusive~~ based on the best available, impartial science, and corrective action is indicated, but there is no manufacturer to be held responsible, such as where the manufacturer is out of business or the manufacturer is bankrupt, the certification organization shall immediately notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

Statement of Problem and Substantiation for Public Comment

"Conclusive" science does not ensure impartiality. I substituted the words "best available" and "impartial" to ensure that the science is sound and unbiased.

Related Item

• FR

Submitter Information Verification

Submitter Full Name: Kyla Bennett
Organization: PEER
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 03 16:54:16 EST 2023
Committee: FAE-SPF

Public Comment No. 198-NFPA 1970-2023 [Section No. 4.7.10]

4.7.10

Where the facts are ~~conclusive and~~ scientifically tested supported and corrective action is indicated, but there is no manufacturer to be held responsible, such as where the manufacturer is out of business or the manufacturer is bankrupt, the certification organization shall immediately notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

Statement of Problem and Substantiation for Public Comment

Science can be supported with evidence and testing and be proven true or false. It is never "conclusive" by definition. A characteristic of pseudoscience is that it is proven true beyond a reasonable doubt and is typically not peer-reviewed. The changes proposed are necessary that testing becomes backed by science and not pseudoscience in the interest of protecting lives. Without a definition of "conclusive" in Chapter 3: Definitions, there is no set limit for what is "conclusive."

Related Item

• Chapter 3: Definitions

Submitter Information Verification

Submitter Full Name: Travis Temarantz
Organization: Wilkes Barre City Firefighters Union IAFF Local 104
Affiliation: General Membership and Cancer Prevention Committee
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 13:33:06 EST 2023
Committee: FAE-SPF

Public Comment No. 43-NFPA 1970-2022 [Section No. 4.7.10]

4.7.10

Where the facts are ~~conclusive~~ scientifically supported and corrective action is indicated, but there is no manufacturer to be held responsible, such as where the manufacturer is out of business or the manufacturer is bankrupt, the certification organization shall immediately notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

Statement of Problem and Substantiation for Public Comment

"Conclusive" is a term that is excluded from Chapter 3 – Definitions, therefore the Marriam-Webster's Collegiate Dictionary, 11th edition's illustration is too restrictive to the purpose of this Chapter. Conclusive facts is a threshold which is too high when considering the Precautionary Principle, and the risk to end-users. Facts based in evidence which is scientifically sound, is a reasonable benchmark for corrective action.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 39-NFPA 1970-2022 [Section No. 4.1.9]	
Public Comment No. 44-NFPA 1970-2022 [Section No. 4.7.11]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

• 4.1.9 •

Submitter Information Verification

Submitter Full Name: Neil McMillan
Organization: IAFF
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 22 05:43:09 EST 2022
Committee: FAE-SPF

Public Comment No. 199-NFPA 1970-2023 [Section No. 4.7.11]

4.7.11*

Where the facts are ~~conclusive~~ scientifically supported and corrective action is indicated, the certification organization shall take one or more of the following corrective actions:

(1) Parties authorized and responsible for issuing a safety alert shall be notified when, in the opinion of the certification organization, such a safety alert is necessary to inform the users.

(2) Parties authorized and responsible for issuing a product recall shall be notified when, in the opinion of the certification organization, such a recall is necessary to protect the users.

(3) The mark of certification shall be removed from the product.

(4) Where a hazardous condition exists and it is not practical to implement 4.7.11(1), 4.7.11(2), or 4.7.11(3), or the responsible parties refuse to take corrective action, the certification organization shall notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

Statement of Problem and Substantiation for Public Comment

Science can be supported with evidence and testing and be proven true or false. It is never "conclusive" by definition. A characteristic of pseudoscience is that it is proven true beyond a reasonable doubt and is typically not peer-reviewed. The changes proposed are necessary that testing becomes backed by science and not pseudoscience in the interest of protecting lives. Without a definition of "conclusive" in Chapter 3: Definitions, there is no set limit for what is "conclusive."

Related Item

• Chapter 3: Definitions

Submitter Information Verification

Submitter Full Name: Travis Temarantz
Organization: Wilkes Barre City Firefighters Union IAFF Local 104
Affiliation: Representing General Membership and Cancer Prevention Committee
Street Address:
City:
State:
Zip:

Submittal Date: Wed Jan 04 13:35:49 EST 2023
Committee: FAE-SPF

Public Comment No. 44-NFPA 1970-2022 [Section No. 4.7.11]

4.7.11*

Where the facts are ~~conclusive~~ scientifically supported and corrective action is indicated, the certification organization shall take one or more of the following corrective actions:

(1) Parties authorized and responsible for issuing a safety alert shall be notified when, in the opinion of the certification organization, such a safety alert is necessary to inform the users.

(2) Parties authorized and responsible for issuing a product recall shall be notified when, in the opinion of the certification organization, such a recall is necessary to protect the users.

(3) The mark of certification shall be removed from the product.

(4) Where a hazardous condition exists and it is not practical to implement 4.7.11(1), 4.7.11(2), or 4.7.11(3), or the responsible parties refuse to take corrective action, the certification organization shall notify relevant governmental and regulatory agencies and issue a notice to the user community about the hazard.

Statement of Problem and Substantiation for Public Comment

"Conclusive" is a term that is excluded from Chapter 3 – Definitions, therefore the Marriam-Webster's Collegiate Dictionary, 11th edition's illustration is too restrictive to the purpose of this Chapter. Conclusive facts is a threshold which is too high when considering the Precautionary Principle, and the risk to end-users. Facts based in evidence which is scientifically sound, is a reasonable benchmark for corrective action.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 43-NFPA 1970-2022 [Section No. 4.7.10]	
Public Comment No. 42-NFPA 1970-2022 [Section No. 4.7.9]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

• Chapter 3 Definitions

Submitter Information Verification

Submitter Full Name: Neil McMillan

Organization:	IAFF
Street Address:	
City:	
State:	
Zip:	
Submittal Date:	Thu Dec 22 05:45:51 EST 2022
Committee:	FAE-SPF

Public Comment No. 133-NFPA 1970-2023 [Section No. 5.1.1.8]

5.1.1.8

Other than for the testing for certification of structural or proximity protective garments to the optional liquid and particulate hazard protection requirements, Chapters 5 through 9 of this standard shall not specify the respiratory protection that is necessary for protection with structural or firefighting protective ensembles.

Statement of Problem and Substantiation for Public Comment

The specification of an SCBA is only for testing purposes, not the actual certification. The current language could be construed to mean the SCBA is part of the garment certification.

Related Item

- FR299

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 03 14:09:23 EST 2023
Committee: FAE-SPF

Public Comment No. 145-NFPA 1970-2023 [Section No. 6.1.7 [Excluding any Sub-Sections]]

The information contained in Table 6.1.7 shall be printed on each product label or printed directly on the product, or product packaging, where permissible, with all letters at least 1.5 mm (1⁄16 in.) in height.

Table 6.1.7 Information Required to Be Present on Product Labeling

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

Statement of Problem and Substantiation for Public Comment

Some PFAS are applied as after market coatings/finishes, so this was added.

Related Item

• FR

Submitter Information Verification

Submitter Full Name: Kyla Bennett
Organization: PEER
Street Address:
City:
State:
Zip:
Submittal Date: Tue Jan 03 16:57:12 EST 2023

Committee: FAE-SPF

Public Comment No. 200-NFPA 1970-2023 [Section No. 6.1.7 [Excluding any Sub-Sections]]

The information contained in Table 6.1.7 shall be printed on each product label or printed directly on the product, or product packaging, where permissible, with all letters at least 1.5 mm (1⁄16 in.) in height.

Table 6.1.7 Information Required to Be Present on Product Labeling

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

Statement of Problem and Substantiation for Public Comment

"Materials" are not defined in Chapter 3 - Definitions. Without definition, there will be different interpretations of what "material" means. Because of this, a revision to the term "material," is needed which would leave no room for interpretation as to what "materials" are in the gear-making process.

Related Item

• Chapter 3: Definitions

Submitter Information Verification

Submitter Full Name: Travis Temarantz
Organization: Wilkes Barre City Firefighters Union IAFF Local 104
Affiliation: Representing General Membership and Cancer Prevention Committee
Street Address:

City:
State:
Zip:
Submittal Date: Wed Jan 04 13:40:35 EST 2023
Committee: FAE-SPF

Public Comment No. 45-NFPA 1970-2022 [Section No. 6.1.7 [Excluding any Sub-Sections]]

The information contained in Table 6.1.7 shall be printed on each product label or printed directly on the product, or product packaging, where permissible, with all letters at least 1.5 mm (1⁄16 in.) in height.

Table 6.1.7 Information Required to Be Present on Product Labeling

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

Statement of Problem and Substantiation for Public Comment

Due to the term “principle” and “materials” as being absent from those listed in Chapter 3 – Definitions. It is incumbent that all constituents known to presently and/or historically contain hazardous chemicals be are included in the labelling requirement. Such action will allow for ease of tracking, and reporting, when transitional periods exists for end-users who have revised purchase agreements with manufacturers mid-contract.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- Chapter 3 Definitions

Submitter Information Verification

Submitter Full Name: Neil McMillan
Organization: IAFF
Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 22 05:48:40 EST 2022
Committee: FAE-SPF

Public Comment No. 167-NFPA 1970-2023 [New Section after 6.1.7.6]

6.1.7.7* For helmet labels, a smaller label with the informaiton required in Table 6.1.7 (1), (4), (5) and the words "NFPA 1970 (1971), 2024 ED" shall placed inside the helmet and shall lay securely against the inner surface of the helmet.

A.6.1.7.7 The purpose of this smaller label is to contain critical infromation required for inspeciton and retirement purposess. Some larger labels may detach from the helmet. By having a smaller label containing this infromation there is more liklihood the label will remain in place.

Statement of Problem and Substantiation for Public Comment

As discussed in the helmet task group a smaller label with critical inspection information may improve adhesion durability until a suitable adhesion test method can be developed for helmets.

Related Item

- PI178

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Wed Jan 04 10:53:09 EST 2023
Committee: FAE-SPF

Public Comment No. 146-NFPA 1970-2023 [Section No. 6.1.7.6]

6.1.7.6

Where claimed, protective elements represented as having no ~~intentionally added~~ PFAS, including in any material, component, or as part of the protective element, shall be permitted to include as part of their label the following additional language where evidence is presented as specified in 6.4.13:

THIS *[type of protective element]* IS PFAS FREE

Statement of Problem and Substantiation for Public Comment

I removed the word "intentionally added," because we have learned that there can be dangerous amounts of PFAS present due to contamination, etc. that are not INTENTIONALLY added. Removing these words will ensure that the products are truly PFAS-free.

Related Item

• FR

Submitter Information Verification

Submitter Full Name: Kyla Bennett
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Submittal Date: Tue Jan 03 16:58:02 EST 2023
Committee: FAE-SPF

Public Comment No. 201-NFPA 1970-2023 [Section No. 6.1.7.6]

6.1.7.6

Where ~~claimed~~ proven by scientific testing , protective elements represented as having no ~~intentionally added~~ PFAS, including in any material, component, product(s), finishings, or coatings or as part of the protective element, shall be permitted to include as part of their label the following additional language where evidence is presented as specified in 6.4.13:

THIS *[type of protective element]* IS PFAS FREE

Statement of Problem and Substantiation for Public Comment

Any person can claim anything. Substantial scientific evidence needs to be provided to prove that components are completely PFAS-free. "No intentional PFAS added" can easily be voided by someone claiming "they weren't aware" that PFAS were added. The job of the NFPA is to "save lives". Removing any doubt or suspicion will substantiate the goals of the NFPA, "to save lives." If a manufacturer makes a claim their gear is PFAS-free, then it needs to be 100% PFAS-free, intentionally or unintentionally added.
An end user should have 100% confidence that components marked as PFAS-free are in fact 100% free of chemicals that can ultimately lead to fatal diseases.

Related Item

• TIA 1594 on NFPA 1971 / Previous public comment on 1st draft relating to labeling of components with known PFAS

Submitter Information Verification

Submitter Full Name: Travis Temarantz
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Submittal Date: Wed Jan 04 13:43:16 EST 2023
Committee: FAE-SPF

Public Comment No. 46-NFPA 1970-2022 [Section No. 6.1.7.6]

6.1.7.6

Where claimed, protective elements represented as having ~~no intentionally added PFAS~~ no PFAS , including in any material, component, finishes/coatings or as part of the protective element, shall be permitted to include as part of their label the following additional language where evidence is presented as specified in 6.4.13:

THIS *[type of protective element]* IS PFAS FREE

Statement of Problem and Substantiation for Public Comment

The phrase “no intentionally added PFAS” does not denote a PFAS-free (protective element), and as such does not construe any substantive information at all. If a claim is made that a “protective element” (which is a term not identified in Chapter 3 – Definitions) is PFAS-free, then “intentionally added” should be removed from the Chapter section, and “finishes/coatings” should be included in writing as a “material/component”.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 47-NFPA 1970-2022 [Section No. 6.4.13]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- NFPA 1971 TIA 1594

Submitter Information Verification

Submitter Full Name: Neil McMillan
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Street Address:
City:
State:
Zip:
Submittal Date: Thu Dec 22 05:52:10 EST 2022
Committee: FAE-SPF

Public Comment No. 5-NFPA 1970-2022 [New Section after 6.3.5]

6.4 Additional Product Label Requirements for Structural and Proximity Firefighting Protective Ensembles and Ensemble Elements Containing Electrical Circuitry

6.4.1 Nonincendive Equipment and Systems.

The following additional compliance statement shall be printed on the product label for each structural and proximity firefighting protective ensemble and ensemble element containing electrical circuitry that complies with 7.19.2. The term for the element type — garment, helmet, glove, footwear, hood — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm (3⁄32 in.) in height.

THIS (insert STRUCTURAL or PROXIMITY) FIREFIGHTING PROTECTIVE (insert element term here) CONTAINS ELECTRICAL CIRCUITRY MEETING THE REQUIREMENTS OF UL 121201, 2017, FOR CLASS I & II, DIVISION 2, GROUPS C, D, F, G AND CLASS III, (insert temperature class).

DO NOT REMOVE THIS LABEL.

Note: “Class” designations use Roman numerals, and Division” designations use Arabic numerals.

6.4.2 Intrinsically Safe Apparatus and Systems.

The following additional compliance statement shall be printed on the product label for each structural and proximity firefighting protective ensemble and ensemble element containing electrical circuitry that complies with 7.19.3. The term for the element type — garment, helmet, glove, footwear, hood — shall be inserted in the compliance statement text where indicated. All product label letters and figures shall be at least 2.5 mm (3⁄32 in.) in height.

THIS (insert STRUCTURAL or PROXIMITY) FIREFIGHTING PROTECTIVE (insert element term here) CONTAINS ELECTRICAL CIRCUITRY MEETING THE REQUIREMENTS OF UL 913, SIXTH EDITION, FOR CLASS I & II, DIVISION 1, GROUPS C, D, E, F, G AND CLASS III, (insert temperature class).

DO NOT REMOVE THIS LABEL.

Note: “Class” designations use Roman numerals, and Division” designations use Arabic numerals.

Statement of Problem and Substantiation for Public Comment

(Submitted on behalf of the FAE-ELS/FAE-SCE HazLoc Harmonization Task Group)
Additional product label requirements needed to differentiate between IS (Division 1) designs and NI (Division 2) designs.

Subsequent Chapter 6 clauses need to be renumbered.

Related Item

- FR-139

Submitter Information Verification

Submitter Full Name: Paul Kelly
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Submittal Date: Thu Sep 08 22:58:25 EDT 2022
Committee: FAE-SPF

Public Comment No. 176-NFPA 1970-2023 [New Section after 6.4.5]

New Specific User Information for Gloves

6.4.6*

For gloves only, manufacturers shall provide a chart and other information to identify the ability of the end user to select the appropriate size based on hand measurements or other approaches to help ensure adequate fit and function of the gloves. If hand measurements are used, this information shall include diagrams or descriptions for how the hand measurements are to be made.

A.6.4.6

It is recommended that manufacturers also describe how an individual selecting a specific glove size assess the relative fit and function of the glove with suggestions for changing to a different glove size if hand function or protection is impaired.

Statement of Problem and Substantiation for Public Comment

With changes made in permitting an alternative system of glove sizing, it is important that the manufacturers include details for their sizing system as part of the user instructions for protective gloves.

Related Item

- FR88

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
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Submittal Date: Wed Jan 04 11:21:27 EST 2023
Committee: FAE-SPF

Public Comment No. 204-NFPA 1970-2023 [Section No. 6.4.10]

~~**6.4.10** –~~

~~The manufacturer shall report the percent water absorption and drying time in hours.~~

Statement of Problem and Substantiation for Public Comment

This is already required by 9.72.6

Related Item

• FR100

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Submittal Date: Wed Jan 04 14:01:59 EST 2023
Committee: FAE-SPF

Public Comment No. 79-NFPA 1970-2022 [Sections 6.4.10, 6.4.11, 6.4.12]

Sections 6.4.10, 6.4.11, 6.4.12

6.4.10

For footwear only, The manufacturer shall report the percent water absorption and drying time in hours as determined in Section 9 .72.

6.4.11*

Where the manufacturer indicates the footwear as being breathable, the footwear moisture vapor transmission rate shall be reported in grams/hour (g/hr) as determined in Section 9 .74.

6.4.11.1*

Alternatively, where the manufacturer indicates the footwear as being breathable, the footwear evaporative resistance shall be reported in Pascals, meters square per Watt (Pa m^2/W) as determined in Section 9 .73.

6.4.12

For footwear only, The force required to bend the footwear shall be reported in kg force as determined in Section 9 .76.

Statement of Problem and Substantiation for Public Comment

If these test methods remain in the standard it should be identified what test methods dictate the value reported in the user information.

Related Item

• FR107 • FR104 • FR103 • FR102

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Wed Dec 28 12:58:29 EST 2022

Committee: FAE-SPF

Public Comment No. 229-NFPA 1970-2023 [Section No. 6.4.11]

6.4.11*

Where the manufacturer indicates the footwear as being breathable, the footwear ~~moisture vapor transmission rate shall be reported in grams/hour (g/hr).~~

~~**6.4.11.1 * –**~~

~~Alternatively, where the manufacturer indicates the footwear as being breathable, the footwear~~

evaporative resistance shall be reported in Pascals, meters square per Watt (Pa m^2 /W).

Statement of Problem and Substantiation for Public Comment

An investigation of ASTM D8041 test method as applied to several different types of footwear revealed a high degree of variability with only general discrimination between boots that are breathable versus those that are not breathable (i.e., rubber footwear styles). Therefore, the test is being removed.

Related Item

• FR105

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
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Submittal Date: Wed Jan 04 16:39:29 EST 2023
Committee: FAE-SPF

Public Comment No. 206-NFPA 1970-2023 [Section No. 6.4.12]

~~**6.4.12** –~~

~~The force required to bend the footwear shall be reported in kg force.~~

Statement of Problem and Substantiation for Public Comment

This is already required by 9.76.6

Related Item

• FR109

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Street Address:
City:
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Zip:
Submittal Date: Wed Jan 04 14:09:00 EST 2023
Committee: FAE-SPF

Public Comment No. 230-NFPA 1970-2023 [Section No. 6.4.12]

~~6.4.12~~ –

~~The force required to bend the footwear shall be reported in kg force.~~

Statement of Problem and Substantiation for Public Comment

A single laboratory investigation for applying this test method indicated that additional rigor would be needed to justify this requirement even though some differences in footwear were observed.

Related Item

• FR109

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
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Submittal Date: Wed Jan 04 16:42:54 EST 2023
Committee: FAE-SPF

Public Comment No. 147-NFPA 1970-2023 [Section No. 6.4.13]

6.4.13*

If the manufacturer claims that no PFAS are ~~intentionally~~ used in the protective element, then the manufacturer shall make available to the AHJ upon request ~~specific evidence~~ impartial and reproducible evidence that the respective element does not contain PFAS.

Statement of Problem and Substantiation for Public Comment

I removed the word "intentionally," because we have learned that there can be dangerous amounts of PFAS present due to contamination, etc. that are not INTENTIONALLY used. Removing these words will ensure that the products are truly PFAS-free.

Related Item

• FR

Submitter Information Verification

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Submittal Date: Tue Jan 03 16:59:08 EST 2023
Committee: FAE-SPF

Public Comment No. 205-NFPA 1970-2023 [Section No. 6.4.13]

6.4.13*

If the manufacturer claims that ~~no PFAS are intentionally used in the protective element~~ any protective element is PFAS free , then the manufacturer shall make available to the AHJ upon request ~~specific evidence that~~ verifiable scientific evidence that the respective element ~~does not contain~~ is PFAS free .

Statement of Problem and Substantiation for Public Comment

Any person can claim anything. Substantial scientific evidence needs to be provided to prove that components are completely PFAS-free. "No intentional PFAS added" can easily be voided by someone claiming "they weren't aware" that PFAS were added. The job of the NFPA is to "save lives". Removing any doubt or suspicion will substantiate the goals of the NFPA, "to save lives." If a manufacturer makes a claim their gear is PFAS-free, then it needs to be 100% PFAS-free, intentionally or unintentionally added.
An end user should have 100% confidence that ANY component marked as PFAS-free is in fact 100% free of chemicals that can ultimately lead to fatal diseases.

Related Item

• TIA 1594 on NFPA 1971 - Prior comments on labeling components with known PFAS

Submitter Information Verification

Submitter Full Name: Travis Temarantz
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Submittal Date: Wed Jan 04 14:02:33 EST 2023
Committee: FAE-SPF

Public Comment No. 47-NFPA 1970-2022 [Section No. 6.4.13]

6.4.13*

If the manufacturer claims that no PFAS are ~~intentionally~~ used in the protective element, then the manufacturer shall make available to the AHJ upon request ~~specific~~ verifiable evidence that the respective element does not contain PFAS.

Statement of Problem and Substantiation for Public Comment

The term “intentionally” is not contained in Chapter 3 – Definitions, and as such can too broadly be interpreted, and subsequently provides no reasonable assurances of the absence of PFAS. Additionally “specific evidence”, not being a defined term in Chapter 3, can be unsubstantiated, irrelevant, and non-descript. What is required, is verifiable evidence, which is scientifically sound, reproducible, and accessible to those seeking confirmation.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 46-NFPA 1970-2022 [Section No. 6.1.7.6]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- NFPA 1971 TIA 1594

Submitter Information Verification

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Submittal Date: Thu Dec 22 05:55:00 EST 2022
Committee: FAE-SPF

Public Comment No. 83-NFPA 1970-2022 [Section No. 7.1.1 [Excluding any Sub-Sections]]

Protective garment elements shall have at least the applicable design requirements specified in this section where inspected and evaluated by the certification organization as specified in Section 4.~~4~~ 3 , Inspection and Testing.

Statement of Problem and Substantiation for Public Comment

Editorial Correction

Related Item

• FR298

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Fri Dec 30 08:00:54 EST 2022
Committee: FAE-SPF

Public Comment No. 84-NFPA 1970-2022 [Section No. 7.1.12]

7.1.12*

When life safety harnesses, escape belts, and ladder belts penetrate the outer shell, are incorporated as part of a garment closure system, or are temporarily or permanently attached to the garment, the harness or belt components shall meet the applicable requirements of NFPA 1983 as contained in NFPA 2500 , and the optional requirements for flame-resistant life safety harnesses or optional requirements for flame-resistant belts.

Statement of Problem and Substantiation for Public Comment

Adding the reference to NFPA 2500 as NFPA 1983 is now incorporated in that standard.

Related Item

• FR280

Submitter Information Verification

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Submittal Date: Fri Dec 30 08:12:50 EST 2022
Committee: FAE-SPF

Public Comment No. 85-NFPA 1970-2022 [Section No. 7.2.1]

7.2.1

Structural firefighting protective garment elements shall also have at least the applicable design requirements specified in this section in addition to the design requirements specified in Section 7.1, Protective Garment Element Design Requirements for Both Ensembles, where inspected and evaluated by the certification organization as specified in Section 4.~~4~~ 3 , Inspection and Testing.

Statement of Problem and Substantiation for Public Comment

Correction of section referenced.

Related Item

• FR298

Submitter Information Verification

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Submittal Date: Fri Dec 30 08:26:31 EST 2022
Committee: FAE-SPF

Public Comment No. 86-NFPA 1970-2022 [Section No. 7.4.9]

7.4.9

Helmet ~~ear cover materials, suspension materials, and retention system materials~~ material soft good that come into contact with the head when the helmet is properly donned shall be recognized components and meet the levels of restricted substances as specified in Section 8.20.

Statement of Problem and Substantiation for Public Comment

Based on helmet task group discussions, clarification of what components of the helmet are to be tested for this requirement was necessary.

Related Item

• FR218

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Fri Dec 30 08:31:40 EST 2022
Committee: FAE-SPF

Public Comment No. 87-NFPA 1970-2022 [Section No. 7.5.1]

7.5.1

Structural firefighting protective helmet elements shall also have at least the applicable design requirements specified in this section in addition to the design requirements specified in Section 7.4, Protective Helmet Element Design Requirements for Both Ensembles, where inspected and evaluated by the certification organization as specified in Section 4.~~4~~ 3 , Inspection and Testing.

Statement of Problem and Substantiation for Public Comment

Reference correction

Related Item

• FR298

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Fri Dec 30 08:34:54 EST 2022
Committee: FAE-SPF

Public Comment No. 29-NFPA 1970-2022 [Section No. 7.5.2]

7.5.2*

Helmets shall consist of at least all of the following assembled components:

(1) Shell

(2) Energy absorbing system

(3) Retention system

(4) Fluorescent and retroreflective trim

(5) ~~Ear covers~~
~~A faceshield~~

7.5.2.1

Helmets may have the following optional components:

(1) Ear Covers

(2) A Faceshield or goggles, or both

Any helmets that do not come with assembled ear covers or eye protection shall have a label affixed to them, in accordance with NFPA 1970 Chapter 6, 6.2.2, that states ear covers, a flash hood, and/or eye protection must be worn in conjunction with the helmet.

7.5.2.~~1~~ 2

Where a faceshield is selected in accordance with 7.5.2(6), the faceshield component shall be attached to the helmet.

7.5.2.~~2~~ 3

Where the goggle component is selected in accordance with 7.5.2(6), the goggles shall be permitted to be unattached, not assembled, to the helmet.

7.5.2.~~3~~ – 4

Where the manufacturer provides or intends to provide both a faceshield and goggles with the helmet, whether the faceshield is or is not provided installed or attached to the helmet, both the faceshield and the goggles shall be considered components of the helmet.

Statement of Problem and Substantiation for Public Comment

CAL FIRE, as well as many other agencies and organizations, require that employees engaged in structural firefighting operations wear a flash hood for neck and ear protection. The requirement for structural helmets to come with ear covers means that anyone wearing a flash

hood will have to either remove the ear covers or will need to tuck those ear covers into the helmet which reduces the breathability performance of the helmet.

For eye protection, goggles and faceshields can break or become damaged after time. Since goggles are not required to come affixed to the helmet, agencies and organizations should be able to purchase other googles that meet or exceed the same protective requirements to be worn with the helmets.

Related Item

• N/A

Submitter Information Verification

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Affiliation: CAL FIRE Safety Program
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Submittal Date: Wed Nov 23 12:52:29 EST 2022
Committee: FAE-SPF

Public Comment No. 35-NFPA 1970-2022 [Section No. 7.5.5]

7.5.5

~~Faceshield/goggle~~ Goggle components shall meet the respective requirements for goggles ~~or faceshields~~ and be marked “Z87+” in accordance with ANSI/ISEA Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices*.

7.5.6

Faceshield components shall meet the respective requirements for faceshields and be marked either "Z87+" or "Z87+O2" in accordance with ANSI/ISEA Z87.1, *Occupational and Educational Personal Eye and Face Protection Devices.*

Statement of Problem and Substantiation for Public Comment

The 2020 edition of ANSI Z87.1 added a “Relaxed Optics Level” (section 6.1) that reduced the Resolving Power requirement from Pattern 20 to Pattern 17 and the Luminous Transmittance requirement from 85% to 78%. The ANSI Z87.1 committee added this option for eyewear for end uses that does not require extreme optical precision. Resolving Power was one of the more difficult requirements to implement for Structural helmet faceshields when the requirement for ANSI Z87.1 was added in the 2013 edition of NFPA 1971 because of the nature of typical faceshields. Faceshields do not necessarily need to provide precise optical clarity. NFPA 1971 already has a requirement for Luminous Transmittance of 85% for clear lenses (and 43% for tinted lenses), so the reduction in the Luminous Transmittance requirement for the “Relaxed Optics Level” of ANSI Z87.1 would not impact current requirements. This allowance is being suggested for faceshields only (and not goggles) because goggles typically meet the “standard” optical requirement, and goggles meet the definition of primary eye protection whereas faceshields do not meet this definition.

Related Item

• PI68

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Submittal Date: Wed Dec 21 09:14:55 EST 2022
Committee: FAE-SPF

Public Comment No. 88-NFPA 1970-2022 [Section No. 7.7.1]

7.7.1

Protective glove elements shall have at least the applicable design requirements specified in this section when inspected and evaluated by the certification organization as specified in Section 4.~~4~~ 3, Inspection and Testing .

Statement of Problem and Substantiation for Public Comment

Corrected referenced section, also added back in section title to be consistent with other similar sections in this document (see 7.1, 7.2, etc)

Related Item

• FR298

Submitter Information Verification

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Submittal Date: Fri Dec 30 08:43:02 EST 2022
Committee: FAE-SPF

Public Comment No. 89-NFPA 1970-2022 [Section No. 7.7.3.5]

7.7.3.5*

The location of the wrist crease shall be determined by the following procedures, as shown in Figure 7.7.3.5:

(1) The location of the wrist crease shall be determined by first placing the glove on a measurement board palm down and securing (i.e., locking) the fingertips down onto the board.

(2) A 0 .45 kg (1 lb) weight shall be attached to the end of the glove body, glove interface component, or glove extension. The weight shall not be attached to a knitted wristlet glove interface component. The weight shall be applied evenly across the glove.

(3) The weight shall be allowed to hang freely for 60 seconds prior to taking any measurements.

(4) * The bottom of digit three shall be found by drawing a line on the back side of the glove from the finger crotches on either side of digit three. A point shall then be placed at the center of that line. Depending on the index finger length for the glove size, the distance to the wrist crease shall be determined by laying a ruler parallel with the length of the glove from the point representing the bottom of digit three to a second point using one of the following dimensions that corresponds to the index finger length. The second point shall be marked on the back of the glove.

(5) 64 [N (normal), W (wide), and XW (extra-wide)]: 8.36 cm (3.29 in.)

(6) 70 (N, W, and XW): 9.46 cm (3.72 in.)

(7) 76 (N, W, and XW): 10.68 cm (4.20 in.)

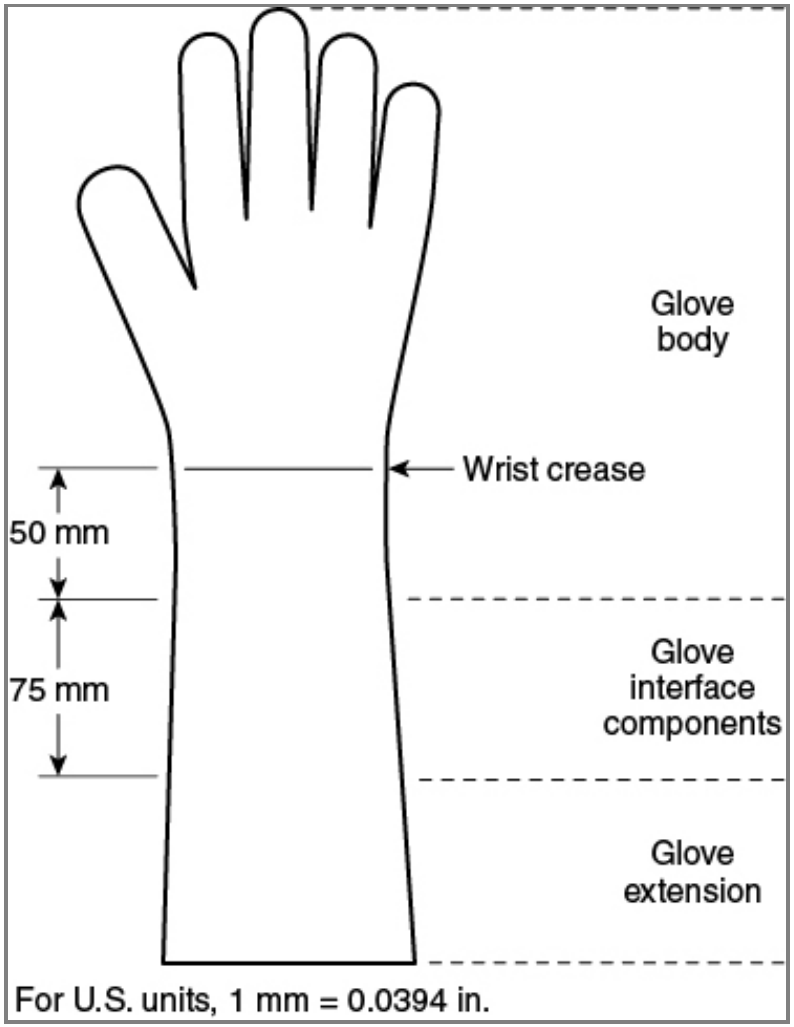
(8) 82 (N, W, and XW): 11.73 cm (4.62 in.)

(9) A straight line shall be drawn across the back of the glove perpendicular to the two points. This line shall be extended around the side edges of the glove.

(10) The glove shall be removed from the measurement board. A line shall be drawn on the palm side of the glove by connecting the lines from the side edges of the glove.

(11) The resulting straight line around the circumference of the glove shall be the location of the wrist crease.

Figure 7.7.3.5 Location of Wrist Crease.



Statement of Problem and Substantiation for Public Comment

Editorially there should be a leading 0 in front of a decimal.

Related Item

- FR88

Submitter Information Verification

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Submittal Date: Fri Dec 30 08:47:48 EST 2022
Committee: FAE-SPF

Public Comment No. 170-NFPA 1970-2023 [Section No. 7.7.4.1]

7.7.4.1

For testing purposes or when the default system is used for labeling the slze of gloves , gloves shall be classified as the following sizes in accordance with dimensional ranges for both index finger length and hand breath as shown in Figure 7.7.4.1:

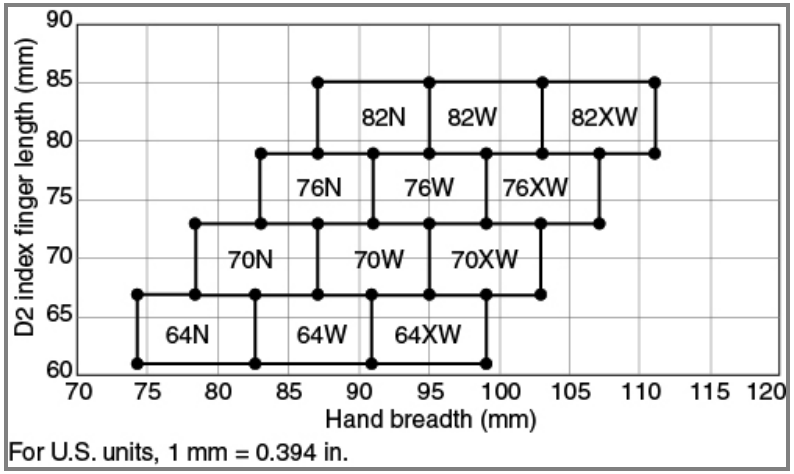
(1) 64N (normal), 64W (wide), 64XW (extra-wide)

(2) 70N (normal), 70W (wide), 70XW (extra-wide)

(3) 76N (normal), 76W (wide), 76XW (extra-wide)

(4) 82N (normal), 82W (wide), 82XW (extra-wide)

Figure 7.7.4.1 NFPA 1971 Size Definitions.



Statement of Problem and Substantiation for Public Comment

The language in this requirement has been corrected to reflect that this method of designation also applies to gloves where the manufacturer chooses to apply the default glove sizing system.

Related Item

• FR88

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
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Zip:
Submittal Date: Wed Jan 04 10:58:21 EST 2023
Committee: FAE-SPF

Public Comment No. 173-NFPA 1970-2023 [Section No. 7.7.5]

7.7.5*

To be labeled as compliant with this standard, gloves shall be provided and labeled in at least the following 7 sizes as determined by accommodating the respective ranges of index finger length and hand breadth established in Figure 7.7.4.1:

(1) 64N (normal)

(2) 70N (normal)

(3) 70W (wide)

(4) 76N (normal)

(5) 76W (wide)

(6) 82N (normal)

(7) 82W (wide)

7.7.5.1

Alternatively, gloves shall be provided in a minimum of seven unique sizes that accommodate a range of specific hand sizes for both men and women based on achieving accommodation of the 5th to 95th percentile dimensions in both hand breadth and hand length as established in the NIOSH Firefighter Anthropometric Data Base (https://www.cdc.gov/niosh/data/datasets/rd-1007-2015-0/default.html).

7.7.5.1.1*

Manufacturers shall be permitted to establish their own unique sizing system and method of designating glove sizing based on their respective glove designs.

7.7.5.1.2

Manufacturers shall be required to ~~design~~ designate which of their unique sizes conform to the individual sizes defined in 7.7.5 as required for testing purposes.

7.7.5.1.3*

Manufacturers shall provide the certification organization with the specific details for how a glove wearer can determine size.

7.7.5.1.4

Manufacturers shall label their gloves consistent with the unique size as indicated by their sizing system.

A.7.7.5.1.3 (new)

An example for these details include the method by which an individual's hands are measured and the specific size that is recommended for the specific measurements used in the manufacturer's glove system system.

Statement of Problem and Substantiation for Public Comment

Changes have been made to correct and clarify how to relate the unique sizing system to the glove sample sizes that are already established in the default sizing system and that are applied for various whole glove tests. This includes the addition of an annex section to explain how the sizing system for the gloves is to be applied by the certification organization.

Related Item

• FR88

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
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City:
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Submittal Date: Wed Jan 04 11:07:16 EST 2023
Committee: FAE-SPF

Public Comment No. 217-NFPA 1970-2023 [Section No. 7.7.6]

7.7.6

Glove composite materials, including shells, moisture barriers, linings, and wristlets shall be recognized components that meet levels of restricted substances as specified in Section 8.20.

7.7.6.1

~~Emblems utilized on the exterior of the glove and measure larger~~ Any additional materials that directly contact the wearer's hands, wrist area, or lower arm when worn collectively measuring larger than a total area of 225 cm^2 (~~35 in~~ 36 $in.^2$) shall be recognized components that meet levels of restricted substances as specified in Section 8.20.

~~**7.7.6.2**~~ ~~–~~

~~Emblems utilized on the interior of the glove shall be recognized components that meet levels of restricted substances as specified in Section 8.20 .~~

Statement of Problem and Substantiation for Public Comment

Clarifications have been made for the types of materials to be subject to testing for restricted substances as applied to gloves. The specified materials include the materials that typically represent glove construction and larger materials that may be in contact with the firefighter's hands or lower arms.

Related Item

• FR308

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
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Submittal Date: Wed Jan 04 14:49:00 EST 2023
Committee: FAE-SPF

Public Comment No. 90-NFPA 1970-2022 [Section No. 7.7.6.1]

7.7.6.1

Emblems utilized on the exterior of the glove and measure larger than a total area of ~~225~~ 25 cm^2 (~~35 in~~ 4 in $.^2$) shall be recognized components that meet levels of restricted substances as specified in Section 8.20.

Statement of Problem and Substantiation for Public Comment

Proposing for gloves that the size of the exclusion be smaller than that of garments. The overall size of a glove is much smaller than a coat/pant so a proportional requirement should be set. The proposed size is purely a suggestion, and the final determined size should be discussed by the committee.

Related Item

- FR308

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Street Address:
City:
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Submittal Date: Fri Dec 30 08:52:24 EST 2022
Committee: FAE-SPF

Public Comment No. 91-NFPA 1970-2022 [Section No. 7.9.1]

7.9.1

Proximity firefighting protective glove elements shall also have at least the applicable design requirements specified in this section in addition to the design requirements specified in Section 7.7, Protective Glove Elements Design Requirements for Both Ensembles, where inspected and evaluated by the certification organization as specified in Section 4.~~4~~ 3 , Inspection and Testing.

Statement of Problem and Substantiation for Public Comment

Correction of referenced section.

Related Item

• FR298

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
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Submittal Date: Fri Dec 30 08:56:39 EST 2022
Committee: FAE-SPF

Public Comment No. 92-NFPA 1970-2022 [Section No. 7.10.1]

7.10.1

Protective footwear elements shall have at least the applicable design requirements specified in this section where inspected and evaluated by the certification organization as specified in Section 4.~~4~~ 3 , Inspection and Testing.

Statement of Problem and Substantiation for Public Comment

Correction of referenced section

Related Item

• FR298

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Fri Dec 30 08:57:57 EST 2022
Committee: FAE-SPF

Public Comment No. 202-NFPA 1970-2023 [Section No. 7.10.3]

7.10.3

Footwear height shall be as specified in Table 7.10.3 for the respective footwear size.

Table 7.10.3 Minimum Height by Footwear Size

Size	Men's 5–7	Men's 8–10	Men's 11–16	Women's 5–7	Women's 8–10	
Height	200 mm	225 mm	250 mm	180 mm	205 mm	
	-	(7.87 in.)	(8.85 in.)	(9.84 in.)	(7.09 in.)	(8.07 in.)

7.10.3.1

The footwear height shall be determined by measuring inside the footwear from the center of the insole at the heel up to a perpendicular reference line extending across the footwear at the lowest point of the top line, excluding the tongue and gusset as specified in 9.1.23.

7.10.3.2

Removable insoles shall not be removed prior to measurement.

7.10.3.3

Thermal, physical, and moisture protection shall be continuous circumferentially to within 50 mm (2 in.) of the footwear top line at all locations, with the exception of the area inside of and within 13 mm (½ in.) around pull-up holes that fully penetrate the footwear from outside to inside. The height of thermal, physical, and moisture protection at all locations of the boot shall be no less than the value specified in Table 7.10.3 for the respective footwear size when measured as described in 7.10.3.1. The technique specified in 9.1.23 shall be used for making these measurements, particularly when it is not obvious where the moisture protection location ends in the top of the footwear.

~~**7.10.3.4** –~~

~~Thermal and physical protection shall be continuous circumferentially to within 50 mm (2 in.) of the footwear top line at all locations, with the exception of the gusset and the area inside of and within 13 mm (**1**⁄**2** in.) around pull-up holes that fully penetrate the footwear from outside to inside. The height of thermal and physical protection at all locations of the boot, with the exception of the gusset, shall be no less than 250 mm (9.84 in.) when measured as described in 7.10.3.1 .~~

Statement of Problem and Substantiation for Public Comment

This requirement is a duplicate to the newly added table.

Related Item

- FR95

Submitter Information Verification

Submitter Full Name: Amanda Newsom
Organization: UL LLC
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Submittal Date: Wed Jan 04 13:47:57 EST 2023
Committee: FAE-SPF

Public Comment No. 219-NFPA 1970-2023 [Section No. 7.10.10]

7.10.10

Footwear composite materials, including exterior layer(s), barrier layers(s), and lining(s), shall be recognized components that meet levels of restricted substances as specified in Section 8.20.

~~**7.10.10.1** –~~

~~Textiles, rubber, emblems, and leather materials utilized on the exterior of the footwear and measuring larger than a total area of 225 cm ^{2} (35 in. ^{2}) shall be recognized components that meet levels of restricted substances as specified in Section 8.20 .~~

~~**7.10.10.2** –~~

~~Textiles, rubber, emblems, and leather materials utilized on the interior of the footwear shall be recognized components that meet levels of restricted substances as specified in Section 8.20 .~~

Statement of Problem and Substantiation for Public Comment

For the first implementation of restricted substance requirements for footwear, a recommendation has been made to limit testing to the principal materials used in the footwear's construction.

Related Item

• FR220

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
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Zip:
Submittal Date: Wed Jan 04 15:39:56 EST 2023
Committee: FAE-SPF

Public Comment No. 93-NFPA 1970-2022 [Section No. 7.10.10.1]

7.10.10.1

Textiles, rubber, emblems, and leather materials utilized on the exterior of the footwear and measuring larger than a total area of ~~225 cm~~ 103 cm ^{2} (~~35 in~~ 16 in .^{2}) shall be recognized components that meet levels of restricted substances as specified in Section 8.20.

Statement of Problem and Substantiation for Public Comment

Proposing for footwear that the size of the exclusion be smaller than that of garments. The overall size of footwear is smaller than a coat/pant so a proportional requirement should be set. The proposed size is purely a suggestion, and the final determined size should be discussed by the committee.

Related Item

• fr220

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
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Zip:
Submittal Date: Fri Dec 30 09:01:57 EST 2022
Committee: FAE-SPF

Public Comment No. 30-NFPA 1970-2022 [Sections 7.13, 7.14]

Sections 7.13, 7.14

7.13 Protective Hood Interface Component Design Requirements for ~~Both Ensembles.~~ Structural Fire Fighting

7.13.1

Hood interface components shall have at least the applicable design requirements specified in this section where inspected and evaluated by the certification organization as specified in Section 4.4, Inspection and Testing.

7.13.2

Hoods shall be permitted to be integrated with the protective coat.

7.13.3

The hood shall be designed to cover and provide the limited protection, as specified within this section, to the head, face, and neck areas but not including the face opening specified in 7.13.6.

7.13.3.1

Where the hood is integrated with the protective coat, the hood shall not be required to meet the design requirement specified in 7.13.5.

7.13.4

All sewing thread utilized in the construction of hoods shall be made of an inherently flame-resistant fiber.

7.13.5

To label or otherwise represent a protective hood as compliant with the requirements of this standard, the manufacturer shall provide protective hoods in the following sizes: the single size or multiple sizes of the protective hoods shall demonstrate fit on each of the respective headforms specified in ISO 16900-5, *Respiratory protective devices — Methods of test and test equipment — Part 5: Breathing machine, metabolic simulator, RPD headforms and torso, tools and verification tools*, as specified in 7.13.5.1 through 7.13.5.3.

7.13.5.1*

The hood shall be donned in accordance with the manufacturer's instructions for wearing, on the respective headform that is fitted with a surrogate SCBA facepiece that meets the design requirements set forth by NFPA 1981.

7.13.5.2

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

7.13.5.3

In this position, the hood shall provide a minimum full coverage around the circumference of the reference plane specified in Table 7.13.5.3.

Table 7.13.5.3 Minimum Coverage

Size	Minimum Coverage
Small	400 mm (15.7 in.)
Short/Wide	410 mm (16.14 in.)
Medium	420 mm (16.5 in.)
Long/Narrow	430 mm (16.92 in.)
Large	440 mm (17.3 in.)

7.13.6

Hoods shall be designed with a face opening.

7.13.6.1

Other than where the hood face opening is designed to interface with a specific SCBA facepiece, or where the hood face opening is designed to be adjustable, the hood face opening shall be able to be stretched to a circumference of at least 800 mm (31 in.).

7.13.6.2

Where the hood face opening is designed to interface with a specific SCBA facepiece, the hood face opening shall overlap the outer edge of the specific SCBA facepiece-to-face seal perimeter by not less than 13 mm (½ in.). It shall be permitted to use the test equipment and approach specified in 9.47.4.2 and 9.47.4.5.

7.13.6.3*

The interface and integration of the selected respirator with the protective ensemble shall not invalidate the NIOSH certification of the respective respirator.

7.13.7

Hood fabric materials, including particulate blocking layers, as applicable, shall be recognized components that meet levels of restricted substances as specified in Section 8.20.

7.13.7.1

Emblems utilized on the exterior of the hood and measuring larger than a total area of 225 cm^2 (35 $in.^2$) shall be recognized components that meet levels of restricted substances as specified in Section 8.20.

7.13.7.2

All emblems utilized on the interior of the garment shall be recognized components that meet levels of restricted substances as specified in Section 8.20.

7.13.8

The portions of the hood interface component that include a particulate blocking material specifically for meeting the requirements of 7.14.1 shall include all areas of the hood except as specified in 7.13.9 and 7.13.10.

7.13.9

Particulate blocking hood material shall be extended at least to within 19 mm (¾ in.) of any hem of the hood bib.

7.13.10

Binding, including the elastic and stitching around the hood face opening, shall be permitted to exclude particulate blocking material specifically for meeting the requirements of 7.14.1 for a distance of 19 mm (¾ in.) from the leading edge of the hood face opening. The distance shall be measured in eight separate locations with the hood lying on a flat surface with the face opening facing upward and measured from the innermost row of stitching to the face opening leading edge.

7.14 ~~Additional~~ Protective Hood Interface Component Design Requirements for Proximity ~~Firefighting Protective Hood Interface Components Only. (Reserved)~~ **~~Fire Fighting~~**

7.14.1 use design requirements from NFPA 1971 , 2018 edition for hoods.

7.14.2 use performance requirements from NFPA 1971, 2018 edition for hoods

Statement of Problem and Substantiation for Public Comment

The task group recommending only one hood (blocking) probably over looked that the title was for both ensembles. The blocking hood for Proximity Fire Fighting is not necessary and might hinder the safety of the proximity fire fighter. The hood is worn under the aluminized shroud which covers the fire fighter down to the shoulder area. The aluminized material is totally impermeable and nothing is going through the system. I'm going to talk about one area of Proximity Fire Fighting aircraft fire fighting. The products of combustion from a structural fire and a aircraft frame are totally different. The Naval Air community is one of the major users of the standard. Their fire personnel can be in this hood on a daily basis for up to 12 hrs. When seconds count to respond to a aircraft incident by using the blocking hood we have added an extra burden to the fire fighter. Therefore this comments adds back the the hood requirements from NFPA 1971 / 2018 edition for Proximity fire fighters only.

Related Item

• FR51,221,303

Submitter Information Verification

Submitter Full Name: Harry Winer
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Submittal Date: Fri Dec 09 11:16:04 EST 2022
Committee: FAE-SPF

Public Comment No. 94-NFPA 1970-2022 [Section No. 7.13.1]

7.13.1

Hood interface components shall have at least the applicable design requirements specified in this section where inspected and evaluated by the certification organization as specified in Section 4.~~4~~ 3 , Inspection and Testing.

Statement of Problem and Substantiation for Public Comment

Correction of referenced section

Related Item

• FR298

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
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Submittal Date: Fri Dec 30 09:03:59 EST 2022
Committee: FAE-SPF

Public Comment No. 95-NFPA 1970-2022 [Section No. 7.13.5.1]

7.13.5.1*

The hood shall be donned in accordance with the manufacturer's instructions for wearing, on the respective headform that is fitted with a surrogate SCBA facepiece that meets the design requirements set forth ~~by NFPA 1981~~ in Chapter 17 .

Statement of Problem and Substantiation for Public Comment

Since NFPA 1981 is now incorporated in this standard the reference should be to the appropriate chapter/section of this standard.

Related Item

• FR51

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Street Address:
City:
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Submittal Date: Fri Dec 30 09:09:47 EST 2022
Committee: FAE-SPF

Public Comment No. 96-NFPA 1970-2022 [Section No. 7.13.7.1]

7.13.7.1

Emblems utilized on the exterior of the hood and measuring larger than a total area of ~~225 cm~~ 58 cm ^{2} (~~35 in~~ 9 in .^{2}) shall be recognized components that meet levels of restricted substances as specified in Section 8.20.

Statement of Problem and Substantiation for Public Comment

Proposing for hoods that the size of the exclusion be smaller than that of garments. The overall size of a hood is much smaller than a coat/pant so a proportional requirement should be set. The proposed size is purely a suggestion, and the final determined size should be discussed by the committee.

Related Item

• FR221

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Street Address:
City:
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Submittal Date: Fri Dec 30 09:13:17 EST 2022
Committee: FAE-SPF

Public Comment No. 98-NFPA 1970-2022 [Sections 7.13.8, 7.13.9, 7.13.10]

Sections 7.13.8, 7.13.9, 7.13.10

7.13.8

The portions of the hood interface component that include a particulate blocking material specifically for meeting the requirements of ~~7~~ 8 .~~14~~ 13 .~~1 shall~~ 13 shall include all areas of the hood except as specified in 7.13.9 and 7.13.10.

7.13.9

Particulate blocking hood material shall be extended at least to within 19 mm (¾ in.) of any hem of the hood bib.

7.13.10

Binding, including the elastic and stitching around the hood face opening, shall be permitted to exclude particulate blocking material specifically for meeting the requirements of ~~7~~ 8 .~~14~~ 13 .~~1 for~~ 13 for a distance of 19 mm (¾ in.) from the leading edge of the hood face opening. The distance shall be measured in eight separate locations with the hood lying on a flat surface with the face opening facing upward and measured from the innermost row of stitching to the face opening leading edge.

Statement of Problem and Substantiation for Public Comment

The referenced sections no longer exist in the standard. The hood task group / committee should verify the proposed referenced sections are correct.

Related Item

• FR303

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Street Address:
City:
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Submittal Date: Fri Dec 30 09:16:34 EST 2022
Committee: FAE-SPF

Public Comment No. 32-NFPA 1970-2022 [New Section after 7.14]

TITLE OF NEW CONTENT

7.14.2 Hood composite materials and seams that incorporate a particulate blocking layer shall be tested for particulate blocking as specified in Section 8.71, Particulate Blocking Test, and shall have a particulate filtration efficiency of 90 percent or greater for each particle size from 0.1 µm to 1.0 µm.

Statement of Problem and Substantiation for Public Comment

Seams play an important role in turnout gear as well as in hoods. There are many requirements for seams in the NFPA 1971-2018. For example, there is a specific requirement for moisture barrier seams to be tested for resistance to liquids. It is believed that seams encounter similar challenges as the rest of PPE during a fire. However, the incumbent standard does not have a particulate blocking requirement for barrier hood seams. Therefore, adding this requirement will ensure the seams provide proper smoke particulate protection similar to composite materials for firefighters

Related Item

• NFPA 1971 7.14.2

Submitter Information Verification

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Submittal Date: Wed Dec 14 11:14:36 EST 2022
Committee: FAE-SPF

Public Comment No. 36-NFPA 1970-2022 [New Section after 7.16]

Performance & Design Requirement for Turnout Bunker Coat Sleeves (NFPA 1971)

Wristlet or Gauntlets

Will these be required to be mandatory for Turnout Bunker Coat or will the AHJ be allowed to specify other means for keeping water from entering the coat?

According to new proposal - Gloves must now extend a total of **2 inches beyond the wrist crease** whether with a gauntlet or wristlet, representing an additional 1 inch of glove coverage from the existing standard.

Submitted by: Albert V. Condello III CSP CHMM NREMT

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Statement of Problem and Substantiation for Public Comment

Will Fire Departments be allowed to specify Turnout Bunker Coat not to have wristlets or gauntlets?

Related Item

• NFPA 1971, 2018 ed.

Submitter Information Verification

Submitter Full Name: Albert V Condello
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Affiliation: George Clay Fire Company - Station 39 Montgomery County PA Fire & Rescue
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Submittal Date: Wed Dec 21 10:04:28 EST 2022
Committee: FAE-SPF

Public Comment No. 99-NFPA 1970-2022 [Section No. 7.18.4.1 [Excluding any Sub-Sections]]

Liquid and particulate contaminant protective garments shall have at least the applicable design requirements specified in this subsection in addition to the design requirements specified in Section 7.1 and Section 7.2, or as in Section 7.3, where inspected and evaluated by the certification organization as specified in Section 4.~~4~~ 3, Inspection and Testing .

Statement of Problem and Substantiation for Public Comment

Correction of reference and adding the section title to be consistent with similar sections in this chapter (see 7.1, 7.2, etc)

Related Item

• FR236

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
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Submittal Date: Fri Dec 30 09:21:51 EST 2022
Committee: FAE-SPF

Public Comment No. 102-NFPA 1970-2022 [Section No. 7.18.4.4 [Excluding any Sub-Sections]]

The manufacturer shall be permitted to specify undergarments or other related garments worn as part of the ensemble when the identified items are required to be worn with the ensemble as indicated on the product label for particulate and liquid protection ~~, are involved in~~ as specified in 6.2.1.1 and 6.2.2. The undergarments shall also be used in the evaluation of the garment for overall liquid integrity and particulate inward leakage, and must be worn for the garment to function for providing the wearer protection from liquid and particulate exposure. The use of the undergarments shall also be included in the User Information required in Chapter 6.

Statement of Problem and Substantiation for Public Comment

More detail on the requirements for the permitted use of undergarments needs to be included in this standard. This is a new concept for structural and proximity fire fighting garments and should have more attention to the requirements for labeling and user information included so that the end user fully understands the particulate and liquid protection potentially requires the use of additional garments.

Related Item

- FR304

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Fri Dec 30 09:40:28 EST 2022
Committee: FAE-SPF

Public Comment No. 101-NFPA 1970-2022 [New Section after 7.18.4.4.3]

7.18.4.4.4

For structural fire fighting garments, the undergarments or related garments shall also be included as part of the performance requirements in 8.2.2 and 8.2.2.1.

Statement of Problem and Substantiation for Public Comment

If an undergarment is going to be allowed to be used as part of a particulate blocking ensemble it should be required to be evaluated with the garment for THL and Ret. Some undergarments can create a significant increase in physiological burden to the wearer, therefore this assessment should be part of the requirements for this combination of garments. Consideration could be given that this be a requirement or a test and report only result, but the purchases should be aware of the impact the undergarments have on the composite.

Related Item

- FR304

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Fri Dec 30 09:32:14 EST 2022
Committee: FAE-SPF

Public Comment No. 6-NFPA 1970-2022 [Section No. 7.19]

7.

~~19 Design~~

19 Design Requirements for Electrical Circuitry.

7.19.

~~1 General~~

1 General .

Structural and proximity firefighting protective ensembles and ensemble elements

~~that contain~~

involving electrical circuitry shall only utilize circuitry that

~~has been certified, at a minimum, for use in Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 and 2 hazardous locations; and with a temperature class within the range of T3 through T6 inclusive. The suitability shall be demonstrated by being certified as one of the following in accordance with ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous (Classified) Locations* :~~

meets the requirements of this standard for one of the following types of explosion protection:

(1) Nonincendive equipment, stand-alone type (i.e., individual pieces of equipment separately certified for Class I and II, Division 2 and Class III applications, without any external electrical interconnection means, and intended for stand-alone use)

(2) Nonincendive equipment, electrically interconnected type (i.e., individual pieces of equipment separately certified for Class I and II, Division 2 and Class III applications, with external electrical interconnection means involving plugs and jacks, and intended for electrical interconnection to other separately certified nonincendive equipment, electrically interconnected types)

(3) Nonincendive system (i.e., multiple pieces of nonincendive equipment certified together for Class I and II, Division 2 and Class III applications, with electrical interconnection means, and intended for dedicated system use)

(4) Intrinsically safe apparatus, stand-alone type (i.e., individual pieces of apparatus separately certified for Class I and II, Division 1 and Class III applications, without any external electrical interconnection means, and intended for stand-alone use)

(5) Intrinsically safe system (i.e., multiple pieces of intrinsically safe apparatus certified together for Class I and II, Division 1 and Class III applications, with electrical interconnection means, and intended for dedicated system use)

7.19.1.

~~1~~

1

Passive electrical circuitry that relies on a supplemental device to energize it is exempt from

~~the requirement in~~

this requirement since it does not present a risk of ignition in an explosive atmosphere, or a risk of fire and electric shock, based on compliance with 7.19.1

~~because it does not generate power and is considered intrinsically safe.~~

.2.

7.19.1.

~~2~~

2

The instructions supplied with

~~supplemental devices used to power the passive devices shall include information that requires the device to~~

ensembles/elements that utilize such passive electrical circuitry shall indicate that the supplemental device relied upon to energize the circuitry shall not be used or stored in the hazardous location.

7.19.2

~~Electrical circuitry that is certified as part of~~

Nonincendive Equipment and Systems.

7.19.2.1 General.

Electrical circuitry contained within structural and proximity firefighting protective ensembles and ensemble elements shall, at a minimum, be suitable for use in Class I, Division 2, Groups C and D; Class II, Division 2, Groups F and G; and Class III, Divisions 1 and 2 hazardous (classified) locations, and with a temperature class within the range of T3 through T6 inclusive. This suitability is demonstrated by being certified as one of the following in accordance with UL 121201, Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations, Ninth Edition, 2017:

(1) Nonincendive equipment, stand-alone type

(2) Nonincendive equipment, electrically interconnected type

(3) Nonincendive system

7.19.2.2 Interconnection of Nonincendive Equipment, Electrically Interconnected Types.

7.19.2.2.1

Interconnection of electrical circuits that are separately certified as nonincendive equipment, electrically interconnected types, shall be by means of a plug and jack that comply with the device connector requirements as specified in Section 6.10 of NFPA 1802.

7.19.2.2.2

The electrical parameters for this interconnection shall be in accordance Table 7.19.2.2.2.

<<<Renumber and insert Table 17.1.8.2.2.2 as Table 7.19.2.2.2, with the title “Electrical Parameters for Interconnection of Separately Certified Nonincendive Equipment, Electrically Interconnected Types”>>>

*Assumption for cable capacitance (Ccable) and cable inductance (Lcable): 200 pF/m and 1µH/m respectively.

7.19.2.2.3

The instructions supplied with ensembles/elements that contain such circuits shall identify the circuits as nonincendive equipment, electrically interconnected types, and indicate the ability to interconnect the circuitry with any other such circuitry that is also identified as nonincendive equipment, electrically interconnected types in accordance with this standard.

7.19.2.3 Interconnection of Nonincendive Systems.

7.19.2.3.1

Electrical circuits that are certified as part of a nonincendive system shall only be interconnected with the other electrical circuits also certified as part of the same nonincendive system.

7.19.2.3.2

The instructions supplied with ensembles/elements that contain such circuits shall identify the circuits as part of a nonincendive system and indicate the other circuits that comprise the nonincendive system in accordance with this standard.

7.19.3 Intrinsically Safe Apparatus and Systems.

7.19.3.1 General.

Electrical circuitry contained within structural and proximity firefighting protective ensembles and ensemble elements shall be permitted to be certified at a minimum for use in Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G, Class III, Division 1 and 2 hazardous locations, and with a temperature class within the range of T3 through T6 inclusive. This suitability is demonstrated by being certified as one of the following in accordance with UL 913, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division1 Hazardous (Classified) Locations, Sixth Edition, 2002:

(1) Intrinsically safe apparatus, stand-alone type

(2) Intrinsically safe system

7.19.3.2 Interconnection of Intrinsically Safe Systems.

7.19.3.2.1

Electrical circuits that are certified as part of an intrinsically safe system shall only be interconnected with the other

~~pieces also~~

electrical circuits certified as part of the same intrinsically safe system.

7.19.3.2.2

The instructions supplied with ensembles/elements that contain such circuits shall identify the circuits as part of an intrinsically safe system and indicate the other circuits that comprise the intrinsically safe system in accordance with this standard.

Statement of Problem and Substantiation for Public Comment

(Submitted on behalf of the FAE-ELS/FAE-SCE HazLoc Harmonization Task Group)
This comment aligns the explosion protection requirements for electrical circuitry contained within ensembles with the explosion protection requirements for SCBA and PASS devices. Specifically, it provides both an IS (Division 1) and NI (Division 2) option.

Related Item

• FR-139

Submitter Information Verification

Submitter Full Name: Paul Kelly
Organization: UL LLC
Street Address:
City:
State:
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Submittal Date: Thu Sep 08 23:10:23 EDT 2022
Committee: FAE-SPF

Public Comment No. 104-NFPA 1970-2022 [Section No. 7.19.1 [Excluding any Sub-Sections]]

Revise this section to be consistent with the changes agreed upon in the SCBA and PASS committees

Structural and proximity firefighting protective ensembles and ensemble elements that contain electrical circuitry shall only utilize circuitry that has been certified, at a minimum, for use in Class I, Division 1, Groups C and D; Class II, Division 1, Groups E, F, and G; Class III, Division 1 and 2 hazardous locations; and with a temperature class within the range of T3 through T6 inclusive. The suitability shall be demonstrated by being certified as one of the following in accordance with ANSI/UL 913, *Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1 Hazardous (Classified) Locations* :

(1) Intrinsically safe apparatus, stand-alone type (i.e., individual pieces of apparatus separately certified for Class I and II, Division 1 and Class III applications, without any external electrical interconnection means, and intended for stand-alone use)

(2) Intrinsically safe system (i.e., multiple pieces of intrinsically safe apparatus certified together for Class I and II, Division 1 and Class III applications, with electrical interconnection means, and intended for dedicated system use)

Statement of Problem and Substantiation for Public Comment

The task group for SCBA and PASS has agreed upon alternate language and requirements for this section. The requirements in this standard should be the same for correlation purposes.

Related Item

• FR139

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
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Submittal Date: Fri Dec 30 09:47:45 EST 2022
Committee: FAE-SPF

Public Comment No. 203-NFPA 1970-2023 [Section No. 8.1.27]

8.1.27

Protective garment element composites consisting of an outer shell, a moisture barrier, and a thermal barrier shall be tested for thermal insulation as specified in Section 9.~~79~~ 78 , and shall have an average ERV of not more than 0.300 (30 percent). ADJUST performance criteria according to exploratory testing currently underway.

Statement of Problem and Substantiation for Public Comment

Correct reference for Small-Scale Flash Fire Exposure Test 1 is 9.78.

Testing of a variety of composites is currently underway. This may require adjustment of the performance requirements upon completion in the coming weeks.

Related Item

• FR-169

Submitter Information Verification

Submitter Full Name: Brian Shiels
Organization: ArcWear
Street Address:
City:
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Submittal Date: Wed Jan 04 14:01:00 EST 2023
Committee: FAE-SPF

Public Comment No. 105-NFPA 1970-2022 [Sections 8.1.27, 8.1.28]

Sections 8.1.27, 8.1.28

~~**8.1.27** –~~

~~Protective garment element composites consisting of an outer shell, a moisture barrier, and a thermal barrier shall be tested for thermal insulation as specified in Section 9.79 , and shall have an average ERV of not more than 0.300 (30 percent).~~

~~**8.1.28** –~~

~~Protective garment element composites consisting of an outer shell, a moisture barrier, and a thermal barrier shall be tested for thermal insulation while allowing for shrinkage as specified in Section 9.78 , and shall have an average CTPP of not less than 30.~~

Statement of Problem and Substantiation for Public Comment

These requirements should be deleted or revised based on the test results provided by the design and test method task groups. The decision should be based on the testing results and the relevance and significance of such results.

Related Item

• FR168 • FR169 •

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
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Submittal Date: Fri Dec 30 10:10:24 EST 2022
Committee: FAE-SPF

Public Comment No. 106-NFPA 1970-2022 [Section No. 8.2.7]

8.2.7

Garment outer shells shall be evaluated for flame resistance following fuel exposure and cleaning as specified in Section 9.82, and shall have an afterflame time of not more than 2 seconds average.

Statement of Problem and Substantiation for Public Comment

Clarification added that the requirement for flame resistance should be less than 2 seconds. The draft is missing the word 'not'.

Related Item

- FR207

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
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Submittal Date: Fri Dec 30 10:14:33 EST 2022
Committee: FAE-SPF

Public Comment No. 107-NFPA 1970-2022 [Section No. 8.4.5]

8.4.5

Helmets shall be tested for resistance to flame as specified in Section 9.3, Flame Resistance Test 2, Procedures A and C and shall not show any visible afterflame or glow 5.0 seconds after removal from the test flame in each test.

~~**8.4.5.1** –~~

~~Helmets shall be tested for resistance to flame as specified in Section 9.5 , and not have any visible afterflame or glow 5.0 seconds after removal from the test flame, not have any components melt or drip, and not exhibit any burn through. The heat rise shall be reported.~~

Statement of Problem and Substantiation for Public Comment

Based on testing conducted by the helmet task group the results did not justify or show significant relevance over the current requirements. Therefore, the proposed new flame test method is being deleted and the requirements for the current flame test restored.

Related Item

• FR70

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Fri Dec 30 10:18:22 EST 2022
Committee: FAE-SPF

Public Comment No. 108-NFPA 1970-2022 [Section No. 8.5.10]

8.5.10

Helmet ear covers, sweatbands, chin straps, nape ~~straps~~ device coverings , if provided, and any other textile-based soft goods, ~~not including suspension~~ excluding suspension soft goods, that come in contact with the wearer's head shall be evaluated for ease of removal and reinstallation as specified in Section 9.75, and have a test time of 20 minutes.

Statement of Problem and Substantiation for Public Comment

Revisions and clarity being provided based on helmet task group discussions relevant to what should be included and excluded from this requirement. The task group also reaffirmed the 20 minute test time requirement.

Related Item

• FR69

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Street Address:
City:
State:
Zip:
Submittal Date: Fri Dec 30 10:26:16 EST 2022
Committee: FAE-SPF

Public Comment No. 189-NFPA 1970-2023 [Section No. 8.5.10]

8.5.10

Helmet ear covers , sweatbands, chin straps, nape straps, if provided, and any other textile-based soft goods, not including suspension soft goods, that come in contact with the wearer's head shall be evaluated for ease of removal and reinstallation as specified in Section 9.75, and have a test time of 20 minutes or less .

Statement of Problem and Substantiation for Public Comment

As written if the test time isn't exactly 20 minutes, the sample would fail. This comment corrects to include any time equal to or less than 20 minutes.

Related Item

• FR69

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Street Address:
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Zip:
Submittal Date: Wed Jan 04 12:51:28 EST 2023
Committee: FAE-SPF

Public Comment No. 196-NFPA 1970-2023 [Section No. 8.7.1]

8.7.1

The glove body composite shall be tested for thermal insulation as specified in Section 9.10, and shall have an average TPP rating of at least 35.0.

~~**8.7.1.1** –~~

~~The glove body composite shall be tested for thermal insulation while allowing for shrinkage as specified in Section 9.77 , and shall have an average CTPP of not less than 30.~~

~~**8.7.1.2** –~~

~~Whole protective gloves shall be tested for thermal insulation as specified in Section 9.79 , and shall have an average ERV of not more than 0.300 (30.0 percent).~~

Statement of Problem and Substantiation for Public Comment

While the new tests have merit for better addressing the shrinkage associated with many glove material composites that sometime results in artificially elevated TPP results, insufficient testing has been performed to adequately set and validate acceptable performance criteria.

Related Item

• FR91

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
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Submittal Date: Wed Jan 04 13:14:42 EST 2023
Committee: FAE-SPF

Public Comment No. 109-NFPA 1970-2022 [Sections 8.7.1.1, 8.7.1.2]

Sections 8.7.1.1, 8.7.1.2

~~**8.7.1.1** –~~

~~The glove body composite shall be tested for thermal insulation while allowing for shrinkage as specified in Section 9.77 , and shall have an average CTPP of not less than 30.~~

~~**8.7.1.2** –~~

~~Whole protective gloves shall be tested for thermal insulation as specified in Section 9.79 , and shall have an average ERV of not more than 0.300 (30.0 percent).~~

Statement of Problem and Substantiation for Public Comment

If test data is not provided to support the inclusion of these test methods for gloves the requirements and associated test methods should be removed.

Related Item

• FR91

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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City:
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Zip:
Submittal Date: Fri Dec 30 10:56:04 EST 2022
Committee: FAE-SPF

Public Comment No. 184-NFPA 1970-2023 [Section No. 8.7.6]

8.7.6

The glove body composite, including, but not limited to, trim, external labels, external nonvisual/machine-readable tags, and external tags, but excluding hardware, and excluding hook and pile fasteners that do not directly contact the wearer's body, shall be tested for resistance to flame as specified in Section 9.4, and shall not have an average char length of more than 100 mm (4 in.), shall not have an average afterflame of more than 2.0 seconds, shall not melt or drip, and shall not have the amount of consumed materials exceed 5 percent.

8.7.6.1

Whole gloves, excluding hardware and excluding hook and loop pile fasteners that do not directly contact the wearer's body, shall be tested for resistance to flame as specified in Section 9.5, and not have an afterflame of more than 5.0 seconds, not melt or drip, not exhibit any burn-through, and not exhibit melting of the barrier layer.

8.7.6.2

Gloves ~~shall~~ , excluding hardware and excluding hook and loop pile fasteners that do not directly contact the wearer's body, shall be tested according to Section 9.79, and shall not have an average afterflame time of more than 2.0 seconds, and shall not melt or drip.

Statement of Problem and Substantiation for Public Comment

Similar exclusions for the new test have been made as applied to the original incumbent test performed on glove composite samples.

Related Item

- FR89

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
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Submittal Date: Wed Jan 04 12:28:04 EST 2023

Committee: FAE-SPF

Public Comment No. 185-NFPA 1970-2023 [Section No. 8.7.6]

8.7.6

The glove body composite, including, but not limited to, trim, external labels, external nonvisual/machine-readable tags, and external tags, but excluding hardware, and excluding hook and pile fasteners that do not directly contact the wearer's body, shall be tested for resistance to flame as specified in Section 9.4, and shall not have an average char length of more than 100 mm (4 in.), shall not have an average afterflame of more than 2.0 seconds, shall not melt or drip, and shall not have the amount of consumed materials exceed 5 percent.

