Change for the better

Making the most of improved belt technology

In many industries, especially mining, even the thickest and heaviest of conveyor belts such as a 5-ply belt can be ripped or torn by large lumps of heavy, sharp rock, either falling from height or becoming trapped. It is not uncommon for a belt, even one fitted with rip stop breakers, to be destroyed within a matter of weeks or months. In some cases, a trapped object can cause irreparable damage before anyone has a chance to stop the conveyor.

This is, of course, a problem well known to a great many mine operators. When faced with the need to repeatedly repair damaged belts and, ultimately, to prematurely replace a barely worn belt, the most obvious answer would seem to be to fit an even heavier belt with even thicker covers. However, the reality is that this is very rarely the best solution. In fact having increasingly heavy, thick belts can lead to other operational problems.

In truth, the real answer to impact and ripping problems is the same that applies to virtually all other conveyor belt problems, which is to fit belts that have a carcass that is specifically designed for the purpose and which is protected by top quality, high performance rubber covers.

The dilemma for operators is that from the point of view of the vast majority of belt manufacturers, as well as the vulcanizing companies that supply, repair and fit the belts, frequent repair and replacement makes for good business. Supplying conveyor belts that provide a considerably longer operational lifetime is not really in their best interests. Fortunately,not all manufacturers and service companies think that way.

The fact is that conveyor belt technology has advanced quite significantly, especially in recent years. Today's belts, even those that carry the heaviest, hardest and sharpest materials, should be able to handle such aggressive materials and yet still run for far longer than they currently do. So, the technology and the solutions are out there. You just have to know what to look for and where to look. So we asked one of the most respected names in conveyor belting, Netherlands-based Dunlop Conveyor Belting to do just that.

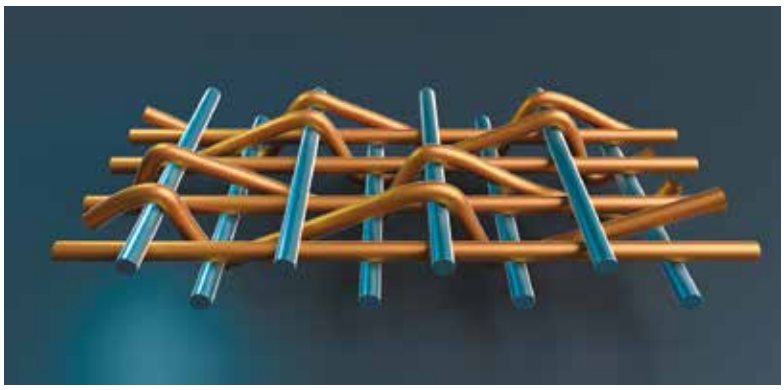
Here, director of development, Dr. Michiel Eijpe, dispels some of the outdated misconceptions about heavy duty belting and throws new light on a unique conveyor belt construction that has proved remarkably successful in some of the toughest and harshest environments imaginable.

A VERY DIFFERENT APPROACH

Our traditional market strategy at Dunlop has always been to approach the market from the opposite direction of our competitors by actually *maximising* the working life of belts. Longest possible life is therefore the golden rule for all of our belts. At the same time, our aim is also to dramatically reduce the direct and indirect operational costs for the operator including belt repairs and lost production time. In effect, we compete against low priced, low quality production values by using greater cost-efficiency as the buying motive for our customers.

Several years ago, in keeping with this tradition, our engineers set about creating a new and unique concept of conveyor

belt construction. The objective was to create a belt that could handle the kind of tough materials and conditions that have been described earlier much more effectively than any other belt on the market. This included the kind of impact that would normally destroy conventional rubber multi-ply belting.



The unique strength comes from the unique fabric ply construction

THE ULTIMATE SOLUTION

The result of this pioneering development work was Dunlop UsFlex, which went on to become one the most successful conveyor belts that we have ever produced. Looking back, the success that followed is hardly surprising because UsFlex has a resistance to impact that is up to three times greater than that of conventional plied belting and rip and cutting resistance which is more than four times greater. It is even far superior to steel reinforced, solid woven and other conventional heavy-duty belt constructions of a similar tensile strength.

