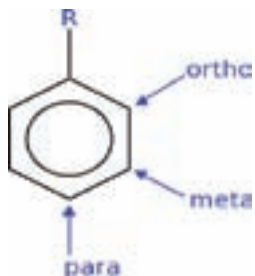


# How does your fire kit work?



Many firefighters think of their fire kit as little more than a piece of industrial clothing. Yes, it has some reflective tape on it and it may even have a radio loop or similar, as well as the word “fire” on the back, but surely it’s little more than a fancy “donkey” jacket? Not so! Kevan Whitehead goes back to basics and debunks a few myths whilst he’s at it.

**H**ow further from the truth can this belief be? Firefighting protective clothing is some of the most technically advanced fabric based clothing in the world. It really does save firefighters from injury and death.

At a severe house fire last year in the UK, a firefighter was exposed to unimaginably hostile conditions, estimated to be producing a heat flux of around 3,500 Kw – despite suffering severe injuries he survived the incident and is well on the way to recovery.

These figures are really significant in themselves especially when you consider that medical opinion advises that skin begins to burn and suffer first degree burns at 45°C and at 72°C, skin is destroyed at once – somehow this fancy “donkey” jacket was able to stop the micro-climate within his suit from getting above 45°C when the outside temperature in the compartment was an estimated 500°C. Firefighters are better protected than ever.

Fire suits throughout Europe conform to the European Standard, EN 469. To achieve this standard a suit needs to pass a whole series of tests undertaken by an approved test house. Typically, the suit is a multi-layered assembly, each layer bringing its own unique qualities to the finished product – no layer can provide the overall required protection on its own, it needs “partner” layers which are complementary and compatible to each other.

## The outer-shell layer & its fluorocarbon finish

The outer shell fabric is treated with a chemical finish, similar to products you will have heard about on soft furnishings and curtains “to resist stains and dirt” – often people use the proprietary name Scotchguard as a general term. This finish is usually a fluorocarbon substance which, as an experiment, if you



spray the outer fabric surface with water, will cause the water to form bobbles on its surface.

However, unlike your soft furnishings, the fluorocarbon finish for fire suits is not to keep it clean or maintain its aesthetic appearance, it is in fact the firefighters first line of defence against chemicals.

The test undertaken at the testing laboratory requires it to achieve a minimum 80% fluid run off when subjected to Sulphuric Acid, Hydrochloric Acid, Sodium Hydroxide and O-Xylene. So when a firefighter consults his “Hazchem” Card or similar and the code S, T, Y or Z is recommended, it is the fluorocarbon finish that provides the first level of protection – that is unless it washes out or needs re-activating!

Older finishes are known to wash out after three to four washes, and sometimes they can be re-activated by tumble drying the garment at high temperature. Newer finishes can last for 30 to 40 washes without failure. Despite claims by some, it is not really possible to re-treat a garment by applying a fluorocarbon finish in the final rinse of the wash – such a process will also re-proof the membranes, tape, inner linings and cuffs, so it is better to specify a long lasting finish at the point of purchase.

## The outer-shell fabric

The outer-shell is a woven fabric and now appears in a variety of colours, some are dyed (navy, black or other exotic colours) whereas others appear in their natural colour state (for example, gold). This fabric is inherently fire resistant – it does not have a fire resistant treatment added, the very fibres within its weave cannot burn, as a result it remains fire resistant throughout its life.