~~**8.7.6.1** –~~

~~Whole gloves shall be tested for resistance to flame as specified in Section 9.5 , and not have an afterflame of more than 5.0 seconds, not melt or drip, not exhibit any burn-through, and not exhibit melting of the barrier layer.~~

~~**8.7.6.2** –~~

~~Gloves shall be tested according to Section 9.79 , and shall not have an average afterflame time of more than 2.0 seconds, and shall not melt or drip.~~

Statement of Problem and Substantiation for Public Comment

While overall glove tests have merit for simplifying the evaluation of flame resistance, insufficient work has been performed to validate either new test and one test is sufficient for this test property.

Related Item

• FR89

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 12:37:50 EST 2023
Committee: FAE-SPF

Public Comment No. 191-NFPA 1970-2023 [Section No. 8.7.6]

8.7.6

~~The glove body composite, including, but not limited to, trim, external labels, external nonvisual/machine-readable tags, and external tags, but excluding hardware,~~ Gloves excluding hardware and excluding hook and pile fasteners that do not directly contact the ~~wearer's~~ wearer's body,~~shall~~ shall be tested ~~for resistance to flame as specified in~~ according to Section 9.~~4~~ 79 , and shall not have an average ~~char length of more than 100 mm (4 in.), shall not have an average afterflame~~ afterflame time of more than 2.0 seconds, shall not melt or drip, and shall not ~~have the amount of consumed materials exceed 5 percent.~~

~~**8.7.6.1** –~~

~~Whole gloves shall be tested for resistance to flame as specified in Section 9.5 , and not have an afterflame of more than 5.0 seconds, not melt or drip, not exhibit any burn-through, and not exhibit melting of the barrier layer.~~

~~**8.7.6.2** –~~

~~Gloves shall be tested according to Section 9.79 , and shall not have an average afterflame time of more than 2.0 seconds, and shall not melt or drip.~~

result in the melting of the internal moisture barrier.

Statement of Problem and Substantiation for Public Comment

An overall glove test for evaluating flammability is preferred over an individual composite evaluation test given the complexity of certain designs and would further be consistent in the manner for which footwear is currently evaluated in the standard.

Related Item

• FR89

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jan 04 13:00:48 EST 2023

Committee: FAE-SPF

Public Comment No. 111-NFPA 1970-2022 [Section No. 8.7.26]

~~**8.7.26** –~~

~~Glove body composites, including, but not limited to, shell materials, moisture barrier layers, and linings, shall be evaluated for ease of cleaning where the glove manufacturer is required to report the contaminant removal efficiency for semi-volatile organic compounds and heavy metals as specified in Section 9.81 .~~

Statement of Problem and Substantiation for Public Comment

This section either needs to be revised (as well as the associated test method) or removed. How will this testing be conducted on gloves? Should there be specific requirements for gloves as the test method proposed is for garments and uses the extractor as the cleaning method. This may not be practical for gloves or even glove composites.

Related Item

• FR210

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Street Address:
City:
State:
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Submittal Date: Fri Dec 30 11:48:16 EST 2022
Committee: FAE-SPF

Public Comment No. 227-NFPA 1970-2023 [Section No. 8.10.17]

8.10.17

Where the manufacturer indicates the footwear as being breathable, footwear shall be tested for breathability as specified in Section 9.~~74~~ ~~, and the manufacturer shall report the moisture vapor transmission rate as part of the user information as required by 6.4.11 .~~

~~**8.10.17.1** –~~

~~Alternatively, where the manufacturer indicates the footwear as being breathable, footwear shall be tested for breathability as specified in Section 9.~~

73 , and the manufacturer shall report the moisture vapor transmission rate as part of the user information as required by 6.4.11.1 .

Statement of Problem and Substantiation for Public Comment

An investigation of this test method as applied to several different types of footwear revealed a high degree of variability with only general discrimination between boots that are breathable versus those that are not breathable (i.e., rubber footwear styles). Therefore, the test is being removed.

Related Item

• FR106

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
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Submittal Date: Wed Jan 04 16:30:53 EST 2023
Committee: FAE-SPF

Public Comment No. 228-NFPA 1970-2023 [Section No. 8.10.18]

~~8.10.18~~ –

~~Footwear shall be tested for outer sole flexibility as specified in Section~~ 9.76 ~~, and the manufacturer shall report the force required to flex the footwear outer sole as required by~~ 6.4.12 ~~.~~

Statement of Problem and Substantiation for Public Comment

A single laboratory investigation for applying this test method indicated that additional rigor would be needed to justify this requirement even though some differences in footwear were observed

Related Item

• FR108

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
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Submittal Date: Wed Jan 04 16:35:53 EST 2023
Committee: FAE-SPF

Public Comment No. 110-NFPA 1970-2022 [Section No. 8.10.19]

~~8.10.19~~ –

~~Footwear upper composite materials, including, but not limited to, exterior layers, barrier layers, and linings, shall be evaluated for ease of cleaning where the footwear manufacturer is required to report the contaminant removal efficiency for semivolatile organic compounds and heavy metals as specified in Section~~ ~~9.81~~ .

Statement of Problem and Substantiation for Public Comment

This section either needs to be revised (as well as the associated test method) or removed. How will this testing be conducted on footwear? Should there be specific requirements for footwear as the test method proposed is for garments and uses the extractor as the cleaning method. This is not practical for footwear or even footwear composites.

Related Item

• FR211

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Street Address:
City:
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Submittal Date: Fri Dec 30 11:44:51 EST 2022
Committee: FAE-SPF

Public Comment No. 112-NFPA 1970-2022 [Section No. 8.13.11]

~~8.13.11~~ –

~~Hood composites shall be tested for thermal insulation as specified in Section~~ 9.78 ~~, and shall have an average ERV of not more than 0.450 (45.0 percent).~~

Statement of Problem and Substantiation for Public Comment

This section should be removed or revised based on task group testing showing sufficient differentiation by adding this test method.

Related Item

• FR171

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
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Submittal Date: Fri Dec 30 12:53:38 EST 2022
Committee: FAE-SPF

Public Comment No. 113-NFPA 1970-2022 [Sections 8.13.13, 8.13.14, 8.13.15]

Sections 8.13.13, 8.13.14, 8.13.15

8.13.13

Hood composite materials ~~that incorporate a particulate blocking layer~~ shall be tested for particulate blocking as specified in Section 9.70, and shall have a particulate filtration efficiency of 90 percent or greater for each particle size from 0.1 µm to 1.0 µm.

8.13.14

Hood composites ~~including a particulate blocking layer~~ shall be tested for evaporative heat transfer as specified in Section 9.33, and shall have a THL of not less than 325 W/m^2.

8.13.15

Hood composite materials ~~that incorporate a particulate blocking layer~~ shall be tested for transmitted and stored thermal energy as specified in Section 9.66, and shall have a predicted time to second-degree burn greater than or equal to 100 seconds.

Statement of Problem and Substantiation for Public Comment

If the requirement of a particulate blocking layer remains mandatory, then this language is not needed as it will be required to be part of a hood composite. Leaving this language in implies it is an option.

Related Item

• FR305 • FR61

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
Organization: LION Group, Inc.
Street Address:
City:
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Submittal Date: Fri Dec 30 12:55:23 EST 2022
Committee: FAE-SPF

Public Comment No. 114-NFPA 1970-2022 [Section No. 8.13.14]

8.13.14

Hood composites including a particulate blocking layer shall be tested for evaporative heat transfer as specified in Section 9.33, and shall have a THL of not less than ~~325 W~~ 300 W /m^2.

Statement of Problem and Substantiation for Public Comment

If particulate blocking hoods are made mandatory, then additional leeway may be necessary to provide a range of hood products with different layering depending on fire department tactical operations and training. Lowering the current THL requirement would allow for a greater flexibility in the choice of hood materials and layering. The recommended minimum requirement of 300 W/m2 is still very high when compared to garment, which have a requirement of 205 W/m2 and above most of the current higher breathability composites in the marketplace. Further, there is tradeoff between total heat loss and thermal insulation that would be better accommodated with this proposed change.

Related Item

• FR-66

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
Organization: International Personnel Protection, Inc.
Street Address:
City:
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Submittal Date: Fri Dec 30 13:12:27 EST 2022
Committee: FAE-SPF

Public Comment No. 188-NFPA 1970-2023 [Section No. 8.13.15]

~~8.13.15~~ –

~~Hood composite materials that incorporate a particulate blocking layer shall be tested for transmitted and stored thermal energy as specified in Section 9.66 , and shall have a predicted time to second-degree burn greater than or equal to 100 seconds.~~

Statement of Problem and Substantiation for Public Comment

Removing this performance requirement to align with the removal of the test method.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 181-NFPA 1970-2023 [Section No. 9.66]	

Related Item

- FR67

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Street Address:
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Submittal Date: Wed Jan 04 12:48:54 EST 2023
Committee: FAE-SPF

Public Comment No. 126-NFPA 1970-2023 [Section No. 8.20]

8.20* Acceptable Levels of Restricted Substances in Specified Protective Element Recognized Components.

Components that are required to be certified for individual protective elements shall meet the acceptable restricted substances as established in Table 8.20(a) when tested as specified in Section 9.83, subject to the following applications or exceptions:

(1) Testing for azo-amines and aryl amine salts shall be excluded for materials and components that are plastics, rubber, or polymers.

(2) Testing for bisphenols shall only be applied to materials and components that are plastics, rubber, or polymers.

(3) Testing for chlorobenzenes and chlorotoluenes shall only be applied to materials and components that include synthetic fibers, natural and synthetic fiber blends, or artificial leather.

(4) Testing for chlorinated paraffins shall be excluded for materials and components that consist of natural fibers, synthetic fibers, or natural and synthetic fiber blends.

(5) Testing for chlorophenols shall be only applied to materials and components that include natural fibers, synthetic fibers, natural and synthetic fiber blends, or natural leather.

(6) Testing for Dimethylfurmate shall only be applied to materials and components that include natural leather.

(7) Testing for dyes shall only be applied to materials and components that include synthetic fibers or natural and synthetic fiber blends.

(8) Testing for formaldehyde shall be excluded for materials and components that are plastics or polymers.

(9) Testing for heavy metal Chromium VU shall be only applied to materials and components that consist of natural fibers, synthetic fibers, or natural leather.

(10) Testing for total heavy metal content that includes arsenic, cadmium, lead, and mercury shall be excluded for materials and components that include synthetic fibers.

(11) Testing for monomers shall be only applied to materials and components that include artificial leather or are plastics, rubber, and polymers.

(12) Testing for nitrosamines shall be only applied to materials and components that are rubber.

(13) Testing for Otho-phenylphenol shall be excluded for materials and components that are plastics, rubber, or polymers.

(14) Testing for phthalates shall be excluded for materials and components that include natural fibers, synthetic fibers, natural and synthetic fiber blends, and natural leather.

(15) Testing for polycyclic aromatic hydrocarbons shall be excluded for materials and components that include natural fibers, synthetic fibers, natural and synthetic fiber blends, and natural leather.

(16) Testing for Quinoline shall be applied to materials and components that include synthetic fibers or natural and synthetic fiber blends.

(17) Testing for solvent residuals shall be applied to materials and components that include artificial leather or are polyurethane-based plastics or polymers.

(18) Testing for UV stabilizers shall be applied to materials and components that include plastics, rubber, or polymers.

(19) Testing for volatile organic compounds shall be applied to materials and components that include artificial leather or are polyurethane-based plastics or polymers.

Table 8.20(a) Acceptable Levels of Restricted Substances in Specified Protective Element Recognized Components

Chemical Class or Group	Restricted Substance(s)	Maximum Level
Acidity and Alkaline Substances	Measured by reporting pH	Acceptable range 4.0–7.5 (if direct skin contact) 4.0–9.0 (if not direct skin contact)
Akyl phenols and ethoxylates	Sum of 4-tert Butylphenol, Nonylphenol, Octylphenol, Heptaphenol, and Pentylphenol	10.0 mg/kg
	Sum of 4-tert butyl phenol, Nonylphenol, Octylphenol, Heptaphenol, Pentylphenol, Nonylphenolethoxylates, and Octylphenol-ethoxylates	100.0 mg/kg
Azo-amines and aryl amine salts	Each individual substance in Table 8.20(b)	20 mg/kg
Chlorinated benzenes and toluenes	Sum of all chemicals in Table 8.20(c)	1.0 mg/kg
Chlorinated paraffins (for leather only)	Sum of short chain chlorinated paraffins (C10–C13) and medium chain chlorinated paraffins (C14–C17)	50 mg/kg
Chlorinated phenols	Pentachlorophenol	0.5 mg/kg
	Tetrachlorophenols	0.5 mg/kg
	Trichlorophenols	2.0 mg/kg
	Dichlorophenols	3.0 mg/kg
	Monochlorophenols	3.0 mg/kg
Dimethylfumarate	Dimethylfumarate	0.1 mg/kg
Dyes	Each individual substance in Table 8.20(d)	50 mg/kg
	Navy blue	Not present
Flame retardant	Each individual substance in Table 8.20(e)	10 mg/kg
	Sum of all chemicals in Table 8.20(e)	50 mg/kg
Formaldehyde	Free and partially releasable	75 mg/kg
Heavy metals, extractable	Antimony	30.0 mg/kg
	Arsenic	1 mg/kg
	Barium	1000 mg/kg

Chemical Class or Group	Restricted Substance(s)	Maximum Level
	Cadmium	0.1 mg/kg
	Chromium	2.0 mg/kg
	Chromium VI	0.5 mg/kg
	Cobalt	4.0 mg/kg
	Copper	50.0 mg/kg
	Lead	1.0 mg/kg
	Mercury	0.02 mg/kg
	Nickel	4.0 mg/kg
	Selenium	100 mg/kg
Heavy metals, total content	Arsenic	100 mg/kg
	Cadmium	40.0 mg/kg
	Lead	90.0 mg/kg
	Mercury	0.5 mg/kg
Monomers	Styrene	0.005 kg/m^3
	Vinyl Chloride	0.002 kg/m^3
Nitrosamines	Each individual substance in Table 8.20(f)	0.5 mg/kg
Organotin Compounds	Tributyltin (TBT)	1.0 mg/kg
	Triphenyltin (TPhT)	1.0 mg/kg
	Each individual substance in Table 8.20(g)	2.0 mg/kg
Ortho-phenylphenol	Ortho-phenylphenol	25 mg/kg
Per- and polyfluorinated compounds	Sum of Perfluorooctane Sulfonic Acid and Sulfonates (PFOS), Perfluorooctane Sulfonamide (PFOSA), Perfluorooctance Sulfonfuoride (PFOSF), N-Methyl Perfluorooctane Sulfonamide (N-Me-FOSA), N-Ethyl Perfluorooctane Sulfonamide (N-Et-FOSA), N-Methyl Perfluorooctane Sulfonamide Ethanol (N-Me-FOSE), and N-Ethyl Perfluorooctane Sulfonamide Ethanol (N-Et-FOSE)	1.0 $\mu g/m^2$
	Sum of Perfluorooctanoic Acid and salts (PFOA)	0.025 mg/kg
	Perfluoroheptanoic Acid and salts (PFHpA)	0.1 mg/kg
	Perfluorononanoic Acid and salts (PFNA)	0.1 mg/kg
	Perfluorodecanoic Acid and salts (PFDA)	0.1 mg/kg
	Henicocafluoroundecanoic Acid and salts (PFUdA)	0.1 mg/kg
	Trisafluorododecanoic Acid and salts (PFDoA)	0.1 mg/kg

Chemical Class or Group	Restricted Substance(s)	Maximum Level
	Pentacosafluorotridecanoic Acid and salts (PFTrDA)	0.1 mg/kg
	Heptacosafluorotetradecanoic Acid and salts (PFTeDA)	0.1 mg/kg
	Sum of 1H,1H,2H,2H-Perfluorooctyl Acrylate (8:2 FTA), 1H,1H,2H,2H-Perfluoro-1-decanol (8:2 FTOH), and 1H,1H,2H,2H-Perfluorodecanesuphonic Acid and its salts (8:2 FTS)	1.0 mg/kg
Phthalates	Sum of substances listed in Table 8.20(h)	0.05 wt.%
Polycyclic aromatic hydrocarbons (PAH)	Benzo(a)pyrene	1.0 mg/kg
	Benzo(e)pyrene	1.0 mg/kg
	Benzo(a)anthracene	1.0 mg/kg
	Chrysene	1.0 mg/kg
	Benzo(b)fluoroanthrene	1.0 mg/kg
	Benzo(j)fluoroanthrene	1.0 mg/kg
	Benzo(k)fluoroanthrene	1.0 mg/kg
	Dibenzo(a,h)anthracene	1.0 mg/kg
	Sum of substances listed in Table 8.20(i)	10.0 mg/kg
Quinoline	Quinoline	50.0 mg/kg
Solvent residues	Dimethylacetamide	0.05 wt.%
	Dimethylformamide	0.05 wt.%
	N-Methyl-2-Pyrrolidone	0.05 wt.%
UV absorbers or stabilizers	2-Benzotriazol-2-yl-4,6-di-tert-butylphenol (UV 320)	0.1 wt.%
	2,4-Di-tert-butyl-6-(5-chlorobenzotriazol-2-yl) phenol (UV 327)	0.1 wt.%
	2-(2H-Benzotriazol-2-yl)-4,6-di-tert-penthylphenol (UV 328)	0.1 wt.%
	2-(2H-Benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV 350)	0.1 wt.%

Table 8.20(b) List of Restricted Azo-amines and Aryl Amine Salts

Azo-amine or Aryl Amine Salt Chemical	CAS Number
4-Aminobiphenyl	92-67-1
Benzidine	92-87-5
Chloro-o-toluidine	95-69-2 4
Naphthylamine	91-59-8 2
o-Aminoazotoluene	97-56-3

Azo-amine or Aryl Amine Salt Chemical	CAS Number
2-Amino-4-nitrotoluene	99-55-8
p-Chloraniline	106-47-8
2,4-Diaminoanisole	615-05-4
4,4’-Diaminodiphenylmethane	101-77-9
3,3’-Dichlorobenzidine	91-94-1
3,3’-Dimethoxybenzidine	119-90-4
3,3’-Dimethylbenzidine	119-93-7
3,3’-dimethyl-4,4’-diaminodiphenylmethane	838-88-0
p-Cresidine	120-71-8
4,4’-Methylen-bis(2-chloraniline)	101-14-4
4,4’-Oxydianiline	101-80-4
4,4’-Thiodianiline	139-65-1
o-Toluidine	95-53-4
2,4-Toluenediamine	95-80-7
2,4,5-Trimethylaniline	137-17-7
2,4 Xylidine	95-68-1
2,6 Xylidine	87-62-7
2-Methoxyaniline (= o-Anisidine)	90-04-0
p-Aminoazobenzene	60-09-3
4-Chloro-o-toluidinium chloride	3165-93-3
2-Naphthylammoniumacetate	553-00-4
4-Methoxy-m-phenylene diammonium sulphate	39156-41-7
2,4,5-Trimethylaniline hydrochloride	21436-97-5

Table 8.20(c) List of Restricted Chlorinated Benzenes and Toluenes

Chlorinated Benzene or Toluene Chemical	CAS Number
2-Chlorotoluene	95-49-8
3-Chlorotoluene	108-41-8
4-Chlorotoluene	106-43-4
2,3-Dichlorotoluene	32768-54-0
2,4-Dichlorotoluene	95-73-8

Chlorinated Benzene or Toluene Chemical	CAS Number
2,5-Dichlorotoluene	19398-61-9
2,6-Dichlorotoluene	118-69-4
3,4-Dichlorotoluene	95-75-0
3,5-Dichlorotoluene	25186-47-4
2,3,5-Trichlorotoluene	56961-86-5
2,3,6-Trichlorotoluene	2077-46-5
2,4,5-Trichlorotoluene	6639-30-1
3,4,5-Trichlorotoluene	21472-86-6
2,4,6-Trichlorotoluene	23479-65-7
2,3,4,5-Tetrachlorotoluene	76057-12-0
2,3,4,6-Tetrachlorotoluene	875-40-1
2,3,5,6-Tetrachlorotoluene	1006-31-1
Pentachlorotoluene	877-11-2
1,3-Dichlorobenzene	541-73-1
1,4-Dichlorobenzene	106-46-7
1,2,3-Trichlorobenzene	87-61-6
1,2,4-Trichlorobenzene	120-82-1
1,3,5-Trichlorobenzene	108-70-3
1,2,3,4-Tetrachlorobenzene	634-66-2
1,2,3,5-Tetrachlorobenzene	634-90-2
1,2,4,5-Tetrachlorobenzene	95-94-3
Pentachlorobenzene	608-93-5
p-Chlorobenzotrichloride	5216-25-1
Benzotrichloride	98-07-7

Chlorinated Benzene or Toluene Chemical	CAS Number
Benzyl Chloride	100-44-7
1,2-Dichlorobenzene	95-50-1

Table 8.20(d) List of Restricted Dyes

Dye Chemical	CAS Number
C.I. Acid Red 26	3761-53-3
C.I. Acid Red 114	6459-94-5
C.I. Basic Blue 26	2580-56-5
C.I. Basic Green 4	569-4-2, 10309-95-2, and 2437-29-8
C.I. Basic Red 9	569-61-9
C.I. Basic Violet 3	548-62-9
C.I. Basic Violet 14	632-99-5
C.I. Basic Yellow	222465-27-2, 492-80-9
C.I. Direct Black 38	1937-37-7
C.I. Direct Blue 6	2602-46-2
C.I. Direct Blue 15	2429-74-5
C.I. Direct Brown 95	16071-86-6
C.I. Direct Red 28	573-58-0
C.I. Disperse Blue 1	2475-45-8
C.I. Disperse Blue 3	2475-46-9
C.I. Disperse Blue 7	3179-90-6
C.I. Disperse Blue 26	3860-63-7
C.I. Disperse Blue 35	12222-75-2
C.I. Disperse Blue 102	12222-97-8
C.I. Disperse Blue 106	12223-01-7
C.I. Disperse Blue 124	61951-51-7
C.I. Disperse Brown 1	23355-64-8
C.I. Disperse Orange 1	2581-69-3
C.I. Disperse Orange 3	730-40-5

Dye Chemical	CAS Number
C.I. Disperse Orange 11	82-28-0
C.I. Disperse Orange 37/76/59	12223-33-5, 13301-61-6, and 51811-42-8
C.I. Disperse Orange 149	85136-74-9
C.I. Disperse Red 1	2872-52-8
C.I. Disperse Red 11	2872-48-2
C.I. Disperse Red 17	3179-89-3
C.I. Disperse Red 60	12223-37-9, 17418-58-5
C.I. Disperse Yellow 1	119-15-3
C.I. Disperse Yellow 3	2832-40-8
C.I. Disperse Yellow 7	6300-37-4
C.I. Disperse Yellow 9	6373-73-5
C.I. Disperse Yellow 23	6250-23-3
C.I. Disperse Yellow 39	12236-29-2
C.I. Disperse Yellow 49	54824-37-2
C.I. Pigment Red 104 (Lead chromate molybdate sulphate red)	12656-85-8
C.I. Pigment Yellow 34 (Lead sulfochromate yellow)	1344-37-2
C.I. Solvent Blue 4	6786-83-0
C.I. Solvent Yellow 1 (4-Aminoazobenzene)	60-09-2
C.I. Solvent Yellow 3 (2-Aminoazobenzene)	97-56-3
4,4'-bis(dimethylamino)-4"-(methylamino)trityl alcohol	561-41-1

Table 8.20(e) List of Restricted Flame Retardant Substances

Flame Retardant Chemical	CAS Number
Decabromodiphenyl ethane (DBDPE)	84852-53-9
Pentabromodiphenyl ether (PentaBDE)	32534-81-9
Octabromodiphenyl ether (OctaBDE)	32536-52-0
Decabromodiphenyl ether (DecaBDE)	1163-19-5
All other Polybrominated diphenyl ethers (PBDEs)	
Tetrabromobisphenol A (TBBP A)	79-94-7
Polybromobiphenyls (PBB)	59536-65-1
Hexabromocyclododecane (HBCDD)	3194-55-6

Flame Retardant Chemical	CAS Number
2,2-bis(bromomethyl)-1,3-propanediol (BBMP)	3296-90-0
Tris(1,3-dichloro-isopropyl) phosphate (TDCPP)	13674-87-8
Trixylyl phosphate (TXP)	25155-23-1
Tris(2,3,-dibromopropyl) phosphate (TRIS)	126-72-7
Tris(1-aziridinyl)phosphine oxide) (TEPA)	545-55-1
Tris(2-chloroethyl)phosphate (TCEP)	115-96-8
Bis(2,3-dibromopropyl) phosphate (BDBPP)	5412-25-9

Table 8.20(f) List of Restricted Nitrosamines

Nitrosamine Chemical	CAS Number
N-nitrosodimethylamine (NDMA)	62-75-9
N-nitrosodiethylamine (NDEA)	55-18-5
N-nitrosodipropylamine (NDPA)	621-64-7
N-nitrosodibutylamine (NDBA)	924-16-3
N-nitrosopiperidine (NPIP)	100-75-4
N-nitrosopyrrolidine (NPYR)	930-55-2
N-nitrosomorpholine (NMOR)	59-89-2
N-nitroso N-methyl N-phenylamine (NMPhA)	614-00-6
N-nitroso N-ethyl N-phenylamine (NEPhA)	612-64-6

Table 8.20(g) List of Restricted Organotin Substances

Organotin Chemical	CAS Number
Dibutyltin (DBT)	Various
Dimethyltin (DMT)	Various
Dicotyltin (DOT)	Various
Diphenyltin (DPhT)	Various
Dipropyltin (DPT)	Various
Monobutyltin (MBT)	Various
Monooctyltin (MOT)	Various
Monomethyltin (MMT)	Various
Monophenyltin (MPhT)	Various
Tetrabutyltin (TeBT)	Various
Tetraethyltin (TeET)	Various

Organotin Chemical	CAS Number
Tetraoctyltin (TeOT)	Various
Tricylohexyltin (TCyHT)	Various
Trimethyltin (TMT)	Various
Trioctyltin (TOT)	Various
Triproyltin (TPT)	Various

Table 8.20(h) List of Restricted Phthalate Substances

Phthalate Chemical	CAS Number
Butylbenzylphthalate (BBP)	85-68-7
Dibutylphthalate (DBP)	84-74-2
Diethylphthalate (DEP)	84-66-2
Dimethylphthalate (DMP)	131-11-3
Di-(2-ethylhexyl)-phthalate (DEHP)	117-81-7
Di-(2-methoxyethyle)-phthalate (DMEP)	117-82-8
Di-C6-8 branched alkylphthalates (DIHP)	71888-89-6
Di-C7-11 branched and linear alkylphthalates (DHNUP)	68515-42-4
Di-cyclohexyl phthalate (DCHP)	84-61-7
Di-hexylphthalates, branched and linear (DHxP)	68515-50-4
Di-iso-butylphthalate (DIBP)	84-69-5
Di-iso-hexyl phthalate (DIHxP)	71850-09-4
Di-iso-octyl phthalate (DIOP)	27554-26-3
Di-iso-nonylphthalate (DINP)	28553-12-0
Di-iso-decylphthalate (DIDP)	26761-40-0
Di-n-propyl phthalate (DPrP)	131-16-8
Di-n-hexylphthalate (DHP)	84-75-3
Di-n-octylphthalate (DNOP)	117-84-0
Di-n-nonylphthalate (DNP)	84-76-4
Di-n-pentyl phthalate (DPP)	131-18-0, 605-50-5, 776297-69-9, and 84777-06-0
1,2-Benzenedicarboxylic acid, di-C6-10-alkyl esters	68515-51-5
1,2-Benzenedicarboxylic acid, mixed decyl and hexyl and octyl diesters	68648-93-1

Table 8.20(i) List of Restricted Polycyclic Aromatic Hydrocarbon (PAH) Substances

PAH Chemical	CAS Number
Acenaphtene	83-32-9
Acenaphthylene	208-96-8
Anthracene	120-12-7
Benzo[a]anthracene	56-55-3
Benzo[a]pyrene	50-32-8
Benzo[b]fluoranthene	205-99-2
Benzo[e]pyrene	192-97-2
Benzo[g,h,i]perylene	191-24-2
Benzo[j]fluoranthene	205-82-3
Benzo(k)fluoranthene	207-08-9
Chrysene	218-01-9
Cyclopenta[c,d]pyrene	27208-37-3
Dibenzo[a,h]anthracene	53-70-3
Dibenzo[a,e]pyrene	192-65-4
Dibenzo[a,h]pyrene	189-64-0
Dibenzo[a,i]pyrene	184-55-9
Dibenzo[a,l]pyrene	191-30-0
Fluoranthene	206-44-0
Fluorene	86-73-7
Indeno(1,2,3-cd)pyrene	193-39-5
1-Methylpyrene	2381-21-7
Naphthalene	91-20-3
Phenanthrene	85-01-8
Pyrene	129-00-0

Additional Proposed Changes

File Name	Description	Approved
ORAFOL_Americas_NFPA_1970_Comment_12292022.docx	Comments on section 8.20	

Statement of Problem and Substantiation for Public Comment

Confirmation of methods, requirements and due diligence for the addition of this work

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 127-NFPA 1970-2023 [Section No. 9.83]	

Related Item

- FR-223

Submitter Information Verification

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Comments on Restricted Substances, Section 8.20 & 9.83

General Comments

Restricted substances is a critical issue that is addressing a level protection for the firefighter(s).

The current proposed testing is a very wide brush stroke that captures many substances.

Has due diligence been conducted on this process, the testing and reporting? There has been very little time to work through these new requirements.

The process and testing is loosely based on OKEO-TEX. Many of the test methods are proprietary. Have we confirmed that the appropriate methods have been chosen for the materials? On the OKEO-TEX website, they state “In many cases the limit values for the STANDARD 100 go beyond national and international requirements.” Are the limit values set appropriately?

How will UL or the certifier of the garment or component verify? Will they conduct the testing and/or accept other 3rd party testing? Multiple 3rd party reports may be required to capture all of the testing.

Would it be possible to make this process optional for this revision? This would allow time for manufacturers and test facilities to ensure that the process can be conducted appropriately.

An alternative could be to reduce the current quantity of restricted substance to a manageable number of the most critical substances.

Comments specific to 8.20

1. The monomer requirements are listed as kg/m^3 (emission measurement) believe it should be mg/kg
2. PAH’s requirements seem too high. See the attached AFPS GS 2019 summary found on the SGS website. German AfPS Publishes Latest Version of PAH Specifications Under GS-Mark | SGS

Comments specific to 9.83

A test lab reviewed the list and provided the following:

1. Alkyl phenols and ethoxylates method described cannot be used here
2. Organotin Compounds reference ISO/TS 16179 (footwear) as the test method is ISO 22744 (textiles) more appropriate?
3. PAH’s method is AFPS GS 2019. Should this be EN 17132
4. UV Stabilizers referenced method is EN62321-6, which is for electro-technical products. Is this a correct reference?

SGS Website Summary

Germany's Product Safety Committee has published the April 2020 version of AfPS GS 2019:01 PAK under the voluntary GS-Mark. This latest edition clarifies the scope of Category 1 materials.
In May 2019, the German Product Safety Committee (Ausschuss für Produktsicherheit, AfPS) issued AfPS GS 2019:01 PAK on a new set of specifications for polycyclic aromatic hydrocarbons (PAHs) under the voluntary Geprüfte Sicherheit Mark (GS-Mark, 'Tested Safety' Mark). This document on the testing, evaluation and specifications on PAHs replaces AfPS GS 2014:01 PAK and will become mandatory for issuing the GS-Mark from July 1, 2020. The GS mark can only be awarded to ready-to-use products (e.g. machines, hand tools, toys, electrical appliances, lights, household appliances or furniture) as outlined in Chapter 5 of the German Product Safety law (ProdSG).

On April 10, 2020, the AfPS issued the latest version of AfPS GS 2019:01 PAK. This latest edition, in German and English, clarifies the scope of materials falling under Category 1, which applies to:

- Materials intended to be placed in the mouth, or
- Materials coming into long-term contact with the skin (more than 30 seconds) during intended use:
- In toys falling under the scope of Directive 2009/48/EC (Toy Safety Directive, TSD), or
- For use by children up to three years of age

The other provisions in AfPS GS 2019:01 PAK of April 2020 are essentially similar to those in the May 2019 AfPS GS 2019:01 PAK document.

In Germany, PAHs are still a critical group of substances in consumer products. These have an impact on the meaningful test scope of consumer goods where GS-Mark certification is not desirable. According to §30 of the German Food and Feed Code ((Lebensmittel-, Bedarfsgegenstände- und Futtermittelgesetzbuch, LFGB) on general product safety and recommendations from the German Federal Institute for Risk Assessment (*Bundesinstitut für Risikobewertung, BfR*) to reduce the amount of PAHs in consumer products as much as possible, it is advisable to continue testing according to the list of PAHs in AfPS GS 2014:01 PAK after its sunset date of June 30, 2020

Highlights of the PAH requirements in AFPS GS 2019:01 PAK of April 10, 2020 for GS-Mark certification are summarized in Table 1.

German Product Safety Commission (AfPS)
Testing and Assessment of Polycyclic Aromatic Hydrocarbons (PAHs) in the Award of GS Marks – Specification Pursuant to Article 21(1) No. 3 of the Product Safety Act (ProdSG)
AfPS GS 2019:01 PAK, April 10, 2020

	Category 1	**Category 2**		**Category 3**	
	Materials intended to be placed in the mouth, or materials coming into long-term contact with skin (> 30 seconds) during intended use:	**Materials not covered by Category 1, coming into long-term contact (> 30 seconds) or short-term repetitive contact*** with skin during intended or foreseeable use**		**Materials not covered by Category 1 or 2, coming into short-term contact (≤ 30 seconds) with skin during intended or foreseeable use**	
	In toys (Directive 2009/48/EC) or For use by children*, ** up to 3 years of age	**2a Used by children under 14 (mg/g)**	**2b Other consumer products (mg/kg)**	**3a Used by children under 14 (mg/kg)**	**3b Other consumer products (mg/kg)**
	(mg/kg)				
Benzo[a]pyrene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Benzo[e]pyrene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Benzo[a]anthracene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Benzo[b]fluoranthene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Benzo[j]fluoranthene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Benzo[k]fluoranthene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Chrysene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Dibenzo[a,h]anthracene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Benzo[g,h,i]perylene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Indeno[1,2,3-cd]pyrene	< 0.2	< 0.2	< 0.5	< 0.5	< 1
Anthracene, fluoranthene, phenanthrene, pyrene	< 1 (sum)	< 5 (sum)	< 10 (sum)	< 20 (sum)	< 50 (sum)
Naphthalene	< 1	< 2		< 10	
Sum of 15 PAHs	< 1	< 5	< 10	< 20	< 50

*'Child' is legally defined as a person under 14 years of age
**Use by children includes both active and passive direct contact by children
***Definition of 'short-term repetitive contact' has the same meaning as amended entry 50 to Annex XVII of REACH (Regulation (EC) 1272/2013)
**** According to Article 2(28) to Chapter 1 of the Product Safety Act (ProdSG), 'foreseeable use' means the use of a product in a manner that is not intended by the person who places it on the market, but is reasonably foreseeable

Effective date: July 1, 2020 for issuing of GS-Mark

Public Comment No. 156-NFPA 1970-2023 [Section No. 9.1.2]

Change numbering of this section to 9.1. 12 and swap with current 9.1. 2

9.1.2 Front-Loading Washing and Drying Procedure.

9.1.2.1

A front-loading washer/extractor shall be used. The capacity shall be between 16 kg (35 lb) and 24.9 kg (55 lb).

9.1.2.2

The wash load shall be 55 to 65 percent of an adjusted washer capacity where the volume-to-weight ratio equals 5.7 lb/ft^3. The capacity can be calculated as follows:

$$5.7\left(\frac{lb}{ft^3}\right) X\ Washer\ Volume\ \left(ft^3\right) = Washer\ Capacity\ \left(lb\right) \quad \textbf{[9.1.2.2]}$$

9.1.2.2.1

If ballast is needed to reach capacity, similar material or outer shell material consisting of 212 g/m^2 (7.5 oz/yd^2) woven 93 percent meta-aramid, 5 percent para-aramid, and 2 percent antistatic fiber shall be used.

9.1.2.3

The wash cycle procedure and water levels specified in Table 9.1.2.3(a) and Table 9.1.2.3(b) shall be followed. In addition, the *g* force shall not exceed 125 *g* throughout the wash cycle.

Table 9.1.2.3(a) Front-Loading Wash Cycle

Operation	Time (min)	Temperature ±3°C	Temperature ±5°F	Water Level
Suds using AATCC detergent #1993 without optical brighteners, 1.0 g/gal ±1% water	10	60	140	Low*
Drain	1	—	—	—
Carryover	5	60	140	Low*
Drain	1	—	—	—
Rinse	2	Unheated	Unheated	High*
Drain	1	—	—	—
Rinse	2	Unheated	Unheated	High*
Drain	1	—	—	—
Rinse	2	Unheated	Unheated	High*
Drain	1	—	—	—
Extract	5	—	—	—

*See Table 9.1.2.3(b) for high and low water levels.

Table 9.1.2.3(b) Water Level for Front-Loading Wash Cycle Procedure

Low Water Level ±1 cm (3⁄18 in.)		High Water Level ±1 cm (3⁄18 in.)	
cm	in.	cm	in.
12.7	5.0	25.4	10.0

9.1.2.4

Samples shall be dried using a tumble dryer with a stack temperature of 38°C to 49°C (100°F to 120°F) when measured on an empty load 20 minutes into the drying cycle.

9.1.2.5

Samples shall be tumbled until dry and shall be removed immediately at the end of the drying cycle. At the conclusion of the final drying cycle, the samples shall be allowed to air dry for at least 48 hours prior to conducting the test and the use of a forced-air dryer operated at ambient temperature, −0°+ 5°C (−0°+ 10°F) shall be permitted.

9.1.2.5.1

At the conclusion of the final drying cycle, glove or glove pouch samples shall be dried on a forced-air, non-tumble-drying mechanism operated at 10ºC ± 5°C (18°F ± 9°F) above current room temperature until dry but not less than 8 hours.

9.1.2.6

Garments, garment materials, wristlets, hoods, gloves, and glove pouches shall be washed and dried for a total of ~~thirty cycles~~ five cycles unless otherwise specified.

9.1.2.7

Where washing complete garments all closures shall be fastened in its “as-worn” orientation. Garments with separable liners shall not have the liners separated.

Statement of Problem and Substantiation for Public Comment

The laundering conditioning changes made in first revision did not produce the results expected. The five laundering conditioning in the top loader showed similar impact on the specimens. Therefore to reduce the amount of time for conditioning, the impact of the extra cycles in consumables (detergent, water, etc) the laundering conditioning will be the updated AATCC method using a top loading machine. The front loader will still be used for specific tests requiring that type of conditioning.

Related Item

• FR120

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Public Comment No. 157-NFPA 1970-2023 [Section No. 9.1.12]

Renumber to 9.1. 2. Swap locations with the front loading procedure.

9.1. 12 Top-Loading Washing and Drying Procedure.

9.1.12.1

Unless otherwise specified, specimens shall be subjected to ~~thirty cycles~~ five cycles of washing and drying in accordance with the procedure specified in Machine Cycle 1, Wash Temperature V, and Drying Procedure Ai of AATCC TM135, *Test Method for Dimensional Changes of Fabrics after Home Laundering*. A 1.82 kg ± 0.1 kg (4.0 lb ± 0.2 lb) load shall be used. A laundry bag shall not be used.

9.1.12.2

Gloves shall be tumble dried for 60 minutes and shall be removed immediately at the end of the drying cycle. At the conclusion of the final drying cycle, the gloves shall be direct dried on a forced-air non-tumble-drying mechanism operated at 10ºC ± 5°C (18°F ± 9°F) above current room temperature until dry but for not less than 8 hours.

Statement of Problem and Substantiation for Public Comment

The laundering conditioning changes made in first revision did not produce the results expected. The five laundering conditioning in the top loader showed similar impact on the specimens. Therefore to reduce the amount of time for conditioning, the impact of the extra cycles in consumables (detergent, water, etc) the laundering conditioning will be the updated AATCC method using a top loading machine. The front loader will still be used for specific tests requiring that type of conditioning.

Related Item

• FR119

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Committee: FAE-SPF

Public Comment No. 158-NFPA 1970-2023 [Section No. 9.1.22]

9.1.22 Multienvironmental Conditioning Procedure.

9.1.22.1

Samples of suitable size shall be prepared in the configuration as specified by the respective test method.

9.1.22.2

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

(1) Composite samples shall be laundered a total 10 laundering cycles as specified in 9.1.2 or 9.1.12 as required by the specific test method.

(2) Composite samples shall be subjected to convective heat conditioning procedures as specified in 9.1.5.

(3) Composite samples shall be laundered a total 10 laundering cycles as specified in 9.1.2 or 9.1.12 as required by the specific test method.

(4) Composite samples shall be subjected to convective heat conditioning procedures as specified in 9.1.5.

(5) Composite samples shall be laundered a total 10 laundering cycles as specified in 9.1.2 or 9.1.12 as specified in the specific test method.

(6) Composite samples shall be subjected to convective heat conditioning procedures as specified in 9.1.5.

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

~~Composite samples shall be subject to repeated flexing as specified in~~

(8)

9.1.

~~19.~~

- ~~The specific layer of the composite to be tested shall be subject to repeated abrasion as specified in 9.1.21 .~~

~~9.1.~~ 22.3

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

Statement of Problem and Substantiation for Public Comment

This conditioning test method cannot be physically performed the way it is currently written and provide sufficient size specimens for testing. The task group continues to work on alternate methodology to produce the intended effect but at time of public comment closing a method has not been identified.

Related Item

• FR122

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Committee: FAE-SPF

Public Comment No. 194-NFPA 1970-2023 [Section No. 9.4]

~~**9.4** – Flame Resistance Test 3.~~

~~**9.4.1** – Application.~~

~~**9.4.1.1** –~~

~~This test method shall apply to the protective glove body, glove interface components, and glove extension composites.~~

~~**9.4.1.2** –~~

~~Modifications to this test method for evaluation of glove body composites shall be as specified in 9.4.8 .~~

~~**9.4.1.3** –~~

~~Modifications to this test method for evaluation of glove interface components other than wristlet composites shall be as specified in 9.4.9 .~~

~~**9.4.1.4** –~~

~~Modifications to this test method for evaluation of wristlet glove interface components shall be as specified in 9.4.10 .~~

~~**9.4.1.5** –~~

~~Modifications to this test method for evaluation of glove extension composites shall be as specified in 9.4.11 .~~

~~**9.4.2** – Specimens.~~

~~Three specimens shall be tested for each material. Three specimens shall be tested after the conditioning specified in 9.1.3 . Three additional specimens shall be tested after the conditioning specified in 9.1.2 followed by the conditioning specified in 9.1.3 .~~

~~**9.4.3** – Samples.~~

~~**9.4.3.1** –~~

~~Samples shall be prepared for each glove body, glove interface component, and glove extension composite.~~

~~**9.4.3.2** –~~

~~Samples shall be conditioned as specified in 9.1.2 and 9.1.3 .~~

~~**9.4.4** – Apparatus.~~

~~**9.4.4.1** –~~

~~The test apparatus specified in Method 5905.1, *Flame Resistance of Material; High Heat Flux Flame Contact* , of Federal Test Method Standard 191A, *Textile Test Methods* , shall be used.~~

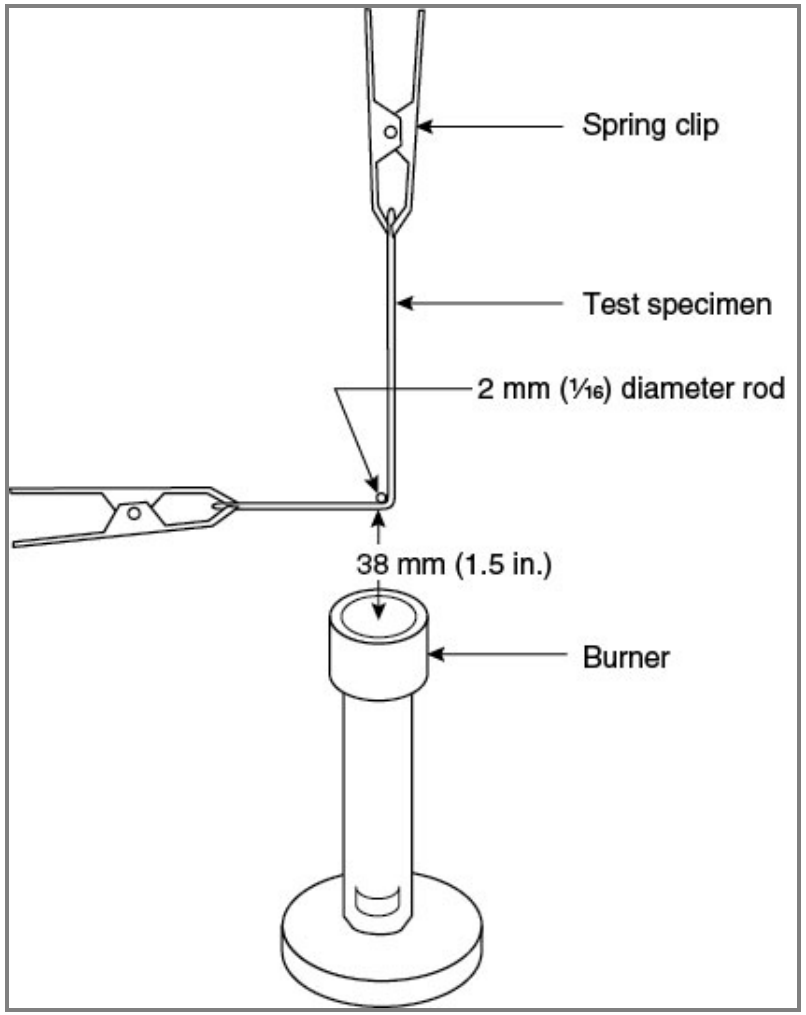
9.4.4.2 –

A freestanding flame height indicator shall be used to assist in adjusting the burner flame height. The indicator shall mark a flame height of 75 mm (3 in.) above the top of the burner.

9.4.4.3 –

A specimen support assembly shall be used that consists of a frame and steel rod of 2 mm (**1** ⁄ **16** in.) in diameter to support the specimen in an L-shaped position as shown in Figure 9.4.4.3 .

Figure 9.4.4.3 Relationship of Test Material to Burner.



9.4.4.4 –

The horizontal portion of the specimen shall be not less than 50 mm (2 in.), and the vertical portion shall be not less than 100 mm (4 in.). The specimen shall be held at each end by spring clips under light tension as shown in Figure 9.4.4.3 .

9.4.5 – Procedure.

9.4.5.1 –

A balance shall be used to determine the weight of each specimen to the nearest 0.1 g (0.04 oz) before and after testing.

9.4.5.2 –

The burner shall be ignited and the test flame shall be adjusted to a height of 75 mm (3 in.) with the gas on/off valve fully open and the air supply completely and permanently off, as it is important that the flame height be closely controlled. The 75 mm (3 in.) height shall be obtained by adjusting the orifice in the bottom of the burner so that the top of the flame is level with the marked flame height indicator.

9.4.5.3 –

With the specimen mounted in the support assembly, the burner shall be moved so that the middle of the folded corner projects into the flame 38 mm (1 **1**⁄**2** in.) as shown in Figure 9.4.4.3 .

9.4.5.4 –

The burner flame shall be applied to the specimen for 12 seconds. After 12 seconds, the burner shall be removed.

9.4.5.5 –

The afterflame time shall be measured as the time, in seconds, to the nearest 0.2 second that the specimen continues to flame after the burner is removed from the flame.

9.4.5.6 –

Each layer of the specimen shall be examined for melting or dripping.

9.4.5.7 –

Each tested sample shall be reconditioned as specified in 9.1.3 and then weighed to the nearest 0.1 g (0.04 oz).

9.4.5.8 –

The specimen then shall be further examined for char length. The char length shall be determined by measuring the length of the tear through the center of the charred area as specified in 9.4.5.8.1 through 9.4.5.8.4 .

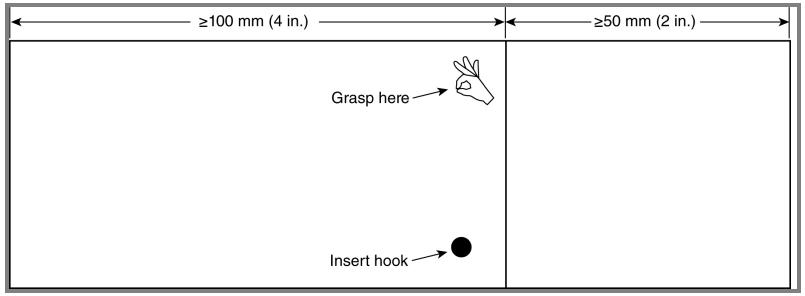
9.4.5.8.1 –

The specimen shall be folded lengthwise and creased, by hand, along a line through the highest peak of the charred area.

9.4.5.8.2 –

The hook shall be inserted into a hole punched in the specimen that is 6 mm (1/4 in.) in diameter or less. The hole shall be punched out for the hook at one side of the charred area that is 6 mm (1/4 in.) from the adjacent outside edge, at the point where the specimen contacted the steel rod, and 6 mm (1/4 in.) away from the point where the specimen contacted the steel rod in the 101 mm (4 in.) direction as shown in Figure 9.4.5.8.2 .

Figure 9.4.5.8.2 Position of Hole and Side to Grasp for Determining Char Length.



9.4.5.8.3 –

A weight of sufficient size so that the weight and hook together equal the total tearing weight required by Table 9.4.5.8.3 shall be attached to the hook. The total tearing weight for determining charred length shall be based on the weight of the composite specimen and shall be determined from Table 9.4.5.8.3 .

Table 9.4.5.8.3 Determination of Tearing Weight

Specified Weight per Square Yard of Material Before Any Fire-Retardant Treatment or Coating		Total Tearing Weight for Determining Charred Length	
g/m^2	oz/yd^2	kg	lb
68–203	2.0–6.0	0.1	1/4
>203–508	>6.0–15.0	0.2	1/2
>508–780	>15.0–23.0	0.3	3/4
>780	>23.0	0.45	1

9.4.5.8.4 –

A tearing force shall be applied gently to the specimen by grasping the side of the material at the edge of the char opposite the load as shown in Figure 9.4.5.8.2 and raising the specimen and weight clear of the supporting surface. The end of the tear shall be marked off on the edge, and the char length measurement made along the undamaged edge.

9.4.6 – Report.

9.4.6.1 –

The afterflame time and char length shall be recorded and reported for each specimen. The average afterflame time and char length shall also be calculated, recorded, and reported. The afterflame time shall be recorded and reported to the nearest 0.2 second and the char length to the nearest 2.5 mm (0.10 in.).

9.4.6.2 –

The percent consumed shall be calculated using the following formula:

$$\text{Percent consumed} = \frac{W - R}{W} \times 100 \qquad \text{[9.4.6.2]}$$

where:

W = original conditioned weight

R = conditioned weight 24 hours after testing

9.4.6.2.1 –

The percent consumed shall be recorded and reported for each specimen to the nearest 0.1 percent. The average percent consumed shall be calculated, recorded, and reported to the nearest 0.1 percent.

9.4.6.3 –

Observations of melting or dripping for each specimen shall be recorded and reported.

9.4.7 – Interpretation.

Pass or fail performance shall be based on melting or dripping, the average afterflame time, and the average char length.

9.4.8 – Specific Requirements for Testing Glove Body Composites.

9.4.8.1 –

Samples for conditioning shall be glove body composite pouches as specified in 9.4.8.3 .

9.4.8.2 –

Specimens shall be representative of each glove body composite construction.

9.4.8.3 –

For glove body composites, samples for conditioning shall be in the form of a pouch as described in 9.1.14 .

9.4.8.4 –

After conditioning, the pouch and necessary stitching shall be cut to form 50 mm × 150 mm (2 in. × 6 in.) specimens for testing.

9.4.9 – Specific Requirements for Testing Protective Glove Interface Components Other than Wristlet Composites.

9.4.9.1 –

Samples for conditioning shall be glove interface component composite swatches as specified in 9.4.9.3 .

9.4.9.2 –

Specimens shall be representative of the glove interface component composite construction.

9.4.9.3 –

For glove interface component composites, samples for conditioning shall be in the form of a pouch as described in 9.1.14 .

~~**9.4.9.4** –~~

~~After conditioning, the necessary stitching shall be cut to form 50 mm × 150 mm (2 in. × 6 in.) specimens for testing.~~

~~**9.4.10** – Specific Requirements for Testing Protective Wristlet Glove Interface Components.~~

~~**9.4.10.1** –~~

~~Samples for conditioning shall be wristlet glove interface component composite swatches as specified in 9.4.10.3 .~~

~~**9.4.10.2** –~~

~~Specimens shall be representative of the wristlet glove interface component composite construction.~~

~~**9.4.10.3** –~~

~~For wristlet glove interface component composites, samples for conditioning shall include wristlet material. Three specimens shall be tested after the conditioning specified in 9.1.3 . Three additional specimens shall be tested after the conditioning specified in 9.1.12 followed by the conditioning specified in 9.1.3 .~~

~~**9.4.10.4** –~~

~~After conditioning, the material shall be cut to form 50 mm × 150 mm (2 in. × 6 in.) specimens for testing. Specimens shall not include seams where multiple layers are involved.~~

~~**9.4.11** – Specific Requirements for Testing Protective Glove Extension Composites.~~

~~**9.4.11.1** –~~

~~Samples for conditioning shall be glove extension composite swatches as specified in 9.4.11.3 .~~

~~**9.4.11.2** –~~

~~Specimens shall be representative of the glove extension composite construction.~~

~~**9.4.11.3** –~~

~~For glove extension composites, samples for conditioning shall be in the form of a pouch as described in 9.1.14 .~~

~~**9.4.11.4** –~~

~~After conditioning, the necessary stitching shall be cut to form 50 mm × 150 mm (2 in. × 6 in.) specimens for testing.~~

Statement of Problem and Substantiation for Public Comment

An overall glove test for evaluating flammability is preferred over an individual composite evaluation test given the complexity of certain designs and would further be consistent in the manner for which footwear is currently evaluated in the standard.

Related Item

• FR89

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Public Comment No. 115-NFPA 1970-2022 [Section No. 9.5]

9.5 Flame Resistance Test 4.

9.5.1 Application.

9.5.1.1

This test method shall apply to protective ~~helmets,~~ protective gloves, and footwear.

9.5.1.2

Modifications to this test method for evaluating protective ~~helmets shall be as specified in 9.5.8 .~~

~~**9.5.1.3** –~~

~~Modifications to this test method for evaluating protective~~ gloves shall be as specified in 9.5.9.

9.5.1.~~4~~ 3

Modifications to this test method for evaluating protective footwear shall be as specified in 9.5.10.

9.5.2 Samples.

9.5.2.1

Samples shall be complete ~~helmets,~~ gloves, and footwear.

9.5.2.2

~~Helmet and footwear~~ Footwear samples shall be conditioned as specified in 9.1.3.

9.5.2.3

Glove samples shall be conditioned as specified in 9.1.2.

9.5.3 Specimens.

Three complete ~~helmet,~~ glove, and footwear items shall be tested.

9.5.4 Apparatus.

9.5.4.1

The test apparatus shall consist of a fuel pan, movable shutter(s), specimen holder, n-heptane, ignition source, and timing device.

9.5.4.1.1

The fuel pan shall be 305 mm × 457 mm × 63.5 mm (12 in. × 18 in. × 2.5 in.).

9.5.4.1.2

The movable shutter(s) shall be located at a height of 255 mm ± 13 mm (10 in. ± ½ in.) above the surface of the water and n-heptane fluid as measured before ignition. The shutter(s) shall be of a size to cover the surface area of the fuel pan and shall be capable of being fully retracted or fully extended within 1 second.

9.5.4.1.3

The specimen holder shall be capable of suspending the specimen over the flame in a manner such that the holder does not impede the flames.

9.5.4.1.4

The stopwatch or other device shall measure the burning time to the nearest 0.1 second.

9.5.5 Procedure.

9.5.5.1

The test shall be conducted in a draft-free area.

9.5.5.2

The fuel pan shall be level.

9.5.5.3

Water shall be placed in the fuel pan to a height of 13 mm (½ in.).

9.5.5.4

400 to 500 mL of n-heptane shall be added to the fuel pan such that it will burn freely for 1.5 to 2.0 minutes.

9.5.5.5

The specimen shall be mounted in a specimen holder.

9.5.5.6

With the shutter retracted, the n-heptane shall be ignited using an ignition source.

9.5.5.6.1

Where paper or other material is used to ignite the n-heptane, it shall not be left in the fuel pan, where it can disturb the flame pattern.

9.5.5.7

The n-heptane shall burn freely for 1 minute, ±5 seconds.

9.5.5.8

The shutter(s) shall be positioned above the flame.

9.5.5.9

The specimen shall be positioned above the shutter(s) over the approximate center of the flame area.

9.5.5.10

The shutter(s) shall be retracted and specimen flame exposure shall commence not longer than 1 minute, 15 seconds from ignition.

9.5.5.11

The specimen shall be exposed to the flame for 12 seconds ± 0.2 second.

9.5.5.12

Following flame exposure, the shutter(s) shall be repositioned above the flame.

9.5.5.13

The afterflame time shall be measured as the time, in seconds, to the nearest 0.1 second that the specimen continues to flame after the shutter is repositioned over the flame.

9.5.5.14

Following the flame exposure, the specimen shall be visually examined for melting, dripping, and burn-through.

9.5.6 Report.

9.5.6.1

The afterflame time shall be recorded and reported for each specimen. The average afterflame time shall be calculated and reported. The afterflame time shall be recorded and reported to the nearest 0.2 second.

9.5.6.2

Observations of melting, dripping, or burn-through for each specimen shall be recorded and reported.

9.5.7 Interpretation.

Pass or fail performance shall be based on the average afterflame time and any observed melting, dripping, or burn-through.

9.5.8 Specific Requirements for Testing Protective ~~Helmets~~ Gloves .

9.5.8.1

~~Helmet samples shall include all individual components necessary for the certification of the helmet.~~

~~**9.5.8.2** –~~

~~Where different eye and face protection are used, each helmet and eye/face protection component interface shall be separately evaluated.~~

~~**9.5.8.3** –~~

~~The specimen holder for the helmet shall be an inverted flame resistant, nonconductive ISO Size J headform on which the helmet is placed at the manufacturer-specified HPI and with the lowest point of the helmet at 305 mm ± 25 mm (12 in. ± 1 in.) from the surface of the water and n-heptane fluid as measured before ignition.~~

~~**9.5.8.4** –~~

~~A Type K thermocouple shall be placed on the top of the headform at the intersection of the coronal and mid-sagittal plane (in its normal upright configuration) prior to the helmet being mounted on the headform for testing, connected to a data logger with an temperature acquisition rate of at least one measurement each 0.5 s, and used to measure the maximum temperature rise that occurs during and following the exposure to the burning pan.~~

~~**9.5.9** – Specific Requirements for Testing Protective Gloves.~~

~~**9.5.9.1** –~~

Glove samples shall include complete gloves.

9.5.9 8 .2

Where gloves have had different interface area components, each glove configuration shall be separately tested.

9.5.9 8 .3

The specimen holder for the glove shall be an inverted flame resistant, nonconductive handform that holds the glove in a vertical position, fingers down, at 305 mm ± 25 mm (12 in. ± 1 in.) from the tip of the lowest finger to the surface of the water and n-heptane fluid as measured before ignition.

9.5.~~10~~ 9 Specific Requirements for Testing Protective Footwear.

9.5.~~10~~ 9 .1

Footwear samples shall include complete footwear with all elements closed or secured.

9.5.~~10~~ 9 .2

The specific holder for footwear shall provide the following mounting and positioning of the specimen:

(1) The toe shall be at an angle of 7.5 degrees ± 2.5 degrees, above the heel.

(2) The height of the lowest edge of the specimen shall be 305 mm ± 25 mm (12 in. ± 1 in.) from the surface of the water and n-heptane fluid as measured before ignition.

(3) The heel-toe axis of the specimen shall be parallel with the 457 mm (18 in.) side of the fuel pan.

Statement of Problem and Substantiation for Public Comment

Based on discussions in the helmet task group, this method did not provide the differentiation needed to support moving forward utilizing this method. The methods currently used are being restored in the document.

Related Item

• FR71

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Public Comment No. 212-NFPA 1970-2023 [Section No. 9.5.1]

9.5.1 Application.

9.5.1.1

This test method shall apply to ~~protective helmets, protective gloves, and footwear~~ protective footwear .

9.5.1.2

Modifications to this test method for evaluating protective ~~helmets shall be as specified in 9.5.8 .~~

~~**9.5.1.3** –~~

~~Modifications to this test method for evaluating protective gloves shall be as specified in 9.5.9 .~~

~~**9.5.1.4** –~~

~~Modifications to this test method for evaluating protective~~ footwear shall be as specified in 9.5.10.

Statement of Problem and Substantiation for Public Comment

Specific adaptations for this test method have not been validated for other protective elements.

Related Item

• FR71

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Committee: FAE-SPF

Public Comment No. 190-NFPA 1970-2023 [Section No. 9.5.6]

9.5.6 Report.

9.5.6.1

The afterflame time shall be recorded and reported for each specimen. The average afterflame time shall be calculated and reported. The afterflame time shall be recorded and reported to the nearest 0.2 second.

9.5.6.2

Observations of melting, dripping, or burn-through for each specimen shall be recorded and reported.

9.5.6.3

For helmets, the maximum temperature measured shall be recorded and reported.

Statement of Problem and Substantiation for Public Comment

There is a requirement to take this measurement, but nothing requires it to be reported. This comment is adding that requirement.

Related Item

- FR71

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Public Comment No. 214-NFPA 1970-2023 [Sections 9.5.8, 9.5.9]

~~**Sections 9.5.8, 9.5.9**~~

~~**9.5.8** – Specific Requirements for Testing Protective Helmets.~~

~~**9.5.8.1** –~~

~~Helmet samples shall include all individual components necessary for the certification of the helmet.~~

~~**9.5.8.2** –~~

~~Where different eye and face protection are used, each helmet and eye/face protection component interface shall be separately evaluated.~~

~~**9.5.8.3** –~~

~~The specimen holder for the helmet shall be an inverted flame resistant, nonconductive ISO Size J headform on which the helmet is placed at the manufacturer-specified HPI and with the lowest point of the helmet at 305 mm ± 25 mm (12 in. ± 1 in.) from the surface of the water and n-heptane fluid as measured before ignition.~~

~~**9.5.8.4** –~~

~~A Type K thermocouple shall be placed on the top of the headform at the intersection of the coronal and mid-sagittal plane (in its normal upright configuration) prior to the helmet being mounted on the headform for testing, connected to a data logger with an temperature acquisition rate of at least one measurement each 0.5 s, and used to measure the maximum temperature rise that occurs during and following the exposure to the burning pan.~~

~~**9.5.9** – Specific Requirements for Testing Protective Gloves.~~

~~**9.5.9.1** –~~

~~Glove samples shall include complete gloves.~~

~~**9.5.9.2** –~~

~~Where gloves have had different interface area components, each glove configuration shall be separately tested.~~

~~**9.5.9.3** –~~

~~The specimen holder for the glove shall be an inverted flame resistant, nonconductive handform that holds the glove in a vertical position, fingers down, at 305 mm ± 25 mm (12 in. ± 1 in.) from the tip of the lowest finger to the surface of the water and n-heptane fluid as measured before ignition.~~

Statement of Problem and Substantiation for Public Comment

Specific adaptations for this test method have not been validated for other protective elements.

Related Item

- FR91

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Public Comment No. 148-NFPA 1970-2023 [Section No. 9.6.1.1]

9.6.1.1

This test method shall apply to the following:

(1) Garment outer shells,~~- moisture~~ thermal barriers, ~~thermal barriers,~~ collar linings, winter liners, trim, lettering, and other materials used in garment construction, including, but not limited to, padding, reinforcement, labels, interfacing, binding, hanger loops, emblems or patches, and elastic and hook and pile fasteners (when used where in contact with the wearer's body)

(2) Moisture barrier seams

(3) Hoods, wristlets, helmet ear cover materials, helmet shroud materials, helmet cover materials, helmet chin strap materials, innermost glove lining materials, trim, and label materials

(4) Protective helmets, protective gloves, and protective footwear

Statement of Problem and Substantiation for Public Comment

Moisture barriers, the middle layer of turnout gear, is not protected from UV light and many contaminants, and therefore should be removed from this section.

Related Item

• FR

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Public Comment No. 48-NFPA 1970-2022 [Section No. 9.6.1.1]

9.6.1.1

This test method shall apply to the following:

(1) Garment outer shells, ~~moisture barriers,~~ thermal barriers, collar linings, winter liners, trim, lettering, and other materials used in garment construction, including, but not limited to, padding, reinforcement, labels, interfacing, binding, hanger loops, emblems or patches, and elastic and hook and pile fasteners (when used where in contact with the wearer's body)

(2) Moisture ~~barrier seams~~ barriers and seams will be subject to ISO 17493:2016, Clothing and Equipment for Protection Against Heat - test method for convecting heat resistance using a hot air circulating oven.

(3) Hoods, wristlets, helmet ear cover materials, helmet shroud materials, helmet cover materials, helmet chin strap materials, innermost glove lining materials, trim, and label materials

(4) Protective helmets, protective gloves, and protective footwear

Statement of Problem and Substantiation for Public Comment

The moisture barrier is the inner component in structural firefighting PPE. The ASTM F2894/F2894M test is overly prescriptive and does not simulate realistic conditions. ISO 17493:2016, as used in EN-469 for structure turnout gear, applies a more appropriate shrinkage test for the Moisture Barrier component. It is reasonable to remove Moisture Barriers from the ASTM test, and apply the ISO test to said component.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 49-NFPA 1970-2022 [Section No. 9.6.1.2]	
Public Comment No. 50-NFPA 1970-2022 [Section No. 9.6.4]	
Public Comment No. 51-NFPA 1970-2022 [Section No. 9.6.3.3]	
Public Comment No. 52-NFPA 1970-2022 [Section No. 9.6.5.1]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- NFPA 1971 TIA 1594

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Committee: FAE-SPF

Public Comment No. 149-NFPA 1970-2023 [Section No. 9.6.1.2]

9.6.1.2

Modifications to this test method for testing garment outer shell, ~~moisture~~ thermal barrier, ~~thermal barrier,~~ winter liner, helmet ear cover, helmet shroud, helmet cover, and innermost glove lining materials shall be as specified in 9.6.8.

Statement of Problem and Substantiation for Public Comment

Moisture barriers, the middle layer of turnout gear, is not protected from UV light and many contaminants, and therefore should be removed from this section.

Related Item

• FR

Submitter Information Verification

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Submittal Date: Tue Jan 03 17:01:48 EST 2023
Committee: FAE-SPF

Public Comment No. 49-NFPA 1970-2022 [Section No. 9.6.1.2]

9.6.1.2

Modifications to ~~this~~ these test ~~method~~ methods for testing garment outer shell, moisture barrier, thermal barrier, winter liner, helmet ear cover, helmet shroud, helmet cover, and innermost glove lining materials shall be as specified in 9.6.8.

Statement of Problem and Substantiation for Public Comment

The premise is to have two tests, with one being specific to the Moisture Barrier, as such this revision to 9.6.1.2 is appropriate. The moisture barrier is the inner component in structural PPE. The ASTM F2894/F2894M test is overly prescriptive and does not simulate realistic conditions. ISO 17493:2016, as used in EN-469 for structure turnout gear, applies a more appropriate shrinkage test for the Moisture Barrier component. It is reasonable to remove Moisture Barriers from the ASTM test, and apply the ISO test to said component.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 48-NFPA 1970-2022 [Section No. 9.6.1.1]	
Public Comment No. 50-NFPA 1970-2022 [Section No. 9.6.4]	
Public Comment No. 51-NFPA 1970-2022 [Section No. 9.6.3.3]	
Public Comment No. 52-NFPA 1970-2022 [Section No. 9.6.5.1]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- NFPA 1971 TIA 1594

Submitter Information Verification

Submitter Full Name: Neil McMillan
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Committee: FAE-SPF

Public Comment No. 51-NFPA 1970-2022 [Section No. 9.6.3.3]

9.6.3.3

The unit area weight of materials specified in 9.6.3.2 shall be measured in accordance with the ~~method~~ methods in ASTM D3776/D3776M, *Standard Test Methods for Mass Per Unit Area (Weight) of Fabric*, and ISO 17493:2016, *clothing and equipment for protection against heat - test method for convecting heat resistance using a hot air circulating oven* .

Statement of Problem and Substantiation for Public Comment

The premise is to have two tests, with one being specific to the Moisture Barrier, as such the removal of this component form 9.6.1.2 is appropriate. The moisture barrier is the inner component in structural PPE. The ASTM F2894/F2894M test is overly prescriptive and does not simulate realistic conditions. ISO 17493:2016, as used in EN-469 for structure turnout gear, applies a more appropriate shrinkage test for the Moisture Barrier component. It is reasonable to remove Moisture Barriers from the ASTM test, and apply the ISO test to said component.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 49-NFPA 1970-2022 [Section No. 9.6.1.2]	
Public Comment No. 48-NFPA 1970-2022 [Section No. 9.6.1.1]	
Public Comment No. 50-NFPA 1970-2022 [Section No. 9.6.4]	
Public Comment No. 52-NFPA 1970-2022 [Section No. 9.6.5.1]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

• NFPA 1971 TIA 1594

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Public Comment No. 50-NFPA 1970-2022 [Section No. 9.6.4]

9.6.4 Apparatus.

The test ~~oven~~ ovens shall be as specified in ASTM F2894/F2894M, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, and ISO 17493:2016, *Clothing and Equipment for Protection Against Heat - test method for convecting heat resistance using a hot air circulating oven* .

Statement of Problem and Substantiation for Public Comment

The premise is to have two tests, with one being specific to the Moisture Barrier, as such the removal of this component form 9.6.1.2 is appropriate. The moisture barrier is the inner component in structural PPE. The ASTM F2894/F2894M test is overly prescriptive and does not simulate realistic conditions. ISO 17493:2016, as used in EN-469 for structure turnout gear, applies a more appropriate shrinkage test for the Moisture Barrier component. It is reasonable to remove Moisture Barriers from the ASTM test, and apply the ISO test to said component.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 48-NFPA 1970-2022 [Section No. 9.6.1.1]	
Public Comment No. 49-NFPA 1970-2022 [Section No. 9.6.1.2]	
Public Comment No. 51-NFPA 1970-2022 [Section No. 9.6.3.3]	
Public Comment No. 52-NFPA 1970-2022 [Section No. 9.6.5.1]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- NFPA 1971 TIA 1594

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Public Comment No. 52-NFPA 1970-2022 [Section No. 9.6.5.1]

9.6.5.1

Specimens other than moisture barriers shall be tested in accordance with ASTM F2894/F2894M, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, at a temperature of 260°C, +8°/−0°C (500°F, +14°/−0°F) for 5 minutes +15/−0 seconds. Moisture barriers, tested according to ISO 17493:2016 at a temperature of (180 + 5) C for an exposure time of five minutes, each moisture barrier material used in the garment assembly shall not ignite or melt and shall not shrink more than 5% in either machine or cross direction. Each layer of the material shall be tested separately. If a specimen of sufficient size cannot be taken it may be fixed on the carrying material as used in the garment.

Statement of Problem and Substantiation for Public Comment

The premise is to have two tests, with one being specific to the Moisture Barrier, as such the removal of this component form 9.6.1.2 is appropriate. The moisture barrier is the inner component in structural PPE. The ASTM F2894/F2894M test is overly prescriptive and does not simulate realistic conditions. ISO 17493:2016, as used in EN-469 for structure turnout gear, applies a more appropriate shrinkage test for the Moisture Barrier component. It is reasonable to remove Moisture Barriers from the ASTM test, and apply the ISO test to said component.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 48-NFPA 1970-2022 [Section No. 9.6.1.1]	
Public Comment No. 49-NFPA 1970-2022 [Section No. 9.6.1.2]	
Public Comment No. 50-NFPA 1970-2022 [Section No. 9.6.4]	
Public Comment No. 51-NFPA 1970-2022 [Section No. 9.6.3.3]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- NFPA 1971 TIA 1594

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Submitter Full Name: Neil McMillan
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Public Comment No. 159-NFPA 1970-2023 [Section No. 9.6.13.4]

9.6.13.4

The glove body shall then be filled with nominal 4 mm (⅛ in.) sized perforated soda-lime or borosilicate glass beads in the body of the glove and borosilicate glass rods in the fingers in the following manner:

(1) A borosilicate glass rod composite measuring 12.7 mm (½ in.) in diameter and 5 cm (2 in.) in length shall be placed in each of the five digits.

(2)* A lightweight bag constructed of 170 g/m^2 (5.0 oz/yd^2) 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) If the glove is of an extended gauntlet style where glove body materials continue into the glove interface component area and beyond, an extra bag of the same construction features described in (2) shall be used.

(4) The glass beads and rods shall be at a temperature of 21°C ± 3°C (71°F ± 5°F).

(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 and not less than 150 mm (6 in.) from any other specimen, and airflow is parallel to the plane of the material. In the testing of gloves with wristlets, it shall be permitted to remove the wristlet to within 25 mm (1 in.) from its point of attachment if all of the wristlet is homogeneous and does not contain other materials for aiding in closing the glove sample.