BELT CHARACTERISTICS

The toughness of UsFlex lies within its unique carcass, which differs fundamentally from that of standard 'warp and weft' construction conveyor belts. Conventional wisdom would seem to dictate that increasing the number of plies will naturally result in a stronger belt that is more able to resist impact and ripping and tearing. Actually this is not the case. The greatest influence on the strength and other physical properties of a conveyor belt are the actual design and quality of the ply material used to create the carcass.

The 'secret' behind the amazing impact and tear resistant characteristics of UsFlex is the use of a unique and innovative 'straight-warp' woven fabric ply. This consists of heavy strands of polyester running lengthwise and nylon running crosswise. The strands are completely straight in both directions and not interlocked as in a conventional belt carcass. This allows the weft to float free from the warp, providing two major benefits. Firstly, the design minimises the peak point of impact because the energy is absorbed (dissipated) over a larger area.

Secondly, if a sharp object penetrates the carcass the nylon crosswise strands have the strength and the 'freedom' to compact (gather) together, effectively forming an increasingly stronger barrier. It is a broadly similar principle to that of a fabric rip stop breaker ply except significantly more effective.

UsFlex belts are either a one or two ply construction, from a 400/1 through to a 1600/2. The two most popular versions of UsFlex are a 2-ply 1000N/mm (for heavier duty applications) and a single-ply 630N/mm. In all cases, it is the unique design of the special fabric ply that soaks up the impact and resists the ripping and tearing.

ARMOUR PLATING?

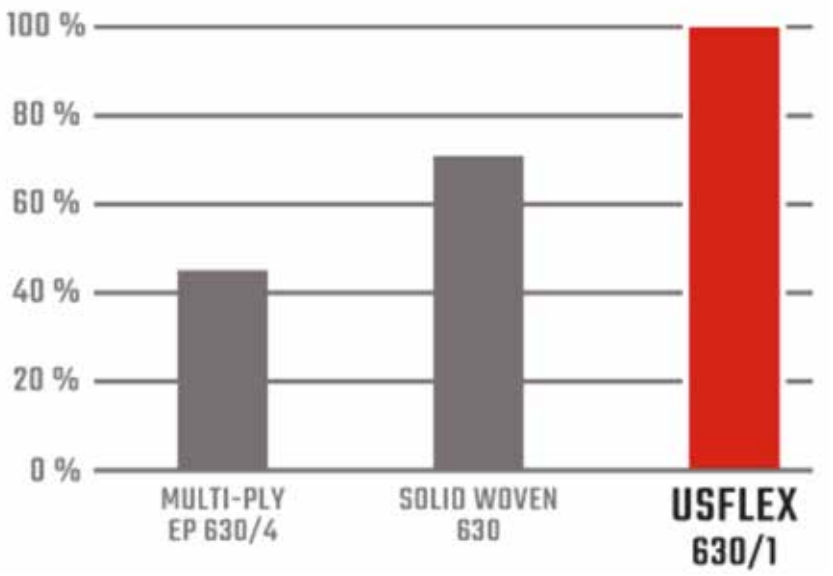
For some, the very idea that a conveyor belt with only one or two plies could be so much stronger than a belt with multiple (4 or 5) plies may not make much sense. The fact that it is genuinely much stronger is due to advances in technology and design. The analogy that I would use is armour plating on military tanks. The modern composite armour used on military vehicles nowadays is a much thinner and lighter construction than the extremely thick and heavy steel plating used in the past yet it provides greater protection than ever.

