



5685 Utah Avenue So., Seattle, WA 98134
(206)762-7410 Fax (206)767-5728
www.Vinatronics.com



VINATRONICS TECHNICAL BRIEF: Fire Resistant (FR) High Visibility Apparel ANSI 107-2010 Requirements vs. NFPA 701, ASTM F1506, & 70E Arc Fabrics. Page 1 of 3

Introduction: For workers exposed to fire, flame, extreme heat, molten metals, chemical, electrical hazards, IN ADDITION TO Traffic Hazards, finding the right High Visibility Garment that includes appropriate “FR” protection is challenging. The Forward section of the ANSI 107-2010 acknowledges fluorescent dyes may be incompatible with some FR coatings used in National Fire Protection Association (NFPA) and American Society for Testing and Materials (ASTM) Fire and 70E Arc Resistant fabrics.

[The FR fabrics selected by Vinatronics for use in our High Visibility Apparel offer different levels of protection. Depending on the work environment, some are defined as “ANSI-Compliant”, and others as “ANSI-Style”. All are considered “Best Practices” for FR and ANSI combined performance High Visibility Apparel.](#) This Technical Brief is written to assist our Customers in understanding the relevant FR standards and in selecting, based on ANSI and FR Combined Performance differences, the right High Visibility FR Product for their work conditions.

Flame Resistant vs. Flame Retardant:

This Technical Brief references the BEST PRACTICES “FR” standards and tests by name. Supported by 3rd party FR test documentation, some of this FR Information was provided to Vinatronics by our Fabric and Reflective suppliers. As working definitions, Flame Resistant is commonly defined as fabric that is first woven, then a “FR” coating is applied. Flame Retardant is commonly defined when each thread receives a FR coating, the fabric is woven together, and a second FR coating is applied. Regardless of the method used, Garments are presented as Flame/Fire **Resistant** to meet one of 3 different levels of protection.

Flammable Fabrics Act 1610: The [Flammable Fabrics Act 1610](#) was written primarily for consumer clothing. One of the most common applications of this FR standard is primarily import children’s sleepwear and bedding. Although the FR coatings used may be the same, the level of FR Protection used in this standard may not appropriate for Industrial Applications

[Vinatronics has determined use of this 1610 FR fabric is inadequate for Industrial and Public Safety workers and will not be used in Vinatronics High Visibility Garments.](#) For information and comparison purposes only, the Flammable Fabrics Act 1610 test used for this FFA fabric is as follows:

The 16CFR 1610 Flammability Test Summary is defined as: “A butane flame applied to a 45 degree mounted fabric specimen for one (1) second to determine flashing. Five length and 5 width fabric specimens are tested in original condition. If the specimens did not ignite (DNI) the fabric is classified as Class 1, “Normal Flammability”.

National Fire Protection Association 701:

A higher level of FR protection used in many Industrial applications requiring Fabric FR Safety is the [National Fire Protection Association NFPA 701-2004](#). The NFPA 701 tests fabrics for a more difficult to pass vertical burn. This standard is the most common test in drapery. The “Vertical Flame Test” was viewed as sufficient FR protection in many work situations as well, therefore, this NFPA standard has been adopted for many Safety Vest and Safety Clothing Applications. Because all of our customers are either Industrial or Public Safety professionals, [Vinatronics uses NFPA 701-2012 compliant fabric as the minimum FR “Best Practices” fabric for our ANSI High Visibility “FR” Products.](#) Vinatronics products made of NFPA 701 fabrics are a good balance of FR Protection and ANSI High Visibility Protection, but are not rated for Arc. Product selection include ANSI Class 1, 2, and 3 High Visibility Apparel using NFPA 701 Summer weight Mesh, All-Season Breathable Polyesters, and Winter weight Water Repellent jacket Nylon/Polyesters. Products are designed for First Responders, Police, Fire and Emergency workers, as well as workers exposed to NON-high voltage electrical hazards, such as electrical, lighting and public utilities. Vinatronics High Visibility Apparel made with NFPA 701 fabrics are considered secondary protection, with the primary protection provided by “FR” shirts, pants, “Bunker Gear”, and/or underclothing as defined by an industry “Competent Person”. For an extra level of safety in High Risk or uncertain work environments, Vinatronics offers Velcro “Break-Away” Shoulders and Sides for fast removal in an emergency.

The NFPA 701-2004 Small Scale Flammability Test Summary is defined as: “A four inch 97 percent pure methane gas flame from a horizontal burner is applied to the center of the lower edge of a freely hanging 6 inch wide x 16 inch long fabric specimen for 45 seconds. Residual (flame) cannot exceed an average of two seconds. In addition, specimens are tested directly from a 30 minute oven time of 220 degrees. Ten (10) specimens cut in length direction are weighed originally and after testing to determine weight loss. Weight loss cannot exceed 40 percent.

