FR/AR Myths and Misconceptions:

Plus, some Do's and Don'ts about Flame-Resistant & Arc Rated Clothing

Most common myths, misconceptions, misunderstandings & some flat-out wrongs:

1. **It is all the same**
2. The hazard is Arc Flash or Flash Fire
3. **They are too hot**
4. They are too expensive
5. **They don’t really work**
6. Doesn’t matter what I wear underneath
7. **FR raingear is good enough**
8. I want the lowest BB
9. **Cotton is Fine**
10. Inherent vs. Treated

10.1 Task-based vs. Daily wear

And a Bonus

What you may be hearing out there …

“It is all the same…” Is it?

- Fire-resistant
- 88/12
- Flame-retardant
- Fire-rated
- Cotton Nomex

…is it all the same?

Same Fabric, same test results but way cheaper

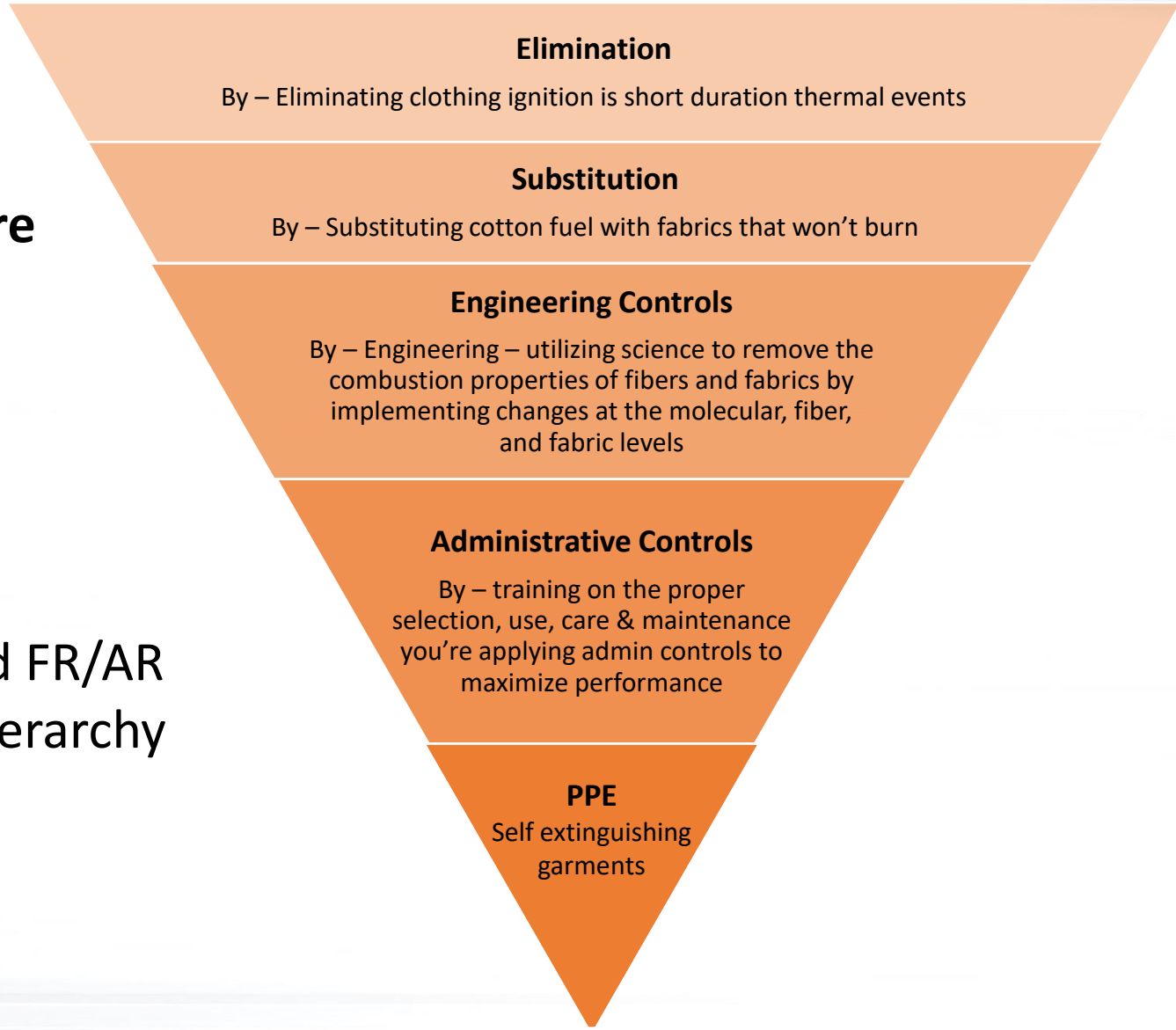
KNOW your supply chain

What is the Hazard?

