Fig. 1: Conveyor belt durability and reliability can be critical factors in both productivity and cost management.

# Meeting the Requirements

## Getting the Best from Conveyor Belts

*L. Williams, The Netherlands*

*Conveyors continue to remain the most effective method of on-site transportation but their durability and reliability can be critical factors in both productivity and cost management. Experienced users certainly need no reminder of the huge cost implications of a plant downtime because a conveyor belt needs to be repaired or replaced.*

Especially during recent years, the technology used to manufacture conveyor belts has advanced enormously and today's users of belts should rightfully expect a much higher level of performance and longer operational life from their belts. Sadly, this is quite frequently not the case. Getting the best advice and guidance is not always as easy because for many suppliers and service companies, conveyor belts that last longer and require less maintenance are not good for business. In some cases, their philosophy seems to be 'sell cheap and replace often'.

As if to confuse the user even further, conveyor belt suppliers (and the companies that fit and maintain them) also seem to have developed a language all of their own. Therefore, some basic information might be useful for those users who may not necessarily be conveyor belt experts. Hence, the following sections will provide general information on conveyor belt construction and give some valuable advice on how to choose the best type of conveyor belt to deal with the different kinds of requirements that are placed on them.

### The Basic Belt Structure

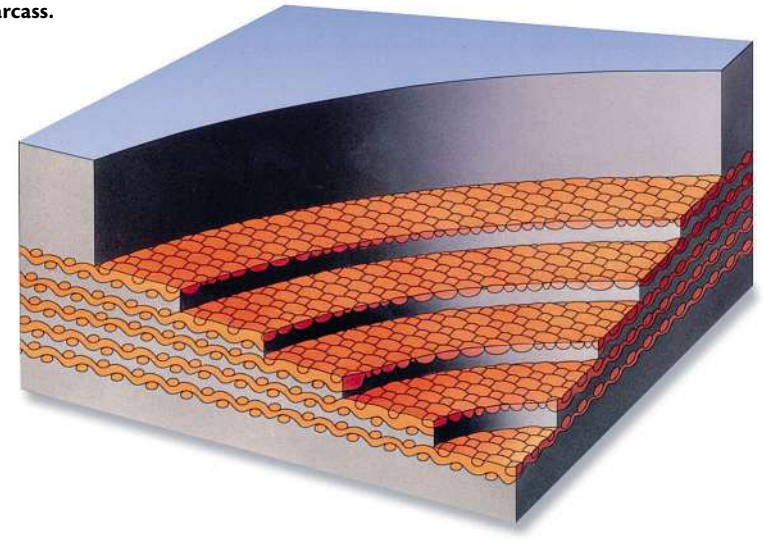
Rubber belts with 'multi-ply' textile reinforcement are the most commonly used type within the bulk handling industry and usually consist of two elements. The basis of every conveyor belt is the carcass, which typically contains layers of extremely strong but flexible fabric embedded in the rubber, see Fig. 2. It is the carcass that provides the inherent characteristics of a conveyor belt such as its tensile strength and elongation (elasticity or 'stretch' under tension).

The use of wide conveyors naturally helps to increase the capacity. It is important, that the belt has good flexibility to allow troughing when empty while at the same time provide sufficient transversal stiffness or cross-stability for good support when loaded. This means that the belt strength and construction should not only be based on calculated belt forces and required safety factors but also on transversal stiffness to fulfil the criteria for both the loaded and unloaded situation.

Consideration needs to be given to the type of material being carried because weight influences the required stiffness of the belt. In other words, the heavier the material to be conveyed the stiffer the belt has to be.

This kind of calculation requires specialist knowledge but a good manufacturer or supplier should be able to help. Dunlop's application engineering and local sales representatives provide this technical support service to their customers as part of what they call their 'total service package'.

**Fig. 2: The basis of every conveyor belt is the carcass.**



## Protecting the Carcass

An outer cover of rubber protects the belt carcass. Different types of rubber compound are used for rubber multi-ply belting covers; each designed to withstand damaging effects such as wear caused by abrasion, tearing and cutting, heat, fire and oil penetration. These different covers are generally referred to as 'cover grade qualities'. The most commonly used types of cover grade used for bulk materials are abrasion resistant and oil resistant.

