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FEATURES

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Stepping it up a gear

bulk conveying systems

A matter of life and death

If a conveyor belt does not perform according to the manufacturer's claims by wearing out prematurely or is ripped too easily by a trapped foreign object, the risk to life and limb is relatively small. It can certainly be expensive but highly unlikely to be life threatening. However, what if a supposedly fire-retardant conveyor belt catches fire and does not perform according to the manufacturer's claims? Although conveyors are a very efficient method for conveying materials, they can also be deadly efficient when it comes to conveying fire. The consequences of non-performance can be quite literally be a matter of life and death. Here, *conveyor specialist Bob Nelson* looks at how a growing number of operators may be risking employee safety in the pursuit of economy.

Cost before safety?

There can be little doubt that the increased financial pressures caused by the Coronavirus pandemic will cause even more organizations to re-examine their day-to-day running costs and, almost inevitably, seek greater cost savings. Much of the pressure to cut costs will naturally fall on the shoulders of the procurement departments. I would like to think that no one would be irresponsible enough to ignore the safety implications of what they are buying but the reality is that, for the uninitiated at least, fire safety classifications and standards relating to conveyor belts can be confusing. Added to which, belt manufacturers and suppliers can sometimes be less than totally honest. The fact is that there can be a very significant difference in the level of fire protection provided by belts supplied by different manufacturers even though they might claim to technically meet the same standard.

A false sense of security

Although belt manufacturers and suppliers are willing to provide test certificates relating to specific fire safety standards and certificates of origin for example, in many cases those certificates are not worth the paper on which they are printed. For example, a fire safety test certificate may only relate to the belting that the manufacturer produced specifically for test certification purposes. The actual belt delivered to site may not be up to the required standard. For certificates proclaiming the origin to be somewhere in

Some conveyor belts are not nearly as resistant to fire as the operators have been led to believe.

Europe, the belt could have actually been manufactured in Asia and merely been temporarily warehoused in Europe.

Anecdotal, as well as factual evidence gained from numerous laboratory tests, certainly indicates that even some of Europe's biggest users of conveyor belts, including major terminal and ports, are using conveyor belts that are not nearly as resistant to fire as they should be. Even more worryingly, more and more operators seem to be willing to use fire-resistant conveyor belts of questionable provenance purely because they are the most competitively priced. Their key requirement seems to be that they are provided with documentary 'evidence' by the belt manufacturer/supplier to 'prove' that the belt meets the required fire safety standards. In other words, in the event of a fire, their corporate and personal culpability is protected even though their workforce may well not be. In the pursuit of 'economy' such decisions are seen as being low risk because the chances of an actual conveyor belt fire are relatively low. That same 'low risk' factor can also apply to belt manufacturers and suppliers who can be confident that the chances of the customer actual having a sample of the belt subjected to independent testing is very small indeed.

Insurance nightmare

Insurance companies are becoming increasingly alarmed about conveyor fires. This is hardly surprising when you consider that according to at least one major insurer, claims for fires directly involving conveyor belts are costing an average of nearly $8 million per claim. One insurance consultant told me recently, and I quote,

$8 million

Conveyor belt fires cost an average of nearly $8 million per claim

"I'm concerned by the over-reliance being placed on the broad requirement for fire-resistant belts. I've seen numerous instances where locations are recommended to use 'K grade' (EN 12882 Class 2A) belts but with no further information specified. Procurement departments will often find the cheapest belt which meets this criteria and the site seems to think they no longer need to worry about the possibility of fire — as though they have a 'fire proof' belt".

Rubber conveyor belts can never be totally fire proof.

Fortunately, having a basic understanding of fire-resistant conveyor belting and the relevant test methods and standards can help to make sure that the belts you are buying will provide the level of fire safety needed for your site and, most importantly of all, for your colleagues.

