Westex

ShieldCXP™

Inadvertent Chemical Splash & Flame Resistant Fabric

Following the tragic 2008 laboratory accident and fatality at UCLA, many laboratories have since transitioned from a non-flame resistant (FR) poly/cotton lab coat to an FR lab coat. However, until ShieldCXP, there has not been a fabric that is both flame resistant and inadvertent chemical splash resistant. This has caused laboratory workers to have to choose protection for one hazard or the other, or to put on an additional layer of protection (typically a rubber apron) over top of their flame resistant garment when handling certain chemicals. Finally, there is a fabric available that combines flame resistance, inadvertent chemical splash resistance, and daily wear comfort.

Milliken is excited to announce that its team of innovators has developed a groundbreaking inadvertent chemical splash resistant technology that eliminates the need for the second layer of protection. Westex ShieldCXP™ fabric is made with DuPont™ Nomex® IIIA fibers and combines revolutionary chemical splash resistant technology with Milliken's patented SofTouch™ technology to provide an innovative fabric that is comfortable, breathable, flame resistant and inadvertent chemical resistant - all in one.

FLAME RESISTANCE

Flame resistance has been shown to be a significant factor when wearers are subject to potential flammable chemical hazards, such as in a laboratory environment.

NFPA 2112 Flash Fire Standard

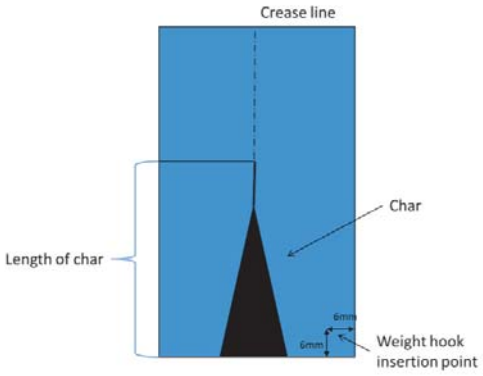
A flash fire is a short-duration rapidly moving flame front, which can be a combustion explosion. A flash fire may occur in an environment where fuel and air become mixed in adequate concentrations to combust. Flame resistant (FR) clothing will minimize burn injury and provide the worker a few seconds of escape time. Non-flame resistant clothing can ignite in a flash fire exposure, providing an additional fuel source and dramatically increasing the burn injury extent and severity well beyond that of the initial exposure. Two of the flammability requirements of the NFPA 2112 Flash Fire Standard are the NFPA D6413 Vertical Flame Test and the ASTM F1930 Instrumented Manikin Test.

ASTM D6413 Vertical Flame Test

The ASTM D6413 test requires a fabric to be subjected to a vertical flame for 12 seconds. Immediately following the 12 second vertical flame exposure, the charred area is put under a specific load to tear the fabric along the charred direction. Specifications for the NFPA 2112 Flash Fire Standard require for this length of char to be less than 4 inches.

Example of ASTM D6413 Test

Maximum Char length of 4 inches per NFPA 2112



The 4.5oz/yd^2 and the 6.0oz/yd^2 Westex ShieldCXP™ fabrics have an average char length of 2.4 inches.

ASTM F1930 Instrumented Manikin Test

Another flammability test that is required for the NFPA 2112 standard is ASTM F1930 (Standard Test Method for Evaluation of Flame Resistant Clothing for Protection Against Flash Fire Simulations Using an Instrumented Manikin). In this test method, fabric is sewn into a standard coverall and subjected to fire engulfment for 3 seconds. The manikin sensors determine total extent, severity and location of burn injury; 2nd and 3rd degree burn combined must be below 50% to pass.

Westex ShieldCXP™

	4.5 oz. fabrics	6.0 oz. fabrics	NFPA 2112 Spec
3 Second Burn	34%	20%	≤ 50%

(Lower number means 2nd & 3rd degree burns)

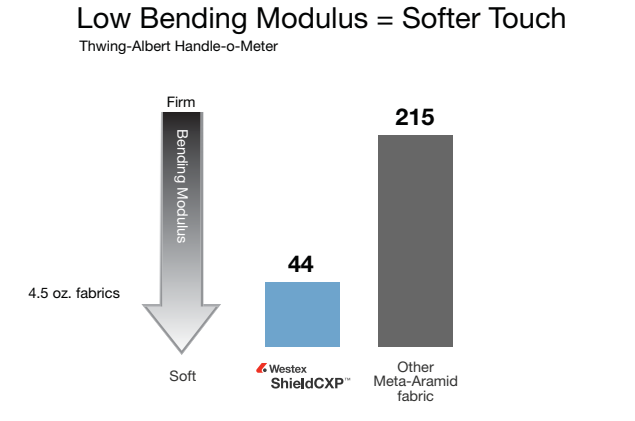
Source: N.C. State University

COMFORT

Comfort is subjective to the wearer, but typical areas of interest are the "feel" of the fabric and the ability of the fabric to maintain or release heat from the wearer (breathability). The stiffness of a fabric can be measured by several test methods or equipment. Comfort was evaluated for Westex ShieldCXP™ two different ways: the Thwing-Albert Handle-o-Meter and the ASTM D737 test method.

