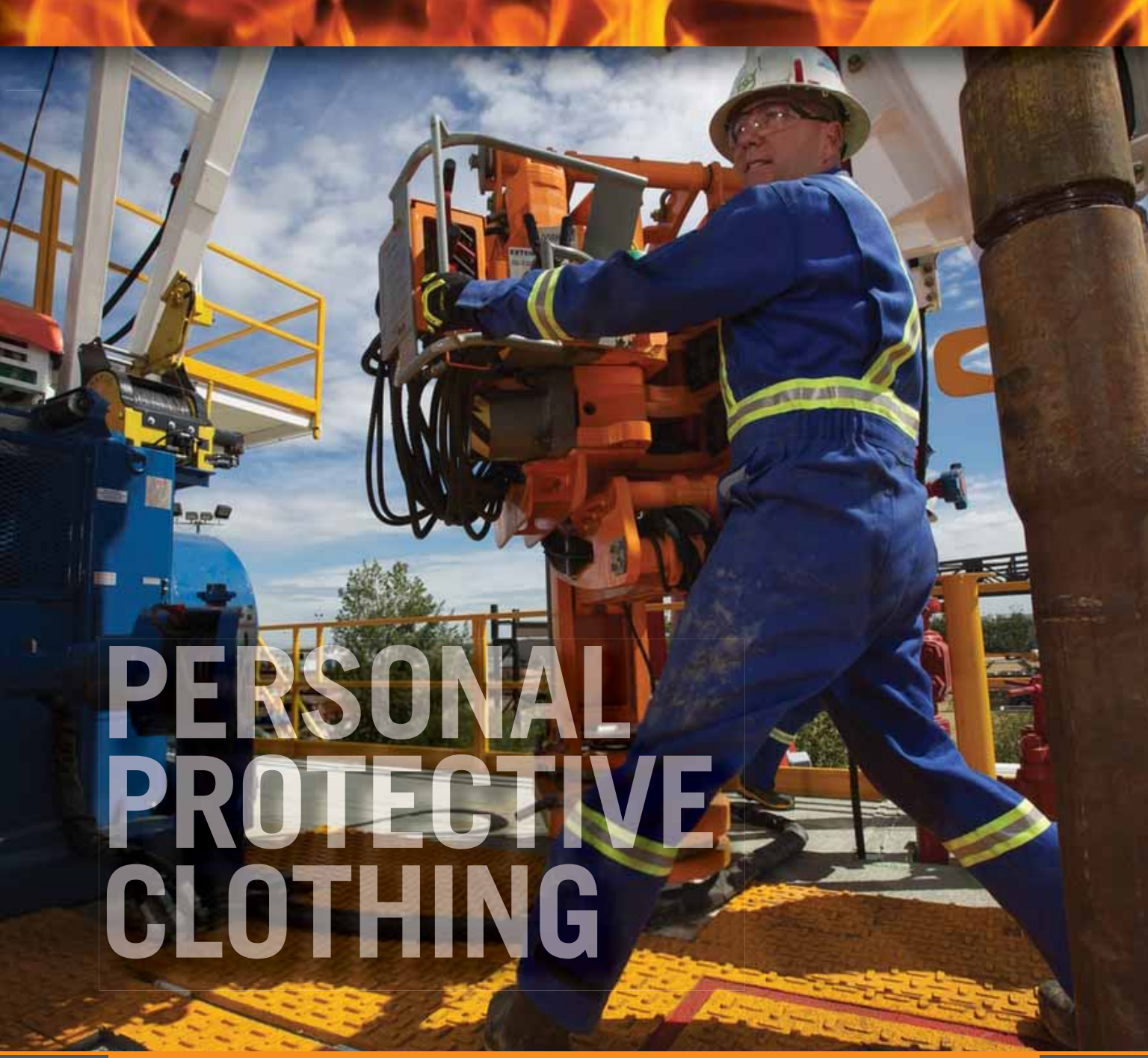

PERSONAL PROTECTIVE CLOTHING

FLAME RESISTANT

Mark's COMMERCIAL | WHERE SAFETY WORKS

The importance of flame resistant clothing.

Personal protective clothing (PPC) and personal protective equipment (PPE) are important factors in protecting workers in many occupations and environments. Personal protective clothing is considered to be a worker's last line of defence in most situations involving flame hazards. Although it may be the last line of defence, a worker must wear their PPC for long periods of time and perform many different jobs while wearing it. PPC must not only protect workers, but keep them comfortable as well.

Mark's Commercial carries the brands that are known and respected in the industry. The following pages are just a few of the styles we carry. Consult with your client service representative for the styles that will work for your company.

Mark's COMMERCIAL

BulwarkFR

iQ SERIES®

Introducing the new iQ Series® Endurance Collection.

The iQ Series® Endurance Collection is a line of durable FR without the tradeoffs and compromises traditionally associated with durability. iQ's revolutionary dual element protection penetrates FR chemistry deep into the fiber of the fabric without adding weight, while the addition of polyester improves strength, resistance to tearing, and overall durability.

iQ SERIES®

SHORT SLEEVE POLO

Exclusively with Westex G2™ fabrics by Milliken®. Flame-resistant, 5.3 oz. FR cotton / 25% polyester / 6% poloxadiazole knit fabric. Zipper front placket. Raglan sleeves.Dyed to match concealed rib knit cuffs.Chest pocket. Fabric is moisture wicking and breathable.
SAFETY & COMPLIANCE INFORMATION:
Compliant to CSA Z462, NFPA 70E and NFPA 2112. Arc Rating: 8.2 cal./cm^2. Cat 2.

COLOURS:
Black, Blue, Dark Blue, Red, Charcoal
SIZES: S-4XL
STYLE: QT10

iQ SERIES®

SHORT SLEEVE TEE

Exclusively with Westex G2™ fabrics by Milliken®.
5.3 oz. 69% FR cotton / 25% polyester / 6% polyoxadiazole knit fabric. Dyed to match rib knit collar. Raglan sleeves. Dyed to match concealed rib knit cuffs. Chest pocket. Fabric is moisture wicking and breathable.
SAFETY & COMPLIANCE INFORMATION: Compliant to CSA Z463, NFPA 70E, NFPA 2112. Arc Rating: 8.2 cal./cm^2. Cat 2.

COLOURS: Black, Dark Blue, Red, Blue, Charcoal
SIZES: S-4XL **STYLE:** QT30

iQ SERIES®

MEN'S LONG SLEEVE PATCH POCKET SHIRT

Exclusively with Westex G2™ fabrics by Milliken®. 5.7 oz. 88% Lyocell/12% polyester twill fabric. Banded, topstitched collar with red trim at neck seam. Topstitched cuffs with two-button adjustable closures. Tailored sleeve placket. Hemmed front placket with button closure. Patch chest pockets with concealed pocket at right. Napoleon pocket at left front. Stretch woven mobility panel at back armhole. Full sideseam gusset.

SAFETY & COMPLIANCE INFORMATION:
Complaint to CSA Z462, NFPA 70E, NFPA 2112.
Arc Rating: 6.3 cal./cm². Cat 1.

COLOURS: Charcoal **SIZES:** S-4XL, L-3XL Long
STYLE: QS30

iQ SERIES®

WOMEN'S LONG SLEEVE SHIRT

Exclusively with Westex G2™ fabrics by Milliken®. 5.7 oz. 88% lyocell / 12% polyester twill fabric. Banded, topstitched collar with red trim at neck seam. Topstitched cuffs with button closures. Tailored sleeve placket. Hemmed front placket with button closure. Concealed sleeve pockets with concealed closure on left. Princess seams at front body for feminine fit. Stretch woven mobility panel at back armhole. Full sideseam gusset.

SAFETY & COMPLIANCE INFORMATION:
Compliant to CSA Z462, NFPA 70E, NFPA 2112. Arc Rating 6.3 cal./cm². Cat 1.

COLOURS: Light Blue
SIZES: XS-2XL
STYLE: QS31

FR NOTE

FR clothing must be washed as directed on the label. Using fabric softener and some bleaches can compromise the FR properties of fabrics - both inherent and treated.

Black Blue Dark Blue

iQ SERIES®

LONG SLEEVE HENLEY

Exclusively with Westex G2™ fabrics by Milliken®. 5.3 oz. 69% FR Cotton/ 25% polyester / 6% polyoxadiazole knit fabric. Four-button placket. Dyed to match rib knit henley collar. Raglan sleeves. Dyed to match concealed rib knit cuffs. Chest pocket. Fabric is moisture wicking and breathable.

SAFETY & COMPLIANCE INFORMATION:
Compliant to CSA Z462, NFPA 70E, NFPA 2112. Arc Rating 8.2 cal./cm². Cat 2.

COLOURS: Blue, Red, Dark Blue, Black, Khaki, Charcoal
SIZES: S-4XL
STYLE: QT20

iQ SERIES®

MEN'S COMFORT KNIT CSA TEE

Westex G2™ fabrics by Milliken®. 5.3 oz. 69% FR cotton / 25% polyester / 6% polyoxadlazole knit fabric. Full underarm gussets. Concealed front pocket with pencil stall. Hidden rib knit cuffs. Moisture wicking, highly breathable fabric.

SAFETY & COMPLIANCE INFORMATION:
Compliant to CSA Z462, NFPA 70E, NFPA 2112.
Arc rating: 8.2 cal/cm². Cat 2. CSA Z96 Class 2, Level 2.

COLOURS: Orange
SIZES: S-4XL Reg., L-3XL Long
STYLE: QT34

Front

Back

More people wear Bulwark® than any other FR brand.

Bulwark is the only FR brand that brings 45 years of front line experience, understanding and insight to the table. That outfits you with the finest, most advanced and intuitively designed FR apparel ever made. So when you see our triangle on your left, trust you've done everything right. Because with Bulwark, you are more than just protected. You. Are. Armed. Literally, and figuratively, with the world's best.

