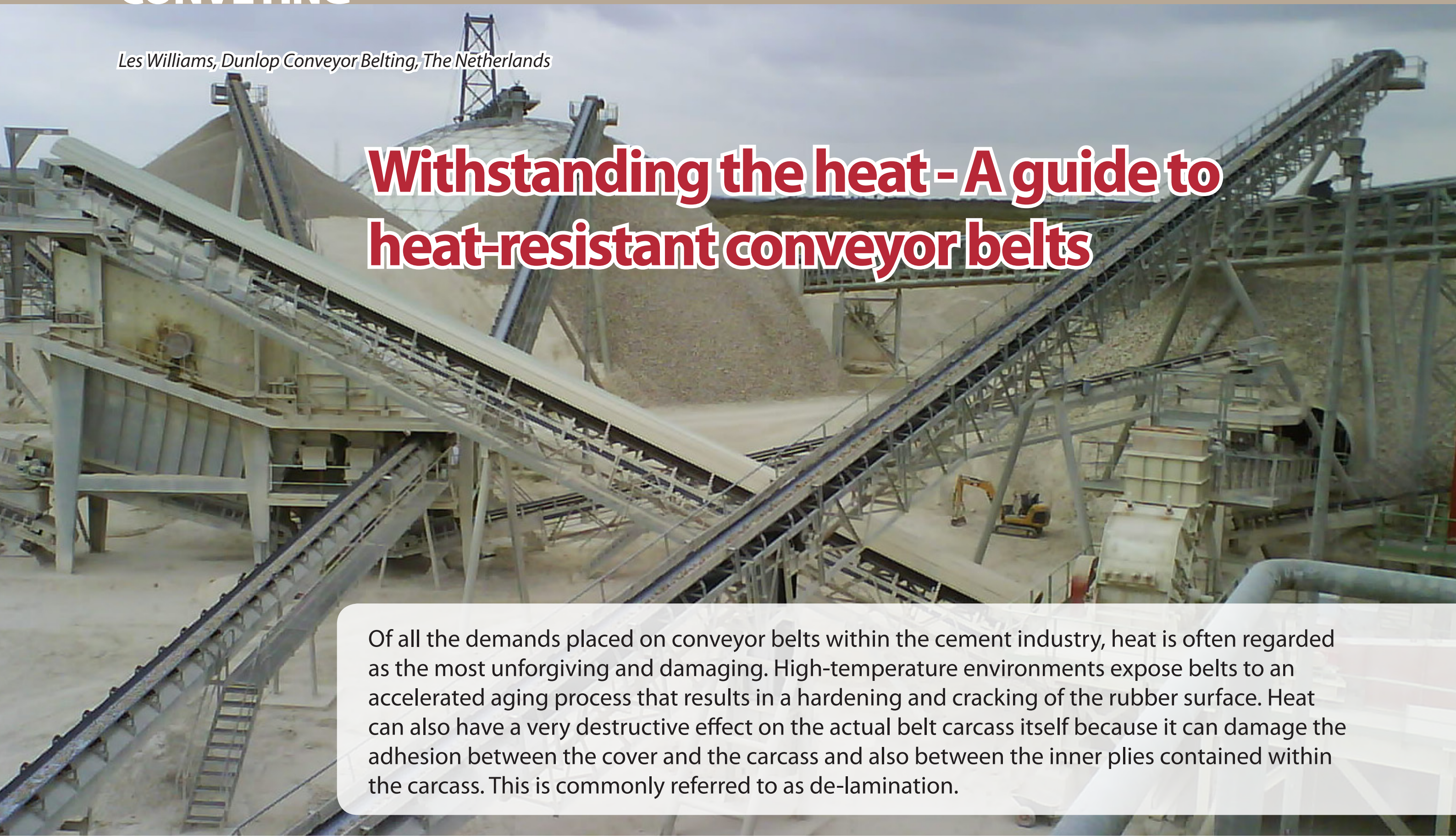
Les Williams, Dunlop Conveyor Belting, The Netherlands

Withstanding the heat - A guide to heat-resistant conveyor belts



Above: Cement plants are full of conveyor belts, many of which have to withstand sustained extremes of temperature.

Of all the demands placed on conveyor belts within the cement industry, heat is often regarded as the most unforgiving and damaging. High-temperature environments expose belts to an accelerated aging process that results in a hardening and cracking of the rubber surface. Heat can also have a very destructive effect on the actual belt carcass itself because it can damage the adhesion between the cover and the carcass and also between the inner plies contained within the carcass. This is commonly referred to as de-lamination.