No conveyor belt is fire proof

The most important thing to bear in mind is that rubber conveyor belts can never be totally fire proof. Rubber is flammable, full stop. Secondly, the fabrics used in the carcass of multi-ply belts are mostly polyester and nylon, which have virtually no resistance to fire. Consequently, every belt will burn when exposed to a naked flame that is sufficiently energized to cause it to ignite. The two most frequently used descriptions relating to fire safety used for conveyor belts are 'fire retardant' and, most commonly of all, 'fire resistant'. In truth, a better and more accurate description would be 'self-extinguishing'. This is because the ability of a rubber conveyor belt to 'resist' fire is actually achieved by adding special chemicals and additives to the rubber compound during the mixing process. What happens is that when the rubber has been vulcanized and is ignited it emits gases that effectively suffocate (extinguish) the fire by starving the flames of oxygen.

Conveyors convey fire extremely quickly – every second counts.

Different recipes or 'cocktails' of rubber compound are necessary depending on the level (standard) of fire resistance required. However, the chemical additives are costly so if low grade or insufficient quantities of the additives are used in the rubber compound (in order to minimize costs and keep the selling price artificially low) then the ability of the belt to self-extinguish will be slower and less effective than it could and should be. As will be explained in more detail later, the time it takes for the belt to self-extinguish is enormously important because the conveyor is doing what it is meant to do, which is to convey at speed; only this time it is conveying fire. This means that literally every second counts.

Standards and test methods for above ground applications

The basis of most tests for belting used in normal industrial applications is EN/ISO 340 and is included within the classifications of EN 12882 on electrical and flammability safety requirements for general purpose conveyors used above ground. These standards make the distinction between fire resistance with covers, which is Class 2A (or K grade) and fire resistance with and without covers, which is Class 2B (or S grade). The relevance of 'with and without covers' is that surface wear reduces the amount of fire-resistant rubber that protects the internal flammable carcass. Although no longer used in the current EN ISO 340, the market still commonly refers to grades 'K' for testing with covers and 'S' for testing with and without covers. This originates from DIN 22103 that was used as the basis during the creation of EN ISO 340.

EN/ISO 340 testing

EN/ISO 340 tests involve exposing six individual samples of belt to a naked flame causing them to burn. The source of the flame is then removed and the combustion time (duration of flame) of the test piece is recorded. A current of air is then applied to the test piece for a specified time after the removal of the flame. The flame should not re-ignite.

The time it takes for the belt sample to self-extinguish after the flame has been removed is then measured. The duration of continued burning (visible flame) should be

less than 15 seconds for each sample with a maximum cumulative duration of 45 seconds for each group of six tests. This means that the average allowable time per sample is 7.5 seconds. This factor is of paramount importance because it determines the distance that the fire can be effectively carried by a moving belt.

Even if a manufacturer states that their fire resistant belt has passed the ISO 340 test, the buyer should still exercise caution. A typical conveyor belt can easily travel more than 40 metres within the 15 seconds that is allowable for a belt sample to pass the test, which is a potentially very dangerous distance. For this reason, one manufacturer (Dunlop in The Netherlands) applies an average maximum time limit standard of only one second, which is more than six times faster than the required standard and decidedly safer as a consequence.

ISO 340 testing.

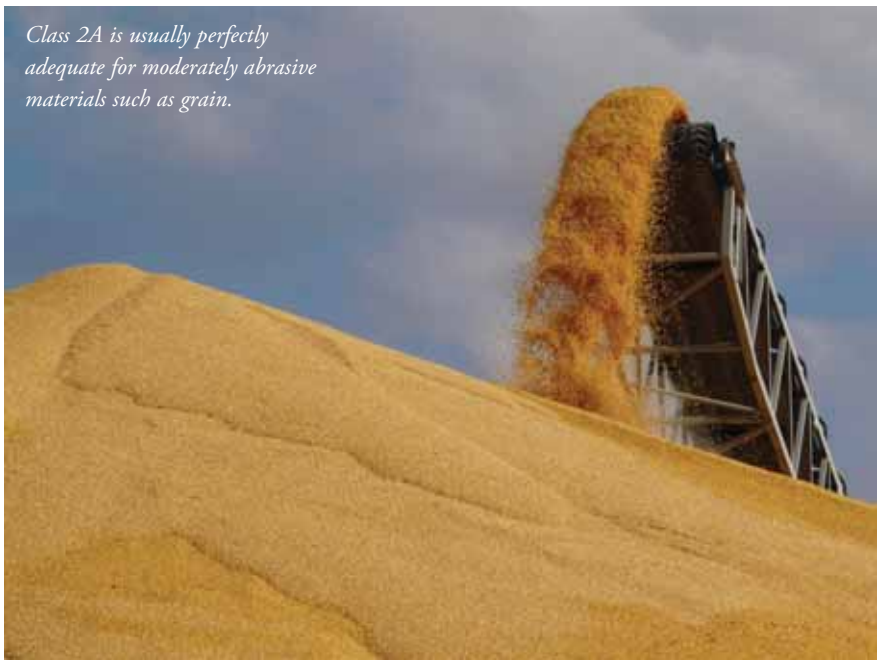
Choosing the correct standard of fire resistance