7 oz. ULTRA SOFT® COVERALL w/CSA COMPLIANT REFLECTIVE TRIM

7 oz. 88% cotton / 12% nylon twill fabric. Mandarin, stand-up, two-way safety collar. Deep pleated action-back. Two-way concealed Nomex® taped brass breakaway zipper, concealed snap at top of zipper and at neck. Topstitched patch chest pockets with flaps and concealed snap closures.
Two topstitched and lined inset lower front pockets, side vent openings with snaps. Two patch hip pockets w/single concealed snap closures. One left sleeve patch pocket with pencil stall, one piece rule pocket on right leg. Elastic waist inserts. 360° visibility with 3M™ 2" #8940 silver reflective tape.
SAFETY & COMPLIANCE INFORMATION: Compliant to CSA Z462, NFPA 70E, NFPA 2112. Arc Rating: 8.7 cal/cm². Cat 2. CSA Z96 Class 3, Level 2.
COLOUR: Orange **SIZES:**
STYLE: CTBBOR

9 OZ. EXCEL FR® COMFORTOUCH® CARGO POCKET WORK PANT

Westex Ultrasoft® 9oz. 88% FR cotton / 12% nylon twill fabric. Interlined waistband with hook-and-bar closure. Two slack style front pockets. Two set in hip pockets, left hip pocket with button closure. Cargo pocket on each leg.
SAFETY & COMPLIANCE INFORMATION: Compliant to CSA Z462, NFPA 70E, NFPA 2112. Arc Rating: 12 cal/cm². Cat 2.
COLOURS: Navy **SIZES:** 28"-52" waist
STYLE: PLC2

DRESS UNIFORM SHIRT w/CSA REFLECTIVE TRIM

EXCEL FR® ComforTouch® 6 oz. 88% FR cotton / 12% nylon twill fabric. Banded, topstitched collar. Two chest pockets with button flap closures and sewn-in pencil stall. Placket front with button closure. Topstitched cuff with button closure. Tailored sleeve plackets. 360° visibility with front and back 2" flame resistant silver reflective striping.
SAFETY & COMPLIANCE INFORMATION: Compliant to CSA Z462, NFPA 70E. Arc Rating: 8.7 cal/cm². Cat 2. CSA Z96 Class 2, Level 2.
COLOURS: Orange **SIZES:** S-3XL, L-2XL Long
STYLE: SLUS

DELUXE INSULATED BIB OVERALL w/REFLECTIVE TRIM

Shell: Westex Ultrasoft® 7 oz. 88% FR cotton / 12% nylon twill fabric with water-repellent finish. Lining: 100% FR cotton. Insulation Package: 12 oz. 100% modacrylic. Two-way, extra heavy-duty, Nomex® taped, brass zipper front with concealed flap. Elasticized shoulder straps with non-conductive adjustable hardware. Five large patch pockets. Hip pocket with closure. Reinforced double knees. Full, Nomex® taped, ankle-to-hip brass zippers, concealed snap closure. Elastic waist inserts. Inside zipper guards on all zippers.
SAFETY & COMPLIANCE INFORMATION: Compliant to CSA Z462 & NFPA 70E. Arc Rating: 34 cal/cm². Cat 3.

COLOUR: Orange **SIZES:** S-3XL **STYLE:** BLCSOR

DELUXE EXCEL FR® COMFORTOUCH® PARKA w/CSA COMPLIANT REFLECTIVE TRIM

Westex Ultrasoft® 7 oz. 88% FR cotton/ 12% nylon twill shell fabric with water-repellent finish. 100% FR cotton lining. 12 oz.100% modacrylic insulation. Two-way, separating, heavy-duty Nomex® taped, brass zipper, fully covered with insulated storm flap, concealed snap closure. Fully insulated stand-up collar. Knit storm cuffs with hook-and-loop suppression tabs. Three large patch pockets with concealed snaps (lower pocket with handwarmers), one inside chest pocket, sleeve pocket. Deep-pleated action back. Elastic inserts at waist across back. Internal snow belt. Accommodates snap-on hood HLH2RB, sold separately. 360° visibility with front and back 2" silver reflective striping.
SAFETY & COMPLIANCE INFORMATION: Compliant to CSA Z462, NFPA 70E and NFPA 2112. Arc Rating: 34 cal/cm². Cat 3. CSA Z96 Class 2, Level 2.

COLOUR: Orange **SIZES:** S-4XL **STYLE:** JLPS

DAKOTA FR

FLAME RESISTANT

Dakota FR is designed for functionality and value.
Each feature has been carefully selected and designed to provide
the wearer with a practical, long-lasting garment
that meets stringent North American FR standards.

DAKOTA FR FLAME RESISTANT

FR 9oz. TWILL CARGO COVERALL w/CSA REFLECTIVE TAPE

9 oz., 88% FR cotton/12% nylon flame resistant twill fabric. Generous fit for comfort and mobility. Tunnel style stand up, 2-way safety collar with Velcro® closure and inside locker loop. Action back. 4-needle lined waistband with concealed snap closure. Elasticized side inserts for improved fit. Leg opening fits over boots for easy on-off. Double stitched main seams and bartacked at points of stress. Inner and outer plackets conceal 2-way Nomex® taped brass YKK® breakaway front zipper. Velcro® closures at top of front zipper. 2 patch chest pockets with flaps and concealed snap closures with pencil stall. 2 front swing pockets with extra heavy double-lined 100% FR cotton pocket bags. Velcro® close side pass through vents for access to pant pockets. 2 stall pencil/tool pocket on left sleeve. 2 large back patch pockets. Expandable cargo pockets with Velcro® close flaps on left and right legs. Velcro® adjustable sleeve cuffs. 360° visibility with RT80 flame resistant industrial wash reflective tape featuring 3M™ Reflective material 9740 silver trim. All seams sewn with inherently flame-resistant spun Nomex® thread.

SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1506, NFPA 70E and CSA Z462. NFPA 70E & CSA Z462. Arc Rating: 14 cal/cm². Cat 2. CSA Z96 Class 1, Level FR.

COLOURS: Royal Blue, Black **SIZES:** M-3XL, Reg. & Tall **STYLE:** 1AACDK-FR9TU2

FR NOTE

The two North American flash fire standards, Canadian CGSB 155.20 and American NFPA 2112 are similar in many ways with the bench-scale tests measuring the same properties but with slightly different test methods.

See page 24 for additional information.

DAKOTA FR FLAME RESISTANT

9oz. AMPLITUDE DELUXE COVERALL w/CSA REFLECTIVE TAPE

9 oz. Amplitude® FR (88% FR cotton / 12% nylon) fabric. Two-way break-away brass zipper w/Nomex® zipper tape. FR mesh gas monitor pocket. Adjustable hook-and-loop closures at collar, sleeve cuffs and ankles. Pass-through vents with with hook-and-loop closures. Multiple tool and utility pockets. Elastic inserts at waist.

SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1506, NFPA 70E and CSA Z462. NFPA 70E & CSA Z462. Arc Rating: 12 cal/cm². Cat 2. CSA Z96 Class 1, Level FR.

COLOURS: Royal Blue, Red
SIZES: XS-5XL Reg. & MT-4XLT Tall
STYLE: 1AACDK-FR9AU1

FR 9oz. TWILL CONTRACTOR COVERALL w/REFLECTIVE TAPE

9 oz. 88% FR cotton/12% nylon blend twill fabric. Generous fit for comfort and mobility. Tunnel style stand up, 2-way safety collar with Velcro® closure and inside locker loop. Action back. 4-needle lined waistband with concealed snap closure. Elasticized side inserts for improved fit. Leg opening fits over boots for easy on-off. Double stitched main seams and bartacked at points of stress. Inner and outer plackets conceal 2-way Nomex® taped brass YKK® breakaway front zipper. Velcro® closures at top of front zipper.
2 chest patch pockets, one with pencil stall.
2 large lower front patch pockets. Velcro®-close side pass-through vents for access to pant pockets.
2-stall pencil/tool pocket on left sleeve.
2 large back patch pockets. Tool pocket on right leg.
Velcro® adjustable sleeve cuffs. 360° visibility with RT80 flame resistant industrial wash reflective tape. All seams sewn with inherently flame-resistant spun Nomex® thread.
SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1506, NFPA 70E & CSA Z462.
Arc Rating: 14 cal/cm^2. Cat 2.

COLOURS: Royal Blue, Black
SIZES: M-3XL, Reg. & Tall
STYLE: 1AACDK-FR9TU1

FR RAIN JACKET

14.5 oz. Nomex® IIIA fabric coated w/FR neoprene (78% neoprene/22% Nomex® IIIA) that protects from flash fire, electric arc and chemical splash hazards. Made from 100% non-conductive materials for superior strength, abrasion and puncture resistance. Waist length jacket w/set-in sleeves, tunnel style stand-up collar w/snap closure, elasticized back waistband. Two needle full felled seam construction w/100% waterproof seam. Storm flap front w/non-conductive YKK® zipper and 7 hidden snap closure. FR Velcro® wrist adjusters. Large lower-front pockets w/Velcro® close flaps. Generous sizing. 2" 3M™ Scotchlite™ Retroreflective material. 360° visibility: two vertical stripes on chest, "X" on back, encircling arms.
SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F2733. ASTM F1891, NFPA 70E, CSA Z462.
Arc Rating: 28 cal/cm². Cat 3.

COLOURS: Black **SIZES:** S-3XL **STYLE:** 1AALDK-FRWJU1

FULL ZIP JACKET

10 oz. 50% Nomex®/30% wool/ 17% viscose/ 3% antistatic high pile knit fabric. Features detachable hood, ribbed Nomex® sleeve cuffs, YKK zipper, Nomex® draw cord.
SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F1506. NFPA 70E. CSA Z462. Arc Rating: 20 cal/cm². Cat 2.

COLOUR: Blue **SIZES:** S-2XL
STYLE: 6BSFDKASFRRJKT

THERMAL HIGH PILE PULLOVER

10 oz. 50% Nomex®/30% wool/17% viscose/3% antistatic high pile knit fabric. Detachable hood, ribbed Nomex® sleeve cuffs, Nomex® draw cord.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F1506. NFPA 70E. CSA Z462. Arc Rating: 20 cal/cm². Cat 2.