Most would answer **Arc Flash** or **Flash Fire**

Is it?

Clothing ignition is the real **HAZARD** and FR/AR clothing allows you to implement the hierarchy of safety by…



FR/AR is too Hot!!!

FR Clothing's Top 3 Problems

1. It's TOOOOOOOOOO HOTTTTTTT!!!!!
2. It's heavy and uncomfortable.
3. Doesn't fit well.

Safety" then responds with..

They can just put it on when they need it"

- [X] Putting a 7oz or 9 oz. garment over top of 100% cotton work clothing
- [X] Adding additional cumbersome layers
- [X] Wearing a Coverall

Thus, reinforcing the "Top 3" problems, so -
Wear light weight, air permeable, moisture wicking daily wear

FR/AR is too HOT!!!

What is the best way to encourage compliance when it's HOT?

The short answer is: **Wear Trials and Training**

Single-layer FR/AR clothing does not trap heat or restrict heat removal any more than regular non-FR clothing. May 1, 2019, OHS – The Truth about Heat Stress and FRC

Heat is shed primarily by evaporation of sweat. Restriction or loss of this function either due to physiological conditions such as dehydration and/or clothing that restricts this action (such as raingear or impermeable membranes, or multiple layers), which can contribute to heat stress.

OH&S The Truth About Heat Stress and FRC May 01, 2019

https://www.npr.org/2012/07/25/157302810/summer-science-clothes-keep-you-cool-more-or-less

TLV Clothing Corrections

Clothing Type	WBGT Correction
Work clothes (long sleeve and pants)	0
Cloth (woven material) coveralls	0
Double layer woven clothing	3
SMS polypropylene coveralls	0.5
Polyolefin overalls	1
Limited use vapour-barrier overalls	11

Work clothes (long sleeve and pants)	0
Cloth (woven material) coveralls	0

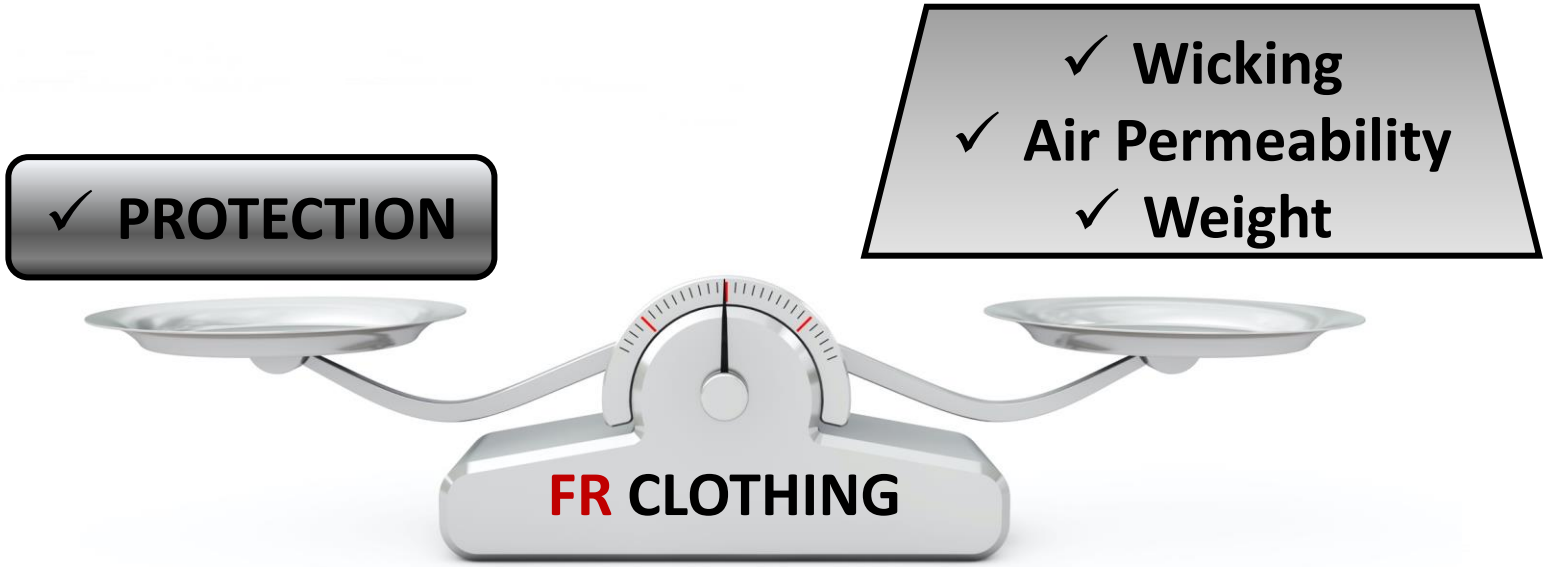
Lighter is more comfortable ….