As rubber becomes harder and less elastic its tensile strength and elongation at breaking point can fall by as much as 80%, effectively destroying its operational strength and flexibility. At the same time, resistance to wear (abrasion) can decrease dramatically, often by 40% or more.

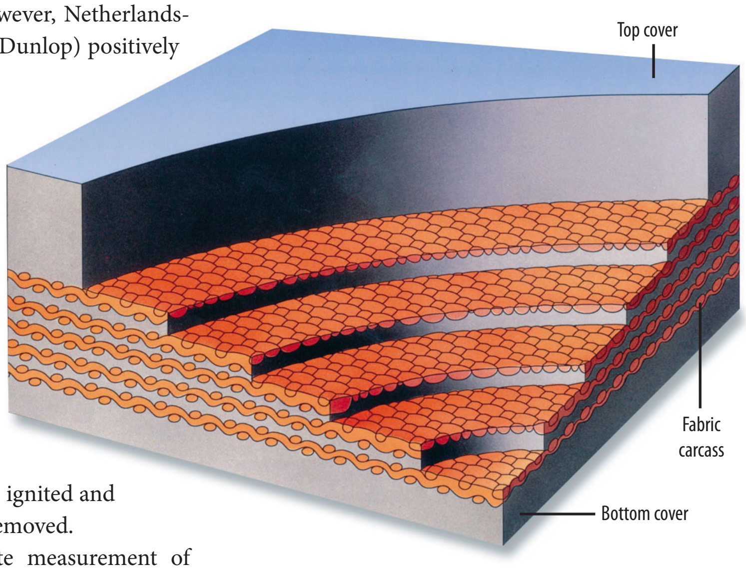
With so much that can go wrong, is it any wonder that some manufacturers and traders appear to prefer supplying belts for less demanding applications? Perhaps the phrase, 'If it is too hot then stay out of the kitchen!' may be appropriate. However, Netherlands-based Dunlop Conveyor Belting (Dunlop) positively welcomes such challenges.

ISO 4195 heat-resistance testing

There is a significant difference between heat- and fire-resistance. In basic terms, heat-resistant belts are designed to carry materials at high temperatures whereas fire-resistant (or flame-retardant) belts are constructed using materials that, for safety reasons, do not continue to burn once they have been ignited and the source of the flame has been removed.

To provide the most accurate measurement of heat-resistance and therefore anticipated working life, accelerated aging tests are conducted by placing rubber samples in high-temperature ovens for a period of seven days. The effects on its various mechanical properties are then measured. The three classes of aging within ISO 4195 are 100°C, 125°C and 150°C. In order to include more extreme temperature-resistance qualities, Dunlop also carries out tests at 175°C.

The temperature limits that a belt can withstand are viewed in two ways - the maximum continuous temperature of the conveyed material and the maximum temporary peak temperature. The two main classifications of heat resistance recognised in the market are T150, which relates to a maximum continuous temperature of 150°C and T200, which is for more extreme heat conditions.



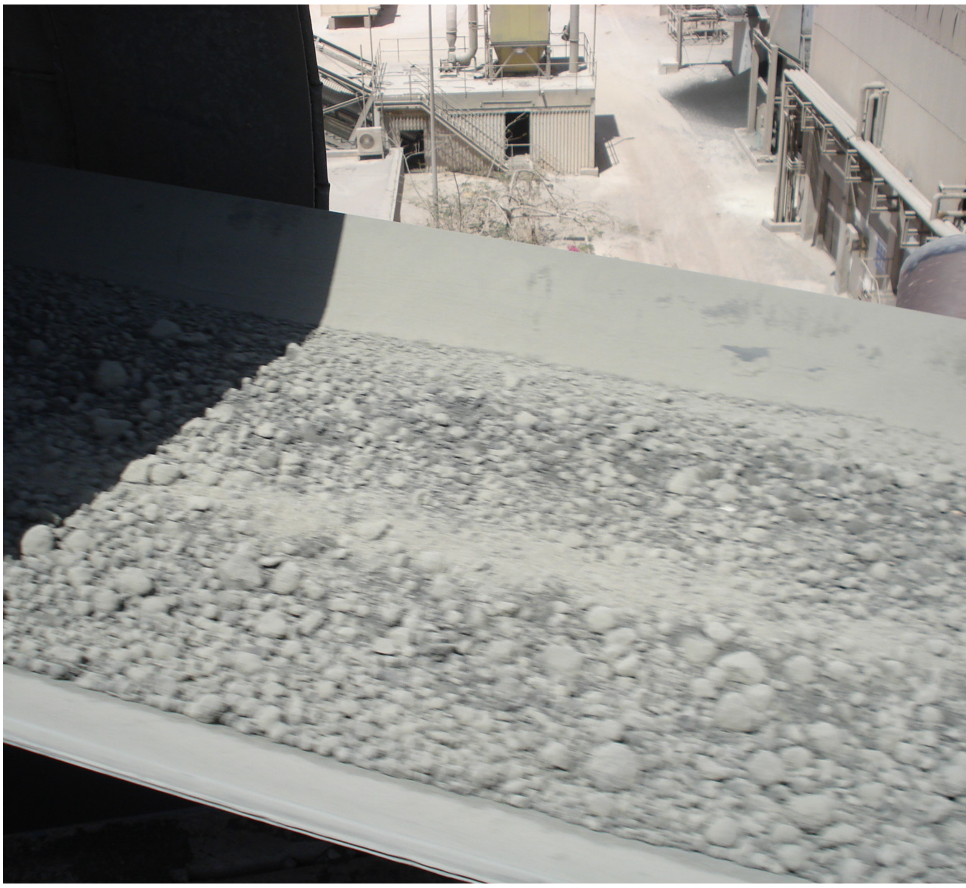
Right: Heat-resistant covers prevent the carcass of the belt from damage.