(6) One to three glove specimens shall be placed in the test oven at one time.

(7) The glove specimens shall be suspended such that each specimen is the same distance from the airflow source so that no glove sample is blocking the airflow to other glove samples.

Statement of Problem and Substantiation for Public Comment

Adjustment have been made in modified test method to accommodate the gloves with extended gauntlets.

Related Item

• FR84

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
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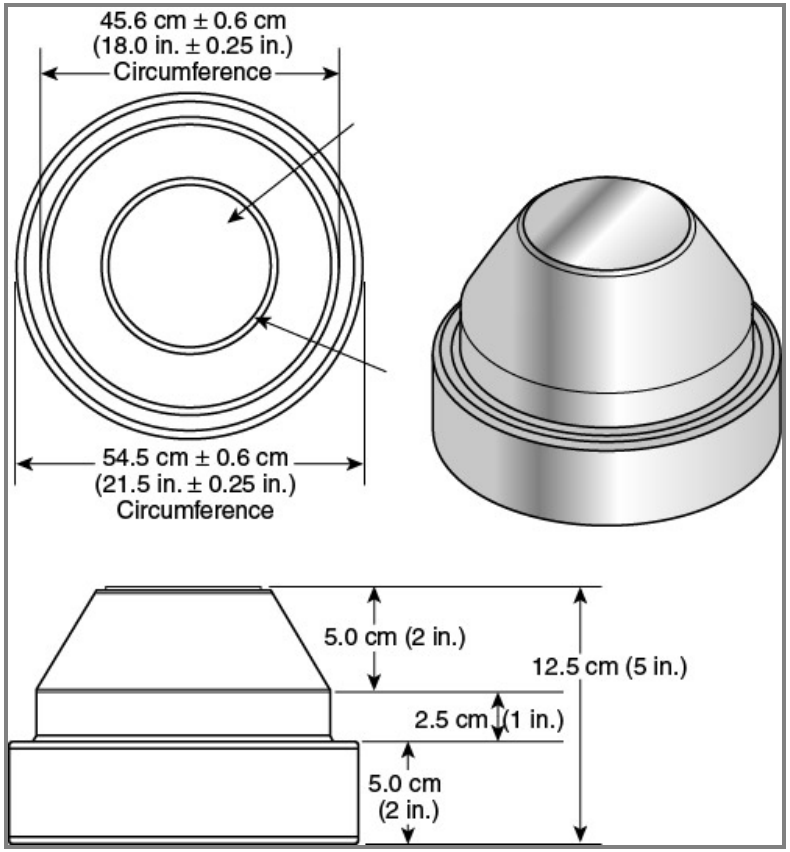
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Submittal Date: Wed Jan 04 10:33:08 EST 2023
Committee: FAE-SPF

Public Comment No. 186-NFPA 1970-2023 [Section No. 9.6.16.4]

9.6.16.4

Specimen face openings with elastic or manually adjustable face openings shall be placed over a hood measuring device as shown in Figure 9.6.16.4. ~~This measuring device shall have marked graduations at 5 mm (0.2 in.) increments on its conical portion.~~ Specimen face openings in the relaxed state shall slide freely over the top half of the device where the circumference measures 45.6 cm ± 0.6 cm (18.0 in. ± 0.25 in.). Specimen face openings shall then be placed around the lower half of the device where the circumference measures 54.5 cm ± 0.6 cm (21.5 in. ± 0.25 in.). Specimens shall then be visually inspected for gaps between the hood and the measuring device surface.

Figure 9.6.16.4 Hood Measuring Device.



9.6.16.4.1

Specimen hoods with SCBA facepiece openings shall be measured as specified in 9.47.5.1 through 9.47.5.3.

Statement of Problem and Substantiation for Public Comment

It is unclear what the purpose of this new requirement is. The hood is measured using the first flat circumference and the lower flat circumference. The conical portion of the device is just to aid in the hood sliding over the top.

Related Item

• FR62

Submitter Information Verification

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Submittal Date: Wed Jan 04 12:40:22 EST 2023
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Public Comment No. 53-NFPA 1970-2022 [Section No. 9.27.4.2]

9.27.4.2*

Each of the following liquids shall be tested separately against each test specimen:

(1) Aqueous film-forming foam (AFFF), 3 percent concentrate

(2) Battery acid (37 percent by weight sulfuric acid to water)

(3) ~~Fire-resistant hydraulic fluid, phosphate ester base, containing 50 to 80 percent tributyl phosphate [CAS No. 126-73-8]~~

(4) Surrogate gasoline Fuel H as defined in ASTM D471, *Standard Test Method for Rubber Property–Effect of Liquids*, consisting of 42.5% toluene, 42.5% iso-octane, and 15% ethanol, by volume, respectively.

(5) Swimming pool chlorinating chemical containing at least 65 percent-free chlorine (saturated solution)

(6) Automobile antifreeze fluid (ethylene glycol, 90 percent by weight or higher concentration)

Statement of Problem and Substantiation for Public Comment

Phosphate ester based fire-resistant hydraulic fluid is not a “common fire ground hazard” as would be required for this list (Annex B - Description of Performance Requirements and Test Methods for NFPA 1971 states in B.2 Garments, 7.1.15 - "The Liquid Penetration Resistance Test is used to evaluate whether or not the garment's moisture barrier and seams resist penetration of liquids meant to be representative of those commonly encountered on the fireground."). Phosphate ester based fire-resistant hydraulic fluid has been phased out by hydraulic rescue tool manufacturer (since 2008), and is not commonly used in any form of application outside the aviation industry. Current tactics and practices of pump-&-roll extinguishment for aviation incidents ensures that any such low frequency occurrence poses little risk from this hazard. As such this specific fluid hazard is not representative of the common hazards structural firefighting PPE will encounter.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

• NFPA 1971 TIA 1594

Submitter Information Verification

Submitter Full Name: Neil McMillan

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Submittal Date: Thu Dec 22 06:27:33 EST 2022
Committee: FAE-SPF

Public Comment No. 215-NFPA 1970-2023 [Sections 9.27.7, 9.27.8]

Sections 9.27.7, 9.27.8

9.27.7 Specific Requirements for Testing Moisture Barrier Materials and Moisture Barrier Seams.

9.27.7.1

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz/yd^2 woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber with a nonfluorinated finish, the moisture barrier, a layer of 7.8 oz/yd^2 ± 0.3 oz/yd^2 thermal barrier consisting of a woven plain weave face cloth quilted to two layers of aramid nonwoven~~, and another layer of 7 . 5 oz/yd 2 woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber with a nonfluorinated finish.~~ Where the sample includes the seam, the moisture barrier layer shall be constructed with a straight center seam that shall extend across the entire 380 mm (15 in.) width of the specimen. The ~~four~~ three -layer composite shall be stitched around the entire periphery.

9.27.7.1.1

Where the layer intended to be the moisture barrier is configured of a composite that includes outer shell, moisture barrier, or thermal barrier combinations, the samples to be conditioned shall be constructed using those materials.

9.27.7.2

The moisture barrier layer shall be removed from the four-layer composite samples after all conditioning has been completed and shall become the moisture barrier specimen.

9.27.7.2.1

Where the moisture barrier is configured as indicated in 9.27.7.1.1, specimens shall be permitted to be a composite of layers provided that the layer intended to be the moisture barrier is visible in the test cell, and provided that the specimen was preconditioned according to 9.27.7.1.1.

9.27.7.3

Testing shall be performed as specified in 9.27.3 through 9.27.6.

9.27.8 Specific Requirements for Testing Glove Moisture Barrier Materials and Glove Moisture Barrier Seams.

9.27.8.1

Specimens shall be representative of the glove moisture barrier and moisture barrier seams. Three specimens shall be tested.

9.27.8.2

Samples for conditioning shall be in the form of a pouch as described in 9.1.15.

9.27.8.3

The glove moisture barrier layers shall be removed from the multilayer composite samples after all conditioning has been completed and shall become the glove barrier test specimen.

9.27.8.4

Specimens for testing shall be the barrier layer only.

9.27.8.5

Testing shall be performed as specified in 9.27.2 through 9.27.6.

9.27.8.6

Where the moisture barrier material is continuous through the glove body, only the barrier straight seams shall be tested. The test cell shall include both the moisture barrier material and the straight moisture barrier seam. The seam shall be located in the approximate center of the test cell.

Statement of Problem and Substantiation for Public Comment

The layer of outer shell on the back of the composite specimen does not add value to the test as the thermal barrier layer adds sufficient protection to the moisture barrier and is more representative of what is found in the actual ensemble.

Also revising the glove testing to include straight seams to align with garments and footwear.

Related Item

• FR159 • FR160

Submitter Information Verification

Submitter Full Name: Amanda Newsom
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Submittal Date: Wed Jan 04 14:38:30 EST 2023
Committee: FAE-SPF

Public Comment No. 54-NFPA 1970-2022 [Section No. 9.28.1.1]

~~9.28.1.1~~ –

~~This test method shall apply to garment moisture barrier materials and moisture barrier seams, footwear moisture barrier materials and moisture barrier seams, bootie moisture barrier materials and moisture barrier seams where present, and glove moisture barrier materials and moisture barrier seams.~~

Statement of Problem and Substantiation for Public Comment

Structural and proximity firefighting ensembles are just that. Purpose made PPE for medical emergencies, and trauma incidents should be the standards where such language is found. Alternate PPE should be encouraged and specified for fire service response roles outside of firefighting responses. This test adds to the overly prescriptive nature of firefighting PPE, and the endeavour to engineer the ensemble to withstand hazards outside of it's primary function.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- NFPA 1971 TIA 1594

Submitter Information Verification

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Submittal Date: Thu Dec 22 06:43:05 EST 2022
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Public Comment No. 209-NFPA 1970-2023 [Section No. 9.28.7.1]

9.28.7.1

Samples for conditioning shall be at least 380 mm (15 in.) square and shall consist of a composite constructed using a layer of 7.5 oz/yd^2 woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber with a nonfluorinated finish, the moisture barrier, a layer of 7.8 oz/yd^2 ± 0.3 oz/yd^2, and a thermal barrier consisting of a woven plain weave face cloth quilted to two layers of aramid nonwoven~~, and another layer of 7~~ . ~~5 oz/yd~~ $^{~~2~~}$ ~~woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber with a nonfluorinated finish.~~ Where the sample includes ~~the seam~~ a seam , the moisture barrier layer shall be constructed with a ~~straight center seam that shall extend~~ straight seam that located in the center of the composite that extends across the entire 380 mm (15 in.) width of the specimen. The ~~four~~ three -layer composite shall be stitched around the entire periphery.

Statement of Problem and Substantiation for Public Comment

The layer of outer shell on the back of the composite specimen does not add value to the test as the thermal barrier layer adds sufficient protection to the moisture barrier and is more representative of what is found in the actual ensemble.

Related Item

• FR164

Submitter Information Verification

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Submittal Date: Wed Jan 04 14:27:15 EST 2023
Committee: FAE-SPF

Public Comment No. 213-NFPA 1970-2023 [Section No. 9.28.8]

9.28.8 Specific Requirements for Testing Glove ~~Materials~~ Moisture Barrier Materials and Glove Moisture Barrier Seams.

9.28.8.1

Specimens shall be representative of the glove moisture barrier and moisture barrier seams. Three specimens shall be tested.

9.28.8.2

Samples for conditioning shall be in the form of a pouch as described in 9.1.15.

9.28.8.3

The glove moisture barrier layers shall be removed from the multilayer composite samples after all conditioning has been completed and shall become the glove barrier test specimen.

9.28.8.4

Specimens for testing shall be the barrier layer only.

9.28.8.5

Testing shall be performed as specified in 9.28.2 through 9.28.6.

9.28.8.6

Where the moisture barrier material is continuous throughout the glove body, only the barrier straight seams shall be tested. The test cell shall include both the moisture barrier material and the moisture barrier straight seam. The seam shall be located in the approximate center of the test cell.

Statement of Problem and Substantiation for Public Comment

Updating the requirement to indicate testing of straight seams only. This is the same as what is performed in garments and was also added for footwear.

Related Item

• FR165

Submitter Information Verification

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Submittal Date: Wed Jan 04 14:33:37 EST 2023
Committee: FAE-SPF

Public Comment No. 161-NFPA 1970-2023 [Section No. 9.42.2.2]

9.42.2.2

Samples shall be conditioned as specified in 9.1.3, 9.1.4, 9.1.6, ~~and~~ 9.1.7, and 9.41.4.2 for labels.

Statement of Problem and Substantiation for Public Comment

Per discussions in the helmet task group an abrasion test is being added to helmet labels for durability and legibility purposes.

Related Item

• PI178

Submitter Information Verification

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Submittal Date: Wed Jan 04 10:42:47 EST 2023
Committee: FAE-SPF

Public Comment No. 135-NFPA 1970-2023 [Section No. 9.48]

9.48 Whole Garment and Ensemble Liquid Penetration Test.

9.48.1 Application.

9.48.1.1

This test method shall apply to protective garments, protective coats with an integrated garment-glove interface, protective trousers with integrated booties, protective garments with integrated hoods, and protective garments that are being evaluated for the optional liquid and particulate contaminant protection.

9.48.1.2

Modifications to this test method for testing protective coats and protective coats with an integrated garment-glove interface shall be as specified in 9.48.9.

9.48.1.3

Modifications to this test method for testing protective trousers and protective trousers with integrated booties shall be as specified in 9.48.10.

9.48.1.4

Modifications to this test method for testing protective coat and trouser sets or protective coveralls shall be as specified in 9.48.11.

9.48.1.5

Modifications to this test method for testing proximity firefighting ensemble garment elements shall be as specified in 9.48.12.

9.48.1.6

Modifications to this test method for testing garments for optional liquid and particulate contaminant protection shall be as specified in 9.48.13.

9.48.2 Samples.

9.48.2.1

Samples shall be complete garments or ensemble elements.

9.48.2.2

Samples shall be conditioned as specified in 9.1.3.

9.48.3 Specimens.

9.48.3.1

A minimum of three specimens shall be tested. Specimens shall consist of individual coats, trousers, coverall elements, or sets of coats and trousers elements for liquid and particulate contaminant protection. Each element shall have in place all layers that are required for the element to be compliant.

9.48.3.2

The size of the elements comprising the specimens shall be chosen to conform with the dimensions of the manikin for proper fit of the specimen on the manikin in accordance with the manufacturer's sizing system. The size of the elements comprising the specimen shall be the same size as the manikin in chest circumference, waist circumference, and inseam height.

9.48.3.3

Specimens to be tested shall be conditioned as specified in 9.1.3.

9.48.4 Sample Preparation.

~~9.48.4.1~~ –

~~Specimens to be tested shall be conditioned as specified in 9.1.3 .~~

~~9.48.4.~~ 2

Samples to be conditioned shall be complete garments.

9.48.5 Apparatus.

The apparatus and supplies for testing shall be those specified in ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, with the following modifications:

(1) The surface tension of the water used in testing shall be 35 dynes/cm ± 5 dynes/cm.

(2) * The manikin used in testing shall be fully upright and shall have straight arms and legs with the arms positioned at the manikin’s side.

9.48.6 Procedure.

Liquid penetration testing of garments shall be conducted in accordance with ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, with the following modifications:

(1) Procedure B shall be used with an overall exposure period of 10 minutes with 2.5 minutes in each of the four orientations.

(2) Blocking of the specimen shall be as specified in 9.48.~~8~~ 9 , 9.48. ~~9,~~ 10 and 9.48.~~10~~ 11 , as appropriate, for the type of specimen being tested.

(3) The method used for mounting of the manikin in the spray chamber shall not interfere with the water spray.

(4) The normal outer surface of the material shall be exposed to the liquid as oriented in the clothing item.

(5) Fluorescent or visible dyes shall not be used in the water for spraying the suited manikin.

(6) The manikin shall be positioned so that the manikin body is in a full vertical orientation with the manikin head looking forward, manikin legs straight, and manikin arms pointing downward by the sides of the manikin torso. The manikin joints shall be tightened to ensure that the manikin maintains this position during testing.

9.48.7* Report.

A diagram shall be prepared for each test that identifies the locations of any liquid leakage detected on the liquid-absorptive garment.

9.48.8 Interpretation.

9.48.8.1

Any evidence of liquid on the liquid-absorptive garment, as determined by visual, tactile, or absorbent toweling, shall constitute failure of the specimen.

9.48.8.2

In determining the compliance of the specific garments or ensemble being evaluated, one of the three specimens shall be permitted to display leakage on the liquid-absorptive garment of an area that is collectively not greater than 20 cm^2 (3.1 $in.^2$).

9.48.9 Specific Requirements for Testing Coats and Coats with an Integrated Garment-Glove Interface.

9.48.9.1

The liquid-absorptive garment shall only cover the upper torso and arms of the manikin from the middle of the manikin’s neck, down to the manikin’s waistline, and down to the manikin’s wrist crease.

9.48.9.2

The coat shall be donned on the manikin in accordance with the manufacturer's instructions for proper wearing.

9.48.9.3

The coat collar shall be placed in the up position on the manikin with the collar closure system fastened in the closed position. The head of the manikin shall be sealed off with a plastic bag. The plastic bag shall extend downward over the collar a distance of not greater than 25 mm (1 in.) and shall be taped down using duct tape or similar waterproof tape. The tape shall not extend downward more than 75 mm (3 in.) from the top of the collar. The bottom edge of the tape and the plastic bag shall not come closer than 25 mm (1 in.) of the collar seam where a collar seam is present. Where present, the collar neck seam shall not be covered.

9.48.9.4

The test shall be conducted with the manikin's hands removed. The coat sleeve hem shall be taped smoothly to a can or an object of similar cylindrical, rigid shape of the same nominal diameter as the sleeve opening. The can or cylindrical object shall be fitted over the wristlet and under the coat's outer shell sleeve hem. The tape shall be duct tape or similar waterproof tape.

9.48.9.4.1

Where garments are supplied with an integrated garment-glove interface, the manikin's hands shall not be removed. The garment-glove combination shall be donned on the manikin in accordance with the manufacturer's instructions for proper wearing.

9.48.9.5

The coat shall be tested in conjunction with the protective trousers specified by the manufacturer, even where the trousers are not specifically evaluated in this test.

9.48.10 Specific Requirements for Testing Trousers.

9.48.10.1

The liquid-absorptive garment shall cover only the lower torso and legs of the manikin from the manikin's waistline down to the manikin's ankles.

9.48.10.2

The trousers shall be donned on the manikin in accordance with the manufacturer's instructions for proper wearing.

9.48.10.3

Trousers shall be tested in conjunction with the protective coat specified by the manufacturer, even where the coat is not specifically evaluated in this test.

9.48.10.4

Absorbent toweling or similar material shall be placed underneath the manikin in order to prevent water splashing up inside the trouser leg.

9.48.10.5

Where trousers are provided with integrated booties, outer footwear specified to be worn with the booties shall be donned on the manikin in accordance with the manufacturer's instructions for proper wearing.

9.48.11 Specific Requirements for Testing Coveralls.

9.48.11.1

The liquid-absorptive garment shall only cover the torso, arms, and legs of the manikin from the middle of the manikin's neck, down to the manikin's wrist crease, and down to 200 mm (8 in.) above the bottom of the heel.

9.48.11.2

The coverall or set of coat and trousers shall be donned on the manikin in accordance with the manufacturer's instructions for proper wearing.

9.48.11.3

The coat collar shall be placed in the up position on the manikin with the collar closure system fastened in the closed position. The head of the manikin shall be sealed off with a plastic bag. The plastic bag shall extend downward over the collar a distance of not greater than 25 mm (1 in.) and shall be taped down using duct tape or similar waterproof tape. The tape shall not extend downward more than 75 mm (3 in.) from the top of the collar. The collar neck seam shall not be covered.

9.48.11.4

The test shall be conducted with the manikin’s hands removed. The knit wristlet shall be tucked up inside the sleeve to prevent the water from absorbing into the wristlet.

9.48.11.4.1

Where garments are supplied with an integrated garment-glove interface, the manikin’s hands shall not be removed. The garment-glove combination shall be donned on the manikin in accordance with the manufacturer’s instructions for proper wearing.

9.48.11.5

Absorbent toweling or similar material shall be placed underneath the manikin to prevent water splashing up inside the trouser leg.

9.48.11.6

Where trousers are provided with integrated booties, outer footwear specified to be worn with the booties shall be donned on the manikin in accordance with the manufacturer's instructions for proper wearing.

9.48.12 Specific Requirements for Testing Proximity Firefighting Ensemble Garment Elements.

9.48.12.1

Garment element specimens shall be complete proximity firefighting protective coats, protective trousers, or protective coveralls.

9.48.12.2

Specimens shall be conditioned as specified in 9.1.3.

9.48.12.3

Where the proximity firefighting garment design has passed the liquid penetration requirements specified for structural firefighting garments and the only change to the proximity garment is from a structural garment outer shell to a proximity garment outer shell, at least one specimen shall be tested.

9.48.12.4

Where the proximity firefighting garment design has not been tested for structural firefighting garment liquid penetration requirements, then a minimum of three specimens shall be tested.

9.48.13 Specific Requirements for Testing Garments for Optional Liquid and Particulate Contaminant Protection.

9.48.13.1

Specimens for testing shall consist of liquid and particulate contaminant garment elements.

9.48.13.2

A total of three different specimens shall be evaluated.

9.48.13.3

Garment elements shall be conditioned as specified in 9.1.2.

9.48.13.4

The upper torso liquid-absorptive garment shall cover the upper torso and arms of the manikin from the middle of the manikin's neck, down to the manikin's waistline, and down to the manikin's wrist crease. The lower torso liquid-absorptive garment shall cover the legs of the manikin from the manikin's waistline down to the manikin's ankles. The garment or garments shall be made of fabric meeting the requirements specified in ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*. The liquid-absorptive garment shall not interfere with the correct wearing of the ensemble.

9.48.13.4.1

Where the coat consists of an attached hood, the upper torso indicator garment shall also incorporate a hood.

9.48.13.5

Specimens provided in 9.48.13.1 shall be donned on the manikin in accordance with garment manufacturer's specifications.

9.48.13.6

The manikin with ensemble in place shall be evaluated using Procedure A as specified in ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, with the following modifications:

(1) Procedure A shall be used.

(2) If the garment does not have an integrated hood, a plastic bag shall be applied over the manikin head without the protective helmet as specified in 9.48.13.1.

(3) If the garment does have an integrated hood, it is permitted to apply duct tape to the interface between the SCBA-facepiece and the particulate blocking hood while still using the helmet as part of the test specimen.

(4) The suited manikin shall be exposed to the liquid spray for 2.5 minutes in each of the four manikin orientations for a total of 10 minutes.

9.48.13.7*

Following the test, the portions of the liquid-absorptive garment that are underneath the garments being evaluated shall be inspected to determine evidence of liquid leakage.

Statement of Problem and Substantiation for Public Comment

Delete 9.48.4.1 as specimens are covered in 9.48.3
Correct references in 9.48.6 (2)

Related Item

- FR241

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Submittal Date: Tue Jan 03 14:26:07 EST 2023
Committee: FAE-SPF

Public Comment No. 34-NFPA 1970-2022 [Sections 9.59.4, 9.59.5]

~~**Sections**~~

9.59.4

~~**, 9.59.5** 9.59.4~~

_ Apparatus.

9.59.4.1 _

One pair of protective gloves shall be provided.

9.59.4.1.1 _

The gloves shall be certified as compliant with this standard and shall be sized to fit the test technician.

9.59.4.1.2 _

For structural firefighting ensembles, the protective gloves shall be structural firefighting gloves.

9.59.4.1.3 _

For proximity firefighting ensembles, the protective gloves shall be proximity firefighting gloves.

9.59.4.2 _

One IAFF "Rescue Randy" Model 1475 manikin or equivalent, shall be provided as the test manikin.

9.59.4.3 _

One open-circuit SCBA shall be provided.

9.59.4.3.1 _

The SCBA shall be certified as compliant with Chapters 15 through 19 of this standard.

9.59.4.3.2 _

The SCBA shall be equipped with an empty 60-minute-rated breathing air cylinder.

9.59.4.4 * _

~~**One flashlight approved for use in structural firefighting environments shall be provided.**~~

~~**9.59.4.5** –~~

~~Disposable peripheral-loss simulator glasses shall be provided.~~

A SCBA face-piece shall be supplied so that it is fitting to the test technician. The face-piece shall be obscured according to the following:

1. An adhesive vinyl shall be adhered to the external side of the viewing area of the face-piece.

2. The vinyl shall be hazed so that there is a maximum of 71 percent blackout.

3. The vinyl shall cover enough of the viewing area so that the test technician cannot perform the test without looking through the blackout area.

9.59.5 _ Procedure.

9.59.5.1 _

The DRD shall be inspected to

~~insure~~

ensure correct installation within the garment element in accordance with manufacturer's instructions.

9.59.5.2 _

The DRD shall be in the secured,

~~nondeployed~~

non-deployed position.

9.59.5.3 _

The size of the specimen shall fit the manikin by conforming to the dimensions of the manikin chest circumference in accordance with the manufacturer's sizing system.

9.59.5.4 _

The test specimen shall be donned on the test manikin in accordance with the manufacturer's instructions for wearing, and shall be tested with an SCBA.

9.59.5.5 _

The SCBA harness and cylinder shall be donned on the test manikin in accordance with the SCBA manufacturer's instructions over the specimen.

9.59.5.6 _

The test manikin shall be placed on its side on a concrete surface.

9.59.5.7 _

With the test manikin in position, the test technician shall don the gloves specified in 9.59.4.1

~~;~~

and the

~~disposable peripheral-loss simulator glasses, and the SCBA facepiece~~

SCBA face-piece specified in 9.59.4.

~~3~~

4 . The regulator port shall remain uncovered to allow air to enter the

~~facepiece~~

face-piece .

9.59.5.8

_

~~9.59.5.9~~ –

~~The test technician shall approach the manikin and shall be allowed to use the handheld flashlight to locate and deploy the DRD according to the manufacturer's instructions.~~

Deployment time shall be measured beginning when the test technician touches the manikin and shall stop when the dragging motion begins.

9.59.5.

~~10~~

9 _

The test technician shall drag the manikin in a straight line using the DRD, in accordance with the manufacturer’s instructions, for a distance of 2.5 m, +0.5/−0 m (8 ft, +1 **1**⁄**2** /−0 ft).

9.59.5.

~~11~~

10 _

The deployment of the DRD and the dragging of the manikin shall be observed to determine if the SCBA is dislodged from the "as donned position."

A.9.59.4.4

The blackout film is intended to simulate the use of the DRD in fire ground scenarios. The adhesive vinyl being specified is a lightly obscured vinyl that provides vision up to 3 feet, silhouettes up to 10 feet, and provides 70.4 percent blackout when applied to the face-piece. The Eclipse Fireground Solutions Level 1 vinyl has been found to be an appropriate material. However, equivalent materials may be sourced.

Statement of Problem and Substantiation for Public Comment

These revisions are being proposed based on work performed by the design task group. The vinyl being proposed is used in fireground training exercises and has proven to be an appropriate level of blackout to simulate actual use. Testing was performed at UL utilizing the material being specified and resulted in an increase of 1 to 2 seconds for deployment time. The testing was limited, but did demonstrate that the blackout material being specified does not prevent the test from being performed, however adds a more realistic aspect to the test.

Related Item

• FR118

Submitter Information Verification

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Submittal Date: Tue Dec 20 10:11:45 EST 2022
Committee: FAE-SPF

Public Comment No. 136-NFPA 1970-2023 [Section No. 9.65.2]

9.65.2 Samples.

9.65.2.1

Samples shall consist of liquid and particulate garments combined with the following elements, specified by the manufacturer, for testing a full ensemble:

(1) A specific protective helmet certified to the firefighting protective helmet requirements of this standard.

(2) A specific pair of protective gloves certified to the firefighting protective glove requirements of this standard where the glove is of a gauntlet style and the glove length measured from the tip of the longest glove finger to the edge of the gauntlet is no longer than 305 mm (12 in.).

(3) A specific pair of protective footwear certified to the firefighting protective footwear requirements of this standard where the height of the footwear, as measured from the sole wear surface, is no higher than 406 mm (16 in.).

(4) A specific particulate-blocking hood certified to the firefighting hood requirements in this standard~~, including the additional design and performance requirements for optional firefighting protective hood interface requirements for providing particulate protection~~ .

(5) An SCBA certified to ~~the 2019 edition of NFPA 1981~~ Chapters 15-19 of this standard .

9.65.2.2

Garment elements shall be conditioned as specified in 9.1.~~11~~ 2 .

9.65.2.3

Samples shall then be conditioned at 21°C ± 6°C (70°F ± 11°F) and 50 percent ± 30 percent relative humidity for at least 4 hours.

Statement of Problem and Substantiation for Public Comment

Modifications to the test method based on proposed changes to this standard.

Related Item

• FR244

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Public Comment No. 181-NFPA 1970-2023 [Section No. 9.66]

9.66 Transmitted and Stored Thermal Energy Test.

9.66.1 Application.

9.66.1.1

This test method shall apply to garment sleeve composites containing enhancements as defined in 8.2.4 exterior to the outer shell and glove body composites .

9.66.1.2

Modifications to this test method for testing garment sleeve composites containing enhancements exterior to the outer shell shall be as specified in 9.66.7.

9.66.1.3

Modifications to this test method for testing the glove body composite at the back of the glove shall be as specified in 9.66.8.

9.66.~~1~~ 2 Samples . ~~4~~

~~Modifications to this test method for testing particulate blocking hoods shall be as specified in~~

Samples shall consist of sleeve enhancements and glove body composites in their full width.

9.66. ~~9~~ 3 Specimens .

9.66.2 ~~– Samples.~~

~~Samples~~

3.1 _

Testing shall be conducted on five specimens.

9.66.3.2

Specimens shall measure 150 mm × 150 mm ± 6 mm (6 in. × 6 in. ± **1**⁄**4** in.), and shall consist of all layers representative of the item to be tested. ~~Samples shall~~

9.66.3.3

Specimens shall not be stitched to hold individual layers together during testing. ~~Enhancements~~

9.66.3.4

Speicmens of sleeve enhancements shall be sewn to the center of the outer shell of the composite if they cannot meet the sample measurement requirements.

9.66.3 ~~Specimens~~ .

~~**9.66.3.1** –~~

~~Transmitted and stored thermal energy testing shall be conducted on five specimens.~~

~~**9.66.3.** **2**~~

~~Garment sleeve~~ Specimen composites shall be conditioned in accordance with Section 9.3 of ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy in Fire Fighter Protective Clothing Systems*.

9.66.4 Procedure.

9.66.4.1

Transmitted and stored thermal energy testing shall be conducted in accordance with ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy in Fire Fighter Protective Clothing Systems*, Procedure B, with the modification specified in 9.66.4.1.1.

9.66.4.1.1

~~For garment sleeve composites, the~~ The exposure time shall be for a period of 120 seconds, +1/−0 seconds.

9.66.5 Report.

The average time to second-degree burn shall be calculated and reported. If no burn injury occurs, the time to second-degree burn shall be reported as “no burn.”

9.66.6 Interpretation.

Pass/fail determination shall be based on the average reported time to second-degree burn of all specimens tested.

9.66.7 Specific Requirements for Testing Garment Sleeve Composites Containing Enhancements Exterior to the Outer Shell.

9.66.7.1

A three-layer composite shall be used to test enhancements exterior to the outer shell. The composite shall be constructed using a layer of 7.5 oz/yd^2 natural woven 93 percent meta-aramid, 5 percent para-aramid, 2 percent antistat fiber, 4.7 oz/yd^2 ± 0.2 oz/yd^2, expanded PTFE laminated to a woven aramid fabric, and a layer of 3.8 oz/yd^2 ± 0.3 oz/yd^2, aramid needle punched nonwoven, quilted to 3.4 oz/yd^2, aramid plain weave thermal barrier material. Additional layers found used in the construction of the garment shall be placed in the composite as found in the garment.

9.66.8 Specific Requirements for Testing Glove Body Composites at the Back of the Glove.

9.66.8.1

Specimens shall be representative of the glove body composite construction at the back of the glove at the following glove areas described in 9.1.17: A-A, B-B, the 25 mm (1 in.) of C-B adjacent to the wrist crease, D-B, and E-B.

9.66.8.2

The thickness of each specimen shall be measured in accordance with ASTM D1777, *Standard Test Method for Thickness of Textile Materials*, and provided in the report.

9.66.8.3

The weight of each specimen shall be measured in accordance with the method in ASTM D3776/D3776M, *Standard Test Methods for Mass Per Unit Area (Weight) of Fabric*, and provided in the report.

9.66.8.4

Glove body composites at the back of the glove shall be conditioned as specified in 9.1.9.

9.66.8.5

The specimens shall be tested as specified in 9.66.4 with the exception that the radiant heat exposure period shall continue until the second-degree burn point is reached. No compression period shall be used for this testing.

9.66.8.6

The testing shall be run on separate samples at each of the three moisture conditions specified in 9.1.9.

~~**9.66.9** – Specific Requirements for Testing Particulate Blocking Hoods.~~

~~**9.66.9.1** – Samples.~~

~~**9.66.9.1.1** –~~

~~Specimens for conditioning shall measure 150 mm x 150 mm ± 6 mm (6 in. x 6 in.± **1**/**4** in.).~~

~~**9.66.9.1.2** –~~

~~Specimens shall consist of a composite constructed of all layers utilized in the particulate blocking hoods, oriented in the order as worn.~~

~~**9.66.9.2** – Specimens.~~

~~**9.66.9.2.1** –~~

~~A total of 5 specimens in each condition shall be tested.~~

~~**9.66.9.2.2** –~~

~~One set of specimens shall be preconditioned by uniformly applying 3.4 grams ± 0.2 grams of water to the innermost layer of the composite and shall be tested within 2 minutes after preconditioning.~~

~~**9.66.9.3** – Procedure.~~

~~Transmitted and stored thermal energy testing shall be conducted in accordance with ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Thermal Energy in Fire Fighter Protective Clothing Systems, Procedure B* , with the following modifications:~~

(1) ~~Compression of the specimen shall not be required.~~

(2) ~~The exposure time shall be for a period of 120 seconds, + 1/– 0 seconds, or until a time to predicted second-degree burn is achieved up to 240 seconds.~~

~~**9.66.9.4** – Report.~~

~~The average time to second-degree burn shall be calculated, recorded, and reported for each test condition (dry and wet). If no burn injury occurs with the maximum exposure period of 240 seconds, the time to second-degree burn shall be reported as "no burn."~~

~~**9.66.9.5** – Interpretation.~~

~~Pass/fail determination shall be based on the lowest average reported time to second-degree burn of both sets of specimens that are tested in each of the two conditions.~~

Statement of Problem and Substantiation for Public Comment

The additional requirement to test particulate blocking hoods is being proposed to be removed due to the lack of information on how current products perform using this method. There is full agreement that there may be a need to do a less than flashover thermal test on these products, but there is no evidence being presented on how to implement this test that will replicate that scenario.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 188-NFPA 1970-2023 [Section No. 8.13.15]	

Related Item

• FR67

Submitter Information Verification

Submitter Full Name: Amanda Newsom

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Submittal Date: Wed Jan 04 11:39:04 EST 2023
Committee: FAE-SPF

Public Comment No. 163-NFPA 1970-2023 [Section No. 9.69.4.1]

9.69.4.1

Glove tool testing shall be evaluated with the use of the following apparatus:

(1) A hand tool vertical test apparatus consisting of one horizontal board with one vertical board attached in the middle of the horizontal board. The vertical board shall have holes drilled 50 mm (2 in.) apart in a “T”-shaped fashion with a row of three holes and a row of one hole directly under and in the center of the top row.

(2) Four M12-1.75 mm (3/4 in.) bolts, each with one nut and two washers

(3) 9.5 mm (3/ 8 in.) drive deep-well 19 mm (3/4 in.) socket

(4) 19 mm (3/4 in.) box-end wrench

(5) 9.5 mm (3/ 8 in.) drive torque wrench

Statement of Problem and Substantiation for Public Comment

The English to metric conversions were completed for all of the specific measurement parameters in this test method apparatus specification.

Related Item

• FR87

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
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Submittal Date: Wed Jan 04 10:43:56 EST 2023
Committee: FAE-SPF

Public Comment No. 175-NFPA 1970-2023 [Sections 9.70.4, 9.70.5, 9.70.6, 9.70.7]

Sections 9.70.4, 9.70.5, 9.70.6, 9.70.7

9.70.4 Apparatus.

The test apparatus shall be as specified in ASTM F2299/F2299M, *Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres*, with the following modifications:

(1) A stainless-steel reinforcement screen with a mesh size of 1 mm × 1 mm (0.04 in. × 0.04 in.) shall be used adjacent to the test specimen on the downstream side.

(2) Particle detection shall be accomplished with the use of an SMPS (scanning mobility particle sizer) or an OPC (optical particle counter) capable of measuring 0.1 µ at 100 percent counting efficiency.

(3) The material specimen cross section diameter shall be ~~60 mm (2.36 in.).~~ large enough to cover the entire testing area.

9.70.5 Procedure.

9.70.5.1

Prior to testing, the composite and composite seam samples shall be tested for air permeability in accordance with ASTM D737, *Standard Test Method for Air Permeability of Textile Fabrics*.

9.70.5.1.1

Where the air permeability result is less than 25 cubic feet per minute (CFM), testing, according to 9.70.5 is permitted to be waived and the results shall be reported ~~as hood material or seam has an air permeability of less~~ .

9.70.5.1.2

Where the air permeability result indicates testing of the composite and the seam is acceptable, the straight seam specimens shall be permitted to be tested in lieu of composite specimens. The seam shall be located in the center of the test area.

9.70.5.2*

The latex sphere sizes used in testing shall range from 0.1 µm to 1.0 µm and shall be created using at least eight different known particle sizes from 0.1 µm to 1.0 µm.

9.70.5.3

The required ~~airflow shall~~ face velocity shall be 1.~~7 L~~ 0 cm /~~min ±~~ s ± 0.1 ~~L~~ cm /~~min in 9.70.5.1(3)~~ s.

9.70.5.4

The efficiency for each specimen shall be calculated for each sequence for conditioning using the following equation:

$$\%\text{Efficiency} = \eta = [1\text{- (downstream counts/upstream counts)}] * 100 \qquad \textbf{[9.70.5.4]}$$

9.70.5.5

The average efficiency for each particle size shall be calculated for each test condition.

9.70.6 Report.

9.70.6.1

The final measurement ~~airflow~~ face velocity shall be recorded and reported in ~~L~~ cm /~~min for~~ s for each specimen.

9.70.6.~~2~~ 1.1

The upstream and downstream particulate counts shall be recorded and reported for each particle size for each specimen.

9.70.6.~~3~~ – 1.2

The average percent efficiency for each particle size per test condition and type of sample (e.g., composite and composite seams) shall be recorded and reported.

9.70. 6.2

Where testing in 9.70.5 was waived due to the air permeability result, the air permeability shall be recorded and reported.

9.70. 7 Interpretation.

9.70.7.1

The lowest average percent efficiency in either test condition for each particle size and each type of sample shall be used to determine pass or fail performance.

9.70.7.2

Where the air permeability result is less than 25 cubic feet per minute, the performance requirements shall be waived and the material or seam shall be considered passing.

Statement of Problem and Substantiation for Public Comment

As a result of the changes made during first revision, more equipment options are available for labs to use. Not all equipment available utilizes the same specimen holder as the one that was utilized when adding this test method to the 2018 edition of the standard. When considering the different equipment options, it is most critical to maintain the face velocity since the specimen size can change, which would also impact airflow. This change ensures that multiple labs performing this test can do so consistently.

Made an editorial revision to 9.70.5.1.1

Added reporting and interpretation clarifications for when air permeability allows the waiving of the particle testing.

Related Item

• FR306

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Submittal Date:	Wed Jan 04 11:16:55 EST 2023
Committee:	FAE-SPF

Public Comment No. 226-NFPA 1970-2023 [Section No. 9.74]

~~**9.74** – Footwear Breathability Test.~~

~~**9.74.1** – Application.~~

~~This test method shall apply to protective footwear.~~

~~**9.74.2** – Samples.~~

~~**9.74.2.1** –~~

~~Samples for conditioning shall be complete footwear.~~

~~**9.74.2.2** –~~

~~Samples shall be tested after being subjected to the conditioning procedure specified in 9.1.3 .~~

~~**9.74.3** – Specimens.~~

~~A minimum of three complete footwear items men's size 9 middle width, including booties where provided, shall be tested.~~

~~**9.74.4** – Apparatus.~~

~~The test apparatus shall be as specified in ASTM D8041/D8041M, *Standard Test Method for Whole Boot Breathability (MVTR)* .~~

~~**9.74.5** – Procedure.~~

~~Specimens shall be tested as specified by Option 1 in ASTM D8041/D8041M, *Standard Test Method for Whole Boot Breathability (MVTR)* .~~

~~**9.74.6** – Report.~~

~~**9.74.6.1** –~~

~~The moisture gain in grams and moisture vapor transmission rate in grams per hour (g/hr) shall be reported for each specimen.~~

~~**9.74.6.2** –~~

~~The average moisture gain and moisture vapor transmission rate shall be calculated for all tested specimens.~~

~~**9.74.6.3** –~~

~~Representative photographs of the test specimen in the test apparatus shall be provided as part of the test report.~~

~~**9.74.7** – Interpretation.~~

~~The average moisture vapor transmission rate shall be used for reporting purposes.~~

Statement of Problem and Substantiation for Public Comment

An investigation of this test method as applied to several different types of footwear revealed a high degree of variability with only general discrimination between boots that are breathable versus those that are not breathable (i.e., rubber footwear styles). Therefore, the test is being removed.

Related Item

• FR104

Submitter Information Verification

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Submittal Date: Wed Jan 04 16:19:53 EST 2023
Committee: FAE-SPF

Public Comment No. 231-NFPA 1970-2023 [Section No. 9.76]

~~**9.76** – Footwear Flexibility Test.~~

~~**9.76.1** – Application.~~

~~This test method shall apply to protective footwear.~~

~~**9.76.2** – Samples.~~

~~**9.76.2.1** –~~

~~Samples for conditioning shall be complete footwear.~~

~~**9.76.2.2** –~~

~~Samples shall be tested after being subjected to the conditioning procedure specified in 9.1.3 .~~

~~**9.76.3** – Specimens.~~

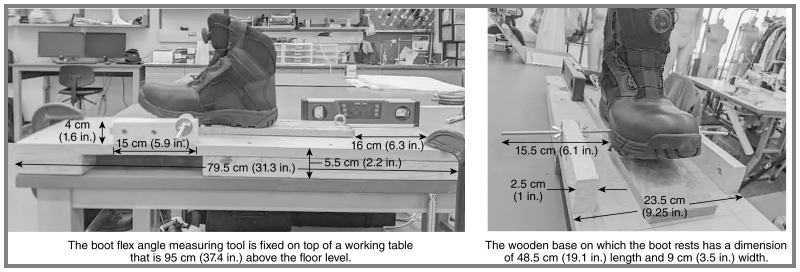
~~A minimum of three complete footwear items, men's size 9 middle width, shall be tested.~~

~~**9.76.4** – Apparatus.~~

~~9.76.4.1~~ –

~~Testing shall be performed using a custom-made footwear flex measurement tool that is shown in~~ ~~Figure 9.76.4.1(a)~~ ~~through~~ ~~Figure 9.76.4.1(c)~~ .

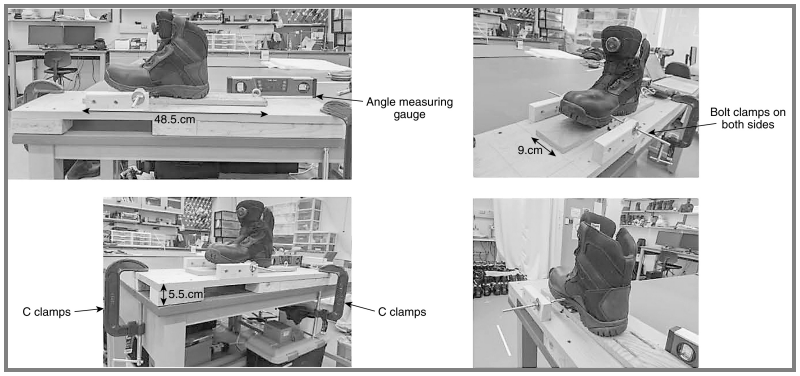
~~Figure 9.76.4.1(a) Dimensions of Footwear Flex Measurement Tool.~~



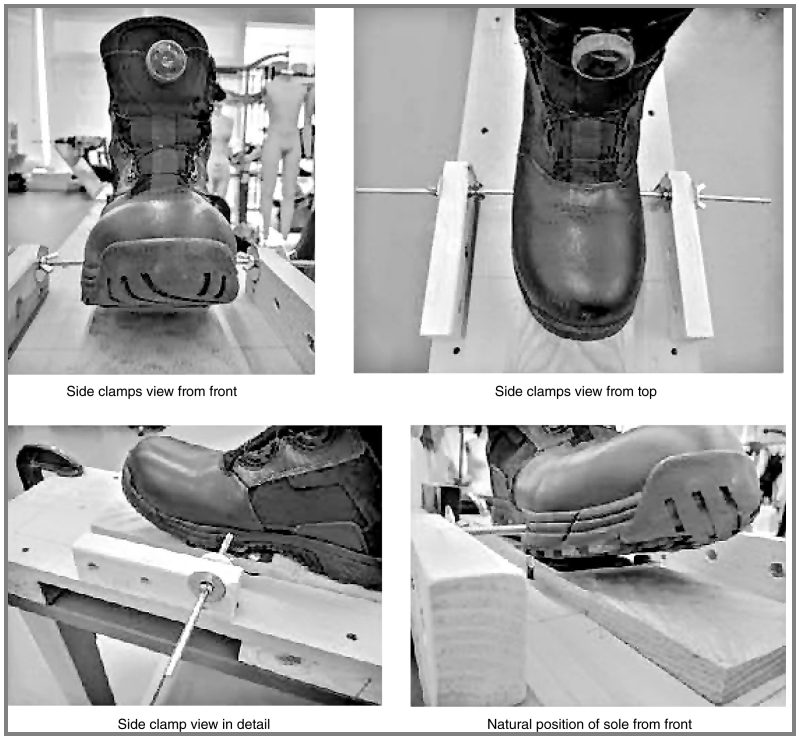
The boot flex angle measuring tool is fixed on top of a working table that is 95 cm (37.4 in.) above the floor level.

The wooden base on which the boot rests has a dimension of 48.5 cm (19.1 in.) length and 9 cm (3.5 in.) width.

~~Figure 9.76.4.1(b) Configuration of Test Apparatus for Footwear Flex Measurement Tool.~~



~~Figure 9.76.4.1(c) Selected Views of Footwear Flex Measurement Tool Set Up.~~



9.76.4.2 –

C-clamps shall be used to secure the footwear specimens to the footwear flex measurement tool.

9.76.4.3 –

An angle measuring level with an accuracy of 1 degree shall be used to measure the angle of the specimen in the footwear flex measurement tool.

9.76.4.4 –

A vertical, hand-held force gauge with hook having a capacity of 50 kg (110 lb) force with a precision of 0.2 kg (**1/2** lb) force shall be used to measure the force of the specimen when flexed to the specified angle.

9.76.5 – Procedure.

9.76.5.1 –

The specimen shall first be flexed by hand to locate the correct flex position and marked with tape starting from one side, going under the sole and then finishing on the other side of the boot sole.

9.76.5.2 –

The specimen shall be stuffed with crumpled 20 lb printing paper in the lower footwear vamp section.

~~**9.76.5.3** –~~

~~The specimen shall be placed on the bottom bracket of the footwear flex measurement tool, with the bottom tape aligned to the bottom hinge.~~

~~**9.76.5.4** –~~

~~The bolts of the footwear flex measurement device on the sides and the tape on the boot from both sides shall be aligned.~~

~~**9.76.5.5** –~~

~~The tension of the wing-bolt tension on each side shall be adjusted to get a firm hold on the specimen from each side.~~

~~**9.76.5.6** –~~

~~A check for any sideways movements shall be made by holding the specimen from the front and back with lateral movement.~~

~~**9.76.5.7** –~~

~~The angle measuring level shall be positioned for showing the incline of the hinged plate.~~

~~**9.76.5.8** –~~

~~The force gauge shall be attached to the back eyelet of the footwear flex measurement tool.~~

~~**9.76.5.9** –~~

~~The force shall be measured at a deflection of 30 degrees three times for each specimen.~~

~~**9.76.6** – Report.~~

~~**9.76.6.1** –~~

~~The force measured for each deflection iteration shall be reported for each specimen.~~

~~**9.76.6.2** –~~

~~The average force at a deflection of 30 degrees shall be calculated for all tested specimens.~~

~~**9.76.6.3** –~~

~~Representative photographs of the test specimen in the test apparatus shall be provided as part of the test report.~~

~~**9.76.7** – Interpretation.~~

~~The average force shall be used for reporting purposes.~~

Statement of Problem and Substantiation for Public Comment

A single laboratory investigation for applying this test method indicated that additional rigor would be needed to justify this requirement even though some differences in footwear were observed.

Related Item

• FR107

Submitter Information Verification

Submitter Full Name: Jeffrey Stull
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Submittal Date: Wed Jan 04 16:54:33 EST 2023
Committee: FAE-SPF

Public Comment No. 137-NFPA 1970-2023 [Section No. 9.77]

~~**9.77** – Cylinder Thermal Protective Performance (CTPP) Test.~~

~~**9.77.1** – Application.~~

~~**9.77.1.1** –~~

~~This test method shall apply to multilayer protective garment composites and glove body composites.~~

~~**9.77.1.2** –~~

~~Modifications to this test method for testing garment composites shall be as specified in 9.77.8 .~~

~~**9.77.1.3** –~~

~~Modifications to this test method for testing glove body composites shall be as specified in 9.77.9 .~~

~~**9.77.2** – Samples.~~

~~Samples shall measure 140 mm x 280 mm ± 5 mm (5.5 in. x 11 in. ± 1/8 in.) and shall consist of all layers representative of the clothing item being tested. Where testing woven textiles, the long dimension shall be parallel to the warp yarns.~~

~~**9.77.3** – Specimens.~~

~~**9.77.3.1** –~~

~~Thermal protective performance testing shall be conducted on three specimens of each unique composite.~~

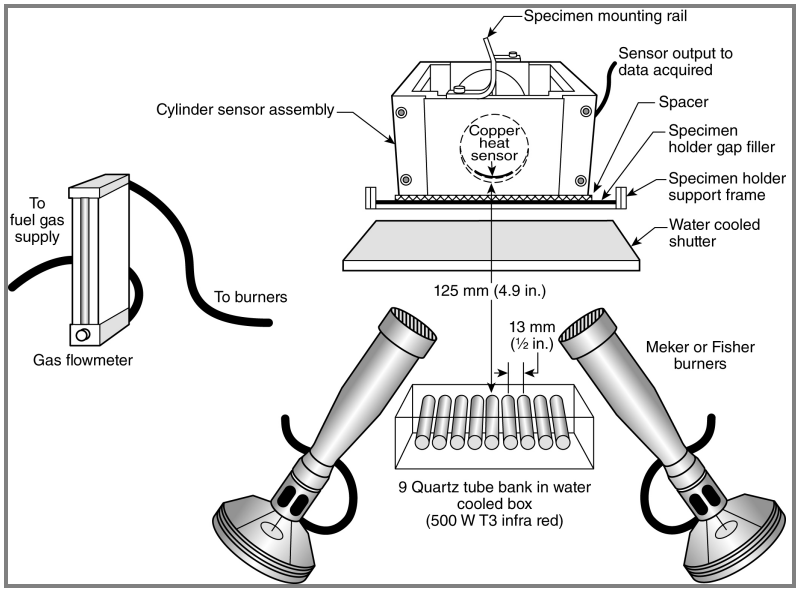
~~**9.77.3.2** –~~

~~Specimens shall be tested after conditioning as specified in 9.1.3 .~~

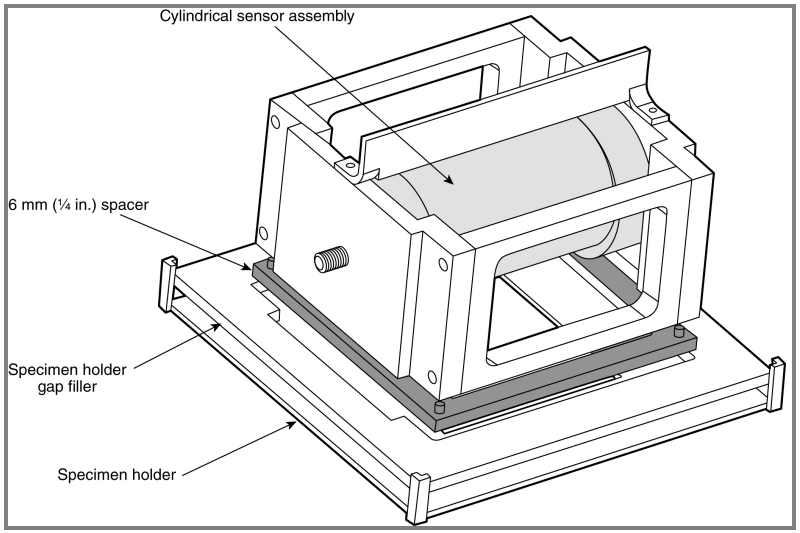
~~**9.77.4** – Apparatus.~~

~~The test apparatus specified in ISO 17492, *Clothing for protection against heat and flame—determination of heat transmission on exposure to both flame and radiant heat* , shall be used with the following exception. The coper calorimeter sensor assembly specified in ASTM F2700, *Standard Test Method for Unsteady-State Heat Transfer Evaluation of Flame-Resistant Materials for Clothing with Continuous Heating* , shall be replaced with the cylinder calorimeter specimen test assembly shown in Figure 9.77.4(a) and Figure 9.77.4(b) .~~

~~Figure 9.77.4(a) Apparatus Used to Measure Cylinder Heat Transfer Performance of Textile Materials.~~



~~Figure 9.77.4(b) Cylindrical Specimen Test Assembly (Cylindrical Sensor Assembly, Gap Filler, Holder, and Spacer).~~



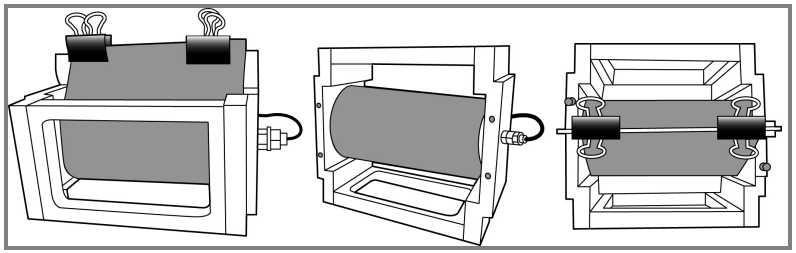
9.77.5 – Procedure.

Thermal protective performance testing shall be performed in accordance with ISO 17492, *Clothing for protection against heat and flame—determination of heat transmission on exposure to both flame and radiant heat,* except as provided in 9.77.5.1 .

9.77.5.1 –

Specimens shall be mounted to the cylindrical sensor assembly as shown in Figure 9.77.5.1 . The 140 mm (5.5 in.) wide specimens shall be wrapped lengthwise around the cylinder with the edges of the fabric on the larger diameter cylinder at each end of the tester inside the frame as shown in Figure 9.77.5.1 . The free ends of the specimen shall be clamped to the specimen mounting rail with spring clamps. The surface that is worn next to the skin shall face up toward the copper calorimeter.

Figure 9.77.5.1 Specimen Mounting.



9.77.5.1.1 –

The specimen shall be placed on the cylinder so that it creates a smooth cylinder and shall not be pulled toward, nor bow away from, the sensor.

9.77.6 – Report.

9.77.6.1 –

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

9.77.6.2 –

The average CTPP rating shall be calculated and reported.

9.77.6.3 –

Where a CTPP rating is greater than 60, then the CTPP rating shall be recorded and reported as ">60."

9.77.7 – Interpretation.

9.77.7.1 –

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

9.77.7.2 –

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

9.77.8 – Specific Requirements for Testing Garments.

9.77.8.1 –

Specimens shall consist of outer shell, moisture barrier, and thermal barrier. Winter liners shall not be included in the test composite. Collar lining fabric shall be permitted to be included in the protective garment collar fabric composite specimen. Specimens shall not include seams. Specimens shall not be stitched to hold individual layers together during testing.

9.77.8.2 –

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

9.77.8.3 –

Testing shall be performed as described in 9.77.2 through 9.77.7 .

9.77.9 – Specific Requirements for Testing Protective Glove Body Composites.

9.77.9.1 –

Specimens shall be representative of each glove body composite construction. All variations in composite construction, including number of layers 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).

9.77.9.2 –

For glove body composites, samples for conditioning shall be in the form of a pouch as described in 9.1.14 .

9.77.9.3 –

Specimens shall be tested both before and after conditioning as specified in 9.1.2 and then conditioned as specified in 9.1.3 .

9.77.9.4 –

~~After conditioning, the pouch and stitching shall be cut to form 140 mm x 280 mm ± 5 mm (5.5 in. x 11 in. ± 1/8 in.) specimens for testing. Specimens shall not include seams where multiple layers are involved, except in the following cases:~~

(1) ~~Where a ridged area or similar stitching is used to create specific performance characteristics rather than for glove assembly~~

(2) ~~Where size constraints of a material make it necessary to allow stitching to create the sample size required~~

~~9.77.9.4.1~~ ~~–~~

~~Stitching shall be of the same type as is used in the actual glove construction.~~

~~9.77.9.4.2~~ ~~–~~

~~Specimens shall not be stitched to hold individual layers together during testing.~~

~~9.77.9.5~~ ~~–~~

~~Testing shall be performed as described in 9.77.2 through 9.77.7 .~~

~~9.77.9.6~~ ~~–~~

~~The requirements of 9.77.7.2 shall not apply.~~

Statement of Problem and Substantiation for Public Comment

Revise or delete this test method based on the relevance established from the task group testing

Related Item

• FR167

Submitter Information Verification

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Submittal Date: Tue Jan 03 14:42:46 EST 2023
Committee: FAE-SPF

Public Comment No. 208-NFPA 1970-2023 [Section No. 9.77]

9.77 Cylinder Thermal Protective Performance (CTPP) Test.

9.77.1 Application.

9.77.1.1

This test method shall apply to multilayer protective garment composites and glove body composites.

9.77.1.2

Modifications to this test method for testing garment composites shall be as specified in 9.77.8.

9.77.1.3

Modifications to this test method for testing glove body composites shall be as specified in 9.77.9.

9.77.2 Samples.

Samples shall measure 140 mm x 280 mm ± 5 mm (5.5 in. x 11 in. ± ⅛ in.) and shall consist of all layers representative of the clothing item being tested. Where testing woven textiles, the long dimension shall be parallel to the warp yarns.

9.77.3 Specimens.

9.77.3.1

~~Thermal~~ Cyliner thermal protective performance testing shall be conducted on three specimens of each unique composite ASTM F3538 Standard Test Method for .

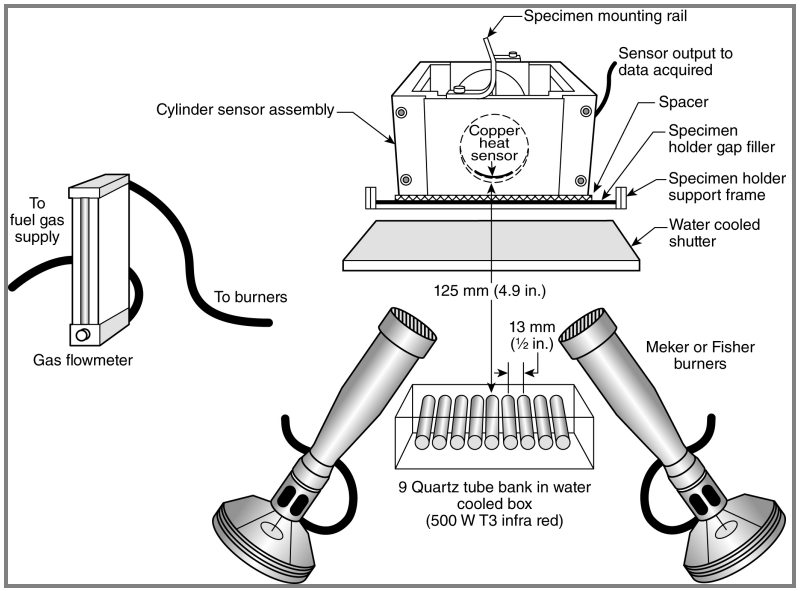
9.77.3.2

Specimens shall be tested after conditioning as specified in 9.1.3.

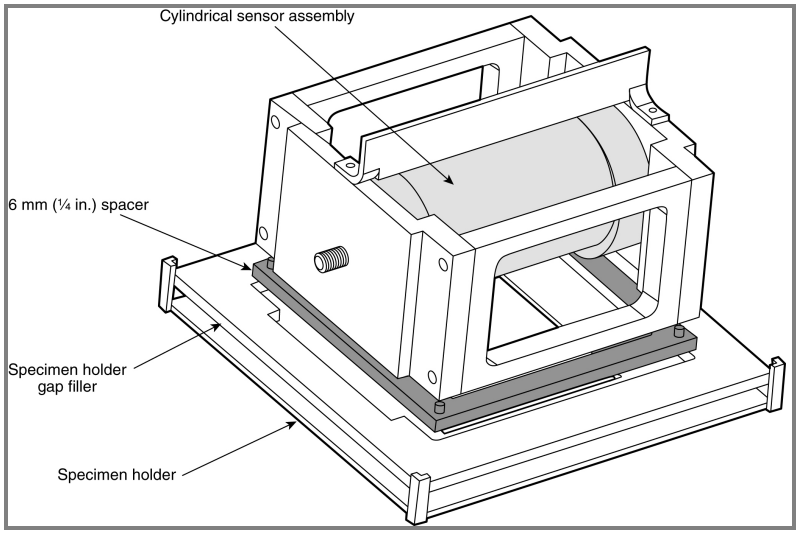
9.77.4 Apparatus.

The test apparatus ~~specified in ISO 17492, *Clothing for protection against heat and flame—determination of heat transmission on exposure to both flame and radiant heat* , shall be used with the following exception. The coper calorimeter sensor assembly~~ shall be as specified in ASTM ~~F2700~~ F3538 ,~~Standard~~ Standard Test Method for ~~Unsteady-State Heat Transfer Evaluation of~~ Measuring Heat Transmission Through Flame-Resistant Materials for Clothing ~~with Continuous Heating, shall be replaced with the cylinder calorimeter specimen test assembly shown in Figure 9.77.4(a) and Figure 9.77.4(b) .~~

~~Figure 9.77.4(a) Apparatus Used to Measure Cylinder Heat Transfer Performance of Textile Materials.~~



~~Figure 9.77.4(b) Cylindrical Specimen Test Assembly (Cylindrical Sensor Assembly, Gap Filler, Holder, and Spacer).~~



in Flame Exposure Using a Cylindrical Specimen Holder.

9.77.5 Procedure.

~~Thermal~~

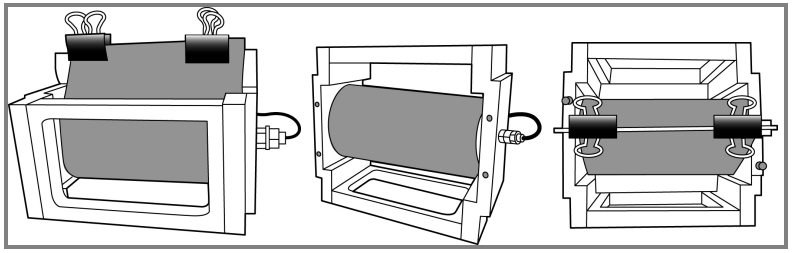
Cylinder thermal protective performance testing shall be performed in accordance with

~~ISO 17492, *Clothing for protection against heat and flame—determination of heat transmission on exposure to both flame and radiant heat,* except as provided in 9.77.5.1 .~~

~~**9.77.5.1** –~~

~~Specimens shall be mounted to the cylindrical sensor assembly as shown in Figure 9.77.5.1 . The 140 mm (5.5 in.) wide specimens shall be wrapped lengthwise around the cylinder with the edges of the fabric on the larger diameter cylinder at each end of the tester inside the frame as shown in Figure 9.77.5.1 . The free ends of the specimen shall be clamped to the specimen mounting rail with spring clamps. The surface that is worn next to the skin shall face up toward the copper calorimeter.~~

~~**Figure 9.77.5.1 Specimen Mounting.**~~



~~**9.77.5.1.1** –~~

~~The specimen shall be placed on the cylinder so that it creates a smooth cylinder and shall not be pulled toward, nor bow away from, the sensor.~~

~~9.77.~~

ASTM 3538 Standard Test method for Measuring Heat Transmissions Through Flame-Resistant materials for Clothing in Flame Exposure Using a Cylinderical Specimen Holder.

9.77.6 Report.

9.77.6.1

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

9.77.6.2

The average CTPP rating shall be calculated and reported.

9.77.6.3

Where a CTPP rating is greater than 60, then the CTPP rating shall be recorded and reported as ">60."

9.77.7 Interpretation.

9.77.7.1

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

9.77.7.2

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

9.77.8 Specific Requirements for Testing Garments.

9.77.8.1

Specimens shall consist of outer shell, moisture barrier, and thermal barrier. Winter liners shall not be included in the test composite. Collar lining fabric shall be permitted to be included in the protective garment collar fabric composite specimen. Specimens shall not include seams. Specimens shall not be stitched to hold individual layers together during testing.

9.77.8.2

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

9.77.8.3

Testing shall be performed as described in 9.77.2 through 9.77.7 .

9.77.9 Specific Requirements for Testing Protective Glove Body Composites.

9.77.9.1

Specimens shall be representative of each glove body composite construction. All variations in composite construction, including number of layers 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).

9.77.9.2

For glove body composites, samples for conditioning shall be in the form of a pouch as described in 9.1.14 .

9.77.9.3

Specimens shall be tested both before and after conditioning as specified in 9.1.2 and then conditioned as specified in 9.1.3 .

9.77.9.4 _

After conditioning, the pouch and stitching shall be cut to form 140 mm x 280 mm ± 5 mm (5.5 in. x 11 in. ± 1/8 in.) specimens for testing. Specimens shall not include seams where multiple layers are involved, except in the following cases:

(1) Where a ridged area or similar stitching is used to create specific performance characteristics rather than for glove assembly

(2) Where size constraints of a material make it necessary to allow stitching to create the sample size required

9.77.9.4.1 _

Stitching shall be of the same type as is used in the actual glove construction.

9.77.9.4.2 _

Specimens shall not be stitched to hold individual layers together during testing.

9.77.9.5 _

Testing shall be performed as described in 9.77.2 through 9.77.7 .

9.77.9.6 _

The requirements of 9.77.7.2 shall not apply.

Statement of Problem and Substantiation for Public Comment

This adds the recently approved ASTM standard and removes the procedural language from the section.

Related Item

• FR 167

Submitter Information Verification

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Submittal Date: Wed Jan 04 14:26:45 EST 2023
Committee: FAE-SPF

Public Comment No. 138-NFPA 1970-2023 [Section No. 9.78]

~~**9.78** – Small-Scale Flash Fire Exposure Test 1.~~

~~**9.78.1** – Application.~~

~~**9.78.1.1** –~~

~~This test method shall apply to protective garment and hood composites.~~

~~**9.78.2** – Samples.~~

~~**9.78.2.1** –~~

~~Single-layer specimens shall be 310 mm x 375 mm ±5 mm (12 in. x 15 in. ± 3/16 in.).~~

~~**9.78.2.1.1** –~~

~~For multilayer composite specimens, the innermost layer shall be 310 mm x 375 mm ±5 mm (12 in. x 15 in. ± 3/16 in.). Each subsequent layer shall increase in the longest direction by 6 mm (1/4 in).~~

~~**9.78.2.2** –~~

~~Specimens shall consist of all layers used in the construction of the element, excluding any areas with special reinforcements.~~

~~**9.78.2.3** * –~~

~~Specimens consisting of multiple layers shall be fastened together and shall be constructed so that the outermost layer receives all initial direct flame contact.~~

~~**9.78.2.4** –~~

~~The ends of the specimen shall be folded so as to not crease the fabric and shall be fastened together so that the surface worn next to the skin comprises the inside of the cylindrical specimen. The ends shall overlap no more than 13 mm (0.5 in.) to form a cylindrical sleeve that is 310 mm ± 5 mm (12 1/4 in. ± 1/4 in.) tall and has an interior circumference of 360 mm ± 5 mm (14 1/4 in. ± 1/4 in.).~~

~~**9.78.3** – Specimens.~~

~~**9.78.3.1** –~~

~~Three specimens shall be tested.~~

~~**9.78.3.2** –~~

~~Specimens shall be tested after conditioning as specified in 9.1.3 .~~

~~**9.78.4** – Apparatus.~~

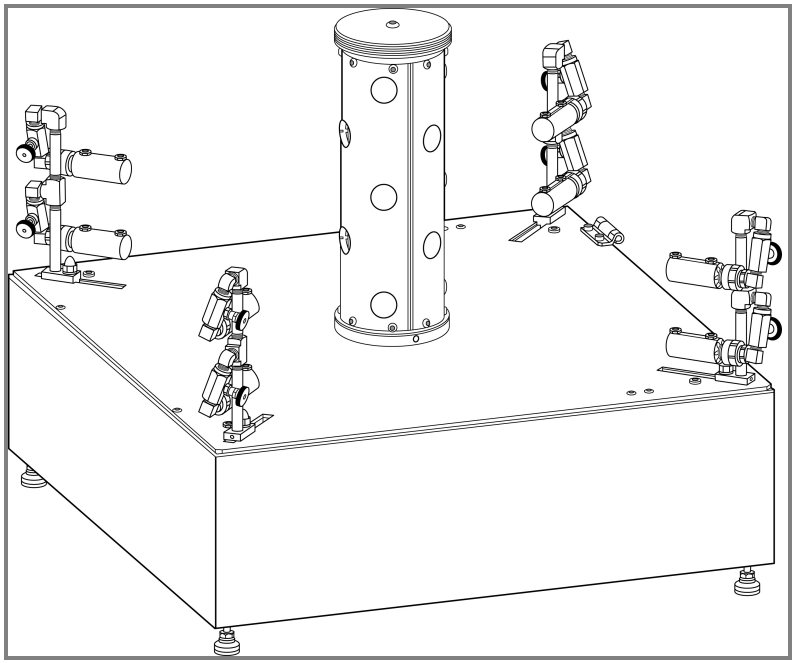
9.78.4.1 –

The test apparatus shall be as specified in ASTM WK70964, *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Clothing Materials for Protection Against Fire Simulations (Cylinder Method)* .

9.78.4.2 –

The measurement apparatus configuration shall consist of a vertically aligned instrumented cylinder, specimen holder assembly, fuel and fuel delivery system, data acquisition hardware, and data analysis software programs. *(See Figure 9.78.4.2 .)*

Figure 9.78.4.2 General Arrangement of Apparatus.



9.78.4.2.1 –

A vertically aligned instrumented cylinder measuring 310 mm (12 **1** / **4** in.) tall and 102 mm (4 in.) in diameter shall be used.

9.78.4.2.2 –

The cylinder surface shall be constructed of thermally stable, nonmetallic materials that will not contribute fuel to the combustion process. The resulting cylinder shall be compatible with cleaning by damp cloth or compatible cleaning liquid and not be damaged by moisture, high humidity, or cleaning liquid.

9.78.4.2.3 * –

Copper calorimeter thermal energy sensors shall be used. Each sensor shall have the capacity to measure the incident heat flux over a range from 0.0 to 165 kW/m ^{2} (0.0 to 4.0 cal/s-cm ^{2}).

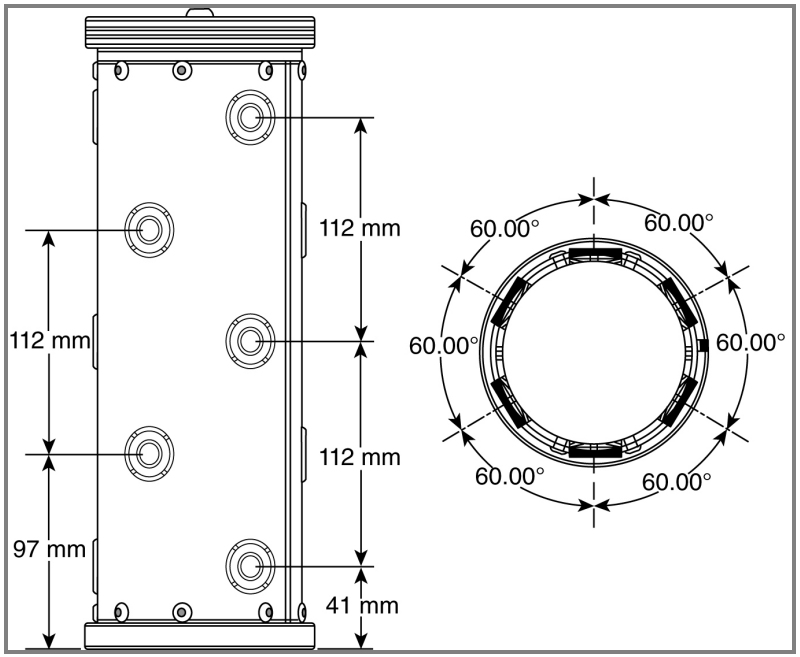
9.78.4.2.4 –

The sensors shall be constructed of a material with known thermal and physical characteristics that shall be used to indicate the time-varying heat flux received by the sensors. The minimum response time for the thermal-energy-sensor data acquisition system shall be ≤ 0.2 s.

