

Gloves are essential for a number of sporting activities and many have been developed to protect against specific hazards associated with particular sports. Injuries to hands, especially fingers, are common in most physical sports and can occur from contact with other players, the playing surface or from equipment such as sticks, bats and balls.

Other gloves are designed to improve grip, which not only improves performance but can reduce the risk of accidents. Protection against extremes of temperature is an important characteristic in many sports, however, general environmental protection is also a prime consideration as many medical problems of hand and digit can develop due to long-term exposure to cold and wet conditions.



## A safe pair of hands

**T**he style of protective gloves is dependent on the hazards associated with particular activities and, to a certain extent, they have been developed not only for their protective qualities but also to suit the rules and traditions of the game. Protective gloves are a feature of many sports, such as cricket and hockey, and are generally intended to provide protection against impacts from balls or sticks. Gloves used for motorcycling need high abrasion and cut resistive properties in the event of an accident, while gloves for other motor sports are often made from flame-retardant materials. Some are designed to reduce the impact when catching balls but are subject to maximum dimension limitations. Other gloves are required to be protective but not bulky - for instance, cricket batsmen need protection but are reluctant to wear anything that increases the possibility of being caught out from a ricochet, where the ball touches the glove and flies off to a waiting fielder.

Whilst protective sports gloves are often unique to a particular game, the requirement to CE Mark them in accordance with the European Personal Protective Equipment (PPE) Directive is common to all if supplied to the European Community. SATRA, a UK-based international testing and technology centre with strong links to the footwear and clothing industries, is a member of the European working group, set up by the Committee for European Normalisation (CEN), responsible for the drafting of general protective clothing standards for sports players. The organisation also sits on many of the project groups which have developed the requirements and test equipment. There is a statutory obligation for manufacturers or importers supplying protective gloves into the European market to conform to the PPE Directive, and have their products CE Marked.

Many of the items are considered to be 'intermediate' category. These are products that claim to provide protection against risks of severe injury rather than just minor knocks and abrasions.

The design of the prototype and associated documentation of these items of PPE must be certified by a Notified Body, such as SATRA, in accordance with Article 10 of the PPE Directive (89/686/EEC). This involves examination of the 'technical' file - the basic design data - and ensuring the product conforms to the relevant sections from the list of basic health and safety requirements given in Annex II of the PPE Directive. The adequacy of the product description will also be checked and diagrams and lists of source materials validated. The performance of the glove is confirmed through tests and examinations on prototype products to ensure that they meet the claimed performance levels. In the case of industrial PPE, many European (EN) standards - 'Euro Norms', have been completed and these are often used as the basis for test. The standards for sports protective equipment are not so advanced at present, therefore the Notified Body often has to test against the basic health and safety requirements of the Directive using an agreed technical specification instead of a harmonised standard.

Whilst protective gloves should give the best possible protection, it is generally recognised, and a mandatory requirement of the PPE Directive, that ergonomic considerations are also important and the design of the glove should still enable it to be worn comfortably and not reduce the wearer's effectiveness. It is also recognised that the risk of injury is likely to change at different levels of the same sport. Batsmen playing for the village cricket team are unlikely to face the speed of delivery from international Test Match level bowlers. For these reasons the concept of different levels of protection is inherent in sports PPE. Conversely,

some sports are played with less finesse by amateurs and it can be argued that the risk of injury from impacts and abrasions can be greater than at professional level.

The availability of different levels of protection allows players to make a choice regarding the most appropriate glove for their own circumstances. Protective sports gloves are generally designed to reduce the severity of injuries caused by impacts, cuts and abrasion, and the effects of heat and cold. Impacts can be caused in many circumstances, including other players, sticks and balls, falling down or colliding with equipment. The results of impacts range from bruises and lacerations to fractures. Hand and digit injuries from impacts represent a significant proportion of all sports injuries. A bad injury, or a series of relatively minor ones, can cripple hands, preventing full participation in the sport and even wider lives. Sports impacts can be accidental, or as a result of a deliberate action within the rules. For example, hockey outfield players do not intend contact although impacts between players and from sticks are inevitable.

Gloves have a dual role; reducing the effect of impact from a stick or ball and offering impact protection to the outside of the hand from accidental contact with the ground while keeping the stick low. On the other hand, goalkeepers will deliberately place themselves between ball and goal and may be hit many times. In this situation, gloves made of high energy absorbing materials are needed to prevent excessive force being transmitted through. Cricket batsmen are often hit and injured by the ball. American football, ice hockey and the martial arts are extremes of physical contact sports and those taking part wear considerable protective equipment. Strikes from small, hard balls and pucks used in games like hockey and cricket are often of high velocity, impacting onto the body for a fraction of a second. This concentrates the kinetic energy in relatively small areas and the transmitted forces can cause serious injury. Hand and digit bones are close to the skin surface and vulnerable to fracture. Protection against impacts is therefore designed to spread the impact over a longer time and over a larger area. Various types of compressible foams spread the time of impact.



