ASTM D 1460 oil resistance testing.

Les Williams, Dunlop Conveyor Belting, the Netherlands, provides an inside view of what goes on behind the usually closed doors of the company's R&D laboratory.

WHERE THE SCIENTIST IS KING

The laboratory housed inside Dunlop Conveyor Belting's manufacturing plant in the Netherlands is at the heart of its quality control process. It is here that every batch of rubber compound is checked and tested to the limit before it can be used to produce conveyor belts that are guaranteed to perform as they are designed to. It may be a painstaking process, but the company insists that it creates a consistency in the quality of every belt it makes.

The aim is to exceed the highest international standards, rather than just complying with them – which is not easy when you consider that there are dozens of standards relating to almost every conceivable aspect of the conveyor below. "We are very fortunate to have a very experienced and dedicated team of laboratory technicians and engineers here in Dunlop," said Sytze Brouwers,

Dunlop's chief application engineer. "Most of them have worked for Dunlop for many years and they are very passionate about what they do. They need to be because conveyor belt technology is far more complex than some people might believe."

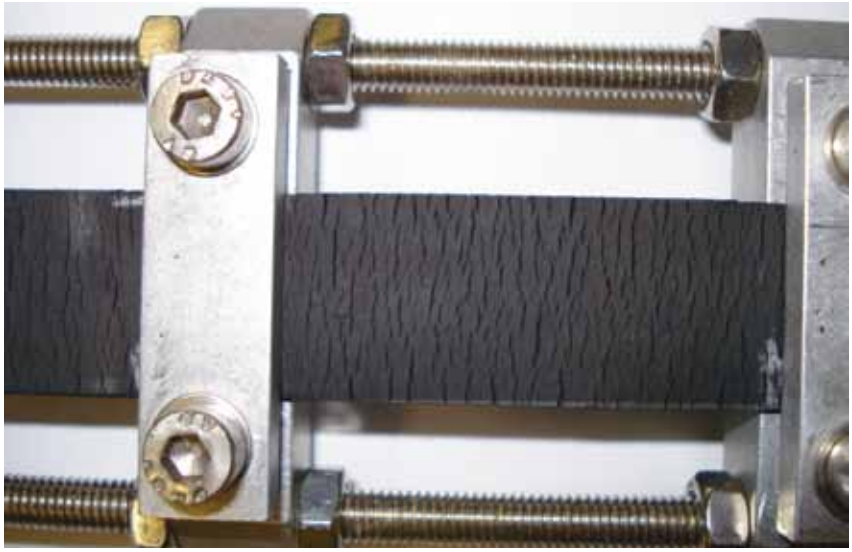
When standing still is going backwards

It is Dunlop's belief that, because of the growing demand for longer belt life economy, as well as rapidly evolving technology, failing to move forward is the equivalent of going backwards. So, despite increasing market austerity, especially in terms of R&D, it has taken the step of expanding its laboratory and investing in the very latest technology.

Dr Michiel Eijpe, the company's technical director, has been charged with the task of heading up a new wave of R&D: "Our competitors seem determined to [...] cut costs so that they can offer lower prices. But the old saying that you only get what you pay for has never been truer," he said. "We are sticking to the principle of greater economy for our customers through longer belt life."

Thanks to the developments that take place in the laboratory, Dunlop is creating a new generation conveyor belts that are increasingly able to withstand just about anything that can be thrown at them. From highly abrasive, razor sharp materials to ozone pollution and extremes of heat cold, Dunlop belts can handle it because the wizards of the laboratory make sure they can. But simply maintaining the company's reputation for producing the best conveyor belts in the world is only part of the story.

Mad science: creating the next generation conveyor belts.



Not what it's cracked up to be: the effects of ozone on a competitors belt.

New demands, new tests

Health, safety and the environment

The world of conveyor belts is changing in other ways just as quickly, and nowhere more so than the awareness of health and safety and the environment.

Regardless of market demands for lower prices, there should never be any compromise when safety is involved. To conduct independent tests on its range of fire-resistant BV belting to certify its suitability for use in ATEX 95 (94/9/EC Directive) classified zones, Dunlop enlisted the services of one of the world's leading experts on fire and explosion protection: the German Institute Dekra Exam GmbH.

