Emergency service

Although they are still called by their original titles of 'the Fire Brigade' or 'the Fire Service', it is a matter of recorded fact that the members of these almost elite organisations fully deserve to be known as 'the Emergency Service'. Of course they still fight fires and also offer an advisory fire-prevention function to commerce, industry and private citizens. But they also attend road traffic accidents and chemical hazard spillages, train youth organisations, and provide a rescue service for everything from the aftermath of earthquakes to the results of international terrorism.

At a recent product launch by W L Gore, attendees were told 'nowadays more than half of all fire brigade missions are of a technical nature, only one third are fire fighting'.

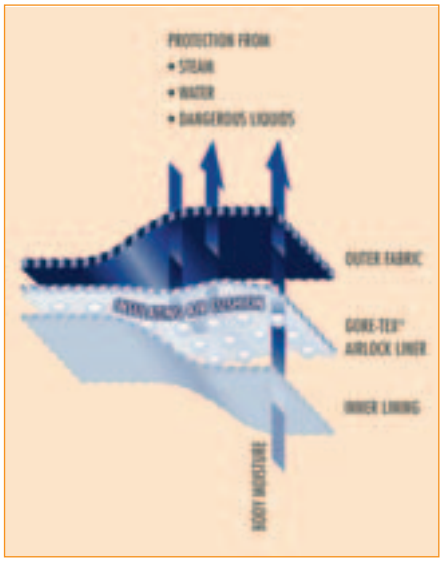
To match the versatility of the personnel it follows that the clothing worn by modern fire fighters must also be versatile in application. It must protect the wearer from burns and scalds, and it should be comfortable enough for extended missions and technical tasks. In Europe, standard EN 469 governs the performance profile of fire fighting clothing. Conventional suits are made from a multi-layer material comprising a flame-resistant face fabric, a moisture barrier, a textile insulation layer and an inner lining.

The protective clothing currently worn by fire officers in Europe, based on the European standard EN 469, consists typically of a multi-layered material structure with a flameproof outer, a liquid repellent coating, a textile thermal insulating layer and an inner lining. The textile thermal insulation layer in particular has disadvantages in use because of its weight and lack of flexibility.

Physical exertion means that the clothing also absorbs a great deal of perspiration, adding to the weight and, more importantly, creating a risk of scalding when the heat deflection function is called into play. Additionally, the fibre insulation layer loses volume over time and the personal risk is increased as a result.

A protective cushion of air

W L Gore has therefore developed a completely new product to replace the conventional textile insulation layer. Gore-Tex Airlock is the application of the company's experience in the development of expanded PTFE to provide what it sees as a unique combination of heat protection and liquid repellent that creates a protective cushion of air for the fireman. The new functional textile is based on small silicone spacers firmly anchored directly to the microporous Gore-Tex membrane on a wafer-thin fibre backing. The spacers, just a few millimetres high, are foamed and consequently extremely light and flexible, and they create a large enough gap for a layer of air that guarantees highly effective thermal insulation. The chemical-resistant silicone does not change its characteristics even at high temperatures and its effectiveness is



Gore-Tex Airlock - designed to operate under the most hazardous conditions.

W. L. Gore

retained even after many washes. Because of the layered structure of the clothing there is always a close-fitting textile layer over the spacers. This creates an effective, thoroughly protective cushion of air.

Using Gore-Tex Airlock functional textile makes it possible to reduce the weight of thermal insulation by 50% without cutting back on thermal protection. Even the breathability of this protective clothing for fire services can be more than double that of conventional insulation. Removing the bulk and stiffness of the standard textile layer gives a significantly improved freedom of movement to the wearer and allows him or her to operate for long periods even when in close proximity to heat.

Surveys carried out by the Hohenstein Research Institute in Germany, gave the following results when compared with conventional insulation:

- transports over 30% more liquid perspiration
- absorbs about 40% less sweat and consequently dries some 30% faster
- has up to 150% better breathability compared with the material structure required by the HuPF standard for thermal insulation.