COLOUR: Blue **SIZES:** S-2XL
STYLE: 6BSFDKASFRRPUL

MERINO WOOL SHIRT

4.4 oz. 50% merino wool/50% viscose knit fabric. Lightweight & breathable; features the thermal control & odour resistant benefits of merino wool.
SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F1506. CSA Z462. NFPA 70E. Can be worn alone as a protective layer in areas requiring Cat 1 protection. Arc Rating: 4.7 cal/cm². Cat 1.
COLOUR: Grey **SIZES:** S-2XL
STYLE: 6BSFDKASFRYTOP

THERMAL HIGH PILE PANT

10 oz. 50% Nomex®/ 30% wool /17% viscose/ 3% antistatic high pile knit fabric. Ribbed Nomex® pant cuffs and encased elastic waistband.
SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F1506. NFPA 70E. CSA Z462. Arc Rating: 20 cal/cm². Cat 2.
COLOUR: Blue
SIZES: S-2XL
STYLE: 6BSSGDKASFRRPNTT

THERMAL HIGH PILE COWL NECK

50% Nomex®/30% wool / 17% viscose/3% antistatic high pile knit fabric. Features a contoured neck opening to fit comfortably under a jacket.
SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F1506. NFPA 70E.CSA Z462.Arc Rating: 20 cal/cm². Cat 2.
COLOUR: Blue **SIZES:** One Size
STYLE: 6CTEDKASFRRCOWL

MERINO WOOL PANT

4.4 oz. 50% merino wool/ 50% viscose knit fabric. Lightweight & breathable; features the thermal control & odour resistant benefits of merino wool.
SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F1506. NFPA 70E. CSA Z462. Can be worn alone as a protective layer in areas requiring Cat 1 protection. Arc Rating: 4.7 cal/cm². Cat 1.
COLOUR: Grey
SIZES: M-2XL
STYLE: 6BSGDKASFRYPNT

FR RAIN HOOD

Made from the same material as the FR Rain jacket and pants. Designed to snap on to jacket (left). Three piece design, drawcord with barrel lock adjusters.
SAFETY & COMPLIANCE INFORMATION: ASTM F2733. ASTM F1891, NFPA 70E & CSA Z462. Arc Rating: 28 cal/cm². Cat 3.

COLOURS: Black
SIZES: One Size
STYLE: 1AALDK-FRWHU1

DAKOTA FR FLAME RESISTANT

FR RAIN PANTS

14.5 oz. Nomex® IIIA fabric coated w/FR neoprene (78% neoprene/22% Nomex® IIIA) that protects from flash fire, electric arc and chemical splash hazards. Made from 100% non-conductive materials for superior strength, abrasion and puncture resistance. Features self-fabric and elastic suspenders w/quick release buckles, adjustable Velcro® leg cuff straps. Adjustable FR Velcro® side straps and 15" leg zippers. Inner/outer plackets protect non-conductive YKK® leg zipper. 2" 3M™ Scotchlite™ Retro reflective material. 360° visibility; reflective material encircles legs.
SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F2733. ASTM F1891, CSA Z462 & NFPA 70E. Arc Rating: 28 cal/cm². Cat 3.
COLOURS: Black **SIZES:** S-3XL
STYLE: 1AALDK-FRWBU1

carhartt FR

FLAME-RESISTANT FORCE COTTON HYBRID SHIRT

Original fit. 6.75 oz. 100% FR cotton jersey knit fabric. Carhartt Force® fights odor and its Fast-Dry® technology wicks away sweat for comfort. Button-down collar with button closure. FR melamine buttons throughout. Two chest pockets with button closure. Triple-stitched main seams. Side-seamed construction minimizes twisting. Extended sleeve plackets with two-button adjustable cuffs. Carhartt FR label sewn on left pocket.

SAFETY & COMPLIANCE INFORMATION: Compliant to NFPA 2112, CSA Z462 & NFPA 70E. Arc Rating: 8.9 cal/cm^2. Cat 2.

COLOURS: Dark Navy, Khaki

SIZES: S-4XL Reg., M-4XLT Tall

STYLE: 101698-410, 101698-250

250
Khaki

410
Dark Navy

250
Khaki

051
White

410
Dk. Navy

465
Med. Blue

Our flame-resistant clothing

If exposed to electric arc flashes or flash fires, clothing made from most untreated (e.g., non-FR) fibers will continue to burn once ignited. In contrast, Carhartt FR clothing is specially designed to self-extinguish within two seconds after the source of ignition is removed-thereby limiting the worker's degree of burns, and body burn percentage. FR fabrics are not flame proof; however, they are specially designed to be flame-resistant.

Carhartt FR clothing is clearly identified on the outside with a "Carhartt FR" label in place of the traditional Carhartt label. Additionally, all Carhartt FR clothes have external PPE CAT rating tags - making it easy for supervisors and safety officers to see if workers are in compliance with regulations (not all FR clothing is so labeled). ATPV/EBT values are shown on inside labels. In addition, product hangtags also distinguish Carhartt FR clothing. Garments that meet UL Classification for NFPA 2112 have a label sewn inside.

carhartt FR

FLAME-RESISTANT FULL SWING™ QUICK DUCK® COAT

8.5 oz. FR Quick Duck® 88% FR cotton/12% nylon with Rain Defender® durable water repellent. 20% lighter but just as warmas heavier outerwear. Insulated with 150g 3M™ Thinsulate™ Platinum Insulation FR. Mighty back™ bi-swing between shoulders for instant recovery. Flex Elbow™ for less restriction. Freedom Gusset™ under the arms. Stand-up collar with flap to cover hidden snaps for detachable optional hood (102183).Two chest pockets with flaps and hidden snap closures. Two lower front pockets with snap closures. Left sleeve upper arm pocket. Two inside patch pockets with FR hook-and-loop closures. Brass zipper front with Nomex® FR zipper-tape plus inside and outside protective flaps and snap closure for electric-arc protection. Nomex® FR inside waist adjustable draw cord. Internal rib knit storm cuffs with ergonomic shaped sleeve hem. Inside pocket with hook-and-loop closure. Triple-stitched main seams. Back length: Large regular 30", Large Tall 32".
SAFETY & COMPLIANCE INFORMATION: NFPA 70E. Compliant to NFPA 2112, CSA Z462 & NFPA 70E. Arc Rating: 36 cal/cm^2. Cat 3.
COLOURS: Dark Navy **SIZES:** S-4XL Reg., L-3XL Tall
STYLE: 102182-410

carhartt FR

FLAME-RESISTANT FORCE® COTTON LONG-SLEEVE T-SHIRT

Original fit. 6.75 oz. 100% FRcotton jersey knit. Carhartt Force® fights odor and it's FastDry® technology wicks away sweat for comfort. Rib-knit crewneck collar and cuffs. Left-chest pocket. Side-seamed construction. minimizes twisting.
SAFETY & COMPLIANCE INFORMATION: Compliant to NFPA 2112. CSA Z462 & NFPA 70E. Arc Rating: 8.9 cal/cm^2. Cat 2.

COLOURS: Dark Navy, Light Gray, Khaki, Medium Blue, Dark Crimson
SIZES: S-4XL Reg., M-3XL Tall
STYLE: 100235-410, 100235-051, 100235-250, 100235-465, 100235-608

carhartt FR

FLAME-RESISTANT WASHED DUCK WORK DUNGAREE

11 oz. 88% FR cotton/12% nylon duck fabric. Loose original fit sits at the waist. Full seat and thigh. Garment washed for soft finish. Arc-resistant button closure at waist. Brass zipper fly with Nomex® FR zipper tape. Left-leg utility band. Triple-stitched main seams. Straight leg opening.

SAFETY & COMPLIANCE INFORMATION:
Compliant to NFPA 2112. CSA Z462 & NFPA 70E. Arc Rating 15 cal/cm². Cat 2.

COLOURS: Dark Navy, Mid-Brown, Black
SIZES: 30-54" waist, 30-36" inseam
STYLE: 100791-410, 100791-246, 100791-001

FR NOTE

Flame-resistant (FR) fabrics and garments are intended to resist ignition, and to self-extinguish upon removal of the ignition source.

Non-FR work apparel will ignite and continue to burn if exposed to an ignition source such as flame or electric arc. Everyday fabrics will continue to burn until they are extinguished or all flammable material is consumed.

FLAME-RESISTANT FLEECE 2-IN-1 HAT

10.5 oz., FR Polartec® Wind Pro® fleece. 44% Viscose/39% Modacrylic/14% Para-aramid/3% Spandex with Rain Defender® durable water repellent. High warmth-to-weight ratio. Wind resistant & breathable. Pull-down face mask. 6 oz., 48% modacrylic/48% Tencel/4% Spandex face and chin guard. Fits nicely under a hard hat.

SAFETY & COMPLIANCE INFORMATION:
NFPA 70E. CAT 2. EBT 16 iCal/cm².
COLOURS: Dark Navy, Black
SIZES: One Size
STYLE: 101579-410, 101579-001

FLAME-RESISTANT KNIT WATCH HAT

10.5 oz. 100% modacrylic, stretchable rib-knit fabric. Carhartt FR label sewn on front.

SAFETY & COMPLIANCE INFORMATION:
NFPA 70E. CAT 2. EBT 15 iCal/cm².
COLOURS: Dark Navy, Black
SIZES: One Size
STYLE: 102178-410, 102178-001

FLAME-RESISTANT DOUBLE-LAYER FORCE BALACLAVA

6 oz., 2-ply FR knit. 48% modacrylic/48% Tencel®/4% Spandex. Carhartt Force® fights odor. FastDry® technology. Full facial protection that extends below the neckline. Face mask pulls down below the chin when not needed. Flat-seam, 2-ply construction. Carhartt FR label sewn on back.

SAFETY & COMPLIANCE INFORMATION:
NFPA 70E. CAT 2. EBT 15 iCal/cm².
COLOURS: Dark Navy, Black
SIZES: One Size
STYLE: FRA003-DNY, FRA003-BLK

FLAME-RESISTANT FLEECE NECK GAITOR

10.5 oz., FR Polartec® Wind Pro® fleece. 44% Viscose/39% Modacrylic/14% Para-aramid/3% Spandex with Rain Defender® durable water repellent. High warmth-to-weight ratio. Wind resistant & breathable.

