



DR. NANDAN KUMAR
Masters in (Advanced
Textiles & Performance
Clothing) & PhD,
University of Leeds, UK

TECHNICAL TEXTILES

Personal protection: Protecting our skilled “hands” against heat and mechanical risks

In recent years, the use of personal protection equipments, especially for hand/arm protection has gained significant importance in India amongst ‘skilled’ workforce. The government regulations, awareness amongst skilled and educated workforce, presence of overseas companies in India imposing their own high standards of health and safety regulations could be few reasons behind it. The various industries such as mechanical, automotives, construction, machine or compartment assembly, recycling, glass handling, etc have also understood that even a minor ‘hand or finger’ injuries due to contact with sharp objects/equipments require at least a day away from work which could be easily avoided by offering suitable protective equipments, in this case gloves or sleeves. In addition to the industrial workforce, these gloves are also recommended for our medical community (surgeons, pathologists, dentists, nurse or other medical staff) where these gloves can be used in combination with standard latex medical gloves to prevent infections which could occur when hands are exposed simultaneously to body fluids and sharp edges (e.g. medical support during road accidents involving metal, sharp plastics or shattered glass).

However, it is very important to understand that there is NO ideal glove available that could be used in every situation and while giving preference to the cut-protection, other aspects such as dexterity and tactile sensitivity can’t be ignored. This makes the glove selection criteria or understanding ‘risks

involved’ an utmost priority for management involved in the tendering or procurement of gloves for their workforce.

This article aims to discuss recent developments in the field of industrial gloves for cut/slash protection and various standards available for testing & validation. Subsequent parts of the article will concentrate on hand protection against thermal and electrical (arc-protection) hazards.

IT IS VERY IMPORTANT TO UNDERSTAND THAT THERE IS NO IDEAL GLOVE AVAILABLE THAT COULD BE USED IN EVERY SITUATION AND WHILE GIVING PREFERENCE TO THE CUT-PROTECTION, OTHER ASPECTS SUCH AS DEXTERITY AND TACTILE SENSITIVITY CAN'T BE IGNORED

Most commonly, cut-resistant gloves are made-up of yarns having synthetic high performance fibres (tenacity > 10 g/denier) with a very high degree of molecular orientation and crystallinity such as paraaramids (Kevlar®, Twaron®, Heracron®), high molecular weight polyethylene (Spectra®, Dyneema®) to name a few. Depending on the end-user requirements, these gloves are further coated with different polymers (such as latex, neoprene,

nitrile, polyvinyl chloride and butyl rubber) as summarized below (Table 1) or even stitched with leather or metal meshes.

Recently, hybrid or reinforced yarns in combination with stainless steel wire or with glass or other filaments have also been developed. The gloves are made-up of 'reinforced yarns' offer best cut-protection in comparison with cotton, nylon, polyester or other synthetic fibres when compared on weight to weight basis. Our Dualtec® and Powerguard® range of yarns have been uniquely designed and developed keeping above points in mind.

Dualtec® yarns are manufactured using patented technology where filaments are incorporated during spinning. These yarns are designed to manufacture clothing or other protective equipments (such as gloves, socks, balaclava, sleeve, cuffing, aprons or jackets as well as sporting wear for sports such as fencing) for heat and cut protection while retaining softness and comfort to the touch. These yarns are ideal for knitting or weaving.

Examples:

- Dualtec HT (high temperature short term >350°C): Aramid/Carbon with wire or glass;
- Dualtec FR (good thermal resistance >200°C): Aramid/Modacrylic with wire or glass;
- Dualtec ABR (high abrasion resistance with heat and cut): Para-aramid / Modacrylic / polyamide with wire or glass.

The Dualtec® yarns can be further optimized to develop gloves for any of the requirements as mentioned below:-

- a. where only cut/slash protection is required (e.g. food processing, recycling/handling surgical equipments, intricate sharp parts handling, construction, glass and bottling, canning, meat/poultry industry etc);
- b. where intermittent heat protection is required (e.g. chemical, mechanical, steel industry, etc);
- c. where both cut/slash and intermittent heat-protection is required (e.g. handling hot and sharp objects, metal stamping, machine and compartment assembly to name a few).

Powerguard® yarns are manufactured using both spun and filament yarns by using a combination of texturing, twisting

and wrapping techniques that allow precise positioning of the fibres within the yarn construction. The yarns tend to be heavier in construction than Dualtec® range; however these can be designed as per requirements for knitting or weaving.

Examples:

- PowerGuard AEGIS AB: High Performance, CUT Protection with Antibacterial protection;
- PowerGuard Greystripe & ABS: High Specification CUT Protection;
- PowerGuard Stripy: High Performance blended Filament / Staple Yarns thermal FR and cut resistance

General points for glove selection

- For general handling of goods – basic abrasion and cut-



resistance is required;

- Heavy duty and mechanical hazards (abrasion, cut, tear, puncture) – good abrasion, cut-resistance and grip is required;
- Precision handling and assembly – High dexterity, grip and high cut-resistance is required;
- Chemical hazards – coated (polymers) gloves are required;
- Thermal hazards – Inherent flame-retardant, heat and weld spatter resistance is required.

Testing and validation of cut-resistance gloves: There are

RECENTLY, HYBRID OR REINFORCED YARNS IN COMBINATION WITH STAINLESS STEEL WIRE OR WITH GLASS OR OTHER FILAMENTS HAVE ALSO BEEN DEVELOPED. THE GLOVES ARE MADE-UP OF 'REINFORCED YARNS' OFFER BEST CUT-PROTECTION IN COMPARISON WITH COTTON, NYLON, POLYESTER OR OTHER SYNTHETIC FIBRES WHEN COMPARED ON WEIGHT TO WEIGHT BASIS

three standards currently being used for testing and comparison of cut/slash resistance of gloves using three types of cut testing equipments (CPP tester, TDM tester, Couptest tester) as shown below:

- ASTM F 1790 (standard used in USA);
- ISO 13997 (international standard);
- EN 388 (European standard).

HPT technology defined

- engineered yarns are used for improved cut and heat protection;
- high level of cut protection without sacrificing flexibility, durability or comfort;
- ideal for work environments where sharp parts and materials are handled;
- high performance fibres such as m-aramid, p-aramid (Kevlar®, Twaron®, Heracron®), PBI etc. fibres are used.

Conclusions and future challenges

- Cut/slash protection issue should not be ignored by man-

POWERGUARD® YARNS ARE MANUFACTURED USING BOTH SPUN AND FILAMENT YARNS BY USING A COMBINATION OF TEXTURISING, TWISTING AND WRAPPING TECHNIQUES THAT ALLOW PRECISE POSITIONING OF THE FIBRES WITHIN THE YARN CONSTRUCTION

agement especially to protect our 'skilled' workforce in India. This should also be extended to unskilled workers or anyone involved with the sharp objects both in organized and unorganized sector;

- Government can also support by reducing import duties on 'high performance fibers' intended to be used in personal protective equipments;
- Testing and validation initiatives should be taken by Indian laboratories to get quality certification in India;
- Innovation in gloves design should be initiated as per local industrial requirements.