Fabric Weight in and of Itself is NOT an Indicator of Comfort
Look deeper than just the brochure…

High air perm alone is not an indicator of comfort (aka a screen door)

Make sure moisture wicking is a property of the fiber blend and not a finish (all wicking finishes are temporary)

Remember: there must be a balance



“FR/AR is too expensive.”

Evaluating FR/AR only on cost can **eliminate “safety”** from the selection PROCESS

Purchasing FR/AR strictly on price puts incredible pressure on FR/AR manufacturers, virtually **eliminating innovation**

Safety programs selecting FR/AR solely on price sends **the wrong message** to your team.

Low-cost FR/AR often comes with **poor quality and durability**, replacement cost will outweigh any initial savings

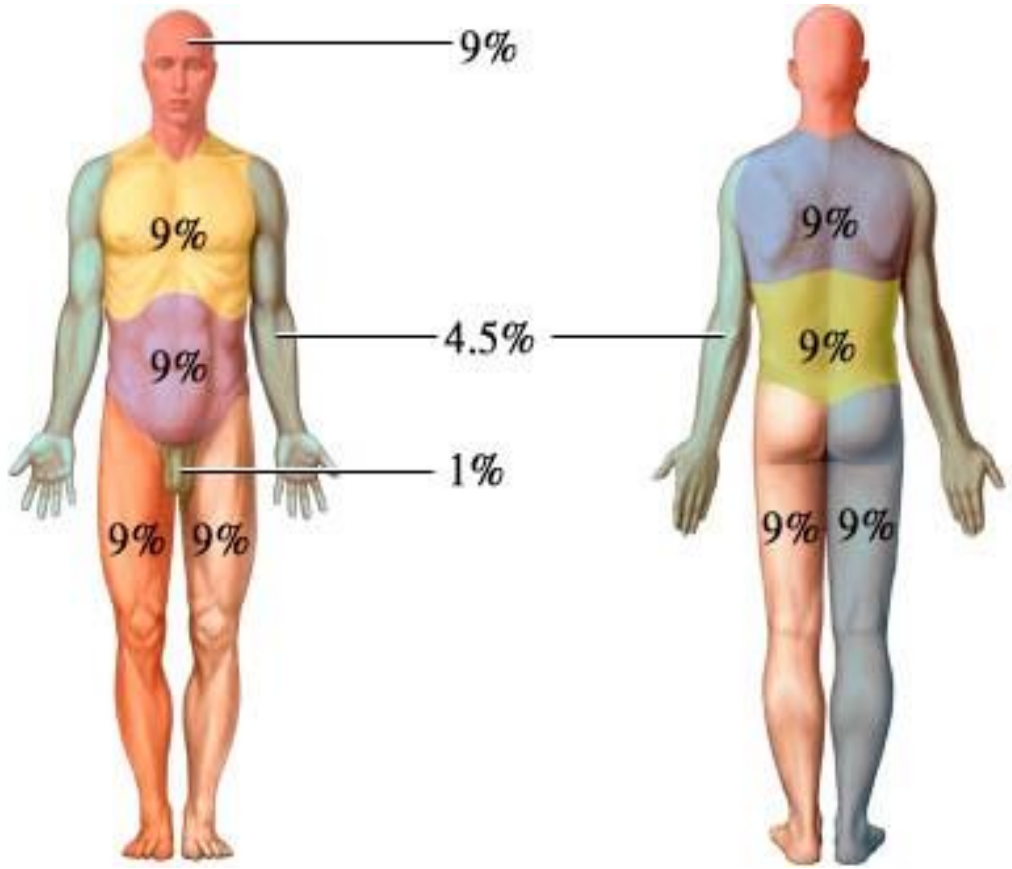
It is unlikely a single supplier can offer the lowest price across multiple product lines, meaning multiple suppliers leading to **increase costs to source**, manage and deliver

Purchasing FR/AR solely on price creates transactional relationships and **eliminates** the building of mutually beneficial partnerships