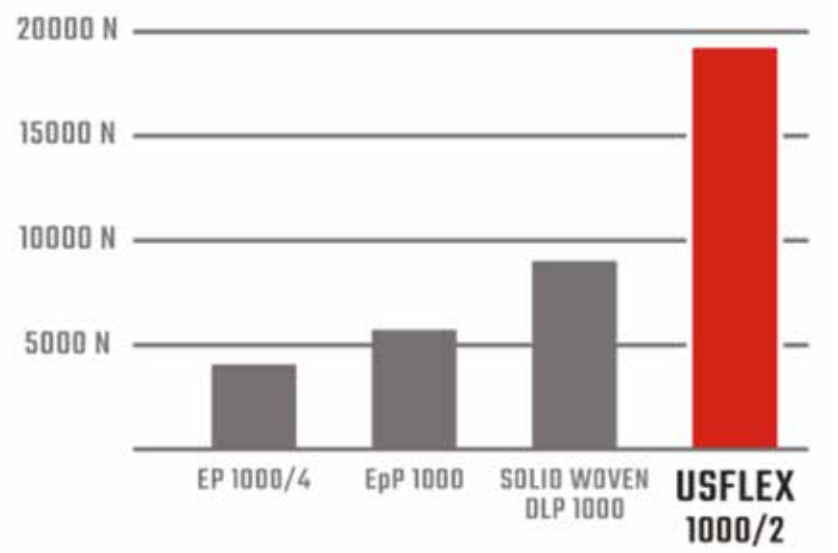
TESTED TO DESTRUCTION

It is important to point out at this stage that the tests for impact, rip and tear resistance referred to below are only made on the actual belt carcass itself. The top and bottom covers are always removed to ensure that the thickness and quality of the rubber cover does not influence the validity and consistency of the tests.

When compared to conventional multi-ply and solid woven belting, the impact resistance of UsFlex is quite exceptional. For example, a single ply UsFlex type 630/1 has the impact absorbing qualities of a 4-ply EP belt type 1600/4 or an EPP 1250/2. The chart shows the comparable results of impact tests on 630 rated UsFlex, Solid woven and multi-ply belting.

The longitudinal ripping of a conveyor belt is caused when sharp foreign objects penetrate the moving belt and then become trapped. In laboratory tests we pierce a belt with a sharp hook and pull the belt to simulate the ripping action, the force of which is then measured. Such testing consistently shows that the rip resistance of UsFlex is over five times that of conventional multi-ply belts with a similar tensile strength and far superior to Solid Woven and EpP constructions.





The rip resistance of UsFlex is over five times that of conventional multi-ply belting

The tear resistance of UsFlex, measured according to the international EN ISO 505 standard, also significantly exceeds that of conventional multi-ply belts with a comparable tensile strength. As you might expect, there is no shortage of imitators and rival products such as belts fitted with steel breakers. Having spent years refining UsFlex, we continually test not only our own belts but also belts manufactured by our competitors so that we can continue to prove the strengths and advantages. I am proud to say that we have never tested a competitor's belt that could even remotely compare to the sheer strength and durability of UsFlex.

ADDED PROTECTION

As explained earlier, the two key elements that are needed to create any high performance conveyor belt are firstly to have a carcass that is specifically designed for the purpose and secondly to protect that carcass as much as possible by using top quality, high performance rubber covers.

Because UsFlex is designed to handle extremely aggressive materials and harsh working conditions, all UsFlex belts are fitted with Dunlop RS covers as standard. This is because of the excellent resilience of the RS rubber compound to the cutting and gouging caused by sharp rocks combined with a resistance to abrasion that exceeds the very highest abrasion standards, which are DIN W and the equivalent ISO 'D' standard.

Other qualities, such as oil, fire and heat resistant covers are available. Because of the combined strengths of the carcass and the rubber covers, UsFlex belts with homogeneous chevron profiles have also proved to be a great success on mobile road surfacing machinery.

OZONE & UV DEGRADATION

Apart from being able to resist the wear and damage physically caused by the materials they have to convey, all conveyor belts also need to have first class resistance to the effects of ozone and sunlight (UV). This especially applies to belts being in used in sunny climates and/or coastal areas, even if the belts are under cover.