Selecting the best type of outer cover will largely determine the effectiveness and operational lifetime of conveyor belts. The wear resistance qualities of a conveyor belt are one of the major factors that determine its life expectancy and ultimately the truest test of its value for money. As a general rule, 80 per cent of conveyor belt surface wear occurs on the top cover of the belt with approximately 20 per cent 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 (Fig. 3). 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 longer belts. For these reasons, 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. Factors such as ozone penetration or 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.

## The Thicker the Better?

The actual thickness of the cover is an important consideration. 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 theory, the more abrasive the material and the shorter the conveyor, the thicker the cover should be. In reality, the actual abrasion resistance quality of the belt cover is more important than the thickness. In an effort to compensate for poor abrasion resistant qualities, many conveyor belt suppliers offer belts with covers that are thicker than are actually necessary but this can lead to other operational problems.

**Fig. 3: Wear especially occurs at the loading point where the belt is exposed to impact.**

## Types of Abrasion

It is a common misconception that a belt specified by a supplier as being 'abrasion resistant' should naturally be expected not to wear quickly. In actual fact, because of the variety of materials that are carried on conveyor belts, there are a number of different causes of wear and abrasion. For example, heavy and/or sharp objects can cause cutting and gouging of the belt surface whereas materials such as coal, sand and gravel literally act like sandpaper constantly scouring the rubber cover (Fig. 4). For this reason, there are different types of abrasion resistant cover.

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 recognised and accepted. Generally speaking, DIN Y relates to 'normal' service conditions and DIN W for resistance to abrasion, cutting, impact (from high drop heights), and gouging re-

sulting from large lump sizes of heavy and sharp materials.

Each manufacturer uses its own mix or 'recipe' of polymers to create cover compounds that have different abrasion (wear) resistance qualities. The main polymers used are SBR (Styrene-Butadiene-Rubber) and BR (Butadiene-Rubber). Both SBR and BR have particularly good resistance not only to abrasion but also tearing, cutting, ripping and gouging. Many manufacturers try to avoid the use of natural rubber wherever possible in order to keep costs (prices) low.

## Careful with Standards

It is important that buyers of conveyor belts remember that DIN and ISO standards are only the minimum benchmark of acceptability. Conveyor belts that conform to the international standards still often have to be replaced after unacceptably short periods. Despite the claims of the manufacturers, tests have revealed that more than 50 per cent are found to be significantly below those minimum standards.

In terms of resistance to wear, Dunlop's approach has been to provide a longer lasting and therefore more cost-effective solution by developing covers that significantly exceed international quality standards. An excellent example of this is their RA 'standard' abrasion resistant cover, which exceeds the DIN Y standard by more than 30 per cent.

For extremely abrasive materials, or simply to achieve an even more extended working life, Dunlop have developed their RS cover, which exceeds the highest abrasion standard (DIN W) by nearly 30 per cent and the equivalent ISO 'D' standard by more than 40 per cent.

**Fig. 5: Some bulk materials can have a surprisingly high level of oil.**

**Fig. 4: Materials such as coal literally act like sandpaper constantly scouring the rubber cover.**

## Oil and Fat Penetration

Many bulk materials contain oil and fat. This can have a very detrimental effect on the performance and life expectancy of a conveyor belt because it penetrates into the rubber causing it to swell and distort, often resulting in serious operational problems.

Despite the untold damage caused to rubber there are, as yet, no recognised EN/ISO test standards for oil and fat penetration. This in itself can pose a big question mark against the oil resistance claims made by some manufacturers. In the Dunlop laboratories they apply the stringent ASTM D 1460 test standard, which originated in the USA.

## Two Types of Oil

Oil and fat (grease) resistance can be divided into two sources – mineral oils and greases and vegetable, animal oils and fats. Mineral oil and grease is most commonly present when transporting goods that have either contained or been exposed to oil or grease at some stage.

Mineral oils are the most aggressive kind and therefore require a particularly high level of protection. This is when a full nitrile belt is usually the best type to use. Dunlop recommends its ROS specification.

Bulk materials such as grain can have a surprisingly high level of vegetable oil (Fig. 5). To provide added protection compared to standard abrasion resistant covers, Dunlop have developed a very special compound formula in the ROM cover grade quality, which is specifically designed to resist wear as well as the penetration of this type of oil and fat. When particularly high concentrations of animal and vegetable oils are present then nitrile compound belts (ROS) should be used. ■

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