





Is the future Karting-wear seen from all angles already upon us?

We have already seen particular details concerning karting suits in previous issues, this time we will take a look at the latest ideas and designs for van products – fibres and material used – at the basis of the longed for Level 3 homologation.

Report D.Leone – Photos E.Di Stefano

Technical offices and research labs are already at work, the announcement of a higher level homologation has not yet come, but the time is right for using Level 1 and Level 2, and Vroom has sparked off another fuse: the suit of the future! Ahead of time and fashion, let's see the innovative solutions that stimulate the designer's imagination and that we hope to see with the next homologation.

Level 3 as a logical evolution

Although the four main standards for homologating Level 1 and Level 2 are believed to be sufficient for facing any unexpected accident on karting tracks (resistant to tear and heatproof), we cannot but underline the fact that it's better to be safe than sorry. That's why Level 3 would be better now, not so much for taking over from Level 2, but as a logical and gradual evolution requested for a special market, the karting market, which has been a habitual and conservatory one

for far too long now.

Karting accidents: various sorts

CI think that we still remember what happened in 1976 to Nikki Lauda, at the Nurburgring Grand Prix and to Gerhard Berger at Imola in 1972. In the first case – although they were already using kevlar in 1972, you can still see the marks left by that accident. In the second case, the Austrian driver is very thankful to the factory (OMP) that made his suit and gloves – made of Nomex; they prevented him from getting burnt in a terrible fire.

Although you find several types of material on the market toady, what's worrying is that in karting research for protective clothing derives, or follows the fashion of motor racing or motorcycling.

However, considering the first suits, made in the 80's – starting from the standards requested for Formula racing – progress has undoubtedly been made. Karts though, are quite different to cars; there's no cock-pit, and no protection roll-bar and bumpers are smaller. What I mean is, the driver's body is not protected properly

Futuristic ideas from the Universities

The prototype of the suit that has been photographed in this article has been made by Riccardo Imperio for his thesis for his degree in Architecture. The title of the thesis is: "Protective clothing for motor-racing events". His Professor was Massimi Ruffili, from the University of Florence who teaches "Technology and Design Planning. The suit was made with the help of the Spidi Sport development and research centre directed by Piero Zanetti.

Material used for making the prototype

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Cordura: made by Du Pont, weaving carried out by Lenzi Egisto S.p.a., weight 500g material used for the torso and lower limbs. Hide: 11/10 mm thick. Placed at the upper part of the arm, along the triceps of the femur and along the spine.

Shock-resistant silicon rubber: made by Elle Res, R1218 model, specific weight: 0.066 gr/cm³, 6mm thick. Used for "plaques" along the spine, on the chest, inside knees and near the femur and malleolar articulation. **Kevlar:** made by Du Pont, weight 500g; used at the abdominal and renal parts. **Keprotect:** made by Shoeller Switzerland, weight 370 g; composition 10% EL, 26% AR Kevlar Du Pont, 64% PA; 45% longitudinal elasticity, 35% transversal elasticity. It is used inside legs, behind the knees, in area around torso.

Mono-material products: polyurethane shells on shoulders and elbows, up to ulna and radius of each arm.



because he is inside the vehicle and not on it as in motorcycling, and in an accident, he usually falls on one side and the bike on the other.

In kart driving, 38% of the accidents involve upper limbs and 24% ribs while the remaining 11% concern lower limbs.

From these results, and seeing the different areas, one should be able to see the direction that level 3 suits ought to follow. They should comply with regulating norms and offer the best that manufacturing can.

CIK-FIA conceptual evolution: homologation of individual parts

SAAlthough "revolutions" always start from below, evolution can but start from the top... In this sense we suggest that the court of CIK-FIA experts re-consideration how things stand for sports wear homologation, perhaps it is better to homologate protective clothing differently, distributing protection over the whole suit.

At the moment homologation is given after testing the material to see whether it is resistant to tear, abrasion, cuts and

heat. However, the manufacturers themselves suggest different standards for parts of the body that run more risk. Where the impact cut risk is higher (around vital organs) you ought to have a higher standard respect to where there's less risk. Today though, the respect of the four main homologation criteria (valid for the entire body, no differences) imply that the solutions used by manufacturers are an average that lower the safety level.

So, Level 3, could consider homologation for the various parts, so firms can use specific material in given parts.