At high altitude, ozone acts as a protective shield but at ground level it is a pollutant. The effects are known as ozonolysis. If you search for "the effects of ozonolysis on rubber" on the internet it will tell you under 'Susceptible elastomers' that *"Tiny traces of ozone in the air will attack double bonds in rubber chains, with natural rubber, polybutadiene, styrene-butadiene rubber and nitrile rubber being most sensitive to degradation."*

Exposure to ozone increases the acidity of carbon black surfaces and causes reactions to take place within the molecular structure of the rubber. This can have several consequences such as a surface cracking, a marked decrease in the tensile strength of the rubber and consequently a much shorter belt life. The same applies to exposure to ultra violet light (including fluorescent light) and is referred to as 'UV degradation'.

Even more significant are the environmental and health and safety consequences because dust particles penetrate the surface cracks caused by the ozone and UV. This dust is then discharged (shaken out) on the return (underside) run of the belt. You will hardly ever find a belt manufacturer that even mentions ozone or UV. This is because although the problem can be prevented by adding anti-ozonants to the rubber compound before vulcanisation, these additives are quite expensive. As a matter of policy, every rubber cover grade that we make is guaranteed to be resistant to both ozone and ultra violet.

We have hardly ever tested a competitor's belt that was able to pass the EN/ISO 1431 test specific conditions. When ordering any conveyor belt, regardless of type, my advice is to always insist on certification confirming that the belt you are ordering has successfully passed the EN/ISO 1431 test.

LIFE AT THE SHARP END

There is, of course, no truer test of a belt's durability,

The invisible belt destroyer. The test sample shows serious lateral cracking following exposure to ozone. (EN/ISO 1431 testing)

resilience and length of operational life than seeing it perform in the toughest possible conditions. Over the years, we have been fortunate to have been given the opportunity to put UsFlex to the test in a wide range of industries carrying an equally wide range of highly aggressive materials and environments. We have more 'success stories' involving UsFlex than any other belt that we produce.

One such example is a site handling in excess of one million tonnes per annum of Dolerite, which is a notoriously hard and sharp rock. The primary jaw crusher being used was widely recognised as being an exceptionally tough applications because it was processing up to 650 tons per hour of sub-250mm material that fell some two meters onto the conveyor.

New belts had been lasting as little as two months before signs of deterioration due to impact damage started to appear. Desperate for a solution, the site management agreed to undertake trials to assess the long-term benefits of UsFlex in terms of durability, performance and especially the opportunity for planned preventive maintenance.

The performance of three previous 'conventional' multi-ply conveyor belts was measured. The first belt operated for 26 weeks before replacement. The second belt only lasted for 9 weeks and the third ran for some 15 weeks before failing.

An UsFlex 1000/2 8 + 3 conveyor belt was then fitted. After carrying more than one million tonnes and reducing the cost per ton by almost 50% the trial was unsurprisingly considered to be a complete success! Examination of the belt did reveal some cuts in the top cover rubber but most importantly there was no evidence of carcass damage. The introduction of UsFlex improved continuous production and reduced belt maintenance and downtime. After 3 years, the UsFlex belt was still operating successfully, ultimately resulting in a reduction in cost per ton of more than 80%.

VULCANISED SPLICE

It is widely recognised that the weakest part of any conveyor belt is the splice joint. For maximum splice strength, we recommend finger splicing. Some people in the industry seem to have something of a phobia when it comes to finger splicing but it is actually quite straightforward. In destructive testing it achieves in excess of 90% of the belt strength at failure. This is far stronger than conventional multi-ply belting where splice strength is typically 60-70% of the breaking strain. On two-ply UsFlex belts such as the 1000/2, conventional step splicing techniques can be used but a great many of our regular UsFlex users prefer the finger splice method due to its far greater strength.

SEEING IS BELIEVING

Changing from a heavy duty 4 or 5-ply belt with extra thick covers to a single ply or dual ply construction belt with 6+3 or 8+3 covers may sound like a big step. As you might expect, I would argue that it is not a big step at all because the laboratory test data and the countless real life success stories of UsFlex provide irrefutable evidence to the contrary. As the old adage goes, "seeing is believing".

info@dunlopcb.com/ www.dunlopconveyorbelting.com