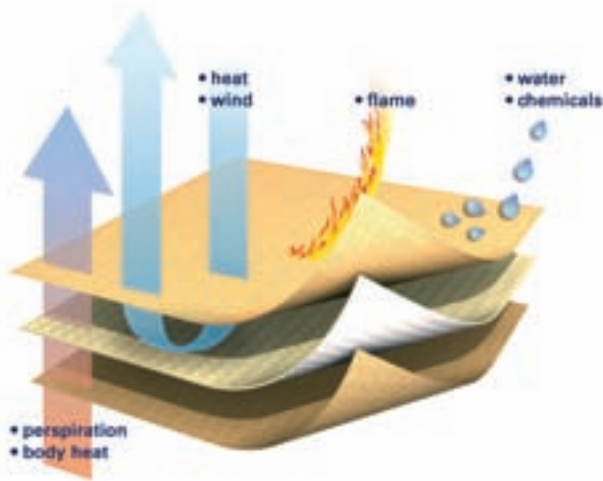
All these fabrics are based on a oil derivative chemical structure known as a benzene ring and are collectively known as “aramids”.

When these structures join together into long chains they are known as polymers. The point at which the ring joins gives it its name, thus benzene rings that join at the “meta” point are known as meta-aramids (see top). Probably the best known meta-aramids are Nomex and Kermel fabrics.

Benzene rings that join at the “para” point are known as para-aramids. These para-aramids, due to their straight line chain polymers, are extremely strong and robust and create really strong fibres. Such fibres are woven into fabrics and are typically gold in colour, the fibres being so robust that they even resist attempts to successfully dye them. Examples of such fabrics using these fibres are PBI Gold and the latest product to hit the market, Millenia Light (see page 44).

Irrespective of the fabric chosen by end users, all the aramids undoubtedly do the job they are intended to do – there are no bad outer shell fabrics, it is simply a matter of ranking and

Once cool, the meta-aramids may become discoloured, brittle and can break open.



# New Millenia

A new turnout system with exceptional qualities has been launched in Europe by international manufacturer TenCate Protective Fabrics.

TenCate believes that Millenia 450 is the lightest multi-layer system on the international market (450 g/m<sup>2</sup>) to meet the European standard for firefighting clothing EN 469: 2005, level 2. The outershell of this system, TenCate Millenia Light, is made from a mixture of para-aramid and PBO (not to be confused with PBI) fibres.

Senior Product Development Engineer Mike Allen, who relocated from the US (where Millenia Light has been available for a number of years from sister company TenCate Southern Mills) to oversee the launch of the new products, explained that the new fabric was the lightest in the market (at 180gms) that met firefighting PPE standard EN 469 class 2. "It is exceptionally strong and it has undergone flashover tests twice without breaking up or even the moisture barrier being damaged. The moisture barrier was not damaged after 17.5 seconds of TPP exposure and the outershell was tested twice on the manikin. We believe this is the strongest outershell in the world."

In the report *Thermal Capacity of Fire Fighter Protective Clothing*, published October 2008 prepared by National Institute for Occupational Safety and Health, the National Personnel Protection Technology Laboratory, National Institute of Standards and Technology, and North Carolina State University, PBO excelled in a test measuring the effect of the outer shell on predicted burn time from stored energy (without trim).

The Millenia 450 system has been developed especially for the European market, which means that it is of a lighter weight than its US counterpart and it also has additional anti-static properties as well as a PTFE moisture barrier. However, PBO is even harder to dye than PBI and is only available in one colour – gold.

It is expected however that the high strength of the fabric will help overcome colour preferences in the European market, and Allen highlighted this characteristic by explaining that PBO had been featured on a BBC programme (Bang Goes the Theory) that looked at how science shaped the world. "In the programme they were looking at the strength of a spider's web. To show how strong it was, they used strands of a spider's web to lift a person out of the water. They tried it with 1mm of steel and it broke. They then did the same experiment with 1mm of PBO, and it worked. In fact they lifted two people out at the same time with 1mm of PBO."

Although the fabric is new to Europe, there are already some fire brigades outside the US using Millenia Light, including Netherlands, Gothenburg, and Kuwait. In the US Millenia Light customers include USAR teams in New York and Washington DC.

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# In the need for speed

New super quick-don CBRN kit designed for the UK police could have uses in the industrial sector and is already receiving overseas interest, writes Dan Worth.

