



Bruck
Textiles

PR97[®]

NATURALLY, SUPERIOR PROTECTION

Resource Guide



METAL SPLASH PROTECTIVE FABRICS

Protection - Comfort - Breathability - Durability

www.brucktextiles.com.au



History



Bruck Textiles is a privately owned Australian company with over 70 years of fabric development and manufacturing history. With proven design capability, integrated product development processes and sophisticated planning and warehousing systems, Bruck has become a globally recognised competitive supplier of high performance textiles.

The Bruck management team has a wealth of technical fabrics and manufacturing knowledge and their commitment to pursuing excellence is the cornerstone of Bruck's success. Bruck specialises in protective textiles providing protective fabric solutions for fire, police, military and industrial work place applications; including protection against specific threats such as molten metal splash, fire, bullets, chemical agents and electrical hazards.

PR97® is an internationally recognised brand, renowned for its superior protective and comfort benefits in protective clothing for the molten metals industry. Developed in conjunction with an internationally recognised research company, and launched onto the market in 1997, PR97® was positioned then, and still remains the world's best *secondary protective clothing fabric for the aluminium smelting and hot metals industry.

PR97® was viewed as a revolutionary fabric due to its inherent or 'built in' protection which doesn't diminish through washing or use; unlike treated products which can lose their protective properties over time. To this day, the superior protective properties of PR97® have not been surpassed. The product range also sets a new benchmark for wearer comfort by using only natural uncoated fibres; so their breathable, moisture wicking properties are maintained.

The PR97® product portfolio has been further enhanced to now include two new fabrics: PR97 Ultra™ 220 and PR97 Comfortknit™ 165. PR97 Ultra™ 220 is a new lightweight woven shirting fabric which achieves a D1/E1 molten metal splash rating without an undergarment. PR97 Ultra™ fabric design provides the very best combination of protection and comfort in hot working conditions. PR97 Comfortknit™ 165 is a new lightweight knitted fabric for use as a flame retardant undergarment providing a complete and complimentary PR97® layering system for protection against flame, molten metal splash and electric arc flash.

(*secondary protection is often referred to as "uniform" clothing designed to be worn everyday, all day, e.g. shirts and trousers. In contrast primary protection or "front line" protection are garments which are worn to undertake a certain hazardous task, then removed. Tapping jackets, specialised gloves and hoods and other accessories worn over everyday secondary protective clothing are examples.)

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PR97[®] Profile



PR97[®] has been specifically designed for use as secondary or “everyday - all day” protective workwear. It provides personnel in the molten metal industries with the following benefits:

1. Uncompromising Safety

- Inherently flame retardant with ‘built-in’ protection that cannot be laundered out.
- Outstanding splash protection against molten aluminium, cryolite, iron, steel, copper, magnesium & nickel.
- Excellent protection against electric arc.
- Protects against exposure to radiant & convective heat.

2. Naturally Comfortable

- Its blend of natural fibres and innovative construction, has the ability to effectively wick sweat and vapour away from the skin, facilitating the cooling process.
- In the absence of any chemical FR treatments, the fabric has the ability to breathe which allows air to circulate freely without jeopardising the protective integrity of the garment.
- The innovative PR97 Ultra™ fabric provides additional protection at lighter fabric weights for improved comfort.

3. The Cost Effective Safety Solution

- Multifunctional applications, can be used from the pot room through to re-melt, casting, rodding, electrical and maintenance areas.
- Easy care option, it can be wet laundered or dry cleaned allowing for a flexible garment/inventory management program.
- Inherent or “built in” protective properties, providing a consistently high level of protection throughout the entire service life of a garment.

4. Proven Performance

- By specifying PR97[®] you are providing your personnel with a product that offers the highest standards of health and safety in secondary protective workwear.
- Since its launch in 1997, PR97[®] has successfully provided well over 50 million man days of life and burn protection in some of the most demanding work environments in the world.
- The standard by which all other protective fabrics are judged. Our dominant position as metal splash protective clothing of choice in the potentially dangerous environment of the world’s smelters, is testimony to the long term protective qualities and superb wearer comfort that PR97[®] provides.

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PR97®

Summary

What is PR97®

The leading range of protective fabrics available for the hot metals industry where secondary or 'everyday' protection from molten metal splash, flame, ignition, radiant and convective heat and electric arc hazards is required. PR97® garments are used extensively around the world, and PR97® is specified as the protective fabric of choice by a number of the world's largest smelting companies.

How does it protect?

PR97® is a blend of natural fibres – Merino wool and Lenzing™ FR (flame retardant viscose) – a cellulose fibre derived from wood pulp. The fibres are carefully blended then spun into yarns and woven to create a unique protective fabric which sheds hot metals very effectively and won't support flame.

The FR (flame retardant) properties of PR97® are manufactured or 'built in' to the FR viscose fibre. This means the fabrics' protection cannot diminish over time through washing or laundering; unlike treated or chemically coated products where their protection can diminish through use, PR97® fabrics will continue to protect the wearer to a consistently high standard throughout the entire service life of the garment.