SAFETY & COMPLIANCE INFORMATION:
NFPA 70E. CAT 2. EBT 16 iCal/cm².
COLOURS: Dark Navy, Black
SIZES: One Size
STYLE: 101580-410

carhartt FR

FLAME-RESISTANT CLASSIC TWILL SHIRT

Original fit. 7 oz. 88% FR cotton twill / 12% high-tenacity nylon. Button-down collar with button closure. FR melamine buttons throughout. Two chest pockets with flaps and button closures. Extended sleeve plackets with two-button adjustable cuffs. Triple-stitched main seams.
SAFETY & COMPLIANCE INFORMATION:
NFPA 70E. Arc Rating: 8.6 cal/cm². Cat 2.

COLOURS: Khaki, Dark Navy, Gray, Medium Blue, Dark Crimson
SIZES: S-4XL Reg., M-4XL Tall
STYLE: FRS-160-KHI, FRS160-DNY, FRS160-GRY, FRS160-MBL, FRS-160608

Gray FRS160-GRY

Dark Navy FRS160-DNY Khaki FRS160-KHI Med. Blue FRS160-MBL Dk. Crimson FRS160-608

carhartt FR

FLAME-RESISTANT MIDWEIGHT LOOSE ORIGINAL FIT CANVAS PANT

8.5 oz. 88% FR cotton/12% high-tenacity nylon canvas fabric. Loose original fit sits slightly above the waist. Loose seat and thigh. Arc-resistant button closure at waist. Brass zipper fly with Nomex® FR zipper tape. Cell phone pocket on left leg and multiple utility pocket on right leg. Two reinforced back pockets. Triple-stitched main seams. Straight leg opening.

Dark Navy FRB159-DNY Golden Khaki FRB159-GKH Moss FRB159-MOS

SAFETY & COMPLIANCE INFORMATION:
Compliant to NFPA 2112. CSA Z462 & NFPA 70E.
Arc Rating: 12 cal/cm². Cat 2.

COLOURS: Dark Navy, Golden Khaki, Moss
SIZES: 30-54" waist, 30-36" inseam
STYLE: FRB159-DNY, FRB159-GKH, FRB159-MOS

WABUSH JACKET & BIB PANTS

FR PU coated Aramid® knit. 3M™ Scotchlite™ Reflective material CSA style for enhanced visibility. MicroWeld™ seams. Reinforced stress points. Jacket: Stow away hood. Vented back. Nomex® brass zipper over Velcro® closing front storm flap. Elastic casing in back hem. Bib Pants: Adjustable suspenders. Quick release buckles. Two-way Nomex®/brass zipper w/double storm flap & Velcro® closure. Leg zipper and outer storm flap and Velcro® closure. Side gusset for easy entry.

SAFETY & COMPLIANCE INFORMATION:
CGSB 155.20 (6.1.1). CSA Z96. NFPA 70E. ASTM F1891. Arc rating: 8.6 cal/cm².

COLOURS: Fluorescent Orange
SIZES: XS-5XL
STYLE: 70257 Jacket, 70518 Bib Pants

CORNERBROOK JACKET & BIB PANT

FR PU coated Aramid® knit. 3M™ Scotchlite™ Reflective material CSA style for enhanced visibility. MicroWeld™ seams. **Jacket:** Velcro® detachable generously cut 3 panel helmet hood with elastic gathered hood. Inside double stormflap with concealed nickel plated brass snaps and Velcro® closure. MicroWeld™ seams. **Bib Pants:** Can be worn back to front for longer wear. Adjustable suspenders. Quick release buckles. Side gusset for easy entry.

SAFETY & COMPLIANCE INFORMATION:
CGSB 155.20 (6.1.1). CSA Z96. NFPA 70E. ASTM F2733. Arc rating: 8.6 cal/cm².

COLOURS: Fluorescent Orange
SIZES: XS-5XL
STYLE: 70219 Jkt. 70519 Bib Pants

DULUTH FR JACKET w/DETACHABLE HOOD

50% Kermel® /25% wool / 22% Lenzing®/3% antistatic fibre. Extreme insulation for cold weather. Soft hand for comfort. Flatlock seams. Front Nomex® brass zipper closure with inner storm flap. Reinforced zipper and collar edge with FR binding. Velcro® detachable hood with adjustment at top. FR knit cuffs at wrists.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F1506, CSA Z462 & NFPA 70E. Arc Rating: 14 cal/cm². Cat 2.

COLOURS: Grey **SIZES:** XS-5XL **STYLE:** 79235

DULUTH FR THERMAL PANT

50% Kermel® /25% wool / 22% Lenzing® / 3% antistatic fibre. All FR components for extra protection. Permanent FR properties. Extreme insulation for cold weather. Soft hand for comfort. Flatlock seams. FR knit cuffs at ankles. Enclosed elastic hem waist.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F1506, CSA Z462 & NFPA 70E. Arc Rating: 14 cal/cm². Cat 2.

COLOURS: Orange, Grey
SIZES: XS-3XL
STYLE: 72490

DULUTH FR SWEATER

50% Kermel® / 25% wool / 22% Lenzing® / 3% antistatic fibre. All FR components for extra protection. Permanent FR properties. Extreme insulation for cold weather. Soft hand for comfort. Flatlock seams. FR knit cuffs at wrists. FR knit waist.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM F1506, CSA Z462 & NFPA 70E. Arc Rating: 14 cal/cm². Cat 2.

COLOURS: Grey **SIZES:** XS-3XL **STYLE:** 72237

FARGO FR CREWNECK

48.5% Kermel / 48.5% Lenzing® / 3% antistatic fibre. High resistance to abrasion. Flatlock seams. Double knit cuffs.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM 1506, CSA Z462 & NFPA 70E. Arc rating: 12 cal/cm². Cat 2.

COLOURS: Royal Blue **SIZES:** XS-5XL **STYLE:** 75090

FARGO FR PANT

48.5% Kermel / 48.5% Lenzing®/3% antistatic fibre. No shoulder seams. High resistance to abrasion. Flatlock seams. Double knit cuffs.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM 1506, CSA Z462 & NFPA 70E. Arc rating: 12 cal/cm². Cat 2.

COLOURS: Royal Blue **SIZES:** XS-5XL **STYLE:** 75490

FARGO FR BALACLAVA

48.5% Kermel / 48.5% Lenzing® / 3% Antistat. High resistance to abrasion. Flatlock seams.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM 1506, CSA Z462 & NFPA 70E. Arc rating: 12 cal/cm². Cat 2.

COLOURS: Royal Blue **SIZES:** XS-5XL **STYLE:** 79892

FARGO FR NECK GAITER

48.5% Kermel / 48.5% Lenzing® / 3% Antistat. High resistance to abrasion. Flatlock seams. Generous neck coverage.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM 1506, CSA Z462 & NFPA 70E. Arc rating: 12 cal/cm². Cat 2.

COLOURS: Royal Blue **SIZES:** XS-5XL **STYLE:** 79893

FARGO FR TOQUE

48.5% Kermel / 48.5% Lenzing® / 3% Antistat. High resistance to abrasion. Flatlock seams. Double layer.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM 1506, CSA Z462 & NFPA 70E. Arc rating: 12 cal/cm². Cat 2.

COLOURS: Royal Blue **SIZES:** XS-5XL **STYLE:** 79895

FALHER PARKA

100% FR cotton outershell. FireLite™ by Eurotex 2" reflective striping. Double top stitching provides durability and strength. Front storm flap over Nomex®/ brass zipper with concealed snap closure. Large front cargo pockets. Inside storage pockets. Elastic back waist. Wind proof and water resistant.

SAFETY & COMPLIANCE INFORMATION: Complaint to ASTM 1506, CSA Z462 & NFPA 70E. Arc Rating 73 cal/cm². Cat 4.

COLOURS: Navy **SIZES:** XS-5XL **STYLE:** 76349

FR NOTE

PPE (HRC) Categories are rated from 1 - 4. The categories are determined by the arc ratings and are tested to ASTM F1506. In order to be arc tested, fabrics are tested to determine the amount of energy (cal/cm²) that it takes for a sensor to reach 2nd degree burn criteria through the fabric.

For more information, see page 26.

FALHER BIB PANT

100% FR cotton outershell. FireLite™ by Eurotex 2" reflective striping. Full 2 way leg Nomex®/ brass zipper with stormflap and Velcro® closure. Double top stitching provides durability and strength. Front storm flap over Nomex®/ brass zipper with concealed snap closure. Large front cargo pockets. Inside storage pockets. Elastic back waist. Wind proof and water resistant.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM 1506, CSA Z462 & NFPA 70E. Arc rating: 73 cal/cm². Cat 4.

COLOURS: Navy **SIZES:** XS-5XL **STYLE:** 76549

FR HARD HAT PULLOVER

100% FR cotton outershell. FireLite™ by Eurotex 2" reflective striping. Adjustable front closure. Wind proof and water resistant.

SAFETY & COMPLIANCE INFORMATION:
Compliant to ASTM 1506, CSA Z462 & NFPA 70E. Arc Rating: 73 cal/cm². Cat 4.

COLOURS: Navy **SIZES:** XS-3XL **STYLE:** 79936

FALHER HELMET HOOD

100% FR cotton outershell. FireLite™ by Eurotex 2" reflective striping. Wind proof and water resistant.

SAFETY & COMPLIANCE INFORMATION: Compliant to ASTM 1506, CSA Z462 & NFPA 70E. Arc Rating: 73 cal/cm². Cat 4.

