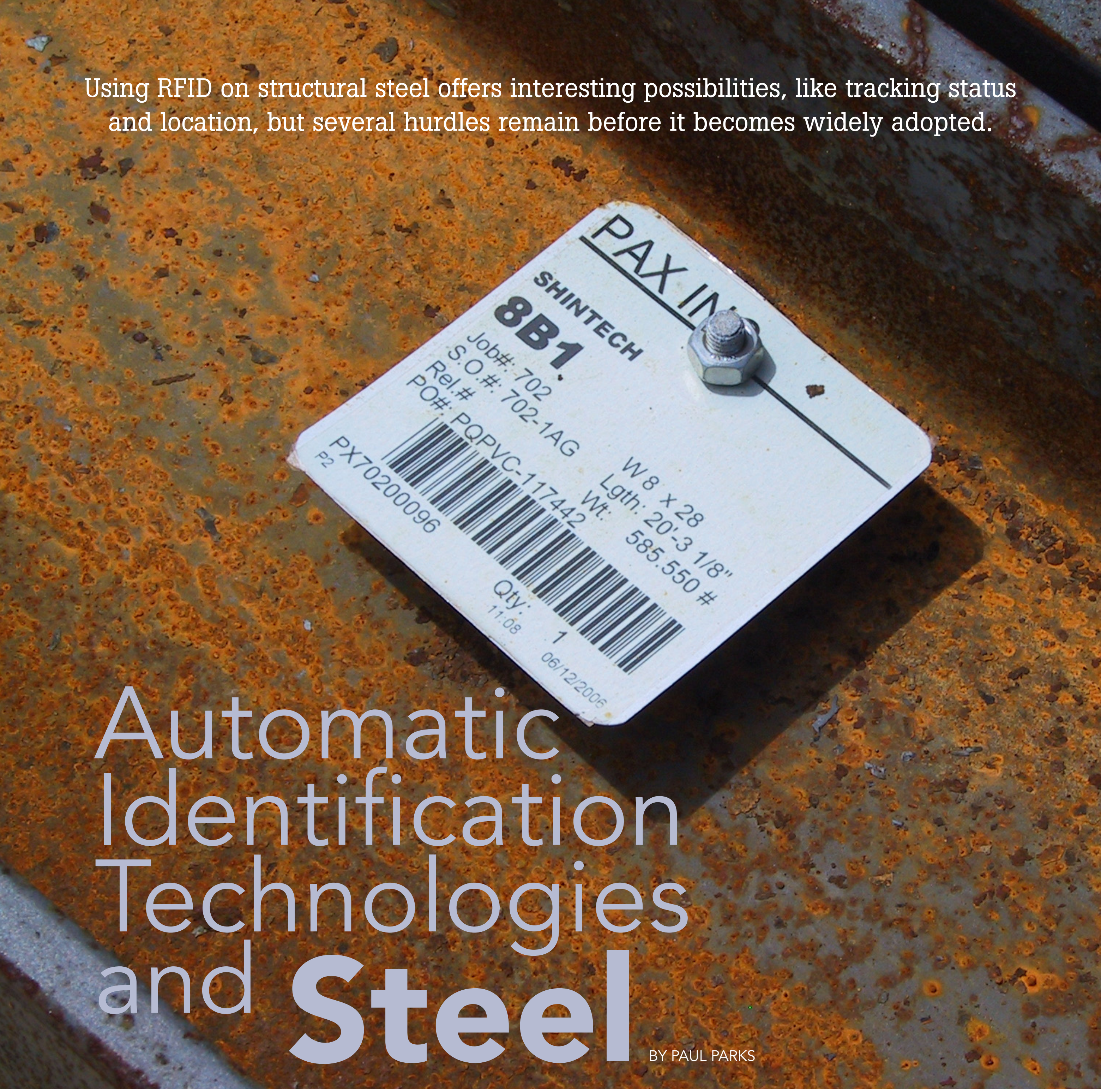
Using RFID on structural steel offers interesting possibilities, like tracking status and location, but several hurdles remain before it becomes widely adopted.



Automatic Identification Technologies and Steel

BY PAUL PARKS

BARCODES ARE PERVASIVE. From the ubiquitous UPCs in the retail environment to a wide variety of 2D and 3D codes used in manufacturing and other industries, this cost-effective technology facilitates data exchange in a wide range of industries. With roots in the retail grocery industry of the 1970s, barcoding today is a relatively mature technology in the world of automatic identification (Auto ID).

Radio frequency identification (RFID), another Auto-ID technology that offers greatly expanded capabilities, has become a popular subject for discussion, most recently at the 2011 NASCC: The Steel Conference in Pittsburgh. Many consider this to be "leading edge" technology in the Auto-ID industry, and it has many uses. We are all familiar with the alarms that go off when you leave a retail establishment with a product that has not been "deactivated" at the checkout counter. More advanced uses include tracking equipment (containers, ships, trucks, etc.), products or people through the use of either satellites, mobile readers or fixed position interrogators whose information is usually displayed on a map to show the user the exact location of the item in question.