Evolutionary planning: using a combination of technological material

Firmly upholding the homologation principles, we expect to see an innovative idea as the basis of a new models

Besides the strength of the technological material used today and that will probably still be appropriate in the future



Karting is quite different to car racing; there's no cockpit, no overhead protection structure like the rollbar and the bumpers are quite smaller. Well, in case of accidents the driver's body is completely at risk

Always van products with Du Pont

In 1938 there was a small revolution throughout the female world; the field of stockings were astounded by the invention of nylon that could be used instead of silk, which was very frail and easily broke. Then during the second world war, they started using nylon for parachutes and tyres for jeeps. Du Pont de Nemours and Co., was the first to discover nylon. They had the right idea, use this material for a variety of things and then develop more and more sophisticated material over the years, material that could be applied for industrial use (defined as "engineering" fibres) that could be used for most articles. Not the factory is a leader in its field, and has patented many important but what's more common products like: Kevlar, Nomex, Teflon, Telfaire, Lycra, Cordura, Tyvek, Antron and Tactel. Du Pont is one of the biggest industrial businesses in the world with branches in Wilmington (Delaware, USA) and branches in over 70 countries, with 56 dedicated to production and development in Europe only. It was founded in 1802, it has products and technologies for various fields like agriculture, alimentary, pharmaceutical, transport, telecommunication, textile industries, building, automobiles electricity and electronics.



for the Higher level; practically the same parameters to be respected - but now divided in parts - and new proposals. Apart from the technological material used that will still be suitable for the future, the frontier that today's industrial research must face is in trying to match all the various materials perfectly. The factory that manages to combine elasticity and solidness of movable parts combined with shock absorption and abrasion resistance of the various materials will probably dictated tomorrow's best model. All this considered, it's easy to imagine that besides the multi-layered material - now used for all Level 2 clothing - there will also be multi-layered material that will make the difference in unexpected accidents that karters may be involved in. This is proof that racing-wear manufacturers prefer to put together various



The real frontier that industrial research has to face in the immediate future is in combining various materials for the different parts

Level 3 will probably consider divide the homologation areas, so that firms can use the most appropriate material in specific areas of the suit



technological material, already existing on the market, rather than spend time on specific research, that is, at least until there are the numbers that make it an interesting field of investment for karting (hope soon). After having stepped into karting important factories, such as Swift and Alpinstar, have been obliged to take a step back after finding the market unsatisfactory for their investment. Drivers aren't just drawn by the brand name, performance of the products, like engine, chassis, suits, helmets and so on, is very important too.

Fibre and material for the future

The material used is made of fine warp and wefts, and the threads are all made of different fibres. Research in this field, already in the 40's had already been started by Du Pont. Different fine fibres were developed, with diameter varying from 6 to 10 microns. There are threads made up of 4000 fibres twisted together, cables of 15000 fibres and roving, that is, compact bundles of thread. Fibres can be aligned in one direction so as to form a surface or they can be crossed by transversal elements.

The difference of the various material or cloth lies in the type of fibres used, the number of threads per centimetre and

the way these are woven together. As the variants produce unlimited results, we have a vast variety of material and any application can theoretically speaking have a perfect cloth to make the garment they want. Most cloths are flat (maximum stability and changeability), diagonal (good changeability but less stability), satinized (good changeability, limited stability)

Micro Shock against cuts

Besides being conform to CIK-FIA regulations, any cloth or material used for racing-wear must also be conform to EC norms.

As for rib protection (waist-coat), they must be conform to norm En 1621-1, which standardizes impact (impact force must be less than 35 kN, kN = Kilo Newton, i.e. crash force in kilos in ratio with crash speed), and it consists in measuring the absorption ability of the force on impact. The type of material that will probably have the most success in future is the natural elastomer, named Micro Shock, which can knock out 58.8-61.6 Kn of the traditional products bringing it down to 21.5 kN.

Carefully studying the use of Micro Shock in areas with more crash risk, we can foresee suits with rib protectors already

in them, and probably this, Micro Shock could also be extended to the external part of the leg, which runs a higher risk of getting injured in impact.