COLOURS: Navy **SIZES:** XS-5XL **STYLE:** 76949

NASCO

Omega by NASCO

OMEGA FR OUTER SHELL & BIB PANT

9 oz. Omega FR outer shell; Nomex® knit inside. Waterproof, breathable. Wind-proof. Electric arc/flash fire resistant. Removable winter liners available. 2 needle stitched and sealed with Nomex® tape.
Jacket: hood-in collar, nonconductive zipper with Velcro® storm fly front, fall protection access, 2 side entry pockets, tool belt slit with zippers, liner attachments, 3M™ Scotchlite™ 2" reflective trim around chest, shoulder harness and biceps. **Bib Pants:** Klein tool pocket on right thigh, reinforced knees, non-conductive leg zippers with overfly, 3M™ Scotchlite™ 2" reflective trim at calves and ankles.
SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1891, NFPA 70E & CSA Z462.
Arc Rating: 10.7 cal/cm^2. Cat 2. (yellow) 11.8 cal/cm^2. Cat 2. (orange)

COLOURS: Navy/Fluorescent Yellow, Navy/Fluorescent Orange (Jacket). Fluorescent Yellow, Fluorescent Orange Bib Pants.
SIZES: S-5XL, Reg. & M-5XL Tall
STYLE: 5503JFO-145 Jacket, 5001T Bib Pant

Sentinel™ by NASCO

SENTINEL FR WAIST LENGTH RAIN JACKET & BIB PANT

10 oz. 100% FR cotton knit outer shell. Waterproof. Chemical splash resistance. Jacket: 3 piece hood-in-collar, non-conductive zipper front with Velcro® closure, Nomex® mesh ventilation system, fall protection access, Velcro® tab type wrist adjusters, two pockets with Velcro® closure, 3M™ Scotchlite™ 2" reflective trim. Also available as a 48" coat. **Bib Pants:** Bib style trouser with quick release suspender system, fly front with snap, Velcro® tab type leg cuff adjusters, 3M™ Scotchlite™ 2" reflective trim around calves and ankles.
SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1891, NFPA 70E & CSA Z462.
Arc Rating: 14 cal/cm^2. Cat 2. (yellow) 16 cal/cm^2. Cat 2. (orange)

COLOURS: Fluorescent Yellow, Fluorescent Orange
SIZES: S-5XL, Reg. & M-5XL Tall
STYLE: 4503JFO45 Jacket, 4501TFO Bib Pant

IFR WORKWEAR INC.

ULTRASOFT® SUIT-TOP

9 oz., 88% FR cotton / 12% high tenacity nylon Ultrasoft® twill fabric.
Trim featuring 3M™ Scotchlite™ Reflective Material. Patch pockets with snap close flap.
Mesh H2S monitor pocket. YKK zipper. Mic straps. Velcro® closure on collar.
Snap closure. Pen pocket on sleeve.
SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1506, CSA Z462 & NFPA 70E. Arc Rating 12.4 cal/cm². Cat 2.

COLOURS: Royal Blue **SIZES:** 34"-58", 34T"-58T" **STYLE:** USB150

ULTRASOFT® SUIT-BOTTOM

9 oz. 88% FR cotton / 12% high tenacity nylon from Ultrasoft® twill fabric. Trim featuring 3M™ Scotchlite™ Reflective Material. Adjustable Velcro® closure at waist hem. Flap over zipper closure. Side elastic. Tool pocket. Adjustable Velcro® closure at hem.
SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1506, CSA Z462 & NFPA 70E.
Arc Rating: 12.4 cal/cm². Cat 2.

COLOURS: Royal Blue **SIZES:** 34"-58" **STYLE:** USB151

IFR WORKWEAR INC.

RELIANT® RIB KNIT PULLOVER

9.5 oz. 55% modacrylic / 45% cotton knit fabric.
8" Vislon zipper with inside placket. Protective zipper flap.
SAFETY & COMPLIANCE INFORMATION:
Compliant to ASTM F1506, CSA Z462 & NFPA 70E.
Arc rating: 18 cal/cm². Cat 2.

COLOURS: Black **SIZES:** S-3XL **STYLE:** RKPBK335

IFR Workwear manufactures high-quality, trusted products. We offer our customers comprehensive options for safety and comfort, through our full line of protective workwear, which includes coveralls, insulated coveralls, parkas, insulated bib overalls, fleecewear, headwear and hard hat liners.

IFR Workwear only uses proven and tested fabrics like DuPont™ Nomex®IIIA and Westex™ Ultrasoft®, Indura™ and other components made in North America.3M™ Scotchlite™ Reflective materials are used on all the garments to help improve visibility.

IFR provides workers with premium safety protection, increasing productivity and overall satisfaction through excellent fitsizing, customizations, fabrics and styles.

IFR WORKWEAR INC.

AVENGER COVERALLS

7 oz. 88% cotton / 12% nylon twill weave. Preshrunk FR fabric. Multi-purpose protection from electric arc and flash fire. Velcro® closure on collar. YKK zipper. Side entry pass-thru opening. Flap over zipper closure. Adjustable Velcro® closure at leg hem. Mic strap. Pen pocket. Patch pockets with Velcro® close flap. Waist striping. Velcro® closure at cuff. Tool pocket. 3M™ Scotchlite™ Reflective Material.

SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20. ASTM F1506. CSA Z462 & NFPA 70E.
Arc Rating: 8.9 cal/cm². Cat 2.

COLOURS: Royal Blue
SIZES: 38"-62:, 38T"-62T"
STYLE: ASB3108

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IFR WORKWEAR INC.

ULTRASOFT® 9 OZ. DELUXE COVERALLS

9 oz. 88% cotton / 12% high tenacity nylon. Trim features 3M™ Scotchlite™ Reflective material. Lowered X striping on back. Velcro® closure on collar. Mic straps. Snap closure. YKK zipper. Side entry pass-thru opening. Flap over zipper closure. Adjustable Velcro® closure at leg hem. Patch pockets with snap close flap. Front patch pockets, pen pocket on sleeve, tool pocket on pant leg.

SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1506, CSA Z462 & NFPA 70E.
Arc Rating: 12.4 cal/cm². Cat 2.

COLOURS: Orange
SIZES: 36"-66", 38T"-66T"
STYLE: USO409

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IFR WORKWEAR INC.

ULTRASOFT® 9 OZ. INSULATED PARKA

9 oz. 88% cotton / 12% high tenacity nylon Ultrasoft® shell fabric. 7 oz. modacrylic FR insulation. Wind/vapour barrier. 7oz. 100% FR cotton lining. Velcro® closure on collar. Patch pockets with snap close flaps. Draw cord. Fleece lined side pocket. Knit cuff. Laminated wind and vapour barrier. Mic strap. YKK zipper. H2S monitor mesh pocket. Snaps for hood. 3M™ Scotchlite™ Reflective material.

SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1506, CSA Z462 & NFPA 70E. Arc Rating: 40.6 cal/cm². Cat 4.

COLOURS: Royal Blue, Red, Green, Grey, Navy
SIZES: XS-5XL
STYLE: US215

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IFR WORKWEAR INC.

ULTRASOFT® 9OZ. INSULATED BIB PANTS

9 oz. 88% FR cotton / 12% high tenacity nylon Ultrasoft shell fabric. 7 oz. modacrylic FR insulation. Wind/vapour barrier. 7oz. 100% FR cotton lining. Adjustable straps. YKK zipper. Patch pockets, tool pocket, front slash pockets. Leg zipper with flaps. Side elastic. 3M™ Scotchlite™ Reflective material.

SAFETY & COMPLIANCE INFORMATION:
Compliant to CGSB 155.20, ASTM F1506, CSA Z462 & NFPA 70E. Arc Rating: 40.6 cal/cm². Cat 4.

COLOURS: Royal Blue, Red, Green, Grey, Navy
SIZES: XS-5XL
STYLE: US225

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Workrite FR

HOW SHIELDTEC TECHNOLOGY CREATES SAFER LABS

Laboratories can be a hazardous place to work as workers are frequently exposed to chemical, biological, physical, and radioactive hazards.

The importance and value of high-quality laboratory coats cannot be overstated. Our flame-resistant and chemical-splash protection lab coats are constructed with Nomex® IIIA and Westex® ShieldTEC to improve the safety of laboratory employees. Nomex® IIIA is a flame-resistant fabric that prevents clothing ignition during short-duration thermal incidents and emergency exposure to flame.

ShieldTEC is NFPA 2112 certified and chemical splash resistant while providing the wearer with excellent comfort thanks to the highly breathable nature of the material.

In addition to providing protection against multiple hazards, the FR/CP Lab Coat is lightweight, durable, and available in cuts for both men and women.

FR/CP LAB COAT

4.5 oz. Nomex® IIIA. Built with Westex® ShieldCXP for chemical-splash protection. Black lay-down collar for easy recognition as a CP lab coat. Knit cuffs. Concealed snap front closure. Splash-resistant pass-through access to inner clothing. Pockets include one double-stitched chest pocket and two lower pockets with snap front closures.

SAFETY & COMPLIANCE INFORMATION:
Compliant to ASTM F1506, CSA Z462.
Arc Rating: 5.6 cal/cm². Cat 1.

COLOURS: Royal Blue **SIZES:** S-2XL
STYLE: 353CH-45

6 OZ. NOMEX® IIIA LAB COAT

6 oz. Nomex® IIIA fabric. Knee length, worn directly over street clothes. Side pass-through for access to inner clothing. Two large double-stitched lower-front patch pockets. Two double-stitched chest pockets. Concealed snap front closure. Seamed back for closure.

SAFETY & COMPLIANCE INFORMATION:
Compliant to ASTM F1506, CSA Z462 & NFPA 70E. Arc Rating: 6 cal/cm². Cat 1.

COLOURS: Royal Blue **SIZES:** S-2XL
STYLE: 352NX60

Understanding Flame Resistant Clothing

Introduction

Flame resistant PPC is used to keep workers safe in environments where thermal hazards exist. The thermal hazards most commonly encountered by our clients are flash fire and electric arc flash. The garments in this catalogue are those designed to protect workers from one or both of these hazards. The garments discussed are not intended for repeated exposure to flame, sparks or intense heat, and are not intended for fire entry (for example, like a firefighter's bunker gear).

Background

Before FR clothing was used in oilfield work, it was noted that when flash fires occurred, people's burn injuries were worse in areas of the body covered by clothing than areas that were not covered, such as the hands and face. Flash fires usually last only a few seconds. This exposure was not enough to cause extensive harm to exposed skin, but it was enough to ignite the clothing worn by the workers. Because the clothing was not FR, once it ignited, it continued to burn, causing serious burn injuries.