I like the Wikipedia definition because it describes the technology in a simple way: "Radio-frequency identification (RFID) is a technology that uses communication through the use of radio waves to exchange data between a reader and an electronic tag attached to an object, for the purpose of identification and tracking." Although not an infallible source, on this entry Wikipedia covers the topic well and I would highly rec-

Barcode tags can provide large amounts of information about the objects to which they are attached, often including some in human readable form in addition to the information encoded in the barcode itself.

ommend you read the information posted there. It provides a great history and more in-depth discussion of the technology than can be covered in this article.

The RFID tags, which are either "passive" or "active," are an imperative part of any RFID system. A passive tag responds or transmits only when power is supplied from an external source. This type of tag is most prevalent in the retail industry. An active tag has a built in power supply, like a battery, that it uses to broadcast or transmit its information. This is the type of tag used in installations that track assets, containers, trucks, etc. Many active tag installations also work in conjunction with global positioning systems (GPS).

Having been in the Auto-ID industry since 1986, I am familiar with the technology and its various implementations. The majority of our work and experience has been in and around steel and steel construction, typically with barcode installations. Some of our first experiences with RFID technology were with a Louisiana company that moved offshore drilling rigs. Embedding RFID chips in their "steel anchors" proved to be an interesting learning experience. Once attached to the anchors, the "read distance" from the chip went from about two ft down to a matter of inches. RFID and steel, or more generically, metal, do not "play together" well.

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A Supplier's Perspective on RFID

While radio frequency identification (RFID) offers many exciting advantages in tracking materials and assets to build and maintain profiles of production lots, it's not a recommended choice for steel fabrication applications. Used widely in automotive assembly plants to track chassis and engine blocks, successful RFID installations require a relatively cool environment compared to temperatures found in steel forging and galvanizing processes. The temperature ratings that apply to any RFID tags from most manufacturers are well below 850° F. Typical "high temperature" tags reach into the 200° to 250° C range (392° to 482° degrees F).

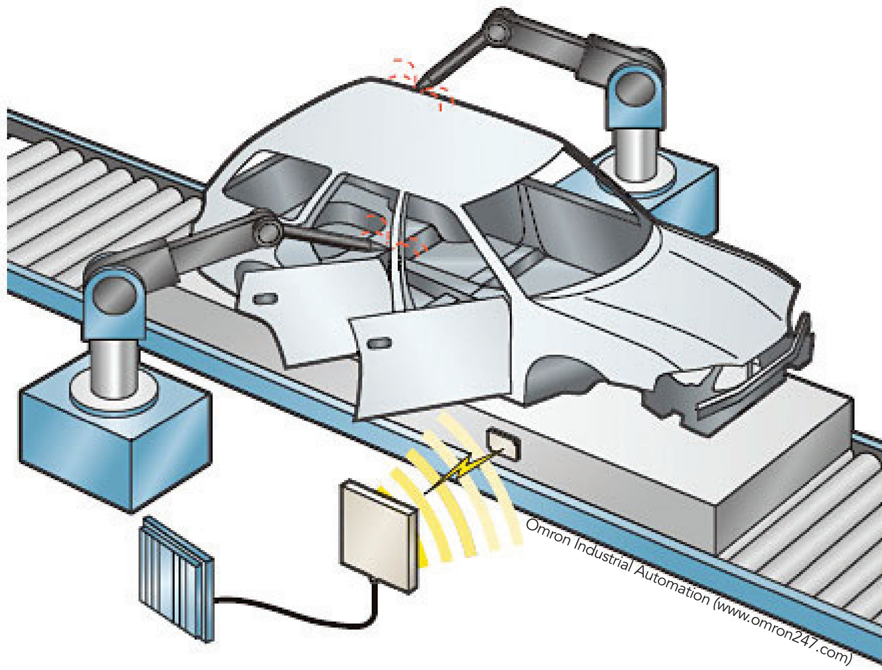
One advantage of RFID is that it does not require direct line-of-sight to obtain data. However, that capability is compromised when it comes to detecting radio signals in an environment full of steel. Metal does, in general, have a negative impact on the read/write capabilities of RFID tags. Some tags are designed to be mounted directly on metal, or have mounting brackets that can be used to stand the RFID tag away from the metal to improve reading/writing capabilities. Careful tag placement is required to ensure proper data exchange. For example, RFID tags surrounded by stacked steel beams would not transmit or receive data reliably due to the shielding effect. However, bar codes cannot be detected in the middle of a stack of metal, either. A considerable investment in testing would be required to determine the best placement of tags and antenna to reliably read various formulations and densities.

