



## TECHNICAL ARTICLES

# WEARING THIN – CAUSES AND SOLUTIONS FOR CONVEYOR BELTS THAT HAVE TO BE REPLACED PREMATURELY DUE TO SURFACE WEAR

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Conveyor operators all over the world waste millions very year because the belts they are using are wearing out much faster than they should be doing. The biggest single influence on the wear rate of a conveyor belt is its ability to resist the effects of abrasion. Here, conveyor belt specialist Leslie David looks at the question of abrasion resistant belting and provides some helpful advice on how to save money by increasing the working life of your conveyor belts.

## It's all about the Quality

The wear resistant quality of the outer covers of a conveyor belt is the biggest single influence on the working life of the belt and consequently its 'whole life' economic cost. The rubber used for the outer covers usually constitutes at least 70% of the overall thickness of both multi-ply and steelcord belts. This makes the cost

rubber the single biggest element of cost when manufacturing a conveyor belt. Consequently it is therefore the single biggest opportunity for manufacturers to minimise costs and to compete for orders based on price rather than quality and performance. From the buyers point of view, although the price of a belt may be 30% lower than other offers, if it wears out 30% faster then it really is not such a bargain after all.



*Conveyor belts are wearing out faster than they should*

Two of the most common methods used to minimise rubber costs are using recycled rubber, usually of highly questionable origin, within the mix and the use of cheap ‘bulking’ fillers such as chalk to replace part of the rubber polymers in the rubber compound. There are a great many different types of rubber compound used because modern-day belts have to deal with a multitude of different (and often combined) demands. Because of its adaptability, most of the rubber used in conveyor belting is synthetic. Literally hundreds of different chemical components and substances are needed to create these synthetic rubber compounds that, once vulcanized, are able to meet the specific physical performance and safety requirements.

## Different Kinds of Wear and Tear

It is a common misconception that a belt specified by a supplier as being ‘abrasion resistant’ should naturally be expected not to wear quickly. Different causes of wear and abrasion require different kinds of abrasion resistant covers. For example, belts that transport heavy and/or sharp objects such as rocks, timber or glass that cause cutting and gouging of the belt surface need different resistance properties compared to belts carrying ‘fine’ materials such as aggregate, sand and gravel, which literally act like a piece of coarse sandpaper that is constantly scouring the rubber cover.



*Fine materials act like sandpaper on the rubber surface*

As a general rule, 80% of conveyor belt surface wear occurs on the top cover of the belt with approximately 20% of wear on the bottom cover. Wear on the top cover is primarily caused by the abrasive action of the materials being carried, especially at the loading point or ‘station’ where the belt is exposed to impact by the bulk material and at the discharge point where the material is effectively ‘accelerated’ by the belt surface. Contrary to popular belief, short belts (below 50 metres) usually wear at a faster rate because they pass the loading and discharge points more frequently compared to long belts. For this reason, the selection of the correct type of cover quality and the thickness of shorter length belts becomes even more important than usual.

Wear on the bottom cover of the belt is mainly caused by the friction contact with the drum surface and idlers. The rate and uniformity of this type of wear can be adversely affected by

many other factors such as misaligned or worn drums and idlers set at incorrect angles. Other factors such as an unclean environment where there is a build up of waste material can accelerate wear. Belt cleaning systems, especially steel edged scrapers, can also cause wear to the top cover surface.

## Thicker is not always better

The actual thickness of the cover is an important consideration. Generally speaking, the more abrasive the material and the shorter the conveyor, the thicker the cover should be. In principle, the difference in thickness between the top cover and the bottom cover should not exceed a ratio of more than 3 to 1. In an effort to extend operational lifetime, many conveyor belt users resort to fitting belts with increasingly thicker covers. However, covers that are too thick can potentially cause other problems. In reality, the single most important factor is the actual abrasion resistance of the belt cover rubber.



*Abrasion resistance is more important than thickness*

## How Ozone & Ultra Violet Light contribute to rapid Wear

There is absolutely no question that ALL rubber conveyor belts should be fully resistant to the damaging effects of ozone and ultra violet light. This is because ozone becomes a pollutant at ground level. Exposure increases the acidity of carbon black surfaces and causes reactions to take place within the molecular structure of the rubber. This has several consequences such as surface cracking and a marked decrease in the tensile strength of the rubber. Likewise, ultraviolet light from sunlight and artificial (fluorescent) lighting also accelerates deterioration. This is because it produces photochemical reactions that promote the oxidation of the surface of the rubber resulting in a loss in mechanical strength. In both cases, this kind of degradation causes the covers of the belt to wear out even faster than it should.



*Close up of ozone cracked belt*

Rubber belts that are not fully resistant to ozone and UV can start to show signs of degradation even before they have been fitted to a conveyor simply by being exposed to the open air and daylight. Sadly, despite its crucial importance in terms of operational lifetime, ozone and UV resistance is very rarely, if ever, mentioned by traders or manufacturers. This is almost certainly because the anti-ozonants that need to be used during the mixing process of the rubber compounds are relatively costly. Building that 'avoidable' cost in would immediately make the belt less competitive on price. My advice is to always make ozone & UV resistance a required part of the specification when selecting any rubber conveyor belt.



## Abrasive Wear Standards and Test Methods

There are two internationally recognised sets of standards for abrasion, EN ISO 14890 (H, D and L) and DIN 22102 (Y, W and X). In Europe it is the longer-established DIN standards that are most commonly used. Generally speaking, DIN Y (ISO 14890 L) relates to 'normal' service conditions. In addition to resisting abrasive wear DIN X (ISO 14890 H) also has good resistance to cutting, impact and gouging. DIN W (ISO 14890 D) is usually reserved for particularly high levels of abrasive wear.



*ISO 4649 / DIN 53516 abrasion testing*

The test method for abrasion (ISO 4649 / DIN 53516) is actually quite simple. Abrasion resistance is measured by moving a test piece of rubber across the surface of an abrasive sheet mounted on a revolving drum. It is expressed as volume loss in cubic millimeters, for instance 150 mm<sup>3</sup>. The most important thing to remember when comparing abrasion test results (or promises!) is that higher figures represent a greater loss of surface rubber which means that there is a lower resistance to abrasion. Conversely, the lower the figure the better the wear resistance.

Comparing (evaluating) one offer from another is made very difficult by virtue of the fact that (with only one exception that I know of) the technical datasheets provided by manufacturers and traders will almost invariably only show the minimum figure demanded by a particular test method or quality standard rather than the actual performance that the belt being offered would be expected to achieve.

It is important that buyers of conveyor belts remember that DIN and ISO standards are only the minimum benchmark of acceptability. Even then, laboratory tests consistently reveal that despite the claims of the manufacturers, more than 50% are found to be significantly below those minimum standards.

### One for the Price of Two?

There is a lot more to conveyor belts than meets the eye. Fitting and replacing two or three 'economically priced' belts rather than opting for the longer operational lifetime provided by a single, good quality abrasion resistant belt is invariably a false economy and much more hassle in the long run! As often as not, the quality of a belt is reflected by its price so it is always worth the effort to check and compare the original manufacturer's specifications very carefully and ask for documented evidence of compliance and performance. ■



*One good quality belt - not two poor quality belts*