Heat-resistant covers

Choosing the quality and thickness of covers that are best suited for the specific conveyor application and the operating environment can significantly increase the operational lifetime of a belt because it is the cover that acts as a barrier between the heat source and the carcass. The most critical area is the splice (joint) because this is invariably the weakest point in any conveyor belt. It is therefore essential that the heat-resistance qualities of the splice materials are comparable to the actual belt cover.

Generally speaking, belt covers that have a high resistance to heat have a lower resistance to wear and tear. The Dunlop solution to this dilemma has been to develop covers that have a virtually unique combination of both heat- and wear-resistant qualities. This results in a much longer operational lifespan. For example, ISO 4195 laboratory testing has shown that following continuous exposure to 130°C for 7 days, Dunlop Deltahete retained its original (pre-test) resistance to abrasion.

Cover quality selection can become much more complicated depending on the nature of the materials being carried. Fine materials such as cement usually cause a greater concentration of heat on the belt surface because of the lack of air circulation between the hot material particles. In the case of clinker, however, although the actual temperature of the material can be extremely high, there is better air circulation between the particles because clinker is coarse.



Above: Dunlop conveyor carrying hot clinker.

The ultimate test?

The ultimate test of heat-resistant belting is often found in elevators because the heat build up in enclosed environments is far higher than conventional conveyor systems. Elevator belts need to operate under high tensile loads and be able to withstand continuous material temperatures as high as 150°C. Conventional textile reinforced belts cannot withstand this kind of treatment and will stretch permanently. Ideally, elevator belts should be steel-reinforced.

Failure of an elevator belt can be catastrophic, both in terms of physical risk and downtime. The price of the belt invariably reflects the quality, so whenever safety is involved, short-term cost 'savings' should never be a consideration.

Having selected the best type of belt construction (including high-performance heat resistant covers), it is then essential that only top quality steel fasteners are used. For this reason, Dunlop has introduced a range of fasteners designed for use in elevators. Replacing an elevator belt is a more highly skilled process compared to conventional conveyor belt replacement so it is equally important to use engineers who are experienced in this field.

Keep it moving

The unloaded return (underside) run is a crucial part of the cycle because the carcass has the opportunity to cool. When a loaded belt is static, the heat is allowed to penetrate through to the carcass. Even the very best heat-resistant belts can be damaged beyond repair if a conveyor loaded with hot materials is allowed to stop. Wherever possible, the loading feed to the conveyor should be stopped first and the belt allowed to fully discharge its load.

It is important to bear in mind that elevator belts have little or no possibility to cool down on the return run, which is why even the higher classification of heat-resistance (Class 3) is often insufficient for use on elevators carrying hot materials.

The Dunlop solution

Supplying heat-resistant belts holds no fears for Dunlop because over the years its engineers have developed covers that are designed to handle even the often extreme conditions created during cement production. For example, Dunlop's 'basic' heat resistant cover, Betahete, consistently exceeds the requirements demanded by ISO 4195 class T150. Betahete is a high performance heat and wear-resistant cover designed for materials at continuous temperatures up to 150°C and peak temperatures as high as 170°C.

For more extreme temperatures Dunlop Deltahete is recommended for use in demanding heavy-duty service conditions such as cement plants to convey high temperature loads of abrasive materials. It is specifically designed to withstand maximum continuous temperature of the conveyed material as high as 200°C and extreme peak temperatures as high as 400°C.

Deltahete exceeds the highest requirements of Class 3 and is therefore effectively Class 4, although this category does not yet exist within the ISO 4195 classifications for heat resistance.