The concern that RFID tags are still too expensive depends on the type of tags used. There are two types: Traditional read/write tags and Write Once, Read Many (WORM). Traditional read/write tags can be written to and read from many times during a process, or reused from product to product; many can be rewritten millions of times. WORM tags can be used to identify products, just like a barcode, but are typically not reused. The cost of these two types of tags is greatly different: traditional read/write tags cost somewhere between \$20 and \$300 each, depending on the amount of data they can hold, temperature ratings, and other factors. WORM tags used in high volumes cost \$0.08 – \$0.20 per tag.

However, tag cost becomes a non-issue if they fail to provide reliable data exchange.

The high-tech advantages of RFID may be too temperamental for wide use in some steel fabrication applications. In those situations, barcodes would be the best choice.

—Information provided by Omron Industrial Automation (**www.omron247.com**)



A basic RFID system consists of a tag on the item being tracked, an antenna to transmit and receive the data communication to and from the tag, and the computer system to which it is linked. Widely used in automotive assembly and production applications, RFID systems like the one shown here can function as a set of plans and specifications that travels with the workpiece. For example, the system might both tell a robotic station what operation to perform and record what has been accomplished.

The first big wave of interest in this technology in the steel industry came after an announcement by Wal-Mart that it was going to require its suppliers to label all products with a passive RFID label. The desired outcomes included increasing inventory accuracy, improving sale transactions, and requiring fewer checkout clerks. RFID promised everything a retail establishment would want—reduced overhead, increased profits, and improved customer satisfaction. The Wikipedia entry previously referred to covers the Wal-Mart mandate and its subsequent pullback, outlining some of the issues but omitting others, such as the failure rate of the printed labels.

Some of the positive benefits of RFID include:

- Quick data capture.
- Low user involvement.
- High accuracy.
- GPS capabilities, but only for some RFID labels or tags.

Some of the negatives of RFID include:

- Cost of the labels or tags.
- Cost of the software.
- Application issues with metal products.
- Material handling issues.
- The technology usually complements but does not replace existing barcode labels.

We spoke to many steel fabricators after the Wal-Mart announcement who wanted a similar system installed in their shops. Many of the key points that make passive RFID labels work in retail environments do not exist in a fabrication environment. In retail, RFID labels usually are applied to cardboard or plastic, in a clean production environment, at high volumes, with fixed production paths, fixed readers, and low variability. By contrast, in a fabrication environment the label usually is applied to a metal product, in a very dirty work environment, where wide bays with high ceilings prevent fixed reader placement. Added to that are the inconsistent product configuration and relatively low volumes in structural steel fabrication. At that point in time, RFID and steel fabrication generally were not a good fit.

As a relatively mature form of automatic identification technology, barcoding provides a very cost-effective way to quickly and accurately capture data about labeled batches or individual pieces.

Understanding a Few Basics

There are really two different installation environments with any Auto-ID system. The first is for *internal use*, within your fabrication facility. With these systems, you should perform a "benchmark" analysis of your existing operation. This benchmark is critical to understanding your existing processes and the inefficiencies that have been accepted as standard operating procedure (SOP) within your facility. Then your cost/benefit analysis is based upon the productivity improvements, reduced errors and manpower required to track your work within your facility. The reduced manpower is a direct cost and usually very easy to measure. The indirect costs of error reduction and productivity improvements are usually harder to quantify. With a benchmark analysis, it is much easier to include these indirect cost reductions when calculating your return on investment (ROI).

The second installation environment is for *external use*, such as on a construction site. Recently, this is where we have found the most interest (from the client or engineering firm) or requests (from the fabricator or erector) to use RFID systems with active tags. With an average RFID installation cost of $300,000 or more, the fabricator/erector is not in a position to absorb this cost without a price increase. This average cost also assumes you are going to remove the RFID tag at the point of erection, and use it again on another piece. But, the question remains: Who is going absorb these additional cost to pay for the system? In my experience, this has always been the biggest hurdle for an RFID system that is "required" by the end user, even for a Wal-Mart sized client.

To be sure, the cost of RFID systems has come down significantly in the last seven to 10 years. But, with other Auto-ID systems costing as much as 20 times less while providing almost the same benefits, it is very hard for the fabricator to justify and absorb the increased cost while maintaining their existing prices. This is exacerbated by the fact that most structural steel is not a "high dollar value" product. In the above example, when the $17 cost of each RFID tag is added to each item that is being shipped to the construction site, and then later removed (to help reduce your RFID tag cost) to be reused on anther piece headed for the construction site—your material handling cost will increase.

The cost of the RFID technology is moving in the right direction. As the RFID tag approaches a "disposable" cost and can survive the harsh processes of galvanizing and/or blasting, the tags can be applied during the fabrication process—saving time and material handling cost over the current processes. At that point, fabricators would be wise to take advantage of the technology to remain competitive in the industry. In the meantime, there are Auto-ID systems available today that can provide a cost-effective solution to get the process controls and information you need to meet your client's requirements, all while reducing operating costs, increasing profits and improving customer satisfaction. As with any highly technical subject, there are exceptions to the general information presented in this article and every potential project should be evaluated based on the situation, usage and, the most important—a cost/benefit analysis. MSC