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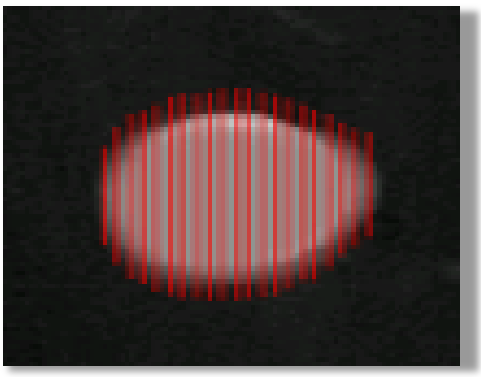
# New Technology Merges Code Reading and Marker Dot Inspection in Tire Manufacturing

In the tire manufacturing industry, the longstanding practice of reading bar codes to track and trace the provenance of tires has been joined in importance by the need to verify the presence and quality of marker dots. This requirement has been largely driven by automotive OEMs; with an eye towards their customers, OEMs have demanded that marker dots be detected and verified as part of the production process.

Laser-based bar code readers, used for years to track and sort tires throughout the production process, have long been the de facto standard for track and trace in the industry. However, historically marker dots were either inspected manually or not at all. This situation has changed with the strict requirement of dot verification.



The challenge for tire manufacturers has been that the process has required two steps: one, reading the code with laser scanners; then two, stopping the tire for manual inspection of dots, which is inherently labor intensive and unreliable. Fortunately for tire manufacturers, technology has emerged to solve the problem. New image-based technology can now read both bar codes and dot markers with a single device that does not impede production throughput.

***Seeing dots***

Ideally, tires are perfectly round and balanced, mounted on perfectly round and balanced wheels, attached to perfectly straight and true-running axles. But this is generally not the case. The demand for identification of marker dots is essentially a quality control issue, because these dots help users increase the safety and productivity of their tires at the mounting stage. Using the dots as a mounting guide helps minimize ride disturbances and irregular wear.

Tires are never perfectly round regardless of how precise the manufacturing process. There are always variations in tires, as well as in wheels, hubs, bolts, axles, and every other part of a wheel end assembly. Even when tires emerge from the factory in nearly flawless

condition, faulty installation or poor maintenance can compromise their use. Variations can create radial and lateral force fluctuations, both of which can be the source of rapid or irregular wear, ride disturbance, and safety issues. Mounting tires with dot markers can mitigate these problems.

As a tire spins, the amount of force it exerts on the road surface varies. One reason for this is that the tire isn't perfectly round, and therefore has high and low spots. The difference between these areas is called radial runout. Using analytics, tire manufacturers can identify the place on the tire where the force variation between high and low is greatest. This is typically marked with a red dot on the tire.

Wheels are similar to tires, in that they have high and low spots due to lack of perfect roundness. Most steel wheels are manufactured with a dimple to mark the low spot of the wheel. By matching the low point on the wheel with the high point on the tire, the forces cancel each other, smoothing the ride and reducing wear on the tires.

Just as perfect roundness is never wholly achievable, perfect balance between the tire and wheel is also extremely difficult to come by. By mounting a tire so that its light balance point is aligned with the wheel's heavy balance point, the amount of weight needed to balance a tire and wheel assembly is minimized. Therefore, tires are marked with yellow dots at their light balance point. (Generally, the heavy balance point of a wheel is at the valve stem.)

Consequently, verifying the presence and quality of the marker dots directly bears on tire performance and customer satisfaction. It is understandable, then, that automotive OEMs have demanded that tire suppliers make this process a standard part of the manufacturing process.

***Simplifying the solution***

Many of today's tire manufacturing facilities use machines and processes that date back to the 1950s and 1960s. Because the use and inspection of marker dots has only come to the fore in recent years, most equipment in place is comprised of laser scanners for bar code reading, which were retrofitted onto the older machines. Traditionally, as tires moved down a production line, they reached a spot where they were stopped and spun so that the code was readable by scanners. After that, the presence of the marker dots was validated manually. This step was time and labor intensive, and slowed product throughput—all anathema to the tire manufacturer's interest.

As retrofits and new machines are going into tire manufacturing facilities, it is becoming increasingly common for these tasks to be performed by a single device, a two-dimensional (2D) omni-directional scanner or code reader. With these image-based scanners, tires no longer need to be stopped and spun to find and read the code—it can be read anywhere on the tire. Even more importantly, the dot marker presence and quality can also be validated in a single step. With one snapshot or scanned image, tire manufacturers can get the requisite information using continuous motion, eliminating point-by-point inspection. The

bottom line: tire manufacturers no longer need a bar code system *and* a dot inspection system; the 2D omni-directional scanner easily handles both functions.

***Advantages at hand***

Two-dimensional omni-directional scanners enable tire manufacturers to efficiently respond to the increased pressure from automotive OEMs by being able to read both bar codes and symbols. These devices are extremely durable, can withstand the harsh environments typical of many tire-making facilities, and have advanced communications interfaces (e.g., USB, Ethernet, PROFIBUS, DeviceNet) beyond that of legacy laser scanners. Further, they not only identify the appropriate presence of marker dots, but also can process information embedded in the bar code to verify the type of marker dots that should be on the tire.

Their benefits are extensive:

- Reduced installation costs due to less hardware and programming of PC/PLC controllers
- Reduced maintenance costs due to less hardware to maintain and software to learn
- Reduced inventory costs
- Simplified communications
- Significant space savings


Most of the newer image-based devices, such as those from Minneapolis-based SICK (ICR880 and 890), have the ability to do calculations and gather information directly onboard, instead of saying “yes” or “no” and sending that information to a PLC and then in a particular format to a customer. With legacy solutions, the PLC typically took information from part A, information from part B, put them into a combined message, and then sent it to the user in a specified format. The newer devices have more processing power so that the information is sent directly to the customer without undue intervention. There is just one datastream.

With a single device solution, the number of items a tire manufacturer needs to know and maintain in its facility is lessened. Staff can become more expert on each item and realize greater uptime (e.g., no need to adjust bar code reader, no need to adjust marker scanner independently). The new devices are one piece with one software package, so the user has less complexity to learn and master. The threshold for employee involvement (i.e., user expertise) is lower. Moreover, if problems occur, they are more easily identified and corrected. Since one system is used instead of two, inventory is halved.

While space savings may not seem a significant issue in terms of the relative size of scanners, multiple locations are involved in laser scanning. So the space needed to accommodate these concerns is reduced with the image-based scanner. Also, by eliminating “dead space,” the new devices enable shorter production lines, which is always a consideration in the valuable real estate of the factory floor.

***Moving Forward with Technology***

The American writer Stewart Brand once noted, "Once a new technology rolls over you, if you're not part of the steamroller, you're part of the road." This is something that tire manufacturers should understand. The emergence of 2D image-based scanners to accommodate both bar code reading and dot marker identification is steamrolling ahead in the tire manufacturing sector, with very good reasons:

- It is a simpler, more cost-effective solution for new installations and new lines.
- It is simple to retrofit to older lines.
- It lowers demands on staffing, in terms of headcount and need for dedicated skillsets.

The way forward is simpler than it may appear on first consideration: just connect the dots.

*For more information, contact Jim Anderson, SICK National Product Manager – Vision.*
*Phone: +1 952-829-4749*
*Email: jim.anderson@sick.com*
*Web: www.sickusa.com*