Anti-shock against blows

This is a silicon rubber used at parts of the body that, when hit, need good anatomical movement. It is a very interesting material, made by ElleRes, and stands out for its ability to react against blows in a "non homogeneous" way. Practically speaking, the Anti-shock rubber, is in its fluid state and, if it undergoes a light, non constant disturbance, it remains soft, but if the shock is hard, the silicon component becomes semi-stiff with high resistance level to blows. It is a very good material that gives the driver appropriate mobility – that's why in Riccardo Imperio's prototype pictured in this article, it has been used around the articulation or joints area; it protects joints from blows that drivers can get at ribs or torso area

Cordura against abrasions

The Cordura brand is registered by DuPont for making a multifilament nylon fibre. A strong, comfortable and light material, which is very resistant to tear, abrasions and perforation. It stands out for its strength and high



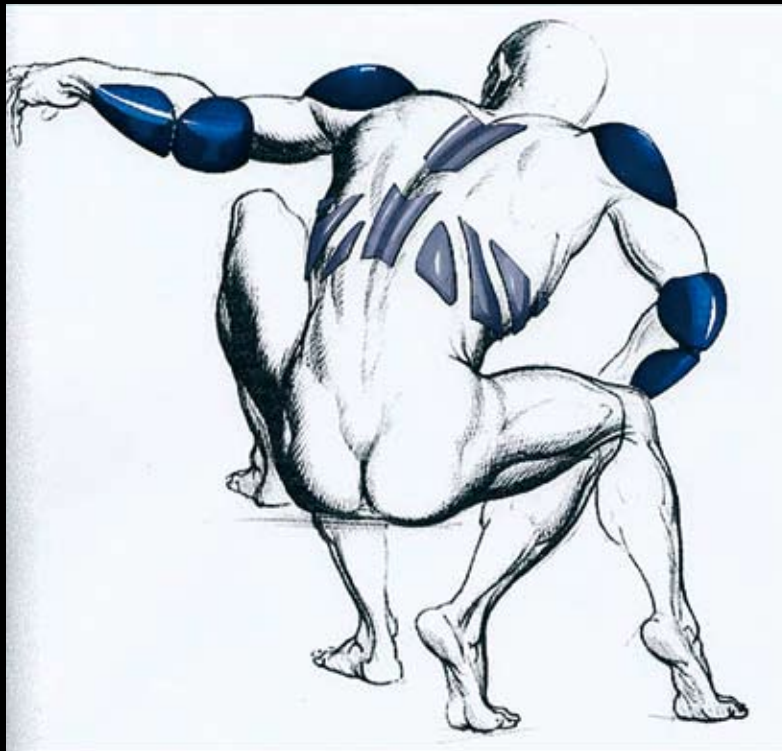
In the future, the winning recipe will probably be dictated by those who manage to combine elasticity and strength of the removable protection with best shock absorption and abrasion resistance of the technological material used.



resistance to abrasion but it is not heat-proof so it cannot be used as fire-proof material (not requested on Cik-Fia regulation norm). Today, Cordura is commonly used for making many of the karting suits on the market. In the suit designed by Riccardo Imperio, it has been applied in all areas where the abrasion risk is high, torso and lower limbs. In the torso area, the Cordura has been integrated with other materials that offer different characteristics of protection. Also in other parts of the suit, the rear, it has been combined with other types of material to give improved elasticity.

Kevlar against tears and perforation

Kevlar too is a name that has been registered by DuPont. It was discovered in 1965 and available on the market from 1972 on. Kevlar is well-known for being used for bullet-proof jackets. In fact, its resistance is five times that of steel. It offers thermal and dimension stability, no corrosion (resistant to most chemical agents), it is heat-proof and flame-proof. It is shock-proof and offers a high degree of vibration absorption. In the motor-racing field it is used for coating tyres and to replace asbestos that used to be used in clutches, brake coating material and



gaskets. Audi BMW and Damier Benz say that they use products that have been re-enforced with kevlar fibre for F1 and Rally engine components, and obviously chassis and tyres too; while the fire-proof suits are made of Nomex III Du

Pont, a composite material that contains Kevlar. The prototype of Level 3 suit uses this fibre to safeguard vital organs that risk getting perforated in accidents.

From skin to technological materials, the evolution is forever closer

In the 70's young karting pioneers like Mike Wilson, Terry Fullerton and Ayrton Senna used to wear leather suits very much like the ones worn in motorcycling. Still today, there's a strong debate on using hide: would it be good also for karting? It could well be, if we were at Level 3 homologation with different parts homologated, a homologation that would open up to several materials – there's nothing to

prevent us from thinking about metallic material like those used for scuba suits that have to face sharks. However, for the time being, suits are mostly made of synthetic material – fibre – also for comfort and obviously costs, but it is natural to think that the new future fibres will also remain in karting. It is up to the factories to determine and interpret in an innovative way the potential of the materials available and direct their use in the karting field too so that drivers can have the best protection and we'll always see less medical assistance and ambulances on the circuits.



There's nothing to stop us from thinking about metal material used for scuba-diving suits that protect against sharks