It was also found that in some cases, workers standing outside of the flash fire itself were still badly burned because the radiant heat ignited their clothing, which continued to burn, causing injuries that should have been preventable.

Purpose of FR Garments

FR garments are intended to provide limited protection in the event of a flash fire or electric arc flash. In other words, the purpose of FR PPC is to limit damage done to the body and to provide extra crucial seconds to get away from the flash fire. It does this in two main ways:

- Slowing the transfer of heat through the garment – insulating the body against the heat source.
- Self-extinguishing – it will not continue to burn when the flame/heat source is removed.

FR Standards

Standards are created when interested committees of people come together to decide what the minimum requirements for PPE for specific uses should be. These committees usually include end users, textile and garment manufacturers, scientists and academics, and other industry experts. Standards are proposed, voted on, and revised until the group finalizes the standard. Standards are revised periodically, usually when new information surfaces in the industry.

Standards provide a list of test methods that must be carried out, as well as providing the minimum results required to meet the standard – this means that standards have pass/fail criteria.

The major standards organizations that our customers encounter include:

CGSB – Canadian General Standards Board

The Canadian General Standards Board (CGSB) is a federal government organization that offers client-centred, comprehensive standards development and conformity assessment services in support of the economic, regulatory, procurement, health, safety and environmental interests of our stakeholders — government, industry and consumers.

ASTM International – (previously American Society for Testing and Materials)

ASTM International is one of the largest voluntary standards developing organizations in the world. They are a not-for-profit organization that provides a forum for the development and publication of international voluntary consensus standards for materials, products, systems and services. Our volunteer members represent producers, users, consumers, government, and academia from more than 140 countries. They develop technical documents that are the basis of manufacturing, management, procurement, codes and regulations for dozens of industry sectors.

NFPA – National Fire Protection Association

The National Fire Protection Association (NFPA) is a global non-profit organization, established in 1896, devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. Founded in 1896, NFPA delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy; and by partnering with others who share an interest in furthering our mission. NFPA membership totals more than 60,000 individuals around the world.

CSA – Canadian Standards Association

The Mission of CSA Group is to represent the interests of its members in creating a better, safer, more sustainable world – primarily through standards development, technical research, and training in relevant fields. Through its world-class commercial subsidiaries, CSA Group engages in testing, certification, and related activities that support the organization technically and financially.

What is a Test Method?

Test methods give a detailed description of how tests should be carried out. Most test methods will test one or two properties, such as how much a fabric shrinks in laundering, or how easily it ignites. Test methods do NOT have pass/fail criteria. It is not possible to 'meet' the requirements of a test method because test methods do not have requirements.

Important North American Standards

The most common North American PPC standards for the oil industry work, and electrical work, are CGSB 155.20, NFPA 2112, ASTM F1506, CSA Z462 and NFPA 70E. There are also standards specifically for rainwear for the oil industry and electrical use-ASTM F2733 and ASTM F1891. Some standards have a Canadian and an American version, listed below.

Note that each standard has a letter code, a number, and a title. These standards are usually referred to by their letter code and number, or a brief description of their title.

OCCUPATION	STANDARD NO.	FULL STANDARD TITLE
Oil Industry (Regular PPE)	CAN/CGSB 155.20	Workwear for protection against hydrocarbon flash fire.
Oil Industry (Regular PPE)	NFPA 2112	Standard on flame-resistant garments for protection of industrial personnel against flash fire.
Oil Industry (Rainwear)	ASTM F2733	Standard specification for flame resistant rainwear for protection against flame hazards
Electrical (Regular PPE)	CSA Z462	Workplace electrical safety.
Electrical (Regular PPE)	NFPA 70E	Standard for electrical safety in the workplace
Electrical (Regular PPE)	ASTM FZ1506	Standard performance specifications 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.
Electrical (Rainwear)	ASTM F1891	Standard specification for arc and flame resistant rainwear.

Each of these standards has several test methods associated with it. The test methods give detailed instructions for how to carry out tests that measure a certain property.

Standards for Flash Fire Hazards

The primary hazard in oilfield work is flash fire. Flash fires occur when a fuel source (such as flammable gas or dust) is ignited. They are usually brief, lasting less than 3 seconds. The temperature of these fires varies and is usually between 600 - 1000°C, depending on the fuel source.

In the mid-1990s, it was realized that workers not wearing FR clothing who had been in flash fires did not suffer the most serious injuries on their uncovered heads and hands, but rather on the areas of their bodies covered by non-FR clothing. People standing outside of the fire even experienced extensive burns because their non-FR clothing ignited and continued to burn until manually extinguished.

The purpose of FR materials is to protect people from flash fires by ensuring that their garments will not ignite and continue to burn. The clothing provides a barrier between the hazard and the person.

The two most common flash fire standards for North America are CGSB 155.20 and NFPA 2112.

CGSB 155.20

CGSB 155.20 is a Canadian standard. This standard includes only three tests, although some of the tests must be carried out in different conditions.

CGSB 155.20 Tests

Vertical Flammability

Test Speciman Preparation: This test involves drying the fabric in an oven so that there is no moisture present in the fabric during testing. This test is conducted on fabrics that are new from the fabric mill, and then it is carried out again after the fabrics have been washed 50 times in a domestic washing machine.

Test: The test itself is similar to holding a match under a piece of fabric for 12 seconds. Burning behaviour and afterflame time are recorded. After the fabric is burned, a weight is attached to the corner of the fabric, and it's picked up by the corner so the burned area of the fabric tears. The torn area is measured and referred to as the damaged length. Tests are conducted in both warp and weft directions.

Requirements: In order to pass, the fabric cannot melt or drip. Any afterflame cannot exceed 2 seconds, and the damaged length cannot exceed 100 mm.

Heat Resistance & Thermal Shrinkage

Test Speciman Preparation: 3 specimens are cut and lines are marked on them, a known distance apart. A large oven is preheated to 260°C.

Test: The specimens are hung in the oven to 'bake' for 5 minutes at 260°C. Fabrics are taken out and observed for signs of melting, separation or ignition. The distance between the marked lines is measured to determine shrinkage.

Requirements: Heat Resistance – fabrics cannot melt, separate or ignite. Thermal Shrinkage-fabrics cannot shrink more than 3%.

Thermal Protective Performance (TPP)

Test Speciman Preparation: 5 specimens are cut for each condition. One group of specimens will be tested with a spacer (air gap between fabric and sensor) and one will be tested without a spacer (fabric and sensor in contact).

Test: The test is set up so that there is a sensor that acts like skin and records the amount of heat being absorbed during the test. This sensor is put on top of the fabric being tested, and then a big torch is pulled under the fabric. This way, the heat getting through the fabric is measured by the sensor.

The amount of heat absorbed is compared to the Stoll curve, which is used to predict second degree burn criteria. The test is over when the sensor has absorbed enough energy to reach a second degree burn. This time, based on the heat flux used, is called the Thermal Protective Performance value.

Requirements: For tests with the spacer, the average TPP must be no less than 6, with no single TPP less than 5.5. There are no requirements for TPP without the spacer – it's just done for comparative information.

NFPA 2112

NFPA 2112 uses tests similar to CGSB 155.20 with the addition of a full-scale mannequin test (tests that don't involve life-sized scenarios are called bench-scale tests).

NFPA 2112 Tests

Vertical Flammability

Test Speciman Preparation: This test is conducted on fabrics that are new from the fabric mill, and then it is carried out again after the fabrics have been washed 100 times in an industrial washing machine.

Test: The test itself is similar to holding a match under a piece of fabric for 12 seconds. Burning behaviour and afterflame time are recorded. After the fabric is burned, a weight is attached to the corner of the fabric, and it's picked up by the corner so the burned area of the fabric tears. The torn area is measured and referred to as the damaged length. Tests are conducted in both warp and weft directions.

Requirements: In order to pass, the fabric cannot melt or drip. Any afterflame cannot exceed 2 seconds, and the damaged length cannot exceed 102 mm.

Heat Resistance & Thermal Shrinkage

Test Speciman Preparation: 3 specimens are cut and lines are marked on them, a known distance apart. A large oven is preheated to 260°C.

Test: The specimens are hung in the oven to 'bake' for 5 minutes at 260°C. Fabrics are taken out and observed for signs of melting, separation or ignition. The distance between the marked lines is measured to determine shrinkage.

Requirements: Heat Resistance – fabrics cannot melt, separate or ignite. Thermal shrinkage-fabrics cannot shrink more than 10%.

Heat Transfer Performance (HTP)

Test Speciman Preparation: 5 specimens are cut for each condition. One group of specimens will be tested with a spacer (air gap between fabric and sensor) and one will be tested without a spacer (fabric and sensor in contact).

Test: The test is set up so that there is a sensor that acts like skin and records the amount of heat being absorbed during the test. This sensor is put on top of the fabric being tested, and then exposed to radiant heat as well as flames from a torch. This way, the heat getting through the fabric is measured by the sensor.

The amount of heat absorbed is compared to the Stoll curve, which is used to predict second degree burn criteria. The test is over when the sensor has absorbed enough energy to reach a second degree burn. The amount of energy (based on time) required to cause second degree burn through the fabric is the Heat Transfer Performance value.

Requirements: For tests with the spacer, the average HTP must be no less than 6 cal/cm2. For tests where the fabric and sensor are in contact, the average HTP must be no less than 3 cal/cm².

Mannequin Test

Test Speciman Preparation: 3 standard coveralls are made. These coveralls have no pockets or special features. The coveralls are washed once in an industrial washing machine.

Test: A mannequin with 100 sensors on its body is dressed in a cotton t-shirt and briefs with the test coverall on top. The mannequin is in a ring of 12 propane torches. The torches are lit up to 3 seconds to simulate a flash fire. The sensors on the mannequin record how much heat is absorbed in each area of the body, predicting 2nd and 3rd degree burns.

Requirements: No more than 50% of the mannequin can reach predicted 2nd and 3rd degree body burn criteria.

Comparison of CGSB 155.20 and NFPA 2112

CGSB 155.20 and NFPA 2112 are similar in many ways. The bench-scale tests measure the same properties, but with slightly different test methods.