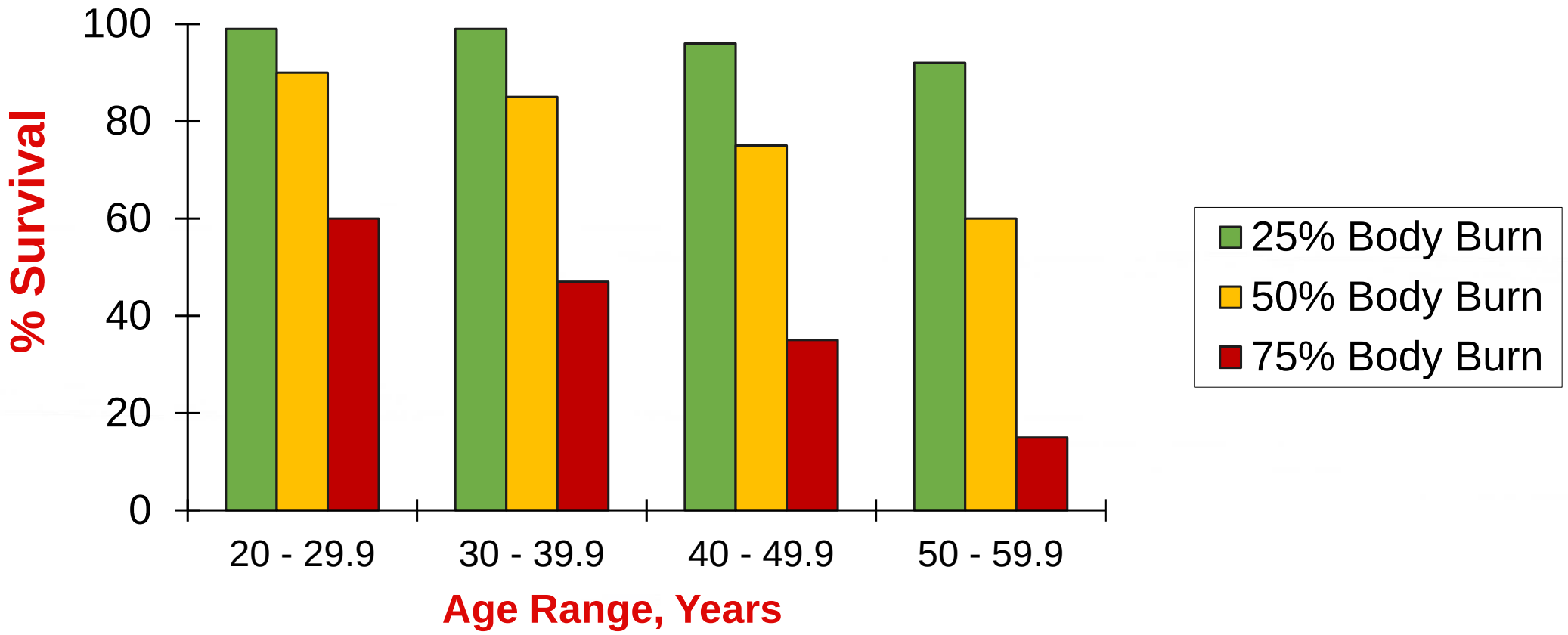
The **real danger** of purchasing FR/AR solely on price is on the front lines, where your team faces the hazards that their FR/AR is intended to mitigate

“FR/AR is too expensive.” Compared to what?

- Burn treatment requires approx. 1.5 days hospitalization per % burn
- The average hospital stay for a survivor with 40-60 percent body burn is 54 days at costs exceeding $25,000/day
- Hospitalization cost typically range from **$200,000 to $750,000, with many over $1,000,000 USD**
- **Lifetime Costs can exceed $10,000,000.00 USD**



FR/AR just doesn't work



American Burn Association 2000 - 2009

“It doesn’t matter what I wear under my FRC’s.”

Basics:

- Any garment worn as the outer layer, including rainwear, must be FR/AR.
- Any garment worn as a base layer **cannot** be made of or contain meltable fibers such as acetate, nylon, polyester, polypropylene and/or spandex.
- Only natural fibers such as silk, cotton or wool are permissible.
- Two lightweight layers of FR/AR may provide greater protection than a single heavier layer

Baselayers Eliminate Problems:

In an Arc Flash the threat of break open is real

AR garment reaches its performance threshold and begins to fail exposing either the naked skin or the light weight Non-AR undershirt to thermal energy causing injury or worse potential ignition adding to the injury.

The need to police underwear

FR/AR Base layers buy into the overall goal of your AR Clothing program which is to minimize injury.

