

Effects of Heat on Belt Life

Elevated temperatures influence all parts of a power transmission drive system. Problems can be expected with motors, bearings, electrical systems, gearboxes, and rubber belts. It is widely known that elevated temperatures lead to reduced belt life. Elevated temperatures in a power transmission drive system cause a number of chemical changes in a belt that result in physical changes that we are familiar with.

There are two ways in which elevated temperatures affect the chemistry of a rubber compound. First, sulfur crosslinks are attacked and broken. A sulfur-cured rubber will contain a number of sulfur chains that link the rubber together. Heat attacks the sulfur-sulfur bonds and begins to pull sulfur atoms out of this chain. The free sulfur atoms then make another sulfur chain, increasing the number of links in the rubber. As these links continue to be attacked, a rubber that contained a few long chains now contains many shorter chains. As a result, the 'new' compound is not as flexible.

Second, things chemists refer to as free radicals, which are created by heat and oxygen, attack the remaining double bonds in the polymer. A free radical breaks up a double bond in the polymer. These broken bonds then find another polymer to hook up with. As these free radicals continue to attack the polymer, more strong polymer-polymer bonds are formed, creating a less flexible compound.

The chemical changes described above are the result of elevated temperatures. Physical changes in the belt are in turn the result of these chemical changes. Elevated temperature causes hardening, increased dynamic stiffness and reduced ultimate elongation of the cushion compound, reducing the belts' flexibility. The loss in flexibility results in increased stress on the cushion stock. Eventually these stresses become too high for the compound to handle and a cushion crack appears. This crack is necessary to bring the stresses down to a manageable level. Continued exposure to elevated temperatures, however, will cause a continuous increase in stress level. The cushion compound will continue to respond by cracking further. Eventually, the cushion stock will be unable to support the cord line and the belt will fail to function.

Excessive heat is the worst thing possible for rubber products. Understanding how heat affects the efficiency and the reliability of power transmission systems can help reduce troublesome downtime and improve productivity.

While there are a number of ingredients a compounder can add to a rubber compound to improve heat resistance, those ingredients merely delay the inevitable. By keeping your operating conditions within the recommended ranges, you can be sure to get the maximum life out of your belts.