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FRAS — Flame Retardant, Anti-Static Requirements and Synthetic Ropes in Mining Applications

FRAS stands for “flame retardant, anti-static” requirements and refers to requirements that exist worldwide in numerous industries to limit flammability and static charge buildup that causes arcing and possible ignition. In mining, FRAS requirements are applied to specific uses for non-metallic materials, such as conveyor belts, ventilation equipment, pipes or hoses, and bags. For non-metallics that don’t fall into the defined categories, there is a Non-Defined Applications category discussed in Australia’s MDG 3608 that requires risk assessment(s) to determine which, if any, requirements apply. Because the character of the defined applications listed in the specifications is very different from the intended uses of rope within a mine, Samson intends to approach FRAS by showing the factors that limit risks posed by rope.

The opinion that static electrical discharges are extremely unlikely is also supported by Samson’s decades of field experience with synthetic rope—producing, testing, and using—without a recorded static discharge. While this is unquantifiable, the experience is extensive.

ANTI-STATIC REQUIREMENTS: Construction, materials and applications of synthetic ropes limit charging capability.

Static charging does not pose a risk with synthetic fiber rope because the construction and material used in the rope limit static charging. The intended uses for rope also limit the potential for charging. The potential for charging, however, can’t be measured by standard test methods and can only be assessed by understanding the construction of the rope and how it would be used.

Synthetic ropes consist of a large number of filaments that are twisted and braided to form the rope. Each of the filaments are coated prior to processing with finishes that are intended to enhance processability by limiting static charging. If the finishes weren’t effective, the individual filaments would charge during rope manufacture and cause the filaments to fuzz out; similar to how hair stands on end when you have built a static charge. This means that every fiber is effectively checked by the rope-making process to ensure that they have had adequate coating to limit static charging. Rope manufacture would be impossible if these finishes failed to control static charging.

In addition to the fiber finishes, the majority of the total surface area of the rope is internal. Each filament has its own surface area and there are thousands to millions in a rope. Because the primary form of static charging comes from contact between two dissimilar surfaces, the rope structure means that only external fibers are vulnerable to charge. The internal surface area is not exposed and therefore does not charge, limiting the amount of charge a rope can hold.

APPLICATIONS IN MINING

The intended uses of rope within a mine are intermittent, not continuous (e.g. towing vehicles or pulling belts into position) and can involve relatively slow speeds. Static charging is controlled by many factors but the relevant one in this situation is the number of contacts between the rope and dissimilar materials. Slower speed reduces those contacts, which reduces charging. Intermittent use is also a plus because it allows static charges to dissipate naturally.

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STANDARD TEST METHODS: Do they apply?

For most non-metallic parts, such as a conveyor belt, it is possible to directly test the surface resistivity to ensure that any charge formed will move across the non-metallic, non-charging surface and dissipate. For rope, however, this type of test can be misleading. As mentioned previously, the surface area of a fiber rope is immense due to the contributions of each fiber's surface area multiplied by the thousands to millions of filaments in the rope's construction. Standard test methods for surface resistivity presume a single continuous piece that a charge can pass across; rope does not fall into either category. Furthermore, some test methods induce a static charge on the surface of the test piece then check how long it takes to dissipate. As rope has most of its surface area shielded from outside contact, the shielded area would not charge in service but does charge during the test. This makes the test unrealistic compared to real world uses. Because of this, the two standard test methods are misleading when applied to rope.

The opinion that unsafe static electrical discharges are extremely unlikely is also supported by Samson's decades of field experience with rope—producing, testing, and using—without a recorded incident of improper static discharge. While this is unquantifiable, the experience and anecdotal evidence is extensive.

FLAME RETARDANCY

The second portion of the general requirements is flame retardancy. In general, synthetic fiber ropes consist of small diameter, high surface-area filaments of polymers that will burn when ignited. While there are means to limit the flammability of the fibers, those means are known to alter the function of the rope in fundamental ways, limiting the usefulness of the rope for the intended applications.

While synthetic fibers will burn, they do require an external flame source to ignite them. They will provide fuel to an existing fire, but, because the length and weight of rope being used is limited, the fuel they will provide will also be limited.

CONCLUSION

While it is not possible to certify synthetic ropes to meet the requirements imposed by the many FRAS specifications across the world, the risk imposed by synthetic ropes is minimal. Synthetic ropes resist static charging by virtue of their construction and types of use. They do burn, but require an external ignition source and would only add a small amount of fuel to an existing fire. Each application will need to be reviewed separately, but synthetic rope should not be expected to pose a significant FRAS concern.

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