Thwing-Albert Handle-o-Meter

A Thwing-Albert Handle-o-Meter measures the bending modulus of a layer of fabric. The bending modulus is the measure of the tendency for a material to bend. Less bending modulus suggests more comfort for the wearer.



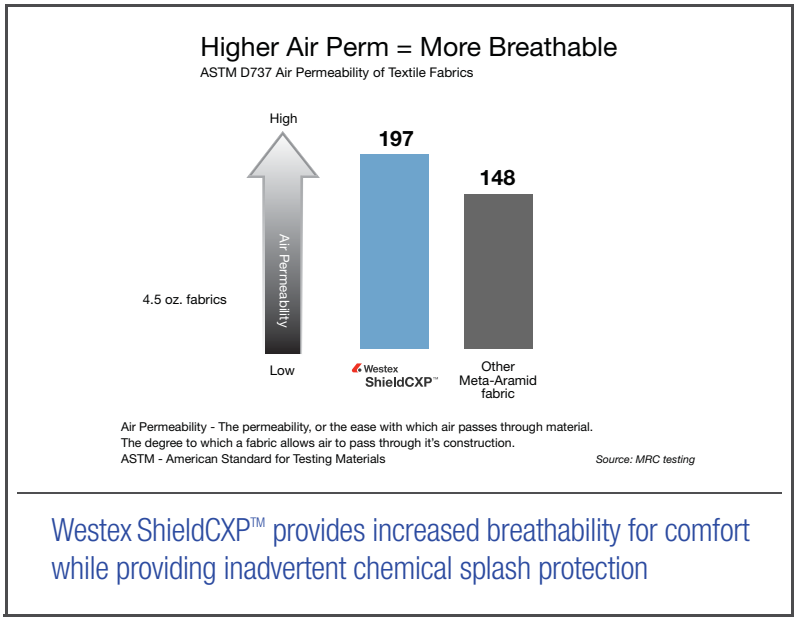
Sending Modulus - The measure of the tendency for a material to bend. Values reported as an average of warp and filling measurements.

Source: MRC testing

Westex ShieldCXP™ has a significantly lower rating indicating more comfort to the wearer

ASTM D737 Test Method

The ASTM D737 test method determines the ease with which air passes through a single layer of fabric and reports this value in cubic feet of air that can be pulled through the fabric per minute. This test indicates how "breathable" the fabric would be to a wearer. The patented SofTouchTM technology increases the air permeability of Westex ShieldCXP™ compared to other meta-aramid fabrics. The innovative Westex ShieldCXP™ fabric provides increased comfort while maintaining resistance to inadvertent chemical splashes.



Westex ShieldCXP™ provides increased breathability for comfort while providing inadvertent chemical splash protection

INADVERTENT CHEMICAL SPLASH RESISTANCE

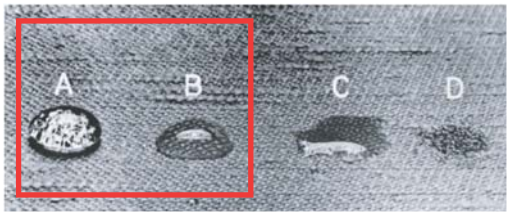
Inadvertent chemical splash resistance is necessary for workers that may be exposed to small quantities of liquid chemicals and/or solvents at atmospheric pressure. Westex ShieldCXP™ is designed to shed liquids following a splash from a wide variety of liquids, thus limiting wearer exposure. Personnel may come in contact with small amounts of chemicals in a very wide range of environments including, but not limited to, educational laboratories, light industrial, and service industries. The fabric is designed to shed these chemicals when they are dropped or splashed on the fabric and to resist wicking through the fabric to the wearer.

If wearers are exposed to large amounts of liquid chemicals, toxic or corrosive gases, and/or chemical mixtures under pressure, primary chemical protection is recommended. In order to protect against primary chemical hazards, as defined by ASTM F903, the garment must often be air-tight and non-breathable. Westex ShieldCXP™ is not designed for primary chemical protection.