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American Society for Testing and Materials (ASTM) F-1506 Standard:

[American Society for Testing and Materials \(ASTM\) Standards for Flame Resistant Wearing Apparel](#) were developed as a response to the Occupational Health and Safety Administration OSHA 1910.269. Over time, the ASTM has created in scientific terms, multiple standards, specifications and tests to define the meaning of “Flame Resistant Apparel” for Workers with high exposure to thermal and arc hazards. Specifically, the [“ASTM F 1506, Standard Performance Specification for Textile Material for Wearing Apparel Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards”](#) is most often specified by companies with Higher FR Exposures. [Vinatronics uses ASTM F-1506 compliant fabrics as the recommended FR Performance level for “Best Practices” for Higher Risk due to exposure to flame, heat or high voltage such as Petroleum, Metals, Utilities, and Fire Industries. When ASTM fabrics are used, a 2nd 70E arc rating defined as Arc Thermal Performance Value \(ATPV\) will be specified for each fabric used.](#)

ASTM F-1506 is the most common standard referenced for high voltage Electrical Workers, Welding Operations, activities exposed to direct flame such as Molten Metal Industries, Fire Service & Electrical Utilities where FR and High Visibility are both needed. Vinatronics Class 1, 2, and 3 High Visibility Apparel made with ASTM and 70E Arc Rated fabrics include FR Cotton, FR Acrylic Blend, Modified Acrylic, and Nomex® fabric Vests. For each fabric used, 70E Arc Thermal Performance Value is listed. For an extra level of safety in High Risk or uncertain work environments, Vinatronics offers select ASTM products with Velcro “Break-Away” Shoulders and Sides for fast removal in an emergency. **The ASTM F-1506 Standard Test Summary** is defined as: “Two basic requirements (1) A sample of fabric must self extinguish with 2 seconds or less after flame, and 6 seconds or less char length according to ASTM Test Method D6413; (2) The fabric must be tested for Arc Thermal Performance according to ASTM Test Method F1959”. For more on these specific tests, see the original ASTM documentation. Specific Arc Thermal Performance Value is then measured separately as HRC 1 (Less than ATPV 8), or HRC 2, (Greater than 8).

ANSI 107-2010 Class 1, 2, and 3 Vest Options using NFPA and ASTM Fabrics:

There have been improvements in fabric technology in recent years, however, the incompatibility of fluorescent dies and FR coatings requires OSHA designated Competent Persons make FR product judgement calls based on their work conditions. The selection of the right combination of ANSI 107-2004, NFPA 701 and/or ASTM F1506 “FR” and 70E arc protection will depend on whether Visibility or Fire /Arc danger are the Primary Hazard. [All “FR” fabrics used by Vinatronics are considered “Best Practices” specific to the NFPA- no arc rating, or ASTM & Arc rated work conditions. Work conditions are determined by the OSHA “Competent Person” on each job site.](#) The ANSI and FR fabric options are as follows:

NFPA 701, no Arc rating Fabric Options:

[Summer Weight NFPA 701 FR Mesh](#) is lightweight and cool for summer and for hot climates. The mesh allows free air flow, is cool, meets the NFPA 701 FR standard, but may not have the fluorescent brightness to meet ANSI. Vinatronics Summer weight FR Mesh Vests may be labeled as ANSI Compliant or ANSI-Style, allowing the combination of an ANSI vest design with NFPA -701 compliant FR MESH fabric for hot climates/conditions. This fabric is un-rated for Arc Thermal Performance Value (ATPV).

[All Season Breathable NFPA and ANSI FR Polyester](#) is a lightweight All-Season Knit Fabric that allows air flow in summer, and water to pass through in winter. The Knit Fabric stays cool and can be worn over summer weight shirts or winter jackets equally. The FR coating is more compatible with fluorescent dies, allowing All Season Breathable Polyester Products to meet both ANSI 107-2004 AND NFPA-701. Vinatronics then makes combined performance All Season Class 1, 2, and 3 “FR” products. This fabric is un-rated for Arc Thermal Performance Value (ATPV).

[Winter Water Repellent Coated FR Nylon/Polyester](#) is a heavier weight water repellent fabric used for winter vests and jackets. This fabric keeps you dry in both rain and snow. The FR outer shell is typically combined with FR polyester lining in spring and summer jackets, and with FR arctic quilt linings when used for winter jackets. Water Repellent FR Polyesters are compliant with both ANSI 107-2004 and NFPA -701. This fabric is un-rated for Arc Thermal Performance Value (ATPV).