(HuPF=Manufacturing and Testing Instructions for Universal Firefighter Protective Garments)

Since the launch of Gore-Tex Airlock Outerwear three years ago numerous fire brigades, professionals and volunteers, in Europe and Asia have already been equipped with this new product. Included amongst them are the fire brigades of Royal Berkshire and Buckinghamshire in the United Kingdom, Versailles and Nancy in France, Helsinki in Finland, Zürich in Switzerland, St. Pölten in Austria, Berlin, Chemnitz and Leipzig in Germany, and the fire brigade at Hamburg Airport, the Fire Fighters School RISC of Rotterdam in The Netherlands, Special Fire Brigades in the Czech Republic and Hungary as well as the fire brigades of Hong Kong, Trinidad and Kuwait.

Other hazards

Flame-retardant clothing is essential in many industries to protect workers from 'sparks and splashes'. Industrial legislation places appropriately high demands on the producers of treated fabrics, and the use of the finished garments is rigorously enforced.

Pincroft Dyeing & Printing is based in North West England, where it finishes fabrics to comply with the two key standards in the field: EN531, which covers general industrial workers, and EN470 part 1, for welding and allied trades, such as foundry workers.

Pincroft's range includes technical flame-retardant and insulating fabrics under the Flamemaster and Proban brand names. These start out as normal cotton and cotton polyester fabrics, and gain their protective qualities through treatment with Rhodia's Proban system.

"Proban is the most effective system for the treatment of apparel," says a spokesman, "It was first launched almost 50 years ago, but research and development has continued to improve the quality of the treated product. One of the benefits is that today's flame-retardant fabrics handle better than those of old.

"The treated fabric has changed from being fairly stiff to soft," he continued. "This broadens the potential market, allowing a wide range of lighter weight treated garments to be worn in comfort."

Flame-retardant finishing follows on from the normal fabric finishing process. Rolls of loomstate fabric arrive at the Lancashire factory from Asia. The first step in the process is to prepare the fabric. It is singed, desized, scoured and bleached, mainly mainly Benninger equipment on which Pincroft has invested some £2.5 million in the last four years – most of it in the past 12 months.

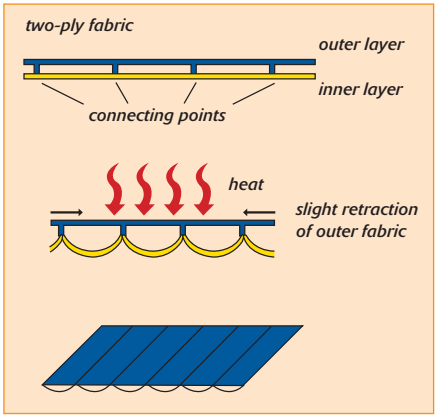
Dyeing uses a mixture of Benninger (wet) and Monforts (dry) equipment and then the next step is to add the flame-retardant treatment. This involves impregnating the fabric with chemicals using Rhodia's patented system. Proban chemicals are padded on, then dried off through a Monforts stenter and cured in ammonia gas in Rhodia-designed equipment. It takes just a few minutes to convert the chemical from a monomer to a polymer embedded within the fabric's fibres.

The polymer formation process is irreversible, with the Proban fully impregnated into the fabric – rather than simply being a coating. It is inert, completely insoluble and cannot be removed by washing.

Production of technical textiles such as these has an additional burden compared

Sweden's Trellchem provides appropriate suits for every possibility where heat and spilt chemicals meet.

Trellchem



Kermel's R-Liner reactive process creates tubular channels as an air barrier.

Kermel

to other types of fabrics. Production quality control has to be very high, given that lives could otherwise be at risk. Effectiveness of the treatment cannot be determined visually – the treated fabric looks and feels just the same as an untreated one – but the simple and effective means of testing is to apply a gas-powered flame to a sample from every batch.