AATCC 193 Test Method

A modified AATCC 193 test method is used to quantify the chemical splash resistance. The method uses an "A" through "D" rating scale to rate the interaction of water and water/alcohol mixtures with the fabric surface. In the test, the fabric is held on a flat surface and the test droplet is placed onto the fabric. An "A", "B", "C", or "D" rating is assigned after ten seconds. An "A" rating corresponds to no interaction with the fabric while a "D" rating designates complete wicking of the solvent across and through the fabric. Ratings "B" and "C" are intermediate designations. See the figure on the next page for examples of each rating.

"A" and "B" ratings indicate that the fabric would possess a resistance to penetration following inadvertent chemical splash.



There are countless liquid chemicals and combinations thereof that could be tested and rated according to the above method. A finite list of challenge chemicals were selected including those from the ASTM F1001-12 method. These challenge chemicals are designed to represent a broad range of chemical classes, hazards, and physical characteristics.

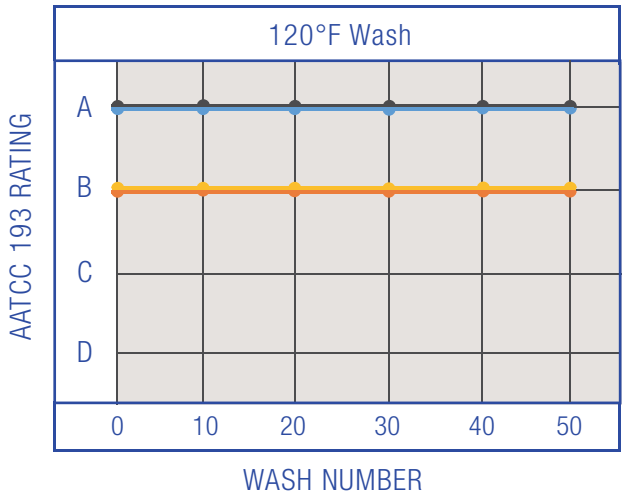
		Westex ShieldCXP™		Other FR Fabric**	65/35 Non-FR Fabric***
The following ratings were recorded:		**4.5oz/yd²**	**6oz/yd²**	**6oz/yd²**	**5.5oz/yd²**
Corrosive Liquids	98% Sulfuric Acid*	A	A	D	D
	37% Hydrochloric Acid	A	A	D	D
	40% Hydrofluoric Acid	A	A	D	D
	50% Sodium Hydroxide*	A	A	D	D
Strong Oxidizers & Corrosive Liquids	70% Nitric Acid	A	A	D	D
	Piranha Solution	B	B	D	D
	50% Hydrogen Peroxide	A	A	D	D
Polar Organic Solvents	Acetonitrile*	A	A	D	D
	Carbon Disulfide*	A	A	D	D
	Dimethylformamide*	A	A	D	D
	DMSO	A	A	D	D
	Nitrobenzene*	A	A	D	D
	Tetrachloroethylene*	A	B	D	D
	Methanol*	A	A	D	D
	Ethanol	B	A	D	D
	i-Propanol	A	A	D	D
Non-Polar Organic Solvents	n-Heptane	C	C	D	D
	n-Hexane*	D	D	D	D
	Acetone*	D	D	D	D
	Dichloromethane*	D	D	D	D
	Diethylamine*	D	D	D	D
	Tetrahydrofuran*	D	D	D	D
	Toluene*	D	D	D	D
	Ethyl Acetate*	D	D	D	D

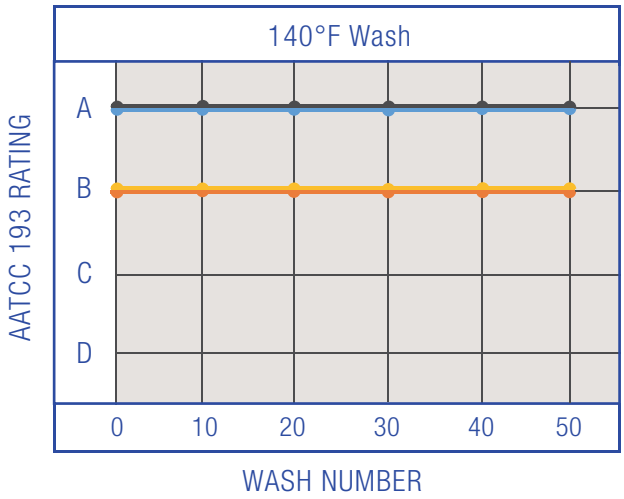
The fabric ratings in the above chart represent fabric as produced (without laundering)
** Included on ASTM F1001-12 list of liquid challenge chemicals* *** FR fabric tested was a commonly used FR fabric in lab coats*
****65% cotton/35% polyester fabric commonly used in non-flame resistant lab coats*