FR Vests and Raingear are Enough

SOME STANDARDS ALONE ARE NOT ENOUGH; SOME ARE JUST WRONG

Noncompliant rainwear and vest can pose a serious problem to an otherwise solid FR/AR clothing program

ASTM F2302 – STANDARD WAS REVISED "Not a STAND-A-LONE STANDARD
ASTM D6413 – NOT A PERFORMANCE STANDARD
NFPA 701 – NOT A GARMENT STANDARD

Rainwear has specific standards for Arc Flash and Flash Fire

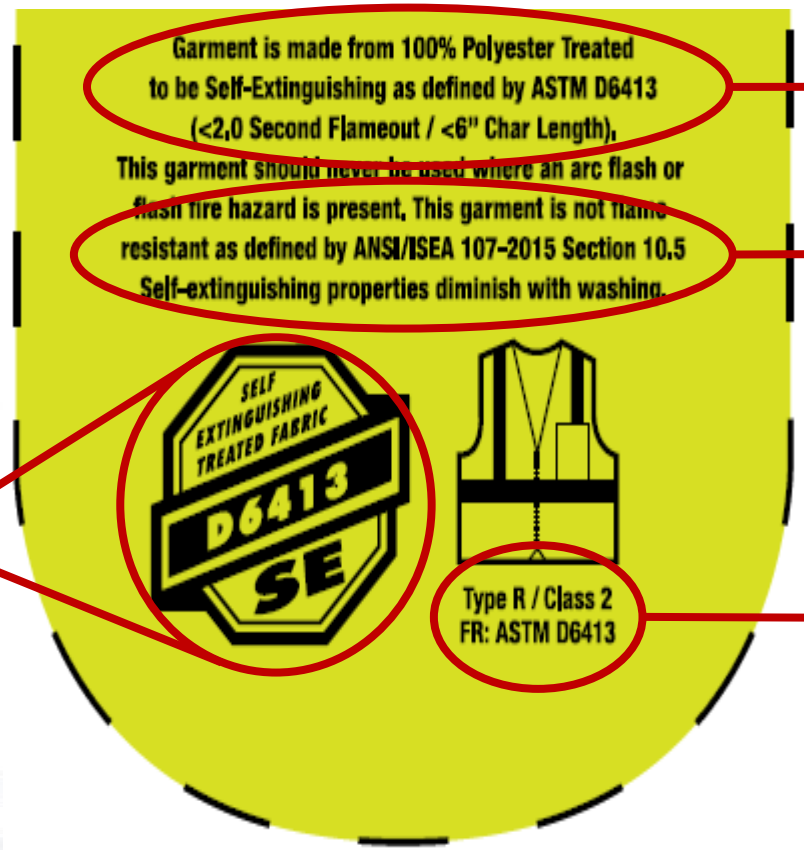
ASTM 1891 – FOR ARC FLASH
ASTM 2733 – FOR FLASH FIRE

For vests – look for **ASTM 1506** and an Arc rating in the label

What's in a Label?

This is misleading and potentially dangerous! How many contradictions can you have in one label?

Notice what is large and bold vs. in small hard to read print. **You must ask what is the purpose???**



Self – extinguishing characteristic that they state **wears out**

ASTM 6413 is **not** a performance standard,

It has to state by ANSI 107-15 it is **nonFR** because it does not meet a performance standard for arc flash or flash fire

How can you say FR when on the same label you say it is nonFR

A correct HVSA Label per ANSI 107-15

FR LABEL

XYZ Company
ANSI/ISEA 107-2015
100% Modacrylic
Model #: ABC
Size: Large

Type R
Class 2
FR: ASTM F1506
ATPV 9.0 cal/cm²

Washing Instructions:

Machine wash warm, 40 °C (105 °F)
Max washings – 50X
Do not bleach
Tumble dry low
Do not iron
Do not dry clean
Made in USA

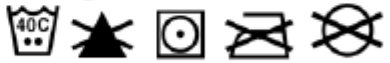
NON-FR LABEL

XYZ Company
ANSI/ISEA 107-2015
100% Polyester
Model #: ABC
Size: Large

Type R
Class 2
Not FR

This garment is not flame resistant as defined by ANSI/ISEA 107-2015 Section 10.5.