9.78.4.2.5 –

Fifteen thermal energy sensors shall be used. The sensors shall be uniformly distributed about the cylinder configured as six alternating columns of two and three sensors spaced 60° apart *(see Figure 9.78.4.2.5).* The representative surface area for each sensor shall be defined by a polygon projected onto the cylinder surface passing through the midpoints of lines drawn between each sensor.

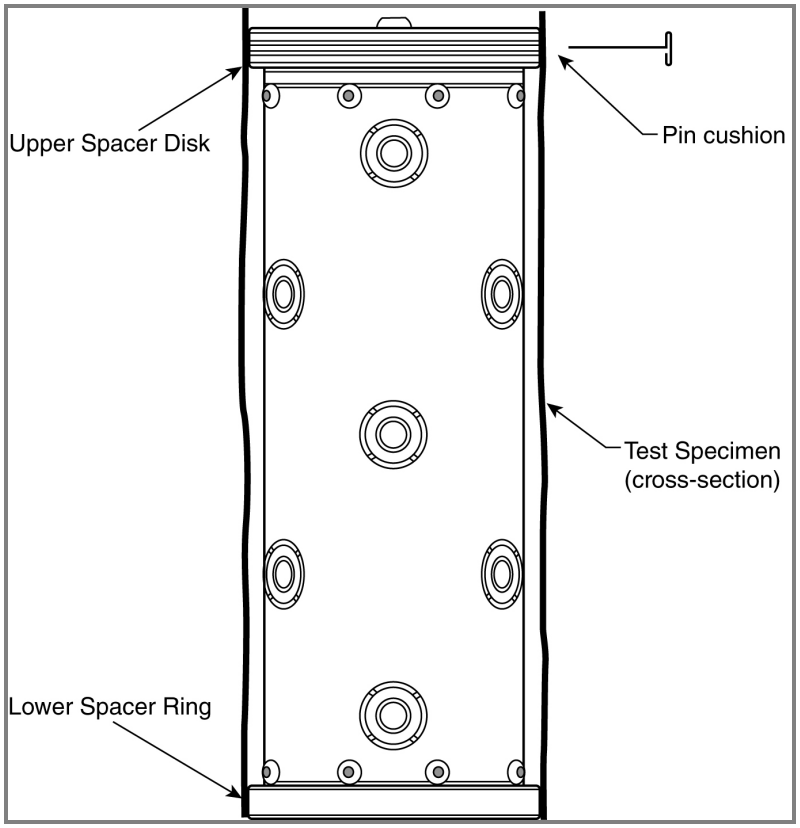
Figure 9.78.4.2.5 Details of Sensor Placement About Cylinder.



9.78.4.2.6 –

A provision shall be made to secure the specimen and maintain even spacing between the test specimen and the instrumented cylinder, and especially necessary for test specimens that are unable to support their own weight and maintain a uniform cylindrical shape. Spacing shall be established by a lower spacer ring and two upper spacer disks, and the specimen shall be secured to a flame-resistant pin cushion. *(See Figure 9.78.4.2.6 .)*

Figure 9.78.4.2.6 Details of Specimen Mounting and Retention.



9.78.4.2.7 * –

A flat disk of flame-resistant, thermally stable, nonmetallic materials that will not contribute fuel to the combustion process shall be used. The material shall allow pins to pass through it, while holding the pins steady throughout the fire exposure.

9.78.4.3 –

The apparatus shall be equipped with fuel supply, delivery, and burner systems to provide reproducible fire exposures.

9.78.4.3.1 –

The propane fuel source shall be liquefied petroleum (LP) gas meeting the HD-5 specification in ASTM D1835, *Standard Specification for Liquified Petroleum (LP) Gases* .

9.78.4.4 –

A system of piping, a pressure regulator, valves, and pressure sensors shall be provided to safely deliver gaseous propane to the pilot/exposure burners. The delivery system shall be able to provide an average heat flux of at least 84 kW/m ^{2} ± 4.2 kW/m ^{2} (2.0 cal/s-cm ^{2} ±0.1 cal/s-cm ^{2}) for an exposure time of at least 8 s, and up to 20 s. The fuel delivery system shall be controlled to provide known exposure duration within ±0.1 s of the set exposure time and the remaining gas between the last valve and the burner shall not exceed 220 cm ^{3} (310 in. ^{3}). The remaining excess gas in the line, after the valve closure, shall not continue to flame more than 0.1 s at the burner.

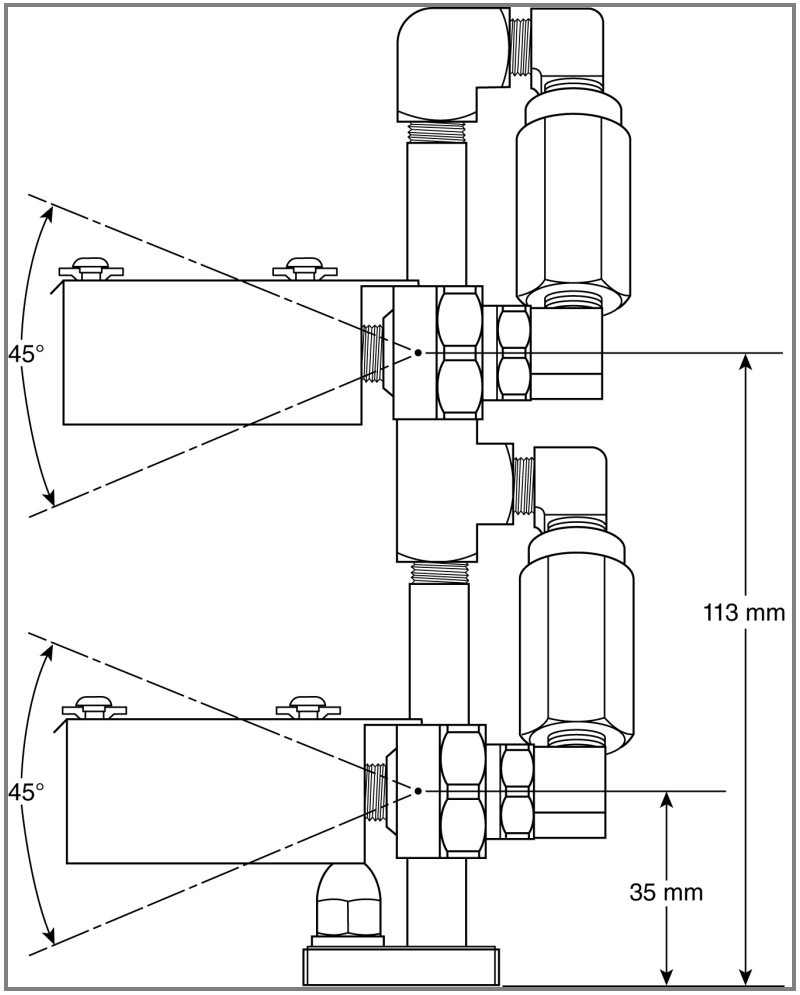
9.78.4.5 –

The burner system shall consist of eight exposure burners arranged in four evenly spaced burner towers with two exposure burners each.

9.78.4.5.1 –

Burners shall be cylindrical with 23 mm (1 in.) inside diameter, 50 mm (2 in.) length, 1.9 mm (1/16 in.) gas orifices, and an operating pressure of 15–20 psi. *(See Figure 9.78.4.5.1 .)*

Figure 9.78.4.5.1 Burner Detail.



9.78.4.5.2 –

The four burner towers *(see Figure 9.78.4.5.1)* shall be distributed at 90-degree intervals around the cylinder. The distance to the cylinder, vertical position, and directional aim of each burner shall be adjustable to yield the exposure level and uniformity described in 9.78.5.3 , 9.78.5.3.1 , and 9.78.5.3.2 .

9.78.4.5.3 –

A standing pilot flame ignition system shall be used. The ignition system shall not interfere with the flame exposure pattern. The ignition system shall be interlocked to the burner gas supply valves to prevent premature or erroneous opening of these valves. Any electrical magnetic field generated by the ignition system shall be small enough so as not to interfere with the quality of the data acquisition and recording process.

9.78.4.6 –

A system shall be provided with the capability of acquiring and storing the results of the measurement from each sensor at least ten times per second for the data acquisition period.

9.78.4.6.1 –

The accuracy of the measurement system shall be less than ±2.0°C (±3.6°F) for temperature measurements. The minimum resolution of the measurement system shall be 0.01°C (±0.018°F).

9.78.4.7 –

The software shall log the output from the thermal energy sensors in identifiable files for the preset time at or above the minimum specified data acquisition rate.

9.78.4.7.1 –

The software shall convert the recorded thermal sensor outputs into a measured heat flux using a method for the thermal energy sensor design. This shall include accounting for the heat losses from the surface and sides of the sensor.

9.78.4.7.2 –

The incident heat flux at each sample point for each thermal energy sensor shall be calculated using the calibration characteristics determined in 9.78.5.2.3 . These values shall be stored for use in calculating the average incident heat flux and its standard deviation for nude exposures as required in 9.78.5.3 .

9.78.4.7.3 –

Using the absorption characteristics of the thermal energy sensors, the absorbed heat flux for each sensor for each sample point shall be calculated and stored.

9.78.4.7.4 –

In addition to monitoring and controlling the operation of the fire, data acquisition systems, and carrying out the incident heat flux and absorbed heat flux, the computer software shall be used to prepare some of the materials for the report, sensors calibrations, and so on.

9.78.5 – Calibration.

9.78.5.1 –

Calibration shall be performed in accordance with ASTM WK70964, *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Clothing Materials for Protection Against Fire Simulations (Cylinder Method)* .

9.78.5.2 – Sensor Calibration.

9.78.5.2.1 –

The thermal energy sensors shall be calibrated using a pure radiant energy source of known characteristics. A traceable calibration heat flux reference sensor shall be used when setting the energy levels for these calibrations. Each thermal energy sensor shall be calibrated before the required flame exposure conditions for specimen testing are set.

9.78.5.2.2 –

The reference heat flux sensor shall be calibrated against a suitable NIST (or other recognized standards body) traceable reference with an accuracy of ±5 percent. Sensors shall be calibrated to at least 40 kW/m^2, and shall demonstrate linearity over this range to extrapolate up to 84 kW/m^2.

9.78.5.2.3 –

Using the calibration energy source, each sensor shall be exposed over the range of 3 to 100 kW/m^2 (0.07 to 2.5 cal/s-cm^2). A minimum of two different heat flux levels shall be used for this calibration, one representative of nude exposure conditions and the other representative of conditions under a test specimen. The heat fluxes produced by the calibration energy source with the reference heat flux sensor shall be measured.

9.78.5.2.4 –

A calibration function shall be generated such that each thermal energy sensor calculates heat flux to within 5 percent of the reference heat flux sensor at all calibration points.

9.78.5.2.5 –

Calibration of each sensor shall be conducted prior to commissioning a new cylinder, and at least once annually thereafter or whenever a sensor is repaired or replaced, and whenever the results appear to have shifted or to differ from the expected values.

9.78.5.3 –

The procedure specified in 9.78.6 shall be used to expose the nude cylinder to the test fire for 4 s. The average calculated incident heat flux shall be confirmed to be 84 kW/m^2 ± 5 percent and its standard deviation of the average heat flux value shall not be greater than 10 kW/m^2 (0.24 cal/s-cm^2) using the procedure in 9.78.5.3.1. If the calculated average heat flux or standard deviation is not within these specifications, the cause shall be determined and corrected before proceeding with specimen testing.

9.78.5.3.1 –

The average value of all sensors shall be determined, and the sensor calibrations and characteristics shall be taken into account. The average heat flux value reported shall be the average of the averages for each of the sensors for the steady region of the exposure duration.

9.78.5.3.1.1 –

The averaging interval for the nude exposure of any duration shall be determined as starting to include the first datapoint where the average heat flux value across all sensors is ≥ 60 kW/m^2 and ending to include the last datapoint where the average heat flux across all sensors is ≥ 60 kW/m^2.

9.78.5.3.2 –

The incident heat flux values calculated for each sensor shall be used to calculate the cumulative incident thermal energy for the cylinder. The cumulative incident thermal energy of the cylinder shall be stored in a file for future use in determining the energy ratio value.

9.78.5.3.2.1 –

Cumulative incident thermal energy shall include the entire test period of exposure time plus extended data acquisition time. For nude exposures, the extended data acquisition time shall be at least 20 s.

9.78.5.3.3 –

The nude cylinder shall be exposed to the flames before testing a set of specimens and the nude exposure shall be repeated at the conclusion of the testing of the set.

9.78.5.3.3.1 –

The cumulative incident thermal energy of the cylinder shall be measured and recorded at the conclusion of the test set. This cumulative incident thermal energy file shall be averaged with the pretest cumulative incident thermal energy file for future use in determining the energy ratio value.

9.78.5.3.4 –

The duration of the fire exposure shall be controlled by the internal clock of the computer control system. The measured duration of the exposure shall be the specified value ± 0.1 s or ± 5 percent, whichever is smaller.

9.78.5.3.5 –

The average heat flux calculated in 9.78.5.3.1 shall be the specified test condition ±5 percent. If not, the fuel flow rate shall be adjusted by modifying the gas pressure or flow at the burner heads. The calibration run(s) shall be repeated until the specified value is obtained. Repeat nude calibrations shall only be conducted when the average temperature of all sensors is less than 34°C (93°F) and no single sensor temperature exceeds 38°C (100°F) to eliminate the effect of any elevated internal temperature or temperature gradients on the calculation of the heat flux.

9.78.5.3.6 –

The sensors shall be cooled after an exposure with a jet of air (or contact with a cold surface) to an average temperature of 32°C ± 2°C (90°F ± 4°F) with no single sensor exceeding 38°C (100°F). A measurement shall not proceed until the sensor temperatures have stabilized (less than 1°C (1.8°F) temperature change for a 1-min duration).

9.78.6 – Procedure.

9.78.6.1 –

The results from three test specimen exposures shall be required for determination of an energy ratio value.

9.78.6.2 –

The specimen shall be placed around the instrumented cylinder so that the overlapped specimen ends (seam) are not covering any sensors. The specimen shall be fastened to the sample holder by inserting pins through the fabric specimen and into the pin cushion. A minimum of four pins, spaced at approximately 90-degree intervals shall be used to mount the specimen.

9.78.6.3 –

An exposure time of 10 s shall be selected.

9.78.6.4 –

A minimum data acquisition time of 120 s shall be used.

9.78.6.4.1 –

Where the amount of transmitted energy is not constant for the last ten seconds of acquisition time, the acquisition time shall be increased to achieve this requirement.

9.78.6.5 –

It shall be confirmed that the pilot flames, including the pilot flames on the burners, are lit.

9.78.6.6 –

The test exposure shall be initiated by pressing the computer or remote key. The computer program shall start the data acquisition, open the burner gas supply solenoid valves for the time of the exposure, and stop the data acquisition at the end of the specified time.

9.78.6.7 –

The data shall be collected from all installed thermal energy sensors. The data collection during and after the fire exposure shall be done in a still-air environment with the fume hood shielded or turned off.

9.78.6.8 –

The requirements in 9.78.6.2 through 9.78.6.7 shall be repeated until all specimens have been exposed. Before starting the next exposure, it shall be ensured that the average temperature of all the sensors is 32°C ± 2°C (90°F ± 4°F) and no single sensor exceeds 38°C (100°F).

9.78.7 – Calculation of Results.

9.78.7.1 –

The energy ratio value shall be calculated using the following:

$$ERV = \frac{Q_{transferred}}{Q_{incident} \times \frac{t_{test}}{t_{cal}}} \qquad \text{[9.78.7.1]}$$

where:

$Q_{transferred}$ = the cumulative thermal energy calculated transferred through the subject material in a material test run

$Q_{incident}$ = the averaged cumulative incident thermal energy calculated during the last heat flux calibration before testing a sample set and during the first heat flux calibration after testing a sample set

t_{cal} = the average exposure duration, in seconds, of the heat flux calibrations used to determine $Q_{incident}$ (maximum 4 s)

t_{test} = the exposure duration, in seconds, of the material test run

~~**9.78.7.1.1** –~~

~~The average of three individual specimen test energy ratio values shall be calculated and reported as the sample average energy ratio value.~~

~~**9.78.8** – Report.~~

~~**9.78.8.1** –~~

~~The individual test ERV of each specimen shall be recorded and reported.~~

~~**9.78.8.2** –~~

~~The average ERV shall be calculated and reported.~~

~~**9.78.9** – Interpretation.~~

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

Statement of Problem and Substantiation for Public Comment

Revise or delete this test method based on the relevance established from the task group testing

Related Item

• FR170

Submitter Information Verification

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Committee: FAE-SPF

Public Comment No. 222-NFPA 1970-2023 [Section No. 9.78.4.1]

9.78.4.1

The test apparatus shall be as specified in ASTM ~~WK70964~~ Insert new Standard Designation here , *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Clothing Materials for Protection Against Fire Simulations (Cylinder Method)*.

Statement of Problem and Substantiation for Public Comment

The ASTM Committee responsible for this Standard has current ballot activity that aims to resolve all previous negative votes. A full ASTM Standard Test Method should be available for reference in the coming weeks.

Related Item

- FR-170

Submitter Information Verification

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Committee: FAE-SPF

Public Comment No. 139-NFPA 1970-2023 [Section No. 9.79]

~~**9.79** – Small-Scale Flash Fire Exposure Test.~~

~~**9.79.1** – Application.~~

~~**9.79.1.1** –~~

~~This test method shall apply to protective gloves.~~

~~**9.79.2** – Samples.~~

~~**9.79.2.1** –~~

~~Samples for conditioning shall be size 70W gloves, as determined by the hand dimensions given in Figure 7.7.4.1 .~~

~~**9.79.3** – Specimens.~~

~~**9.79.3.1** –~~

~~Five whole protective gloves shall be tested.~~

~~**9.79.3.2** –~~

~~Specimens shall be tested after conditioning as specified in 9.1.3 .~~

~~**9.79.4** – Apparatus.~~

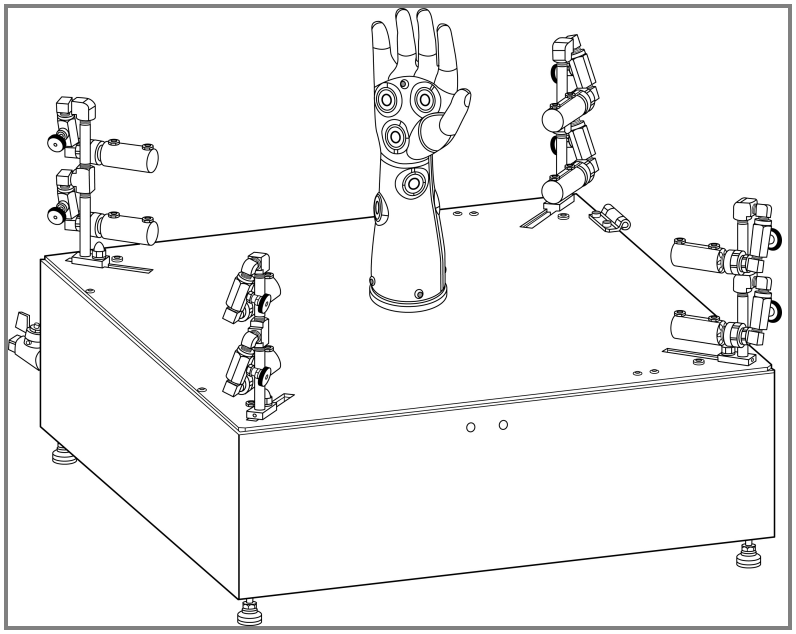
~~**9.79.4.1** –~~

~~The test apparatus shall be that specified in ASTM WK76082, *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Gloves for Protection Against Fire Simulations (Hand Form Method)* .~~

~~**9.79.4.2** –~~

The measurement apparatus configuration shall consist of a vertically aligned instrumented hand form, fuel and fuel delivery system, data acquisition hardware, and data analysis software programs. *(See Figure 9.79.4.2 .)*

Figure 9.79.4.2 General Arrangement of Apparatus.



9.79.4.2.1 –

A vertically aligned hand form measuring approximately 365 mm (14.5 in.) tall, having a hand circumference of 232–272 mm (7.79–9.13 in.), and having a hand length of 186–196 mm (6.96-7.32 in.) shall be used.

9.79.4.2.2 –

The hand-form surface shall be constructed of thermally stable, nonmetallic materials that will not contribute fuel to the combustion process. The resulting hand form shall be compatible with cleaning by damp cloth or compatible cleaning liquid and not be damaged by moisture, high humidity, or cleaning liquid.

9.79.4.2.3 * –

Copper calorimeter thermal energy sensors shall be used. Each sensor shall have the capacity to measure the incident heat flux over a range from 0.0 to 165 kW/m ^{2} (0.0 to 4.0 cal/s·cm ^{2}).

9.79.4.2.4 –

The sensors shall be constructed of a material with known thermal and physical characteristics that shall be used to indicate the time-varying heat flux received by the sensors. The minimum response time for the thermal-energy-sensor data acquisition system shall be ≤ 0.2 s.

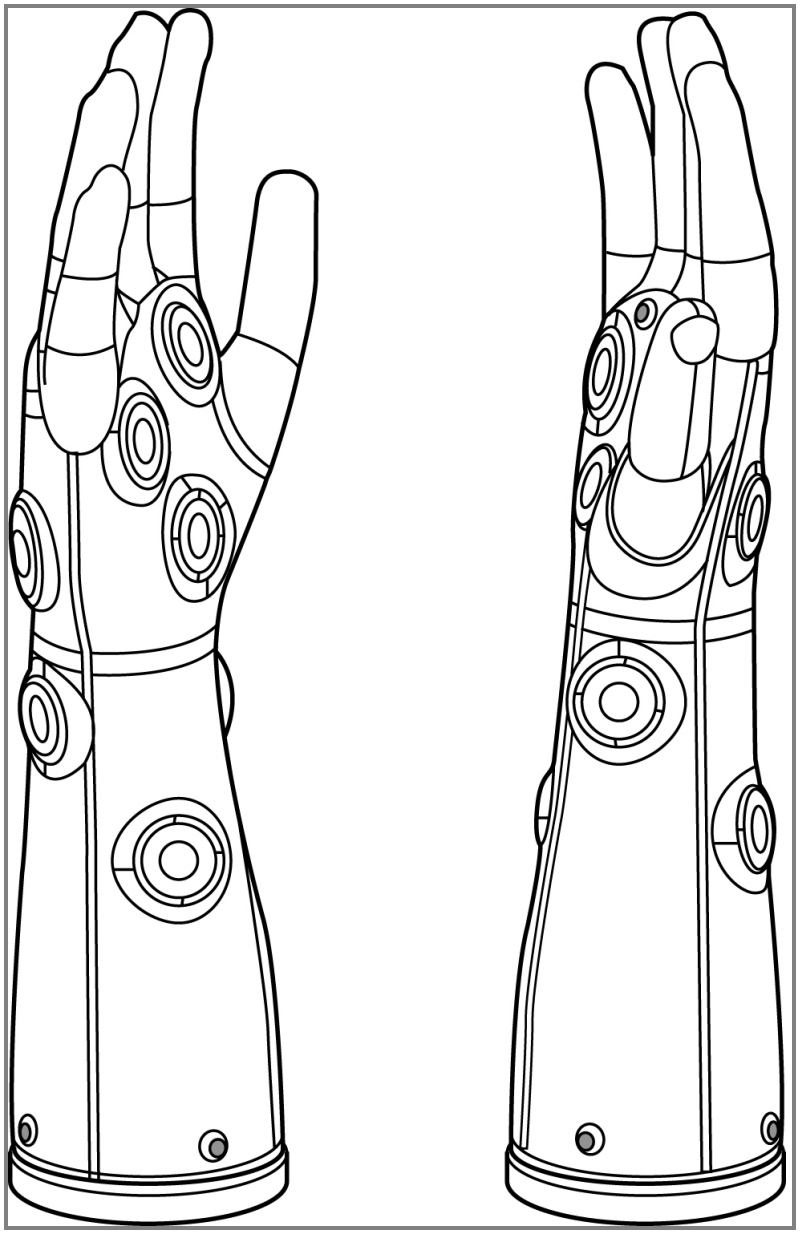
9.79.4.2.5 –

~~Ten thermal energy sensors shall be used. The sensors shall be uniformly distributed about the hand form, excluding the fingers.~~

~~9.79.4.2.5.1~~ –

~~Uniform distribution shall be achieved by distributing three thermal energy sensors on the palm, three thermal energy sensors on the back of the hand, and four thermal energy sensors on the wrist/forearm. The representative surface area for each sensor shall be defined by a polygon projected onto the hand form surface passing through the midpoints of lines drawn between each sensor.~~ ~~*(See Figure 9.79.4.2.5.1 .)*~~

~~Figure 9.79.4.2.5.1 Details of Sensor Placement About Hand Form.~~



~~**9.79.4.3**~~ ~~–~~

~~The apparatus shall be equipped with fuel supply, delivery, and burner systems to provide reproducible fire exposures.~~

9.79.4.3.1 –

The propane fuel source shall be liquefied petroleum (LP) gas meeting the HD-5 specification in ASTM D1835, *Standard Specification for Liquified Petroleum (LP) Gases* .

9.79.4.4 –

A system of piping, a pressure regulator, valves, and pressure sensors shall be able to provided to deliver gaseous propane to the pilot/exposure burners. The delivery system shall be able to provide an average heat flux of at least 84 kW/m ^{2} ± 4.2 kW/m ^{2} (2.0 cal/s-cm ^{2} ±0.1 cal/s-cm ^{2}) for an exposure time of at least 8 s, and up to 20 s. The fuel delivery system shall be controlled to provide known exposure duration within ±0.1 s of the set exposure time and the remaining gas between the last valve and the burner shall not exceed 220 cm ^{3} . The remaining excess gas in the line, after the valve closure, shall not continue to flame more than 0.1 s at the burner.

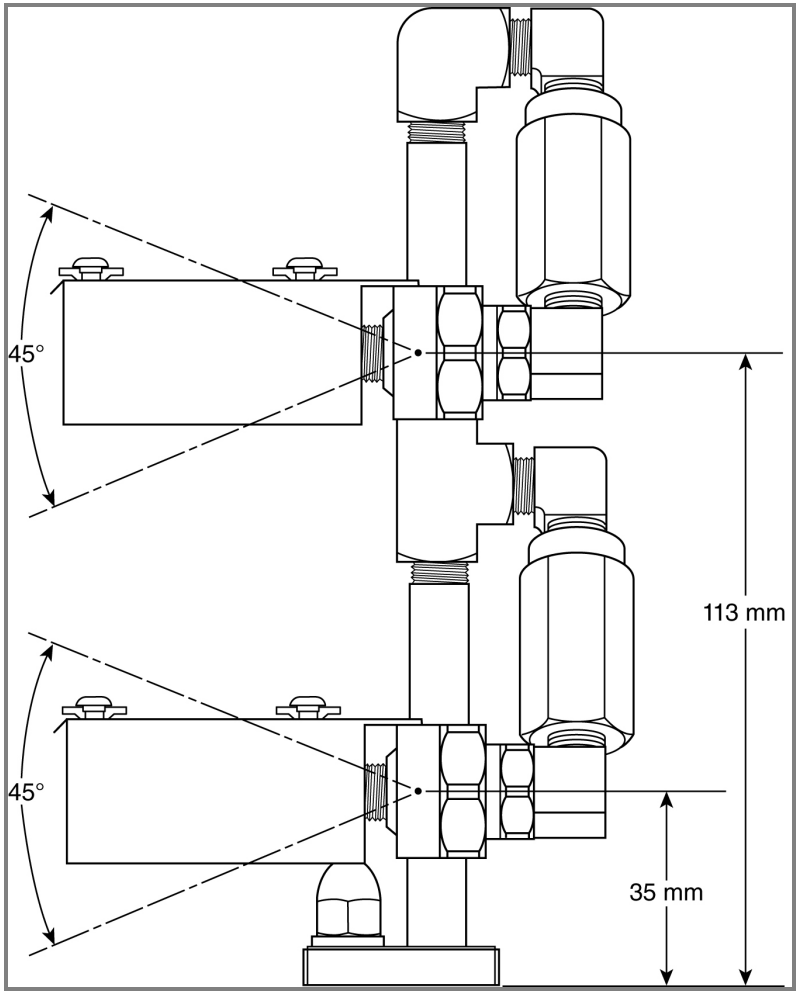
9.79.4.5 –

The burner system shall consist of eight exposure burners arranged in four evenly spaced burner towers with two exposure burners each.

9.79.4.5.1 –

Burners shall be cylindrical with 23 mm (1 in.) inside diameter, 50 mm (2 in.) length, 1.9 mm (1/16 in.) gas orifices, and an operating pressure of 15–20 psi. *(See Figure 9.79.4.5.1 .)*

Figure 9.79.4.5.1 Burner Detail.



9.79.4.5.2 –

The four burner towers shall be distributed at 90-degree intervals around the hand form. The distance to the hand form, vertical position, and directional aim of each burner shall be adjustable to yield the exposure level and uniformity described in 9.79.5.3 , 9.79.5.3.1 , and 9.79.5.3.2 .

9.79.4.5.3 –

A standing pilot flame ignition system shall be used. The ignition system shall not interfere with the flame exposure pattern. The ignition system shall be interlocked to the burner gas supply valves to prevent premature or erroneous opening of these valves. Any electrical magnetic field generated by the ignition system shall be small enough so as not to interfere with the quality of the data acquisition and recording process.

9.79.4.6 –

A system shall be provided with the capability of acquiring and storing the results of the measurement from each sensor at least ten times per second for the data acquisition period.

9.79.4.6.1 –

The accuracy of the measurement system shall be less than ±2.0°C (±3.6°F) for temperature measurements.

9.79.4.7 –

The software shall log the output from the thermal energy sensors in identifiable files for the preset time at or above the minimum specified data acquisition rate.

9.79.4.7.1 –

The software shall convert the recorded thermal sensor outputs into a measured heat flux using a method for the thermal energy sensor design. This shall include accounting for the heat losses from the surface and sides of the sensor.

9.79.4.7.2 –

The incident heat flux at each sample point for each thermal energy sensor shall be calculated using the calibration characteristics determined in 9.79.5.2.3 . These values shall be stored for use in calculating the average incident heat flux and its standard deviation for nude exposures as required in 9.79.5.3 .

9.79.4.7.3 –

Using the absorption characteristics of the thermal energy sensors, the absorbed heat flux for each sensor for each sample point shall be calculated and stored.

9.79.4.7.4 –

In addition to monitoring and controlling the operation of the fire, data acquisition systems, and carrying out the incident heat flux and absorbed heat flux, the computer software shall be used to prepare some of the materials for the report, sensors calibrations, and so on.

9.79.5 – Calibration.

9.79.5.1 –

Calibration shall be performed in accordance with ASTM WK 76082, *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Gloves for Protection Against Fire Simulations (Hand Form Method)*.

9.79.5.2 – Sensor Calibration.

9.79.5.2.1 –

The thermal energy sensors shall be calibrated using a pure radiant energy source of known characteristics. A traceable calibration heat flux reference sensor shall be used when setting the energy levels for these calibrations. Each thermal energy sensor shall be calibrated before the required flame exposure conditions for specimen testing are set.

9.79.5.2.2 –

The reference heat flux sensor shall be calibrated against a suitable NIST (or other recognized standards body) traceable reference with an accuracy of ±5 percent. Sensors shall be calibrated to at least 40 kW/m^2, and shall demonstrate linearity over this range to extrapolate up to 84 kW/m^2.

9.79.5.2.3 –

Using the calibration energy source, each sensor shall be exposed over the range of 3 to 100 kW/m^2 (0.07 to 2.5 cal/s-cm^2). A minimum of two different heat flux levels shall be used for this calibration, one representative of nude exposure conditions and the other representative of conditions under a test specimen. The heat fluxes produced by the calibration energy source with the reference heat flux sensor shall be measured.

9.79.5.2.4 –

A calibration function shall be generated such that each thermal energy sensor calculates heat flux to within 5 percent of the reference heat flux sensor at all calibration points.

9.79.5.2.5 –

Calibration of each sensor shall be conducted prior to commissioning a new instrumented hand form, and at least once annually thereafter or whenever a sensor is repaired or replaced, and whenever the results appear to have shifted or differ from the expected values.

9.79.5.3 –

The procedure specified in 9.79.6 shall be used to expose the nude hand form to the test fire for 4 s or for the test duration, if less than 4 s. The average calculated incident heat flux shall be confirmed to be 84 kW/m^2 ± 5 percent and its standard deviation of the average heat flux value shall not be greater than 10 kW/m^2 (0.24 cal/s-cm^2) using the procedure in 9.79.5.3.1. If the calculated average heat flux or standard deviation is not within these specifications, the cause shall be determined and corrected before proceeding with specimen testing.

9.79.5.3.1 –

The average value of all sensors shall be determined, and the sensor calibrations and characteristics shall be taken into account. The average heat flux value reported shall be the average of the averages for each of the sensors for the steady region of the exposure duration.

9.79.5.3.1.1 –

The averaging interval for the nude exposure of any duration shall be determined as starting to include the first datapoint where the average heat flux value across all sensors is ≥ 60 kW/m^2 and ending to include the last datapoint where the average heat flux across all sensors is ≥ 60 kW/m^2.

9.79.5.3.2 –

The incident heat flux values calculated for each sensor shall be used to calculate the cumulative incident thermal energy for the hand form. The cumulative incident thermal energy of the hand form shall be stored in a file for future use in determining the energy ratio value.

9.79.5.3.2.1 –

Cumulative incident thermal energy shall include the entire test period of exposure time plus extended data acquisition time. For nude exposures, the extended data acquisition time shall be at least 20 s. For specimen exposures, the extended data acquisition time shall be at least 120 s.

9.79.5.3.3 –

The nude hand form shall be exposed to the flames before testing a set of specimens and the nude exposure shall be repeated at the conclusion of the testing of the set.

9.79.5.3.3.1 –

The cumulative incident thermal energy of the hand form shall be measured and recorded at the conclusion of the test set. This cumulative incident thermal energy file shall be averaged with the pretest cumulative incident thermal energy file for future use in determining the energy ratio value.

9.79.5.3.4 –

The duration of the fire exposure shall be controlled by the internal clock of the computer control system. The measured duration of the exposure shall be the specified value ± 0.1 s or ± 5 percent, whichever is smaller.

9.79.5.3.5 –

The average heat flux calculated in 9.79.5.3.1 shall be the specified test condition ±5 percent. If not, the fuel flow rate shall be adjusted by modifying the gas pressure or flow at the burner heads. The calibration run(s) shall be repeated until the specified value is obtained. Repeat nude calibrations shall only be conducted when the average temperature of all sensors is less than 34°C (93°F) and no single sensor temperature exceeds 38°C (100°F) to eliminate the effect of any elevated internal temperature or temperature gradients on the calculation of the heat flux.

9.79.5.3.6 –

The sensors shall be cooled after an exposure with a jet of air (or contact with a cold surface) to an average temperature of 32°C ± 2°C (90°F ± 4°F) with no single sensor exceeding 38°C (100°F). A measurement shall not proceed until the sensor temperatures have stabilized (less than 1°C (1.8°F) temperature change for a 1 min duration).

9.79.6 – Procedure.

9.79.6.1 –

The results from three glove specimen exposures shall be required for determination of an energy ratio value.

9.79.6.2 –

The specimen shall be placed onto the instrumented hand form so that the glove specimen is pulled fully down onto the hand form with each digit of the hand form occupying one digit of the glove specimen.

9.79.6.3 –

An exposure time of 10 s shall be selected.

9.79.6.4 –

A minimum data acquisition time of 120 s shall be used.

9.79.6.4.1 –

Where the amount of transmitted energy is not constant for the last ten seconds of acquisition time, the acquisition time shall be increased to achieve this requirement.

9.79.6.5 –

It shall be confirmed that the pilot flames, including the pilot flames on the burners, are lit.

9.79.6.6 –

The test exposure shall be initiated by pressing the computer or remote key. The computer program will start the data acquisition, open the burner gas supply solenoid valves for the time of the exposure, and stop the data acquisition at the end of the specified time.

9.79.6.7 –

The data shall be collected from all installed thermal energy sensors. The data collection during and after the fire exposure shall be done in a still-air environment with the fume hood shielded or turned off.

9.79.6.8 –

Any afterflame time, melting, and dripping shall be observed and recorded.

9.79.6.9 –

The requirements in 9.79.6.2 through 9.79.6.8 shall be repeated until all specimens have been exposed. Before starting the next exposure, it shall be ensured that the average temperature of all the sensors is 32°C ± 2°C (90°F ± 4°F) and no single sensor exceeds 38°C (100°F).

9.79.7 – Calculation of Results.

9.79.7.1 –

The energy ratio value shall be calculated using the following:

$$ERV = \frac{Q_{transferred}}{Q_{incident} \times \frac{t_{test}}{t_{cal}}} \quad [9.79.7.1]$$

where:

$Q_{transferred}$ = the cumulative thermal energy calculated transferred through the subject material in a material test run

$Q_{incident}$ = the averaged cumulative incident thermal energy calculated during the last heat flux calibration before testing a sample set and during the first heat flux calibration after testing a sample set

t_{cal} = the average exposure duration, in seconds, of the heat flux calibrations used to determine $Q_{incident}$ (maximum 4 s)

t_{test} = the exposure duration, in seconds, of the material test run

9.79.7.1.1 –

The average of three individual specimen test energy ratio values shall be calculated and reported as the sample average energy ratio value.

9.79.8 – Report.

9.79.8.1 –

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

9.79.8.2 –

The average ERV shall be calculated and reported.

9.79.8.3 –

The average afterflame time and its location shall be calculated and reported.

9.79.8.4 –

Observations of melting and dripping shall be reported.

9.79.9 – Interpretation.

9.79.9.1 –

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

9.79.9.2 –

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

9.79.9.3 –

Pass or fail determinations shall be based on individual specimen observations of melting and dripping.

Statement of Problem and Substantiation for Public Comment

Revise or delete this test method based on the relevance established from the task group testing

Related Item

• FR172

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Committee: FAE-SPF

Public Comment No. 223-NFPA 1970-2023 [Section No. 9.79.2.1]

9.79.2.1

Samples for conditioning shall be size ~~70W~~ 76W gloves, as determined by the hand dimensions given in Figure 7.7.4.1.

Statement of Problem and Substantiation for Public Comment

correcting specimen glove size

Related Item

• FR-172

Submitter Information Verification

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Committee: FAE-SPF

Public Comment No. 224-NFPA 1970-2023 [Section No. 9.79.4.1]

9.79.4.1

The test apparatus shall be that specified in ASTM ~~WK76082~~ Insert new ASTM Standard Designation here , *Standard Test Method for Bench-Scale Evaluation of Flame-Resistant Gloves for Protection Against Fire Simulations (Hand Form Method).*

Statement of Problem and Substantiation for Public Comment

The ASTM Committee responsible for this Standard has current ballot activity that aims to resolve all previous negative votes. A full ASTM Standard Test Method should be available for reference in the coming weeks.

Related Item

• FR-172

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Public Comment No. 127-NFPA 1970-2023 [Section No. 9.83]

9.83 Test Method for Acceptable Levels of Specific Restricted Substances.

9.83.1

Specified components of specified protective elements shall be evaluated for each listed restricted substance or category of restricted substances and not exceed the maximum concentration as specified in Table 9.83.1(a).

Table 9.83.1(a) Test Methods for Evaluating Protective Element Components for Specific Restrictive Substances

Chemical Class or Group	Restricted Substance(s)	Test Method
Acidity and alkaline substances	Measured by reporting pH	Textiles and artificial leather: ISO 3071 using KCl solution Leather: ISO 4045
Akyl phenols and ethoxylates	4-tert Butylphenol, Nonylphenol, Octylphenol, Heptaphenol, and Pentylphenol	Textiles and leather: ISO 21084 Polymers and other materials: 1 g sample/20 mL THF, sonification for 60 min at 70°C (158°F) with analysis per ISO 21084
	Nonylphenolethoxylates and Octylphenol-ethoxylates	All materials except leather: ISO 18254-1 with analysis using LC/MS or LC/MS/MS Leather: ISO 18218-1 with quantification using ISO 18254-1
Azo-amines and aryl amine salts	See Table 8.20(b)	All materials except leather: ISO 14362-1 Leather: ISO 17234-1 For p-Aminoazobenzene: All materials except leather: ISO 14362-3 Leather: ISO 17234-2:2011
Bisphenol	Bisphenol A	All materials: Extraction: 1 g sample/20 ml THF, sonication for 60 minutes at 60°C (140°F), analysis with LC/MS
Chlorinated benzenes and toluenes	See Table 8.20(c)	All materials: EN 17137
Chlorinated paraffins	Short chain chlorinated paraffins, SCCP, (C10–C13) and medium chain chlorinated paraffins, MCCP, (C14–C17)	Textiles:

Chemical Class or Group	Restricted Substance(s)	Test Method
		ISO 22818 (SCCP + MCCP) Leather: ISO 18219-1 (SCCP) ISO 18219-2 (MCCP)
Chlorinated phenols	Pentachlorophenol Tetrachlorophenols Trichlorophenols Dichlorophenols Monochlorophenols	All materials: DIN 50009
Dimethylfumarate	Dimethylfumarate	All materials: ISO 16186
Dyes	See Table 8.20(d)	All materials: DIN 54231
	Navy Blue: Component 1: $C_{39}H_{23}ClCrN_7O_{12}S.2Na$; and Component 2: $C_{46}H_{30}CrN_{10}O_{20}S_2.3Na$	All materials: DIN 54231
Flame retardants	See Table 8.20(e)	All materials: ISO 17881-1 and ISO 17881-2
Formaldehyde	Free and partially releasable	All materials except leather: ISO 14184-1 Leather: ISO 17226-2 with ISO 17226-1 (confirmation method in case of interferences)
Heavy metals, extractable	Antimony, Arsenic, Barium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Nickel, and Selenium	All materials except leather: EN 16711-2 Leather: ISO 17072-1
	Chromium VI	Textiles: EN 16711-2 with ISO 17075-1 if Chromium is detected Leather: ISO 17075-1 and ISO 17075-2 for confirmation in case the extract causes interference; alternatively, ISO 17075-2:2017 is permitted to be used on its own
Heavy metals, total content	Arsenic, Cadmium, and Mercury	All materials except leather: EN 16711-2: Leather: ISO 17072-1

Chemical Class or Group	Restricted Substance(s)	Test Method
	Lead	All materials: CPSC-CH-E1002-08.3
Monomers	Styrene, free	Extraction in Methanol; GC/MS, sonication at 60°C (140°F) for 60 minutes
	Vinyl Chloride	All materials: ISO 6401
Nitrosamines	See Table 8.20(f)	All materials: ISO 19577
Organotin Compounds	Tributyltin (TBT), Triphenyltin (TPhT), and chemicals in Table 8.20(g)	All materials: ISO/TS 16179
Ortho-phenylphenol	Ortho-phenylphenol	All materials: DIN 50009
Per- and polyfluorinated compounds	See Table 9.83.1(b)	All materials: ISO 23702-1
Phthalates	See Table 8.20(h)	Sample preparation for all materials: CPSC-CH-C1001-09.4 Measurement: Textiles: GC/MS, ISO 14389 All materials except textiles: GC/MS
Polycyclic aromatic hydrocarbons (PAH)	See Table 8.20(i)	All materials: AFPS GS 2019
Quinoline	Quinoline	All materials: DIN 54231 with methanol extraction at 70°C (158°F)
Solvent residues	Dimethylformamide, and N-Methyl-2-Pyrrolidone	Textiles: EN 17131 All other materials: ISO/TS 16189
UV stabilizers	2-Benzotriazol-2-yl-4,6-di-tert-butylphenol (UV 320), 2,4-Di-tert-butyl-6-(5-chlorobenzotriazol-2-yl) phenol (UV 327), 2-(2H-Benzotriazol-2-yl)-4,6-di-tert-penthylphenol (UV 328), and 2-(2H-Benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV 350)	EN 62321-6; extraction in THF, analysis by GC/MS)

Table 9.83.1(b) Per- and Polyfluorinated Compounds Subject to Analysis

Per- and Polyfluorinated Compounds	CAS Number
Perfluorooctane Sulfonic Acid and Sulfonates (PFOS)	1763-23-1, et al.
Perfluorooctane Sulfonamide (PFOSA)	754-91-6
Perfluorooctance Sulfonfuoride (PFOSF)	307-35-7
N-Methyl Perfluorooctane Sulfonamide (N-Me-FOSA)	31506-32-8
N-Ethyl Perfluorooctane Sulfonamide (N-Et-FOSA	4151-50-2
N-Methyl Perfluorooctane Sulfonamide Ethanol (N-Me-FOSE)	24448-09-7
N-Ethyl Perfluorooctane Sulfonamide Ethanol (N-Et-FOSE)	1691-99-2
Perfluorooctanoic Acid and salts (PFOA)	375-85-9, et al.
Perfluoroheptanoic Acid and salts (PFHpA)	335-67-1, et al.
Perfluorononanoic Acid and salts (PFNA)	375-95-1, et al.
Perfluorodecanoic Acid and salts (PFDA)	335-76-2, et al.
Henicocafluoroundecanoic Acid and salts (PFUdA)	2058-94-8, et al.
Trisafluorododecanoic Acid and salts (PFDoA)	307-55-1, et al.
Pentacosafluorotridecanoic Acid and salts (PFTrDA)	72629-94-8, et al.
Heptacosafluorotetradecanoic Acid and salts (PFTeDA)	376-06-7, et al.
1H,1H,2H,2H-Perfluorooctyl Acrylate (8:2 FTA)	27905-45-9
1H,1H,2H,2H-Perfluoro-1-decanol (8:2 FTOH)	678-39-7
1H,1H,2H,2H-Perfluorodecanesuphonic Acid and its salts (8:2 FTS)	39108-34-4, et al.

9.83.2

Alternative test methods shall be permitted if the test method is capable of providing a lower limit of quantification that is at least 50 percent of the specified limit established for the respective substance in Table 8.20(a) and that provide an 80 percent or better recovery of the respective substance from the tested material or component can be demonstrated.

Additional Proposed Changes

File Name	Description	Approved
ORAFOL_Americas_NFPA_1970_Comment_12292022.docx	Comments on section 9.83	

Statement of Problem and Substantiation for Public Comment

Confirmation of methods, requirements and due diligence for the addition of this work

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 126-NFPA 1970-2023 [Section No. 8.20]	

Related Item

• FR-223 • FR-222

Submitter Information Verification

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Submittal Date: Tue Jan 03 10:45:33 EST 2023
Committee: FAE-SPF

Public Comment No. 150-NFPA 1970-2023 [Section No. 9.83.1]

9.83.1

Specified components of specified protective elements shall be evaluated for each listed restricted substance or category of restricted substances and not exceed the maximum concentration as specified in Table 9.83.1(a).

Table 9.83.1(a) Test Methods for Evaluating Protective Element Components for Specific Restrictive Substances

Chemical Class or Group	Restricted Substance(s)	Test Method		
Acidity and alkaline substances	Measured by reporting pH	Textiles and artificial leather:		
		-	-	ISO 3071 using KCl solution
		-	-	Leather: ISO 4045
Akyl phenols and ethoxylates	4-tert Butylphenol, Nonylphenol, Octylphenol, Heptaphenol, and Pentylphenol	Textiles and leather: ISO 21084		
		-	-	Polymers and other materials: 1 g sample/20 mL THF, sonification for 60 min at 70°C (158°F) with analysis per ISO 21084
	-	Nonylphenolethoxylates and Octylphenol-ethoxylates	All materials except leather:	
		-	-	ISO 18254-1 with analysis using LC/MS or LC/MS/MS
		-	-	Leather: ISO 18218-1 with quantification using ISO 18254-1
Azo-amines and aryl amine salts	See Table 8.20(b)	All materials except leather:		
		-	-	ISO 14362-1
		-	-	Leather: ISO 17234-1
		-	-	For p-Aminoazobenzene:
		-	-	All materials except leather:
		-	-	ISO 14362-3
		-	-	Leather:
		-	-	ISO 17234-2:2011
Bisphenol	Bisphenol A	All materials:		
		-	-	Extraction: 1 g sample/20 ml THF,

Chemical Class or Group	Restricted Substance(s)	Test Method		
		-	-	sonication for 60 minutes at 60°C (140°F), analysis with LC/MS
Chlorinated benzenes and toluenes	See Table 8.20(c)	All materials: EN 17137		
Chlorinated paraffins	Short chain chlorinated paraffins, SCCP, (C10–C13) and medium chain chlorinated paraffins, MCCP, (C14–C17)	Textiles:		
		-	-	ISO 22818 (SCCP + MCCP)
		-	-	Leather:
		-	-	ISO 18219-1 (SCCP) -
		-	ISO 18219-2 (MCCP)	
Chlorinated phenols	Pentachlorophenol	All materials: DIN 50009		
	-	Tetrachlorophenols	-	-
	Trichlorophenols	-		
	-	Dichlorophenols	-	-
	Monochlorophenols	-		
Dimethylfumarate	Dimethylfumarate	All materials: ISO 16186		
Dyes	See Table 8.20(d)	All materials: DIN 54231		
	-	Navy Blue: Component 1: $C_{39}H_{23}ClCrN_7O_{12}S.2Na$; and Component 2: $C_{46}H_{30}CrN_{10}O_{20}S_2.3Na$	All materials: DIN 54231	
Flame retardants	See Table 8.20(e)	All materials: ISO 17881-1 and ISO 17881-2		
Formaldehyde	Free and partially releasable	All materials except leather:		
		-	-	ISO 14184-1
		-	-	Leather: ISO 17226-2 with ISO 17226-1 (confirmation method in case of interferences)
		-	-	

Chemical Class or Group	Restricted Substance(s)	Test Method		
Heavy metals, extractable	Antimony, Arsenic, Barium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Nickel, and Selenium	All materials except leather:		
		-	-	EN 16711-2
		-	-	Leather: ISO 17072-1
		Chromium VI	Textiles: EN 16711-2 with ISO 17075-1 if Chromium is detected	
	-			Leather: ISO 17075-1 and ISO 17075-2 for confirmation in case the extract causes interference; alternatively, ISO 17075-2:2017 is permitted to be used on its own
		-	-	
Heavy metals, total content	Arsenic, Cadmium, and Mercury	All materials except leather:		
		-	-	EN 16711-2:
		-	-	Leather: ISO 17072-1
	-	Lead	All materials:	
		-	-	CPSC-CH-E1002-08.3
Monomers	Styrene, free	Extraction in Methanol; GC/MS, sonication at 60°C (140°F) for 60 minutes		
	-	Vinyl Chloride	All materials: ISO 6401	
Nitrosamines	See Table 8.20(f)	All materials: ISO 19577		
Organotin Compounds	Tributyltin (TBT), Triphenyltin (TPhT), and chemicals in Table 8.20(g)	All materials: ISO/TS 16179		
Ortho-phenylphenol	Ortho-phenylphenol	All materials: DIN 50009		
Per- and polyfluorinated compounds	See Table 9.83.1(b); PFAS shall be measured using a TOF test, with particular	All materials: ISO 23702-1		

Chemical Class or Group	Restricted Substance(s)	Test Method		
	attention paid to the targeted list in the Table below			
Phthalates	See Table 8.20(h)	Sample preparation for all materials:		
		-	-	CPSC-CH-C1001-09.4
		-	-	Measurement:
		-	-	Textiles: GC/MS, ISO 14389
		-	-	All materials except textiles:
		-	-	GC/MS
Polycyclic aromatic hydrocarbons (PAH)	See Table 8.20(i)	All materials: AFPS GS 2019		
Quinoline	Quinoline	All materials: DIN 54231 with methanol extraction at 70°C (158°F)		
Solvent residues	Dimethylformamide, and N-Methyl-2-Pyrrolidone	Textiles: EN 17131 All other materials: ISO/TS 16189		
UV stabilizers	2-Benzotriazol-2-yl-4,6-di-tert-butylphenol (UV 320),	EN 62321-6; extraction		
	-	2,4-Di-tert-butyl-6-(5-chlorobenzotriazol-2-yl) phenol (UV 327),	in THF, analysis by GC/MS)	
	-	2-(2H-Benzotriazol-2-yl)-4,6-di-tert-penthylphenol (UV 328), and	-	
	-	2-(2H-Benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV 350)	-	
-	-	-		

Table 9.83.1(b) Per- and Polyfluorinated Compounds Subject to Analysis

Per- and Polyfluorinated Compounds	CAS Number
Perfluorooctane Sulfonic Acid and Sulfonates (PFOS)	1763-23-1, et al.
Perfluorooctane Sulfonamide (PFOSA)	754-91-6
Perfluorooctance Sulfonfuoride (PFOSF)	307-35-7
N-Methyl Perfluorooctane Sulfonamide (N-Me-FOSA)	31506-32-8

Per- and Polyfluorinated Compounds	CAS Number
N-Ethyl Perfluorooctane Sulfonamide (N-Et-FOSA	4151-50-2
N-Methyl Perfluorooctane Sulfonamide Ethanol (N-Me-FOSE)	24448-09-7
N-Ethyl Perfluorooctane Sulfonamide Ethanol (N-Et-FOSE)	1691-99-2
Perfluorooctanoic Acid and salts (PFOA)	375-85-9, et al.
Perfluoroheptanoic Acid and salts (PFHpA)	335-67-1, et al.
Perfluorononanoic Acid and salts (PFNA)	375-95-1, et al.
Perfluorodecanoic Acid and salts (PFDA)	335-76-2, et al.
Henicocafluoroundecanoic Acid and salts (PFUdA)	2058-94-8, et al.
Trisafluorododecanoic Acid and salts (PFDoA)	307-55-1, et al.
Pentacosafluorotridecanoic Acid and salts (PFTrDA)	72629-94-8, et al.
Heptacosafluorotetradecanoic Acid and salts (PFTeDA)	376-06-7, et al.
1H,1H,2H,2H-Perfluorooctyl Acrylate (8:2 FTA)	27905-45-9
1H,1H,2H,2H-Perfluoro-1-decanol (8:2 FTOH)	678-39-7
1H,1H,2H,2H-Perfluorodecanesuphonic Acid and its salts (8:2 FTS)	39108-34-4, et al.
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	59587-38-1
Perfluorobutanesulfonic acid (PFBS)	375-73-5
Perfluoro-n-butanoic acid (PFBA)	375-22-4
Perfluoro-n-pentanoic acid (PFPeA)	2706-90-3
Perfluorohexanoic acid (PFHxA)	307-24-4
Perfluoro-n-undecanoic acid (PFUnA)	2058-94-8
Perfluorododecanoic acid (PFDoDA)	307-55-1

Statement of Problem and Substantiation for Public Comment

I clarified that the TOF test should be used to determine the presence of PFAS (since there are more than 10,000, and we can only test for roughly 70); I also added seven PFAS that have been found in turnout gear.

Related Item

• FR

Submitter Information Verification

Submitter Full Name: Kyla Bennett
Organization: PEER

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Submittal Date: Tue Jan 03 17:05:33 EST 2023
Committee: FAE-SPF

Public Comment No. 55-NFPA 1970-2022 [Section No. 9.83.1]

9.83.1

Specified components of specified protective elements shall be evaluated for each listed restricted substance or category of restricted substances and not exceed the maximum concentration as specified in Table 9.83.1(a).

Table 9.83.1(a) Test Methods for Evaluating Protective Element Components for Specific Restrictive Substances

Chemical Class or Group	Restricted Substance(s)	Test Method		
Acidity and alkaline substances	Measured by reporting pH	Textiles and artificial leather:		
		-	-	ISO 3071 using KCl solution
		-	-	Leather: ISO 4045
Akyl phenols and ethoxylates	4-tert Butylphenol, Nonylphenol, Octylphenol, Heptaphenol, and Pentylphenol	Textiles and leather: ISO 21084		
		-	-	Polymers and other materials:
		-	-	1 g sample/20 mL THF, sonification for 60 min at 70°C (158°F) with analysis per ISO 21084
	-	Nonylphenolethoxylates and Octylphenol-ethoxylates	All materials except leather:	
		-	-	ISO 18254-1 with analysis using LC/MS or LC/MS/MS
		-	-	Leather: ISO 18218-1 with quantification using ISO 18254-1
Azo-amines and aryl amine salts	See Table 8.20(b)	All materials except leather:		
		-	-	ISO 14362-1
		-	-	Leather: ISO 17234-1
		-	-	For p-Aminoazobenzene:
		-	-	All materials except leather:
		-	-	ISO 14362-3
		-	-	Leather:
		-	-	ISO 17234-2:2011
Bisphenol	Bisphenol A	All materials:		
		-	-	Extraction: 1 g sample/20 ml THF,

Chemical Class or Group	Restricted Substance(s)	Test Method		
		-	-	sonication for 60 minutes at 60°C (140°F), analysis with LC/MS
Chlorinated benzenes and toluenes	See Table 8.20(c)	All materials: EN 17137		
Chlorinated paraffins	Short chain chlorinated paraffins, SCCP, (C10–C13) and medium chain chlorinated paraffins, MCCP, (C14–C17)	Textiles:		
		-	-	ISO 22818 (SCCP + MCCP)
		-	-	Leather:
		-	-	ISO 18219-1 (SCCP) -
		-	ISO 18219-2 (MCCP)	
Chlorinated phenols	Pentachlorophenol	All materials: DIN 50009		
	-	Tetrachlorophenols	-	-
	Trichlorophenols	-		
	-	Dichlorophenols	-	-
	Monochlorophenols	-		
Dimethylfumarate	Dimethylfumarate	All materials: ISO 16186		
Dyes	See Table 8.20(d)	All materials: DIN 54231		
	-	Navy Blue: Component 1: $C_{39}H_{23}ClCrN_7O_{12}S.2Na$; and Component 2: $C_{46}H_{30}CrN_{10}O_{20}S_2.3Na$	All materials: DIN 54231	
Flame retardants	See Table 8.20(e)	All materials: ISO 17881-1 and ISO 17881-2		
Formaldehyde	Free and partially releasable	All materials except leather:		
		-	-	ISO 14184-1
		-	-	Leather: ISO 17226-2 with ISO 17226-1 (confirmation method in case of interferences)
		-	-	

Chemical Class or Group	Restricted Substance(s)	Test Method		
Heavy metals, extractable	Antimony, Arsenic, Barium, Cadmium, Chromium, Cobalt, Copper, Lead, Mercury, Nickel, and Selenium	All materials except leather:		
		-	-	EN 16711-2
		-	-	Leather: ISO 17072-1
		Chromium VI	Textiles: EN 16711-2 with ISO 17075-1 if Chromium is detected	
	-			Leather: ISO 17075-1 and ISO 17075-2 for confirmation in case the extract causes interference; alternatively, ISO 17075-2:2017 is permitted to be used on its own
		-	-	
Heavy metals, total content	Arsenic, Cadmium, and Mercury	All materials except leather:		
		-	-	EN 16711-2:
		-	-	Leather: ISO 17072-1
	-	Lead	All materials:	
		-	-	CPSC-CH-E1002-08.3
Monomers	Styrene, free	Extraction in Methanol; GC/MS, sonication at 60°C (140°F) for 60 minutes		
	-	Vinyl Chloride	All materials: ISO 6401	
Nitrosamines	See Table 8.20(f)	All materials: ISO 19577		
Organotin Compounds	Tributyltin (TBT), Triphenyltin (TPhT), and chemicals in Table 8.20(g)	All materials: ISO/TS 16179		
Ortho-phenylphenol	Ortho-phenylphenol	All materials: DIN 50009		
Per- and polyfluorinated	See Table 9.83.1(b)	All materials: ISO 23702-1		

Chemical Class or Group	Restricted Substance(s)	Test Method		
compounds				
Phthalates	See Table 8.20(h)	Sample preparation for all materials:		
		-	-	CPSC-CH-C1001-09.4
		-	-	Measurement:
		-	-	Textiles: GC/MS, ISO 14389
		-	-	All materials except textiles:
		-	-	GC/MS
Polycyclic aromatic hydrocarbons (PAH)	See Table 8.20(i)	All materials: AFPS GS 2019		
Quinoline	Quinoline	All materials: DIN 54231 with methanol extraction at 70°C (158°F)		
Solvent residues	Dimethylformamide, and N-Methyl-2-Pyrrolidone	Textiles: EN 17131 All other materials: ISO/TS 16189		
UV stabilizers	2-Benzotriazol-2-yl-4,6-di-tert-butylphenol (UV 320),	EN 62321-6; extraction		
	-	2,4-Di-tert-butyl-6-(5-chlorobenzotriazol-2-yl) phenol (UV 327),	in THF, analysis by GC/MS)	
	-	2-(2H-Benzotriazol-2-yl)-4,6-di-tert-penthylphenol (UV 328), and	-	
	-	2-(2H-Benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol (UV 350)	-	
-	-	-		

Table 9.83.1(b) Per- and Polyfluorinated Compounds Subject to Analysis

Per- and Polyfluorinated Compounds	CAS Number
Perfluorooctane Sulfonic Acid and Sulfonates (PFOS)	1763-23-1, et al.
Perfluorooctane Sulfonamide (PFOSA)	754-91-6
Perfluorooctance Sulfonfuoride (PFOSF)	307-35-7
N-Methyl Perfluorooctane Sulfonamide (N-Me-FOSA)	31506-32-8
N-Ethyl Perfluorooctane Sulfonamide (N-Et-FOSA	4151-50-2

Per- and Polyfluorinated Compounds	CAS Number
N-Methyl Perfluorooctane Sulfonamide Ethanol (N-Me-FOSE)	24448-09-7
N-Ethyl Perfluorooctane Sulfonamide Ethanol (N-Et-FOSE)	1691-99-2
Perfluorooctanoic Acid and salts (PFOA)	375-85-9, et al.
Perfluoroheptanoic Acid and salts (PFHpA)	335-67-1, et al.
Perfluorononanoic Acid and salts (PFNA)	375-95-1, et al.
Perfluorodecanoic Acid and salts (PFDA)	335-76-2, et al.
Henicocafluoroundecanoic Acid and salts (PFUdA)	2058-94-8, et al.
Trisafluorododecanoic Acid and salts (PFDoA)	307-55-1, et al.
Pentacosafluorotridecanoic Acid and salts (PFTrDA)	72629-94-8, et al.
Heptacosafluorotetradecanoic Acid and salts (PFTeDA)	376-06-7, et al.
1H,1H,2H,2H-Perfluorooctyl Acrylate (8:2 FTA)	27905-45-9
1H,1H,2H,2H-Perfluoro-1-decanol (8:2 FTOH)	678-39-7
1H,1H,2H,2H-Perfluorodecanesuphonic Acid and its salts (8:2 FTS)	
6:2 FTS	
6:2 FTOH	
PFBS	
PFDoDA	
PFUnA	
PFHxA	
PFPeA	
PFBA	39108-34-4, et al.

Statement of Problem and Substantiation for Public Comment

Structural firefighting ensemble manufacturers have already supplied testing documentation listing 7 of the added referenced PFAS as being found in their products. To exclude them from testing analytes would be illogical.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 56-NFPA 1970-2022 [Section No. 9.83.2]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

• NFPA 1971 TIA 1594

Submitter Information Verification

Submitter Full Name: Neil McMillan
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Submittal Date: Thu Dec 22 06:49:27 EST 2022
Committee: FAE-SPF

Public Comment No. 207-NFPA 1970-2023 [Section No. 9.83.2]

9.83.2

~~Alternative~~ In order to confirm that all materials, components, finishes, coatings and products are free from PFAS, a Total Organic Fluroine Test shall be conducted. Alternative test methods shall be permitted if the test method is capable of providing a lower limit of quantification that is at least 50 percent of the specified limit established for the respective substance in Table 8.20(a) and that provide an 80 percent or better recovery of the respective substance from the tested material or component can be demonstrated.

Statement of Problem and Substantiation for Public Comment

Cancer is killing fire service members at a highly alarming rate. There are countless stories of firefighters, some as young as 24 and 25 years old, being diagnosed with occupational cancer and ultimately being buried by their family, friends, and coworkers. It has to stop. You hold power to facilitate changes that will remove the toxins and carcinogens in our turnout gear.

We, the end users of turnout gear, ask you to advocate for our health and longevity. Do the right thing, and help stop killing our brothers and sisters.

Adding a Total Organic Fluorine Test will help to ensure that end-users are not being put in harm's way by the turnout gear we are wearing. In order to fulfill your mission of "saving lives," PFAS-free ensembles are a step in that direction. Testing for the harmful PFAS carcinogen of Fluorine is a step to help save lives.

Related Item

• TIA 1594 on NFPA 1971,

Submitter Information Verification

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Committee: FAE-SPF

Public Comment No. 56-NFPA 1970-2022 [Section No. 9.83.2]

9.83.2

A Total Organic Fluorine Test shall be conducted on all materials, components, finishes and coatings, to confirm no PFAS are present in the garment. Alternative test methods shall be permitted if the test method is capable of providing a lower limit of quantification that is at least 50 percent of the specified limit established for the respective substance in Table 8.20(a) and that provide an 80 percent or better recovery of the respective substance from the tested material or component can be demonstrated.

Statement of Problem and Substantiation for Public Comment

Fire fighters have made it clear, individually, and through their affiliate organizations (IAFF and Metro Chiefs) that they do not want any amount of PFAS within their firefighting ensembles. The risk from these chemicals is clear and convincing, as proven by science, and NFPA should align with the health wishes of the end-users who will be forced to wear these ensembles.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 55-NFPA 1970-2022 [Section No. 9.83.1]	
Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]	

Related Item

- NFPA 1971 TIA 1594

Submitter Information Verification

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Committee: FAE-SPF

Public Comment No. 172-NFPA 1970-2023 [Section No. A.1.2.3]

~~A.1.2.3~~ —

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

Statement of Problem and Substantiation for Public Comment

See Public Comment 169 which proposes removal of Annex G

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 169-NFPA 1970-2023 [Chapter G]	
Public Comment No. 171-NFPA 1970-2023 [Section No. 1.2.3]	

Related Item

• Annex G

Submitter Information Verification

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Committee: FAE-SPF

Public Comment No. 182-NFPA 1970-2023 [Section No. A.1.2.3]

~~A.1.2.3~~ —

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

Statement of Problem and Substantiation for Public Comment

Remove A.1.2.3 in its entirety. The reference to Annex G along with the purpose and the explanation of these tests for the "...assessment of full ensembles by end user organizations." infers that the tests in Annex G have been condoned by the NFPA and other organizations as being compliant.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 166-NFPA 1970-2023 [Chapter G]	

Related Item

- First Revision No. 232-NFPA 1970-2022

Submitter Information Verification

Submitter Full Name: Robert Sell
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Submittal Date: Wed Jan 04 11:40:44 EST 2023
Committee: FAE-SPF

Public Comment No. 9-NFPA 1970-2022 [Section No. A.3.3.85]

A.3.3.85 Hazardous (Classified) Locations (HazLoc).

A hazardous (classified) location is a location in which an explosive gas atmosphere or explosive dust atmosphere might exist. Electrical equipment used where such atmospheres might exist needs to be protected against the risk of explosion from energy or thermal ignition sources. Within this standard, intrinsic safety (IS) and nonincendive (NI) are protection concepts associated with the rating of equipment for operation in potentially explosive atmospheres. IS and NI ratings take into account the nature of the explosive atmosphere encountered — Class I being explosive gas atmospheres and Class II being explosive dust atmospheres — and the frequency or interval of the presence of such explosive atmospheres (i.e., continuously, intermittently, or abnormally). The frequency or interval of the presence of the explosive atmosphere determines the proper Division (e.g., Division 1 or Division 2) or Zone (e.g., Zone 0, Zone 1, or Zone 2) classifications that are applied to a particular IS or NI rating. To determine the appropriate IS or NI rating for ~~SCBA and PASS~~ electrical devices or circuitry , the AHJ identifies the expected explosive atmospheres likely to be encountered and the expected frequency or interval of the presence of such expected explosive atmospheres.

Statement of Problem and Substantiation for Public Comment

(Submitted on behalf of the FAE-ELS/FAE-SCE HazLoc Harmonization Task Group) Expand the text to cover electrical devices (i.e. involving SCBA and PASS) and electrical circuitry (i.e involving ensemble and apparel).

Related Item

• FR-281

Submitter Information Verification

Submitter Full Name: Paul Kelly
Organization: UL LLC
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City:
State:
Zip:
Submittal Date: Fri Sep 09 18:49:18 EDT 2022
Committee: FAE-SPF

Public Comment No. 37-NFPA 1970-2022 [Section No. A.4.1.2.1]

A.4.1.2.1

NFPA, from time to time, has received complaints that certain items of fire and emergency services protective clothing or protective equipment might be carrying labels falsely identifying them as compliant with an NFPA standard.

NFPA advises those purchasing ~~protective ensembles or protective ensemble elements to~~ products certified to this standard to be aware of the following:

For ~~protective ensembles or protective ensemble elements to meet the requirements of Chapters 5 through 9 of NFPA 1970~~ products to comply with NFPA 1970, they must be certified by an independent third-party certification organization. In addition, the item must carry the label, symbol, or other identifying mark of that certification organization.

~~A protective ensemble or element that~~ If the item does not bear the mark of an independent third-party certification organization, is not compliant with ~~Chapters 5 through 9 of~~ NFPA 1970 even if the product label states that the ~~protective ensemble or element~~ item is compliant.

For further information about certification and product labeling, Chapters ~~4 and 5 of NFPA 1970 should~~ 6, 11, 16 or 21 should be referenced. Also, the definitions for *Certification/Certified*, *Labeled*, and *Listed* in Chapter 3 should be reviewed.

Third-party certification is an important means of ensuring the quality of fire and emergency services protective clothing and equipment. To be certain that an item is properly certified, labeled, and listed, NFPA recommends that prospective purchasers require appropriate evidence of certification for the specific product and model from the manufacturer before purchasing. Prospective purchasers also should contact the certification organizations and request copies of the certification organization's list of certified products to the appropriate NFPA standard. This listing is a requirement of third-party certification by this standard and is a service performed by the certification ~~organization~~ organizations .

All NFPA standards on fire and emergency services protective clothing and equipment require that the item be certified by an independent third-party certification organization- ~~and, as with NFPA 1970 protective ensembles or protective ensemble elements, all items of fire and emergency services protective clothing and equipment must carry the label, symbol, or other identifying mark of that certification organization~~ .

~~**Any item of protective clothing or protective equipment covered by an NFPA standard that does not bear the mark of an independent third-party certification organization is not compliant with the appropriate NFPA standard even if the product label states that the item is compliant.**~~

Statement of Problem and Substantiation for Public Comment

Updating the language since this annex item applies to all products within this standard and not just ensemble elements. Also removing some of the redundancy in the statements.

Related Item

- FR298

Submitter Information Verification

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Submittal Date: Wed Dec 21 11:40:17 EST 2022
Committee: FAE-SPF

Public Comment No. 77-NFPA 1970-2022 [Section No. A.4.1.2.1]

A.4.1.2.1

NFPA, from time to time, has received complaints that certain items of fire and emergency services protective clothing or protective equipment might be carrying labels falsely identifying them as compliant with an NFPA standard.

NFPA advises those purchasing protective ensembles or protective ensemble elements to be aware of the following:

For ~~protective ensembles or protective ensemble elements~~ products to meet the requirements of ~~Chapters 5 through 9 of~~ NFPA 1970 they must be certified by an independent third-party certification organization. In addition, the item must carry the label, symbol, or other identifying mark of that certification organization.

A protective ensemble or element that does not bear the mark of an independent third-party certification organization is not compliant with Chapters 5 through 9 of NFPA 1970 even if the product label states that the protective ensemble or element is compliant.

For further information about certification and product labeling, Chapters 4 ~~and 5 of~~ , 5, 6, 10, 11, 15, 16, 20 and 21 of NFPA 1970 should be referenced. Also, the definitions for *Certification/Certified*, *Labeled*, and *Listed* in Chapter 3 should be reviewed.

Third-party certification is an important means of ensuring the quality of fire and emergency services protective clothing and equipment. To be certain that an item is properly certified, labeled, and listed, NFPA recommends that prospective purchasers require appropriate evidence of certification for the specific product and model from the manufacturer before purchasing. Prospective purchasers also should contact the certification organizations and request copies of the certification organization's list of certified products to the appropriate NFPA standard. This listing is a requirement of third-party certification by this standard and is a service performed by the certification organization.

All NFPA standards on fire and emergency services protective clothing and equipment require that the item be certified by an independent third-party certification organization and, as with NFPA 1970 protective ensembles or protective ensemble elements, all items of fire and emergency services protective clothing and equipment must carry the label, symbol, or other identifying mark of that certification organization.

Any item of protective clothing or protective equipment covered by an NFPA standard that does not bear the mark of an independent third-party certification organization is not compliant with the appropriate NFPA standard even if the product label states that the item is compliant.

Statement of Problem and Substantiation for Public Comment

This section is not just specific to the 1971 chapters, it is relevant to all labeling and certification chapters so this section is being added to reflect that.