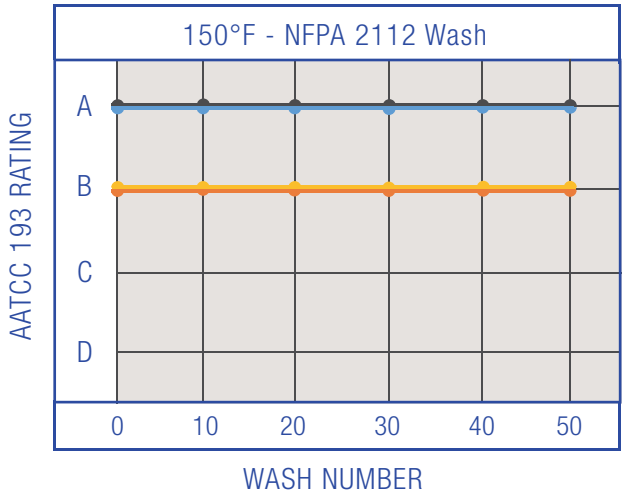
This list is intended to provide a basic guideline as to the capabilities of ShieldCXP fabric. Decisions regarding resistance of the fabric towards a certain chemical or chemical combination, it is recommended that a challenge droplet be applied to the fabric and rated according to the AATCC 193 test method in a controlled manner before the fabric is used as PPE.

Inadvertent Chemical Splash Resistant through 50 Industrial Launderings

Using the modified AATCC 193 test methodology with a limited challenge set composed of water, ethanol, DMSO, and acetonitrile, laundering was performed using 120°F, 140°F, and NFPA 2112 150°F methods and samples were withdrawn every 10 launderings. When subjected to laundering at various temperatures and methods there is little to no degradation in performance up to 50 launderings. The performance of the fabric relies on proper laundering. Care and maintenance laundering guidelines are available at www.Milliken.com/ShieldCXP. It is important to note that chemical exposure may affect future chemical and flame resistant properties. Careful consideration should be taken to replace the effected garment in accordance with the user's standard safety protocol.

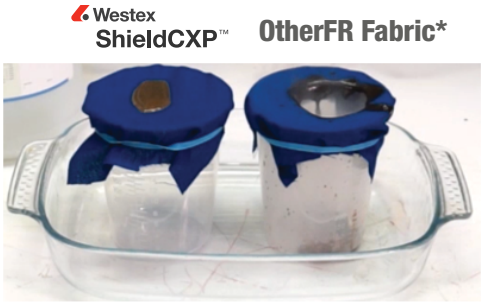




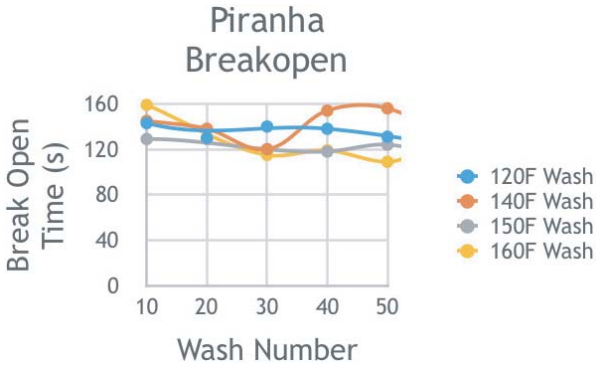


Corrosive and Oxidizing Solvent Combinations

In addition to resistance to the solvents and mixtures in the above chart, it has been found that ShieldCXP is also resistant to corrosive and oxidizing solvent combinations. One particularly dramatic example is piranha solution (a 3:1 mixture of 98% sulfuric acid: 30% hydrogen peroxide). This extremely oxidizing mixture is known to rapidly consume organic matter and presents a significant hazard. Despite its hazardous nature, it is a common mixture used in both academic and industrial laboratories. A test was created to quantify the resistance against the penetration of this mixture. A fabric swatch was spread across the lid of beaker to create a concave surface. A freshly prepared piranha mixture was poured onto the fabric surface. The time to penetration of this mixture through the fabric substrate was recorded in seconds. Other Meta-Aramid laboratory coat FR fabric displays less than 2 seconds resistance whereas the Westex ShieldCXP™ resists penetration for over 100 seconds. Resistance to the piranha mixture was also evaluated through laundering. Westex ShieldCXP™ maintained a greater than one minute resistance through 50 industrial launderings.



**FR fabric tested was a commonly used FR fabric in lab coats*



Additional Chemicals

The challenge chemicals in this document are designed to represent a broad range of chemical classes, hazards, and physical characteristics and although they have been tested, do not represent a complete list of chemicals that are used in a laboratory environment. In the event that questions arise regarding the resistance of the fabric towards a certain chemical or chemical combination, it is recommended that a challenge droplet be applied to the fabric and rated according to the AATCC 193 test method in a controlled manner before the fabric is used as PPE.

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