What molten metals does it protect against?

The main benefit of PR97® is its superior molten metal splash protection against a variety of metals including aluminium, cryolite, iron, steel, copper, magnesium and nickel.

Where should it be used?

PR97® provides comprehensive protection from metal splash, flame, radiant and convective heat and electric arc hazards. It can be worn as secondary protective clothing throughout a smelter and other hot metal facilities. From the pot room through to remelt, casting, rodding, electrical and maintenance areas, PR97® has multifunctional protective applications.

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PR97®

Care

PR97® garments can be either home washed, commercially laundered or dry cleaned. They can be effectively repaired or mended using patches and other techniques. It is important to follow these recommended guidelines:

Detergent

- Use a pH neutral detergent or one approved for use with wool based fabrics by the manufacturer.
- Do not use excessive amounts of detergent and follow the manufacturer's guidelines.
- Never use soaps, bleaches or fabric softeners of any kind.

Wash

- Always wash garments in cold to warm water only. Around 40°C.
- Separate excessively dirty garments from cleaner garments.
- Do not wash PR97® garments with other types of garments.
- Excessively dirty garments should be pre-soaked in cold to warm water using a pH neutral detergent prior to washing.
- Minimise the number of garments per load, but maximise water levels.
- Use a gentle wash cycle setting and minimise agitation during wash and rinse cycles.

Dry

- Never dry PR97® garments on hot temperature settings. Maximum 60°C.
- Do not tumble dry garments for long periods, and do not overdry garments in the drying process, as this could result in excessive shrinkage.
- Do not dry PR97® garments with other types of garments.
- For best results tunnel drying or line drying in the shade is recommended.

Mending

- Always repair holes or damage to garments prior to washing.
- If patching over holes, always ensure patches seal tightly to the garment surface.
- There should be no lifting of patches which could cause metal splash to catch.

DISCLAIMER

Bruck Textiles provides this information as a recommended guide only and accepts no obligation or liability against misuse. In all instances users must first satisfy themselves that these guidelines are suitable for their intended application and monitor best wash practice throughout the service life of each PR97® garment.

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Fabric Tests

Protection Against Molten Metal Splash (ISO 9185)

Single layer and multilayer fabrics are tested by pouring measured quantities of molten metal at a specific angle onto a test specimen.

The damage is assessed by placing a PVC film (having similar qualities to human skin) underneath the test specimen and noting damage after pouring. Any adherence of metal to the specimen is noted. Fabrics are classified according to the minimum quantity of molten metal required to cause damage to the PVC film.

Classification: (according to ISO 11612)

Molten Aluminium Splash		Molten Iron Splash	
Level	Al, grams	Level	Fe, grams
D1	100 - 200	E1	60 - 120
D2	200 - 350	E2	120 - 200
D3	350 +	E3	200 +

Flame Resistance (ISO 15025)

A single layer or multilayer fabric assembly is tested by surface ignition (A1) and/or edge ignition (A2).

Limited spread of flame of the specimen is determined when a calibrated flame is applied to the surface (A1) or hemmed edge (A2) of the vertically oriented specimen for 10 seconds.

"After Flame" (persistence of flaming material after the ignition source is removed), "After Flame Time" (the time duration for which the material continues to flame after the removal of flame) and "After Glow" (persistence of glowing combustion) are recorded.

Molten debris and formation of a hole, if at all, are also reported for classification of the material.

Classification: (according to ISO 11612)

Pass A1:	Pass A2:
No flaming to edge	No flaming to edge
No hole formation	No flaming debris
No flaming debris	
Mean afterflame \leq 2 seconds	Mean afterflame \leq 2 seconds
Mean afterglow \leq 2 seconds	Mean afterglow \leq 2 seconds

Fabric Tests

Protection Against Radiant Heat (ISO 6942 Method B)

The test is carried out on single and multilayer fabrics intended for protection against heat. A heat source for radiant heat is applied to the face of the fabric specimen. A thermal sensor is mounted behind and in contact with the specimen.

The rise in temperature (as recorded by the sensor) when a radiant heat source is applied at a heat flux density of 20 kW/m² and the time taken for a temperature rise of 24°C in the sensor is recorded and expressed as Radiant Heat Transfer Index (RHTI24). This rise in temperature of 24°C is the time it takes for second degree burns to occur, and it is recorded in seconds for classification.

Classification (according to ISO 11612):

Level	RHTI24, seconds
C1	7 - 20
C2	20 - 50
C3	50 - 95
C4	95 +

Protection Against Convective Heat (ISO 9151)

Heat transmission through clothing largely depends upon the thickness, types of fibres used and fabric construction. Air gaps between layers (in the case of multilayer garments) can also affect heat transmission.