Related Item

• FR298

Submitter Information Verification

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Submittal Date: Wed Dec 28 11:50:17 EST 2022
Committee: FAE-SPF

Public Comment No. 180-NFPA 1970-2023 [Section No. A.7.7.5.1.1]

A.7.7.5.1.1

A unique sizing system can include a series of measurements or other means by which an end user can preassess their glove size prior to trying on a glove. Specific dimensions that can be considered include, but are not limited to, hand length, index finger length, length of other fingers or thumb, hand circumference, hand breath, digit length (by individual finger), and digit circumference (by individual finger). One proposed system is based on recent research undertaken by the Division of Safety Research for the National Institute for Occupational Safety and Health (NIOSH) and is reported in Hsiao, H., Whitestone, J., Kau, T. Y., & Hildreth, B. (2015). This sizing system uses a large number of hand and finger dimensions to define a seven-size system, including small, small-medium, small-medium wide, central medium, medium-large, medium-large wide, and large designed to accommodate firefighters with dimensions from the 2.5th to 97.5th percentile. Figure A.7.7.5.1.1 shows how this system is related to the default sizing system. Tables A.7.7.5.1.1(a) and A.7.7.5.1.1(b) show how the hand dimension measurements that applied to the NIOSH-recommended firefighter glove system and how the measurements are made, respectively.

Additional Proposed Changes

File Name	Description	Approved
Stull_NFPA_1970_PC_180_Additional_Material.docx	Figures and Tables for A.7.5.5.1.1	

Statement of Problem and Substantiation for Public Comment

Additional detail has been provided for the NIOSH-recommended glove sizing system and how this system relates to the current default glove sizing system.

Related Item

- FR88

Submitter Information Verification

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Stull PC 180 Additional Material

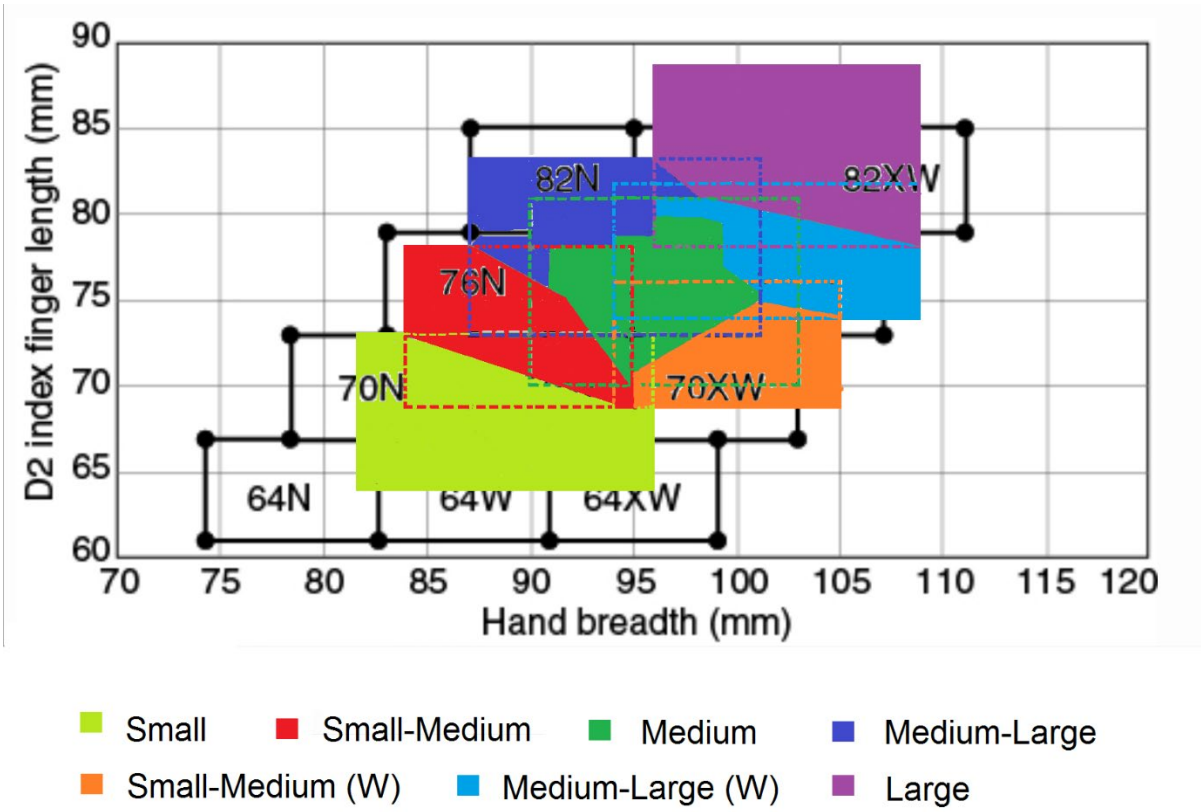


FIGURE A.7.5.5.1.1 Comparison of NIOSH-based Glove System Recommendations (shaded boxes) compared with Default Sizing System

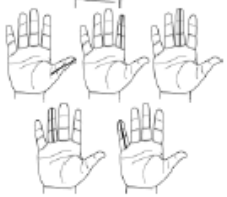
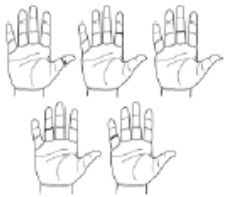
Figure will be redrawn to provide gray shade detail

Table 7.5.5.1.1(a) Specific Hand Dinmensions on Which NIOSH-Recommended Glove Sizing System is Based

	New	Small (n = 94)		S-M (n = 87)		S-M Wide (n = 91)		Central (n = 393)		M-L Wide (n = 78)		M-L (n = 71)		Large (n = 105)	
	Old	XS (n = 3)		S (n = 16)		M (n = 84)		L (n = 188)		XL (n = 100)		XXL (n = 38)		XXXL (n = 5)	
Hand Dimension		*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Hand length	New	180	4.8	190	4.5	191	4.5	196	5.8	203	3.9	204	5.0	211	5.2
	Old	171	5.1	184	9.2	193	7.7	197	8.6	201	8.7	205	8.6	206	7.3
Hand breadth	New	89	4.1	91	3.0	99	3.3	97	3.4	101	3.1	95	3.3	102	3.1
	Old	84	0.6	90	4.8	95	4.3	97	4.2	99	4.3	99	4.2	101	1.6
Palm length	New	104	4.4	109	3.9	111	3.4	113	4.5	118	3.7	117	4.7	120	4.2
	Old	97	3.1	105	6.1	111	5.1	113	5.3	115	5.7	117	4.9	118	4.1
Palm breadth	New	87	4.4	89	2.9	97	3.2	95	3.4	100	3.0	94	3.3	101	2.9
	Old	81	3.0	87	4.2	94	4.3	96	4.2	98	4.3	98	4.3	101	2.1
Palm breadth (finger closed)	New	82	4.2	84	3.1	93	3.6	91	3.8	97	3.4	89	3.7	98	3.3
	Old	77	3.3	83	4.2	89	4.6	91	4.8	93	4.9	94	4.9	98	2.4
Thumb length	New	63	2.5	68	2.8	67	2.6	70	3.1	72	3.1	74	3.0	76	3.2
	Old	60	0.6	65	5.0	69	4.0	71	3.7	72	3.5	74	3.8	70	4.4
Thumb breadth	New	22	1.6	22	1.3	25	1.4	24	1.2	26	1.2	23	1.3	25	1.5
	Old	20	0.6	22	1.0	24	1.5	24	1.7	25	1.5	25	1.5	25	1.2
Index length	New	69	2.3	73	2.5	72	2.3	75	2.8	78	2.1	78	2.4	82	2.6
	Old	69	2.5	71	3.3	74	4.0	76	3.9	77	3.9	79	4.4	79	5.8
Index breadth	New	21	1.2	21	1.4	24	1.1	23	1.0	25	1.1	21	1.3	24	1.4
	Old	19	0.6	21	1.0	22	1.5	23	1.6	23	1.7	23	1.5	24	1.1
Middle length	New	76	2.5	81	2.6	80	2.6	83	2.8	85	2.1	87	2.5	91	2.3
	Old	75	2.1	78	3.9	82	3.9	84	4.5	86	4.1	87	4.8	87	4.9
Middle breadth	New	21	1.3	20	1.2	24	1.3	22	1.1	24	1.1	21	1.6	23	1.4
	Old	19	0.6	21	1.2	22	1.5	22	1.7	23	1.8	23	1.7	24	0.7
Ring length	New	72	2.4	76	2.4	76	2.7	79	2.9	81	2.2	83	2.8	86	2.5
	Old	71	2.0	75	4.4	78	3.8	80	4.5	82	4.1	82	5.1	83	6.3
Ring breadth	New	20	1.3	20	1.2	23	1.2	22	1.1	24	1.1	20	1.6	23	1.4
	Old	18	0.6	20	1.4	21	1.6	22	1.6	22	1.8	22	1.5	23	1.1
Pinky length	New	58	2.4	62	2.6	61	2.6	65	2.8	66	2.8	68	3.0	71	3.3
	Old	55	2.6	61	3.8	64	4.0	65	4.1	67	4.4	68	4.6	66	5.0
Pinky breadth	New	18	1.3	18	1.1	20	1.2	20	1.0	21	1.1	19	1.5	21	1.3
	Old	16	1.0	18	1.2	19	1.6	20	1.5	20	1.4	20	1.2	21	0.9

Table to be updated to remove old system measurements

Table 7.5.5.1.1(b) Description of Specific Hand Dinmensions Used in NIOSH-Recommended Glove Sizing System

Dimension	Figure	Definition
Hand length		The distance from the base of the hand at the wrist crease to the tip of the middle finger, measured along the long axis of the hand.
Hand breadth		Hand breadth is drawn by connecting the point of the left side of the joint connecting the little finger to the palm and the point of the right side of the joint connecting the index finger to the palm (metacarpal-phalangeal joints).
Palm length		The distance from the base of the hand at the wrist crease to the furrow at the base of the middle finger.
Palm breadth		Palm breadth is drawn by connecting the point of the left of the distal transverse crease to the point of the right of the proximal transverse crease.
Thumb and finger lengths		Thumb and finger lengths are defined as the distance from the tip to the base of the finger for thumb, index, middle, ring, and little fingers.
Thumb and finger widths		Thumb and finger widths are defined as the width of the specific finger at the first (proximity) knuckle from the base of the finger for thumb, index, middle, ring, and little fingers.

Submittal Date: Wed Jan 04 11:35:34 EST 2023
Committee: FAE-SPF

Public Comment No. 10-NFPA 1970-2022 [New Section after A.7.18.4.4]

A.7.19

The explosion protection requirements for fire service electrical devices, such as SCBA and PASS devices (and thermal imagers and RF devices) are derived from intrinsic safety (IS) and nonincendive (NI) requirements of the *National Electrical Code* (*NEC*), NFPA 70. With the option for the inclusion of electrical circuitry now added for structural and proximity firefighting protective ensembles and ensemble elements and for work apparel, similar explosion protection requirements have been added. See A.17.1.8 and A.22.5 for additional details.

Statement of Problem and Substantiation for Public Comment

(Submitted on behalf of the FAE-ELS/FAE-SCE HazLoc Harmonization Task Group) This comment provides details regarding the source for the explosion protection requirements for electrical circuitry contained within ensembles and apparel.

Related Item

• FR-139

Submitter Information Verification

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Submittal Date: Fri Sep 09 18:54:26 EDT 2022
Committee: FAE-SPF

Public Comment No. 218-NFPA 1970-2023 [Section No. A.9.1]

A.9.1

Table A.9.1(a) through Table A.9.1(k) are provided as a quick reference for conditioning and testing of elements and cannot be relied on as requirements.

Table A.9.1(a) Testing Structural Firefighting Garments

Test	Section Number	Test Material or Component											
		Garments	Composite	Outer Shell	Moisture Barrier	Thermal Barrier	Winter Liner	Labels	Other Materials	Thread	Seams	Hardware	T
Flame resistance	9.2	-	-			X	X	X	X	-		X	
Heat/thermal resistance	9.6	-	-			X	X	X	X	X	X	-	
TPP	9.10	-		X	-	-	-	-	-	-	-	-	
Thread melting	9.11	-	-	-	-	-	-	-	-				
Tear resistance	9.12	-	-			X	X	X	X	-	-	-	
Seam strength	9.14	-	-	-	-	-	-	-	-	-			
Cleaning shrinkage resistance	9.24	-	-			X	X	X	X	-	-	-	
Water absorption resistance	9.25	-	-			X	-	-	-	-	-	-	
Water penetration resistance	9.26	-	-	-				X	-	-	-	-	
Liquid penetration resistance	9.27	-	-	-				X	-	-	-	-	
Viral penetration resistance	9.28	-	-	-				X	-	-	-	-	
Corrosion resistance	9.29	-	-	-	-	-	-	-	-	-	-		
Total heat loss	9.33	-		X	-	-	-	-	-	-	-	-	
Label durability	9.41	-	-	-	-	-	-						

Test	Section Number	Test Material or Component										
		Garments	Composite	Outer Shell	Moisture Barrier	Thermal Barrier	Winter Liner	Labels	Other Materials	Thread	Seams	Hardware
Trim retroreflectivity	9.45	-	-	-	-	-	-	-	-	-	-	-
Trim fluorescence	9.45	-	-	-	-	-	-	-	-	-	-	-
Overall liquid penetration	9.48	X	-	-	-	-	-	-	-	-	-	-
Breaking strength	9.50	-	-			X	-	-	-	-	-	-
CCHR	9.51	-		X	-	-	-	-	-	-	-	-
Light degradation resistance	9.62	-	-	-				X	-	-	-	-
DRD function	9.59	X	-	-	-	-	-	-	-	-	-	-
DRD material strength	9.58	-	-	-	-	-	-	-				

[a]See 9.1.2.

[b]See 9.1.3.

[c]See 9.1.5.

Table A.9.1(b) Conditioning and Testing of Structural Firefighting Helmets

Test	Section Number	Specimen Numbers					
		Room Temperature[a]	Wet[b]	Low Temperature[c]	Radiant[d]	Convective Heat[e]	Washing/Drying[f]
Helmet, faceshield, and goggle flame test	9.2 & 9.3	1	-	-	-	-	-
Heat resistance	9.6	2	-	-	-	-	-
Retention	9.34	1	-	-	-	-	-
Suspension retention	9.35	1	-	-	-	-	-
Shell retention	9.43	13	-	-	-	-	-
Electrical resistance	9.30	4	-	-	-	-	-
Faceshield, goggle	9.44	6	-	-	-	-	-

Test	Section Number	Specimen Numbers						
		Room Temperature[a]	Wet[b]	Low Temperature[c]	Radiant[d]	Convective Heat[e]	Washing/Drying[f]	
luminous transmittance								
Faceshield, goggle impact resistance	9.17	3	4	9	-		13	-
Top impact	9.15	3	4	9	7	11	-	
Label legibility	9.42	2	4	9	7	-	-	
Impact acceleration	9.16	5	6	10	8	-	-	
Penetration	9.19	3	4	9	14	12	-	
Faceshield, goggle lens abrasion resistance	9.22	8	-	-	-	-	-	
Hardware corrosion	9.29	3	-	-	-	-	-	
Trim retroreflectivity and fluorescence	9.45	X	-	-	-	-	-	
Thread heat resistance	9.11	X	-	-	-	-	-	
Ear cover, chin strap flame resistance	9.2	X	-	-	-	-		X
Ear cover, chin strap heat resistance	9.6	X	-	-	-	-		X
Ear cover TPP	9.10	X	-	-	-	-	-	

[a] See 9.1.3.

[b] See 9.1.7.

[c] See 9.1.4.

[d] See 9.1.6.

[e] See 9.1.5.

[f] See 9.1.2.

Table A.9.1(c) Testing Structural Firefighting Gloves

Test	Section Number	Test Material or Component							Test Conditioning			
		Whole Glove	Glove Composite	Glove Gauntlet	Glove Wristlet	Thread	Hardware	-	Room Temp[a]	Washing/Drying[b]	Convective Heat[c]	Wet[d]
TPP	9.10	-		X	X	X	-	-				X
Heat and thermal shrinkage resistance	9.6	X	-	-	-	-	-	-				
Conductive heat resistance test 1	9.7	-		X	-	-	-	-				
Flame resistance test 3	9.4	-		X	X	X	-	-				X
Thread melting	9.11	-	-	-	-				X	-	-	
Viral penetration resistance	9.28	-		X	-	-	-	-				
Liquid penetration resistance	9.27	-		X	-	-	-	-				
Cut resistance	9.21	-		X	X	X	-	-				X
Puncture resistance test 1	9.20	-		X	-	-	-	-				
Glove hand function	9.37	X	-	-	-	-	-	-				
Burst strength	9.13	-	-	-				X	-	-		
Seam breaking strength	9.14	-	-			X	X	-	-	-		
Overall liquid integrity test 1	9.32	X	-	-	-	-	-	-				

Test	Section Number	Test Material or Component: Whole Glove	Glove Composite	Glove Gauntlet	Glove Wristlet	Thread	Hardware	-	-	Test Conditioning: Room Temp[a]	Washing/Drying[b]	Convective Heat[c]	Wet[d]
Glove donning test	9.36	-	-	-	-	-	-	-	-				
Liner retention test	9.63	X	-	-	-	-	-	-	-				
Label durability and legibility test 1	9.41	X	-	-	-	-	-	-					
Grip	9.38	X	-	-	-	-	-	-	-				
Corrosion resistance	9.29	-	-	-	-	-						X	-

[a] See 9.1.3.

[b] See 9.1.2.

[c] See 9.1.5.

[d] See 9.1.8.

[e] See 9.1.10.

Table A.9.1(d) Testing Structural Firefighting Footwear

Test	Section Number	Test Material or Component: Whole Footwear	Footwear Composite	Footwear Sole	Footwear Toe Section	Footwear Moisture Barrier	Footwear Moisture Barrier Seam	Thread	Labels	-	Test Conditioning: Room Temp[a]	Convective Heat[b]	W
Radiant heat resistance test 1	9.9	X	-	-	-	-	-	-	-	-			
Conductive heat	9.7	X	-	-	-	-	-	-	-	-			

Test	Section Number	Test Material or Component									Test Conditioning		
		Whole Footwear	Footwear Composite	Footwear Sole	Footwear Toe Section	Footwear Moisture Barrier	Footwear Moisture Barrier Seam	Thread	Labels	-	Room Temp[a]	Convective Heat[b]	
resistance test 1													
Conductive heat resistance test 2	9.8	X	-	-	-	-	-	-	-	-			
Flame resistance test 4	9.5	X	-	-	-	-	-	-	-	-			
Thread melting test	9.11	-	-	-	-	-	-						
Liquid penetration resistance	9.27	-	-	-	-					X X	-	-	
Viral penetration resistance	9.28	-	-	-	-					X X	-	-	
Puncture resistance test	9.20	X	X	-	-	-	-	-	-	-			
Cut resistance	9.21	-		X	-	-	-	-	-	- -			
Slip resistance	9.40	X	-	-	-	-	-	-	-	-			
Abrasion resistance	9.23	-	-			X	-	-	-	- -	-		
Electrical insulation test 2	9.31	X	-	-	-	-	-	-	-	-			
Ladder shank bend	9.39	X	-	-	-	-	-	-	-	-			
Eyelet and stud post	9.49	X	-	-	-	-	-	-	-	-			

Test	Section Number	Test Material or Component: Whole Footwear	Footwear Composite	Footwear Sole	Footwear Toe Section	Footwear Moisture Barrier	Footwear Moisture Barrier Seam	Thread	Labels	-	Test Conditioning: Room Temp[a]	Convective Heat[b]
attachment												
Corrosion resistance	89.29	X	-	-	-	-	-	-	-	-		
Label durability and legibility	9.41	-	-	-	-	-	-	-				
Overall liquid integrity test 2	9.70	X	-	-	-	-	-	-	-	-		
Heat and thermal shrinkage resistance test	9.6	X	-	-	-	-	-	-	-	-		
Puncture resistance device flex test	9.20	X	-	-	-	-	-	-	-	-		

[a] See 9.1.3.

[b] See 9.1.5.

[c] See 9.1.9.

Table A.9.1(e) Testing Structural Firefighting Interfaces

Test	Section Number	Test Material or Component: Hood	Hood Material or Composite	Hood Seam	Hood Thread	Wristlet Material or Composite	Wristlet Seam	Wristlet Thread	-	Conditioning: Washing/Drying[a]	Room Temperature[b]
Flame resistance	9.4	-		X	-	-			X -	-	-
Heat/thermal resistance	9.6	X	-	-	-				X -	-	-

Test	Section Number	Test Material or Component								Conditioning		
		Hood	Hood Material or Composite	Hood Seam	Hood Thread	Wristlet Material or Composite	Wristlet Seam	Wristlet Thread	-	Washing/Drying[a]	Room Temperature[b]	-
TPP	9.10	-		X	-	-			X	-	-	
Thread melting	9.11	-	-	-				X	-	-		X
Burst strength	9.13	-		X	-	-			X	-	-	-
Seam strength	9.14	-	-			X	-	-		X	-	-
Cleaning shrinkage	9.24	X	-	-	-				X	-	-	

[a] See 9.1.2.

[b] See 9.1.3.

Table A.9.1(f) Testing Proximity Firefighting Garments

Test	Section Number	Test Material or Composite											
		Garments	Composite	Outer Shell	Moisture Barrier	Thermal Barrier	Winter Liner	Labels	Other Materials	Thread	Seams	Hardware	Tr
Flame resistance	9.2	-	-			X	X	X	X	-		X	-
Heat/thermal resistance	9.6	-	-			X	X	X	X	X	X	-	-
TPP	9.10	-		X	-	-	-	-	-	-	-	-	-
Thread melting	9.11	-	-	-	-	-	-	-	-				
Tear resistance	9.12	-	-			X	X	X	X	-	-	-	-
Seam strength	9.14	-	-	-	-	-	-	-	-	-			
Cleaning shrinkage resistance	9.24	-	-			X	X	X	X	-	-	-	-
Water absorption	9.25	-	-			X	-	-	-	-	-	-	-

Test	Section Number	Test Material or Composite											
		Garments	Composite	Outer Shell	Moisture Barrier	Thermal Barrier	Winter Liner	Labels	Other Materials	Thread	Seams	Hardware	Tr
resistance													
Water penetration resistance	9.26	-	-	-				X	-	-	-	-	-
Liquid penetration resistance	9.27	-	-	-				X	-	-	-	-	-
Viral penetration resistance	9.28	-	-	-				X	-	-	-	-	-
Corrosion resistance	9.29	-	-	-	-	-	-	-	-	-	-		
Total heat loss	9.33	-		X	-	-	-	-	-	-	-	-	-
Label durability	9.41	-	-	-	-	-	-						
Overall liquid penetration	9.48	X	-	-	-	-	-	-	-	-	-	-	-
Breaking strength	9.50	-	-			X	-	-	-	-	-	-	-
CCHR	9.51	-		X	-	-	-	-	-	-	-	-	-
Light degradation resistance	9.62	-	-	-	-	-	-	-	-	-	-	-	-
DRD function test	9.59	-	-	-	-	-	-	-	-	-	-	-	-
DRD material strength test	9.58	-	-	-	-	-	-	-	-	-	-	-	-
Radiant heat resistance test 2	9.61	-	-			X	-	-	-	-	-	-	-
Wet flex	9.54	-	-			X	-	-	-	-	-	-	-
Adhesion after wet flex	9.55	-	-			X	-	-	-	-	-	-	-

Test	Section Number	Test Material or Composite											
		Garments	Composite	Outer Shell	Moisture Barrier	Thermal Barrier	Winter Liner	Labels	Other Materials	Thread	Seams	Hardware	Tr
Flex at low temperature	9.56	-	-			X	-	-	-	-	-	-	-
Resistance to high temperature blocking	9.57	-	-			X	-	-	-	-	-	-	-

[a] See 9.1.2.

[b] See 9.1.3.

[c] See 9.1.5.

Table A.9.1(g) Conditioning and Testing of Proximity Firefighting Helmet

Test	Section Number	Specimen Numbers						
		Room Temperature[a]	Wet[b]	Low Temperature[c]	Radiant[d]	Convective Heat[e]	Washing/Drying[f]	
Helmet, faceshield flame test	9.3	1	-	-	-	-	-	
Heat resistance	9.6	2	-	-	-	-	-	
Retention	9.34	1	-	-	-	-	-	
Suspension retention	9.36	1	-	-	-	-	-	
Shell retention	9.43	13	-	-	-	-	-	
Electrical resistance	9.30	4	-	-	-	-	-	
Faceshield luminous transmittance	9.44	6	-	-	-	-	-	
Faceshield impact resistance	9.17	3	4	9	-		13	-
Faceshield radiant reflective test	9.52	15	-	-	-	-	-	
Top impact	9.15	3	4	9	7	11	-	
Label legibility	9.42	2	4	9	7	-	-	
Impact acceleration	9.16	5	6	10	8	-	-	
Penetration	9.19	3	4	9	14	12	-	

Test	Section Number	Specimen Numbers						
		Room Temperature[a]	Wet[b]	Low Temperature[c]	Radiant[d]	Convective Heat[e]	Washing/Drying[f]	
Radiant heat transmittance test	9.52	15	-	-	-	-	-	
Hardware corrosion	9.29	3	-	-	-	-	-	
Trim retroreflectivity	9.45	X	-	-	-	-	-	
Thread heat resistance	9.11	X	-	-	-	-	-	
Shroud, cover, chin strap flame resistance	9.2	X	-	-	-	-		X
Shroud, cover, chin strap heat resistance	9.6	X	-	-	-	-		X
Shroud TPP	9.10	X	-	-	-	-	-	
Shroud, cover radiant reflective test	9.52	X	-	-	-	-	-	
Shroud, cover wet flex test	9.54	X	-	-	-	-	-	
Shroud, cover flex at low temperature	9.56	X	-	-	-	-	-	
Shroud, cover high temperature blocking	9.57	X	-	-	-	-	-	
Shroud, cover tear resistance	9.12	X	-	-	-	-		X
Shroud, moisture barrier water penetration	9.26	X	-	-	-		X	X
Shroud, moisture barrier liquid penetration	9.27	X	-	-	-		X	X
Shroud, moisture barrier viral penetration	9.28	X	-	-	-		X	X

[a] See 9.1.3.

[b] See 9.1.7.

[c] See 9.1.4.

[d] See 9.1.6.

[e] See 9.1.5.

[f] See 9.1.2.

Table A.9.1(h) Testing Proximity Gloves

	Test Material or Component										Test Conditioning		
Test	Section Number	Whole Glove	Glove Composite	Glove Outer Shell Material	Glove Gauntlet	Glove Wristlet	Thread	Hardware			Room Temp[a]	Washing/Drying[b]	Convect Heat[c]
TPP	9.10	-		X	-		X	X	-	-	-		
Heat and thermal shrinkage resistance	9.6	X	-	-	-	-	-	-	-				
Conductive heat resistance test 1	9.7	-		X	-	-	-	-	-	-			
Flame resistance test 3	9.4	-		X	-		X	X	-	-	-		
Thread melting	9.11	-	-	-	-	-						X	-
Viral penetration resistance	9.28	-		X	-	-	-	-	-	-			
Liquid penetration resistance	9.27	-		X	-	-	-	-	-	-	-	-	-
Cut resistance	9.21	-		X	-		X	X	-	-	-		
Puncture resistance test 1	9.20	-		X	-	-	-	-	-	-			
Glove hand function	9.37	X	-	-	-	-	-	-	-				
Burst strength	9.13	-	-	-	-					X	-	-	-

		Test Material or Component								Test Conditioning		
Test	Section Number	Whole Glove	Glove Composite	Glove Outer Shell Material	Glove Gauntlet	Glove Wristlet	Thread	Hardware		Room Temp[a]	Washing/Drying[b]	Convect Heat[c]
Seam breaking strength	9.14	-	-	-				X	X	-	-	-	-
Overall liquid integrity test 1	9.33	X	-	-	-	-	-	-	-	-			
Glove donning test	9.37	X	-	-	-	-	-	-	-	-			
Liner retention test	9.63	X	-	-	-	-	-	-	-	-			
Label durability and legibility test 1	9.41	X	-	-	-	-	-	-	-				
Radiant heat resistance test 2	9.61	-	-			X	-	-	-	-	-		
Wet flex	9.54	-	-			X	-	-	-	-	-		
Adhesion after wet flex	9.55	-	-			X	-	-	-	-	-		
Flex at low temperature	9.56	-	-			X	-	-	-	-	-		
Resistance to high temperature blocking	9.57	-	-			X	-	-	-	-	-		
Grip test	9.38	X	-	-	-	-	-	-	-	-			
Corrosion resistance	9.29	-	-	-	-	-	-						

[a] See 9.1.3.

[b] See 9.1.2.

[c] See 9.1.5.

[d] See 9.1.8.

[e] See 9.1.10.

Table A.9.1(i) Testing Proximity Firefighting Footwear

		Test Material or Component									Test Conditioni	
Test	Section Number	Whole Footwear	Footwear Composite	Footwear Sole	Footwear Toe Section	Footwear Moisture Barrier	Footwear Moisture Barrier Seam	Thread	Labels	-	Room Temp[a]	Convective Heat[b]
Radiant heat resistance test 2	9.61	X	-	-	-	-	-	-	-	-		
Conductive heat resistance test 3	9.60	X	-	-	-	-	-	-	-	-		
Conductive heat resistance test 2	9.8	X	-	-	-	-	-	-	-	-		
Flame resistance test 4	9.5	X	-	-	-	-	-	-	-	-		
Thread melting test	9.11	-	-	-	-	-	-					
Liquid penetration resistance	9.27	-	-	-	-					X	X	- -
Viral penetration resistance	928	-	-	-	-					X	X	- -
Puncture resistance test	9.20	X	X	-	-	-	-	-	-	-		

		Test Material or Component									Test Conditioni	
Test	Section Number	Whole Footwear	Footwear Composite	Footwear Sole	Footwear Toe Section	Footwear Moisture Barrier	Footwear Moisture Barrier Seam	Thread	Labels	-	Room Temp[a]	Convective Heat[b]
Cut resistance	9.21	-		X	-	-	-	-	-	-		
Slip resistance	9.40	X	-	-	-	-	-	-	-	-		
Abrasion resistance	9.23	-	-			X	-	-	-	-	-	
Electrical insulation test 2	9.31	X	-	-	-	-	-	-	-	-		
Impact and compression	9.18	-	-	-				X	-	-	-	-
Ladder shank bend	9.39	X	-	-	-	-	-	-	-	-		
Eyelet and stud post attachment	9.49	X	-	-	-	-	-	-	-	-		
Corrosion resistance	9.29	X	-	-	-	-	-	-	-	-		
Label durability and legibility	9.41	-	-	-	-	-	-	-				
Overall liquid integrity test 2	9.70	X	-	-	-	-	-	-	-	-		
Heat and thermal shrinkage resistance test	9.6	X	-	-	-	-	-	-	-	-		
Puncture resistance device flex test	9.19	X	-	-	-	-	-	-	-	-		

[a] See 9.1.3.

[b] See 9.1.5.

[c] See 9.1.9.

Table A.9.1(j) Testing Proximity Firefighting Interfaces

Test	Section Number	Test Material or Composite			Conditioning		
		Wristlet Material or Composite	Wristlet Seams	Wristlet Thread	Washing/Drying[a]	Room Temperature[b]	
Flame resistance	9.2	X	-	-			X X
Thermal shrinkage resistance	9.6	X	-	-			X X
Heat resistance	9.6	X	-	-			X X
TPP	9.10	X	-	-	-		X
Thread melting	9.11	-	-		X	-	- X
Burst strength	9.13	X	-	-			X X
Seam strength	9.14	-		X	-		X X
Cleaning shrinkage	9.24	X	-	-			X -

[a] See 9.1.2.

[b] See 9.1.3.

~~Table A.9.1(k) Optional CBRN Protective Ensemble Test Matrix~~

~~- MIST Overall Liquid Penetration Chemical Permeation Resistance Burst Strength Puncture Propagation Tear (PPT) Resistance Cold Temperature Performance Cut Resistance Puncture Resistance Abrasion Resistance Test Material or Component* 9.66 9.48 9.67 9.13 9.68 9.69 9.22 9.20 9.70 Overall ensemble X X - - - - - - - CBRN barrier layer - - X - - - - - - External CBRN barrier layer (garment) - - - X X X - - - External CBRN barrier layer (glove) - - - - - - X X - External CBRN barrier layer (footwear) - - - - - - X X X~~

~~*Each ensemble element must meet the requirements for both ensemble and the respective ensemble as a prerequisite for applying the CBRN protection option.~~

Statement of Problem and Substantiation for Public Comment

Delete the portion of the table related to the CBRN option as that is no longer part of this standard.
The other tables in this section should also be updated to reflect changes made to the standard. If the tables are not maintained, they should be deleted from the document so as not to cause confusion.

Related Item

- FR302

Submitter Information Verification

Submitter Full Name: Karen Lehtonen
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Street Address:
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Submittal Date: Wed Jan 04 15:00:06 EST 2023
Committee: FAE-SPF

Public Comment No. 174-NFPA 1970-2023 [Chapter B]

Add, revise or remove any test method changes acted on in the second draft committee meetings.

Annex B Description of Performance Requirements and Test Methods (NFPA 1971)

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 Overview.

Annex B is intended to serve as a guide for both experienced and rookie firefighters who want to better understand the performance requirements (tests) of the structural firefighting gear they wear and to develop a basic understanding of the minimum test requirements for the structural firefighting gear described in ~~Chapter~~ 8 ~~of the 2018 edition of NFPA 1971~~ Chapters 5 though 9 of this standard .

This annex will also help the reader gain a clearer understanding of the limits of the protective ensemble. However, Annex B only addresses performance requirements and test methods for protective elements (garments, helmets, gloves, footwear, and hoods) used for structural firefighting. Descriptions for specific performance requirements and test methods for proximity firefighting elements will be addressed in a future edition.

Interpretations of tests, test methods, or test results will not be found here. Instead, Annex B provides background information and explains performance requirements and test methods in layman's terms. Fire department equipment officers, safety officers, purchasing agents, members of the selection committee, and end users/wearers will also find this information helpful.

The tests required by NFPA 1971 do not guarantee that the ensemble or ensemble element will not fail in the field. The tests evaluate representative samples of the protective ensemble elements, or materials used in their construction to determine whether the element will pass defined minimum performance requirements under controlled test conditions. These tests cannot be performed in the field — they must be performed by the qualified laboratory of an accredited certification organization.

Annex B also gives a brief description of the required NFPA tests performed by the certification organization (chosen by the manufacturer) on the five elements of the structural firefighting ensemble — protective garment (the coat and pants, outer shell/moisture barrier/thermal liner), protective helmets, protective gloves, protective footwear, and protective hoods — with a section and corresponding table for each element.

The Test Method column in each table shows the number and name of the section in the standard that is described; the Test Method Description column provides an overview of the test, which indicates what is tested and, in general, how it is tested; and the Test Method Application column explains why the test method is specified and how the method is used to assess the performance of firefighter protective clothing.

Some tests evaluate a representative piece or sample of the element while other tests evaluate the whole element as specified in the table. In general, tests are conducted on multiple specimens, not just one specimen. Tests are designed by experts familiar with firefighting field conditions. They are evaluated by firefighters on the NFPA 1971 committee before they are put in the standard to ensure the performance requirements translate to an appropriate minimum level of protection.

Throughout the document, references are made to specimens being tested "as received" and "after conditioning." Specific descriptions and instructions for each type of conditioning can be found in Chapter 9, along with the test method details.

In general, however, the term *as received* means the specimens tested are new, out-of-the-box samples that have not been laundered or subjected to other environmental conditioning; "conditioning" generally refers both to laundering the samples and to exposing the samples to specific environmental conditions. Again, all the specific details for sample treatment can be found in Chapter 9.

To ensure environmental consistency prior to testing, the as-received samples are conditioned in an environmental chamber for 24 hours at 21°C ± 2.8°C (70°F ± 5°F) and 65 percent ± 5 percent humidity. The specific procedure used to condition samples to these parameters is found in ASTM D1776/D1776M, *Standard Practice for Conditioning and Testing Textiles.* As outlined in specific tests, elements might also require conditioning by one or more of the following procedures before testing can proceed:

(1) Washing and drying procedures (AATCC 135, *Dimensional Changes of Fabrics after Home Laundering*)

(2) Low temperature environmental conditioning

(3) Convective heat conditioning

(4) Radiant and convective heat conditioning

(5) Wet conditioning

The Test Method Description column in the tables references specific test methods from other standards organizations such as ASTM or ISO. In these instances, some details found in the referenced test method, but not in NFPA 1971, are described for the respective test method. This information includes specific details that are key to understanding the test method in the context of how it might relate to what is experienced in the field and, therefore, is included in this annex.

Firefighters face many hazards that manufacturers of personal protective equipment attempt to mitigate. The minimum performance requirements that protective ensemble elements have to meet are included in ~~the 2018 edition of NFPA 1971~~ Chapter 8 of this standard . Certification organizations and their laboratories perform these tests and determine whether or not the samples provided pass the tests. Compliance for a particular product is indicated by the certification mark on the product label that is permanently attached to the coat and pants, helmet, gloves, footwear, or hood. The certification mark means representative samples have passed rigorous tests and are compliant with ~~the 2018 edition of NFPA 1971~~ Chapters 4-9 of this standard . If the certification organization mark is not on the label, the equipment is neither NFPA-compliant nor third-party certified and should not be used.

B.2 Garments.

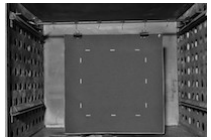
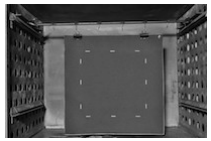
Table B.2 is intended to serve as an abbreviated guide to specified tests that apply to garments, including the outer shell, the moisture barrier, the thermal barrier, garment hardware, and materials used in the construction of the garment. These tests evaluate whether or not the garment meets the minimum performance requirements of ~~the 2018 edition of NFPA 1971~~ Chapters 4 though 9 of this standard . They do not guarantee the safety of the firefighter or ensure the firefighter will not experience injury while wearing the garment.

Table B.2 Garments

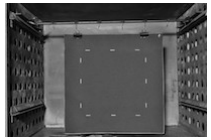
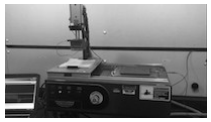
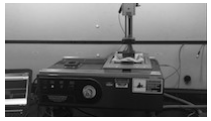
Test Method	Test Method Description	Test Method Application	
7.1.1 Thermal Protective Performance (TPP) Test	This test is performed in accordance with ISO 17492, *Clothing for protection against heat and flame — Determination of heat transmission on exposure to both flame and radiant heat*, on three specimens/samples of the three-layer garment composite, which are tested as received. Specimens comprise the outer shell, thermal liner, and moisture barrier and are layered and tested in the order in which they are worn. The outer shell exterior is exposed to both radiant and convective heat sources.	The Thermal Protective Performance (TPP) test is used to measure the insulating performance of the three-layer system by evaluating how quickly heat is transferred from the outside of the garment to the inside.	
	**TPP Test Apparatus.**	-	
	**TPP Test Being Run.**	-	
	-	The rate of temperature rise is recorded and compared to the known skin response to heat; the recorded time is multiplied by the heat exposure energy to determine the Thermal Protective Performance (TPP) rating.	Under the given test conditions, which simulate severe flashover conditions, the TPP rating divided in half indicates the approximate number of seconds until a firefighter would receive a second-degree burn.
	-	The TPP rating of the garment must be at least 35.	This is the primary test to measure the

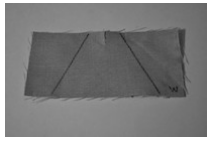
Test Method	Test Method Description	Test Method Application	
			garment's ability to protect the firefighter from severe heat and flame. The higher the number, the higher the protection from heat (under the specific test conditions), and, in general, the higher the heat stress on the firefighter. Firefighters should always consider the TPP rating as it relates to the Total Heat Loss (THL) rating.
7.1.2 Whole Garment and Ensemble Liquid Penetration Test (Shower Test)	This test is performed in accordance with ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, on a full garment set (coat and pants) or coveralls. The whole garment is placed on a manikin dressed in a water-absorptive layer and exposed to 2.5 minutes of liquid spray from four different orientations for a total of 10 minutes. After removal of the garment, the water-absorptive layer is examined for evidence of moisture penetration.	The Shower Test is used to evaluate how well the seams and closures of the garment, under controlled test conditions, resist inward leakage of liquids from exterior sources. Note: The Shower Test is the *only* test performed on assembled garments — coats and pants.	
7.1.3 Flame Resistance Test 1	This test is performed in accordance with ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*, as received and after conditioning with five laundering cycles on garment components (hook and pile, elastic, and labels can be excluded from the test depending on their location in the garment).	The Flame Resistance Test 1 is used to evaluate the material, under controlled test conditions, for its ability to self-extinguish after the flame is removed. The char length of the material after exposure to flame is also measured.	

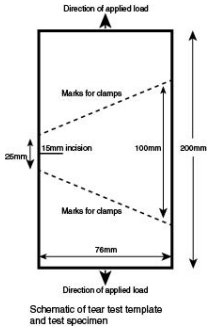
Test Method	Test Method Description	Test Method Application	
	**Test Apparatus in Ready Position.**	-	
	**Flame Test Being Performed.**	-	
	-	Each separable layer of multilayer composites is tested individually. The specimen is suspended over a flame for 12 seconds to determine how easily the material ignites. Ease of ignition and charring characteristics are observed and recorded. Materials cannot char more than 100 mm (4 in.), cannot show afterflame 2 seconds after removal of the test flame, and cannot melt.	This is the primary test to establish the flame-resistant properties of the materials used in garment construction.
7.1.4 Heat and Thermal Shrinkage Resistance Test (shrinkage)	This test is performed as received and after conditioning with five laundering cycles. Outer shells, moisture barriers, thermal barriers, collar linings, and winter liners (where provided) are tested individually. Fabric samples are marked and measured before exposure to 5 minutes of heat in a 260°C (500°F) oven.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate the materials for shrinkage after exposure to high temperatures.	
	-	Excessive shrinkage could compromise the firefighter's mobility and impact the insulating qualities of the garment.	Post-exposure measurements are taken and averaged, and no more than 10 percent shrinkage is permitted.
7.1.5 Heat and Thermal Shrinkage Resistance Test	This test is performed as received and after conditioning with five laundering cycles on garment components, except for hook and loop and elastic, when placed	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to determine whether or not	

Test Method	Test Method Description	Test Method Application	
(melting, separation, ignition)	where they will not contact the firefighter's body. Samples are suspended in a 260°C (500°F) oven for 5 minutes.	components used to construct protective garments will melt, separate, or easily ignite.	
	-	Garment components cannot melt, drip, separate, or ignite.	The test conditions are not intended to simulate actual fireground exposures but rather serve as a means to establish a minimum level of thermal stability for the materials used in the construction of protective clothing elements.
	**Oven Exterior.**	-	
	**Oven Interior.**	-	
7.1.6 Heat and Thermal Shrinkage Resistance Test (moisture barrier seams)	This test is performed as received and after conditioning with 5 laundering cycles on all moisture barrier seams. Samples are prepped and exposed to 5 minutes of heat in a 260°C (500°F) oven. Observations are limited to seam material ignition and dripping.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate the ability of the moisture barrier seams to resist dripping or ignition.	
	**Oven Exterior.**	-	
	**Oven Interior.**	-	

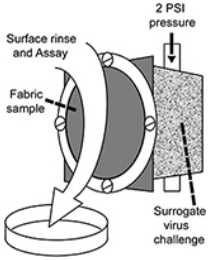
Test Method	Test Method Description	Test Method Application
7.1.7 Heat and Thermal Shrinkage Resistance Test (outer shells and collar linings/char)	This test is performed as received and after conditioning outer shells and collar linings with five laundering cycles to identify charring when specimens are exposed to 5 minutes of heat in a 260°C (500°F) oven. Specimens cannot char.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate whether or not the outer surfaces of the garment will char or break open, exposing interior layers. Charring and breaking open compromise the thermal and physical protection of the garments, which, in turn, increases the risk of firefighter burns and injuries.
	**Oven Exterior.**	-
	**Oven Interior.**	-
7.1.8 Heat and Thermal Shrinkage Resistance Test (hardware)	This test is performed on hardware, excluding hook and pile, when they do not contact a firefighter's body. Performance of the specimens is observed after exposure to 5 minutes of heat in a 260°C (500°F) oven.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the ability of the hardware to remain functional and resist ignition when exposed to heat. This test eliminates the use of hardware on garments that will not withstand exposure to a certain level of heat.
	**Oven Exterior.**	-

Test Method	Test Method Description	Test Method Application
	**Oven Interior.**	-
7.1.9 Conductive and Compressive Heat Resistance (CCHR) Test	This test is performed on composites from the shoulder and knee areas with all layers placed in the same order as they are constructed. Sample sizes are representative of the knee and shoulder area and must be provided for each composite combination used by the garment manufacturer. Samples are tested in both the wet and dry condition under applied pressure.	The Conductive and Compressive Heat Resistance (CCHR) Test is used to evaluate the properties of the garment shoulder and knee areas, which are more likely to become compressed; thermal insulation is reduced under compression. The requirement sets a minimum number of seconds until the firefighter would receive a second-degree burn when these areas are under compression.
	**Conductive and Compressive Heat Resistance (CCHR) Test Machine in the Ready State.**	-
	**Conductive and Compressive Heat Resistance (CCHR) Test Machine in Operation.**	-

Test Method	Test Method Description	Test Method Application
7.1.10 Thread Melting Test	This test is performed in accordance with ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, on the three different specimens of sewing thread used in the construction of the garment as received.	The Thread Melting Test is used to evaluate the thread used in the construction of the garment to determine whether it has at least the same heat resistance as the fabric used in the garment's construction. The temperature at which the thread melts or decomposes is recorded, and if it melts below 260°C (500°F), it fails.
7.1.11 Tear Resistance Test (outer shells and collar linings)	This test is performed in accordance with ASTM D5587, *Standard Test Method for the Tearing of Fabrics by Trapezoid Procedure*, on outer shells and collar linings (tested individually) as received and after the multiconditioning procedure. The test measures the force (in pounds) needed to continue a pre-existing tear. Opposite ends of an intentionally notched, trapezoidal-shaped specimen are gripped in a machine and pulled apart until the specimen tears completely.	The Tear Resistance Test is used for this requirement to measure the ability of the outer shell fabric and collar linings to resist further tearing when a small tear occurs. Fabric tears further expose the firefighter to the products of combustion. It also is a test of the strength and durability of the fabric. Firefighting occurs in a harsh environment that includes many hazards that might tear a garment.
	**Sample Marked and Precut for Test.**	-
	**Test Being Performed.**	-
7.1.12 Tear Resistance Test (moisture barriers, thermal barriers)	This test is performed in accordance with ASTM D5587 on moisture barriers, thermal barriers, and winter liners as received and after the multiconditioning procedure. The test measures the force (in pounds)	The Tear Resistance Test is used for this requirement to measure the ability of the thermal barrier materials and the moisture barrier to

Test Method	Test Method Description	Test Method Application
	needed to continue a preexisting tear. Opposite ends of an intentionally notched, trapezoidal-shaped specimen are gripped in a machine and pulled apart until the specimen tears completely.	resist further tearing when a small tear occurs, which further exposes the firefighter to the products of combustion.
 Schematic of tear test template and test specimen	**Diagram of Trapezoidal Tear Test.**	-
7.1.13 Seam-Breaking Strength Test	This test is performed in accordance with ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, on all garment seam assemblies. Samples are tested after conditioning. Opposite ends of a 50 mm × 200 mm (2 in. × 8 in.) specimen with the seam bisecting the length are gripped in a machine and pulled apart until the specimen breaks.	The Seam-Breaking Strength Test is used to evaluate the strength of garment seams under stress. The test demonstrates the durability of the seam as an indicator of physical performance when subjected to repeated wearer movement, such as bending and stretching.
	**Seam Breaking Strength Test.**	-
7.1.14 Water Penetration Resistance Test (moisture barriers)	This test is performed on specimens of garment moisture barriers as received and after the multiconditioning procedure. A circular portion of the moisture barrier is clamped down in a hydrostatic tester and exposed to high water pressure from underneath. The specimen is then examined for water penetration.	The Water Penetration Resistance Test is used to evaluate the ability of moisture barrier materials to keep water from getting through the barrier. The test demonstrates the capacity of the moisture barrier to keep the firefighter dry from external pressurized water.

Test Method	Test Method Description	Test Method Application
7.1.15 Liquid Penetration Resistance Test (moisture barrier and barrier seams)	This test is performed in accordance with ASTM F903, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, on moisture barrier fabric and seams for the garment, footwear, bootie, and glove. Specimens are conditioned for laundry and heat in specially made pockets comprised of two layers of outer shell and a layer of thermal.	The Liquid Penetration Resistance Test is used to evaluate whether or not the garment's moisture barrier and seams resist penetration of liquids meant to be representative of those commonly encountered on the fireground. After conditioning specimens are placed in a test cell where the normal outer surface of the material is exposed to aqueous film-forming foam, battery acid, surrogate gasoline, fire-resistant hydraulic fluid, swimming pool chlorine, and automobile antifreeze fluid; each liquid is tested separately on an individual specimen. After 1 hour of exposure, each sample is evaluated. No liquid can penetrate any sample.
7.1.16 Viral Penetration Resistance Test (moisture barrier and barrier seams)	This test is performed in accordance with ASTM F1671/F1671M, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X-174 Bacteriophage Penetration as a Test System*, on moisture barrier fabric and seams. Samples are conditioned for laundry and heat in specially made pockets comprised of two layers of outer shell and a layer of thermal barrier. -	The Viral Penetration Resistance Test is used to evaluate the ability of the garment's moisture barrier fabric and seams to keep blood-borne pathogens from coming in contact with the firefighter. After conditioning, the specimens are then placed in a test cell where the film side is exposed to surrogate virus in a liquid solution and -

Test Method	Test Method Description	Test Method Application	
		is evaluated for passage of virus after 1 hour. Any evidence of virus passage through the barrier fabric or seam as determined using a microbiological technique constitutes failure.	
	**Diagram of Viral Penetration Test for Moisture Barrier and Seams.**		
7.1.17 Cleaning Shrinkage Resistance Test (moisture barriers, winter liners, collar liners) *(see also 7.2.4)*	This test is performed on three conditioned specimens of garment moisture barriers, winter liners (when provided), and collar liners, each tested individually.	The Cleaning Shrinkage Resistance Test is used to evaluate how much garment materials shrink after repeated laundering; shrinkage could decrease the firefighter's mobility.	This requirement allows no more than a 5 percent change in the width and length dimensions after five wash and dry cycles in an extractor.
7.1.18 Water Absorption Resistance Test (resistance to water absorption)	This test applies to the garment outer shells and collar lining. The conditioned specimens, tested individually, are mounted on an apparatus specified in AATCC 42, *Test Method for Water Resistance: Impact Penetration Test*, and exposed to a constant flow of water to determine the level of water absorption.	The Water Absorption Resistance Test is used to determine how much water the outer shell absorbs. The requirement limits how much water can be absorbed — absorbed liquid adds weight, which increases firefighter	

Test Method	Test Method Description	Test Method Application	
		fatigue and decreases firefighter mobility.	
7.1.19 Corrosion Resistance Test	This test is performed in accordance with ASTM B117, *Test Method for Water Resistance: Impact Penetration Test*, to measure corrosion. Metal hardware is exposed to a saline solution spray for 20 hours following which base metal can show only slight surface corrosion and the hardware must remain functional.	The Corrosion Resistance Test is used to evaluate whether hardware will (1) corrode and (2) remain functional after extended exposure to salt spray. -	Hardware failure can result in loss of thermal and physical protection for the firefighter.
7.1.20 Label Durability and Legibility Test 1	This test is performed on garment labels attached to sample fabric. Garment label specimens are exposed to 10 laundry cycles in an extractor and then subjected to abrasion in accordance with ASTM D4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Test Method)*. Labels are also evaluated for legibility after a convective heat exposure.	The Label Durability and Legibility Test is used to evaluate whether or not the label stays in place and is legible after exposure to multiple launderings, abrasion, and convective heat. The presence and legibility of labels is important for garment identification and tracking.	
7.1.21 Drag Rescue Device (DRD) Materials Strength Test	This test is performed in accordance with ASTM D6775, *Standard Test Method for Breaking Strength and Elongation of Textile Webbing, Tape and Braided Material*, to measure the breaking strength of DRD materials, seams, splices, and joints. Specimens are conditioned then elongated to the point of breaking. The pounds of force needed to break each specimen is recorded and used to calculate the average breaking strength of the specimens.	The Drag Rescue Device (DRD) Materials Strength Test is used to evaluate the strength of the DRD materials, seams, splices, and joints to determine whether the specimens can withstand the force of dragging a downed firefighter.	

Test Method	Test Method Description	Test Method Application
7.1.22 Drag Rescue Device (DRD) Function Test	This test is used to evaluate DRD functionality as it is installed in the coat or coverall. The garments and DRD, after conditioning at room temperature, are placed on a manikin with an SCBA. The DRD is deployed by the test technician using a gloved hand and having obscured vision, and the manikin is dragged for a specified distance.	The DRD Function Test is used to assess the ease of deploying and using the DRD to remove a downed firefighter. The deployment time is recorded and reported, the ability to drag the manikin the required distance is recorded and reported, and any change in the position of the SCBA during deployment or dragging is recorded and reported. Ten seconds is the maximum amount of time permitted to deploy the DRD. For the DRD to pass the test, the SCBA can neither move higher on the torso than when initially donned nor become separated from the manikin during the test.
-	-	-
-	-	-
-	-	-
-	-	-
7.1.24 Zipper Strength Test	This test is used to evaluate zippers for crosswise breaking strength of the chain and of the separating unit. They are also tested for holding strength of stops, retainers, and separating units and for operating force and slider lock strength.	The Zipper Strength Test is used to assess the durability and functionality of zippers after repeated use.
7.1.25 Fastener Tape Strength Test (breaking)	This test is performed after three launderings in accordance with ASTM D5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics*, and is based on the requirements of A-A-	The Fastener Tape Strength Test is used for this requirement to assess the overall strength of tapes used in hook and pile

Test Method	Test Method Description	Test Method Application
	55126C, *Commercial Item Description, Fastener Tapes, Hook and Loop, Synthetic*. It is used to evaluate the breaking strength of hook and pile tape by separately pulling the hook and pile tapes in the jaws of a tensile testing machine until the tape breaks. The force used at the breaking point is recorded as the breaking strength.	fasteners. The material must meet or exceed industry-established requirements based on the composition and width of the tape.
7.1.26 Fastener Tape Strength Test (shear)	This test is performed after three launderings in accordance with ASTM D5169, *Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners*, and is based on the requirements of A-A–55126C. It is used to evaluate the shear strength of the hook and pile tape by measuring the force required to separate hook tape overlapping pile tape when pulled between two jaws of a tensile testing machine. Testing is performed after the tapes have been repeatedly attached and detached. The maximum measured force is reported as the shear strength.	The Fastener Tape Strength Test is used for this requirement to assess the durability and functionality of the hook and pile to not separate after repeated use.
7.1.27 Fastener Tape Strength Test (peel)	This test is performed after three launderings in accordance with ASTM D5170, *Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners*, and is based on the requirements of A-A-55126C. It is used to evaluate the peel strength of the hook and pile tape. In the test, hook tape is sealed over an equal length of pile tape and the end of the two tapes are separated half their length. The two open ends of tape are attached to the jaws of a tensile testing machine and pulled to measure the force required to completely separate the two tapes. This testing is performed after the tapes have been repeatedly sealed and resealed several times.	The Fastener Tape Strength Test is used for this requirement to assess the durability and functionality of the hook and pile to stay sealed after repeated use.

Test Method	Test Method Description	Test Method Application	
7.2.2 Total Heat Loss (THL) Test	This test is performed in accordance with ASTM F1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, Part C, on samples of the garment composite (outer shell, moisture barrier, and thermal barrier) conditioned at 25°C, 65% RH arranged in the order and orientation as it is worn. Specimens are placed on a sweating hot plate to evaluate heat transfer under wet conditions and thermal resistance under dry conditions. These values are combined in an equation to predict a total heat loss value in 25°C, 65% RH environment with a 2 m/s wind flow.	The Total Heat Loss (THL) Test is used to evaluate the amount of heat that can be transferred out of the garment composite via both sweat evaporation from the wearer's skin and conduction through the garment into a mild environment. The test does not account for other materials attached to the base garment composite such as trim, pockets, and other layers. Additions to the garment can negate benefits provided by a high THL composite. In addition, this test cannot measure the effect of sunlight on the gear where darker colors and dirty gear have shown to lower performance.	Higher values indicate better performance and more heat loss in a mild environment. Appropriate THL values for your department must be considered with TPP and evaporative resistance values. *(See A.7.2.2 for more detail.)*

Test Method	Test Method Description	Test Method Application
	The conditioned garment trim is tested for both retroreflectivity and fluorescence. The coefficient of retroreflection is tested in accordance with ASTM E809, *Standard Practice for Measuring Photometric Characteristics of Retroreflectors*. Once retroreflection is determined, the specimen is evaluated for fluorescence. The colorimetric properties are measured in accordance with ASTM E991, *Standard Practice for Color Measurement of Fluorescent Specimens*.	The Retroreflectivity and Fluorescence Test is used to evaluate how well samples of retroreflective and fluorescent material retain their retroreflectivity and fluorescence. The standard has requirements for retroreflectivity and fluorescence to enhance nighttime/low-light visibility (retroreflection) and daytime visibility (fluorescence).
7.2.3 Retroreflectivity and Fluorescence Test (garment trim)	Retroreflection/retroreflectivity is the reflection of light in which the reflected rays are preferentially returned in the direction close to the opposite of the direction of the incident rays, with the property being maintained over wide variations of the direction of the incident rays.	The visibility of a firefighter is crucial during both interior and exterior operations. In addition, almost all emergency incidents begin in a roadway (apparatus placement), and many emergency incidents are roadway related. For firefighter safety, it is important that garments have effective retroreflectivity and fluorescence for conspicuity (visibility). Fluorescence is the process by which radiant flux of certain wavelengths is absorbed and reradiated nonthermally in other, usually longer, wavelengths.
7.2.4 Cleaning Shrinkage Resistance Test (outer shell, moisture barrier, thermal barrier, winter liner, wristlet, bootie) *(see also 7.1.17)*	This test, performed in accordance with the measurement requirements of AATCC 135 measures the percent of change in the width and length dimensions after five wash and dry cycles in an extractor. Tests are performed on three specimens of the conditioned garment outer shell, moisture barrier, thermal barrier, winter liner, wristlet, bootie material where present, and	The Cleaning Shrinkage Resistance Test is used to measure how much fabrics shrink after cleaning; they will not pass if they shrink more than 5 percent. Excessive shrinkage could compromise the firefighter's mobility and impact the

Test Method	Test Method Description	Test Method Application
	protective hoods. Each material and each separable layer of a composite material is tested separately.	insulating qualities of the garment.
7.2.5 Breaking Strength Test (outer shell and collar lining)	This test is performed in accordance with ASTM D6775 on the garment outer shell and collar lining materials (individually) after conditioning. Five specimens from the sample, in the warp and fill direction, are elongated to the point of breaking.	The Breaking Strength Test is used to evaluate the garment's outer shell and collar lining strength for material robustness so it remains intact in rugged fireground environments. Material breakage can compromise the thermal and physical protection features of the garments, which increases the risk of firefighter burns and injuries.
	**Apparatus Ready for Test.**	-
	**Sample Fabric upon Completion of Test.**	-
7.2.6 Transmitted and Stored Thermal Energy Test (enhanced composites related to sleeves)	This test is performed in accordance with ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy of Firefighter Protective Clothing Systems*, on conditioned garment sleeve composites containing enhancements; enhancements include, but are not limited to, trim, emblems, flags, reinforcements, and so forth. The test is run on a base composite with the enhancement attached, following wet conditioning of the samples.	The Transmitted and Stored Thermal Energy Test is used to evaluate the ability of the garment composite enhancements to store and then transfer heat through the composite and enhancement to the skin. The test is used to evaluate the potential for burn injury when the composite is compressed, during a lower heat, longer time exposure. The test is intended to ensure that there is a level of protection to the firefighter to help prevent a burn injury

Test Method	Test Method Description	Test Method Application		
		when the garment does not indicate evidence of thermal exposure.		
7.2.7 Evaporative Resistance Test	This test is performed in accordance with ASTM F1886, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate, Part B*, on samples of the garments base composite (i.e., outer shell, moisture barrier, and thermal barrier) conditioned in the testing environment in the order and orientation as it is worn. Specimens are placed on a sweating hot plate and heat loss due to evaporation is measured and used to calculate the evaporative resistance value.	The Evaporative Resistance test is used to evaluate the amount of heat that can be transferred out of the garment composite via sweat evaporation from the wearer's skin through the garment to a hot and humid environment. The test does not account for other materials attached to the base garment composite such as trim, pockets, reinforcements, labels, and other accessories. These additional layers can easily negate any advantages gained from a composite with a low evaporative resistance. In addition, this test cannot measure the effect of sunlight on the gear where darker colors and dirty gear have shown to have lower performance.	-	- Lower values indicate better performance and a better ability to lose heat in a hot environment. However, appropriate evaporative resistance values for your department must be considered with THL and TPP values. *(See*

Test Method	Test Method Description	Test Method Application
		A.7.2.2 for more detail).

B.3 Helmets.

Table B.3 is intended to serve as an abbreviated guide to specified tests for helmets, including the whole helmet, the helmet ear cover, materials used in the construction of the whole helmet, the faceshield, and goggle components. The tests evaluate whether or not the helmet meets the minimum performance requirements of the 2018 edition of NFPA 1971. They do not guarantee the safety of the firefighter or ensure the firefighter will not experience injury while wearing the helmet.

Table B.3 Helmets

Test Method	Test Method Description	Test Method Application	
7.4.1 Top Impact Resistance Test (Force)	This test is performed on helmet specimens, each of which is conditioned five ways prior to testing: at room temperature, at low temperature, in convective heat, in radiant and convective heat, and wet conditioning.	The Top Impact Resistance Test (Force) is used to evaluate the helmet's shock absorption characteristics from the impact of a falling object (such as ceiling material) as well as firefighter protection from striking an object while walking, crawling, or falling on an object.	
	-	After conditioning, the helmet is mounted on an aluminum head and adjusted to the size providing the least amount of clearance. A specific weight steel drop mass is dropped from a height that yields a specific impact velocity.	This test is used to assess the effect of force on the top of the helmet when struck by falling or stationary objects. It also assesses the level of protection from a head and or neck injury from the force of impact with a moving or stationary object.
	-	The peak force and impact velocity are recorded for a pass or fail performance. The amount of force transmitted through the helmet specimens cannot exceed 3780 N (850 lbf).	-
7.4.2 Impact Resistance Test (Acceleration)	This test is performed on helmet specimens, each of which is conditioned four ways prior to each impact during testing: at room temperature, at low temperature, in radiant and convective heat, and wet conditioning. The whole helmet will undergo accelerated impact testing on the top, front, left, right, and back, in that order.	The Impact Resistance Test (Acceleration) is used to evaluate the helmet's shock absorption characteristics from the impact of the firefighter falling.	

Test Method	Test Method Description	Test Method Application	
	-	This test assesses the level of protection from a head injury caused by falling and striking the head.	The helmet is tested on a headform using a specific weight drop assembly (test headform, accelerometer, and moving portion of the headform guidance assembly). The drop assembly is dropped from a height that creates a known velocity.
	-	The maximum acceleration and duration of the acceleration values are recorded for each impact for each helmet specimen. If one or more helmet specimens fail in any condition or at any impact site, then the helmet fails in any condition or at any impact site.	-
7.4.3 Physical Penetration Resistance Test	This test is performed on helmet specimens, each of which is conditioned five ways prior to each physical penetration test: at room temperature, at low temperature, in convective heat, in radiant and convective heat, and with wet conditioning.	The Physical Penetration Resistance Test is used to assess how well the helmet will resist penetration by falling sharp objects (such as a nail in a structural member or a shard of glass) or by stationary sharp objects that the firefighter might strike while walking, crawling, or falling.	The test uses an ISO headform, a penetration striker, and an electrical contact indicator. A penetration striker is dropped from a height that yields a consistent velocity for the test on the helmet. A minimum of two penetration tests applied at different test areas on each helmet are performed.
	-		

Test Method	Test Method Description	Test Method Application	
	-	If the test striker electrically or physically contacts the headform in one or more specific tests, the helmet fails.	-
7.4.4 Heat and Thermal Shrinkage Resistance Test (helmet: heat resistance)	This test is performed on complete helmet specimens that are tested with all components in place, as received.	The Heat and Thermal Shrinkage Test is used to evaluate whether the helmet shell and helmet components can resist heat; they do not melt, drip, separate, or ignite. Helmet components that melt, drip, or ignite could contribute to burn injuries.	The helmet is placed in a preheated convective oven for 5 minutes.
	-		The helmet is evaluated for ignition, melting, and dripping. There are several possible points of failure for this test:
	-	(1) Parts of the complete helmet assembly that were not in contact with the headform before the test are in contact with the headform after the test.	-
	-	(2) The back of the helmet becomes distorted and extends more than allowed below the original position of the helmet shell.	-
	-	(3) The front and sides of the helmet shell become distorted and extend more than allowed below the original position of the helmet shell.	-
	-	(4) The retention system, energy absorption system, or ear covers separate, melt, or drip.	-
	-	(5) The chin strap closure device is dysfunctional.	-
	-	(6) Any part of the helmet assembly ignites.	-
	-	(7) The product labels ignite or melt.	-
	-	(8) Any helmet assembly component extends more than allowed below the initial point of the helmet shell in the front, both before and after oven exposure.	-

Test Method	Test Method Description	Test Method Application	
	-	(9) The faceshield/goggle component drips.	-
7.4.5 Flame Resistance Test 2, Procedures A and C	This test is performed on helmet specimens that are tested as received.	The Flame Resistance Test 2, Procedures A and C, is used to evaluate the helmet, under controlled test conditions, for its ability to self-extinguish after the flame is removed.	A flame is applied to the underside of the helmet (Procedure A) and the top of the helmet (Procedure C) using a Bunsen burner for 15 seconds. Once removed, the afterflame and afterglow are evaluated.
	-	The helmet cannot show any visible afterflame or glow 5 seconds after the test flame is removed in each test.	-
7.4.6 Thermal Protective Performance (TPP) Test(ear cover)	This test is performed in accordance with ISO 17492 on helmet ear cover composites after conditioning with five laundering cycles. Specimens consist of materials from the portion of the ear covers that cover the ear and neck.	The Thermal Protective Performance (TPP) test is used to measure the insulating performance of the helmet ear cover by evaluating how quickly heat is transferred from the outside of the helmet to the inside where skin might be in contact with the material. Under the given test conditions, which simulate severe flashover conditions, the TPP rating divided in half indicates the approximate number of seconds until a firefighter would receive a second-degree burn.	
	A sample is exposed to both radiant and convective heat sources to simulate flashover.		
	The rate of rise in temperature is compared to the known skin response to heat; the recorded time is multiplied by the heat exposure energy to determine the TPP rating. The TPP rating of the helmet ear cover has to be at least 20.	This is the primary test to measure the ability of the helmet ear cover to protect the firefighter from severe heat and flame. A TPP rating of 20 is acceptable because the interface area is overlapped by another part of the ensemble that also provides insulation.	

Test Method	Test Method Description	Test Method Application	
7.4.7 Retention System Test	This test is performed on complete helmets tested as received using a mechanical chin structure. This test measures the retention of the chinstrap of a helmet after specific force is applied for a specific time, by a tensile test machine. The distance between the top of the helmet and the bottom of the rollers is measured.	The Retention System Test is used to evaluate the helmet chinstrap's elongation and its resistance to breaking or stretching under applied force. If the helmet chinstrap breaks or stretches too much, the helmet is more likely to fall off the wearer, which increases the risk of injury to the firefighter.	Each helmet is observed for breaks and slip or stretch. Failure occurs if any helmet specimen shows a break or shows slip or stretch measured at more than what is allowed in the requirement.
7.4.8 Suspension System Retention Test	This test is performed on helmets tested as received on a tensile testing machine. The strap is cut to ensure a sufficient length of strap is secured by the jaws of the machine. An increasing force is applied along the centerline of the suspension strap.	The Suspension System Retention Test is used to evaluate whether or not the helmet suspension system separates from the helmet shell under applied force.	
	-	The specimen is inspected for separation from the helmet shell. Failure occurs if the helmet suspension system separates from the helmet shell.	If the helmet suspension system separates from the helmet, the helmet is more likely to fall off the wearer, which will increase the risk of injury to the firefighter.
7.4.9 Shell Retention Test	This test is performed on helmets tested as received using a tensile testing machine. The helmet is firmly attached to the machine, similar to the attachment in the	The Shell Retention Test is used to evaluate the ability of the helmet shell to stay attached to the helmet suspension system or helmet retention system.	

Test Method	Test Method Description	Test Method Application	
	suspension system test, and a specified maximum force is applied to the helmet for specified period.		
	-	The helmet receives a pass or fail performance based on the separation of the helmet shell from the suspension system or helmet retention system. If a helmet shell separates from the helmet suspension system or the helmet retention system, the helmet fails.	-
7.4.10 Flame Resistance Test 1 [all materials used in the construction of helmet chin straps(hook and pile, elastic, and labels might be excluded from the test depending on their location in the garment) and goggle strap materials.]	This test is performed in accordance with ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test),* on five samples of on all materials used in the construction of the helmet chin strap, with each separable layer tested individually after conditioning with five laundry cycles.	The Flame Resistance Test 1 is used to evaluate the helmet chinstraps' and the goggle straps' resistance to an open flame and the ability to self-extinguish once removed. The char length and afterflame are measured and averaged and evidence of melting or dripping is recorded and constitutes failure of the material.	
	-	Helmet chin straps are conditioned samples tested in accordance with ASTM D6413/D6413M. Observers will record the afterglow, char length, and visible melting or dripping.	This is the primary test to establish the flame-resistant properties and the ability of the materials used in chin strap construction to self-extinguish once removed from flame.
	-	Materials cannot char more than 100 mm (4 in.), on average; cannot show afterflame 2 seconds, on average, after removal of the test flame; and cannot melt or drip.	
7.4.11 Heat and Thermal Shrinkage Resistance Test (helmet chin strap: shrinkage, melting, separation and ignition)	This test is performed on helmet chin strap specimens after conditioning with five laundering cycles. The helmet chin strap is suspended in a preheated oven for a specified time.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate the ability of the helmet's chin strap to remain functional and resist melting, separation, ignition, and shrinkage.	

Test Method	Test Method Description	Test Method Application	
	-	Following testing, the samples are observed for evidence of melting, dripping, separation, and ignition. The helmet chin strap specimens cannot shrink more than 10 percent lengthwise, on average, and they cannot melt, separate or ignite. If one or more specimens shows evidence of melting, separation, or ignition, the helmet chin strap fails.	Melting, separation, ignition, and excessive shrinkage of the helmet chin strap might cause injury to the wearer.
7.4.12 Thread Melting Test	This test is performed in accordance with ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers,* on the three different specimens of sewing thread used in the construction of the helmet as received.	The Thread Melting Test is used to evaluate the thread used in the construction of the helmet to determine if it has at least the same heat resistance as the fabric used in garment construction.	
	-		The temperature at which the thread melts or decomposes is recorded, and if it melts below 260°C (500°F), it fails.
7.4.13 Corrosion Resistance Test	This test is performed in accordance with ASTM B117 to measure corrosion. Metal hardware is exposed to a saline solution spray for 20 hours, following which base metal can show only slight surface corrosion and the hardware must remain functional.	The Corrosion Resistance Test is used to evaluate whether hardware will (1) corrode and (2) remain functional after extended exposure to salt spray.	
		-	Hardware failure can result in loss of thermal and physical protection for the firefighter.