ATEX 95 regulations apply to industrial environments where there is a risk of fire or explosion because dust or gas is present in the atmosphere. Dekra's tests proved that Dunlop's BV belt cover exceeded the international EN/ISO 284 standards for anti-static properties by a considerable margin. "This is important because it means that all of our belts equipped with BV fire resistant covers meet the most severe demands for operating within ATEX classified safety zones," said Dr Eijpe.

Dunlop's technicians and engineers have also had to deal with one of the most complex health, safety and environmental regulations in the world. The EU's REACH regulation (EC 1907/2006) came into force in 2007 and, at over 800 pages, is not a light read. It deals with the registration, evaluation, authorisation and restriction of chemical substances with the aim of improving the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances.[1] Dunlop Conveyor Belting claims to be the very first conveyor belt manufacturer to achieve full compliance with REACH regulations – thanks to the work of the company's R&D department.

The problem of ozone

Although the damaging effects of exposure to ozone are now internationally recognised, what is less well recognised are the extremely harmful effects on the cover surfaces of

rubber conveyor belts. Belts that do not operate under shelter are prone to surface cracking, which has serious consequences in terms of the performance of the belt and its working life. There are also significant environmental and health and safety issues, especially where fine particles penetrate the cracks and are then discharged (shaken out) on the return (underside) run of the belt.[2]

Dunlop has invested in the latest, testing equipment so that it could introduce mandatory testing to EN/ISO 1431 (resistance to ozone cracking) international standards. Its technicians also successfully focused on providing increased protection by using special additives in all rubber compound recipes, thereby extending the operational life of Dunlop belts against the effects of ozone.

Raising the standard

Dunlop has also worked to ensure that its belts exceed EN ISO 284/DIN 22104 electrical conductivity standards so that they can be used within ATEX-regulated areas.

Finally, where ISO or DIN standards do not exist, such as resistance to oil and grease, the company works to apply a suitably tough alternative (in this example, the US's ASTM D 1460 standard).

From the lab to the coal mine

It's cold out there...

Compared to many of the materials that Dunlop's belts are used to convey, coal is not unduly aggressive. However, coal mines can be located in some of the most challenging environments on earth. One such case involved coal mines in Mongolia where the belts above ground operate in temperatures as low as -50°C. Although Dunlop's standard abrasion resistant rubber can withstand ambient temperatures as low as -30°C, temperatures as low as -50°C would cause a conventional rubber belt to become as hard as wood and virtually inoperable.

To deal with this, Dunlop gave its technicians the task of developing a compound that could not only act as a durable cover for the belt carcass, but could also be used for the rubber skim between the fabric plies so that the belt would not simply freeze and pull apart. Using liquid nitrogen in test cabinets to simulate freezing conditions, the technicians created a rubber formula that could not only withstand the ultra-low temperatures but which also had outstanding anti-wear properties.

... so turn up the heat

At the other end of the spectrum, the wizards of rubber technology have also successfully developed a compound that is not only fire resistant (i.e. does not continue to burn once ignited and the source of the flame then removed) but is also simultaneously resistant to the effects of both heat (i.e. able to carry materials at high temperatures with minimum ageing) and oil. Such a combination is extremely difficult to achieve because the ingredients needed to achieve one aspect of resistance can conflict with those needed for a different physical property. The compound also needed to maintain other essential qualities, such as above-average resistance to wear (abrasion) and cutting, making it a singularly complex challenge.

Reality checks

Not content with simply relying on scientific laboratory testing, Dunlop engineers also work with customers in order to measure performance by carrying out case studies. One such study involved a large coal import dock terminal where a conveyor situated in the rail loadout area was proving to be a problem. The terminal operator had been experiencing premature wear and de-lamination, resulting in an average belt life of only three months.

A succession of different belts supplied by various manufacturers had failed to deal with the issue. A 2200 mm wide Superfort 1000/4 6+3 BVXS (fire resistant) belt was then fitted and checked at regular intervals. A year later, the belt was still running well with negligible wear and no signs of delamination.

More than meets the eye

So if you thought that all conveyor belts were just long pieces of black rubber with not much to choose between them, then think again. Think of the men and women in long white coats working quietly behind closed doors! WC

References

1. Further information on the REACH regulations can be found at: http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm (accessed: 9 November 2012).
2. For more information on the effect of ozone on conveyor belts, see: WILLIAMS, L. "Cracking up", *World Coal* 20.1 (January 2011), pp. 43 – 46.