One important difference is that the flammability test for CGSB 155.20 involves drying the fabric before testing, making it a much more difficult test to pass.

The other important difference between the standards is that NFPA 2112 involves a mannequin test, whereas the Canadian standard does not.

Key Points

Two garments that meet the standards may still offer very different levels of protection.

Standards for Electrical Hazards

Introduction

The main hazard associated with electrical work is electric arcs. Electric arcs occur when large amounts of energy are suddenly discharged from electrical sources.

Electric arcs last for a fraction of a second but involve huge amounts of energy with sufficient heat to ignite clothing. Arc flashes can reach temperatures more than three times hotter than the surface of the sun. FR clothing protects against arc flash hazards protects the skin by providing a thermal barrier. It also will not ignite, or will self-extinguish, unlike regular clothing, which would continue to burn until manually extinguished or consumed.

Standards for Electrical Work

There are two primary North American standards for electrical work. CSA Z462 is the Canadian standard and NFPA 70E is the American standard. Both standards deal with electrical safety and do not focus solely on protective clothing. These standards have the same requirements for protective clothing.

According to both standards, PPE must be selected based on the amount of energy that the worker could potentially be exposed to. The amount of potential energy exposure is what determines the work site's PPE Category (previously Hazard/Risk Category).

Hazard/Risk Categories

The PPE Categories are set based on the amount of energy that a worker could be exposed to.

In order to be arc rated, fabrics are tested to determine the amount of energy (cal/cm²) that it takes for a sensor to reach 2nd degree burn criteria through the fabric. The amount of energy required is called the arc thermal performance value (ATPV) or the energy break open threshold (E_{BT}), which is the point where the fabric breaks open during testing.

It is very important to note that ATPV/E_{BT} values cannot be added together to get the protection level of different layers worn together. The layers need to be tested together to be certain of their protective values.

The table below lists the PPE Category number with the corresponding minimum arc rating (which is the ATPV or E_{BT} of the protective clothing) and a brief description of the PPE needed to meet the requirements of each PPE Category.

PPE Category (previously HRC)	Minimum Arc Rating (cal/cm²)	PPE Required
1	4	FR PPE covering entire body with APTV>_ 4
2	8	FR PPE covering entire body with APTV>_ 8
3	25	FR PPE covering entire body with APTV>_ 25
4	40	FR PPE covering entire body with APTV>_ 40

In order to be arc rated, fabrics are tested to determine the amount of energy (cal/cm^2) that it takes for a sensor to reach 2nd degree burn criteria through the fabric.

To be considered appropriate as flash fire protection, fabrics must meet the requirements of ASTM F1506. There are different tests for woven and knitted fabrics. There are also different requirements depending on the weight of the fabrics (ex. a heavier fabric must be stronger than a lightweight fabric.).

Arc Testing

Test Speciman Preparation: Fabrics are washed and dried 3 times in a domestic washing machine before testing.

Test: Specimens are set up on a board with sensors behind them. The fabric is exposed to an electric arc flash that releases a huge amount of energy. The amount of energy required to cause 2nd degree burn through the fabric for half of the exposures is the Arc Thermal Protective Value (ATPV). If the fabric breaks open before the burn criteria are reached, the value recorded is E_{BT}. Both values are measured in cal/cm^2.

Requirements: There are no requirements, but the APTV/E_{BT} values will place the fabric in one of the PPE Categories (above).

Vertical Flammability

Test Speciman Preparation: This test is conducted on fabrics that are new from the fabric mill, and then it is carried out again after the fabrics have been washed 25 times in a domestic washing machine.

Test: The test itself is similar to holding a match under a piece of fabric for 12 seconds. Burning behaviour and afterflame time are recorded. After the fabric is burned, a weight is attached to the corner of the fabric, and it's picked up by the corner so the burned area of the fabric tears. The torn area is measured and referred to as the damaged length. Tests are conducted in both warp and weft directions.

Requirements: In order to pass, the fabric cannot melt or drip. Any afterflame cannot exceed 2 seconds, and the damaged length cannot exceed 152 mm.

Breaking Strength (wovens only)

Test Speciman Preparation: This test is conducted on fabrics that are new from the mill. The fabric strength is tested in both (warp & weft) directions.

Test: The fabric is clamped in a machine that pulls the fabric apart and measures how much force is required to break it. This is the fabric's tensile strength.

Requirements: vary by fabric weight.

Burst Strength (knits only)

Test Speciman Preparation: This test is conducted on fabrics that are new from the mill.

Test: The fabric is clamped in a circular frame and a blunt instrument is pushed through it. The force required to break through the fabric is measured. This is the fabric's burst strength.

Requirements: vary by fabric weight.

Tear Strength (wovens only)

Test Speciman Preparation: This test is conducted on fabrics that are new from the mill. The fabric strength is tested in both (warp & weft) directions.

Test: The fabric is clamped in a machine that tears the fabric in opposite directions and measures the force required to tear it.

Requirements: vary by fabric weight.

Yarn Slippage (wovens only)

Test Speciman Preparation: Strips of fabric are cut, and then a seam is sewn into them. The seam is a standard seam, not the one the manufacturer will use.

Test: The fabrics are tested in the same way that breaking strength is tested. The force it takes to make the yarns in the seam slip or break is recorded, then the fabric without the seam is broken. The difference in force required to break the seam and fabric is compared.

Requirements: vary by fabric weight.

Colourfastness to Laundering

Test Speciman Preparation: Small pieces of the fabric are sewn to strips of fabric that are made of different fibres (cotton, acetate, wool, nylon, polyester, silk).

Test: The fabrics are put in a machine that 'accelerates' laundering, then taken out and dried. The colours of the fabrics are compared to the originals to look for colour loss and staining. The degree of colour loss and staining is measured in classes from 1 to 5, with 5 being no change.

Requirements: Class 3 or better.

Colourfastness to Dry Cleaning

Test Speciman Preparation: Small pieces of the fabric are sewn to strips of fabric that are made of different fibres (cotton, acetate, wool, nylon, polyester, silk).

Test: The fabrics are put in a machine that 'accelerates' dry cleaning, then taken out and dried. The colours of the fabrics are compared to the originals to look for colour loss and staining. The degree of colour loss and staining is measured in classes from 1 to 5, with 5 being no change.

Requirements: Class 3 or better.

Dimensional Change (wovens only)

Test Speciman Preparation: Specimens are cut and marks are drawn on them and measured so that the original distance between the marks can be compared to the distance after washing.

Test: Specimens are washed and dried 5 times in a domestic washing machine. The distance between the marks is measured and compared to the original distance. The percent of shrinkage is calculated.

Requirements: Maximum of 3% shrinkage in both directions (warp & weft).

Standards for FR Rainwear

Introduction

Standards for rainwear are becoming increasingly requested by customers. Rainwear must be waterproof in order to serve its primary purpose. Most rainwear is made of materials that melt easily and would be hazardous to the worker that is wearing them if they were exposed to a thermal hazard. Therefore, FR rainwear must meet strict requirements to ensure that the wearers are kept safe should a thermal event occur.

Rainwear Standards

Two FR rainwear standards currently exist in North America. One is for flash fire (ASTM F2733) and the other is for arc flash (ASTM F1891).

ASTM F2733

This standard is for rainwear for protection against flash fire hazards. The FR rainwear fabric must be waterproof and seams must be resistant to leaks. The rainwear is also required to have lower predicted body burn than other PPE when tested on the mannequin. Most garments can have up to 50% predicted burn injury, but rainwear can have only 40%.

ASTM F2733 Tests

Mannequin Test

Test Speciman Preparation: 3 standard coveralls are made. These coveralls have no pockets or special features. The coveralls are cleaned once. 2 sets of garments are also tested in their "as sold" configuration after one cycle of cleaning.

Test: A mannequin with ~100 sensors on its body is dressed in a cotton t-shirt and briefs with the test coverall on top. The mannequin is in a ring of 12 propane torches. The torches are lit up for 3 seconds to simulate a flash fire.

The sensors on the mannequin record how much heat is absorbed in each area of the body, predicting 2nd and 3rd degree burns.

Requirements: No more than 40% of the mannequin can be 'burned' for the standard coveralls. For the "as sold" coveralls, seams can't fail (i.e. split open) and closures must remain operational after testing.

Leak Resistance

Test Speciman Preparation: This test is conducted on fabrics that are new from the mill, and then it is carried out again after the fabrics have been drycleaned 5 times.

Test: Fabric specimens are clamped underneath chambers filled with water. A prescribed amount of pressure is applied. Whether the fabric leaks or not is reported.

Requirements: Both fabric and seams must not leak.

Vertical Flammability

Test Speciman Preparation: This test is conducted on fabrics that are new from the mill, and then it is carried out again after the fabrics have been drycleaned 5 times.

Test: The test itself is similar to holding a match under a piece of fabric for 12 seconds. Burning behaviour and afterflame time are recorded. After the fabric is burned, a weight is attached to the corner of the fabric, and it's picked up by the corner so the burned area of the fabric tears. The torn area is measured and referred to as the damaged length. Tests are conducted in both warp and weft directions.

Requirements: In order to pass, the fabric cannot melt and drip. Any afterflame cannot exceed 2 seconds, and the damaged length cannot exceed 102 mm.

Trapezoidal Tear (wovens only)

Test Speciman Preparation: 3 standard coveralls are made. These coveralls have no pockets or special features. The coveralls are washed once in an industrial washing machine.

Test: A fabric specimen is torn at an angle to see how much force it takes to tear it.

Requirements: It must take more than 2.7 kg of force to tear the fabric.

Burst Strength (knits only)

Test Speciman Preparation: This test is conducted on fabrics that are new from the mill.

Test: The fabric is clamped in a circular frame and a blunt instrument is pushed through it. The force required to break through the fabric is measured. This is the fabric's burst strength.

Requirements: A minimum force of 275 kPa is required to burst through the fabric.

Weight Uniformity

Test Speciman Preparation: Fabrics are tested as they are received from the mill.

Test: Specimens are cut from different areas of the fabric then weighed to determine whether their weight is uniform.

Requirement: The weight of all specimens must be within 10% of the fabric's average weight.