Washing Instructions:



Machine wash warm, 40 °C (105 °F)
Max washings – 50X
Do not bleach
Tumble dry low
Do not iron
Do not dry clean
Made in USA

10.5 Flame Resistance

Manufacturers may opt to have high-visibility garments evaluated for flame resistance and marked accordingly. High-visibility garments marked as flame resistant shall comply with the requirements of one of the following methods in its entirety:

ASTM F1506-10a, *Standard Performance Specification for Flame Resistant and Arc Rated Textile Materials for Wearing Apparel for use by Electrical Workers exposed to Momentary Electric Arc and Related Thermal Hazards*

ASTM F1891-12, *Standard Specification for Arc and Flame Resistant Rainwear*

ASTM F2302-08, *Standard Performance Specification for Labeling Protective Clothing as Heat and Flame Resistant*

ASTM F 2733-09, *Standard Specification for Flame Resistant Rainwear for Protection Against Flame Hazards*

NFPA 1977, *Standard on Protective Clothing and Equipment for Wildland Firefighting*, 2011

NFPA 2112, *Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire*, 2012

(2) If none of the flame resistant standards in Section 10.5 are met, the label shall include the following statement:

"This garment is not flame resistant as defined by ANSI/ISEA 107-2015 Section. 10.5."

I need the lowest Body Burn in my garments!

The Lab vs. Real World

- NFPA 2112 requires
- 3 second burn
- “Jet” fed fuel fire
- 360-degree exposure
- Less than 50% predicted body burn

- Real World
- Rapid moving flame front
- Fuel dependent
- Directional

Test Method vs. Real World

Using the ASTM F1930 test data to choose FR clothing

It is important to understand the difference between the ASTM 1930 test method for fabric and real-world Flash Fires

Many decision makers have been influenced to focus on the results of ASTM 1930 testing alone without fully understanding how to view the information

Some manufacturers have attempted to “make up” a category “flash fire rated” that only focuses on ASTM 1930 test results

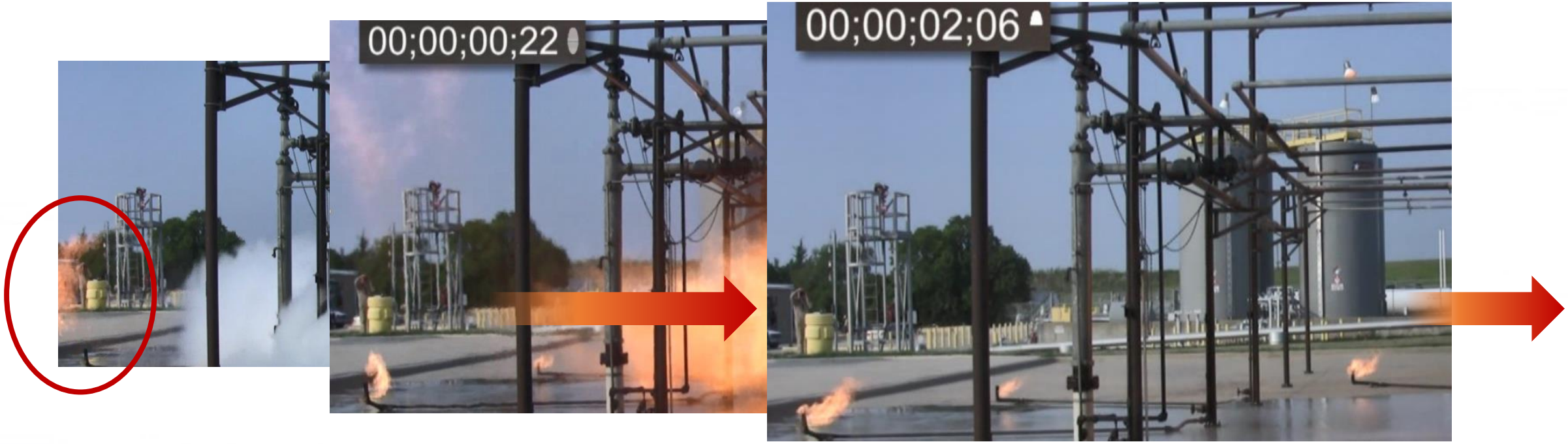
Be Educated About Standards

NFPA 2112-18 Annex A Explanatory Material

A.1.2.3 This standard is not designed to be utilized as a purchase specification. It is prepared, as far as practical, with regard to required performance, avoiding restriction of design wherever possible.

Purchasers should specify departmental requirements for such items as color, markings, closures, pockets, and trim patterns. Tests specified in this standard should not be deemed as defining or establishing performance levels for protection from all flash fire environments.

So how does it look in the real world?




WESTEX INC.

