LOW-COST IMPROVEMENTS FOR TIRE PRODUCERS

Tension Control delivers scrap reduction and improved product quality

For tire manufacturers trying to achieve defect-free product, identifying and minimizing production deviations throughout the tire-making process is critical.

Dover Flexo Electronics has, over the past few years, been successful in helping several large tire producers to correct process problems that affect product quality. Here are examples of tension measurement and control improvements made in three separate sub-processes at tire plants in the Southeast.

Steel Tire Cord

Steel-braided cord used in manufacturing steel-belted radial tires is made up of 10 - 15 wires that have been packaged together by a twister. Upon entering the twister the wires should have matching running tensions in order for a high-quality steel cord to result.

Prior to the twister station, hold-back tension on each wire is created by a tensioning device which can be manually adjusted by the machine operator. At the start of a job run the operator measures the tension on each wire with a hand-held tensiometer and adjusts the individual strand tension accordingly.

The problem with this method of tension measurement is that the lack of repeatability from wire to wire (and from run to run if different operators are performing the measuring and adjustments) causes cord output quality to vary.

The solution at one plant was to install tension transducers to accurately and simultaneously measure all wire tensions throughout a run. The results are consistent finished cord quality from reel to reel. The process uses 12

RFA Tension Transducers

RFA (Ribbon-Filament) tension transducers with tension amplifiers and 12 meters to monitor running tension continuously on each wire. Manual adjustments to the tensioning device are still made by the operators when deviations in wire tension are noted throughout the process.

Sidewall Material

In another of the early tire-making sub-processes, latex impregnated rubber sidewall material is extruded and wound onto reels for further processing. The winding is performed at very low (almost zero) tension to avoid stretching the material. In its uncured state,

the latex impregnated rubber is very tacky, so as it is wound onto its reel a fabric backing/liner is applied. This keeps each layer of rubber separated from the next. See figure 1.

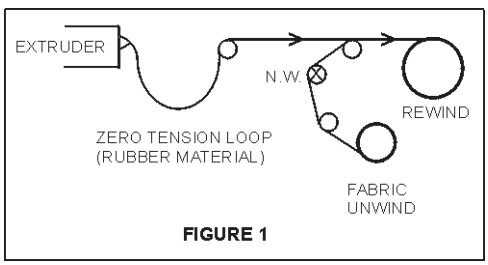

FIGURE 1

Tension on the moving fabric liner as it comes together with the rubber should be controlled for at least two reasons:

1) If too little tension is applied during winding, the fabric tends to bunch, wrinkle or fold over as it is being taken up into the reel with the sidewall material.
2) If too much tension is created, the fabric tends to dig into the soft rubber leaving a deep textured pattern.

When the full reels of sidewall material are later unwound downline and laid into the tire machine, indentations and impressions in the rubber can create hidden air pockets or surface deformation. Then, when the material layers are heated during the curing process the air pockets expand and the final result is often a defective tire.


SteadyWeb™ Automatic Tension Controller

To solve the problem, a pneumatic brake was used on the fabric liner unwind in conjunction with an automatic tension controller, and a 25 pound load-rated 14” Narrow Web transducer measuring 12 pounds of tension. With this system, we were able to successfully reduce the process waste level from about 25% to less than 1%.


NW Narrow Web transducer

Steel Belt Assembly

The same plant was experiencing problems on a line for the production of steel belt material for radial tires. The back-end of the process involves impregnating braided steel wire into soft, uncured rubber; but at the start of the process the rubber web, which is even softer and tackier than the side wall material, comes wound on a core and has a peel-off fabric liner. As the rubber is taken up and gets unwound into a tire assembly machine, the fabric is pulled off and wound onto a separate take-up reel.

Problems arise because the fabric adheres so strongly to the rubber. As the rubber is pulled into the tire assembly machine it can be stretched in opposite directions, often breaking. Accurate tension control on the fabric liner was again essential to solving the problem.

By using unwind tension control in conjunction with edge guiding, we were able to reduce the waste on the bead material from approximately 20% to less than 1%.

A web tension control system with direct tension-sensing will not only improve a machines bottom line performance by reducing web scrap and allowing a process to run at higher speeds with defect-free output, but it can often pay for itself in less than a month.