RECYCLING THE FLAMES

Conveyor belt specialist Les Williams explores the problem of fires in recycling plants

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Two major fires at Hündgen Entsorgungs' Swisttal-Ollheim waste sorting facility in Germany in April and July of this year caused immense damage. The fire in July lasted for four days with damage estimated to cost at least €2m. These fires were just two more examples of the many thousands that are occurring around the world and serve as yet another stark reminder of the huge fire safety challenges facing the waste recycling industry.

According to fire safety experts, the primary cause of waste sorting and recycling plant fires is lithium-ion batteries found in modern-day battery-powered products, which can explode if damaged or crushed. They are found in a diverse range of products including greeting cards that light up or play music, electronic kitchen appliances, toothbrushes, razors; power banks for smartphones or tablets; headphones and hearing aids; e-cigarettes and vape products and even children's toys and light-up shoes.

BREATHTAKING GROWTH

The scale of the problem is quite breathtaking. For example, in the UK in 2024, six billion lithium-ion batteries were discarded, causing an estimated 700 fires in dustcarts and waste-processing centres. The Environmental Services Association in the UK says the resulting fires cost fire services and waste operators some £158m a year. The US and Canada is estimated to have incurred losses worth more than $1.2bn because of lithium-ion battery fires.

Although the problem is making headline news, what appears to be escaping the attention of plant operators and insurers alike is the role of rubber conveyor belts in all of this and how they can potentially reduce the extent of the fire.

The majority of conveyor belts used in recycling are rubber multi-ply construction and the first thing to bear in mind is that they 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. Once alight, they can be remarkably efficient at conveying flames at a frightening speed. Fortunately, they can be engineered so that their ability to do so is dramatically reduced.

Lithium-ion battery fires are costing the industry billion

WHAT IS MEANT BY ‘FIRE-RESISTANT’?

A more accurate description rather than the commonly used term “fire resistant” would be “self-extinguishing”. This is because the ability of a rubber conveyor belt to ‘resist’ fire is achieved by adding special chemicals and additives such as antimony trioxide, decabromodiphenyl, alumina trihydrate and magnesium hydroxide to the rubber compound during the mixing process. The actual amounts depend on the level (international standard) of fire resistance required. Once fire-resistant rubber has been vulcanised and is ignited it emits gases that effectively suffocate (extinguish) the fire by starving the flames of oxygen.

PRIORITISING A COMPETITIVE PRICE

The special additives are costly so if low grade or insufficient quantities are used in order to keep the selling price sufficiently attractive to win orders then the ability of the belt to self-extinguish will be slower (and sometimes non-existent) and therefore much less safe. Especially in the past twenty years or so, the conveyor belt market, particularly in Europe, has been inundated by ‘cheap’ imports from South East Asia, primarily ▸

Low price fire resistant belts can prove deadly

Rubber conveyor belts can never be totally fireproof

▶ China. Performance, longevity and ultimately safety, have all become sacrificial lambs in the effort to win greater market share and force out the competition.

The reality is that 'economy' versions of high-quality fire-resistant belts simply do not exist. The biggest single influence on the ability to resist fire is the quality of the rubber. Unfortunately, because it typically constitutes around 50% of the material cost of a conveyor belt, it is the prime cost saving target for manufacturers who want to compete on price, even though they will claim to meet the same safety specification as the premium brand versions without hesitation.

ADDING FUEL TO THE FIRE

Fire-safety experts describe the ignition of a lithium-ion battery as having the intensity of a blow torch that will continue to burn until the battery cell is exhausted. The duration is therefore very much dependant on the size of the battery. Although the duration and intensity cannot be influenced, the speed at which the flames spread along the conveyor belt is very much influenced by the ability of the rubber to inhibit the flames by starving them of oxygen. Without this, the belt can rapidly become a moving, burning mass, effectively adding fuel to the original source of the fire. 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. With most recycling conveyors housed indoors, the danger is exacerbated.

EVERY SECOND COUNTS

There are international and national standards relating to conveyor belt fire safety performance and separate standards that specify the test methods that measure that performance. 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 is anti-static. Class 2A (K grade) and Class 2B (S grade) make the distinction between fire resistance with covers and fire resistance with and without covers and are tested according to EN ISO 340 specified methods. The testing is very much about the speed and effectiveness of the self-extinguishing process because in the event of a belt being ignited, every second counts.

The relevance of testing 'without covers' is that 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. For the majority of recycling applications, a premium brand EN 12882 Class 2A or Class 2B belt is most probably perfectly adequate but if you are at all unsure then seek expert advice.

EN ISO 340 TESTING

The 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) recorded. A current of air is 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 a maximum of 15 seconds for any individual sample with a maximum cumulative duration for each group of six samples of 45 seconds. This means that the maximum allowable average 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, caution must still be exercised. A typical conveyor belt will easily travel several meters within the 15 seconds allowed for a belt sample to pass the test, which is a potentially very dangerous distance.

SEEK ADVICE

Fire resistant conveyor belts really can be a matter of life and death so never hesitate to seek expert advice. In my professional opinion, the safest option is 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 expert technical support and advice. Although almost certainly higher priced, the cost of a fire-resistant conveyor belt that does not self-extinguish fast enough when ignited by an exploding lithium-ion battery pales into insignificance. •

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