Be Cautious - Understanding ASTM F1930

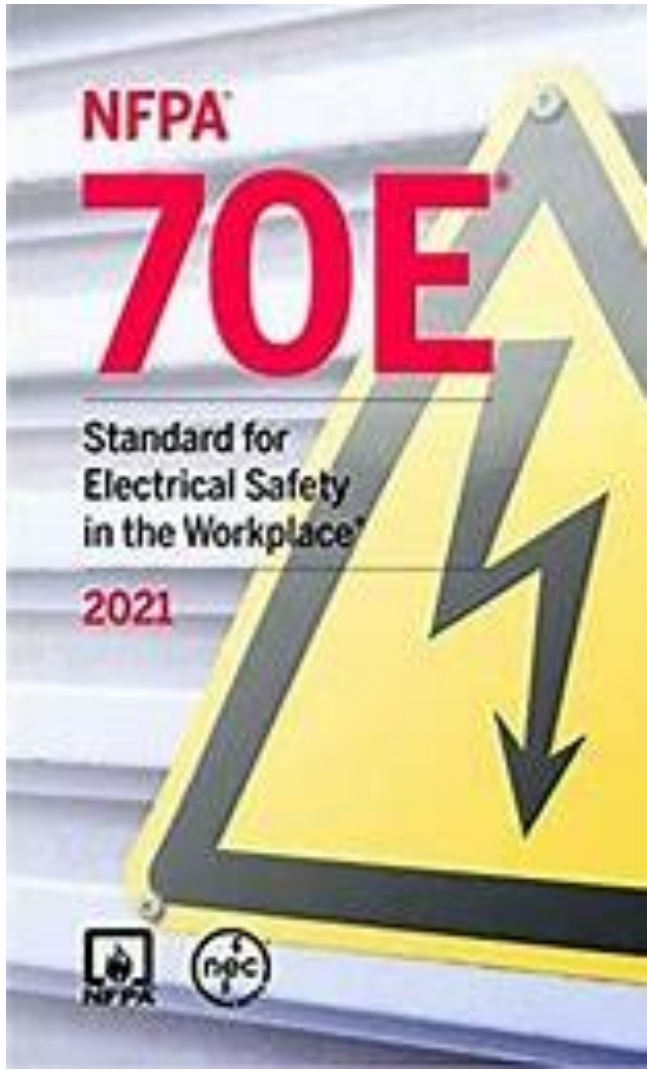
For illustrative purposes **ONLY** as we can't account for **ALL** variables lets look at a specific example which has the ignition source in front of the mannequin and the leak (source) behind and compare this to the laboratory environment.

Let's take two different test results for BB

32% and 14%

Which one is better?

Cotton will work just fine!



70E if followed will prevent this…

TEST PARAMETERS

Voltage= **480**

Amperage= **15.8/ kA**

Cycles= **6**

Distance= **18”**

Incident Energy

4.1 cal/cm^2

Clothing on mannequin:
Non-FR Henley and
Non-FR Jean

BULWARK.COM

Arc Flash Studies Tell an Electrician This…

We will just get FR/AR lab Coats for our techs

Lab Coats DO NOT meet the PPE Category requirements for NFPA70E

Table 130.5(G) Selection of Arc-Rated Clothing and Other PPE When the Incident Energy Analysis Method Is Used

Incident energy exposures equal to 1.2 cal/cm² up to 12 cal/cm²
Arc-rated clothing with an arc rating equal to or greater than the estimated incident energy[a]
Long-sleeve shirt and pants or coverall or arc flash suit (SR)
Arc-rated face shield and arc-rated balaclava or arc flash suit hood (SR)[b]
Arc-rated outerwear (e.g., jacket, parka, rainwear, hard hat liner) (AN)
Heavy-duty leather gloves, arc-rated gloves, or rubber insulating gloves with leather protectors (SR)[c]
Hard hat
Safety glasses or safety goggles (SR)
Hearing protection
Leather footwear
Incident energy exposures greater than 12 cal/cm²
Arc-rated clothing with an arc rating equal to or greater than the estimated incident energy[a]
Long-sleeve shirt and pants or coverall or arc flash suit (SR)
Arc-rated arc flash suit hood
Arc-rated outerwear (e.g., jacket, parka, rainwear, hard hat liner) (AN)
Arc-rated gloves or rubber insulating gloves with leather protectors (SR)[c]
Hard hat
Safety glasses or safety goggles (SR)
Hearing protection
Leather footwear

Inherent vs. Treated or how long will the FR last?

Originating more than 30 years ago the terms inherent and treated referred to single fiber types, so even if they are taken to be accurate in their original context, how can today's blends - be categorized as "inherent" or “treated”?