Unlike conveyors operating below-ground, establishing the correct level or standard of fire resistance needed for conveyors operating in the open air is relatively straightforward. EN 12882 is the standard for safety requirements for conveyor belts for general-purpose use. The most basic safety requirement is EN 12882 Category 1, which simply demands that the belt is anti-static and conforms to EN/ISO 284 international standards. For the vast majority of applications, EN 12882 Class 2A (K grade) or Class 2B (S grade) levels of fire resistance would be perfectly adequate. As described earlier, Class 2A demands that the belt is able to pass the ISO 340 test with the covers intact on the belt samples whereas Class 2B requires that the belt is also able to pass the test with the top and bottom cover rubber removed. Both Class 2A and 2B fulfill the anti-static requirements of ISO 284.

The best way to decide between Class 2A and Class 2B is to consider the material being carried. For moderately abrasive materials, such as grain for example, then Class 2A is usually perfectly adequate. However, if the material is abrasive and tends to wear the top cover quite rapidly then the safest option is be to choose the Class 2B.

I always recommend that technical datasheets be requested before placing an order because they include information on the level of abrasion (wear) resistance. This is important because the ingredients used to create a fire-resistant rubber compound generally have an adverse effect on its wear-resistant properties. Consequently, fire-resistant belts tend to wear faster and as the thickness of the rubber reduces so does the level of protection given to the inflammable carcass. To provide an adequate wear life I would expect an abrasion figure of no higher than 160mm³.

For materials that contain oil such as wood chips and biomass, rubber compounds that have a combined resistance to fire, abrasion and oil are available. This is yet another important consideration when deciding on the correct type of fire resistant belt so it's important to be very specific when making requests for quotations from manufacturers and suppliers.



Class 2A is usually perfectly adequate for moderately abrasive materials such as grain.

Environments with inflammable dust and gas

For environments where coal dust, fertilizer, grain or other potentially combustible materials such as biomass are present, it is essential that the conveyor belt cannot create static electricity that could ignite the atmosphere. Belts need to be able to allow static electricity to pass through the metal frame of the conveyor structure down to earth rather than allow static to build up. The safest approach is for all belts to be anti-static and conform to EN/ISO 284 international standards. This means that they can all be used in ATEX 95 (94/9/EC Directive) classified zones if necessary. Some people mistakenly believe that all belts used in ATEX classified zones must be flame retardant but actually that is not the case.

Handling biomass

One of the biggest dangers concerning belts that carry biomass is dust emission and the prevention of explosion. In the production process of biomass wood

pellets, wood chip and similar renewable resources, the materials are continually broken down. This results in high levels of combustible dust. The dry flammable dust found in biomass can be ignited by static electricity created by abrasion within the conveyor system because the source only requires ignition energy as low as 17mJ for the ultimate ignition to take place. Biomass dust can also be highly prone to self-ignition, especially if the material has become damp. A chemical reaction can take place that causes self-heating and what is referred to as 'off-gassing' (carbon dioxide, carbon monoxide and methane emissions).


Biomass dust can be prone to self-ignition.