### Accelerated research

Spreading the impact over a larger area requires more rigid materials, such as hard plastics. Products are often made from a combination of materials that embody the different characteristics required. Better understanding of the ergonomic aspects of glove design and PPE requirements have led to accelerated research into new impact material technology, especially in the area of foams such as PVC nitriles and polyethelene. Techniques such as thermoforming, have also enabled better manufacturing methods.

It is important that laboratory tests reflect real situations as far as practical. One challenge for standards-making bodies is to devise laboratory tests which adequately simulate the conditions which occur in each sport, while ensuring some continuity of equipment that keeps the costs of testing to a minimum. The weights and speeds of players and balls, for example, are taken into account and tests generally involve some form of impact drop test. In this a weight of a similar shape to the object used in the sport is dropped a predetermined distance onto the sample. Suitability is determined by examining the results of either transmitted force measured through the sample or by a measurement of deceleration. A significant amount of research has been carried out into the forces required to cause bruises or

*Protection and security.  
Cricketing gloves with  
diverse functions.*

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*Motorcycle glove abrasion is tested by a test specimen being dropped from a height of 50mm onto an abrasive belt. The belt moving at a speed of 8 m/s produces a contact force of 49N. The time to abrade through the full thickness of the sample is then measured by an electronic timer triggered by a system of trip wires.*



Since the launch of its first goalkeeper's glove 30 years ago, products from the German-based glove giant Reusch have been selected by 46 German federal league goalkeepers and by almost five times that number of internationals. The 2001 collection includes two models of particular interest.

Aqua Keeper has been developed to take advantage of Reusch's new latex-enhanced AquaTech material, a fabric which shows its true potential when faced with the wettest surfaces. Then the glove becomes softer and develops a larger gripping surface – said to be similar in effect to the suction cups on the arms of an octopus.

A larger cut in an ergonomic form is the main feature of the new Volume model glove. This format offers a greater area of attack to the ball. The lining is another new Reusch fabric called Latex Ultragrip which provides an improved adhesion for the hand inside the glove. The company says that performance and flexibility are not affected by the weather conditions under which any game may be played.



Reusch's Ultra Volume and Aqua Keeper gloves.

The Armadillo is a complete rethink in current ice climbing glove design, which for the most part is that of a standard outdoor glove with foam patches on the back and spaces to enable the fingers to bend - spaces just where there should be insulation and protection from low temperatures and rock scrapes.

British company Equip Outdoor Technologies says that it applies alternative thinking to problems encountered by end users, and the answer in this case was to use overlapping foam plates to both protect and allow flexibility. The aptly named Armadillo glove was the result.

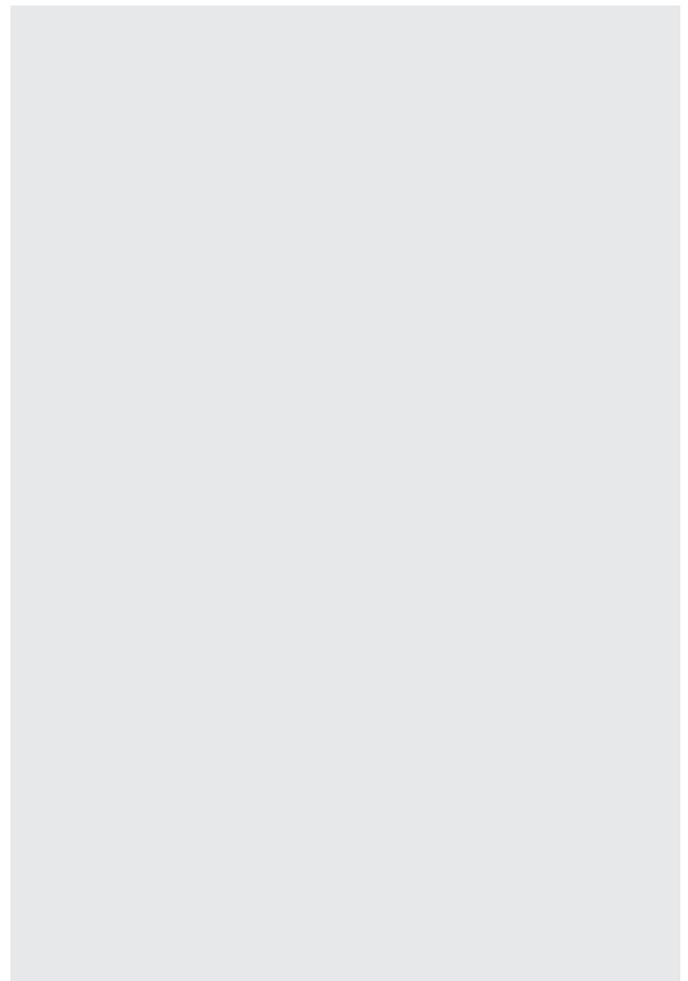
Equip has also introduced the Lite Flex, a glove derived from a Formula One motor racing design that combines a Gore Windstopper fleece back with a Clarino synthetic leather palm. The objective is a design that will allow the wearer to carry out quite delicate operations without removing the gloves. The company suggests that the specification is ideal for activities such as outdoor photography. DD

fractures in various parts of the human body, much of it in the automotive industry, and pass/fail thresholds are set using this and other medical data. For impact protective gloves the coverage area is particularly important. Minimum dimensions are specified in standards, usually dependent on the size of the intended wearers, and the area is often checked against a standard template. Dimensions are crucial, insufficient protective area increases the risk of injury while excessive coverage reduces ergonomic effectiveness. For this reason some standards also specify maximum dimensions.