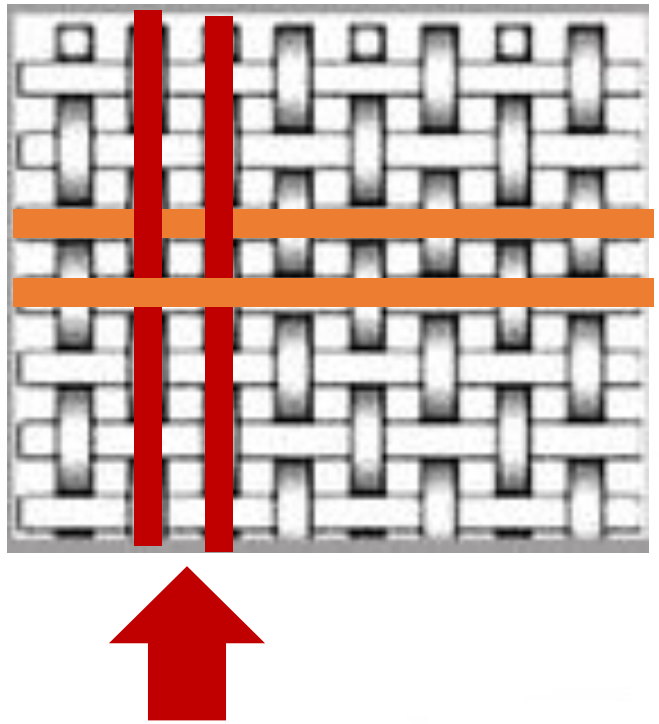
INHERENT	TREATED
Inherent fabrics tend to be aramid fabrics and fabrics where the flame-resistant properties are engineered into the fiber before the fabric is woven.	*Treated fabrics are typically cotton or cotton-based fabrics, which are engineered to be flame resistant after the fabric is woven.*

Common MISunderstanding of “The Terms”

INHERENT	TREATED
- Inherent - Better performance - How it is laundered doesnt matter	- Chemically dependent - Surface/topical treatment - Launderings affect FR properties

The State of FR Today

So, what do we call it? Inherent or treated?



Natural Fibers that may
or may not have FR properties:
Cotton, Rayon, Lyocell, Lenzing

Synthetic Fibers that may or may not have FR properties:
Kermel, Modacrylic, Aramid, Kevlar, Nylon

Updating the Definition - FR Engineering

FR/AR fabrics in common use today for arc flash and flash fire protection are **engineered** to have FR/AR properties. (FR/AR properties defined as the fabric will self-extinguish when the ignition source is removed)

There are 3 levels at which those FR/AR properties can be achieved:

- **The Molecular Level –** Synthetic derivatives are engineered at the molecular level to be FR (e.g., Nomex®, Kermel®, Twaron®, Kevlar®, etc.)

- **The Fiber Level –** At this level, flame retardant chemicals are added during fiber extrusion (e.g., FR Modacrylics, FR Rayons)

- **The Fabric Level –** Flammable fabrics are engineered at the fabric level through chemical and mechanical processes to permanently impart FR properties (e.g., FR Cotton, 88/12)

We will just put it on when we need it – Task-based vs. Daily Wear

Primary Protective Clothing

– Definition: “Clothing that is designed to be worn for work activities where significant exposure to molten substance splash, radiant heat, and flame is likely to occur.” Example- Firefighter Turnout Gear

Secondary Protective Clothing

– Definition: “Clothing that is designed for continuous wear in designated locations where intermittent exposure to molten substance splash, radiant heat, and flame is possible.” Example- Utility workers, Refinery workers

PPE is Your Last Line of Defense…

But it doesn’t work unless you are wearing it and wearing it correctly

BONUS….

It’s Ok to share PPE, face shields, flash suits, gloves …

NO!! Don’t Share your PPE

Arc Flash Kits are a huge concern

Virus can remain for days on different surfaces

Different surfaces need to be disinfected/sanitized differently

(you can have a lot of different surfaces – rubber, leather, poly carbonate, HD plastics etc.)

Virtually impossible to decontaminate PPE in the field

Do you need to have special processing for FR/AR clothing for COVID 19

How to destroy the Coronavirus

- **Time** - dry's out the virus and it becomes inactive
- **Sanitizers** – bleach, alcohol, etc. destroy the virus but not appropriate for all surfaces/applications and don’t remove the virus
- **Soap and water** – as effective or more effective than sanitizers and can be used on all surfaces, destroys and removes the virus

Thank You!

Questions & Discussion

Bulwark Protective Apparel

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