Test Method	Test Method Description	Test Method Application	
7.4.14 Label Durability and Legibility Test 2	This test is performed on helmets with labels attached, each of which is conditioned four ways prior to testing: at room temperature, at low temperature, in radiant and convective heat, and with wet conditioning.	The Label Durability and Legibility Test 2 is used to evaluate whether or not the label is legible after room and low temperature exposure, radiant and convective heat exposure, and wet conditioning. The presence and legibility of labels is important for helmet identification and tracking.	After all conditioning methods are completed, the labels are visually evaluated by a person with 20/20 vision or corrected to 20/20 at a distance of 305 mm (12 in.) in a well-illuminated area.
	-	Helmet labels are examined to see if they both remained in place and attached and to determine if they are still legible. One or more label specimens failing either the placement or the legibility test results in failure.	-
7.4.15 Faceshield/Goggle Component Lens Impact Resistance Test, Tests 1 and 2	This test is performed on complete helmets with the faceshield component or goggle components, each of which is conditioned four ways prior to testing: at room temperature, at low temperature, in convective heat, and with wet conditioning.	The Faceshield/Goggle Component Lens Impact Resistance Test is used to evaluate whether or not the faceshield and goggle components resist impact. In either test, if the “eye” of the headform is contacted by parts or fragments of the faceshield or goggle component then the helmet fails.	
	-	Test One is a high-mass-impact procedure that secures the specimen for testing on a facial feature headform. A missile is dropped through a loose-fitting guide tube from a specific distance in line with the eyes of the faceshield or goggle component. At least four specimens are tested, and a lens break constitutes failure.	This test evaluates the impact resistance of the faceshield/goggle component lens to impact from flying or falling objects.
	-	Test Two is a high-velocity-impact procedure that secures the specimen for testing on a facial feature headform. A	-

Test Method	Test Method Description	Test Method Application	
		steel ball weighing and measuring specific amounts is propelled toward the faceshield or goggle component at various locations at a specific speed. One or more helmet specimens failing this test means the helmet fails.	
	-	Both tests are evaluated for evidence of ejected parts or fragments of the faceshield or goggle component touching the “eye” of the headform. More specifically, no faceshield/goggle components can contact an “eye” of the headform, and no parts or fragments can be ejected from the component that could contact the “eye” of the headform.	-
7.4.16 Flame Resistance Test 2, Procedure B (faceshield/goggle components)	This test is performed on helmet specimens with the faceshield/goggle components attached as received on the faceshield and goggle components of the complete helmet. The bottom edge of the faceshield/goggle components is subjected to a flame for a specific time, using a Bunsen burner underneath, after which the duration of the afterflame is measured, reported, and recorded.	The Flame Resistance Test 2, Procedure B, is used to evaluate the faceshield and goggle component’s resistance to an open flame and the ability to self-extinguish once removed.	
	-	The faceshield/goggle component cannot show any visible afterflame 5 seconds after removal of the test flame.	-
7.5.2 Flame Resistance Test 1 (all fabrics used in the construction of faceshield/goggle components)	This test is performed in accordance with ASTM D6413/D6413M on all fabric strap materials used in the construction of the faceshield and goggle components. The faceshield and goggle components are tested	The Flame Resistance Test is used to evaluate the faceshield or goggle strap material, under controlled test conditions, for its ability to self-extinguish after the flame is removed. The char length of the material after exposure to flame is also measured.	

Test Method	Test Method Description	Test Method Application	
	after five conditioning laundry cycles.		
	-	The faceshield or goggle strap materials are evaluated on a pass/fail performance based on any observed melting, dripping, afterflame, and length of charring.	This is the primary test to establish the flame-resistant properties of the materials used in faceshield/goggle component construction to self-extinguish once removed from flame.
	-	Materials cannot char more than 100 mm (4 in.), and cannot show afterflame 5 seconds after removal of the test flame.	
7.5.3 Faceshield/Goggle Component Lens Scratch Resistance Test	This test is performed on specimens of faceshield/goggle component lenses in as-received condition.		
	-	The Faceshield/Goggle Component Lens Scratch Resistance Test is used to assess the durability and clarity of the faceshield and goggle lens material after exposure to abrasion.	The specimen is placed in the test fixture and a specific diameter wool felt polishing pad is attached to the pad holder. The abrasive disc is rotated on top of each specimen for a specific number of cycles. The haze of the specimen is evaluated before and after abrasion using a haze meter in accordance with ASTM D1003, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*. The delta haze is calculated by subtracting the initial haze measurement from the final haze measurement, the values for all tests are then averaged.
	-	The average change in haze cannot increase more than 25 percent after abrasion.	-
7.5.4 Luminous (Visible) Transmittance Test (faceshield/goggle component lenses)	This test is performed on complete faceshield/goggle component lenses in as-received condition to determine how much light is transmitted through the lens. The standard source	The Luminous (Visible) Transmittance Test is used to measure how much light passes through the faceshield/goggle component lens.	

Test Method	Test Method Description	Test Method Application	
	for measuring radiant energy of luminous transmittance is used to determine the average amount of light transmittance. A pass/fail rating is administered.		
	-	Clear lenses must transmit a minimum of 85 percent of the incident visible radiation and colored lenses must transmit a minimum of 43 percent of the incident visible radiation.	All lenses block some visible light and firefighters have to wear protective faceshields/goggles. This requirement limits how much light can be blocked to prevent the use of lens materials that reduce a firefighter's ability to see by more than an industry-accepted amount.
7.5.5 Flame Resistance Test 2, Procedure D (faceshield/goggle component attachment hardware, where provided)	This test is performed on helmets with faceshield/goggle component attachment hardware in place in as-received condition.		
	-	The Flame Resistance Test 2, Procedure D, is used to evaluate the resistance of the faceshield/goggle component's mounting hardware to an open flame and its ability to self-extinguish after the flame is removed.	The complete helmet with faceshield/goggle component is mounted on a headform, and the faceshield/goggle component is exposed for a specific time, to an open flame using a Bunsen burner. The specimens are evaluated for the duration of an afterflame and afterglow.
	-	The longest measured afterflame time is used to determine pass or fail. Any afterglow exceeding 5 seconds constitutes failure.	-

Test Method	Test Method Description	Test Method Application	
7.5.6 Electrical Insulation Test 1, Procedure A and Procedure B	These tests are performed on complete helmets in as received condition.		
	-	The Electrical Insulation Test 1, Procedure A and Procedure B, is used to evaluate the ability of the helmet to protect the firefighter against electricity conducted through accidental contact with live wires.	Procedure A — the helmet is inverted and filled to a specific line with tap water. The specimen is then submerged in the same type of water to the test line. An electric voltage is applied to the water inside the specimen at a specific voltage for a specific time. The water outside the helmet is measured for current leakage.
	-	Procedure B — The specimen and the retention system are submerged in tap water for a specific time, then they are removed from the water and allowed to drain for no more than 2 minutes. A lead carrying 60 Hz alternating voltage is attached to the metal hardware parts on the exterior of the helmet, at or above the brim edge. Voltage is applied to the external helmet shell lead and increased to a specific level for a specific time. The metal headform is used to measure the current leakage or evidence of breakdown.	-
	-	One or more helmet specimens cannot have leakage current exceeding 3 mA in either test Procedure A or Procedure B.	-
7.5.7 Flame Resistance Test 1 (all materials used in helmet ear covers, except elastic and hook and pile where these items do not come in direct contact with the wearer’s body or hood)	This test is performed in accordance with ASTM D6413 individually on all materials used in the construction of helmet ear covers (except elastic and hook and pile when they are placed so that they will not directly contact the wearer’s body or hood) after conditioning.	The Flame Resistance Test 1 is used to evaluate the helmet ear cover material, under controlled test conditions, for its ability to self-extinguish after the flame is removed. The char length of the material after exposure to flame is also measured.	

Test Method	Test Method Description	Test Method Application	
	-	Each separable layer of multilayer composites are tested individually.	This is the primary test to establish the flame-resistant properties of the materials used in ear cover construction.
	-	The specimen is suspended over a flame for 12 seconds to determine how easily the material ignites. Ease of ignition and charring characteristics are observed and recorded.	
	-	Materials cannot char more than 100 mm (4 in.), cannot show afterflame 2 seconds after removal of the test flame, and cannot melt or drip.	-
7.5.8 Heat and Thermal Shrinkage Resistance Test [all materials used in helmet ear covers (elastic and hook and pile might be excluded from the test depending on their location in the garment) for shrinkage, melting, separation and ignition]	This test is performed individually on specimens of all materials used in the construction of helmet ear covers (elastic and hook and pile might be excluded from the test depending on their location in the garment) in as received-condition.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the materials for shrinkage, melting, separation, and ignition after exposure to high temperatures.	
	The specimen is suspended in the center of the oven facing the airflow. Post-exposure measurements are taken to ensure that heat shrinkage is less than 10 percent in each direction.	Melting, separation, ignition, or excessive shrinkage can cause injury to the wearer.	
	-	Materials cannot shrink more than 10 percent in any direction, and they cannot melt, separate, or ignite.	-
7.5.9 Retroreflectivity and Fluorescence Test (helmet visibility markings)	The conditioned helmet trim is tested for both retroreflectivity and fluorescence. The coefficient of retroreflection is tested in accordance with ASTM E809. Once retroreflection is determined, the specimen is evaluated for	The Retroreflectivity and Fluorescence Test is used to evaluate how well samples of retroreflective and fluorescent material retain their retroreflectivity and fluorescence. The standard has requirements for retroreflectivity and fluorescence to enhance nighttime/low light visibility (retroreflection) and daytime visibility (fluorescence).	

Test Method	Test Method Description	Test Method Application	
	fluorescence. The colorimetric properties are measured in accordance with ASTM E991.		
	-	Retroreflection/retroreflectivity is the reflection of light in which the reflected rays are preferentially returned in the direction close to the opposite of the direction of the incident rays, with the property being maintained over wide variations of the direction of the incident rays.	The visibility of a firefighter is crucial during both interior and exterior operations. In addition, almost all emergency incidents begin in a roadway (apparatus placement), and many emergency incidents are roadway-related. For firefighter safety, it is important that garments have effective retroreflectivity and fluorescence for conspicuity (visibility).
	-	Fluorescence is the process by which radiant flux of certain wavelengths is absorbed and reradiated nonthermally, in other, usually longer, wavelengths.	
7.5.10 Helmet Ear Cover Removal Test	An individual provided with the manufacturer instructions is timed on how long it takes to remove the ear covers from the helmet.	This requirement is intended to promote the removal of ear covers from helmets to enable their cleaning.	

B.4 Gloves.

Table B.4 is intended to serve as an abbreviated guide to specified tests for gloves, including the whole glove, glove interface, glove body, glove lining materials, glove extension, and materials used in the construction of the whole glove. These tests evaluate whether or not the gloves meet the minimum performance requirements of the 2018 edition of NFPA 1971. They do not guarantee the safety of the firefighter or ensure the firefighter will not experience injury while wearing the gloves. Some tests are performed on “new, as distributed” gloves that have undergone conditioning. This might seem contradictory, but the conditioning is limited to environmental parameters, and “new, as distributed” condition ensures that the gloves have not been broken in in any way.

Table B.4 Gloves

Test Method	Test Method Description	Test Method Application
7.7.1 Thermal Protective Performance (TPP) (glove body composite)	This test is performed in accordance with ISO 17492 on the glove body composite as received and after conditioning with five laundering cycles. The glove body composite is exposed to direct flame and radiant heat to simulate flashover. The rate of rise in temperature is recorded and compared to the known skin response to heat; the recorded time is multiplied by the heat exposure energy to determine the TPP rating. The average TPP rating has to be at least 35.	The Thermal Protective Performance (TPP) test is used to measure the insulating performance of the composite by evaluating how quickly heat is transferred from the outside of the glove body to the inside. Under the given test conditions, which simulate severe flashover conditions, the TPP rating divided in half indicates the approximate number of seconds until a firefighter would receive a second-degree burn. This is the primary test to measure the glove body's ability to protect the firefighter from severe heat and flame. The higher the number, the higher the protection from heat (under the specific test conditions).

Test Method	Test Method Description	Test Method Application
7.7.2 Thermal Protective Performance (TPP) (glove interface component composite)	This test is performed in accordance with ISO 17492 on the glove interface component as received and after conditioning with five laundering cycles. Specimens are exposed to direct flame and radiant heat to simulate flashover. The rate of rise in temperature is compared to the known skin response to heat; the recorded time is multiplied by the heat exposure energy to determine the TPP rating. The TPP rating of the glove interface component composite has to be at least 20.	The Thermal Protective Performance (TPP) test is used to measure the insulating performance of the interface component by evaluating how quickly heat is transferred from the outside of the glove interface to the inside. Under the given test conditions, which simulate severe flashover conditions, the TPP rating divided in half indicates the approximate number of seconds until a firefighter would receive a second-degree burn. This is the primary test to measure the glove interface's ability to protect the firefighter from severe heat and flame. A TPP rating of 20 is acceptable because the interface area is overlapped by another part of the ensemble that also provides insulation.
7.7.3 Heat and Thermal Shrinkage Resistance Test (gloves: shrink, melt, separate, or ignite)	This test is performed in accordance with ASTM F2894, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven*, after conditioning the whole. Whole glove samples are measured in length and width directions, laundered, exposed to heat, and then measured a second time. For the heat exposure, the glove fingers are filled with a finite amount of glass beads and the glove body is packed with a mesh bag containing a finite amount of glass beads, then the glove opening is clamped together. The glove is suspended by a clamp and placed in a preheated oven for a specified period. After the heat exposure and second measuring, the glove is donned and flexed. The specimen cannot melt, separate, ignite, or shrink more than 8 percent in length or width. The specimen also has to be donnable and flexible.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the gloves for melting, separation, ignition, and shrinkage after exposure to high temperatures. Specimens cannot melt, separate, or ignite, and they cannot shrink more than 8 percent. Excessive shrinkage will limit the dexterity and thermal protection of the glove. The glass beads simulate the mass of the hand inside the glove.

Test Method	Test Method Description	Test Method Application
7.7.4 Heat and Thermal Shrinkage Resistance Test (glove lining materials: melt, separate, or ignite)	This test is performed in accordance with ASTM F2894, after conditioning with of five laundering cycles; all layers of the glove lining material between the moisture barrier layer and the hand are tested individually. The glove lining is suspended by a clamp and placed in a preheated oven for a specified period. Following exposure, the glove lining material is evaluated for evidence of melting, dripping, separation, or ignition.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the glove lining materials for melting, separation, or ignition after exposure to high temperatures. This test attempts to prevent the use of materials that melt, separate, or ignite, against the wearer's hands, under specific test conditions.
7.7.5 Conductive Heat Resistance Test 1 (glove body composite)	This test is performed in accordance with ASTM F1060, *Standard Test Method for Thermal Protective Performance of Materials for Protective Clothing for Hot Surface Contact*, on the glove body composite palm side under four separate conditions: unlaundered wet, unlaundered dry, laundered wet, and laundered dry. The test measures the heat transfer through the composite when it is placed on a hot plate at a specific temperature and relates the transferred heat energy to predicted times to sensation of pain and second-degree burn injury. The test is conducted under pressure. Both the time to pain and time to second-degree burn (based on the Stoll Curve) are recorded for each specimen. The average time to pain cannot be fewer than 6 seconds, and the average time to second-degree burn cannot be fewer than 10 seconds.	The Conductive Heat Resistance Test 1 is used to evaluate the glove body palm side materials for thermal insulation when the glove is compressed in both dry and wet environments. The test conditions are not intended to simulate all fireground exposures but rather to evaluate glove materials for resistance to conductive heat transfer under a specific condition. This test is used to determine the protection provided by the glove when a firefighter makes direct contact with a heated object. -

Test Method	Test Method Description	Test Method Application	
7.7.6 Flame Resistance Test 3 (glove body composite: char length, afterflame, melt, drip, consumed materials) 7.7.7 Flame Resistance Test 3 (glove interface component composite: char length, afterflame, melt, drip, consumed materials)	This test is performed in accordance with ASTM D6413/D6413M on the glove body composite (7.7.6), glove interface (7.7.7), and glove extension composite (7.7.8). Specimens are tested after conditioning. The specimen is mounted and suspended over a burner flame for 12 seconds. Once removed from the flame, the specimens are examined for afterflame, melting, dripping, and the amount of material that is consumed as a result of the heat exposure. Charring characteristics are evaluated after the specimen has been conditioned.	The Flame Resistance Test 3 is the primary test used to establish the flame-resistant properties of the materials used in glove construction. This test is used to evaluate the material's ability to self-extinguish after the flame is removed, and how much the material chars or disintegrates following the exposure.	
7.7.8 Flame Resistance Test 3 (glove extension composite: afterflame, melt, drip, consumed materials)	The glove body composite cannot have an average char length of more than 100 mm (4 in.); the average afterflame of the specimens cannot be more than 2 seconds; the specimens cannot melt or drip; the amount of consumed materials cannot exceed 5 percent.		
7.7.9 Thread Melting Test	This test is performed in accordance with ASTM D7138 on the three different specimens of sewing thread used in the construction of gloves as received. -	The Thread Melting Test is used to evaluate the thread used in the construction of the gloves to determine if it has at least the same heat resistance as the fabric used in its construction.	The temperature at which the thread melts or decomposes is recorded; if it melts below that specific temperature, it fails.

Test Method	Test Method Description	Test Method Application
7.7.10 Viral Penetration Resistance Test (glove body seams)	This test is performed in accordance with ASTM F1671/F1671M on the moisture barrier fabric and seams. Samples are conditioned in multilayer composite samples by subjecting them to repeated cycles of laundering, followed by convective heat conditioning. After conditioning, the moisture barrier layer is placed in a test cell where the film side is exposed to a surrogate virus in a liquid solution and is evaluated for passage of the virus after 1 hour.	The Viral Penetration Resistance Test is used to evaluate the ability of the glove body moisture barrier fabric and seams to keep blood-borne pathogens from coming in contact with the firefighter's skin. Any evidence for virus passing through the barrier fabric or seam, as determined using a microbiological technique, constitutes a failure.
7.7.11 Liquid Penetration Resistance Test (glove body seams)	This test is performed in accordance with ASTM F903 on the glove body moisture barrier fabric and seams. Samples are conditioned in multilayer composite samples by subjecting them to repeated cycles of laundering, followed by convective heat conditioning. The moisture barrier specimens are then placed in a test cell where the film side is exposed to aqueous film-forming foam, battery acid, surrogate gasoline, fire-resistant hydraulic fluid, swimming pool chlorine, and automobile antifreeze fluid. Each liquid is tested separately on an individual specimen. After 1 hour of exposure, each sample is evaluated. No liquid can penetrate any sample.	The Liquid Penetration Resistance Test is used to evaluate whether or not the glove body moisture barrier fabric and seams resist penetration of liquids meant to be representative of those commonly encountered on the fireground. However, liquid chemicals can still permeate the clothing materials by passing through moisture barriers and seams on a molecular level.

Test Method	Test Method Description	Test Method Application
7.7.12 Cut Resistance Test (glove body composite)	This test is performed in accordance with ASTM F1790, *Test Methods for Measuring Cut Resistance of Materials Used in Protective Clothing*, on at least three conditioned samples of the glove body composite under a specific load. Small specimens of the glove body composite are clamped to a metal rod while a blade passes across the specimen until it makes contact with the metal rod. The distance the blade passes across each specimen without cutting through the material is recorded, then averaged. The average distance the blade travels across the material without cutting through the material has to be more than a specific length.	The Cut Resistance Test is used for this requirement to evaluate the ability of the glove body composite to resist being cut under specific test conditions. Longer blade travel distances represent greater cut resistance because it takes longer for the blade to cut through the material.
7.7.13 Cut Resistance Test [glove interface areas (wristlets and glove interface component)]	This test is performed in accordance with ASTM F1790 on conditioned samples of the glove interface component under a specific load. The specimen is clamped to a metal rod while a blade passes across the specimen until it makes contact with the metal rod. The distance the blade passes across each specimen without cutting through the material is recorded, then averaged. The average distance the blade travels across the material without cutting through the material has to be more than a specific length.	The Cut Resistance Test is used for this requirement to evaluate the ability of the glove interface areas to resist being cut, under specific test conditions. Longer blade travel distances represent greater cut resistance because it takes longer for the blade to cut through the material.
7.7.14 Puncture Resistance Test (glove body composite)	This test is performed in accordance with ASTM F1342/F1342M, *Standard Test Method for Protective Clothing Material Resistance to Puncture*, on complete gloves or glove composite pouches that are both dry and wet. Specimens are clamped into a fixture while force is applied to puncture the specimen with a nail-like probe. The force required to puncture each sample is recorded then averaged, and the samples have to resist puncture under at least the specified force.	The Puncture Resistance Test is used to evaluate the ability of the gloves or glove composite pouches to resist puncture under specific test conditions. (Note: this test does not ensure that gloves will be puncture-proof, only puncture resistant.) Higher force averages indicate greater puncture resistance.
7.7.15 Glove Hand Function Test	This test is performed in accordance with ASTM F2010/F2010M, *Standard Test Method for Evaluation of Glove Effects on Wearer Hand*	The Glove Hand Function Test is used to determine whether the glove meets a minimum

Test Method	Test Method Description	Test Method Application	
	Dexterity Using a Modified Pegboard Test, on at least three pairs of whole gloves, in two sizes, as received.	requirement for dexterity. The lower percentages indicate that the gloves have fewer adverse effects on firefighter dexterity.	
	-	A test subject picks up metal pins and places them in a horizontal pegboard without gloves. The subject immediately repeats the test while wearing the correct size specimen gloves. The time it takes to complete the task is recorded for both tests, and an average is calculated and used to calculate a percentage that represents how much faster the test was completed bare-handed than with gloved hands.	To meet this requirement, bare-handed control cannot offer more than 220 percent better control than gloved hands. In other words, if it takes, on average, 60 seconds to complete the test barehanded, it cannot take more than 132 seconds, on average, to complete the same task with gloved hands.
	-	That percentage is reported as the bare-handed control for each glove size. The average result for bare-handed control cannot exceed 220 percent.	-
7.7.16 Burst Strength Test (knit glove wristlet material)	This test is performed in accordance with ASTM D6797, *Standard Test Method for Bursting Strength of Fabrics Constant-Rate-of-Extension (CRE) Ball Burst Test*, on the knit glove wristlet materials as received.	The Burst Strength Test is used to evaluate the strength of the glove wristlet material by measuring its resistance to bursting or rupturing when force is applied under specific test conditions.	
	A tensile testing machine is used to push a steel ball through the clamped wristlet material. The maximum force used to burst the material is recorded. The specimen cannot burst under less than the specified force.	It is used to determine whether, on average, the glove wristlet can sustain applied force of at least the specified force, under specific test conditions. Higher bursting force resistance numbers indicate stronger wristlet materials.	

Test Method	Test Method Description	Test Method Application	
7.7.17 Seam-Breaking Strength Test	This test is performed in accordance with ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, on the conditioned glove body and glove interface component seams.	The Seam-Breaking Strength Test is used to evaluate the strength of the glove's interface seams under stress. The durability of the seam is an indicator of physical performance when the glove is subjected to repeated donning, doffing, gripping, bending, and stretching. Higher breaking forces indicate stronger seams. If testing knit materials, the test is performed in accordance with ASTM D6797. The force required to break the seam is recorded and averaged for the test specimens and the average result cannot be less than the specified force.	Opposite ends of a specimen, with the seam bisecting the length, are gripped in a machine and pulled apart until the specimen breaks.
7.7.18 Overall Liquid Integrity Test 1	This test is performed on at least three pairs of whole gloves, in two sizes, after conditioning and convective heat conditioning.	The Overall Liquid Integrity Test 1 is used to evaluate the glove's resistance to leakage when submerged in water, under specific test conditions. Surfactant treatments are used to lower water surface tension, making water penetration easier. The appearance, after testing, of any water mark on the inner glove of any of the three pairs of gloves is recorded and reported. The appearance, after testing, of any water mark on the inner glove of any glove is considered leakage and constitutes failing.	The test subject dons an inner glove then the glove to be tested and submerges the gloved hand in surfactant-treated water to the height line on the glove below the opening, for 5 minutes while flexing the hands into a fist every 10 seconds.

Test Method	Test Method Description	Test Method Application	
7.7.19 Glove Donning Test	This test is performed on at least three conditioned pairs of whole gloves in two sizes.		
	-	The Glove Donning Test is used to evaluate the ease of donning the gloves with a wet and dry hand; whether or not the inner lining will become detached under the specific test conditions; and whether or not each digit of each glove of each size allows full insertion during the test.	While wearing a glove on one hand, the wearer must don a single glove on the opposite hand, without altering the glove lining, three consecutive times. The test is performed three times with a dry hand and dry gloves and three times with a wet hand and wet gloves.
	-	The time of each donning for each size is recorded and is averaged as a measure of the ease of donning.	-
	-	The standard requires a maximum average donning time for dry gloves and a separate maximum average donning time for wet gloves.	-
	-	While wearing a glove on one hand, the wearer must don a single glove on the opposite hand, without altering the glove lining, three consecutive times. The test is performed three times with a dry hand and dry gloves and three times with a wet hand and wet gloves.	-
	-	The key to this test is that pass or fail determinations are made based on the donning time (if one size fails, the glove fails), separation (any detachment of the inner liner and/or moisture barrier is a failure), and insertion (any glove digits that do not allow full insertion is a failure).	-

Test Method	Test Method Description	Test Method Application	
7.7.20 Liner Retention Test	This test is performed on at least three conditioned pairs of whole gloves, in two sizes. - - -	The Liner Retention Test is used to evaluate the ability of the glove's inner liner and moisture barrier to stay attached under applied force after laundering. Each digit of each glove is inspected for inner liner detachment. The appearance of inner liner detachment in any digit of any glove of any size constitutes a failure. Gloves can be cut open to look for detachment.	A set of locking forceps is attached to the interior glove liner near the fingertip, which is then attached to a strain gauge and pulled, until the specified force registers on the machine. -
7.7.21 Label Durability and Legibility Test 1	This test is performed on the whole glove, with labels attached, after laundering, abrasion, and convective heat exposure. The gloves are exposed to 10 laundry cycles as outlined in AATCC 135 subjected to abrasion in accordance with ASTM D4966 and, lastly, subjected to convective heat. -	The Label Durability and Legibility Test 1 is used to evaluate whether or not the label stays in place and is legible to the unaided eye after exposure to multiple launderings, abrasion, and convective heat. - Glove labels are examined for continued presence (have to remain attached to the glove) and for legibility.	In addition to being legible, the labels must remain in place following the testing. The presence and legibility of labels is important for glove identification and tracking.
7.7.22 Grip Test	This test is performed on at least three pairs of new, as distributed gloves in two sizes. - -	The Grip Test is used to evaluate the glove's gripping ability, under applied force and specific test conditions. The test is designed to simulate use of a pike pole in ceiling pulls. The peak pull force value for each individual pull is recorded and reported. The minimum pull force	Six separate pull types are tested with three pulls each on a wet conditioned overhead vertical pole. The test subjects wet condition the gloves before each set of three pulls. -

Test Method	Test Method Description	Test Method Application	
		value that occurs after the peak pull force value is recorded and reported.	
	-	The individual percentage drop between the peak pull force value and the minimum pull force value is calculated and used to determine pass or fail performance (the drop cannot be more than 30 percent).	-
	-	In addition, failure during any pull constitutes glove failure of the overall test.	-
7.7.23 Torque Test	This test is performed on at least three pairs of new, as distributed gloves in two sizes.		
	-	The Torque Test is used to evaluate how gloves affect a firefighter's ability to perform gripping and twisting actions. The results compare the same gripping/twisting action performed both bare-handed and with the gloves. Percentages less than 100 percent mean that the gloves diminish gripping/twisting action while percentages over 100 percent mean that the gloves enhance gripping/twisting motion.	The test subject dons the glove and attempts to twist a vertical rod mounted on a torque meter. The maximum force applied by the test subject in this twisting motion is measured.
	-		The test is performed both bare-handed and with gloves donned. The test results are recorded and averaged and the percent difference between the bare-handed results and the results for tests using gloves is used to determine glove performance. Gloves must allow at least 80 percent of the twisting force for the test subject compared to tests performed bare-handed.

Test Method	Test Method Description	Test Method Application	
7.7.24 Glove Tool Test	This test is performed on at least three pairs of new, as distributed gloves in two sizes.		
	-	The Glove Tool Test is used to evaluate the effect of gloves on completing a task compared to completing the same task without gloves. Lower percentages indicate that the gloves have less adverse effects on firefighter tool use.	The test requires the wearer to pick up a bolt, nut, and washer set and assemble them on a test stand. While being timed, the wearer has to fill all holes across the top and all holes across the bottom of the test stand until all bolt, nut, and washer sets have been installed in the test board.
	-	The test is also performed without gloves to establish a baseline result to determine the effect of the gloves when the wearer has to handle small objects. The difference in times for the tests performed bare-handed (control) and with gloves is reported as a percentage.	-
	-	The difference cannot exceed 175 percent. This means that the use of the gloves cannot result in this task taking more than 1.75 times longer when performing the same task without gloves.	-
7.7.25 Transmitted and Stored Thermal Energy Test	This test is performed in accordance with ASTM F2731 on the glove body composite back side under wet conditions. The test measures the heat transfer through the composite when it is exposed to a radiant heat source at a specific heat flux and relates the transferred heat energy to a predicted time of second-degree burn injury.	The Transmitted and Stored Thermal Energy Test is used to evaluate, on average, how long it takes to experience a second-degree burn on the back of the hand caused by radiant heat.	
	-	The time to second-degree burn are recorded for each specimen.	-
	-	The time to second-degree burn cannot be less than 130 seconds.	-

Test Method	Test Method Description	Test Method Application
7.8.2 Corrosion Resistance Test (glove metal hardware and hardware that includes metal parts)	The test is performed in accordance with ASTM B117 to measure corrosion. Metal hardware is exposed to a saline solution spray for 20 hours, following which base metal can show only slight surface corrosion and the hardware must remain functional.	The Corrosion Resistance Test is used to evaluate whether hardware will (1) corrode and (2) remain functional after extended exposure to a salt spray. Hardware failure can result in loss of thermal and physical protection for the firefighter.

B.5 Footwear.

Table B.5 is intended to serve as an abbreviated guide to specified tests for footwear, including the whole footwear boot, the footwear upper, and materials used in the construction of the whole footwear element. The tests are intended to evaluate whether or not the footwear meets the minimum performance requirements of the 2018 edition of NFPA 1971. They do not guarantee the safety of the firefighter or ensure the firefighter will not experience injury while wearing the footwear.

Table B.5 Footwear

Test Method	Test Method Description	Test Method Application	
7.10.1 Conductive Heat Resistance Test 2	This test is performed on the conditioned complete footwear element with removable soles in place. Thermocouples are taped to the insole surface inside the footwear, and the footwear is filled with a specified weight of steel balls. The weighted footwear is placed on a hot plate set at a specific temperature for a specific time. The thermocouples inside the boot measure the temperature of the footwear insole.	The Conductive Heat Resistance Test 2 is used to evaluate the footwear's resistance to heat transferred through the sole by conduction. The steel balls weigh the footwear down to place pressure on the sole against the hot surface, similar to what happens on the fireground. The test conditions are not intended to simulate actual fireground exposures but rather serve as a means for measuring the footwear's response to heat. The performance requirement relates to the temperature that causes pain sensation.	The average temperature at each test location of the specimen at the end of the specified period is recorded. The temperature of the insole cannot exceed the allowed temperature.
7.10.2 Flame Resistance Test 4	This test is performed on the whole footwear element in a draft-free area as received. A tray of fuel is used to create the flame exposure. The fuel in the tray is ignited and is allowed to burn to produce a stable flame. The footwear specimen is clamped on a fixture then positioned above the burning tray where a shutter controls the exposure of the footwear specimen to flames for a specified period.	The Flame Resistance Test 4 is used to evaluate whether the footwear melts, drips, or exhibits burn-through and determines whether it has an afterflame lasting more than 5 seconds. This is the primary test to establish the flame-resistant properties of the materials used in footwear construction. Once the flame exposure is stopped, the footwear specimen is examined for afterflame (not more than 5 seconds allowed), melting, dripping, and burn-through. The specimen cannot melt, drip, or exhibit any burn-through.	-

Test Method	Test Method Description	Test Method Application	
7.10.3 Thread Melting Test	This test is performed in accordance with ASTM D7138 on the three different specimens of sewing thread used in the construction of footwear as received.	The Thread Melting Test is used to evaluate the thread used in the construction of the footwear element to determine whether it has at least the same minimum heat resistance as the fabric used in the footwear's construction.	The temperature at which the thread melts or decomposes is recorded and if it melts below the specific temperature, it fails.
7.10.4 Liquid Penetration Resistance Test	This test is performed in accordance with ASTM F903 on the footwear moisture barrier and moisture barrier seams. Swatches representative of the footwear construction (not just the barrier layer) are exposed to convective heat conditioning; then the barrier layer is separated and becomes the testing specimen. The normal outer surface of the material is exposed to aqueous film-forming foam, battery acid, surrogate gasoline, fire-resistant hydraulic fluid, swimming pool chlorine additive, and automobile antifreeze fluid. Each liquid is tested separately on an individual specimen.	The Liquid Penetration Resistance Test is used to evaluate whether or not the footwear's moisture barrier material and seams resist penetration of liquids meant to be representative of those commonly encountered on the fireground.	
		During the exposure, pressure is applied behind the liquid for a period of time. At the end of exposure, each sample is evaluated. No liquid can penetrate any sample.	
7.10.5 Viral Penetration Resistance Test	This test is performed in accordance with ASTM F1671/F1671M on the footwear moisture barrier and moisture barrier seams. Swatches representative of the footwear construction (not just the barrier layer) are exposed to convective heat conditioning, then the barrier layer is separated and becomes the testing specimen. The normal outer surface of the material is exposed to a surrogate virus in a liquid solution and is evaluated for passage of virus after a specific time.	The Viral Penetration Resistance Test is used to evaluate the ability of the footwear's moisture barrier materials and seams to keep blood-borne pathogens from coming in contact with the firefighter.	
		During the specified time exposure, pressure is applied behind the	

Test Method	Test Method Description	Test Method Application
		liquid. At the end of exposure, the specimen is rinsed with a clean solution and examined. Any evidence of viral passage through the barrier fabric or seam as determined using a microbiological technique constitutes a failure.
7.10.6 Puncture Resistance Test	This test is performed in accordance with ASTM F1342/F1342M Test Method A, on footwear uppers as received. Footwear uppers are clamped into a fixture while force is applied to a nail-like probe in an effort to puncture the specimen. The force required to puncture each specimen is recorded and averaged, and the resulting average cannot be lower than the specified force.	The Puncture Resistance Test is used to evaluate the ability of the footwear uppers to resist puncture under specific test conditions. Higher average force measurements indicate greater puncture resistance.
7.10.7 Cut Resistance Test	This test is performed in accordance with ASTM F1790 on footwear uppers as received under a specific load. The specimen (a composite of footwear upper used in the actual footwear construction, including the tongue but excluding the gusset, with layers arranged in proper order) is clamped to a metal rod while a blade passes across the specimen until it makes contact with the metal rod. After testing, the average distance of blade travel is recorded and cannot be more than the specified length.	The Cut Resistance Test is used to evaluate the ability of the footwear upper composite to resist cutting under specific test conditions. Longer blade travel distances represent greater cut resistance because it takes longer for the blade to cut through the material.
7.10.8 Slip Resistance Test	This test is performed in accordance with 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,* on the whole footwear element. A footwear specimen is placed in a machine that slides the footwear along a wet tile surface. This test measures the friction (traction) between the soles of the footwear and the tile surface. The coefficient of friction is recorded for each specimen and averaged. The result should be 0.40 or greater.	The Slip Resistance Test is used to evaluate the ability of the footwear to resist slipping under specified test conditions. The surface condition is chosen to simulate a typical slippery surface encountered by firefighters.
7.10.9 Abrasion Resistance Test	This test is performed in accordance with ISO 4649, *Rubber, vulcanized or thermoplastic — Determination of abrasion resistance using a rotating cylindrical drum device*, Method A, on	The Abrasion Resistance Test is used to evaluate the footwear's ability to resist abrasion under specified test conditions. The test is

Test Method	Test Method Description	Test Method Application
	material pieces removed from the footwear soles and heel as received. These material specimens are repetitively rubbed against a specific type of sandpaper under a specified pressure, then the amount of material removed by abrasion is measured. Abrasion resistance of the footwear sole and heel materials is adjusted by relative loss of material.	intended to measure how easily sole and heel material wear away.
7.10.10 Electrical Insulation Test 2	This test is performed in accordance with Section 9 of ASTM F2412, *Standard Test Methods for Foot Protection*, on whole footwear elements as received. The sample footwear are tested to a specific voltage. Voltage is applied to the footwear specimen through the metal mesh platform.	The Electrical Insulation Test 2 is used to evaluate the footwear's resistance to electricity under specified test conditions. The test simulates conditions when a firefighter steps on a live wire.
	-	The footwear element is evaluated for current leakage or evidence of breakdown. The footwear should not have a leakage in excess of the specified amount.
7.10.11 Ladder Shank Bend Resistance Test	This test is performed on footwear ladder shanks or whole sole equivalents as received. The specimen is placed on mounting blocks, as it would be oriented toward the ladder, and subjected to force on its center with the test probe operated at a specific force.	The Ladder Shank Bend Resistance Test is used to evaluate the footwear soles or ladder shanks for resistance to bending when supported only in the middle of the footwear. The test simulates what occurs when a firefighter uses a ladder.
	-	The average deflection is recorded and should not deflect more than a specific distance.
7.10.12 Eyelet and Stud Post Attachment Test	This test is performed on footwear eyelets and stud posts as received. Specimens are removed from the footwear element and attached to the upper position of the tensile testing machine using the proper puller fixture. The test is started and force is applied.	The Eyelet and Stud Post Attachment Test is used to evaluate the footwear stud posts and eyelets for attachment strength when force is applied. This test is used to determine whether stud posts and eyelets will stay attached under normal use conditions.
	-	At a minimum, the average of all specimen tests can be no less than the specified force. The footwear eyelets and stud posts have to be

Test Method	Test Method Description	Test Method Application	
		able to withstand, on average, at least the specified force.	
7.10.13 Corrosion Resistance Test (metal hardware and hardware that includes metal parts)	This test is performed in accordance with ASTM B117 to measure corrosion on all footwear hardware as received. Metal hardware is exposed to a saline solution for a specified period. Following the test, the hardware is evaluated for the appearance of corrosion or oxidation and to see if it remains functional. Evidence of corrosion on the base metal signifies failure.	The Corrosion Resistance Test is used to evaluate whether hardware will (1) corrode and (2) remain functional after extended exposure to salt spray. Hardware failure can result in loss of thermal and physical protection for the firefighter.	
7.10.14 Label Durability and Legibility Test 1	This test is performed in accordance with ASTM D4966 on the complete footwear element, with labels attached. Legibility is assessed with labels attached to the footwear after convective heat/ thermal exposure and assessed on individual labels after abrasion. - -	The Label Durability and Legibility Test 1 is used to evaluate whether or not the label stays in place and is legible to the unaided eye after abrasion and thermal exposure. The presence and legibility of labels is important for footwear identification and tracking.	Footwear specimens are subjected to abrasion and are exposed to convective heat to test for heat durability. Footwear labels are examined for continued presence (have to remain attached to the footwear) and for legibility.
7.10.15 Heat and Thermal Shrinkage Resistance Test	This test is performed in accordance with ASTM F2894 on at least three men's size 9D complete footwear elements as received. The footwear component is filled with glass beads and exposed to thermal insult for a specified period of time.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate the footwear for heat degradation effects after exposure to high temperatures.	

Test Method	Test Method Description	Test Method Application	
	-	Post-exposure, the specimen is examined inside and outside before conditioning in an environmental chamber and again after conditioning for melting, separation, or ignition. Next, the footwear specimen is tested in accordance with Appendix B of FIA 1209, *Whole Shoe Flex*, and flexed on a machine 100,000 times to simulate walking movement. Lastly, the footwear specimen is immersed in surfactant-treated water to a certain height for 2 hours then evaluated for leakage. The appearance of any liquid inside the footwear after exposure is reported as a failure. Also, all components must remain functional.	Footwear is not permitted to melt, separate, or ignite under these conditions. Footwear is also tested for liquid penetration resistance after thermal exposure and flexing to show that footwear will continue to maintain its integrity following simulated use and heat exposure.
7.11.2 Radiant Heat Resistance Test 1	This test is performed on each area of the footwear upper, as well as the tongue but excluding the gusset, including booties, where provided, as received. -	The Radiant Heat Resistance Test 1 is used to evaluate the footwear for resistance to heat transfer from exposure to radiant energy. The test conditions are not intended to simulate actual fireground exposures, but rather serve as a means for measuring the footwear's response to radiant heat.	The specimen is placed in front of a radiometer and exposed to heat for a specified period at a specific temperature. The temperature at 30 seconds of exposure for each area is recorded and reported, then averaged; the average cannot exceed the specified temperature.

Test Method	Test Method Description	Test Method Application	
7.11.3 Conductive Heat Resistance Test 1	This test is performed in accordance with ASTM F1060 on the footwear upper composites as received. Composite specimens are placed on a hot plate that is heated to a specific temperature, while a specific pressure is applied. A weighted sensor on top of the specimen measures the rate of heat transfer.	The Conductive Heat Resistance Test 1 is used to evaluate the upper portion of the footwear for thermal insulation. The test conditions are not intended to simulate actual fireground exposures, but rather serve as a means for measuring the footwear upper's resistance to heat transfer when contacted is made with a hot surface.	The heat transfer data are used to predict the time to pain and the time to second-degree burn.
-	-	The average time to pain cannot be fewer than 6 seconds, and the average time to second-degree burn cannot be fewer than 10 seconds.	-

B.6 Hoods.

Table B.6 is intended to serve as an abbreviated guide to specified tests for hoods, including the whole hood, with or without an SCBA facepiece and materials used in the construction of the hood. In addition, the Optional Particulate Hood Requirements are included. The tests evaluate whether or not the hood meets the minimum performance requirements of the 2018 edition of NFPA 1971. They do not guarantee the safety of the firefighter or ensure the firefighter will not experience injury while wearing the hood.

Table B.6 Hoods

Test Method	Test Method Description	Test Method Application	
7.13.1 Hood Opening Size Retention Test	This test is performed on the protective hood as received. The whole hood is placed on a tensile tester and elongated and returned to its original position 50 times to simulate donning and doffing.	The Hood Opening Size Retention Test is used to evaluate the ability of the hood to retain its shape after being pulled over the head many times and to make sure it does not fit too tightly around the neck when not deployed.	Once completed, the hood is removed from the tensile tester and allowed to rest for 1 minute. The hood is then placed on the hood face opening measuring device to determine compliance.
		The hood opening has to slide freely over the top half of the hood measuring device while in the relaxed state and cannot show any gaps when placed on the lower half of the hood measuring device.	
7.13.1.1 Hood Opening Size Retention Test (when the hood is designed for a specific SCBA facepiece)	This test is performed on the protective hood as received. The whole hood is placed on a tensile tester and elongated and returned to its original position 50 times to simulate donning and doffing. If the hood is designed to be manually adjusted when donned, the person performing the test has to manually adjust the hood each time it is placed on the facepiece.	This test evaluates the ability of the hood's SCBA face piece opening to retain its shape after being pulled over the head and the specified SCBA face piece many times.	
		Once completed, the hood is removed from the tensile tester and allowed to rest for 1 minute. The hood is then donned on the headform and placed over the facepiece. The hood is evaluated in the original eight (or more) locations to determine if the hood opening retains its shape.	

Test Method	Test Method Description	Test Method Application	
	-	The hood used in this test has to overlap the outer edge of the specific SCBA facepiece-to-face seal perimeter by at least 13 mm (½ in.).	-
7.13.2 Thermal Protective Performance (TPP) Test	This test is performed in accordance with ISO 17492 on the portions of the hood that cover the neck and facial area as received and after conditioning with five laundering cycles. Specimens used for testing must be at least a specific size. The hood is exposed to both radiant and convective heat sources.	The Thermal Protective Performance (TPP) test is used to measure the insulating performance of the hood by evaluating how quickly heat is transferred from the outside of the hood to the inside.	
	-	Under the given test conditions, which simulate severe flashover conditions, the TPP rating divided in half indicates the approximate number of seconds until a firefighter would receive a second-degree burn.	The rate of rise in temperature is recorded and compared to the known skin response to heat; the recorded time is multiplied by the heat exposure energy to determine the TPP rating.
	-	The TPP rating of the hood has to be at least 20.	This is the primary test to measure the hood's ability to protect the firefighter from severe heat and flame. A TPP rating of 20 is acceptable because the hood area is overlapped by another part of the ensemble that also provides insulation.
7.13.3 Flame Resistance Test 1	This test is performed in accordance with ASTM D6413/D6413M on five individual samples of hood material(s) and five individual samples of labels attached to hood material(s).	The Flame Resistance Test 1 is used to evaluate the hood materials, under controlled test conditions, for the ability to self-extinguish after the flame is removed and to resist charring, melting, and dripping.	
	-		Specimens are tested as received and after conditioning with five laundry cycles. Hood labels are cut from the conditioned samples and tested in a vertical flame chamber in accordance with ASTM D6413/D6413M.

Test Method	Test Method Description	Test Method Application	
	-	Specimens are evaluated for average char length [cannot exceed 100 mm (4 in.]; for average afterflame (cannot be more than 2 seconds); and for evidence of melting or dripping (material cannot melt or drip).	-
7.13.4 Heat and Thermal Shrinkage Resistance Test (shrinkage)	This test is performed on complete hoods as received and after conditioning with five laundry cycles. The hood is placed on a nonconductive headform in the center of the test oven and exposed to 260°C (500°F) for 5 minutes. -	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the hood materials for shrinkage after exposure to high temperatures. - After this exposure hoods are evaluated on a hood measuring device. Hoods are required to slide freely over the top half of the hood measuring device while in the relaxed state, and cannot show any gaps when placed on the lower half of the hood measuring device. Measurements from the top of the hood down the sides and down the back are used to determine shrinkage. Hoods cannot shrink more than 10 percent.	Excessive shrinkage could impact the insulating qualities of the hood.
7.13.5 Heat and Thermal Shrinkage Resistance Test (melting, separation, ignition)	This test is performed after conditioning hoods and labels with five laundry cycles. The specimen is placed on a nonconductive headform in the center of the oven and exposed to 260°C (500°F) for 5 minutes. Hoods cannot show evidence of melting, separation, or ignition after this test.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the hood materials for melting, separation, and ignition after exposure to high temperatures.	
7.13.6 Cleaning Shrinkage Resistance Test	This test is performed on complete hoods as received. - -	The Cleaning Shrinkage Resistance Test is used to evaluate hood materials for shrinkage after cleaning. Hoods are machine washed five times using a specific laundry procedure. After washing, hoods are evaluated on a hood measuring device. Hoods are required to slide freely over the	Excessive shrinkage increases the possibility of burns. -

Test Method	Test Method Description	Test Method Application	
		top half of the hood measuring device while in the relaxed state, and cannot show any gaps when placed on the lower half of the hood measuring device. Measurements from the top of the hood down the sides and down the back are used to determine shrinkage. Hoods cannot shrink more than 5 percent.	
7.13.7 Thread Melting Test	This test is performed in accordance with ASTM D7138 on the three different specimens of sewing thread used in the construction of the hood as received.	The Thread Melting Test is used to evaluate the thread used in the construction of the hoods to determine if it has at least the same heat resistance as the fabric used in garment construction.	The temperature at which the thread melts or decomposes is recorded, and if it melts below 260°C (500°F), it fails.
7.13.8 Burst Strength Test	This test is performed in accordance with ASTM D6797 on the hood materials as received. Hood Material: A tensile testing machine is used to push a steel ball through the clamped hood material. The maximum force used to burst the material is recorded. The specimen cannot burst under less than the specified force.	The Burst Strength Test is used to evaluate the strength of the hood material by measuring its resistance to bursting or rupturing when force is applied under specific test conditions.	This test is used to determine whether, on average, the hood material can sustain applied force, under specific test conditions. Higher bursting force resistance numbers indicate stronger hood materials.
7.13.9 Seam-Breaking Strength Test	This test is performed in accordance with ASTM D6797 on at least five specimens of conditioned hood seams.	The Seam-Breaking Strength Test is used to evaluate the strength of the hood seams under stress. The durability of the seam is an indicator of physical performance when subjected to repeated donning and doffing. Higher breaking forces indicate stronger seams.	The seam breaking strength (the amount of pounds force required to break the seam) is recorded and reported for each specimen, and those values are averaged for the assessment.

Test Method	Test Method Description	Test Method Application	
	-	The force required to break the seam is recorded and averaged for the test specimens, and the average result cannot be less than the specified force.	-
7.13.10 Label Durability and Legibility Test 1	These tests are performed on hood labels on complete hoods with labels attached (laundering), individual labels (abrasion), and labels sewn onto a separate square of hood material (convective heat exposure).	The Label Durability and Legibility Test 1 is used to evaluate whether or not the label stays in place and is legible to the unaided eye after exposure to multiple launderings, abrasion, and convective heat.	
	-	The laundering test is performed in accordance with AATCC 135 and the abrasion test is performed in accordance with ASTM D4966.	In addition to being legible, the labels must remain in place following testing. The presence and legibility of labels is important for hood identification and tracking.
	-	Hood labels are examined for continued presence (have to remain attached to the hood) and for legibility.	
7.14.2 Particulate Blocking Test (Optional Requirement)	This test is performed in accordance with ASTM F2299/F2299M, *Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres,* on three specimens of conditioned particulate blocking materials.	The Particulate Blocking Test is intended to replicate smoke exposure to hoods. The hoods are evaluated for particulates penetrating the hood.	
	Modifications were made to the test method to allow for testing materials that are not air permeable. Materials are required to meet 90 percent efficiency.	-	

Test Method	Test Method Description	Test Method Application
7.14.3 Total Heat Loss (THL) Test (Optional Requirement)	This test is performed in accordance with ASTM F1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate,* on samples of the hood composite conditioned at room temperature arranged in the order and orientation it is worn. Specimens are placed on a sweating hot plate to evaluate heat transfer under wet conditions and thermal resistance under dry conditions. These values are combined in an equation to provide a total heat loss value.	The Total Heat Loss (THL) Test is used to evaluate the amount of heat that can be transferred out of the hood composite via both sweat evaporation from the wearer's skin and conduction through the garment to the outside environment. Higher values indicate better performance and more heat loss. However, appropriate THL values for your department must be considered with TPP values. *(See A.7.2.2 for more details.)*

B.7 Wristlets.

Table B.7 is intended to serve as an abbreviated guide to specified tests for wristlets and materials used in the construction of protective wristlet interface components. The tests evaluate whether or not the wristlet meets the minimum performance requirements of the 2018 edition of NFPA 1971. They do not guarantee the safety of the firefighter or ensure the firefighter will not experience injury while wearing protective elements including wristlets.

Table B.7 Wristlets

Test Method	Test Method Description	Test Method Application	
7.16.1 Thermal Protective Performance (TPP) Test	This test is performed in accordance with ISO 17492 on the protective wristlet interface components as received and after conditioning. The protective wristlet interface components are exposed to both radiant and convective heat sources.	The Thermal Protective Performance (TPP) test is used to measure the insulating performance of the protective wristlet interface components by evaluating how quickly heat is transferred from the outside of the protective wristlet interface components to the inside.	
	-	The rate of rise in temperature is recorded and compared to the known skin response to heat; the recorded time is multiplied by the heat exposure energy to determine the TPP rating.	Under the given test conditions, which simulate severe flashover conditions, the TPP rating divided in half indicates the approximate number of seconds until a firefighter would receive a second-degree burn.
	-	The TPP rating of the protective wristlet interface components has to be at least 20.	This is the primary test to measure the protective wristlet interface component's ability to protect the firefighter from severe heat and flame. A TPP rating of 20 is acceptable because the protective wristlet interface component area is overlapped by another part of the ensemble that also provides insulation.
7.16.1.1 Thermal Protective Performance (TPP) Test (coat sleeve ends in a garment-glove interface)	This test is performed in accordance with ISO 17492 on the interface composite where the coat sleeve end terminates in a garment-glove interface, as received and after conditioning. The interface composite is exposed to both radiant and convective heat sources.	The Thermal Protective Performance (TPP) test is used to measure the insulating performance of the garment-glove interface by evaluating how quickly heat is transferred from the outside of the interface composite to the inside.	
	-	The rate of rise in temperature is recorded and compared to the	Under the given test conditions, which simulate severe flashover

Test Method	Test Method Description	Test Method Application	
		known skin response to heat; the recorded time is multiplied by the heat exposure energy to determine the TPP rating.	conditions, the TPP rating divided in half indicates the approximate number of seconds until a firefighter would receive a second-degree burn.
	-	The TPP rating of the protective wristlet interface components has to be at least 35.	This is the primary test to measure the interface composite's ability to protect the firefighter from severe heat and flame.
7.16.2 Flame Resistance Test 1	This test is performed in accordance with ASTM D6413/D6413M on five individual samples of protective wristlet interface component material(s). Specimens are tested after conditioning with five laundry cycles. -	The Flame Resistance Test 1 is used to evaluate the protective wristlet interface component materials, under controlled test conditions, for the ability to self-extinguish after the flame is removed and to resist charring, melting, and dripping.	Specimens are evaluated for average char length (cannot exceed a specified length); for average afterflame (cannot be more than 2 seconds); and for evidence of melting or dripping (material cannot melt or drip).
7.16.3 Heat and Thermal Shrinkage Resistance Test (shrinkage)	This test is performed after conditioning with five laundry cycles on protective wristlet interface components materials.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the protective wristlet interface components materials for shrinkage after exposure to high temperatures.	
	Protective wristlet interface components cannot shrink more than 10 percent in any direction.	Excessive shrinkage could impact the insulating qualities of the protective wristlet interface components.	
7.16.4 Heat and Thermal Shrinkage Resistance Test (melting, separation, ignition)	This test is performed after conditioning protective wristlet interface components and labels with five laundry cycles. Protective wristlet interface components cannot show evidence of melting, separation, or ignition after this test.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the protective wristlet interface components materials for melting, separation, and ignition after exposure to high temperatures.	

Test Method	Test Method Description	Test Method Application	
7.16.5 Cleaning Shrinkage Resistance Test	This test is performed after conditioning with five laundry cycles on protective wristlet interface component materials.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the protective wristlet interface component materials for shrinkage after exposure to high temperatures.	
	-	Protective wristlet interface component cannot shrink more than 5 percent in any direction.	Excessive shrinkage could impact the insulating qualities of the protective wristlet interface components.
7.16.6 Thread Melting Test	This test is performed in accordance with ASTM D7138 on the three different specimens of sewing thread used in the construction of the protective wristlet interface components as received.	The Thread Melting Test is used to evaluate the thread used in the construction of the protective wristlet interface components to determine if it has at least the same heat resistance as the fabric used in garment construction.	
	-		The temperature at which the thread melts or decomposes is recorded, and if it melts below a specific temperature, it fails.
7.16.7 Burst Strength Test (knit wristlet material)	This test is performed in accordance with ASTM D6797 on the knit protective wristlet interface components materials as received.	The Burst Strength Test is used to evaluate the strength of the protective wristlet interface components by measuring its resistance to bursting or rupturing when force is applied under specific test conditions.	
	-	A tensile testing machine is used to push a steel ball through the clamped protective wristlet interface component materials. The maximum force used to burst the material is recorded. The specimen cannot burst under less than the specified force.	This test is used to determine whether, on average, the protective wristlet interface components can sustain applied force of at least the specified force, under specific test conditions. Higher bursting force resistance numbers indicate stronger protective wristlet interface components.

Test Method	Test Method Description	Test Method Application
7.16.8 Seam-Breaking Strength Test (knit wristlet seams)	This test is performed on at least five specimens of conditioned knit protective wristlet interface components seams. The seam breaking strength (the amount of pounds force required to break the seam) is recorded and reported for each specimen and those values are averaged for the assessment. -	The Seam-Breaking Strength Test is used to evaluate the strength of the protective wristlet interface component seams under stress. The durability of the seam is an indicator of physical performance when subjected to repeated donning and doffing. Higher breaking forces indicate stronger seams. The force required to break the seam is recorded and averaged for the test specimens, and the average result cannot be less than the specified force. -
7.16.9 Whole Garment and Ensemble Liquid Penetration Test (Shower Test) (where the coat sleeve end terminates in a garment-glove interface)	This test is performed in accordance with ASTM F1359/F1359M on a full garment set (coat and pants) or coveralls. The whole garment is placed on a manikin dressed in a water-absorptive layer and exposed to 2.5 minutes of liquid spray from four different orientations for a total of 10 minutes. After removal of the garment, the water-absorptive layer is examined for evidence of moisture penetration.	The Shower Test is used to evaluate how well the seams and closures of the garment, under controlled test conditions, resist inward leakage of liquids from exterior sources. This is a test to determine whether or not the garment will help keep the firefighter dry from hose streams, standing water, and precipitation. Note: The Shower Test is the *only* test performed on assembled garments — coats and pants.

Statement of Problem and Substantiation for Public Comment

This annex needs to be updated with new test methods included at the end of second draft. Several new methods were included in the first draft and as they are validated Annex B should be revised to include those methods and their purpose.

Related Item

• FR167

Submitter Information Verification

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Public Comment No. 57-NFPA 1970-2022 [Section No. B.2]

B.2 Garments.

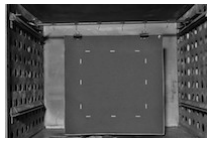
Table B.2 is intended to serve as an abbreviated guide to specified tests that apply to garments, including the outer shell, the moisture barrier, the thermal barrier, garment hardware, and materials used in the construction of the garment. These tests evaluate whether or not the garment meets the minimum performance requirements of the 2018 edition of NFPA 1971. They do not guarantee the safety of the firefighter or ensure the firefighter will not experience injury while wearing the garment.

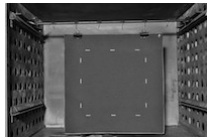
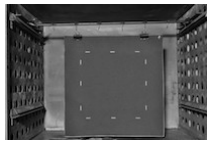
Table B.2 Garments

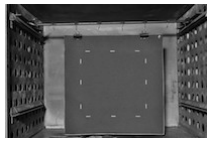
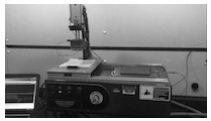
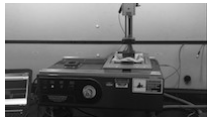
Test Method	Test Method Description	Test Method Application	
7.1.1 Thermal Protective Performance (TPP) Test	This test is performed in accordance with ISO 17492, *Clothing for protection against heat and flame — Determination of heat transmission on exposure to both flame and radiant heat*, on three specimens/samples of the three-layer garment composite, which are tested as received. Specimens comprise the outer shell, thermal liner, and moisture barrier and are layered and tested in the order in which they are worn. The outer shell exterior is exposed to both radiant and convective heat sources.	The Thermal Protective Performance (TPP) test is used to measure the insulating performance of the three-layer system by evaluating how quickly heat is transferred from the outside of the garment to the inside.	
	**TPP Test Apparatus.**	-	
	**TPP Test Being Run.**	-	
	-	The rate of temperature rise is recorded and compared to the known skin response to heat; the recorded time is multiplied by the heat exposure energy to determine the Thermal Protective Performance (TPP) rating.	Under the given test conditions, which simulate severe flashover conditions, the TPP rating divided in half indicates the approximate number of seconds until a firefighter would receive a second-degree burn.
	-	The TPP rating of the garment must be at least 35.	This is the primary test to measure the garment's ability to

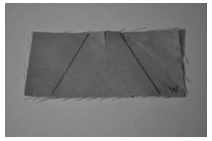
Test Method	Test Method Description	Test Method Application	
			protect the firefighter from severe heat and flame. The higher the number, the higher the protection from heat (under the specific test conditions), and, in general, the higher the heat stress on the firefighter. Firefighters should always consider the TPP rating as it relates to the Total Heat Loss (THL) rating.
7.1.2 Whole Garment and Ensemble Liquid Penetration Test (Shower Test)	This test is performed in accordance with ASTM F1359/F1359M, *Standard Test Method for Liquid Penetration Resistance of Protective Clothing or Protective Ensembles Under a Shower Spray While on a Manikin*, on a full garment set (coat and pants) or coveralls. The whole garment is placed on a manikin dressed in a water-absorptive layer and exposed to 2.5 minutes of liquid spray from four different orientations for a total of 10 minutes. After removal of the garment, the water-absorptive layer is examined for evidence of moisture penetration.	The Shower Test is used to evaluate how well the seams and closures of the garment, under controlled test conditions, resist inward leakage of liquids from exterior sources. Note: The Shower Test is the *only* test performed on assembled garments — coats and pants.	
7.1.3 Flame Resistance Test 1	This test is performed in accordance with ASTM D6413/D6413M, *Standard Test Method for Flame Resistance of Textiles (Vertical Test)*, as received and after conditioning with five laundering cycles on garment components (hook and pile, elastic, and labels can be excluded from the test depending on their location in the garment).	The Flame Resistance Test 1 is used to evaluate the material, under controlled test conditions, for its ability to self-extinguish after the flame is removed. The char length of the material after exposure to flame is also measured.	

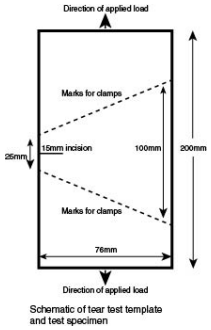
Test Method	Test Method Description	Test Method Application	
	**Test Apparatus in Ready Position.**	-	
	**Flame Test Being Performed.**	-	
	-	Each separable layer of multilayer composites is tested individually. The specimen is suspended over a flame for 12 seconds to determine how easily the material ignites. Ease of ignition and charring characteristics are observed and recorded. Materials cannot char more than 100 mm (4 in.), cannot show afterflame 2 seconds after removal of the test flame, and cannot melt.	This is the primary test to establish the flame-resistant properties of the materials used in garment construction.
7.1.4 Heat and Thermal Shrinkage Resistance Test (shrinkage)	This test is performed as received and after conditioning with five laundering cycles. Outer shells, moisture barriers, thermal barriers, collar linings, and winter liners (where provided) are tested individually. Fabric samples are marked and measured before exposure to 5 minutes of heat in a 260°C (500°F) or 180 C (for moisture barriers) oven.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate the materials for shrinkage after exposure to high temperatures.	
	-	Excessive shrinkage could compromise the firefighter's mobility and impact the insulating qualities of the garment.	Post-exposure measurements are taken and averaged, and no more than 10 percent shrinkage is permitted.
7.1.5 Heat and Thermal Shrinkage	This test is performed as received and after conditioning with five laundering cycles on garment components, except for	The Heat and Thermal Shrinkage Resistance Test is used for this requirement	

Test Method	Test Method Description	Test Method Application	
Resistance Test (melting, separation, ignition)	hook and loop and elastic, when placed where they will not contact the firefighter's body. Samples are suspended in a 260°C (500°F) or 180 C (for moisture barriers) oven for 5 minutes.	to determine whether or not components used to construct protective garments will melt, separate, or easily ignite.	
	-	Garment components cannot melt, drip, separate, or ignite.	The test conditions are not intended to simulate actual fireground exposures but rather serve as a means to establish a minimum level of thermal stability for the materials used in the construction of protective clothing elements.
	**Oven Exterior.**	-	
	**Oven Interior.**	-	
7.1.6 Heat and Thermal Shrinkage Resistance Test (moisture barrier seams)	This test is performed as received and after conditioning with 5 laundering cycles on all moisture barrier seams. Samples are prepped and exposed to 5 minutes of heat in a ~~260°C (500°F) oven~~ 180°C oven . Observations are limited to seam material ignition and dripping.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate the ability of the moisture barrier seams to resist dripping or ignition.	
	**Oven Exterior.**	-	

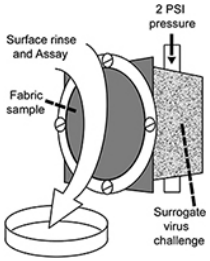
Test Method	Test Method Description	Test Method Application
	**Oven Interior.**	-
7.1.7 Heat and Thermal Shrinkage Resistance Test (outer shells and collar linings/char)	This test is performed as received and after conditioning outer shells and collar linings with five laundering cycles to identify charring when specimens are exposed to 5 minutes of heat in a 260°C (500°F) oven. Specimens cannot char.	The Heat and Thermal Shrinkage Resistance Test is used to evaluate whether or not the outer surfaces of the garment will char or break open, exposing interior layers. Charring and breaking open compromise the thermal and physical protection of the garments, which, in turn, increases the risk of firefighter burns and injuries.
	**Oven Exterior.**	-
	**Oven Interior.**	-
7.1.8 Heat and Thermal Shrinkage Resistance Test (hardware)	This test is performed on hardware, excluding hook and pile, when they do not contact a firefighter's body. Performance of the specimens is observed after exposure to 5 minutes of heat in a 260°C (500°F) oven.	The Heat and Thermal Shrinkage Resistance Test is used for this requirement to evaluate the ability of the hardware to remain functional and resist ignition when exposed to heat. This test eliminates the use of hardware on garments that will not withstand exposure to a certain level of heat.

Test Method	Test Method Description	Test Method Application
	**Oven Exterior.**	-
	**Oven Interior.**	-
7.1.9 Conductive and Compressive Heat Resistance (CCHR) Test	This test is performed on composites from the shoulder and knee areas with all layers placed in the same order as they are constructed. Sample sizes are representative of the knee and shoulder area and must be provided for each composite combination used by the garment manufacturer. Samples are tested in both the wet and dry condition under applied pressure.	The Conductive and Compressive Heat Resistance (CCHR) Test is used to evaluate the properties of the garment shoulder and knee areas, which are more likely to become compressed; thermal insulation is reduced under compression. The requirement sets a minimum number of seconds until the firefighter would receive a second-degree burn when these areas are under compression.
	**Conductive and Compressive Heat Resistance (CCHR) Test Machine in the Ready State.**	-
	**Conductive and Compressive Heat Resistance (CCHR) Test Machine in Operation.**	-

Test Method	Test Method Description	Test Method Application
7.1.10 Thread Melting Test	This test is performed in accordance with ASTM D7138, *Standard Test Method to Determine Melting Temperature of Synthetic Fibers*, on the three different specimens of sewing thread used in the construction of the garment as received.	The Thread Melting Test is used to evaluate the thread used in the construction of the garment to determine whether it has at least the same heat resistance as the fabric used in the garment's construction. The temperature at which the thread melts or decomposes is recorded, and if it melts below 260°C (500°F), it fails.
7.1.11 Tear Resistance Test (outer shells and collar linings)	This test is performed in accordance with ASTM D5587, *Standard Test Method for the Tearing of Fabrics by Trapezoid Procedure*, on outer shells and collar linings (tested individually) as received and after the multiconditioning procedure. The test measures the force (in pounds) needed to continue a pre-existing tear. Opposite ends of an intentionally notched, trapezoidal-shaped specimen are gripped in a machine and pulled apart until the specimen tears completely.	The Tear Resistance Test is used for this requirement to measure the ability of the outer shell fabric and collar linings to resist further tearing when a small tear occurs. Fabric tears further expose the firefighter to the products of combustion. It also is a test of the strength and durability of the fabric. Firefighting occurs in a harsh environment that includes many hazards that might tear a garment.
	**Sample Marked and Precut for Test.**	-
	**Test Being Performed.**	-
7.1.12 Tear Resistance Test (moisture barriers, thermal barriers)	This test is performed in accordance with ASTM D5587 on moisture barriers, thermal barriers, and winter liners as received and after the multiconditioning procedure. The test measures the force (in pounds)	The Tear Resistance Test is used for this requirement to measure the ability of the thermal barrier materials and the moisture barrier to

Test Method	Test Method Description	Test Method Application
	needed to continue a preexisting tear. Opposite ends of an intentionally notched, trapezoidal-shaped specimen are gripped in a machine and pulled apart until the specimen tears completely.	resist further tearing when a small tear occurs, which further exposes the firefighter to the products of combustion.
 Schematic of tear test template and test specimen	**Diagram of Trapezoidal Tear Test.**	-
7.1.13 Seam-Breaking Strength Test	This test is performed in accordance with ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, on all garment seam assemblies. Samples are tested after conditioning. Opposite ends of a 50 mm × 200 mm (2 in. × 8 in.) specimen with the seam bisecting the length are gripped in a machine and pulled apart until the specimen breaks.	The Seam-Breaking Strength Test is used to evaluate the strength of garment seams under stress. The test demonstrates the durability of the seam as an indicator of physical performance when subjected to repeated wearer movement, such as bending and stretching.
	**Seam Breaking Strength Test.**	-
7.1.14 Water Penetration Resistance Test (moisture barriers)	This test is performed on specimens of garment moisture barriers as received and after the multiconditioning procedure. A circular portion of the moisture barrier is clamped down in a hydrostatic tester and exposed to high water pressure from underneath. The specimen is then examined for water penetration.	The Water Penetration Resistance Test is used to evaluate the ability of moisture barrier materials to keep water from getting through the barrier. The test demonstrates the capacity of the moisture barrier to keep the firefighter dry from external pressurized water.

Test Method	Test Method Description	Test Method Application
7.1.15 Liquid Penetration Resistance Test (moisture barrier and barrier seams)	This test is performed in accordance with ASTM F903, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, on moisture barrier fabric and seams for the garment, footwear, bootie, and glove. Specimens are conditioned for laundry and heat in specially made pockets comprised of two layers of outer shell and a layer of thermal.	The Liquid Penetration Resistance Test is used to evaluate whether or not the garment's moisture barrier and seams resist penetration of liquids meant to be representative of those commonly encountered on the fireground. After conditioning specimens are placed in a test cell where the normal outer surface of the material is exposed to aqueous film-forming foam, battery acid, surrogate gasoline, ~~fire-resistant hydraulic fluid,~~ swimming pool chlorine, and automobile antifreeze fluid; each liquid is tested separately on an individual specimen. After 1 hour of exposure, each sample is evaluated. No liquid can penetrate any sample.
7.1.~~16 Viral Penetration Resistance Test (moisture barrier and barrier seams)~~	~~This test is performed in accordance with ASTM F1671/F1671M, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Blood-Borne Pathogens Using Phi-X-174 Bacteriophage Penetration as a Test System* , on moisture barrier fabric and seams. Samples are conditioned for laundry and heat in specially made pockets comprised of two layers of outer shell and a layer of thermal barrier.~~ ~~After conditioning, the specimens are then placed in a test cell where the film side is exposed to surrogate virus in a liquid solution and is evaluated for passage of virus after 1 hour.~~	~~The Viral Penetration Resistance Test is used to evaluate the ability of the garment's moisture barrier fabric and seams to keep blood-borne pathogens from coming in contact with the firefighter.~~ -

Test Method	Test Method Description	Test Method Application		
	~~Any evidence of virus passage through the barrier fabric or seam as determined using a microbiological technique constitutes failure.~~			
	 ~~**Diagram of Viral Penetration Test for Moisture Barrier and Seams.**~~			
~~7.1.~~ 17 Cleaning Shrinkage Resistance Test (moisture barriers, winter liners, collar liners) *(see also 7.2.4)*	This test is performed on three conditioned specimens of garment moisture barriers, winter liners (when provided), and collar liners, each tested individually.	The Cleaning Shrinkage Resistance Test is used to evaluate how much garment materials shrink after repeated laundering; shrinkage could decrease the firefighter's mobility.		This requirement allows no more than a 5 percent change in the width and length dimensions after five wash and dry cycles in an extractor.
7.1.18 Water Absorption Resistance Test (resistance to water absorption)	This test applies to the garment outer shells and collar lining. The conditioned specimens, tested individually, are mounted on an apparatus specified in AATCC 42, *Test Method for Water Resistance: Impact Penetration Test*, and exposed to a constant flow of water to determine the level of water absorption.	The Water Absorption Resistance Test is used to determine how much water the outer shell absorbs. The requirement limits how much water can be absorbed — absorbed liquid adds weight, which increases firefighter fatigue and decreases firefighter mobility.		

Test Method	Test Method Description	Test Method Application	
7.1.19 Corrosion Resistance Test	This test is performed in accordance with ASTM B117, *Test Method for Water Resistance: Impact Penetration Test*, to measure corrosion. Metal hardware is exposed to a saline solution spray for 20 hours following which base metal can show only slight surface corrosion and the hardware must remain functional.	The Corrosion Resistance Test is used to evaluate whether hardware will (1) corrode and (2) remain functional after extended exposure to salt spray. -	Hardware failure can result in loss of thermal and physical protection for the firefighter.
7.1.20 Label Durability and Legibility Test 1	This test is performed on garment labels attached to sample fabric. Garment label specimens are exposed to 10 laundry cycles in an extractor and then subjected to abrasion in accordance with ASTM D4966, *Standard Test Method for Abrasion Resistance of Textile Fabrics (Martindale Abrasion Test Method)*. Labels are also evaluated for legibility after a convective heat exposure.	The Label Durability and Legibility Test is used to evaluate whether or not the label stays in place and is legible after exposure to multiple launderings, abrasion, and convective heat. The presence and legibility of labels is important for garment identification and tracking.	
7.1.21 Drag Rescue Device (DRD) Materials Strength Test	This test is performed in accordance with ASTM D6775, *Standard Test Method for Breaking Strength and Elongation of Textile Webbing, Tape and Braided Material*, to measure the breaking strength of DRD materials, seams, splices, and joints. Specimens are conditioned then elongated to the point of breaking. The pounds of force needed to break each specimen is recorded and used to calculate the average breaking strength of the specimens.	The Drag Rescue Device (DRD) Materials Strength Test is used to evaluate the strength of the DRD materials, seams, splices, and joints to determine whether the specimens can withstand the force of dragging a downed firefighter.	