Abrasive resistance qualities are essential requirements for protective gloves used in motorcycling, cycle racing, downhill mountain biking and similar sports, as well as winter sports such as skiing and bobsledding. Gloves are generally less bulky and made of different materials such as Kevlar and Keprtec which display high resistance to cutting and abrasion. Elastane fibres are often incorporated to improve freedom of movement and comfort. Frequently these gloves also embody protection against environmental conditions, especially cold and wet, and many fibres have been developed to make these products water and wind-resistant, but at the same time breathable and insulating. A tall order for the same glove!

### Martial arts

Gloves and mitts used in martial arts vary in design. Padded gloves are often dual purpose, protecting the assailant from injury but primarily intended to protect the person being attacked. One of the biggest problems facing the competitor wishing to use protective gloves, is to balance the need for protection without unduly affecting performance. Many injuries associated with impacts can be prevented, but often only by wearing quite bulky gloves. Experience has shown that if the gloves are too cumbersome, competitors will not wear them. Part of the process of certifying protective equipment is to ensure not only that the equipment has the necessary performance but that it meets the



ergonomic requirements: for example, that the wearer can play the sport wearing it without any loss of movement or performance. (SATRA uses panels of experienced players who wear the gloves and comment on the ergonomic performance.) In addition to the ability to perform the activity, the gloves may be worn for some time to confirm user comfort. Materials should be chosen that prevent build-up of sweat and heat. This is sometimes assessed by laboratory tests designed to measure water/moisture vapour permeability. In addition to preventing specific injuries, gloves must not introduce additional hazards by being made of materials that could injure the wearer or any one who comes into contact with them. Generally a physical and visual examination checking gloves for the presence of sharp edges and points is carried out. Testing may also include some quantitative tests, for instance measuring the pH or chrome content or checking for trace toxic substances in the product's raw materials. In use, liquids such as perspiration and rain can cause these substances to leach out of the material onto the wearer's skin, which may lead to skin problems.

Outdoor wear is primarily designed to maintain hand temperatures at comfortable levels in a wide range of climatic conditions. This is particularly important for gloves used in sports where climatic conditions may be uncomfortable or arduous. Tests can be carried out for resistance to water penetration, water vapour resistance (the breathability of the fabric) and thermal resistance.

A wide range of protective sports gloves are available which can prevent some injuries and reduce the severity of others, but it remains the user's responsibility to ensure that the most appropriate form of protection is worn. 

Austin Simmons, SATRA, UK

**A** new tanning technology from UK-based Pittards, has the capacity to resist abrasion by as much as a 25% increase over existing leathers.

Of particular value to the sports glove market, the process – known as Armor-Tan – encases the fibres of the leather in ceramic platelets to protect them from the ravages of grip, grab and rub. Included in the process is Pittards highly developed WR100 water repellency system and the company's anti-absorption treatment, which effectively seals the leather from attack by moisture from either side.

**B**ritish snow-sports brand Phoenix, owned by the AMG Outdoor Group, has launched a new range of handwear developed by international glove designer Bridie McEntagart. Split into three sections, ski, freerider and outdoor, the range comprises a total of 17 gloves and mitts – including one boarding glove equipped with ProtonSuper Grip, a 'sticky' finish developing extra grip. Both Gore-Tex and AMG's own breathable fabric, Protex, feature prominently in the range.



Phoenix's Free and Hurricane gloves.

**P**rotection against brand misuse, a fresh approach, and new license agreements has prompted Schoeller to relaunch the Keprotect brand.

The Swiss company is using a marketing mix of advertising, brochures, counterfeit-proof hangtags, and sales training to promote the brand. However, the main thrust of the new strategy is to communicate clearly the special protective functions and added value of Keprotect. In the recent past there has been a proliferation of copycat products and this may have caused speculation and questions among buyers as to the quality and the validity of the product. With this in mind, Schoeller will police more rigorously the use of Keprotect fabrics by undertaking random sample checks of end products and checking the use of the brand name in advertising.

An additional aspect of the new Keprotect positioning is the regulation of the right to use DuPont's Kevlar trademark. Although Kevlar fibres are always a component of Keprotect fabrics, the communication of the Kevlar brand in the future will be restricted to a very limited number of market participants and directly licensed by DuPont (See also WSA – Autumn 2000). Schoeller plans do not include a licensing programme for the use of the Keprotect brand, but its meaning and purpose will be verified. DD