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ASTM & 70E Arc Rated Fabric Options:

ASTM, NFPA Flame Resistant Cotton meets both ASTM F-1506 FR test requirements and 70E Arc specifications. 100% Vest Cotton will wear like Blue Jeans; a look and feel that appeals to many workers in Electrical, Utility, Metals and Construction Industries. Cotton FR T-Shirts will breath and feel similar to standard cotton. Cotton holds FR coatings well and was the only trusted FR and Arc rated fabric available for many years. As a result, many utilities, electrical, metals, and welding companies still specify these fabrics. Vinatronics products made with these Cotton fabrics are labeled as ASTM and 70E Arc Thermal Performance Value compliant as follows: FR Cotton (ATPV 9.4), FR T-Shirts (ATPV 11.0).

ANSI, ASTM FR Polyurethane & Acrylic Blends are high performance blend fabrics designed for Higher Risk Utility work conditions. The NEW T-shirt and NEW Vest blend fabrics is breathable but tough. Polyurethane coated, water repellent Blends are used for FR and Arc rated 3 season Utility Jackets. Both are High Performance FR fabrics and are priced accordingly. "FR" ANSI T-shirts and vests meet ASTM FR with a (ATPV) Arc Thermal Performance Value (ATPV8.1). "FR" Jackets meet ASTM with a (ATPV 8.7) arc rating.

ASTM, NFPA, and ANSI Compliant Modified Acrylic is protected by a U. S. Patent, and is designed to crinkle up and flake off when exposed to even small amounts of heat or flame. This fabric characteristic provides both high ASTM FR protection and ANSI visibility for utility workers at higher risk. Products are labeled as both ASTM "FR" and ANSI Compliant. As a caution, this same dual ANSI/ASTM high performance makes the fabric difficult to wash, as even small amounts of hot water or dryer heat will cause the products to begin to crinkle. While providing a high level of FR in a fluorescent fabric, this fabric is also high priced. Arc Thermal Performance Value (ATPV) is 5.5.

Dielectric Snaps, Velcro, Zippers

"Best Practices" in Vinatronics FR garments include Dielectric zippers, Dielectric snaps, FR Velcro, and Nomex® FR Zippers. On Vests, snaps and zippers are, at times, combined with FR Velcro "Break-Away" sides and shoulders for a extra level of safety. FR Velcro may also be used on the front closure to create "5 Point Break-Away" products used in some Utilities, and recommended in Public Safety. On select Arc Rated FR Winter Jackets, a combination of Dielectric zippers, Dielectric snaps, and FR Velcro are used.

Fire Resistant ASTM & NFPA 701 Reflective:

Vinatronics uses only genuine 3M Scotchlite Reflective Material for ALL our products. 3M Company provides updated 3rd party test documentation on all reflective. Specifically, the silver 3M™ Scotchlite™ Reflective Material is a fabric reflective that will hold the FR coatings needed to meet NFPA 701, ASTM 1506 and 70E Arc rating and is used exclusively on ALL Vinatronics FR garments. Silver FR reflective has a Arc Thermal Performance Value (ATPV) of 11.9, then the base fabrics used is what determines if garments are listed as NFPA and or ASTM and Arc, not the reflective. Vinyl reflective should not be used with either NFPA 701 or ASTM and 70E Arc Rated FR garments as vinyl will melt when exposed to heat.

NFPA, ASTM, and ANSI Labeling Why "Made in the USA" matters:

High Visibility Apparel must now have multiple Garment Labels to protect workers from misrepresentation. ANSI Labels will clearly show the garment as ANSI-Compliant or ANSI-Style. A second "FR" label will identify the fabric as NFPA and/or ASTM. ASTM labels will list the specific Arc Thermal Performance Value (ATPV) of the fabric. The wash labels are WARM wash LOW or NO heat drying to avoid compromising the FR coatings. The life expectancy of an ANSI/FR garment is six months or 25 washings in normal conditions. No FR garment should be used for more than one year to insure FR coating is adequate.

As a USA Manufacturer, Vinatronics believes the "Country of Origin" (Made in the USA) tag is one of the best ways to insure purchasing a properly produced "Best Practices" FR High Visibility ANSI Garment. Vinatronics has designed Pull-Overs, Vests, and Jackets to meet or exceed the "FR" "Best Practices needed by working men and women exposed to both FR and Traffic hazards. As with all safety product selections, the OSHA designated Competent Person in each end user organization has responsibility to determine the most appropriate FR High Visibility Apparel as part of the Employers Hazard Assessment and Worker Safety Plan. For more information, call us at 1-206-762-7410 for a complete catalogue including FR selections.

DISCLAIMER: This summary and appendix is provided for Vinatronics sales and customer service informational purposes only. Please refer to the original MUTCD, OSHA, ANSI, NFPA, and ASTM documents and all supporting Appendixes for complete information on compliance. As a technical summary, the completeness and/or accuracy of this information is neither expressed nor implied.