Test Method	Test Method Description	Test Method Application
7.1.22 Drag Rescue Device (DRD) Function Test	This test is used to evaluate DRD functionality as it is installed in the coat or coverall. The garments and DRD, after conditioning at room temperature, are placed on a manikin with an SCBA. The DRD is deployed by the test technician using a gloved hand and having obscured vision, and the manikin is dragged for a specified distance.	The DRD Function Test is used to assess the ease of deploying and using the DRD to remove a downed firefighter. The deployment time is recorded and reported, the ability to drag the manikin the required distance is recorded and reported, and any change in the position of the SCBA during deployment or dragging is recorded and reported. Ten seconds is the maximum amount of time permitted to deploy the DRD. For the DRD to pass the test, the SCBA can neither move higher on the torso than when initially donned nor become separated from the manikin during the test.
-	-	-
-	-	-
-	-	-
-	-	-
7.1.24 Zipper Strength Test	This test is used to evaluate zippers for crosswise breaking strength of the chain and of the separating unit. They are also tested for holding strength of stops, retainers, and separating units and for operating force and slider lock strength.	The Zipper Strength Test is used to assess the durability and functionality of zippers after repeated use.
7.1.25 Fastener Tape Strength Test (breaking)	This test is performed after three launderings in accordance with ASTM D5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics*, and is based on the requirements of A-A-	The Fastener Tape Strength Test is used for this requirement to assess the overall strength of tapes used in hook and pile

Test Method	Test Method Description	Test Method Application
	55126C, *Commercial Item Description, Fastener Tapes, Hook and Loop, Synthetic*. It is used to evaluate the breaking strength of hook and pile tape by separately pulling the hook and pile tapes in the jaws of a tensile testing machine until the tape breaks. The force used at the breaking point is recorded as the breaking strength.	fasteners. The material must meet or exceed industry-established requirements based on the composition and width of the tape.
7.1.26 Fastener Tape Strength Test (shear)	This test is performed after three launderings in accordance with ASTM D5169, *Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners*, and is based on the requirements of A-A–55126C. It is used to evaluate the shear strength of the hook and pile tape by measuring the force required to separate hook tape overlapping pile tape when pulled between two jaws of a tensile testing machine. Testing is performed after the tapes have been repeatedly attached and detached. The maximum measured force is reported as the shear strength.	The Fastener Tape Strength Test is used for this requirement to assess the durability and functionality of the hook and pile to not separate after repeated use.
7.1.27 Fastener Tape Strength Test (peel)	This test is performed after three launderings in accordance with ASTM D5170, *Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners*, and is based on the requirements of A-A-55126C. It is used to evaluate the peel strength of the hook and pile tape. In the test, hook tape is sealed over an equal length of pile tape and the end of the two tapes are separated half their length. The two open ends of tape are attached to the jaws of a tensile testing machine and pulled to measure the force required to completely separate the two tapes. This testing is performed after the tapes have been repeatedly sealed and resealed several times.	The Fastener Tape Strength Test is used for this requirement to assess the durability and functionality of the hook and pile to stay sealed after repeated use.

Test Method	Test Method Description	Test Method Application	
7.2.2 Total Heat Loss (THL) Test	This test is performed in accordance with ASTM F1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, Part C, on samples of the garment composite (outer shell, moisture barrier, and thermal barrier) conditioned at 25°C, 65% RH arranged in the order and orientation as it is worn. Specimens are placed on a sweating hot plate to evaluate heat transfer under wet conditions and thermal resistance under dry conditions. These values are combined in an equation to predict a total heat loss value in 25°C, 65% RH environment with a 2 m/s wind flow.	The Total Heat Loss (THL) Test is used to evaluate the amount of heat that can be transferred out of the garment composite via both sweat evaporation from the wearer's skin and conduction through the garment into a mild environment. The test does not account for other materials attached to the base garment composite such as trim, pockets, and other layers. Additions to the garment can negate benefits provided by a high THL composite. In addition, this test cannot measure the effect of sunlight on the gear where darker colors and dirty gear have shown to lower performance.	Higher values indicate better performance and more heat loss in a mild environment. Appropriate THL values for your department must be considered with TPP and evaporative resistance values. *(See A.7.2.2 for more detail.)*

Test Method	Test Method Description	Test Method Application
	The conditioned garment trim is tested for both retroreflectivity and fluorescence. The coefficient of retroreflection is tested in accordance with ASTM E809, *Standard Practice for Measuring Photometric Characteristics of Retroreflectors*. Once retroreflection is determined, the specimen is evaluated for fluorescence. The colorimetric properties are measured in accordance with ASTM E991, *Standard Practice for Color Measurement of Fluorescent Specimens*.	The Retroreflectivity and Fluorescence Test is used to evaluate how well samples of retroreflective and fluorescent material retain their retroreflectivity and fluorescence. The standard has requirements for retroreflectivity and fluorescence to enhance nighttime/low-light visibility (retroreflection) and daytime visibility (fluorescence).
7.2.3 Retroreflectivity and Fluorescence Test (garment trim)	Retroreflection/retroreflectivity is the reflection of light in which the reflected rays are preferentially returned in the direction close to the opposite of the direction of the incident rays, with the property being maintained over wide variations of the direction of the incident rays.	The visibility of a firefighter is crucial during both interior and exterior operations. In addition, almost all emergency incidents begin in a roadway (apparatus placement), and many emergency incidents are roadway related. For firefighter safety, it is important that garments have effective retroreflectivity and fluorescence for conspicuity (visibility). Fluorescence is the process by which radiant flux of certain wavelengths is absorbed and reradiated nonthermally in other, usually longer, wavelengths.
7.2.4 Cleaning Shrinkage Resistance Test (outer shell, moisture barrier, thermal barrier, winter liner, wristlet, bootie) *(see also 7.1.17)*	This test, performed in accordance with the measurement requirements of AATCC 135 measures the percent of change in the width and length dimensions after five wash and dry cycles in an extractor. Tests are performed on three specimens of the conditioned garment outer shell, moisture barrier, thermal barrier, winter liner, wristlet, bootie material where present, and	The Cleaning Shrinkage Resistance Test is used to measure how much fabrics shrink after cleaning; they will not pass if they shrink more than 5 percent. Excessive shrinkage could compromise the firefighter's mobility and impact the

Test Method	Test Method Description	Test Method Application
	protective hoods. Each material and each separable layer of a composite material is tested separately.	insulating qualities of the garment.
7.2.5 Breaking Strength Test (outer shell and collar lining)	This test is performed in accordance with ASTM D6775 on the garment outer shell and collar lining materials (individually) after conditioning. Five specimens from the sample, in the warp and fill direction, are elongated to the point of breaking.	The Breaking Strength Test is used to evaluate the garment's outer shell and collar lining strength for material robustness so it remains intact in rugged fireground environments. Material breakage can compromise the thermal and physical protection features of the garments, which increases the risk of firefighter burns and injuries.
	**Apparatus Ready for Test.**	-
	**Sample Fabric upon Completion of Test.**	-
7.2.6 Transmitted and Stored Thermal Energy Test (enhanced composites related to sleeves)	This test is performed in accordance with ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy of Firefighter Protective Clothing Systems*, on conditioned garment sleeve composites containing enhancements; enhancements include, but are not limited to, trim, emblems, flags, reinforcements, and so forth. The test is run on a base composite with the enhancement attached, following wet conditioning of the samples.	The Transmitted and Stored Thermal Energy Test is used to evaluate the ability of the garment composite enhancements to store and then transfer heat through the composite and enhancement to the skin. The test is used to evaluate the potential for burn injury when the composite is compressed, during a lower heat, longer time exposure. The test is intended to ensure that there is a level of protection to the firefighter to help prevent a burn injury

Test Method	Test Method Description	Test Method Application		
		when the garment does not indicate evidence of thermal exposure.		
7.2.7 Evaporative Resistance Test	This test is performed in accordance with ASTM F1886, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate, Part B*, on samples of the garments base composite (i.e., outer shell, moisture barrier, and thermal barrier) conditioned in the testing environment in the order and orientation as it is worn. Specimens are placed on a sweating hot plate and heat loss due to evaporation is measured and used to calculate the evaporative resistance value.	The Evaporative Resistance test is used to evaluate the amount of heat that can be transferred out of the garment composite via sweat evaporation from the wearer's skin through the garment to a hot and humid environment. The test does not account for other materials attached to the base garment composite such as trim, pockets, reinforcements, labels, and other accessories. These additional layers can easily negate any advantages gained from a composite with a low evaporative resistance. In addition, this test cannot measure the effect of sunlight on the gear where darker colors and dirty gear have shown to have lower performance.	-	- Lower values indicate better performance and a better ability to lose heat in a hot environment. However, appropriate evaporative resistance values for your department must be considered with THL and TPP values. *(See*

Test Method	Test Method Description	Test Method Application
		A.7.2.2 for more detail).

Statement of Problem and Substantiation for Public Comment

These revisions to the Annex harmonizes the revisions submitted and the substantiations attached to each therein.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 56-NFPA 1970-2022 [Section No. 9.83.2]	
Public Comment No. 55-NFPA 1970-2022 [Section No. 9.83.1]	
Public Comment No. 54-NFPA 1970-2022 [Section No. 9.28.1.1]	
Public Comment No. 53-NFPA 1970-2022 [Section No. 9.27.4.2]	
Public Comment No. 52-NFPA 1970-2022 [Section No. 9.6.5.1]	
Public Comment No. 51-NFPA 1970-2022 [Section No. 9.6.3.3]	
Public Comment No. 50-NFPA 1970-2022 [Section No. 9.6.4]	
Public Comment No. 49-NFPA 1970-2022 [Section No. 9.6.1.2]	
Public Comment No. 48-NFPA 1970-2022 [Section No. 9.6.1.1]	
Public Comment No. 47-NFPA 1970-2022 [Section No. 6.4.13]	
Public Comment No. 46-NFPA 1970-2022 [Section No. 6.1.7.6]	
Public Comment No. 45-NFPA 1970-2022 [Section No. 6.1.7 [Excluding any Sub-Sections]]	
Public Comment No. 44-NFPA 1970-2022 [Section No. 4.7.11]	
Public Comment No. 43-NFPA 1970-2022 [Section No. 4.7.10]	
Public Comment No. 42-NFPA 1970-2022 [Section No. 4.7.9]	
Public Comment No. 41-NFPA 1970-2022 [Section No. 4.3.9.2]	
Public Comment No. 40-NFPA 1970-2022 [Section No. 4.3.4]	

Related Item

• NFPA 1971 TIA 1594

Submitter Information Verification

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Submittal Date: Thu Dec 22 07:02:39 EST 2022
Committee: FAE-SPF

Public Comment No. 166-NFPA 1970-2023 [Chapter G]

~~**Annex G** – Test Methods Evaluating Different Combinations of Elements~~

~~*This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.*~~

~~**G.1** – Preamble.~~

~~This annex provides several test methods that can be applied to evaluate the performance, integration, and interoperability of full ensembles or groupings of protective clothing and equipment that can be used for structural or proximity firefighting. These test methods are optional and nonmandatory but can be applied by research institutions, manufacturers, and end users for evaluating different combinations of elements. Specific test procedures are provided in several different areas of evaluation that include a general overview and intended use of the test procedures, equipment requirements, test procedures, reportable results, and recommended approach for interpreting test results. In some cases, references are made to already-existing standardized test methods.~~

~~**G.2** – Full Ensemble Thermal Testing.~~

~~**G.2.1** – Full Ensemble Flash Fire Test.~~

~~**G.2.1.1** – Overview and Intended Use.~~

~~This test method provides a means to evaluate the protective ensemble as a whole to a flame engulfment or flash over simulation. Second- and third-degree burn prediction are provided for an exposure with the exception of the hands and feet. In addition, valuable information on the afterflame and durability of the materials can be assessed after the exposure. Provided that the entire ensemble is tested, it will provide a single test that evaluates the thermal performance of each component of an ensemble.~~

~~**G.2.1.2** – Samples.~~

~~**G.2.1.2.1** –~~

~~Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how an ensemble performs as a whole.~~

~~**G.2.1.2.2** –~~

~~At a minimum, a t-shirt and briefs should be worn under the protective ensemble. A station uniform can also be tested under the protective garment but will not represent the worst-case scenario unless the station uniform is required to be worn at all times, day or night.~~

~~**G.2.1.2.3** –~~

~~The ensemble should be tested in as-received state.~~

~~**G.2.1.2.4** –~~

~~Samples should be conditioned at 21°C ± 2°C (70°F ± 4°F) and 65 percent ± 10 percent relative humidity for at least 4 hours.~~

G.2.1.3 – Specimens.

G.2.1.3.1 –

A minimum of three specimens should be tested.

G.2.1.3.2 –

Specimens should be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.2.1.3.2.1 –

If required to dress, ensemble elements can be cut open to dress on the manikin. The cut area should then be reattached after dressing.

G.2.1.4 – Apparatus.

The apparatus should be as specified in ASTM F1930, *Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin* .

G.2.1.5 – Procedure.

G.2.1.5.1 –

Dress the manikin in the protective ensemble to be tested.

G.2.1.5.2 –

Expose the manikin for 12 seconds and record data for a minimum of 120 seconds after the exposure is over.

G.2.1.5.3 –

After the exposure, do the following in addition to the requirements within ASTM F1930, *Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin* :

(1) Record any instances of breakopen in all layers of clothing

(2) Record any melting

(3) Check to make sure the SCBA can still be used and no leaks occur

(4) Verify that the mask can still be seen through

G.2.1.6 –

The report should include the burn injury prediction and all other requirements outlined in ASTM F1930, *Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin* . In addition, information detailed in G.2.1.5.3 should also be reported.

G.3 – Full Ensemble Physiological Testing.

G.3.1 – Predicted Ensemble Physiological Impact Test.

G.3.1.1 – Overview and Intended Use.

This test method provides a consistent means to evaluate protective ensembles for heat stress in firefighters. Predicted core body temperature, mean skin temperature, sweating totals, and cardiac outputs predictions are provided.

G.3.1.2 – Samples.

G.3.1.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. It is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

G.3.1.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

G.3.1.2.3 –

The ensemble should be washed and dried before being tested.

G.3.1.2.4 –

Samples should be conditioned in the testing environment for at least 4 hours.

G.3.1.3 – Specimens.

G.3.1.3.1 –

A minimum of three specimens should be tested.

G.3.1.3.2 –

Specimens should be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.3.1.3.2.1 –

If required to dress, ensemble elements can be cut open to dress on the manikin. The cut area should then be reattached after dressing.

G.3.1.4 – Apparatus.

G.3.1.4.1 –

The apparatus should be as specified in Section 5 of ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin* .

G.3.1.4.2 –

The manikin must also be coupled with a physiological model that reads inputs on the testing environment and the heat flow into the manikin system. With collected data and input data on work rates the software controls the manikin's skin temperature and sweat rate and provides physiological predictions every second.

G.3.1.5 – Procedure.

G.3.1.5.1 –

Dress the manikin in the protective ensemble to be tested outside the test chamber.

~~**G.3.1.5.2** –~~

~~Set the test chamber to the desired testing temperature.~~

~~**G.3.1.5.3** –~~

~~Once set point temperatures have been obtained, start the model and move the manikin into the test chamber.~~

~~**G.3.1.5.4** –~~

~~Run the system for a maximum of 2.5 hours. If the predicted core temperature reaches above 39.5°C (103°F), then testing can stop.~~

~~**G.3.1.6** – Report.~~

~~The report should include the plots for the predicted core body temperature, mean skin temperature, sweat total, and cardiac output.~~

~~**G.3.2** – Measured Ensemble Heat Loss Test.~~

~~**G.3.2.1** – Overview and Intended Use.~~

~~This test method provides a consistent means to evaluate protective ensembles for measured heat loss.~~

~~**G.3.2.2** – Samples.~~

~~**G.3.2.2.1** –~~

~~Samples should consist of at least the bunker pants and coat for evaluation. It is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.~~

~~**G.3.2.2.2** –~~

~~At a minimum, a t-shirt and briefs should be worn under the protective ensemble.~~

~~**G.3.2.2.3** –~~

~~The ensemble should be washed and dried before being tested.~~

~~**G.3.2.2.4** –~~

~~Samples should be conditioned in the testing environment for at least 4 hours.~~

~~**G.3.2.3** – Specimens.~~

~~**G.3.2.3.1** –~~

~~A minimum of three specimens should be tested.~~

~~**G.3.2.3.2** –~~

~~Specimens should be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.~~

~~**G.3.2.3.2.1** –~~

~~If required to dress, ensemble elements can be cut to dress on the manikin. The cut should then be reattached after dressing.~~

G.3.2.4 – Apparatus.

The apparatus should be as specified in Section 5 of ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin* .

G.3.2.5 – Procedure.

G.3.2.5.1 –

Dress manikin in the protective ensemble to be tested outside the test chamber.

G.3.2.5.2 –

Follow the procedures in ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin,* with the following exceptions:

(1) Chamber temperature should be set at 25°C (77°F), 65 percent RH

(2) Wind flow should be set at 2 m/s

(3) Once a steady state has been achieved, record the heat flux at each body section and calculate the overall heat flux with the parallel method

G.3.2.6 – Report.

The report should include the heat flux values for each body section of the manikin and the overall heat flux loss from the manikin.

G.3.3 – Measured Ensemble Evaporative Resistance Test.

G.3.3.1 – Overview and Intended Use.

This test method provides a consistent means to evaluate protective ensembles for measured evaporative resistance of a firefighter ensemble.

G.3.3.2 – Samples.

G.3.3.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. It is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

G.3.3.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

G.3.3.2.3 –

The ensemble should be washed and dried before being tested.

G.3.3.2.4 –

Samples should be conditioned in the testing environment for at least 4 hours.

G.3.3.3 – Specimens.

G.3.3.3.1 –

A minimum of three specimens should be tested.

G.3.3.3.2 –

Specimens should be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.3.3.3.2.1 –

If required to dress, ensemble elements can be cut open to dress on the manikin. The cut area should then be reattached after dressing.

G.3.3.4 – Apparatus.

The apparatus should be as specified in ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin* :

G.3.3.5 – Procedure.

G.3.3.5.1 –

Dress the manikin in the protective ensemble to be tested outside the test chamber.

G.3.3.5.2 –

Follow the procedures in ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin,* except the wind flow should be set at 1 m/s.

G.3.3.6 – Report.

The report should include the evaporative resistance for each body section of the manikin and the overall evaporative resistance from the manikin.

G.4 – Full Ensemble Integrity Testing.

G.4.1 – Outward Particle Leakage Test.

G.4.1.1 – Overview and Intended Use.

This test method provides a means to evaluate a protective ensemble performance against particle infiltration by examining how well it prevents the escape of visible particles. This is a simple method that gives a visual assessment of performance by particles escaping the protective ensemble. This method is not standardized and is only designed to subjectively evaluate how well a suit will resist infiltration of particles by examining where particles can exit the ensemble and the quantity of particles that can exit the ensemble.

G.4.1.2 – Samples.

G.4.1.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the ensemble performs as a whole.

G.4.1.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

G.4.1.3 – Specimens.

G.4.1.3.1 –

A minimum of three specimens should be tested.

G.4.1.3.2 –

Specimens should be provided to fit or be adjustable to fit the manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.4.1.3.2.1 –

If required to dress, ensemble elements can be cut open to dress on the manikin. The cut areas should then be reattached after dressing.

G.4.1.4 – Apparatus.

G.4.1.4.1 –

The apparatus should be a display manikin with movable joints for ease of dressing.

G.4.1.4.2 –

A commercial-grade theatrical smoke machine should be used to generate the particles.

G.4.1.4.2.1 –

The smoke generator should be attached to a holding box with a volume of at least 170 L (1 qt) to provide better control and delivery of the smoke into the manikin. This box will also have tubing exiting the box to provide particles to the manikin. A total of six exit ports should be delivered to the chest and arms, four to the legs, and one for the head.

G.4.1.5 – Procedure.

G.4.1.5.1 –

Attach the smoke delivery tubes to the manikin.

G.4.1.5.1.1 –

The six tubes for the chest and arms should have the tubing placed on the following locations: upper chest, waist, lower back, between the shoulder blades, and one on each of the lower forearms.

G.4.1.5.1.2 –

The four tubes for the leg should be placed on the manikin's groin, buttocks, and lower left and right shin.

G.4.1.5.1.3 –

The tube for the head should be placed on the back of the head.

G.4.1.5.2 –

Dress the manikin in the protective ensemble to be tested.

G.4.1.5.3 –

Place the dressed manikin in front of a black background to provide better assessment of smoke exiting the system.

G.4.1.5.4 –

Turn on the smoke generator and allow particles to flow through the tubing. Once smoke is flowing, measure the time it takes for particles to be visually seen coming from the ensemble. Take notes on all the places smoke is exiting and subjectively rate the amount of visible smoke.

G.4.1.5.5 –

If comparing suits, pictures should be taken.

G.4.1.5.6 –

If smoke exiting the suit is too excessive, isolate smoke flow to one section of the body at a time and make notes on each section.

G.4.1.6 – Report.

The report should provide the time for leakage to occur, notes on where smoke was coming from, and a qualitative assessment of how much exited the suit.

G.4.2 – Inward Particle Leakage Test.

G.4.2.1 – Overview and Intended Use.

This test method provides a means to evaluate a protective ensemble performance against particle infiltration by measuring and comparing the amount of particles inside an ensemble versus outside the ensemble within a particulate-filled room. This method provides a means to give a quantitative measurement of particle infiltration through and around interfaces of a protective ensemble.

G.4.2.2 – Samples.

Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how a protective ensemble performs.

G.4.2.3 – Specimens.

G.4.2.3.1 –

A minimum of three specimens should be tested.

G.4.2.3.2 –

Specimens should be provided to fit or be adjustable to fit the manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.4.2.3.2.1 –

If required to dress, ensemble elements can be cut to dress on the manikin. The cut should then be reattached and sealed after dressing.

G.4.2.4 – Apparatus.

G.4.2.4.1 – Manikin.

G.4.2.4.1.1 –

The apparatus should be as specified in Section 5 of ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin* .

~~**G.4.2.4.1.2** –~~

~~The apparatus must have joints within the shoulders and at the hips to allow for movement.~~

~~**G.4.2.4.1.3** –~~

~~The apparatus must also include a walking stand to allow the manikin to simulate a walk of 3.2 km/h (2 mph).~~

~~**G.4.2.4.2** – Chamber.~~

~~The chamber must be able to control for the following conditions:~~

(1) ~~25°C ± 1°C (77°F ± 1.8°F)~~

(2) ~~50 percent RH ± 5 percent RH~~

(3) ~~1 m/s wind flow perpendicular to the manikin~~

~~**G.4.2.4.3** – Particle Generator.~~

~~A particle generator capable of producing particles with a mean particle size of 0.5 µm with a concentration of at least 100,000 particles is needed.~~

~~**G.4.2.4.4** – Particle Counter.~~

~~**G.4.2.4.4.1** –~~

~~Each counter should be able to measure particles in a range of 0.3 µm to 0.5, and 0.5 µm to 1.0 µm.~~

~~**G.4.2.4.4.2** –~~

~~Each particle counter should sample 1 L (1 qt) of air in 30 seconds.~~

~~**G.4.2.5** – Procedure.~~

~~**G.4.2.5.1** –~~

~~Place the sampling tubes on the surface of the manikin such that clothing will not block the sampling of air.~~

~~**G.4.2.5.1.1** –~~

~~A sampling tube should be placed at least on the upper center chest, forearm, above the pant line, and at mid-calf.~~

~~**G.4.2.5.1.2** –~~

~~All sample ports should exit the protective ensemble or manikin with minimum interference with the ensemble or closure. If holes are cut in the ensemble, they should be sealed to minimize infiltration of particles.~~

~~**G.4.2.5.1.3** –~~

~~If hoods, gloves, or footwear are being testing, additional sampling ports can be placed on those locations.~~

~~**G.4.2.5.2** –~~

~~Dress the manikin in the protective ensemble being evaluated outside the particle chamber.~~

G.4.2.5.3 –

Set the chamber to be at conditions as specified in G.4.2.4.2.1 and turn on the particle generator such that there is greater than 100,000 particles in the 0.3 µm to 0.5 µm range.

G.4.2.5.4 –

Once particle readings are stable, move the dressed manikin into chamber.

G.4.2.5.4.1 –

Start the manikin walking at a rate equivalent to 3.2 km/h (2 mph) for 20 minutes.

G.4.2.5.5 –

At the end of the 20 minutes with the manikin still walking, measure each sampling port under the protective ensemble at least once for a particle count in the two ranges defined in G.4.2.4.4.1 .

G.4.2.5.5.1 –

Also measure the concentration of particles outside the ensemble while measuring the concentration inside the suit.

G.4.2.6 – Calculation.

Calculate the particulate protection factor for each measured sampling port for each particulate size range using the following equation:

$$PF = Ct_{\text{outside}} / Ct_{\text{inside}} \qquad \text{[G.4.2.6]}$$

where:

PF = Protection factor

Ct_{outside} = Concentration of particles outside the suit

Ct_{inside} = Concentration of particles inside the suit

G.4.2.7 – Report.

The report should provide the *PF* for every area of the body measured and include the *PF* for each particle size range.

G.4.3 – Inward Vapor Leakage Test—Man-in-Simulant Test (MIST).

G.4.3.1 – Overview and Intended Use.

This test method provides a means to evaluate a protective ensemble performance against vapor infiltration by measuring and comparing the amount of vapor inside an ensemble versus outside the ensemble within a vapor-filled room. This method provides a means to give a quantitative measurement of vapor infiltration through and around interfaces of a protective ensemble.

G.4.3.2 – Samples.

G.4.3.2.1 –

Samples for conditioning should be complete ensembles and should include the respirator.

G.4.3.2.2 –

Samples should be conditioned in a 21°C (70°F) and 65 percent RG.

G.4.3.3 – Specimens.

G.4.3.3.1 –

The specimen should be a complete ensemble with gloves and footwear and should include a respirator.

G.4.3.3.2 –

A minimum of four specimens should be tested. The specimens should represent a minimum of two different ensemble sizes.

G.4.3.3.3 –

Specimens should be provided to fit or be adjustable to fit the selected test subjects in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.4.3.3.4 –

None of the ensembles or components of the ensemble to be tested should have been previously subjected to MIST testing unless it can be demonstrated that the ensemble or components are free of contamination.

G.4.3.3.5 –

Underclothing and socks should be permitted to be reused, provided they have been laundered with a detergent that has been demonstrated not to cause interference with the analytical method.

G.4.3.4 – Apparatus.

G.4.3.4.1 – Test Facility.

G.4.3.4.1.1 –

The test facility should include areas for dressing—a first-stage undressing area adjacent and accessible to the chamber, and a second-stage undressing area adjacent and accessible to the first-stage undressing area.

G.4.3.4.1.2 –

The test should be conducted in a test chamber with a minimum volume of sufficient dimensions to permit free movement of the test subject(s) when fully dressed in the ensemble and for the test subject(s) to carry out the physical exercise routine specified in G.4.3.5.8.1 .

G.4.3.4.1.3 –

More than one test subject should be permitted in the chamber at the same time, provided they can complete all tasks completely in the appropriate time period and that they have an unobstructed direct path to the wind stream.

G.4.3.4.1.4 –

The test chamber should have a temperature of 25°C, ± 2°C (77°F ± 3.6°F), relative humidity of 55 percent, ± 10 percent, and a nominal wind speed of 0.9 to 2.2 m/sec (2 to 5 mph). The average wind speed should be 1.6 m/sec, ± 0.2 m/sec (3.5 mph, ± 0.5 mph).

G.4.3.4.2 – Test Chemical and Analytical Equipment.

G.4.3.4.2.1 –

The test simulant should be methyl salicylate (MeS; C8H8O3) CAS #119-36-8, more commonly known as oil of wintergreen. The MeS minimum purity should be 95 percent. Vapor doses should be measured using passive adsorbent dosimeters (PADs).

G.4.3.4.2.2 –

The standard concentration of MeS in the vapor chamber should be 150 mg/m ^{3} , ± 10 mg/m ^{3} (0.15 ppm, ± .01 ppm), as measured by a real-time infrared analysis of the chamber air or other validated real-time analytical technique.

G.4.3.4.2.3 –

Readings should be taken every 60 seconds to verify compliance with the concentration requirement, and an air sample should be taken at least every 10 minutes for validation of readings.

G.4.3.4.2.4 –

Every step should be taken to avoid generation of liquid aerosol.

G.4.3.4.2.5 –

The sensitivity of the analytical technique used for the measurement of MeS in the PADs should provide a detection limit of 30 ng MeS per PAD. The analytical technique should have an upper limit of quantification of 50,000 ng.

G.4.3.4.3 – Passive Adsorbent Dosimeters (PADs).

The test should be conducted using PADs that affix directly to the skin of test subjects and that have the following characteristics:

(1) The PADs should be a foil packet, which contains an adsorbent material covered by a high-density polyethylene film that acts as a pseudo-skin barrier.

(2) The high-sensitivity polyethylene film should have an uptake rate of approximately 2.0 cm/min (0.8 in./min).

G.4.3.4.4 – Test Subjects.

G.4.3.4.4.1 –

All test subjects should be medically and physically suitable to perform these tests without danger to themselves. A medical certificate for each test subject should have been issued within 12 months prior to testing.

G.4.3.4.4.2 –

Test subjects should be familiar with the use of protective ensembles and with the selected CBRN SCBA.

G.4.3.5 – Procedure.

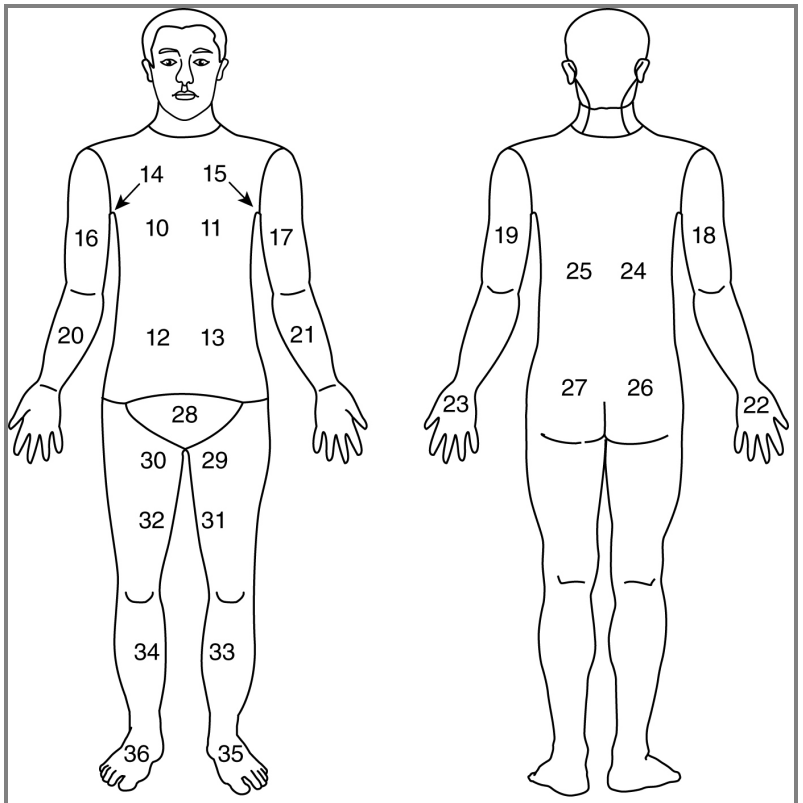
G.4.3.5.1 –

Test subjects should have followed pretrial procedures that include proper hydration and avoiding personal hygiene products that could contain MeS.

G.4.3.5.2 –

~~PADs should be placed on test subjects at the body region locations shown in Figure G.4.3.5.2 .~~

~~Figure G.4.3.5.2 Locations of PADs on Test Subjects.~~



1: Scalp (SCA)
2: Forehead (F)
3: Cheek (LC)
4: Cheek (RC)
5: Behind left ear (LE)
6: Behind right ear (RE)
7: Neck left (LN)
19: Left outer upper arm (LOU)
20: Right forearm (RFA)
21: Left forearm (LFA)
22: Right hand (RH)
23: Left hand (LH)
24: Right middle back (RMB)
25: Left middle back (LMB)

G.4.3.5.2.1 –

All PADs should be applied in a clean dressing area by personnel who have followed pretrial procedures to minimize contamination. Test subjects should also follow pretrial procedures to minimize contamination.

G.4.3.5.2.2 –

Cheek PADs should be located entirely within the respirator facepiece, and all other PADs should be located entirely outside the seal of the respirator facepiece.

G.4.3.5.3 –

Three additional PADs should be used to conduct background sampling and for quality control during the trial. These PADs should be located in the dressing area, the stage 1 undress area, and the stage 2 undress area.

G.4.3.5.4 –

The test subject should don the protective ensemble and respirator in accordance with the manufacturer's instructions in an area located away from the test chamber. The test subject should wear clothing under the protective ensemble as specified by the manufacturer. If no undergarments are specified or required by the manufacturer as part of the ensemble, the test subject should wear a short-sleeve cotton shirt and shorts or underwear.

G.4.3.5.5 –

After sealing the ensemble, the test subject should enter the test chamber, and the test chamber should be sealed.

G.4.3.5.6 –

The test duration will be 30 minutes in the chamber with a 5-minute decontamination period.

G.4.3.5.7 –

The start of the test, in which the test subject enters the MIST chamber, should be initiated within 60 minutes after removal of the ensemble from the conditioning environment.

G.4.3.5.8 – Physical Exercise Routine.

~~G.4.3.5.8.1~~ –

~~Once the chamber concentration has been established, the test subject(s) should perform the following physical activity protocol and the chamber concentration should remain within acceptable limits during the exercise protocol:~~

(1) ~~Drag 70 kg (154 lb) human dummy using both hands a distance of 10 m (33 ft) over a 15-second period. Stop and rest for 15 seconds. Repeat exercise twice.~~

(2) ~~Duck squat, pivot right, pivot left, stand. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.~~

(3) ~~Stand erect. With arms at sides, bend body to left and return, bend body forward and return, bend body to right and return. Rotate orientation 90 degrees to wind stream. between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.~~

(4) ~~Stand erect. Extend arms overhead in the lateral direction, then bend elbows. Extend arms overhead in the frontal direction, then bend elbows. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.~~

(5) ~~Stand erect. Extend arms perpendicular to the sides of torso. Twist torso left and return, twist torso right and return. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.~~

(6) ~~Stand erect. Reach arms across chest completely to opposite sides. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.~~

(7) ~~Climb two steps of the ladder and touch the ceiling with one hand (use alternate hands each time). Climb down, squat, and touch the floor with both hands. Repeat exercise three times within 1 minute.~~

(8) ~~Crawl in place for 1 minute. Rotate orientation 90 degrees to wind stream every 15 seconds.~~

(9) ~~Sit on stool (facing wind) and slowly turn head from side to side between extreme positions on each side. Pause momentarily at each extreme position and inhale. Repeat the exercise for 1 minute.~~

(10) ~~Sit on stool (back to wind) and slowly move head up and down. Pause momentarily at each extreme position and inhale. Repeat the exercise for 1 minute.~~

~~G.4.3.5.8.2~~ –

~~Physical activities and rest periods should be performed in a chamber location that provides an unobstructed exposure of the protective ensemble to the required wind stream.~~

~~G.4.3.5.8.3~~ –

~~Each physical activity and rest cycle should be 10 minutes. The cycle of exercise and rest should be completed a total of three times, for a total chamber exposure of 30 minutes. Each exercise cycle should consist of eight 1-minute activities followed by a 2-minute rest (sitting) period.~~

~~G.4.3.5.8.4~~ –

~~The test subject should begin the first repetition of each activity facing the wind stream and should rotate 90 degrees between each repetition until the time period for that exercise has ended.~~

G.4.3.5.8.5 –

All physical activities should be a full range of motion and performed at a moderate speed.

G.4.3.5.9 – Decontamination and Doffing.

G.4.3.5.9.1 –

After completion of the 30-minute MIST exposure, the test subjects should move to a decontamination area, where they should remain for at least 5 minutes. This area should be well ventilated to assist in off gassing of the outside of the ensemble.

G.4.3.5.9.2 –

In the decontamination area, all exposed ensemble surfaces, including such items as the respirator, boots, gloves, and helmets, should be washed with a liquid soap solution.

G.4.3.5.9.2.1 –

If the garment is designed for wet decontamination, it should be washed with the liquid soap solution as well.

G.4.3.5.9.2.2 –

Alternative decontamination methods, such as an air wash, should be permitted if the selected decontamination method can be demonstrated to remove MeS to levels that do not result in contamination of the test subjects during the doffing of the protective ensemble.

G.4.3.5.9.3 –

The decontaminated test subject should move to the first stage undressing room where all remaining items of clothing, except for underclothes, should be doffed. The undress process should not exceed 5 minutes.

G.4.3.5.9.4 –

As soon as the garment is unsealed and the PADs on the test subject's body are exposed to the ambient atmosphere in the first-stage undressing room, three fresh PADs should be placed near the test subject to detect background MeS concentrations.

G.4.3.5.9.5 –

As soon as all items of clothing, except the underwear, are removed, the decontaminated test subject should proceed to the second-stage undressing room and the background PADs should be collected and handled as specified in 8.2.2.5.9.7. The exposure time for the first-stage undressing room background PADs should be recorded.

G.4.3.5.9.6 –

When the test subject enters the second-stage undressing room, three additional PADs should be placed near the test subject and the exposure PADs should be removed from the test subject's body. Both the second-stage undressing room background PADs and the exposure PADs taken off the test subject's body should be handled as specified in 8.2.2.5.9 of NFPA 1990.

G.4.3.5.9.7 –

The exposure time for the second-stage undressing room PADs should be recorded.

G.4.3.5.9.8 –

Where an adhesive is used on the back of the PADs, each PAD should be backed with aluminum foil, placed in individual sealed glass vials with a nonadsorbent lid liner, and should remain at room temperature of 25°C, ± 3°C (77°F, ± 5°F) for 30 minutes, ± 5 minutes, immediately after exposure.

G.4.3.6 – PAD Qualification and Analysis.

G.4.3.6.1 –

The uptake rate for each lot of PADs should be determined in accordance with 8.2.2.6.2 using a minimum of seven PADs selected randomly from the lot.

G.4.3.6.2 – Measurement of PAD Uptake Rate.

G.4.3.6.2.1 –

PAD uptake rate should be measured by exposing PADs in a small-scale chamber under the following conditions:

(1) The concentration of MeS should be 1 mg/m^3 , ± 0.5 mg/m^3 (.001 ppm).

(2) The temperature should be 35°C, ± 2°C (94°F, ± 4°F).

(3) The relative humidity should be 55 percent, ± 20 percent.

(4) The flow of MeS in the humidified air or nitrogen should be at a rate of 1 cm/sec, ± 0.2 cm/sec over the PAD.

(5) The exposure should be conducted for a period of 30 minutes, +1/–0 minutes.

G.4.3.6.2.2 –

The PAD uptake rate should be calculated in accordance with the procedures provided in 8.2.2.6.4. The average of all PAD uptake rates should be calculated and used in the calculation of MeS dosage on the test subject PADs.

G.4.3.6.3 –

After their initial 30 minutes at room temperature, the PADs should be subjected to one of the following handling and analysis procedures:

(1) The PADs should be stored at a cold temperature sufficient to prevent the migration of MeS from the adhesive until extraction or analysis.

(2) The PADS should be extracted within 4 hours.

(3) The adsorbent should be removed and thermally desorbed within 4 hours.

G.4.3.6.3.1 –

The determination of a sufficiently low temperature that prevents migration of the MeS from the adhesive should be made by exposing 12 PADs simultaneously in the test chamber in a vertical position at a concentration of 100 mg/m ^{3} (0.1 ppm) of MeS for 30 minutes, +5/–0 minutes. After this exposure, the PADs should be covered in foil and each placed in a sealed container and stored at 25°C, ± 3°C (77°F, ± 5°F) for 30 minutes, ± 5 minutes. Four of these PADs should be packed in dry ice for 24 hours, four placed in the proposed cold storage temperature for 24 hours, and four extracted or analyzed within 4 hours. The average mass absorbed on the four PADs stored at the proposed storage temperature should equal with 95 percent confidence the average mass absorbed on four PADs stored for 24 hours in dry ice and the four PADs analyzed immediately after exposure.

G.4.3.6.3.2 –

Where liquid extraction of the PADs samples is performed, the liquid extracts should be stored at 0°C to 4°C (32°F to 39°F) for up to 14 days following their exposure before analysis.

G.4.3.6.4 –

The actual MeS vapor exposure concentration and the actual time of exposure should be used to determine the uptake rate from the following equation:

$$U = m / Act \qquad \textbf{[G.4.3.6.4]}$$

where:

U = the uptake rate in cm/min

m = the total mass of MeS measured on the PAD in mg

A = the average active area of the PAD in cm ^{2}

ct = the exposure vapor dosage in mg/min/cm ^{3}

G.4.3.6.5 –

The range of the analytical technique should be sufficient to measure the expected range of MeS dosage on the test subject PADs.

G.4.3.6.5.1 –

When liquid extraction is used as the analytical technique, the calibration curve used for determining the equipment response to MeS should be established using at least 4 MeS concentration standards accounting for the proper density of the extraction solvent.

G.4.3.6.6 –

For the test results to be considered valid for a given ensemble, no more than one PAD from each of the body region locations tested (i.e., no more than one PAD out of all replicates for any particular region) should be permitted to be lost to analysis.

G.4.3.7 – Calculations.

G.4.3.7.1 –

The dosage measured by each PAD ($Ct_{inside,i}$) should be determined using the average uptake rate determined for the PAD lot used in the evaluation of a specific ensemble using the following equation:

$$Ct_{inside\ i} = m_i / u_{avg} A \qquad \text{[G.4.3.7.1]}$$

where:

$Ct_{inside,i}$ = the MeS vapor dosage at the specific PAD in mg/min/cm ^{3}

mi = the total mass of MeS measured on the specific PAD in mg

u_{avg} = the average uptake of the PAD lot in cm/min

A = the average active area of the PA in cm ^{2}

G.4.3.7.1.1 –

The protection factor at each PAD location should be calculated using the following equation:

$$PF_i = Ct_{outside} / Ct_{inside,i} \qquad \text{[G.4.3.7.1.1]}$$

where:

$Ct_{outside}$ = average of chamber MeS concentration readings taken during the test subject exposure period, determined from the measured chamber vapor dosage of the individual trial over the entire exposure

The $Ct_{outside}$ should be determined from the measured chamber vapor dosage of the individual trial over the entire exposure. The value for $Ct_{outside}$ should be the average of the chamber MeS concentration readings taken during the course of the test subject exposure period.

G.4.3.7.1.2 –

Where the measured total mass of MeS for a given PAD falls below 30 ng, the value of 30 ng should be used for that specific PAD.

G.4.3.7.2 –

All results for each PAD location should be expressed in terms of the local physiological protective dosage factor (PPDF) value and should be calculated according to the following equation:

$$Local\ PPDF_i = \left(OSED_i / 25\right) * PF \qquad \text{[G.4.3.7.2]}$$

where:

$OSED_i$ = onset of symptoms exposure dosages

PF = protection factor

G.4.3.7.2.1 –

The site-specific onset of symptoms exposure dosages (OSED) for each PAD should be based on ECt10 values for mustard blistering/ulceration according to Table G.4.3.7.2.1 .

Table G.4.3.7.2.1 Site-Specific OSED by PAD Location

Body Region PAD Location OSED (mg•min•m ^{3}) Head/neck 1, 2, 3, 4, 5, 6, 7, 8, 9 100 Torso/buttocks (excluding perineum) 10, 11, 12, 13, 24, 25, 26, 27, 28 100 Arm/hand 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 50 Leg/foot 31, 32, 33, 34, 35, 36 100 Perineum 29, 30 25

G.4.3.7.2.2 –

The average local PPDF values at each PAD location for all specimens tested should be calculated.

G.4.3.7.3 –

A systemic PPDF should also be calculated from the PAD data. The systemic protection analysis should use the systemic weighting body region hazard analysis values from the Defense Research Establishment Suffield Report and National Research Council Report to calculate the systemic physiological protective dosage factor for each ensemble test (PPDFsys). The PPDFsys for each specimen is calculated as follows, where each of the terms is calculated using the information in Table G.4.3.7.3 .

$$PPDF_{sys} = \sum_{1}\left(dz_i / ED_{50i}\right) / \sum_{i}\left(dz_i / ED_{50i} * PF_i\right) \qquad \textbf{[G.4.3.7.3]}$$

Table G.4.3.7.3 ED $_{50\,i}$ Values by PAD and Body Location

Body Region *i* for BRHA Model PADs Mapped to This Region (Average Dosage from Each PAD, Then Calculate PF $_{i}$) Area of Body Region (*dz* $_{i}$, cm ^{2}) ED $_{50\,i}$ for Severe Effects (VX) for Body Region (mg/Individual) Scalp 1, 2 350 0.76 Ears 5, 6 50 0.46 Face, cheeks, and neck 3, 4, 7, 8 300 0.48 Chin and neck 7, 8 200 0.36 Nape 9 100 1.72 Chest/Abdomen 10, 11, 12, 13 2858 2.23 Back 24, 25, 26, 27 2540 2.65 Axillae 14, 15 200 2.07 Upper arm medial 16, 17 488 2.8 Upper arm lateral 18, 19 706 6.57 Elbow fold 16, 17, 18, 19, 20, 21 50 2.09 Elbow 16, 17, 18, 19, 20, 21 50 2.25 Forearm extensor 20, 21 487 2.8 Forearm flexor 20, 21 706 6.57 Hands dorsum 22, 23 200 2.91 Hands palmar 22, 23 200 9.24 Buttocks 26, 27 953 4.26 Groin 28 300 1.22 Scrotum 29, 30 200 0.11 Thigh anterior 31, 32 2845 6.57 Thigh posterior 31, 32 1422 4.26 Knee 31, 32, 33, 34 200 7.14 Popliteal space - - - (back of knees) 31, 32, 33, 34 100 2.09 Shins 33, 34 1897 6.57 Calves 33, 34 948 2.8 Feet dorsum 35, 36 500 6.6 Feet plantar 35, 36 300 7.14

G.4.3.7.3.1 –

The average PPDFsys for all specimens tested should be calculated.

G.4.3.7.3.2 –

The protection factor PFi used in the calculation of PPDFsys should be the average PF of all PADs in a specific body region.

G.4.3.8 – Report.

G.4.3.8.1 –

The individual specimen and average local PPDFi values for each PAD location should be recorded and reported.

G.4.3.8.2 –

The PPDFsys value for each specimen and the average PPDFsys value for the ensemble tested should be recorded and reported.

G.4.3.8.3 –

A spreadsheet should be prepared that shows all test measurements and calculations, including at least the following:

(1) The MeS vapor exposure concentration for PAD lot qualification

(2) The exposure time used for PAD lot qualification

(3) The measured MeS mass on each PAD used for PAD lot qualification

(4) Each individual and the average PAD uptake rate

(5) The measured MeS mass on each PAD used in the dressing room, first-stage undressing room, and second-stage undressing room

(6) The measured MeS mass on each PAD placed on the test subject

(7) The calculated vapor dosage for each PAD placed on the test subject

G.5 – Full Ensemble Functionality Testing.

G.5.1 – Fit/Function Test.

G.5.1.1 – Overview and Intended Use.

This test method provides a means to evaluate the protective ensemble as a whole to a task-oriented routine to judge the comfort, fit, and function. Times required to complete tasks and ratings based on each task are collected and reported.

G.5.1.2 – Samples.

G.5.1.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

G.5.1.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

G.5.1.2.3 –

The ensemble should be tested in its as-received state as it represents the worst-case condition.

G.5.1.2.4 –

Samples should be conditioned at 21°C ± 6°C (70°F ± 11°F) and 50 percent ± 30 percent relative humidity for at least 4 hours.

G.5.1.3 – Specimens.

G.5.1.3.1 –

A minimum of eight specimens should be tested.

G.5.1.3.2 –

Specimens should be provided to fit or be adjustable to fit the test subject in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.5.1.4 – Apparatus.

The testing apparatuses should be as specified in ASTM F1154, *Standard Practice for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components* .

G.5.1.5 – Procedure.

G.5.1.5.1 –

Dress subjects in the protective ensemble to be tested.

G.5.1.5.2 –

Follow procedures outlined in ASTM F1154, *Standard Practice for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components,* Option A and Option B.

G.5.1.6 – Report.

The report should include the time required to complete the tasks and the subjective rating on the difficulty of completing said task as defined in ASTM F1154, *Standard Practice for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components* .

G.5.2 – Range of Motion Test.

G.5.2.1 – Overview and Intended Use.

This test method provides a means to evaluate the restriction caused by a protective ensemble on the wearer.

G.5.2.2 – Samples.

G.5.2.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

G.5.2.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

G.5.2.2.3 –

The ensemble should be tested in its as-received state as it represents the worst-case condition.

G.5.2.2.4 –

Samples should be conditioned at 21°C ± 6°C (70°F ± 11°F) and 50 percent ± 30 percent relative humidity for at least 4 hours.

G.5.2.3 – Specimens.

G.5.2.3.1 –

A minimum of eight specimens should be tested.

~~**G.5.2.3.2** –~~

~~Specimens should be provided to fit or be adjustable to fit the human subjects in accordance with the manufacturer's sizing provisions that are specific to each ensemble.~~

~~**G.5.2.4** – Apparatus.~~

~~The apparatus should be as specified in ASTM F3031, *Standard Practice for Range of Motion Evaluation of First Responder's Protective Ensembles* .~~

~~**G.5.2.5** – Procedure.~~

~~**G.5.2.5.1** –~~

~~Dress subjects in the protective ensemble to be tested.~~

~~**G.5.2.5.2** –~~

~~Follow procedures outlined in ASTM F3031, *Standard Practice for Range of Motion Evaluation of First Responder's Protective Ensembles,* and record the maximum range of motion for each exercise.~~

~~**G.5.2.6** – Report.~~

~~The report should include the average range of motion and subjective ratings along with all other reporting requirements specified in ASTM F3031, *Standard Practice for Range of Motion Evaluation of First Responder's Protective Ensembles* .~~

Statement of Problem and Substantiation for Public Comment

Remove Annex G in its entirety. The inclusion of Annex G which covers nine nonmandatory tests that are recommended for use to properly evaluate the performance, integration, and interoperability of full ensembles or groupings of protective clothing and equipment is misleading. The annex information provides an appearance of acceptance that the tests in Annex G are sufficient to evaluate the complete ensemble with all the elements in this compiled NFPA 1970. Standards should address testing/methods that have been properly discussed, evaluated, tested for verification/validation at multiple labs using multiple devices to ensure a proper selection of the tests being referenced for repeatability. In addition, there are too many variables present with multiple elements being tested to determine which component or portion of the ensemble is causing the failure. Therefore, proper evaluation by one or more manufacturers, research institutions or end users is going to be difficult and in some cases the information may be too proprietary to be released without legal activities.

Finally, Annex G specifies tests which encompass items from NFPA 1971,1975, 1981 and potentially 1982. To my knowledge the annex information included has not been discussed, reviewed, and balloted by all of the relevant Technical Committees. There is no data being presented to provide evidence that the tests listed are sufficient for the evaluation other than a statement that some of the tests are already standardized test methods. These standardized test methods are in other standards and have been used for the evaluation of a specific element, component, assembly, etc. and was in some cases specifically designed for a specific test. Therefore, to introduce something that has not been properly vetted by the various Technical Committees within this project is not the correct way to generate a requirement(s) for a standard.

Related Public Comments for This Document

Related Comment	Relationship
Public Comment No. 178-NFPA 1970-2023 [Section No. 1.2.3]	

Public Comment No. 182-NFPA 1970-2023 [Section No. A.1.2.3]

Related Item

- First Revision No. 233-NFPA 1970-2022 [Global Input]

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Public Comment No. 169-NFPA 1970-2023 [Chapter G]

~~**Annex G** – Test Methods Evaluating Different Combinations of Elements~~

~~*This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.*~~

~~**G.1** – Preamble.~~

~~This annex provides several test methods that can be applied to evaluate the performance, integration, and interoperability of full ensembles or groupings of protective clothing and equipment that can be used for structural or proximity firefighting. These test methods are optional and nonmandatory but can be applied by research institutions, manufacturers, and end users for evaluating different combinations of elements. Specific test procedures are provided in several different areas of evaluation that include a general overview and intended use of the test procedures, equipment requirements, test procedures, reportable results, and recommended approach for interpreting test results. In some cases, references are made to already-existing standardized test methods.~~

~~**G.2** – Full Ensemble Thermal Testing.~~

~~**G.2.1** – Full Ensemble Flash Fire Test.~~

~~**G.2.1.1** – Overview and Intended Use.~~

~~This test method provides a means to evaluate the protective ensemble as a whole to a flame engulfment or flash over simulation. Second- and third-degree burn prediction are provided for an exposure with the exception of the hands and feet. In addition, valuable information on the afterflame and durability of the materials can be assessed after the exposure. Provided that the entire ensemble is tested, it will provide a single test that evaluates the thermal performance of each component of an ensemble.~~

~~**G.2.1.2** – Samples.~~

~~**G.2.1.2.1** –~~

~~Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how an ensemble performs as a whole.~~

~~**G.2.1.2.2** –~~

~~At a minimum, a t-shirt and briefs should be worn under the protective ensemble. A station uniform can also be tested under the protective garment but will not represent the worst-case scenario unless the station uniform is required to be worn at all times, day or night.~~

~~**G.2.1.2.3** –~~

~~The ensemble should be tested in as-received state.~~

~~**G.2.1.2.4** –~~

~~Samples should be conditioned at 21°C ± 2°C (70°F ± 4°F) and 65 percent ± 10 percent relative humidity for at least 4 hours.~~

G.2.1.3 – Specimens.

G.2.1.3.1 –

A minimum of three specimens should be tested.

G.2.1.3.2 –

Specimens should be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.2.1.3.2.1 –

If required to dress, ensemble elements can be cut open to dress on the manikin. The cut area should then be reattached after dressing.

G.2.1.4 – Apparatus.

The apparatus should be as specified in ASTM F1930, *Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin* .

G.2.1.5 – Procedure.

G.2.1.5.1 –

Dress the manikin in the protective ensemble to be tested.

G.2.1.5.2 –

Expose the manikin for 12 seconds and record data for a minimum of 120 seconds after the exposure is over.

G.2.1.5.3 –

After the exposure, do the following in addition to the requirements within ASTM F1930, *Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin* :

(1) Record any instances of breakopen in all layers of clothing

(2) Record any melting

(3) Check to make sure the SCBA can still be used and no leaks occur

(4) Verify that the mask can still be seen through

G.2.1.6 –

The report should include the burn injury prediction and all other requirements outlined in ASTM F1930, *Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin* . In addition, information detailed in G.2.1.5.3 should also be reported.

G.3 – Full Ensemble Physiological Testing.

G.3.1 – Predicted Ensemble Physiological Impact Test.

G.3.1.1 – Overview and Intended Use.

This test method provides a consistent means to evaluate protective ensembles for heat stress in firefighters. Predicted core body temperature, mean skin temperature, sweating totals, and cardiac outputs predictions are provided.

G.3.1.2 – Samples.

G.3.1.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. It is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

G.3.1.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

G.3.1.2.3 –

The ensemble should be washed and dried before being tested.

G.3.1.2.4 –

Samples should be conditioned in the testing environment for at least 4 hours.

G.3.1.3 – Specimens.

G.3.1.3.1 –

A minimum of three specimens should be tested.

G.3.1.3.2 –

Specimens should be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.3.1.3.2.1 –

If required to dress, ensemble elements can be cut open to dress on the manikin. The cut area should then be reattached after dressing.

G.3.1.4 – Apparatus.

G.3.1.4.1 –

The apparatus should be as specified in Section 5 of ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin* .

G.3.1.4.2 –

The manikin must also be coupled with a physiological model that reads inputs on the testing environment and the heat flow into the manikin system. With collected data and input data on work rates the software controls the manikin's skin temperature and sweat rate and provides physiological predictions every second.

G.3.1.5 – Procedure.

G.3.1.5.1 –

Dress the manikin in the protective ensemble to be tested outside the test chamber.

~~**G.3.1.5.2** –~~

~~Set the test chamber to the desired testing temperature.~~

~~**G.3.1.5.3** –~~

~~Once set point temperatures have been obtained, start the model and move the manikin into the test chamber.~~

~~**G.3.1.5.4** –~~

~~Run the system for a maximum of 2.5 hours. If the predicted core temperature reaches above 39.5°C (103°F), then testing can stop.~~

~~**G.3.1.6** – Report.~~

~~The report should include the plots for the predicted core body temperature, mean skin temperature, sweat total, and cardiac output.~~

~~**G.3.2** – Measured Ensemble Heat Loss Test.~~

~~**G.3.2.1** – Overview and Intended Use.~~

~~This test method provides a consistent means to evaluate protective ensembles for measured heat loss.~~

~~**G.3.2.2** – Samples.~~

~~**G.3.2.2.1** –~~

~~Samples should consist of at least the bunker pants and coat for evaluation. It is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.~~

~~**G.3.2.2.2** –~~

~~At a minimum, a t-shirt and briefs should be worn under the protective ensemble.~~

~~**G.3.2.2.3** –~~

~~The ensemble should be washed and dried before being tested.~~

~~**G.3.2.2.4** –~~

~~Samples should be conditioned in the testing environment for at least 4 hours.~~

~~**G.3.2.3** – Specimens.~~

~~**G.3.2.3.1** –~~

~~A minimum of three specimens should be tested.~~

~~**G.3.2.3.2** –~~

~~Specimens should be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.~~

~~**G.3.2.3.2.1** –~~

~~If required to dress, ensemble elements can be cut to dress on the manikin. The cut should then be reattached after dressing.~~

G.3.2.4 – Apparatus.

The apparatus should be as specified in Section 5 of ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin* .

G.3.2.5 – Procedure.

G.3.2.5.1 –

Dress manikin in the protective ensemble to be tested outside the test chamber.

G.3.2.5.2 –

Follow the procedures in ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin,* with the following exceptions:

(1) Chamber temperature should be set at 25°C (77°F), 65 percent RH

(2) Wind flow should be set at 2 m/s

(3) Once a steady state has been achieved, record the heat flux at each body section and calculate the overall heat flux with the parallel method

G.3.2.6 – Report.

The report should include the heat flux values for each body section of the manikin and the overall heat flux loss from the manikin.

G.3.3 – Measured Ensemble Evaporative Resistance Test.

G.3.3.1 – Overview and Intended Use.

This test method provides a consistent means to evaluate protective ensembles for measured evaporative resistance of a firefighter ensemble.

G.3.3.2 – Samples.

G.3.3.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. It is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

G.3.3.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

G.3.3.2.3 –

The ensemble should be washed and dried before being tested.

G.3.3.2.4 –

Samples should be conditioned in the testing environment for at least 4 hours.

G.3.3.3 – Specimens.

G.3.3.3.1 –

A minimum of three specimens should be tested.

G.3.3.3.2 –

Specimens should be provided to fit or be adjustable to fit the thermal manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.3.3.3.2.1 –

If required to dress, ensemble elements can be cut open to dress on the manikin. The cut area should then be reattached after dressing.

G.3.3.4 – Apparatus.

The apparatus should be as specified in ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin* :

G.3.3.5 – Procedure.

G.3.3.5.1 –

Dress the manikin in the protective ensemble to be tested outside the test chamber.

G.3.3.5.2 –

Follow the procedures in ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin,* except the wind flow should be set at 1 m/s.

G.3.3.6 – Report.

The report should include the evaporative resistance for each body section of the manikin and the overall evaporative resistance from the manikin.

G.4 – Full Ensemble Integrity Testing.

G.4.1 – Outward Particle Leakage Test.

G.4.1.1 – Overview and Intended Use.

This test method provides a means to evaluate a protective ensemble performance against particle infiltration by examining how well it prevents the escape of visible particles. This is a simple method that gives a visual assessment of performance by particles escaping the protective ensemble. This method is not standardized and is only designed to subjectively evaluate how well a suit will resist infiltration of particles by examining where particles can exit the ensemble and the quantity of particles that can exit the ensemble.

G.4.1.2 – Samples.

G.4.1.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the ensemble performs as a whole.

G.4.1.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

~~**G.4.1.3** – Specimens.~~

~~**G.4.1.3.1** –~~

~~A minimum of three specimens should be tested.~~

~~**G.4.1.3.2** –~~

~~Specimens should be provided to fit or be adjustable to fit the manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.~~

~~**G.4.1.3.2.1** –~~

~~If required to dress, ensemble elements can be cut open to dress on the manikin. The cut areas should then be reattached after dressing.~~

~~**G.4.1.4** – Apparatus.~~

~~**G.4.1.4.1** –~~

~~The apparatus should be a display manikin with movable joints for ease of dressing.~~

~~**G.4.1.4.2** –~~

~~A commercial-grade theatrical smoke machine should be used to generate the particles.~~

~~**G.4.1.4.2.1** –~~

~~The smoke generator should be attached to a holding box with a volume of at least 170 L (1 qt) to provide better control and delivery of the smoke into the manikin. This box will also have tubing exiting the box to provide particles to the manikin. A total of six exit ports should be delivered to the chest and arms, four to the legs, and one for the head.~~

~~**G.4.1.5** – Procedure.~~

~~**G.4.1.5.1** –~~

~~Attach the smoke delivery tubes to the manikin.~~

~~**G.4.1.5.1.1** –~~

~~The six tubes for the chest and arms should have the tubing placed on the following locations: upper chest, waist, lower back, between the shoulder blades, and one on each of the lower forearms.~~

~~**G.4.1.5.1.2** –~~

~~The four tubes for the leg should be placed on the manikin's groin, buttocks, and lower left and right shin.~~

~~**G.4.1.5.1.3** –~~

~~The tube for the head should be placed on the back of the head.~~

~~**G.4.1.5.2** –~~

~~Dress the manikin in the protective ensemble to be tested.~~

~~**G.4.1.5.3** –~~

~~Place the dressed manikin in front of a black background to provide better assessment of smoke exiting the system.~~

G.4.1.5.4 –

Turn on the smoke generator and allow particles to flow through the tubing. Once smoke is flowing, measure the time it takes for particles to be visually seen coming from the ensemble. Take notes on all the places smoke is exiting and subjectively rate the amount of visible smoke.

G.4.1.5.5 –

If comparing suits, pictures should be taken.

G.4.1.5.6 –

If smoke exiting the suit is too excessive, isolate smoke flow to one section of the body at a time and make notes on each section.

G.4.1.6 – Report.

The report should provide the time for leakage to occur, notes on where smoke was coming from, and a qualitative assessment of how much exited the suit.

G.4.2 – Inward Particle Leakage Test.

G.4.2.1 – Overview and Intended Use.

This test method provides a means to evaluate a protective ensemble performance against particle infiltration by measuring and comparing the amount of particles inside an ensemble versus outside the ensemble within a particulate-filled room. This method provides a means to give a quantitative measurement of particle infiltration through and around interfaces of a protective ensemble.

G.4.2.2 – Samples.

Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how a protective ensemble performs.

G.4.2.3 – Specimens.

G.4.2.3.1 –

A minimum of three specimens should be tested.

G.4.2.3.2 –

Specimens should be provided to fit or be adjustable to fit the manikin in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.4.2.3.2.1 –

If required to dress, ensemble elements can be cut to dress on the manikin. The cut should then be reattached and sealed after dressing.

G.4.2.4 – Apparatus.

G.4.2.4.1 – Manikin.

G.4.2.4.1.1 –

The apparatus should be as specified in Section 5 of ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin* .

~~**G.4.2.4.1.2** –~~

~~The apparatus must have joints within the shoulders and at the hips to allow for movement.~~

~~**G.4.2.4.1.3** –~~

~~The apparatus must also include a walking stand to allow the manikin to simulate a walk of 3.2 km/h (2 mph).~~

~~**G.4.2.4.2** – Chamber.~~

~~The chamber must be able to control for the following conditions:~~

(1) ~~25°C ± 1°C (77°F ± 1.8°F)~~

(2) ~~50 percent RH ± 5 percent RH~~

(3) ~~1 m/s wind flow perpendicular to the manikin~~

~~**G.4.2.4.3** – Particle Generator.~~

~~A particle generator capable of producing particles with a mean particle size of 0.5 µm with a concentration of at least 100,000 particles is needed.~~

~~**G.4.2.4.4** – Particle Counter.~~

~~**G.4.2.4.4.1** –~~

~~Each counter should be able to measure particles in a range of 0.3 µm to 0.5, and 0.5 µm to 1.0 µm.~~

~~**G.4.2.4.4.2** –~~

~~Each particle counter should sample 1 L (1 qt) of air in 30 seconds.~~

~~**G.4.2.5** – Procedure.~~

~~**G.4.2.5.1** –~~

~~Place the sampling tubes on the surface of the manikin such that clothing will not block the sampling of air.~~

~~**G.4.2.5.1.1** –~~

~~A sampling tube should be placed at least on the upper center chest, forearm, above the pant line, and at mid-calf.~~

~~**G.4.2.5.1.2** –~~

~~All sample ports should exit the protective ensemble or manikin with minimum interference with the ensemble or closure. If holes are cut in the ensemble, they should be sealed to minimize infiltration of particles.~~

~~**G.4.2.5.1.3** –~~

~~If hoods, gloves, or footwear are being testing, additional sampling ports can be placed on those locations.~~

~~**G.4.2.5.2** –~~

~~Dress the manikin in the protective ensemble being evaluated outside the particle chamber.~~

G.4.2.5.3 –

Set the chamber to be at conditions as specified in G.4.2.4.2.1 and turn on the particle generator such that there is greater than 100,000 particles in the 0.3 µm to 0.5 µm range.

G.4.2.5.4 –

Once particle readings are stable, move the dressed manikin into chamber.

G.4.2.5.4.1 –

Start the manikin walking at a rate equivalent to 3.2 km/h (2 mph) for 20 minutes.

G.4.2.5.5 –

At the end of the 20 minutes with the manikin still walking, measure each sampling port under the protective ensemble at least once for a particle count in the two ranges defined in G.4.2.4.4.1 .

G.4.2.5.5.1 –

Also measure the concentration of particles outside the ensemble while measuring the concentration inside the suit.

G.4.2.6 – Calculation.

Calculate the particulate protection factor for each measured sampling port for each particulate size range using the following equation:

$$PF = Ct_{\text{outside}} / Ct_{\text{inside}} \qquad \text{[G.4.2.6]}$$

where:

PF = Protection factor

Ct_{outside} = Concentration of particles outside the suit

Ct_{inside} = Concentration of particles inside the suit

G.4.2.7 – Report.

The report should provide the *PF* for every area of the body measured and include the *PF* for each particle size range.

G.4.3 – Inward Vapor Leakage Test—Man-in-Simulant Test (MIST).

G.4.3.1 – Overview and Intended Use.

This test method provides a means to evaluate a protective ensemble performance against vapor infiltration by measuring and comparing the amount of vapor inside an ensemble versus outside the ensemble within a vapor-filled room. This method provides a means to give a quantitative measurement of vapor infiltration through and around interfaces of a protective ensemble.

G.4.3.2 – Samples.

G.4.3.2.1 –

Samples for conditioning should be complete ensembles and should include the respirator.

G.4.3.2.2 –

Samples should be conditioned in a 21°C (70°F) and 65 percent RG.

G.4.3.3 – Specimens.

G.4.3.3.1 –

The specimen should be a complete ensemble with gloves and footwear and should include a respirator.

G.4.3.3.2 –

A minimum of four specimens should be tested. The specimens should represent a minimum of two different ensemble sizes.

G.4.3.3.3 –

Specimens should be provided to fit or be adjustable to fit the selected test subjects in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.4.3.3.4 –

None of the ensembles or components of the ensemble to be tested should have been previously subjected to MIST testing unless it can be demonstrated that the ensemble or components are free of contamination.

G.4.3.3.5 –

Underclothing and socks should be permitted to be reused, provided they have been laundered with a detergent that has been demonstrated not to cause interference with the analytical method.

G.4.3.4 – Apparatus.

G.4.3.4.1 – Test Facility.

G.4.3.4.1.1 –

The test facility should include areas for dressing—a first-stage undressing area adjacent and accessible to the chamber, and a second-stage undressing area adjacent and accessible to the first-stage undressing area.

G.4.3.4.1.2 –

The test should be conducted in a test chamber with a minimum volume of sufficient dimensions to permit free movement of the test subject(s) when fully dressed in the ensemble and for the test subject(s) to carry out the physical exercise routine specified in G.4.3.5.8.1 .

G.4.3.4.1.3 –

More than one test subject should be permitted in the chamber at the same time, provided they can complete all tasks completely in the appropriate time period and that they have an unobstructed direct path to the wind stream.

G.4.3.4.1.4 –

The test chamber should have a temperature of 25°C, ± 2°C (77°F ± 3.6°F), relative humidity of 55 percent, ± 10 percent, and a nominal wind speed of 0.9 to 2.2 m/sec (2 to 5 mph). The average wind speed should be 1.6 m/sec, ± 0.2 m/sec (3.5 mph, ± 0.5 mph).

G.4.3.4.2 – Test Chemical and Analytical Equipment.

G.4.3.4.2.1 –

The test simulant should be methyl salicylate (MeS; C8H8O3) CAS #119-36-8, more commonly known as oil of wintergreen. The MeS minimum purity should be 95 percent. Vapor doses should be measured using passive adsorbent dosimeters (PADs).

G.4.3.4.2.2 –

The standard concentration of MeS in the vapor chamber should be 150 mg/m ^{3} , ± 10 mg/m ^{3} (0.15 ppm, ± .01 ppm), as measured by a real-time infrared analysis of the chamber air or other validated real-time analytical technique.

G.4.3.4.2.3 –

Readings should be taken every 60 seconds to verify compliance with the concentration requirement, and an air sample should be taken at least every 10 minutes for validation of readings.

G.4.3.4.2.4 –

Every step should be taken to avoid generation of liquid aerosol.

G.4.3.4.2.5 –

The sensitivity of the analytical technique used for the measurement of MeS in the PADs should provide a detection limit of 30 ng MeS per PAD. The analytical technique should have an upper limit of quantification of 50,000 ng.

G.4.3.4.3 – Passive Adsorbent Dosimeters (PADs).

The test should be conducted using PADs that affix directly to the skin of test subjects and that have the following characteristics:

(1) The PADs should be a foil packet, which contains an adsorbent material covered by a high-density polyethylene film that acts as a pseudo-skin barrier.

(2) The high-sensitivity polyethylene film should have an uptake rate of approximately 2.0 cm/min (0.8 in./min).

G.4.3.4.4 – Test Subjects.

G.4.3.4.4.1 –

All test subjects should be medically and physically suitable to perform these tests without danger to themselves. A medical certificate for each test subject should have been issued within 12 months prior to testing.

G.4.3.4.4.2 –

Test subjects should be familiar with the use of protective ensembles and with the selected CBRN SCBA.

G.4.3.5 – Procedure.

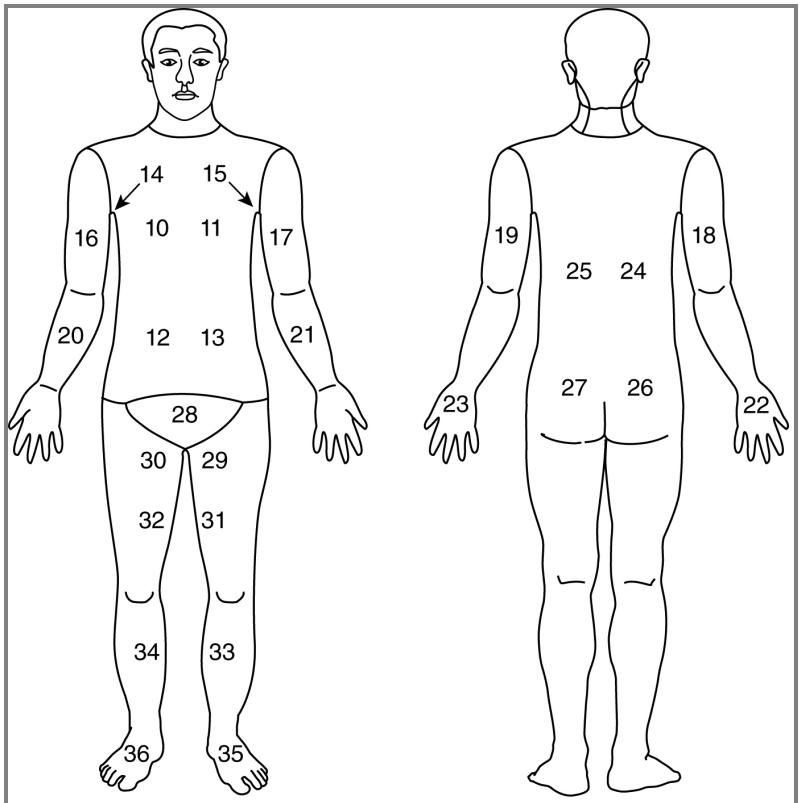
G.4.3.5.1 –

Test subjects should have followed pretrial procedures that include proper hydration and avoiding personal hygiene products that could contain MeS.

G.4.3.5.2 –

~~PADs should be placed on test subjects at the body region locations shown in Figure G.4.3.5.2 .~~

~~Figure G.4.3.5.2 Locations of PADs on Test Subjects.~~



1: Scalp (SCA)
2: Forehead (F)
3: Cheek (LC)
4: Cheek (RC)
5: Behind left ear (LE)
6: Behind right ear (RE)
7: Neck left (LN)
19: Left outer upper arm (LOU)
20: Right forearm (RFA)
21: Left forearm (LFA)
22: Right hand (RH)
23: Left hand (LH)
24: Right middle back (RMB)
25: Left middle back (LMB)

G.4.3.5.2.1 –

All PADs should be applied in a clean dressing area by personnel who have followed pretrial procedures to minimize contamination. Test subjects should also follow pretrial procedures to minimize contamination.

G.4.3.5.2.2 –

Cheek PADs should be located entirely within the respirator facepiece, and all other PADs should be located entirely outside the seal of the respirator facepiece.

