CONVEYING THE FIRE

Leslie David, Dunlop, cuts through the technical jargon to provide a helpful guide to selecting the safest fire-resistant belt for conveying dry bulk.

Conveyors are an extremely efficient method of transporting material. Unfortunately, once alight, they are equally efficient at conveying fire rapidly from one location to another. The standards, classifications, and terminology of fire-resistant conveyor belts can be very confusing.

No conveyor belt is fireproof

The vast majority of conveyor belts used in ports and terminals are rubber multi-ply construction. 'Fire retardant,' 'self extinguishing', and 'fire resistant' are all phrases used for basically the same group of belting, although 'resistant' mistakenly implies that the belts would not be destroyed by fire. The first thing to bear in mind is that rubber conveyor belts can never be totally fireproof. Rubber is flammable and the fabrics used in the carcass of multi-ply belts are mostly polyester and nylon, which have virtually no resistance to fire. Consequently, all belts will be

damaged/destroyed by fire but the essence of fire-resistant belting is that it will not continue to burn without an external fire source, therefore not contributing to the spreading of a fire.

The most commonly used term is 'fire resistant' but 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. Once the rubber has been vulcanised and is ignited it emits gases that effectively suffocate (extinguish) the fire by starving the flames of oxygen.

Different recipes or 'cocktails' of rubber compound are necessary depending on the level (standard) of fire resistance required. A variety of different additives are used including antimony trioxide, decabromodiphenyl, alumina trihydrate, and magnesium hydroxide. These additives can be very costly so if low grade or insufficient quantities of the additives are used in order to 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. The time it takes for a belt to self-extinguish is enormously important for two reasons. Firstly, as mentioned earlier, conveyors are frighteningly effective when it comes to conveying fire. Secondly, burning rubber and synthetic materials such as polyester and nylon release a dangerous thick smoke that contains cyanide, carbon monoxide, sulfur dioxide, and products of butadiene and styrene, which therefore needs to be kept to an absolute minimum. This means that literally every second counts.

Rubber conveyor belts can never be totally fire-proof.

Conveyors convey fire extremely quickly – every second counts.

Before talking about safety classifications, standards of fire resistance, and the process of belt selection, it is important to understand that there are international and national standards relating to safety performance requirements and quite separate standards to specify the test methods used to actually measure safety performance. It is perhaps a good idea to first clarify the test methods used to establish those standards. Please bear in mind that we are only talking about above-ground applications.

Standards and test methods

The EN12882 standard is for safety requirements for conveyor belts for general-purpose, above ground applications and describes a range of classes from '1', '2A', '2B', up to '5C'. The most basic safety requirement is EN 12882 Class 1, which simply demands that the belt conforms to EN ISO 284 anti-static international standards. Class 2A (K grade) and Class 2B (S grade) make the distinction between fire resistance with covers and fire resistance with and without covers. The relevance of testing 'without covers' is that surface wear gradually reduces the amount of fire-resistant rubber protecting the internal flammable carcass. Testing without covers therefore determines that the remaining rubber, especially the 'skim' rubber used between the plies, is sufficiently fire resistant. Although no longer mentioned in the current EN ISO 340 test method specifications, the market still often refers to grades 'K' for testing with covers and 'S' for testing with and without covers.

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 effectively

determines the distance that the fire can be carried by belt when in motion.

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 m 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 major European 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.

Choosing the safest belt – is it cost versus safety?

Like it or not, price is all too often a key factor in the decision-making process even when selecting fire-resistant conveyor belting. It would be nice to think that no one would be irresponsible enough to put cost before safety. Sadly, personal experience and anecdotal evidence strongly indicates that it has happened on countless occasions and continues to happen, in some cases with fatal consequences.

Although safety classifications and standards relating to conveyor belts can be confusing, too many belt manufacturers and traders are more interested in winning the order than supplying the most suitable belt for the circumstances. In reality, the chances of a belt catching fire are pretty slim so some might think that it is a risk worth taking. However, the fact remains 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 technically claim to meet the same safety specification.

Experience shows that 'economy' (low-priced) versions of good quality fire-resistant belts simply do not exist. The biggest single influence on both the ability to resist fire and general wear and tear is the quality of the rubber. Because rubber typically constitutes around 70% of the mass of a conveyor belt it is therefore the first port of call for those manufacturers who want to compete on price. As mentioned earlier, the additives used to create the resistance to fire and self-extinguishing properties can be very costly so ironically, prices that are appreciably less than the premium brands are almost certainly the best indicator of a similarly significant difference in fire safety.

Deciding the level of fire resistance

Both EN 12882 (above ground) and EN 14973 (below ground) standards provide a matrix of requirements or specifications of the individual test methods. The various classes relate to increasing demands and provide a general guideline for end users to select a class based upon their specific circumstances. For example, if a conveyor system is equipped with a sensor to check for belt slippage or temperature increases on pulleys, the need to comply with a drum friction test is not required, as such a situation is unlikely to occur. The drum friction test is demanded in some of the higher safety categories in EN 12882 and in all safety categories of EN 14973.

EN ISO 340 testing.

Low price fire-resistant belts can prove extremely expensive.

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 EN ISO 340 test with the covers intact 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 fulfil the anti-static requirements of EN ISO 284.

The best way to choose between Class 2A and Class 2B is to consider the material being carried. For moderately abrasive materials, such as coal for example, then Class 2A is usually perfectly adequate. However, if the material is abrasive or you simply want to maximise wear life then the best option is Class 2B.

For materials that contain oil such as grain, wood chips and biomass, rubber compounds that have a combined resistance to fire and oil are available. This is an important consideration when deciding on the correct type of fire-resistant belt, so it is 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 coal.

Biomass dust can be prone to self-ignition.

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

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 onsite to be anti-static and conform to EN ISO 284 international standards, which is also required for in ATEX 95 (94/9/EC Directive) classified zones.

Handling biomass

One of the biggest dangers concerning belts that carry biomass is dust emissions and the risk of explosions. 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 dry, combustible dust that can be ignited by static electricity created by abrasion within the conveyor system because the source only requires ignition energy as low as 17 MJ.

Biomass dust can also be 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).

Because of the increased risk of self-ignition, the use of covered conveyors is becoming increasingly commonplace. In enclosed environments, the risk to life is heightened because of the dangerous smoke referred to earlier. For this reason, EN 12882 Class 4A is usually the best choice because it involves a more severe fire test according to EN 12881-1 method A, C, or D in addition to EN ISO 340 testing.

Seek advice

Fire-resistant conveyor belts really can be a matter of life and death so if operators are at all unsure then they should seek expert advice. In Dunlop's opinion, it is far safer to use one of the leading European manufacturers who have well-founded reputations for higher quality and safety standards and are much more able to provide technical support and advice. Higher priced? Almost certainly yes but the cost of a fire-resistant conveyor belt that does not self-extinguish fast enough, or perhaps not at all, is almost impossible to calculate.

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About the author

After spending 23 years in logistics management, Leslie David has specialised in conveyor belting for over 17 years. During that time, he has become one of the most published authors on conveyor belt technology in the world.

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