Because of the increased risk of self-ignition when biomass becomes damp, the use of covered conveyors is becoming increasingly commonplace. In enclosed environments the risk to human life is heightened because burning rubber and other synthetic materials such as polyester and nylon release a dark, thick smoke that contains cyanide, carbon monoxide, sulphur dioxide, and products of butadiene and styrene. For this reason, EN 12882 Class 4A is usually the best choice for conveyors operating in closed or covered conditions because it involves a more severe fire test according to EN12881-1 method A, C or D in addition to EN/ISO 340 testing.


Class 4A entails EN12881-1 method A, C or D in addition to EN/ISO 340 testing.

Be sure of what you are buying

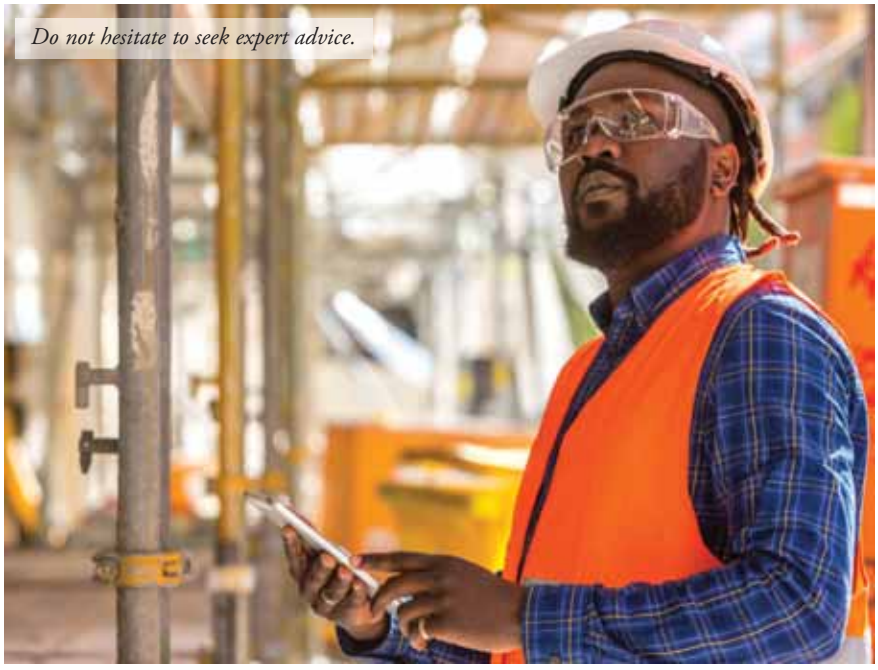
A very significant proportion of belting sold in Europe is imported from South East Asia. This is not to say that all imported belting from Asia is substandard because that is not the case. However, random laboratory testing of imported belt consistently reveals serious shortcomings, especially in tests concerning fire safety. One such test recently revealed a dangerously low level of fire resistance. Although the duration of continued burning (visible flame) should be a maximum of 15 seconds per sample with a maximum cumulative duration of 45 seconds for each group of six samples, one set of Chinese belt samples took to self-extinguish was 102 seconds.

Interestingly but somewhat worryingly, with only one notable exception as far as I am aware, all European-based belt manufacturers import from China and to a lesser extent India and re-sell the belting under their own brand name to supplement their overall output. This allows them to be more competitive on price. The provenance is important because apart from the adherence to European standards, accountability (including warranty issues) can also be problematic.

Still not sure?

If you are still unsure of the fire-resistant grade of belting you need then it is best to carry out an internal risk assessment. If the expertise for this does not exist within your company then do not hesitate to seek expert advice. The major European manufacturers have highly experienced application engineers and there are also external consultancy organizations plus your insurers, who should be willing to perform this important task for you.

Fire-resistant conveyor belts really can be a matter of life and death. In my opinion it is therefore far safer to stick with the 'big name' European manufacturers such as Dunlop Conveyor Belting, Contitech and, perhaps to a lesser extent Semperit, who have well-founded reputations for producing belts of much higher quality and safety standards than those competing at the lower end of the market. More expensive? Almost certainly yes. But a significantly lower price per meter should set the alarm-bells ringing just as a real life fire would. With conveyor belts you almost always get what you pay for. The price of an insufficiently fire-resistant conveyor belt cannot be calculated.


Do not hesitate to seek expert advice.