G.4.3.5.3 –

Three additional PADs should be used to conduct background sampling and for quality control during the trial. These PADs should be located in the dressing area, the stage 1 undress area, and the stage 2 undress area.

G.4.3.5.4 –

The test subject should don the protective ensemble and respirator in accordance with the manufacturer's instructions in an area located away from the test chamber. The test subject should wear clothing under the protective ensemble as specified by the manufacturer. If no undergarments are specified or required by the manufacturer as part of the ensemble, the test subject should wear a short-sleeve cotton shirt and shorts or underwear.

G.4.3.5.5 –

After sealing the ensemble, the test subject should enter the test chamber, and the test chamber should be sealed.

G.4.3.5.6 –

The test duration will be 30 minutes in the chamber with a 5-minute decontamination period.

G.4.3.5.7 –

The start of the test, in which the test subject enters the MIST chamber, should be initiated within 60 minutes after removal of the ensemble from the conditioning environment.

G.4.3.5.8 – Physical Exercise Routine.

G.4.3.5.8.1 –

Once the chamber concentration has been established, the test subject(s) should perform the following physical activity protocol and the chamber concentration should remain within acceptable limits during the exercise protocol:

(1) Drag 70 kg (154 lb) human dummy using both hands a distance of 10 m (33 ft) over a 15-second period. Stop and rest for 15 seconds. Repeat exercise twice.

(2) Duck squat, pivot right, pivot left, stand. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(3) Stand erect. With arms at sides, bend body to left and return, bend body forward and return, bend body to right and return. Rotate orientation 90 degrees to wind stream. between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(4) Stand erect. Extend arms overhead in the lateral direction, then bend elbows. Extend arms overhead in the frontal direction, then bend elbows. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(5) Stand erect. Extend arms perpendicular to the sides of torso. Twist torso left and return, twist torso right and return. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(6) Stand erect. Reach arms across chest completely to opposite sides. Rotate orientation 90 degrees to wind stream between each repetition. Repeat exercise twice in each orientation for a total of 1 minute.

(7) Climb two steps of the ladder and touch the ceiling with one hand (use alternate hands each time). Climb down, squat, and touch the floor with both hands. Repeat exercise three times within 1 minute.

(8) Crawl in place for 1 minute. Rotate orientation 90 degrees to wind stream every 15 seconds.

(9) Sit on stool (facing wind) and slowly turn head from side to side between extreme positions on each side. Pause momentarily at each extreme position and inhale. Repeat the exercise for 1 minute.

(10) Sit on stool (back to wind) and slowly move head up and down. Pause momentarily at each extreme position and inhale. Repeat the exercise for 1 minute.

G.4.3.5.8.2 –

Physical activities and rest periods should be performed in a chamber location that provides an unobstructed exposure of the protective ensemble to the required wind stream.

G.4.3.5.8.3 –

Each physical activity and rest cycle should be 10 minutes. The cycle of exercise and rest should be completed a total of three times, for a total chamber exposure of 30 minutes. Each exercise cycle should consist of eight 1-minute activities followed by a 2-minute rest (sitting) period.

G.4.3.5.8.4 –

The test subject should begin the first repetition of each activity facing the wind stream and should rotate 90 degrees between each repetition until the time period for that exercise has ended.

~~**G.4.3.5.8.5** –~~

~~All physical activities should be a full range of motion and performed at a moderate speed.~~

~~**G.4.3.5.9** – Decontamination and Doffing.~~

~~**G.4.3.5.9.1** –~~

~~After completion of the 30-minute MIST exposure, the test subjects should move to a decontamination area, where they should remain for at least 5 minutes. This area should be well ventilated to assist in off gassing of the outside of the ensemble.~~

~~**G.4.3.5.9.2** –~~

~~In the decontamination area, all exposed ensemble surfaces, including such items as the respirator, boots, gloves, and helmets, should be washed with a liquid soap solution.~~

~~**G.4.3.5.9.2.1** –~~

~~If the garment is designed for wet decontamination, it should be washed with the liquid soap solution as well.~~

~~**G.4.3.5.9.2.2** –~~

~~Alternative decontamination methods, such as an air wash, should be permitted if the selected decontamination method can be demonstrated to remove MeS to levels that do not result in contamination of the test subjects during the doffing of the protective ensemble.~~

~~**G.4.3.5.9.3** –~~

~~The decontaminated test subject should move to the first stage undressing room where all remaining items of clothing, except for underclothes, should be doffed. The undress process should not exceed 5 minutes.~~

~~**G.4.3.5.9.4** –~~

~~As soon as the garment is unsealed and the PADs on the test subject's body are exposed to the ambient atmosphere in the first-stage undressing room, three fresh PADs should be placed near the test subject to detect background MeS concentrations.~~

~~**G.4.3.5.9.5** –~~

~~As soon as all items of clothing, except the underwear, are removed, the decontaminated test subject should proceed to the second-stage undressing room and the background PADs should be collected and handled as specified in 8.2.2.5.9.7. The exposure time for the first-stage undressing room background PADs should be recorded.~~

~~**G.4.3.5.9.6** –~~

~~When the test subject enters the second-stage undressing room, three additional PADs should be placed near the test subject and the exposure PADs should be removed from the test subject's body. Both the second-stage undressing room background PADs and the exposure PADs taken off the test subject's body should be handled as specified in 8.2.2.5.9 of NFPA 1990.~~

~~**G.4.3.5.9.7** –~~

~~The exposure time for the second-stage undressing room PADs should be recorded.~~

G.4.3.5.9.8 –

Where an adhesive is used on the back of the PADs, each PAD should be backed with aluminum foil, placed in individual sealed glass vials with a nonadsorbent lid liner, and should remain at room temperature of 25°C, ± 3°C (77°F, ± 5°F) for 30 minutes, ± 5 minutes, immediately after exposure.

G.4.3.6 – PAD Qualification and Analysis.

G.4.3.6.1 –

The uptake rate for each lot of PADs should be determined in accordance with 8.2.2.6.2 using a minimum of seven PADs selected randomly from the lot.

G.4.3.6.2 – Measurement of PAD Uptake Rate.

G.4.3.6.2.1 –

PAD uptake rate should be measured by exposing PADs in a small-scale chamber under the following conditions:

(1) The concentration of MeS should be 1 mg/m^3 , ± 0.5 mg/m^3 (.001 ppm).

(2) The temperature should be 35°C, ± 2°C (94°F, ± 4°F).

(3) The relative humidity should be 55 percent, ± 20 percent.

(4) The flow of MeS in the humidified air or nitrogen should be at a rate of 1 cm/sec, ± 0.2 cm/sec over the PAD.

(5) The exposure should be conducted for a period of 30 minutes, +1/–0 minutes.

G.4.3.6.2.2 –

The PAD uptake rate should be calculated in accordance with the procedures provided in 8.2.2.6.4. The average of all PAD uptake rates should be calculated and used in the calculation of MeS dosage on the test subject PADs.

G.4.3.6.3 –

After their initial 30 minutes at room temperature, the PADs should be subjected to one of the following handling and analysis procedures:

(1) The PADs should be stored at a cold temperature sufficient to prevent the migration of MeS from the adhesive until extraction or analysis.

(2) The PADS should be extracted within 4 hours.

(3) The adsorbent should be removed and thermally desorbed within 4 hours.

G.4.3.6.3.1 –

The determination of a sufficiently low temperature that prevents migration of the MeS from the adhesive should be made by exposing 12 PADs simultaneously in the test chamber in a vertical position at a concentration of 100 mg/m ^{3} (0.1 ppm) of MeS for 30 minutes, +5/–0 minutes. After this exposure, the PADs should be covered in foil and each placed in a sealed container and stored at 25°C, ± 3°C (77°F, ± 5°F) for 30 minutes, ± 5 minutes. Four of these PADs should be packed in dry ice for 24 hours, four placed in the proposed cold storage temperature for 24 hours, and four extracted or analyzed within 4 hours. The average mass absorbed on the four PADs stored at the proposed storage temperature should equal with 95 percent confidence the average mass absorbed on four PADs stored for 24 hours in dry ice and the four PADs analyzed immediately after exposure.

G.4.3.6.3.2 –

Where liquid extraction of the PADs samples is performed, the liquid extracts should be stored at 0°C to 4°C (32°F to 39°F) for up to 14 days following their exposure before analysis.

G.4.3.6.4 –

The actual MeS vapor exposure concentration and the actual time of exposure should be used to determine the uptake rate from the following equation:

$$U = m / Act \qquad \textbf{[G.4.3.6.4]}$$

where:

U = the uptake rate in cm/min

m = the total mass of MeS measured on the PAD in mg

A = the average active area of the PAD in cm ^{2}

ct = the exposure vapor dosage in mg/min/cm ^{3}

G.4.3.6.5 –

The range of the analytical technique should be sufficient to measure the expected range of MeS dosage on the test subject PADs.

G.4.3.6.5.1 –

When liquid extraction is used as the analytical technique, the calibration curve used for determining the equipment response to MeS should be established using at least 4 MeS concentration standards accounting for the proper density of the extraction solvent.

G.4.3.6.6 –

For the test results to be considered valid for a given ensemble, no more than one PAD from each of the body region locations tested (i.e., no more than one PAD out of all replicates for any particular region) should be permitted to be lost to analysis.

G.4.3.7 – Calculations.

G.4.3.7.1 –

The dosage measured by each PAD ($Ct_{inside,i}$) should be determined using the average uptake rate determined for the PAD lot used in the evaluation of a specific ensemble using the following equation:

$$Ct_{inside\ i} = m_i / u_{avg} A \qquad \text{[G.4.3.7.1]}$$

where:

$Ct_{inside,i}$ = the MeS vapor dosage at the specific PAD in mg/min/cm ^{3}

mi = the total mass of MeS measured on the specific PAD in mg

u_{avg} = the average uptake of the PAD lot in cm/min

A = the average active area of the PA in cm ^{2}

G.4.3.7.1.1 –

The protection factor at each PAD location should be calculated using the following equation:

$$PF_i = Ct_{outside} / Ct_{inside,i} \qquad \text{[G.4.3.7.1.1]}$$

where:

$Ct_{outside}$ = average of chamber MeS concentration readings taken during the test subject exposure period, determined from the measured chamber vapor dosage of the individual trial over the entire exposure

The $Ct_{outside}$ should be determined from the measured chamber vapor dosage of the individual trial over the entire exposure. The value for $Ct_{outside}$ should be the average of the chamber MeS concentration readings taken during the course of the test subject exposure period.

G.4.3.7.1.2 –

Where the measured total mass of MeS for a given PAD falls below 30 ng, the value of 30 ng should be used for that specific PAD.

G.4.3.7.2 –

All results for each PAD location should be expressed in terms of the local physiological protective dosage factor (PPDF) value and should be calculated according to the following equation:

$$Local\ PPDF_i = \left(OSED_i / 25\right) * PF \qquad \text{[G.4.3.7.2]}$$

where:

$OSED_i$ = onset of symptoms exposure dosages

PF = protection factor

G.4.3.7.2.1 –

The site-specific onset of symptoms exposure dosages (OSED) for each PAD should be based on ECt10 values for mustard blistering/ulceration according to Table G.4.3.7.2.1 .

Table G.4.3.7.2.1 Site-Specific OSED by PAD Location

Body Region PAD Location OSED (mg•min•m ^{3}) Head/neck 1, 2, 3, 4, 5, 6, 7, 8, 9 100 Torso/buttocks (excluding perineum) 10, 11, 12, 13, 24, 25, 26, 27, 28 100 Arm/hand 14, 15, 16, 17, 18, 19, 20, 21, 22, 23 50 Leg/foot 31, 32, 33, 34, 35, 36 100 Perineum 29, 30 25

G.4.3.7.2.2 –

The average local PPDF values at each PAD location for all specimens tested should be calculated.

G.4.3.7.3 –

A systemic PPDF should also be calculated from the PAD data. The systemic protection analysis should use the systemic weighting body region hazard analysis values from the Defense Research Establishment Suffield Report and National Research Council Report to calculate the systemic physiological protective dosage factor for each ensemble test (PPDFsys). The PPDFsys for each specimen is calculated as follows, where each of the terms is calculated using the information in Table G.4.3.7.3 .

$$PPDF_{sys} = \sum_{1}\left(dz_i / ED_{50i}\right) / \sum_{i}\left(dz_i / ED_{50i} * PF_i\right) \qquad \textbf{[G.4.3.7.3]}$$

Table G.4.3.7.3 ED $_{50\,i}$ Values by PAD and Body Location

Body Region *i* for BRHA Model PADs Mapped to This Region (Average Dosage from Each PAD, Then Calculate PF $_{i}$) Area of Body Region (dz_{i} , cm ^{2}) ED $_{50\,i}$ for Severe Effects (VX) for Body Region (mg/Individual) Scalp 1, 2 350 0.76 Ears 5, 6 50 0.46 Face, cheeks, and neck 3, 4, 7, 8 300 0.48 Chin and neck 7, 8 200 0.36 Nape 9 100 1.72 Chest/Abdomen 10, 11, 12, 13 2858 2.23 Back 24, 25, 26, 27 2540 2.65 Axillae 14, 15 200 2.07 Upper arm medial 16, 17 488 2.8 Upper arm lateral 18, 19 706 6.57 Elbow fold 16, 17, 18, 19, 20, 21 50 2.09 Elbow 16, 17, 18, 19, 20, 21 50 2.25 Forearm extensor 20, 21 487 2.8 Forearm flexor 20, 21 706 6.57 Hands dorsum 22, 23 200 2.91 Hands palmar 22, 23 200 9.24 Buttocks 26, 27 953 4.26 Groin 28 300 1.22 Scrotum 29, 30 200 0.11 Thigh anterior 31, 32 2845 6.57 Thigh posterior 31, 32 1422 4.26 Knee 31, 32, 33, 34 200 7.14 Popliteal space - - - (back of knees) 31, 32, 33, 34 100 2.09 Shins 33, 34 1897 6.57 Calves 33, 34 948 2.8 Feet dorsum 35, 36 500 6.6 Feet plantar 35, 36 300 7.14

G.4.3.7.3.1 –

The average PPDFsys for all specimens tested should be calculated.

G.4.3.7.3.2 –

The protection factor PFi used in the calculation of PPDFsys should be the average PF of all PADs in a specific body region.

G.4.3.8 – Report.

G.4.3.8.1 –

The individual specimen and average local PPDFi values for each PAD location should be recorded and reported.

G.4.3.8.2 –

The PPDFsys value for each specimen and the average PPDFsys value for the ensemble tested should be recorded and reported.

G.4.3.8.3 –

A spreadsheet should be prepared that shows all test measurements and calculations, including at least the following:

(1) The MeS vapor exposure concentration for PAD lot qualification

(2) The exposure time used for PAD lot qualification

(3) The measured MeS mass on each PAD used for PAD lot qualification

(4) Each individual and the average PAD uptake rate

(5) The measured MeS mass on each PAD used in the dressing room, first-stage undressing room, and second-stage undressing room

(6) The measured MeS mass on each PAD placed on the test subject

(7) The calculated vapor dosage for each PAD placed on the test subject

G.5 – Full Ensemble Functionality Testing.

G.5.1 – Fit/Function Test.

G.5.1.1 – Overview and Intended Use.

This test method provides a means to evaluate the protective ensemble as a whole to a task-oriented routine to judge the comfort, fit, and function. Times required to complete tasks and ratings based on each task are collected and reported.

G.5.1.2 – Samples.

G.5.1.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

G.5.1.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

G.5.1.2.3 –

The ensemble should be tested in its as-received state as it represents the worst-case condition.

G.5.1.2.4 –

Samples should be conditioned at 21°C ± 6°C (70°F ± 11°F) and 50 percent ± 30 percent relative humidity for at least 4 hours.

G.5.1.3 – Specimens.

G.5.1.3.1 –

A minimum of eight specimens should be tested.

G.5.1.3.2 –

Specimens should be provided to fit or be adjustable to fit the test subject in accordance with the manufacturer's sizing provisions that are specific to each ensemble.

G.5.1.4 – Apparatus.

The testing apparatuses should be as specified in ASTM F1154, *Standard Practice for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components* .

G.5.1.5 – Procedure.

G.5.1.5.1 –

Dress subjects in the protective ensemble to be tested.

G.5.1.5.2 –

Follow procedures outlined in ASTM F1154, *Standard Practice for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components,* Option A and Option B.

G.5.1.6 – Report.

The report should include the time required to complete the tasks and the subjective rating on the difficulty of completing said task as defined in ASTM F1154, *Standard Practice for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components* .

G.5.2 – Range of Motion Test.

G.5.2.1 – Overview and Intended Use.

This test method provides a means to evaluate the restriction caused by a protective ensemble on the wearer.

G.5.2.2 – Samples.

G.5.2.2.1 –

Samples should consist of at least the bunker pants and coat for evaluation. However, it is recommended that the station uniform, helmet, hood, gloves, footwear, and the SCBA harness and facemask are also tested to evaluate how the entire system performs as a whole.

G.5.2.2.2 –

At a minimum, a t-shirt and briefs should be worn under the protective ensemble.

G.5.2.2.3 –

The ensemble should be tested in its as-received state as it represents the worst-case condition.

G.5.2.2.4 –

Samples should be conditioned at 21°C ± 6°C (70°F ± 11°F) and 50 percent ± 30 percent relative humidity for at least 4 hours.

G.5.2.3 – Specimens.

G.5.2.3.1 –

A minimum of eight specimens should be tested.

~~**G.5.2.3.2** –~~

~~Specimens should be provided to fit or be adjustable to fit the human subjects in accordance with the manufacturer's sizing provisions that are specific to each ensemble.~~

~~**G.5.2.4** – Apparatus.~~

~~The apparatus should be as specified in ASTM F3031, *Standard Practice for Range of Motion Evaluation of First Responder's Protective Ensembles* .~~

~~**G.5.2.5** – Procedure.~~

~~**G.5.2.5.1** –~~

~~Dress subjects in the protective ensemble to be tested.~~

~~**G.5.2.5.2** –~~

~~Follow procedures outlined in ASTM F3031, *Standard Practice for Range of Motion Evaluation of First Responder's Protective Ensembles,* and record the maximum range of motion for each exercise.~~

~~**G.5.2.6** – Report.~~

~~The report should include the average range of motion and subjective ratings along with all other reporting requirements specified in ASTM F3031, *Standard Practice for Range of Motion Evaluation of First Responder's Protective Ensembles* .~~

Statement of Problem and Substantiation for Public Comment

The inclusion of Annex G which covers nine nonmandatory tests that are recommended for use to properly evaluate the performance, integration, and interoperability of full ensembles or groupings of protective clothing and equipment is misleading.
The annex information provides an appearance of acceptance that the tests in Annex G are sufficient to evaluate the complete ensemble with all the elements in this compiled NFPA 1970. Standards should address testing/methods that have been properly discussed, evaluated, tested for verification/validation at multiple labs using multiple devices to ensure a proper selection of the tests being referenced for repeatability.
In addition, there are too many variables present with multiple elements being tested to determine which component or portion of the ensemble is causing the failure. Therefore, proper evaluation by one or more manufacturers, research institutions or end users is going to be difficult and in some cases the information may be too proprietary to be released without legal activities.

Finally, Annex G specifies tests which encompass items from NFPA 1971,1975, 1981 and potentially 1982. To my knowledge the annex information included has not been discussed, reviewed, and balloted by all of the relevant Technical Committees. No data is being presented to provide evidence that the tests listed are sufficient for the evaluation other than a statement that some of the tests are already standardized test methods. These standardized test methods are in other standards and have been used for the evaluation of a specific element, component, assembly, etc. and was in some cases specifically designed for a specific test. Therefore, to introduce something that has not been properly vetted by the various Technical Committees within this project is not the correct way to generate a requirement(s) for a standard.

Related Public Comments for This Document

Related Comment	Relationship

Public Comment No. 171-NFPA 1970-2023 [Section No. 1.2.3]

Public Comment No. 172-NFPA 1970-2023 [Section No. A.1.2.3]

Related Item

• Annex G

Submitter Information Verification

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Submittal Date: Wed Jan 04 10:58:04 EST 2023
Committee: FAE-SPF

Public Comment No. 216-NFPA 1970-2023 [Chapter H]

Update standard editions and titles as necessary.

Annex H Informational References

H.1 Referenced Publications.

The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

H.1.1 NFPA Publications.

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

NFPA 1500™, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*, 2021 edition.

NFPA 1561, *Standard on Emergency Services Incident Management System and Command Safety*, 2020 edition.

NFPA 1581, *Standard on Fire Department Infection Control Program*, 2022 edition.

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

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

NFPA 1951, *Standard on Protective Ensembles for Technical Rescue Incidents*, 2020 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2007 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2013 edition.

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2020 edition.

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

NFPA 1975, *Standard on Emergency Services Work Apparel,* 2019 edition.

NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Fire Fighting and Urban Interface Fire Fighting*, 2022 edition.

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2019 edition.

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

NFPA 1990, *Standard for Protective Ensembles for Hazardous Materials and CBRN Operations*, 2022 edition.

NFPA 1991, *Standard on Vapor-Protective Ensembles for Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2016 edition.

NFPA 1992, *Standard on Liquid Splash–Protective Ensembles and Clothing for Hazardous Materials Emergencies*, 2018 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents,* 2012 edition.

NFPA 1994, *Standard on Protective Ensembles for First Responders to Hazardous Materials Emergencies and CBRN Terrorism Incidents*, 2018 edition.

NFPA 1999, *Standard on Protective Clothing and Ensembles for Emergency Medical Operations*, 2018 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2021 edition.

H.1.2 Other Publications.

H.1.2.1 AATCC Publications.

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

AATCC TM42, *Test Method for Water Resistance: Impact Penetration Test*, 2013.

AATCC TM135, *Test Method for Dimensional Changes of Fabrics after Home Laundering*, 2018.

AATCC TM158, *Test Method for Dimensional Changes on Dry-Cleaning in Perchloroethylene: Machine Method*, 2016e.

H.1.2.2 ANSI Publications.

American National Standards Institute, Inc., 25 West 43rd Street, 4th floor, New York, NY 10036.

ANSI Z88.2, *Practices for Respiratory Protection*, 2015.

ANSI Z88.6, *Respiratory Protection — Respirator Use — Physical Qualifications for Personnel*, 2006.

ANSI Z88.10, *Respirator Fit Test Methods*, 2010.

H.1.2.3 ASTM Publications.

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

ASTM B16/B16M, *Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines*, 2019.

ASTM B117, *Test Method for Water Resistance: Impact Penetration Test*, 2019.

ASTM D751, *Standard Test Methods for Coated Fabrics*, 2019.

ASTM D1003, *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*, 2021.

ASTM D1683/D1683M, *Standard Test Method for Failure in Sewn Seams of Woven Fabrics*, 2017 (2018).

ASTM D1776/D1776M, *Standard Practice for Conditioning and Testing Textiles*, 2020.

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

ASTM D5034, *Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)*, 2021.

ASTM D5169, *Standard Test Method for Shear Strength (Dynamic Method) of Hook and Loop Touch Fasteners*, 1998 (2021).

ASTM D5170, *Standard Test Method for Peel Strength ("T" Method) of Hook and Loop Touch Fasteners*, 1998 (2021).

ASTM D5587, *Standard Test Method for the Tearing Strength of Fabrics by Trapezoid Procedure*, 2015 (2019).

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

ASTM D6775, *Standard Test Method for Breaking Strength and Elongation of Textile Webbing, Tape and Braided Material*, 2013 (2017).

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

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

ASTM E809, *Standard Practice for Measuring Photometric Characteristics of Retroreflectors*, 2021.

ASTM E991, *Standard Practice for Color Measurement of Fluorescent Specimens Using the One-Monochromator Method*, 2021.

ASTM F903, *Standard Test Method for Resistance of Materials Used in Protective Clothing to Penetration by Liquids*, 2018.

ASTM F1060, *Standard Test Method for Conductive and Compressive Heat Resistance*, 2018.

ASTM F1154, *Standard Practices for Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles, Ensemble Elements, and Other Components*, 2018.

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

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

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

ASTM F1731, *Standard Practice for Body Measurements and Sizing of Fire and Rescue Services Uniforms and Other Thermal Hazard Protective Clothing*, 2021.

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

ASTM F1868, *Standard Test Method for Thermal and Evaporative Resistance of Clothing Materials Using a Sweating Hot Plate*, 2017.

ASTM F1930, *Standard Test Method for Evaluation of Flame-Resistant Clothing for Protection Against Fire Simulations Using an Instrumented Manikin*, 2018.

ASTM F2010/F2010M, *Standard Test Method for Evaluation of Glove Effects on Wearer Finger Dexterity Using a Modified Pegboard Test*, 2018.

ASTM F2299/F2299M, *Standard Test Method for Determining the Initial Efficiency of Materials Used in Medical Face Masks to Penetration by Particulates Using Latex Spheres,* 2003 (2017).

ASTM F2370, *Standard Test Method for Measuring the Evaporative Resistance of Clothing Using a Sweating Manikin*, 2016.

ASTM F2412, *Standard Test Methods for Foot Protection*, 2018a.

ASTM F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy of Firefighter Protective Clothing Systems*, 2018.

ASTM F2894, *Standard Test Method for Evaluation of Materials, Protective Clothing and Equipment for Heat Resistance Using a Hot Air Circulating Oven,* 2021.

ASTM F2913, *Standard Test Method for Measuring the Coefficient of Friction for Evaluation of Slip Performance of Footwear and Test Surfaces/Flooring Using a Whole Shoe Tester,* 2019.

ASTM F3031, *Standard Practice for Range of Motion Evaluation of First Responder's Protective Ensembles*, 2017 (2022).

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

Stull, J. O. and R. M. Duffy, "Field Evaluation of Protective Clothing Effects on Fire Fighter Physiology: Predictive Capability of the Total Heat Loss Test." In *Performance of Protective Clothing: Issues and Priorities for the 21st Century* [ASTM STP 1386], ed. C. N. Nelson and N. W. Henry, 481–503, West Conshohocken, PA.

H.1.2.4 FHWA Publications.

Federal Highway Administration, 1200 New Jersey Avenue, SE, Washington, DC 20590.

Manual on Uniform Traffic Control Devices (MUTCD), 2009. http://mutcd.fhwa.dot.gov

H.1.2.5 FIA Publications.

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

FIA 1209, *Whole Shoe Flex*, 1984.

H.1.2.6 ISEA Publications.

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

ANSI/ISEA 107, *American National Standard for High-Visibility Safety Apparel*, 2020.

ANSI/ISEA 207, *American National Standard for High-Visibility Public Safety Vests*, 2011.

H.1.2.7 ISO Publications.

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

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

ISO/IEC Guide 65, *General requirements for bodies operating product certification systems*, 1996 (withdrawn).

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

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

ISO 13287, *Personal protective equipment — Footwear — Test method for slip resistance*, 2012.

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

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.

H.1.2.8 JEDEC Publications.

JEDEC, 3103 North 10th Street, Suite 240-S, Arlington, VA 22201-2107.

Publication JEP131B, *Potential Failure Mode and Effects Analysis (FMEA)*, 2012.

H.1.2.9 NIOSH Publications.

National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1600 Clifton Road, Atlanta, GA 30329-4027.

NIOSH 77-134-A, *The Development of Criteria for Firefighters' Gloves*, vol. 1, 1976.

NIOSH 77-134-B, *Glove Requirements*, vol. 2, 1976.

H.1.2.10 NIST Publications.

National Institute of Standards and Technology, 100 Bureau Drive, Stop 1070, Gaithersburg, MD 20899-1070.

Hsiao, H., Whitestone, J., Kau, T. Y., & Hildreth, B. (2015). “Firefighter hand anthropometry and structural glove sizing: a new perspective.” *Human factors*, 57(8), 1359–1377.

NIST Note 1540: C.L. Holloway, G. Koepke, D. Camell, K.A. Remley, D.F. Williams, S.A. Schima, S. Canales, and D.T. Tamura, “Propagation and Detection of Radio Signals Before, During, and After the Implosion of a 13-Story Apartment Building,” Natl. Inst. Stand. Technol. May 2005.

NIST Note 1541: C.L. Holloway, G. Koepke, D. Camell, K.A. Remley, D.F. Williams, S.A. Schima, S. Canales, and D.T. Tamura, “Propagation and Detection of Radio Signals Before, During, and After the Implosion of a Large Sports Stadium (Veterans' Stadium in Philadelphia),” Natl. Inst. Stand. Technol. October 2005.

NIST Note 1542: C.L. Holloway, G. Koepke, D. Camell, K.A. Remley, S.A. Schima, M. McKinley, and R.T. Johnk, “Propagation and Detection of Radio Signals Before, During, and After the Implosion of a Large Convention Center,” Natl. Inst. Stand. Technol. June 2006.

NIST Note 1545: C.L. Holloway, W.F. Young, G. Koepke, K.A. Remley, D. Camell, and Y. Becquet, “Attenuation of Radio Wave Signals Coupled into Twelve Large Building Structures,” Natl. Inst. Stand. Technol. April 2008.

NIST Note 1546: K.A. Remley, G. Koepke, C.L. Holloway, C. Grosvenor, D. Camell, J. Ladbury, D. Novotny, W.F. Young, G. Hough, M.D. McKinley, Y. Becquet, and J. Korsnes, “Measurements to Support Broadband Modulated-Signal Radio Transmissions for the Public-Safety Sector,” Natl. Inst. Stand. Technol. April 2008.

NIST Note 1550: K.A. Remley, G. Koepke, C. Grosvenor, R.T. Johnk, J. Ladbury, D. Camell, and J. Coder, “NIST Tests of the Wireless Environment in Automobile Manufacturing Facilities,” Natl. Inst. Stand. Technol. October 2008.

NIST Note 1552: W.F. Young, K.A. Remley, J. Ladbury, C.L. Holloway, C. Grosvenor, G. Koepke, D. Camell, S. Floris, W. Numan, and A. Garuti, “Measurements to Support Public Safety Communications: Attenuation and Variability of 750 MHz Radio Wave Signals in Four Large Building Structures,” Natl. Inst. Stand. Technol. August 2009.

NIST Note 1557: W.F. Young, K.A. Remley, D.W. Matolak, Q. Zhang, C.L. Holloway, C. Grosvenor, C. Gentile, G. Koepke, and Q. Wu, “Measurements and Models for the Wireless Channel in a Ground-Based Urban Setting in Two Public-Safety Frequency Bands,” Natl. Inst. Stand. Technol. May 2011.

K.A. Remley, G. Koepke, C.L. Holloway, C. Grosvenor, D. Camell, J. Ladbury, R.T. Johnk, and W.F. Young, “Radio Wave Propagation into Large Building Structures; Part 2, Characterization of Multipath,” *IEEE Trans. Ant. Propagat.*, vol. 58, no. 4, April 2010, pp. 1290-1301.

H.1.2.11 SAE Publications.

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

SAE Recommended Practice J211b, *Channel Class1000,* 1995.

H.1.2.12 US Department of Defense Publications.

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

A-A-55126C, *Commercial Item Description, Fastener Tapes, Hook and Loop, Synthetic*, December 21, 2016.

H.1.2.13 US Government Publications.

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

FHA *Manual on Uniform Traffic Control Devices*, 2012.

Title 21, Code of Federal Regulations, Part 7, Subpart C, “Enforcement Policy,” April 1, 1995.

Title 23, Code of Federal Regulations, Part 655, "Traffic Operations."

Title 29, Code of Federal Regulations, Part 7, Subpart C, 1 April 1997.

Title 29, Code of Federal Regulations, Part 1910.1030, 6 March 1992.

Title 29, Code of Federal Regulations, Part 1910.134, “Respiratory Protection,” 1 July 2013.

Title 42, Code of Federal Regulations, Part 84, Subpart E.

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

H.1.2.14 Other Publications.

Fabian, T., et al., *Firefighter Exposure to Smoke Particulates*, DHS AFG Grant #EMW-2007-FP-02093, Project Number: 08CA31673, 2010.Greiner, T. M., *Hand Anthropometry of U.S. Army Personnel,* US Army Natick Soldier Research Development and Engineering Center, 1991.

Gao H, Deaton S, Fang X, Watson K, DenHartog EA, Barker R. “Effects of environmental temperature and humidity on evaporative heat loss through firefighter suit materials made with semi-permeable and microporous moisture barriers.” *Textile Research Journal*. 2021 Jul 22:00405175211026537.

Kleeman, M., et al., “Size and Composition Distribution of Fine Particulate Matter Emitted from Wood Burning, Meat Charbroiling, and Cigarettes,” *Environ. Sci. Technol* Vol. 33, pp. 3516–3523, 1999.

Koseki, H., “Large Scale Pool Fires, Results of Recent Experiments,” *Fire Safety Science*, Proceedings of the Sixth International Symposium, pp. 115–132.

Nowlen, S., “A Review of Research at Sandia National Laboratories Associated with the Problem of Smoke Corrosivity,” *Fire Safety Journal*, Vol. 15, Issue 5, 1989, pp. 403–413.

Rau, J., “Composition and Size Distribution of Residential Wood Smoke Particles,” *Aerosol Science and Technology*, Vol. 10, pp. 181–192, 1989.

Simms, D. L. and P. L. Hinkley, *Materials Suitable for Clothing Aircraft Fire Crash Rescue Workers*, Part 10, “The Effect of Water on Clothing,” Fire Research Station, Boreham Wood, Herts, England, 1959.

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

H.2 Informational References.

H.2.1 ASME Publications.

American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME B46.1, *Surface Texture (Surface Roughness, Waviness, and Lay)*, 2009.

ASME Y14.5, *Dimensioning and Tolerancing*, 2009.

ASME Y14.38, *Abbreviations and Acronyms for Use on Drawings and Related Documents*, 2007, reaffirmed 2013.

H.2.2 Other Publications.

Moore, G., "Simplifying FCC Compliance for 802.15.4 2.4 GHz Devices," *National Technical Systems White Paper*. Available at http://www.nts.com

Remley, K.A., M.R. Souryal, W.F. Young, D.G. Kuester, D.R. Novotny, and J.R. Guerrieri, "Interference Tests for 900 MHz Frequency-Hopping Public-Safety Wireless Devices," *IEEE Electromagnetic Compatibility Society Symposium Digest*, August 2011.

Souryal, M.R., D.R. Novotny, D.G. Kuester, J.R. Guerrieri, and K.A. Remley, "Impact of RF Interference Between a Passive RFID System and a Frequency Hopping Communications System in the 900 MHz ISM Band," *IEEE Electromagnetic Compatibility Society Symposium Digest*, July 2010, pp. 495-500.

H.3 References for Extracts in Informational Sections.

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

Statement of Problem and Substantiation for Public Comment

Standard titles and editions should be updated at end of second draft meeting to reflect updates to the document as well as to the referenced publication.

Related Item

• FR273

Submitter Information Verification

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Submittal Date: Wed Jan 04 14:38:50 EST 2023
Committee: FAE-SPF

Public Comment No. 121-NFPA 1970-2023 [Section No. H.1.2.2]

H.1.2.2 ~~ANSI~~ AIHA Publications.

American

~~National Standards Institute, Inc., 25 West 43rd Street, 4th floor, New York, NY 10036.ANSI Z88~~

Industrial Hygiene Association, 3141 Fairview Park Dr, Suite 777, Falls Church, VA 22042.

AIHA Z88 .2, *Practices for Respiratory Protection* , 2015.

~~ANSI~~ AIHA Z88.6, *Respiratory Protection — Respirator Use — Physical Qualifications for Personnel*, 2006.

~~ANSI~~ AIHA Z88.10, *Respirator Fit Test Methods*, 2010.

Statement of Problem and Substantiation for Public Comment

(Submitted on behalf of the FAE-ELS HazLoc Harmonization Task Group) There are other referenced ANSI standards besides AIHA standards under other SDO headings.

Related Item

• FR-280

Submitter Information Verification

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Submittal Date: Mon Jan 02 13:22:56 EST 2023
Committee: FAE-SPF

Correlating Committee Note No. 3-NFPA 1970-2022 [Section No. 7.19]

Submitter Information Verification

Committee: FAE-AAC
Submittal Date: Wed Aug 03 13:38:51 EDT 2022

Committee Statement

Committee Statement: The Correlating Committee requests FAE-SPF and FAE-SCE Technical Committees review their hazardous location electronic requirements (7.19.1 and 12.3.1, respectively) for correlation to 17.1.8 and 22.5, so these requirements are standardized throughout the NFPA 1970 document, or provide reasoning for the differentiation.

FR-139-NFPA 1970-2022

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
5 Not Returned
21 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Area, James B.

Fargo, Cristine Z.

Hosea, Thomas M.

Johnston, Ronald

Legendre, Jeff

Affirmative All

Allen, Jason L.
Arrington, Joseph
Barker, Roger L.
Farley, Edmund
Hess, Diane B.
Lancaster, Beth C.
Lehtonen, Karen E.
Matthews, David G.
Mauti, Benjamin
McKenna, Michael F.
Menard, Douglas
Newsom, Amanda H.
Sanders, Stephen R.
Stull, Jeffrey O.
Swan, Rick L.
Szalajda, Jonathan V.
Tutterow, Jr., Robert D.
Van Lent, William A.
Varner, Bruce H.
Weise, Dick
Winer, Harry P.

Affirmative with Comment

Morris, John H.
A

Correlating Committee Note No. 2-NFPA 1970-2022 [Section No. 12.3]

Submitter Information Verification

Committee: FAE-AAC

Submittal Date: Wed Aug 03 13:38:06 EDT 2022

Committee Statement

Committee Statement: The Correlating Committee requests FAE-SPF and FAE-SCE Technical Committees review their hazardous location electronic requirements (7.19.1 and 12.3.1, respectively) for correlation to 17.1.8 and 22.5, so these requirements are standardized throughout the NFPA 1970 document, or provide reasoning for the differentiation.

FR-44-NFPA 1970-2022

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
5 Not Returned
21 Affirmative All
1 Affirmative with Comments
0 Negative with Comments
0 Abstention

Not Returned

Area, James B.

Fargo, Cristine Z.

Hosea, Thomas M.

Johnston, Ronald

Legendre, Jeff

Affirmative All

Allen, Jason L.
Arrington, Joseph
Barker, Roger L.
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Tutterow, Jr., Robert D.
Van Lent, William A.
Varner, Bruce H.
Weise, Dick
Winer, Harry P.

Affirmative with Comment

Morris, John H.
A

Correlating Committee Note No. 1-NFPA 1970-2022 [Section No. 17.1.15]

Submitter Information Verification

Committee: FAE-AAC
Submittal Date: Wed Aug 03 13:36:35 EDT 2022

Committee Statement

Committee Statement: The CC recommends FAE-RPE add language to 17.1.15, preferably by reference, correlating with NFPA 1971 regarding a requirement that materials meet the levels of restricted substances (for example, see NFPA 1970 7.4.9), along with corresponding Performance Requirements in Chapter 18 (see NFPA 1970 8.20) and test method in 9.83.

FR-255-NFPA 1970-2022

Ballot Results

✔ **This item has passed ballot**

27 Eligible Voters
5 Not Returned
21 Affirmative All
0 Affirmative with Comments
1 Negative with Comments
0 Abstention

Not Returned

Area, James B.
Fargo, Cristine Z.
Hosea, Thomas M.
Johnston, Ronald
Legendre, Jeff

Affirmative All

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Szalajda, Jonathan V.

Tutterow, Jr., Robert D.

Van Lent, William A.

Varner, Bruce H.

Weise, Dick

Winer, Harry P.

Negative with Comment

Morris, John H.

RPE committee needs to review and ensure there are not unintended consequences.

Baio, Debbie

From: Alex Forrest <pres867@aol.com>
Sent: Monday, January 2, 2023 1:44 PM
To: stds_admin

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

January 2, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re:NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to you as a form of Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard.

I recently attended a meeting of IARC of the World Health Organization dealing with the Firefighter Monograph in Lyon France where this organization moved Firefighting to the highest level of cancer Risk as a Class 1 Carcinogen agent to Human Beings.

This underlies the need for the following revisions to standard 1970.

In fact if these changes are not made I believe the credibility of the NFPA process may be at risk.

Health and safety are of the utmost importance to this Association and the fire fighters we represent. Unfortunately, more fire fighters are dying of cancer each year. The disease – now the number one killer of fire fighters – poses the greatest risk to a healthy fire service. Almost 75% of those honored at the IAFF's 2022 Fallen Fire Fighter Memorial (348 of 469) were members who died from occupational cancer. For this reason, removing known carcinogens and toxins from turnout gear is paramount.

Please allow the preceding paragraph to serve as substantiation for all following comments, and may *hazardous substances* serve as the associated Related Item(s).

I am requesting that the following Public Comments be entered into the record and be discussed and adopted during the revision process of Standard 1970:

1. The elimination of the 18-month compliance period suggested in 4.1.8
2. Removal of "manufacturer" from setting testing and inspection criteria, 4.3.4
3. Inclusion of coatings & finishes to the definition of "material(s)" and "component(s)", 4.3.9.2, 6.1.7, 6.1.7.6
4. Removing "intentionally added" from 6.1.7.6, and "intentionally" from 6.4.13
5. Replace the moisture barrier shrink test with the ISO equivalent in EN-469, 9.6.1.1/2, 9.6.3.3, 9.6.4, 9.6.5.1, Annex B.2 - 7.1.16
6. The addition of all recorded PFAS analytes found through existing testing, as reported in studies to the targeted testing list in 9.83.1
7. The addition of a verifiable Total Organic Fluorine test to 9.83.2

Sincerely,

Alex Forrest
Retired Captain, Winnipeg Fire Department
President, Manitoba Professional Firefighters
International Association of Firefighters
Canadian Trustee
204.791.4980
Aforrest@iaff.org



BERT QUINTANA
PRESIDENT

DUSTY WARDEN
SECRETARY-TREASURER

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Bert Quintana

PROFESSIONAL FIRE FIGHTERS
OF NEW HAMPSHIRE

January 3, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re: NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

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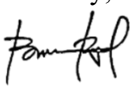
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Sincerely,



Brian Ryll
President - Professional Fire Fighters of New Hampshire
43 Centre Street, Concord N.H. 03301

Professional Fire Fighters Association of Louisiana

AFFILIATED WITH THE INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

CHAD MAJOR
President

STACY BIRDWELL
Secretary-Treasurer

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,



Chad Major
President
Professional Fire Fighters Association of Louisiana

PROFESSIONAL FIRE FIGHTERS OF VERMONT

PO Box 831 - Montpelier, Vermont - 05601 - Phone (800) 305-5510 - Fax (800) 309-7566

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Christopher M. Dube, President
Professional Firefighters of Vermont

Association des Pompiers de Montréal Inc.

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Chris Ross
President

2655, Place Chassé, Montréal (Québec) H1Y 2C3 Tél. 514 527-9691 • Téléc. 514 527-8119

ASSOCIATED FIRE FIGHTERS OF ILLINOIS

President
Chuck Sullivan
Champaign L1260

Secretary Treasurer
Kurt Snow
Streator L56

Vice President
Luke Howieson
DeKalb L1236

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Alton L1255

4th District
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Bolingbrook L3005

5th District
Art Thompson
Barrington L3481

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Steve Shetsky
Lincolnshire L4224

Central District
Jeff Maher
Galesburg L555

Southern District
Brant Maine
Belleville L53

Trustees
Northern District
Mike Laureto
Berwyn L506

Central District
Clayton Matteson
Bloomington L49

Southern District
Bill Hall
Wood River L2371

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts 02169-7471

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Sincerely,

Chuck Sullivan, President
Associated Fire Fighters of Illinois

Nebraska Professional  **Firefighters Association**

January 3, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Respectfully,

Darren Garrean
President
Nebraska Professional Fire Fighters Association
dgarrean@nppfa.org

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Darren Schimke, President
Professional Fire Fighters of North Dakota

Colorado Professional Fire Fighters

Affiliated with the International Association of Fire Fighters

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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David Foster, President
Colorado Professional Fire Fighters
davidfostercpff@gmail.com

Professional Fire Fighters of Alabama

AFFILIATED WITH INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

DAVID J. HARER President | **WILLIAM LIPSCOMB** Vice President | **DEREK W. TOXEY** Secretary-Treasurer | **MARC T. BERRY** Communications

January 1, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

David J. Harer



580 Russet Bend Drive • Hoover, Alabama 35244

MISSOURI STATE COUNCIL OF FIRE FIGHTERS
6320 Manchester Avenue, Suite 42A
Kansas City, MO 64133

Telephone 816-783-5446
WWW.MSCFF.ORG

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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5. Replace the moisture barrier shrink test with the ISO equivalent in EN-469, 9.6.1.1/2, 9.6.3.3, 9.6.4, 9.6.5.1, Annex B.2 - 7.1.16
6. The addition of all recorded PFAS analytes found through existing testing, as reported in studies to the targeted testing list in 9.83.1
7. The addition of a verifiable Total Organic Fluorine test to 9.83.2

Sincerely,



Demetris Alfred

President, Missouri State Council of Fire Fighters

Washington State
Council of Fire Fighters

Affiliated with: AFL-CIO
International Association of Fire Fighters
Washington State Labor Council

January 3, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, MA 02169-7471

Re: NFPA 1970 Second Draft Public Comment

Dear Committee Members:

I am writing to you as a form of Public Comment regarding the Second Draft of the consolidated NFPA 1970 Standard.

Health and safety are of the utmost importance to this association and the fire fighters we represent. Unfortunately, more fire fighters are dying of cancer each year. The disease – now the number one killer of fire fighters – poses the greatest risk to a healthy fire service. Almost 75% of those honored at the International Association of Fire Fighters' 2022 Fallen Fire Fighter Memorial (348 of 469) were members who died from occupational cancer. For this reason, removing known carcinogens and toxins from turnout gear is paramount.

Please allow the preceding paragraph to serve as substantiation for all following comments, and may *hazardous substances* serve as the associated Related Item(s).

I am requesting that the following Public Comments be entered into the record and be discussed and adopted during the revision process of Standard 1970:

1. The elimination of the 18-month compliance period suggested in 4.1.8
2. Removal of "manufacturer" from setting testing and inspection criteria, 4.3.4
3. Inclusion of coatings & finishes to the definition of "material(s)" and "component(s)", 4.3.9.2, 6.1.7, 6.1.7.6
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Sincerely,

Dennis J. Lawson, President
NFPA Member #3239801

Dennis J. Lawson, President
Greg B. Markley, Secretary-Treasurer

1069 Adams Street SE
Olympia, WA 98501

360.943.3030
360.943.2333 Fax

E-mail: wscff@wscff.org
www.wscff.org

OPEIU 8

ALASKA PROFESSIONAL FIRE FIGHTERS ASSOCIATION

PO Box 111222 Anchorage, AK 99511

North Pole – Fairbanks – Shemya – Unalaska - Anchorage
Juneau – Ketchikan – Sitka

alaskapffa.org

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re: NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to you as a form of Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard.

Health and safety are of the utmost importance to this Association and the fire fighters we represent. Unfortunately, more fire fighters are dying of cancer each year. The disease – now the number one killer of fire fighters – poses the greatest risk to a healthy fire service. Almost 75% of those honored at the IAFF's 2022 Fallen Fire Fighter Memorial (348 of 469) were members who died from occupational cancer. For this reason, removing known carcinogens and toxins from turnout gear is paramount.

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Sincerely,

Dominic Lozano
President
Alaska Professional Fire Fighters

Montana State Council of Professional Fire Fighters

President: George Richards Secretary/Treasurer: Scott DeMarois

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re: NFPA 1970 2nd Draft Public Comment

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Sincerely,

George Richards, President

PO Box 25, Anaconda, MT 59711

President: Glenn Miller
50 Woolridge Street, Riverview, NB, E1B 4G3
506-869-1112 presidentappffa@gmail.com

Secretary / Treasurer: Jeremy Quillian
27 Millwood Drive, Riverview, NB, E1B 0B6
506-874-7897 streasurerappffa@icloud.com

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Glenn Miller
President, APPFFA

BRITISH COLUMBIA PROFESSIONAL FIRE FIGHTERS' ASSOCIATION
53 Locals Serving 4000 Fire Fighters Protecting 4.8 million BC Citizens

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Gord Ditchburn
President

OFFICE
Yonge & Wellesley Offices on the Park,
Suite 333, 15 Wellesley Street West,
Toronto, ON, M4Y 0G7
(905) 681-7111
Fax (905) 681-1489

OPFFA

ONTARIO PROFESSIONAL FIRE FIGHTERS ASSOCIATION

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

G Horton

Greg Horton, President
Ontario Professional Fire Fighters Association
ghorton@ontariofirefighters.org
905-252-3550

Professional Firefighters of Utah
INTERNATIONAL ASSOCIATION OF FIREFIGHTERS – AFL-CIO

web: www.pffu.org
@proffutah
Professional Fire Fighters of Utah

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,
Professional Fire Fighters of Utah, President
Jack Tidrow

PROFESSIONAL FIRE FIGHTERS OF MARYLAND

CHARTER 1969

January 3, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts 02169-7471

Re: NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to you as a form of Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard.

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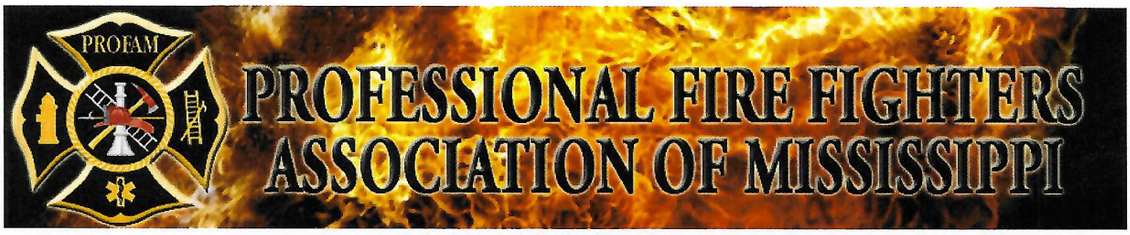
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7. The addition of a verifiable Total Organic Fluorine test to 9.83.2

Sincerely,

Jeffrey Buddle

Jeffrey Buddle, President
Professional Fire Fighters of Maryland



3379 Kimbell Drive
Terry, Mississippi 39170
(601) 832-6233

January 2, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts 02160-7471

Re: NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to you as a form of Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard.

Health and safety are of the utmost importance to this Association and the fire fighters we represent. Unfortunately, more fire fighters are dying of cancer each year. The disease – now the number one killer of fire fighters – poses the greatest risk to a healthy fire service. Almost 75% of those honored at the IAFF's 2022 Fallen Fire Fighter Memorial (348 of 469) were members who died from occupational cancer. For this reason, removing known carcinogens and toxins from turnout gear is paramount.

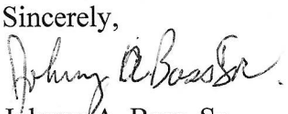
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6. The addition of all recorded PFAS analytes found through existing testing, as reported in studies to the targeted testing list in 9.83.1.
7. The addition of a verifiable Total Organic Fluorine test to 9.83.2.

Sincerely,



Johnny A. Bass, Sr.
President
Professional Firefighters Association of Mississippi (PROFAM)
601.832.6233 cell
jbass54@att.net

Ohio Association of Professional Fire Fighters
140 E. Town St,. Suite 1225 Columbus, Ohio 43215
Jon D. Harvey, President William E. Quinn, Secretary / Treasurer

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re: NFPA 1970 2nd Draft Public Comment

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Sincerely,

Jon D. Harvey

Jon D. Harvey – President
Ohio Association of Professional Fire Fighters
614-488-9920
jharvey@oapff.org

RHODE ISLAND STATE ASSOCIATION OF FIRE FIGHTERS

President
Joseph A. Andriole

Vice President
Armand A. Niquette Jr.

Secretary
Keith A. Calci

Treasurer
Howard F. Tighe

Exec. Board Chair
Derek Crossman

1st District Vice President
Jay T. Petrillo

2nd District Vice President
Edward W. Owens

3rd District Vice President
James M. Rita

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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7. **The addition of a verifiable Total Organic Fluorine test to 9.83.2**

Sincerely,

Joseph A. Andriole

Joseph Andriole,
President

THE PROFESSIONAL FIREFIGHTERS OF IDAHO

Rob Shoplock
President

Grant Hamilton
Vice-President

Curtis Smith
Secretary/Treasurer

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Joseph (Rob) Shoplock

P.O. Box 2620 Pocatello Idaho, 83206 (208)241-3219

OREGON STATE FIRE FIGHTERS COUNCIL

International Association of Fire Fighters

AFL-CIO CLC

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Karl Koenig

Karl Koenig, President
Oregon State Fire Fighters Council

265 Commercial Street S.E., Suite 260 • Salem, Oregon 97301 • Phone (503) 540-0648 • Fax (503) 391-5878

www.osffc.org

THE MASSACHUSETTS HOUSE OF REPRESENTATIVES
REPRESENTATIVE KATE HOGAN
THIRD MIDDLESEX DISTRICT
STATE HOUSE, ROOM 370, BOSTON, MASSACHUSETTS 02133-1053

January 4, 2023

National Fire Protection Association
Structural and Proximity Firefighting Protective Clothing and Equipment Committee
1 Batterymarch Park
Quincy, MA 02169

Re: NFPA 1970 Public Comment

Dear Committee Members,

Thank you for the opportunity to submit public comment on the draft of the upcoming edition of NFPA 1970. I am writing to support the proposed changes relating to the presence of per- and polyfluoroalkyl substances (PFAS) in firefighting gear.

As House Chair of the Massachusetts PFAS Interagency Task Force, I heard testimony from local firefighters and their families about the devastating health impacts of elevated PFAS exposure through firefighting gear. I am deeply concerned about the rates of occupational cancer among firefighters, and I urge your committee to make revisions to NFPA 1970 that will reduce their exposure to PFAS.

In particular, I ask the committee to consider removing the ultraviolet light degradation test requirement for the moisture barrier layer of turnout gear. I have heard from firefighters, advocates, and scientists that the ultraviolet test, which does not accurately reproduce conditions the moisture barrier would be exposed to, serves as an obstacle for fire departments to acquire PFAS-free turnout gear that complies with NFPA standards. Revising this standard would have a profound impact on the health and safety of our firefighters.

Thank you for your work in ensuring our firefighters are protected as they risk their lives to protect ours. I appreciate your consideration of my comment.

Sincerely,

Kate Hogan

Rep. Kate Hogan
Third Middlesex District
Speaker Pro Tempore

Federated Fire Fighters of Wyoming
I.A.F.F. A-0048
P.O. BOX 674 • CHEYENNE, WY 82003-0674

January 2nd, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re: NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to you as a form of Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard.
Health and safety are of the utmost importance to the Federated Fire Fighters of Wyoming and the fire fighters we represent. Unfortunately, more fire fighters are dying of cancer each year. The disease – now the number one killer of fire fighters – poses the greatest risk to a healthy fire service. Almost 75% of those honored at the IAFF's 2022 Fallen Fire Fighter Memorial (348 of 469) were members who died from occupational cancer. For this reason, removing known carcinogens and toxins from turnout gear is paramount.
Please allow the preceding paragraph to serve as substantiation for all following comments, and may hazardous substances serve as the associated Related Item(s).

I am requesting that the following Public Comments be entered into the record and be discussed and adopted during the revision process of Standard 1970:

1. The elimination of the 18-month compliance period suggested in 4.1.8
2. Removal of "manufacturer" from setting testing and inspection criteria, 4.3.4
3. Inclusion of coatings & finishes to the definition of "material(s)" and "component(s)", 4.3.9.2, 6.1.7, 6.1.7.6
4. Removing "intentionally added" from 6.1.7.6, and "intentionally" from 6.4.13
5. Replace the moisture barrier shrink test with the ISO equivalent in EN-469, 9.6.1.1/2, 9.6.3.3, 9.6.4, 9.6.5.1, Annex B.2 - 7.1.16
6. The addition of all recorded PFAS analytes found through existing testing, as reported in studies to the targeted testing list in 9.83.1
7. The addition of a verifiable Total Organic Fluorine test to 9.83.2

Sincerely,

Kevin J. Reddy
President
Federated Fire Fighters of Wyoming I.A.F.F. A-48

CLEAN WATER ACTION

January 3, 2023

National Fire Protection Association
Standards Council and Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, MA 02169-7471

Re: NFPA 1970 Second Draft Public Comment

Dear Committee Members

Clean Water Action is a national environmental nonprofit with offices in Massachusetts. We are a multi-issue organization with a particular focus on environmental hazards that adversely impact human health.

We coordinate closely with the Massachusetts firefighters and with leading scientists, labor organizations and public health organizations.

We are writing to support the Professional Fire Fighters of Massachusetts letter of December 30, 2022. We support all of the recommended revisions submitted by President Richard McKinnon, including:

- Elimination of the 18-month compliance period (4.1.8);
- Removal of "manufacturer" from the list of entities setting testing and inspection criteria;
- Inclusion of "coatings" and "finishes" to the definition of materials and components (4.3.9.2, 6.1.7., 6.1.7.6)
- Addition of all known PFAS analytes be added to the targeted testing list (9.83.2). Because so many PFAS are not known, it is essential that NFPA also require a Total Organic Fluorine test as part of 9.83.2

Because we are not familiar with the details of shrinkage testing, we are not able to comment specifically on that requirement.

Firefighters face high rates of cancer, and high rates of illnesses known to be linked to PFAS, such as kidney and testicular cancer.

We support firefighters and associations such as the Professional Fire Fighters of Massachusetts and the International Association of Fire Fighters in their call for a

88 Broad Street, Lower Level, Boston, MA 02110
Phone 617.338.8131 | bostoncwa@cleanwater.org
www.CleanWaterAction.org/MA

revised 1970 standard that no longer requires perfluoroalkyl substances and polyfluoroalkyl substances.

Thank you.

Sincerely,



Elizabeth Saunders
Massachusetts Director

SASKATCHEWAN
PROFESSIONAL FIRE FIGHTERS
AND PARAMEDICS ASSOCIATION

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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6. The addition of all recorded PFAS analytes found through existing testing, as reported in studies to the targeted testing list in 9.83.1
7. The addition of a verifiable Total Organic Fluorine test to 9.83.2

Sincerely,
SPFFPA President Lloyd Zwack

PROFESSIONAL FIRE FIGHTERS OF WISCONSIN, INC.
321 EAST MAIN STREET, SUITE 200, MADISON, WI 53703-2840
PHONE: (608) 251-5832 / EMAIL: PFFWOFFICE@GMAIL.COM
MEMBER OF INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS
MEMBER OF WISCONSIN STATE AFL-CIO

MAHLON MITCHELL STATE PRESIDENT
MICHAEL WOODZICKA STATE VICE-PRESIDENT
STEVE WILDING STATE SEC. / TREAS.

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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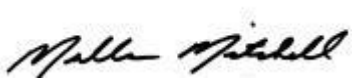
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Sincerely,



Mahlon Mitchell, President
Professional Fire Fighters of Wisconsin

ALBERTA PROFESSIONAL FIRE FIGHTERS & PARAMEDICS ASSOCIATION
APFFPA

Affiliated with International Association of Fire Fighters

January 1, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re: NFPA 1970 2nd Draft Public Comment

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(403) 680-8272 | 2234 30 Avenue N.E. | Calgary, Alberta | T2E 7K9 | apffpa.ca | info@apffpa.ca

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Thank you for the opportunity to provide comment on the NFPA 1970 Standard and please let me know if there are any questions.

Sincerely,



Matt Osborne
President
Alberta Professional Fire Fighters & Paramedics Association

"PROGRESS THROUGH UNITY"

KANSAS STATE COUNCIL OF FIRE FIGHTERS

Affiliated With

INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS • KANSAS AFL-CIO • CENTRAL LABOR BODIES

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,
Matthew M. Jackson
President
Kansas State Council of Firefighters

Michigan Professional
FIRE FIGHTERS UNION

Matthew Sahr
President

1651 Kingsway Ct., Ste. E
Trenton, MI 48183

Terrence Chesney
Secretary-Treasurer

www.mpffu.org

734.675.0206 ~ fax 734.571.5954

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
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02169-7471

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Sincerely,

Matthew Sahr, President
Michigan Professional Fire Fighters Union
586-549-5384
MattSahr@mpffu.org

Tennessee Professional Fire Fighters Association
Matthew Tomek, President • Barry Byers, Sec./Treas.
P.O. Box 100221 • Nashville, TN • 37224

"Serving Tennessee's Bravest Since 1960"

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts 02169-7471

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Sincerely,

Matthew Tomek

Matthew Tomek, President
Tennessee Professional Fire Fighters Association

Professional Fire Fighters of Maine

Affiliated with the International Association of Fire Fighters

Officers

Michael J. Crouse
President

Mike Scott
Secretary

David Bickford
Treasurer

Gerry Gay
1st District Vice-President

Shane Taylor
2nd District Vice-President

Carl Anderson
3rd District Vice-President

Ronnie Green
4th District Vice-President

Kyle Moser
5th District Vice-President

162 Plymouth Road
Etna, Maine 00000

[207] 439 -6214 [O]
www.pffmaine.org

January 2, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Michael J. Crouse, President
Professional Fire Fighters of Maine

Professional Fire Fighters of
WEST VIRGINIA
205 A Tennessee Ave., Charleston West Virginia 25302
Phone: (304) 688-8336

Myron Boggess, President
Mark Walsh, Vice-President
Jayson Nicewarner, Secretary Treasurer

Email mboggess@pffwv.org

29, 2022

re Protection Association
Council & Technical Committee NFPA 1970
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A 1970 2nd Draft Public Comment

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Professional Fire Fighters of
WEST VIRGINIA
205 A Tennessee Ave., Charleston West Virginia 25302
Phone: (304) 688-8336

Myron Boggess, President
Mark Walsh, Vice-President
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Email mboggess@pffwv.org

December 29, 2022

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Standards Council & Technical Committee NFPA 1970
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President PFFWV

Professional Fire Fighters of
WEST VIRGINIA
205 A Tennessee Ave., Charleston West Virginia 25302
Phone: (304) 688-8336

Myron Boggess, President
Mark Walsh, Vice-President
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Email mboggess@pffwv.org

December 29, 2022

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Sincerely, Myron Boggess
President PFFWV

PROFESSIONAL FIREFIGHTERS OF GEORGIA

NATHAN K. BAILEY
President

BILLY KING
Vice President

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Nathan Bailey
President, Professional Fire Fighters of Georgia

UNIFORMED
PROFESSIONAL FIRE FIGHTERS ASSOCIATION
OF CONNECTICUT

AFFILIATED WITH INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS
30 Sherman Street, West Hartford, CT 06110
Office: (860) 953-3200 • Office Fax: (860) 953-3334 • www.upffa.org

Principal Officers
Peter Brown, *President*
Louis P. DeMici, *Secretary*
Steven H. Michalovic, *Treasurer*

January 4, 2023, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
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Health and safety are of the utmost importance to this Association and the fire fighters we represent. Unfortunately, more fire fighters are dying of cancer each year. The disease – now the number one killer of fire fighters – poses the greatest risk to a healthy fire service. Almost 75% of those honored at the IAFF's 2022 Fallen Fire Fighter Memorial (348 of 469) were members who died from occupational cancer. For this reason, removing known carcinogens and toxins from turnout gear is paramount.

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6. The addition of all recorded PFAS analytes found through existing testing, as reported in studies to the targeted testing list in 9.83.1
7. The addition of a verifiable Total Organic Fluorine test to 9.83.2

Sincerely,

Peter M. Brown, President

Peter S. Carozza
President Emeritus

Robert P. Anthony
Treasurer Emeritus

Professional Fire Fighters of Massachusetts

Affiliated with the International Association of Fire Fighters AFL-CIO CLC

Richard MacKinnon Jr.
President

Billy Cabral
Secretary-Treasurer

2 Center Plaza
Suite 4M
Boston, MA 02108
T 617.523.4506
F 877.470.7336
PFFM.ORG

December 30, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts 02169-7471

Re: NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to you as a form of Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard.

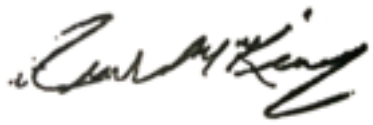
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Sincerely,



Richard D. MacKinnon Jr.
President

GCC/IBT 109C

PROFESSIONAL FIRE FIGHTERS OF OKLAHOMA

AFL-CIO/CLC

AFFILIATED WITH INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

Ricky Burns
President

Michael Korb
Secretary/Treasurer

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Sincerely,
Ricky Burns
President- PFFO AFL/CIO/CLC

6103 Melrose Lane, Oklahoma City, OK 73127 *Tel: 405.789.0061*
OPEIU #381 AFL/CIO

PENNSYLVANIA PROFESSIONAL FIRE FIGHTERS ASSOCIATION

301 Chestnut Street • Suite 101 • Harrisburg, PA 17101

Robert Brooks, *President* | Patrick Martin, *Secretary/Treasurer* | Kevin Ressler, *Recording Secretary* | Patrick Miller, *Western VP* | Jack Gaffney, *Eastern VP*

January 3, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re: NFPA 1970 2nd Draft Public Comment

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Sincerely,

Robert Brooks - President, PPFFA

O: (717) 221-8800 • Fax: (717) 221-8488 • www.ppffa.org

HAWAII FIRE FIGHTERS ASSOCIATION
INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS LOCAL 1463, AFL-CIO
1018 PALM DRIVE, HONOLULU, HAWAII 96814-1929
TELEPHONE (808) 949-1566 FAX: (808) 952-6003
WEBSITE: www.hawaiifirefighters.org

January 3, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts 02169-7471

Re: NFPA 1970 2nd Draft Public Comment

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7. The addition of a verifiable Total Organic Fluorine test to 9.83.2.

Sincerely,

Robert H. Lee
President

Professional Fire Fighters Association of South Carolina

Roger K. Odachowski

President

Cell: (864) 844-1258 Email: president@pffasc.org

117 Royal Dr. Williamston SC 29697

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re: NFPA 1970 2nd Draft Public Comment

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Sincerely,



President
Professional Fire Fighters
Of South Carolina

IOWA PROFESSIONAL FIRE FIGHTERS

P.O. BOX 2268 IOWA CITY, IA 52244

January 2, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts 02169-7471

Re: NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to you as a form of Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard.

Health and safety are of the utmost importance to the Iowa Professional Firefighters and the fire fighters we represent. Unfortunately, more fire fighters are dying of cancer each year. The disease – now the number one killer of fire fighters – poses the greatest risk to a healthy fire service. Almost 75% of those honored at the IAFF's 2022 Fallen Fire Fighter Memorial (348 of 469) were members who died from occupational cancer. For this reason, removing known carcinogens and toxins from turnout gear is paramount.

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Sincerely,

Ryan Hanghian, President
Iowa Professional Firefighters

New York State Professional Fire Fighters Association, Inc.

174 Washington Avenue, Albany, NY 12210
Phone: 518-436-8827 • Fax: 518-436-8830
E Mail: profire@nyspffa.org
www.nyspffa.org

SAMUEL A. FRESINA
President

JAMES J. McGOWAN
Secretary-Treasurer

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7th District V.P.
ROBERT EUSTACE
New York City
Local 94

8th District V.P.
CHRISTOPHER JENSEN
New York City
Local 854

CHAPLAIN

REV. JOHN TALLMAN
40 Collins Place
Albany, NY 12208

January 2, 2023

Re: NFPA 1970 2nd Draft Public Comment

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Sincerely,

Samuel Fresina
President
NYS Professional Fire Fighters Association

National Capital Federal Fire Fighters

International Association of Fire Fighters, Local F-121

P.O. Box 3215 Annapolis, Maryland 21403

Scott A. Burkhardt Jr. – President

January 1, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

CC: Mrs. Christine Taylor & The Family of George Walter Taylor
Governor Larry Hogan
Governor-Elect Wes Moore
Senator Jack Bailey – MD29
Delegate Sara Love – MD16
President Jeffrey Buddle – PFFMD
President Mike Jackson – IAFF Joint Council
Fire Chief Kevin Grinder – Naval District Washington DC Fire Department
Vice President Steve Stockwell – IAFF Local F-121

Re: NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to you as a form of Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard on Protective Ensembles for Structural and Proximity Firefighting.

National Capital Federal Fire Fighters and the Professional Fire Fighters of Maryland take the dangers of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) to heart. Our brother, George Walter Taylor was killed in the line of duty due to cancer from occupational exposures, including these substances. Occupational cancers are the greatest threat to the men and women serving our communities as Professional Fire Fighters and need your support for the elimination of as many hazards as possible. Removing known carcinogens and toxins from turnout gear is a key step in the right direction.

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National Capital Federal Fire Fighters

International Association of Fire Fighters, Local F-121

P.O. Box 3215 Annapolis, Maryland 21403

Scott A. Burkhardt Jr. – President

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Continued use of these substances has very real consequences on Professional Fire Fighters and our families. Below you will find a picture of Walt, he’s a Father, Husband, Brother, IAFF Firefighter and Friend. I will continue to fight with everything I have for the total elimination of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) in the fire service.

We are all confident that you will do the right thing.

For Walt,

Scott “Scotty” Alan Burkhardt Jr.

President – National Capital Federal Fire Fighters
Chairman – Professional Fire Fighters of Maryland



Professional Fire Fighters and Paramedics of North Carolina

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,



Scott Mullins

President

Professional Fire Fighters and Paramedics of North Carolina

Minnesota Professional Fire Fighters

8100 Wayzata Blvd, St Louis Park, MN 55426

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Scott C Vadnais

Scott Vadnais
President Minnesota Professional Firefighters

Professional Firefighters Association of New Jersey

International Association of Fire Fighters AFL-CIO-CLC

Steve McConlogue, President

Anthony Tarantino, 1st Vice President
Matthew Caliente, Treasurer
Dave Hines, 2nd Vice President
Ciri Castro, Secretary

January 2, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Professional Fire Fighters Union of Indiana
Affiliated with International Association of Fire Fighters
Affiliated with Indiana State AFL-CIO

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Anthony L. Murray
President

FLORIDA PROFESSIONAL FIREFIGHTERS

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts 02169-7471

January 2, 2023

Re: NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to submit Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard.

Health and safety are of the utmost importance to the Florida Professional Firefighters Association and the approximately 28,000 firefighters that we represent. Unfortunately, more of Florida's fire fighters are dying of cancer each year. The disease – which now appears to be the number one killer of fire fighters in the US and Canada – poses a grave risk to a healthy fire service. Almost 75% of those honored at the International Association of Fire Fighters' 2022 Fallen Fire Fighter Memorial (348 of 469) were those who died from occupational cancer. For this reason, removing known carcinogens and other toxins from our turnout gear should be one of your highest priorities.

Please allow the preceding paragraph to serve as substantiation for all following comments, and may hazardous substances serve as the associated Related Item(s).

I am requesting that the following Public Comments be entered into the record and be discussed and adopted during the revision process of Standard 1970:

1. The elimination of the 18-month compliance period suggested in 4.1.8
2. Removal of "manufacturer" from setting testing and inspection criteria, 4.3.4
3. Inclusion of coatings & finishes to the definition of "material(s)" and "component(s)", 4.3.9.2, 6.1.7, 6.1.7.6
4. Removing "intentionally added" from 6.1.7.6, and "intentionally" from 6.4.13
5. Replace the moisture barrier shrink test with the ISO equivalent in EN-469, 9.6.1.1/2, 9.6.3.3, 9.6.4, 9.6.5.1, Annex B.2 - 7.1.16
6. The addition of all recorded PFAS analytes found through existing testing, as reported in studies to the targeted testing list in 9.83.1
7. The addition of a verifiable Total Organic Fluorine test to 9.83.2

Sincerely,

Wayne "Bernie" Bernoska, Jr. – President
Florida Professional Firefighters

343 West Madison Street Tallahassee, Florida 32301
Phone: (850) 224-7333 | Fax: (850) 222-1751 | E-mail: fpf@fpfp.org | Website: http://www.fpfp.org
Affiliated with: INTERNATIONAL ASSOCIATION OF FIRE FIGHTERS

Baio, Debbie

From: PRESIDENT PFFN <president@pffn.org>
Sent: Wednesday, January 4, 2023 4:58 PM
To: rheffernan@iaff.org; stds_admin
Subject: Public Comment NFPA 1970 2nd Draft

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

January 4, 2023

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

Re:NFPA 1970 2nd Draft Public Comment

Dear Committee Members,

I am writing to you as a form of Public Comment regarding the 2nd Draft of the consolidated NFPA 1970 Standard.

Health and safety are of the utmost importance to this Association and the fire fighters we represent. Unfortunately, more fire fighters are dying of cancer each year. The disease – now the number one killer of fire fighters – poses the greatest risk to a healthy fire service. Almost 75% of those honored at the IAFF's 2022 Fallen Fire Fighter Memorial (348 of 469) were members who died from occupational cancer. For this reason, removing known carcinogens and toxins from turnout gear is paramount.

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Todd Ingalsbee
President
Professional Firefighters of Nevada
--

Todd Ingalsbee
President
Professional Firefighters of Nevada
702-806-8721

January 4, 2023

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Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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Sincerely,

Brian K. Rice

Brian Rice
President, California Professional Firefighters

Federal Fire Fighter Joint Council

163 South Wells Ave. Glenolden, PA 19036

Michael G Jackson, President

Joseph F. Love III, Secretary/Treasurer

December 29, 2022

National Fire Protection Association
Standards Council & Technical Committee NFPA 1970
1 Batterymarch Park
Quincy, Massachusetts
02169-7471

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President, J0001
Federal Fire Fighters Joint Council