The perceived importance of the fast donning of CBRN protective garments is such that two and a half years ago the UK's lead government department for counter-terrorism, police, and science and research, announced a call to tender for Quick Donning Chemical, Biological, Radiological, Nuclear (CBRN) PPE. The donning of the complete CBRN ensemble needed to break a major speed barrier – to be put on by each individual in under five minutes instead of the usual 15-25 minutes with a "buddy."

This programme quickly became known simply as "The Quick Don", and in late September of 2009 it was subsequently announced that Rempoy Frontline had been chosen as the preferred supplier for this tender with its especially designed "Quick Donning" Swift Responder 3 (SR3) ensemble.

Rempoy Frontline is a global company whose core business model is to design, develop, and manufacture CBRN products in ISO approved plants for civil agencies and military services worldwide.

The ensemble consists of a CBRN protective garment; especially selected gloves and boots; the latest designed full-face mask and respirator; and a state-of-the-art rehydration system.

*IFJ* visited Scotland where the suits are being manufactured by Rempoy and also the product development facility of WL Gore, which is a major supplier to Rempoy in the production of its PPE garment solutions.

At the factory there was the chance to see the processes through which the suits are manufactured, from the initial stages when the 82 individual component shapes required for each SR3 suit are put together, through to the stitching and sealing processes and the final inspection of the garments – where any issues with these processes can be rectified if necessary.

After being made up the suits are hermetically sealed (guaranteeing them a shelf life of 10 years) and sent on to the relevant location, complete with unique serial numbers to allow each individual suit to have full traceability.

Under the current contract, 12,000 training ensembles and 12,000 operational ensembles will be delivered to the UK government by March 2010. The two ensemble garments differ slightly, with the training garment featuring especially selected fabrics to replicate the feel and physiological burden of the carbon and membrane based operational garment. The weight, comfort and feel of the garments remains the same so that the wearers will notice minimal differences between the two ensembles when worn.

Jim O Hara, sales manager for Rempoy, explained the improvements the new Quick-Don ensemble offered and why

this was so important for CBRN incidents: "Due to the new two-layer system, the new ensembles can be donned in under five minutes including all ancillary items such as boots, gloves, face masks etc. The previously supplied CR1 ensembles could take around 15-20 minutes to don, as these were made of up three layers which all needed to be donned separately. Due to its unique design, the new Quick Don ensembles can now be donned as one. One of the unique features of the new system is the separate inner hood that is used to form a seal around the respirator (and face mask), which combined with the specially selected boots and gloves give complete head to toe protection to the highest level possible for this type of specialist PPE."

Global business manager John Armstrong from Rempoy explained why providing the emergency services with a suit of this nature was so important: "First responders can't ignore a threat – they have to walk towards it. As such, it's vital they have the highest level of protection available at this time that allows them to react quickly and efficiently. With the SR3, ensemble, officers can now respond to incidents as they occur far more quickly than previously."

There has been interest from other EU nations and the US as to the availability of the suits.

## A quick breath of fresh air

Avon Protection, part of Avon Rubber, has won the contract to supply its FM12 respirators and CBRNF12CE filters to Rempoy as part of the £14.75 million Quick Don project.

The contract will involve Avon supplying 12,000 FM12 respirators and 24,000 CBRNF12CE filters to Rempoy to be used as part of the Quick Don CBRN ensemble – the complete CBRN personal protection equipment (PPE) suit that can be donned in five minutes.

Peter Slabbert, Avon Rubber's Chief Executive, explained: "Our FM12 mask and filters have been tested in the most stringent of CBRN environments. Add this to its ease of integration with other PPE equipment, and you have a CBRN suit that is completely fit for purpose." The NATO standard FM12 is probably the most widely used respirator across the world by military and law enforcement organisations. It has both CE and NIOSH CBRN certification, and provides high levels of respiratory protection against both classical chemical warfare agents and toxic industrial materials.