Italian input

Using a combination of Kermel HTA high-resist fabrics, Bekinox steel strand inserts and Gore-Tex membranes – the firefighting suits manufactured by Italian-based Alfredo Grassi SpA are intended for 'EN 469-type interventions', which is 'fighting fires' to those who do not indulge in government-speak. The protective jackets and trousers are lined with a thermal felt consisting of a mixture of aramide and viscose for increased comfort.

Visibility in poor lighting conditions is ensured by the application of 3M Scotchlite banding around the hem of the jacket and the cuffs of sleeves and trousers.

Alfredo Grassi also relates to the high proportion of forest and wilderness fires that occur during the summer months on the European mainland, by offering a complete double layer suit for those involved in containment. Consisting of an outer one-piece and a three-piece baselayer, the set is said to offer mobility and protection in some very difficult circumstances. The outer suit is in a 50-50 mixture of Kermel and FR viscose, zipped from crotch to neck and with fully adjustable wrist and ankle closures. Again visibility is assured by the application of 3M Scotchlite.

The baselayer consists of long johns, long-sleeved undershirt and a helmet liner/face protector. Again the textile is 50% Kermel and 50% FR viscose.

Hazchem

The Swiss company Trelleborg has a deservedly high reputation for the provision of emergency shelters in most of the world's trouble spots. It follows that the same care and attention to detail goes into the company's Trellchem protective suits – intended for those situations where firefighters and others truly earn their 'Emergency Services' soubriquet.

There are three specialised designs, Trellchem HPS, VPS and TLU-A, all of which meet the stringent requirements the US Standard NFPA 1991 including the criteria for flammability and abrasion resistance. All are manufactured in rubber-based textiles and equipped with fully-effective wrist and ankle seals. The fabric is a five-layer composite consisting of (from the outside) Viton rubber, butyl rubber, polyamide textile, chloroprene rubber and, finally, a polymer film laminate.

Thermal barrier

The French protective fabric manufacturer Kermel provides specialised textiles to many parts of the world where emergency services clothing is produced. One of its latest products is a composite thermal barrier known as the Kermel R-Liner.

Dedicated to the manufacture of firefighting suits, it is constructed so that it changes its form when exposed to extremes of heat – creating air-filled channels to provide an additional barrier between the heat and the operative. Forming the inner of a three-part system, R-Liner consists of two layers of aramide textile laid face-to-face and laminated at regular intervals to form flat tubes. The lower, outer fabric is slightly thermo-retractable so that when the heat absorbed reaches a pre-determined temperature it contracts to generate three-dimensional channels, thus providing a continuous air barrier to the further progression of the high temperatures.

R-Liner meets the requirements of EN 469 and is said to be an excellent base for the modern applications for thin, lightweight, breathable composites.

Putting the takeover events of the past months firmly behind it, Quebec-based Huntingdon Mills has released details of two fresh fire-retardant fabrics with which it is said to be enjoying some considerable success. The first is a singular textile that has all of the softshell characteristics in a Nomex fire retardent structure combined with the stretch of Lycra. Anti-static properties are said to be excellent. The company describes this as 'the ultimate in protection technology where comfort is also required.'

The result is a fabric that is wind proof, water proof, fire retardent, with excellent antistatic dissipation of less than 0.02 sec for a 5 KV charge, all while being comfortable.

Huntingdon's C1995-A2 product is a one sided OSO fleece fabric, made with a special blend of polyester, and Conductrol. The fabric fully meets the most stringent tests, with a dissipation performance of 0.01 to 0.06 sec. (Standard FTMS 191 A Method 5931 requires no more than 0.5 sec.) This OSO fleece fabric is said to be superior to any circular knit fleece available on the market today.

Derryck Draper

Protective underwear for wilderness fire fighting. Long johns - shirt - and helmet lined in Kermel nylon and FR vicose.

Alfredo Grassi