Comparing fire standards on conveyor belts

RECENT fatalities in the Aracoma Alma mine in West Virginia have again focused attention on conveyor belt related fires and the devastating impact they can have on miner safety.

Conveyor belts represent a high risk because they have the ability to spread a fire over long distances. Fires on belt conveyors are mostly ignited by mechanical failures, for instance in an idler bearing, or by friction.

A comparison of international requirements for conveyor belt safety holds some salutary lessons for mines interested in improving safety.

International Standards

Except in the US, fire safety requirements are similar for the largest hard coal mining countries China, India, Australia, South Africa, Russia and Poland.

Drum friction test: The drum friction test simulates a belt slipping over a jammed pulley, or a pulley rotating under a stationary conveyor belt. This measures whether the surface temperature remains under a required maximum after a specific time and under a specific tension. Generally a rubber conveyor belt can produce a pulley surface temperature of up to 500∞C (930∞F). The visual appearance of flame or glow is not permitted.

Surface resistance test: An electrostatic charge may build up on the conveyor belt surface and ignite a mixture of flammable gases and air. Therefore the surface resistance of the conveyor belt covers has to be below a maximum number measured in Ohms (mostly 300MO)

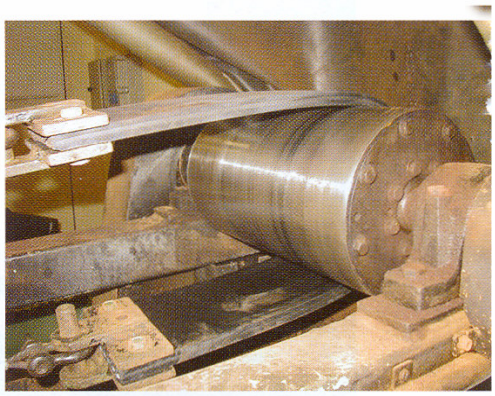
High-energy propane burner test: Conveyor belts must not propagate fire. To determine whether a conveyor belt fulfils this requirement, it is ignited by a propane burner. After the ignition source has been removed, the flames must self-extinguish within a certain timeframe or within a certain distance. A typical sample for this test is 2m long at full width.

Spirit burner test: A small piece of the conveyor belt is held over a spirit burner flame. After a certain time the burner is removed. The duration of flame and glow has to be within a specified time limit.

More tests: In addition to the above tests, some countries have even more stringent requirements, for instance regarding the belt's toxicity, hygiene or cover roughness.

The exact specifications can be found in the AS, MT, PN, SABS and DIN standards.

Quality control (LOI): It is obvious that not every single belt can be tested as per the above procedure. Therefore, a kind of fingerprint method was developed in Europe: The Lowest Oxygen Index (LOI). This method is an effective and inexpensive quality control. It determines the minimum concentration of oxygen that will support combustion of a specific belt sample. A typical value would be 35. The result of the approved belt must comply with any supplied belt of the same type. This method has been implemented in Australia.



Drum friction test.

United States Requirements

The requirement in the United States is quite simple.

Bunsen burner test: A small piece of a belt is held over a Bunsen burner flame and the duration of the belt's afterglow must be less than a specified maximum time.

This test, which was implemented 37 years ago as per the 1969 Federal Coal Mine Health and Safety Act, is similar to a standard that was in force in Europe until the mid 1970s for underground conveyor belts (fire resistant, grade K or S).

Later, these conveyor belts were only allowed to be used in aboveground applications. The German mining authority, as an example, stated that such conveyor belts could act as a fuse. The present specification for such lower safety belts is ISO 340 (flame retardation of conveyor belts).

In December 1992, the US Department of Labor, Mine Safety and Health Administration (MSHA), proposed a new rule for conveyor belt test requirements (Federal Register, Vol57, No248) that would bring safety standards up to the international level.

This proposed rule was withdrawn in July 2002. The reasons given for withdrawal were that the number of conveyor belt fires had significantly declined and improvements in belt monitoring had been implemented.

Differences

The basic difference between the present US requirements and the international standards in regards to conveyor belt production is that for the US, conveyor belts made with natural rubber (NR) or styrene butadiene rubber (SBR) can be used, while to meet the more stringent international requirement, polychlorobutadiene rubber (CR or "Neoprene"), acrylonitrile butadiene rubber (NBR or "Nitrile") or polyvinylchloride (PVC) must be used.

Practical application

In US coal mines, rubber conveyor belts with textile plies are used almost exclusively. Thus, if higher safety rules would be implemented the best option would be for belts to be manufactured with CR instead of NR/SBR.

The geometry of the conveyor belts and of the belt conveyors could remain unchanged.

Millions of meters/feet of such belts manufactured with CR compounds have proven their high reliability and safety over the last 30 years.

Outlook

Although there are several methods for detecting fires, high temperatures, slippage etc, it is better to prevent such fires rather than deal with them. This is accomplished by producing belts designed specifically for this purpose.

Safer requirements in the US could also open the door to the most modern and reliable type of belt that combine the advantages of high fire resistance and self-extinguishing materials. An example is the new generation PVG conveyor belt, supplied by German company Phoenix Conveyor Belts.

This belt consists of a PVC impregnated solid woven fabric with CR covers.

Compared to other belts its splice strength, vulcanized or mechanical, is higher; elongation (stretch) is lower (= smaller tensioning); fatigue strength is higher; and impact and rip resistance is higher.

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