ASTM F1891

This standard is for rainwear for use in environments where electric arc flash is a potential hazard. The testing for this standard is very similar to the testing for ASTM F2733, with the important exception that mannequin testing is replaced by arc testing.

ASTM F1891 Tests

Arc Testing

Test Speciman Preparation: Fabrics are washed and dried 3 times in a domestic washing machine before testing.

Test: Specimens are set up on a board with sensors behind them. The fabric is exposed to an electric arc flash that releases a huge amount of energy. The amount of energy required to cause 2nd degree burn through the fabric for half of the exposures is the Arc Thermal Protective Value (ATPV). If the fabric breaks open before the burn criteria are reached, the value recorded is E_{BT}. Both values are measured in cal/cm².

Requirements: There are no requirements, but the APTV/EBT values will place the fabric in one of the Hazard/Risk Categories (above).

Leak Resistance

Test Speciman Preparation: This test is conducted on fabrics that are new from the mill, and then it is carried out again after the fabrics have been drycleaned 5 times.

Test: Fabric specimens are clamped underneath chambers filled with water. A prescribed amount of pressure is applied. Whether the fabric leaks or not is reported.

Requirements: Both fabric and seams must not leak.

Vertical Flammability

Test Speciman Preparation: This test is conducted on fabrics that are new from the mill, and then it is carried out again after the fabrics have been washed 25 times in a domestic washing machine.

Test: The test itself is similar to holding a match under a piece of fabric for 12 seconds. Burning behaviour and afterflame time are recorded. After the fabric is burned, a weight is attached to the corner of the fabric, and it's picked up by the corner so the burned area of the fabric tears. The torn area is measured and referred to as the damaged length. Tests are conducted in both warp and weft directions.

Requirements: In order to pass, the fabric cannot melt or drip. Any afterflame cannot exceed 2 seconds, and the damaged length cannot exceed 152 mm.

Burst Strength (knits only)

Prep: This test is conducted on fabrics that are new from the mill.

Test: The fabric is clamped in a circular frame and a blunt instrument is pushed through it. The force required to break through the fabric is measured. This is the fabric's burst strength.

Requirements: Fabrics must withstand at least 275 kPa of pressure before bursting.

Trapezoidal Tear (wovens only)

Test Speciman Preparation: 3 standard coveralls are made. These coveralls have no pockets or special features. The coveralls are washed once in an industrial washing machine.

Test: A fabric specimen is torn at an angle to see how much force it takes to tear it.

Requirements: It must take more than 2.7 kg of force to tear the fabric.

FR Base layers

Base layers are the clothing items worn closest to the skin. Most occupations with thermal hazards require that workers wear non-melting natural fibres underneath their FR clothing. This is done to prevent the fabrics from melting onto the workers' skin and making burn injuries worse if a thermal incident occurs.

FR base layers are now available. They increase safety by improving the arc ratings and increasing the protective barrier between workers and thermal hazards.

Impact on Comfort

Base layers are most often worn for insulation, wicking, or both. They can improve comfort by helping the wearer maintain a thermal balance or by moving moisture away from the body.

Thermal conductivity is another important factor in influencing comfort. Thermal conductivity simply refers to how well a garment insulates the wearer. A shirt with low thermal conductivity will keep the person wearing it warm, while a shirt with high thermal conductivity will keep the person wearing it cooler.

Moisture management is a very important property in base layers, both for summer and for winter. In summer, good moisture management keeps a worker dry and cooler. In winter, good moisture management keeps workers dry and warm, which can be particularly important if there are periods of strenuous work followed by periods of rest in the cold.

Impact on Safety

Wearing FR base layers can increase workers' safety. The additional protective layers provide an additional barrier that will not ignite in a thermal hazard situation. When tested with coveralls, FR base layers generally perform better than non-FR base layers. The added benefit is that if a worker is exposed to a thermal hazard and is not wearing their outerwear correctly (ex. coverall zipper is not done up), the FR base layer will not ignite.

It should be noted that the protective effects of wearing FR base layers cannot be estimated – they must be tested. This means that it is not possible to take results from testing coveralls and base layers individually and simply add them. This is particularly important to note for arc ratings - adding values together for individual layers to state a total arc rating for the system of layers is a common mistake.

PPE Fabric Information

There are a limited number of FR fibers that exist currently, although these fibers can be spun or woven together to form many different fabric blends with different characteristics. Some of these characteristics include strength, durability, protection from different types of heat, colour, feel (hand), etc. The characteristics of the fabric will determine what it is used for. For example, a stiff heavy fabric can be excellent as an outer layer such as coveralls or a jacket, but would not be used as a base layer.

The standards described in the previous sections help to determine what a fabric can be used for. Some fabrics will be appropriate for some FR applications, but may not be suitable for others.

Inherent vs. Treated Fabrics

There are two basic categories that fibres fall into: Inherently FR and FR treated.

If a fabric is inherently FR, that means that the molecular makeup and structure of the fibres is such that the fibres themselves will not sustain flames. Basically, the fibres are naturally FR. Many people are under the impression that inherently FR fabrics are superior.

Other fabrics need to be treated in order to be FR. The two most common examples of this are cotton and rayon. These fabrics are produced and then FR chemicals are applied to them and absorbed into the fabric. This is why people will sometimes assume that the FR finish can be washed out of the garments. For most North American products, fabrics will be tested after at least 100 washes to ensure that they do not lose their FR properties. It is possible, however for poorly-made FR fabrics to lose their FR after a number of washes. We take care not to sell such products at Mark's.

There is another group of fibres that is a sort of middle-ground. You are not likely to find these fabrics alone in FR clothing – they are not inherently FR and (at least currently) cannot be adequately treated to become FR. However, these fibre types (and others) will often turn up in FR blends because they have the ability to enhance the feel or function of the garment.

Fabric Care

Laundering any FR incorrectly has the potential to remove its FR properties. FR clothing must be washed as directed on the garment label. Using fabric softener and some bleaches can take away the FR properties of garments – for both inherent and treated fabrics.

Below, you will find some main characteristics and a brief description of some of the more common FR fabrics.

Aramids

Common aramids include Nomex, Kermel, Twaron and Kevlar. Aramids are inherently FR – this means that their chemical structure is what makes them flame resistant. They do not require any FR treatment. Aramids are the most common inherently FR fibres.

Aramids come in a wide range of weights, particularly lighter weights than most other fabrics. The lighter weight and slightly more open weave of the fabric makes the fabric breathable, which helps keep workers cooler. Aramids are very strong and durable and hold up well to most elements. They are usually found in lighter weight fabrics, which can make them appealing for warm weather conditions.

Aramid coveralls include the Nomex that we see frequently - usually Nomex IIIA. Kermel is the other common aramid found in FR protective clothing.

FR Cottons

FR cottons are made FR through various treatments. Cottons are also frequently blended with other fibres, most notably nylon. Common trade names for FR cottons and cotton-based blends include Indura (100% cotton) and several 88% cotton /12% nylon blends including Firewall, Amplitude and Indura UltraSoft.

Cotton-based coveralls have a soft hand that most people find preferable to aramids. The cotton fabric is also breathable. FR cottons come in slightly higher weights than aramids, starting around 7 oz/yd^2 for coveralls and going as high as 13 or 14 oz/yd^2.

Durability has been improved by the addition of nylon, which is a very strong fibre. The addition of 12% nylon that is now common in cotton blends improves strength and durability in the garments considerably.

FR Rayon

FR rayons are most commonly found in blends. They may also be referred to as FR viscose. Rayon and viscose are essentially the same fibre, made from wood pulp, but processed differently. The most common FR rayon trade name is Lenzing FR. It is most commonly found in blends. One common blend is 50% FR Lenzing/50% Kermel.

Modacrylic

Modacrylic fibres are synthetic fibres that are inherently FR. They are often sought-after because they are a cheaper fibre that feels soft to the touch.

Glossary

ASTM F1506 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 Standard Specification for Arc and Flame Resistant Rainwear

ASTM F2733 Standard Specification for Flame Resistant Rainwear for Protection Against Flame Hazards CGSB 155.20 - Workwear for Protection Against Hydrocarbon Flash Fire.

ASTM International Previously American Society for Testing and Materials.

CAN/CGSB 155.22 Fireline Workwear for Forest Firefighters

CGSB Canadian General Standards Board (also written as CAN/CGSB)

CSA Canadian Standards Association

CSA Z462 Workplace Electrical Safety Standard (Canadian standard equivalent of NFPA 70E)

Electric Arc Flash A sudden release of energy discharged from an electrical source.

Flame Resistant Flame resistant, or FR, refers to any fabric or garment that either burns briefly and self-extinguishes, or does not burn. FR can also stand for flame retardant, fire retardant, or fire resistant. The most commonly used term is flame resistant.

Flash Fire A rapidly moving flame front which can be a combustion explosion. Flash fire may occur in an environment where fuel and air become mixed in adequate concentrations to combust and where all sources of ignition have not been controlled. Hydrocarbon flash fire has a heat flux of approximately 84 kW/m^2 for relatively short periods of time, typically three seconds or less. (From CGSB 155.20-2000.)

NFPA National Fire Protection Association

NFPA 1977 Standard on Protective Clothing and Equipment for Wildland Fire Fighting

NFPA 2112 Standard on Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire NFPA 70E - Standard for Electrical Safety in the Workplace

Personal Protective Equipment Personal protective equipment, or PPE, refers to both the clothing and equipment (such as boots, helmets, harnesses, etc) that are used to keep workers safe on the job.

Personal Protective Clothing Personal protective clothing, or PPC, refers to the specialized clothing that workers wear to protect themselves from hazards such as electric arc and flash fire. PPC is a component of workers' overall PPE. For the purposes of this guide book, PPC will refer mainly to FR clothing.

Thermal Hazard Any hazard or accident scenario where extreme heat is involved, i.e. flash fire or electric arc. Warp - The yarns threaded through the loom in a woven fabric; the lengthwise direction of a fabric, parallel to the selvage (the long edge of the fabric).

Weft The yarns that interlace with the warp yarns in a woven fabric; the crosswise direction of the fabric, perpendicular to the selvage (the long edge of the fabric).

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