This test determines the transmission of heat through a fabric when it is exposed to flames. A horizontally oriented specimen is subjected to a gas flame from a gas burner beneath it. The heat passing through the fabric is measured by means of a thermal sensor. The time taken for the thermal sensor to rise in temperature by 24°C is recorded in seconds for classification. It is expressed as Heat Transfer Index (HTI24).

Classification (according to ISO 11612):

Level	HTI24, seconds
B1	4 - 10
B2	10 - 20
B3	20 +

Fabric Tests

Protection Against Electric Arc (ASTM F 1959)

An electric arc flash hazard is a dangerous condition associated with the possible release of energy caused by an electric arc. This hazard may exist when energised electrical conductors or circuit parts are exposed or when they are within equipment in a guarded or enclosed condition, and a person is interacting with the equipment in such a manner that could cause an electric arc.

In addition to the risk of electrocution and physical shock, an electric arc flash hazard poses a significant threat to human life through its thermal effect and afterflame effect. The thermal effect is measured by attributing a value to fabrics that describe their performance to exposure to an electrical arc discharge. The Arc Rating is expressed in calories/cm² and is derived from the Arc Thermal Performance Value (ATPV) or energy of break open threshold (EBT) (should a fabric system exhibit a break open response below the ATPV value).

ATPV is described as the incident energy of an electric arc flash that results in sufficient heat transfer through the fabric to cause the onset of a second degree burn. Break open is evidenced by the formation of one or more holes in the innermost layer of the FR (flame retardant) fabric/s that would allow flame to pass through the fabric/s.

PR97[®], PR97 Ultra[™] garments and PR97 Comfortknit[™] undergarments provide protection against electric arc flash, either as single or multilayers, by reducing the thermal effect and preventing afterflame.

Classification (according to NFPA 70E):

Hazard / Risk Category	cal/cm ²
0	0 - 4
1	4 - 8
2	8 - 25
3	25 - 40
4	40 +

Metal Splash ISO 9185						
Fabric	Composition	Useable Width [cm]	Weight [g/m ²]	Molten Aluminium	Molten Cryolite	Molten Iron
PR97 Ultra™ 220	Wool / Lenzing™ FR	150	220	D1	-	E1
PR97® 265	Wool / Lenzing™ FR	150	265	D1	75g	E1
PR97 Ultra™ 290	Wool / Lenzing™ FR	150	290	D3	> 100g	E3
PR97® 320	Wool / Lenzing™ FR	150	320	D3	85g	E3
PR97® 380	Wool / Lenzing™ FR	150	380	D3	> 100g	E3

All fabrics are tested to the Performance Standard ISO 11612

Property	Method	Performance
Limited Flame Spread -Face Ignition	ISO 15025 Procedure A	A1
Limited Flame Spread -Edge Ignition	ISO 15025 Procedure B	A2
Convective Heat	ISO 9151	B1
Radiant Heat	ISO 6942 Method B @ 20 kW/m ²	C1
Contact Heat	ISO 12127 @ 250°C	F1
Heat Resistance	ISO 17493 @ 180°C	No Ignition No Melt Shrinkage ≤ 5%
Dimensional Change	ISO 5077	≤ 3% warp and weft
Tear Strength	ISO 13937-2	≥ 10N warp and weft
Tensile Strength	ISO 13934-1	≥ 300N warp and weft
pH Value ¹	ISO 3071	> 3.5 and < 9.5

KEY PHYSICAL CHARACTERISTICS

Fabric	Composition	Useable Width [cm]	Weight [g/m ²]	Knit Construction
PR97 Comfortknit™ 165	Fine Wool / Lenzing™ FR	155	165	Single Jersey
PR97 Comfortknit™ 230	Fine Wool / Lenzing™ FR	165	230	Interlock

KEY PERFORMANCE CHARACTERISTICS

Fabric	Limited Flame Spread ISO 15025 A	Metal Splash ISO 9185		Electric Arc Protection NFPA 70E
		Al	Fe	
PR97 Comfortknit™ 165	No molten or flaming debris Average afterflame ≤ 2s Average afterglow ≤ 2s	Not Tested	Not Tested	Category 2 (with PR97 Ultra™ 290)
PR97 Comfortknit™ 230	No molten or flaming debris Average afterflame ≤ 2s Average afterglow ≤ 2s	D1	E1	Category 2 (Dark Colours) Category 1 (Light Colours)

¹ No pretreatment. Lenzing™ FR is a registered trademark of Lenzing AG. PR97®, PR97 Ultra™ and PR97 Comfortknit™ are trademarks of Bruck Textiles Pty Ltd.

Head Office & Sales - Sydney

9 Power Avenue,
Alexandria
NSW 2015
Australia

tel: +61 2 9366 3300
fax: +61 2 9366 3380

Sales - Melbourne

Unit 15, 79-83 High Street,
Kew
VIC 3101
Australia

tel: +61 3 9418 1200
fax: +61 3 9418 1288

Manufacturing Mill

Sisely Avenue,
Wangaratta
VIC 3677
Australia

