The cost of inspection today is an ongoing issue between the automotive companies and precision parts manufacturers. As the automotive parts manufacturers work to reduce price by means of improving the efficiency of the manufacturing process, their inspection costs have risen dramatically.

Historically, these manufacturers have focused on the production side of manufacturing parts, with sorting as an afterthought. Now, because of the quality demands placed on them, the sorting departments are growing fast. This growth has created new variables for the manufacturer, including cost, time, and—many times—inferior inspection processes.

Are possibilities for reducing costs the same in the inspection area as they are in the production area? Yes, however they are not as easily identified as in the production area. Although the automotive industry recognizes the cost in the inspection of the manufacturer’s product, they aren’t willing to pay higher prices to reduce suppliers’ PPM levels. Suppliers cannot always include inspection costs into the piece price, especially on grandfathered parts. Regardless, the expectations from the automotive industry still remain at zero PPM levels. And, in most cases, the precision parts manufacturer has to incur the inspection cost.

Suppliers are feeling the heat to achieve zero defects PPM. Old methods are giving way to automated systems. Here’s a look at how lasers are leading the way.

By Terry Hoffman
Vice president, Mectron Engineering Co.
Inspection departments today incorporate a variety of different methods to provide what is called 100 percent inspection. Methods that include hand sorting, roll sorting, acoustic, inductors, vision and single laser inspection all reduce PPM levels to some degree.

The remaining defects that make it through these methods cause the manufacturer additional costs that should not be overlooked. These include chasing problems in the field, flying personnel to customer’s plants to resolve issues, hiring outside sorting companies to manually inspect product on the line, air freighting replacement parts, customer visits, 8D’s, and the potential loss of business due to reputation.

When you add up these costs along with any original equipment investment, the cost of sending product out or buying superior equipment no longer seems as expensive. Another potential cost is the automotive industries’ back charges for assembly line shutdowns due to defective parts. This is becoming more common every day, and it is impossible to factor into a business plan. Line shutdown costs can be enormous and can cripple the supplier’s bottom line.

**Multi-Laser Inspection**

The industrial laser is well applied in workpiece inspection. It’s fast, flexible and easy to set up to measure a variety of different workpieces. The laser inspection process is non-contact, so accuracies are not affected by mechanical wear.

Like most of metalworking, the sophistication of a laser inspection system is a function of the complexity and requirements of the application. Let’s start with the least sophisticated system.

For basic inspection, inspection equipment manufacturer Mectron Engineering Company (Saline, Michigan) offers a two-laser inspection unit. This machine provides cross-sectional measurement and is ideal for many screw machine and other precision turned parts.

The system provides inspection and measurement of coordinate points in the X-Y plane on a part. With its two lasers, the unit gives four chords of inspection along the entire length of a part. Its gauge tolerance capability is 0.0004 inch.

In operation, the laser scans parts as they pass by it traveling down a V-track. The two lasers are arranged at 90 degrees to one another and radially to the workpiece. Measurements on this two-laser system are taken at four points on the cross section over the entire length of the part as it passes through the beam.

In addition to providing part measurements, the system provides inspection for detecting mixed products, oversized and undersized diameters, short and missing threads and some radial part damage. Laser inspection is well applied to eliminate non-functional parts from a run, such as a part that missed a grinding operation. The shortcoming of the two-laser system is that part segments that fall between the four inspection points may not be seen by the laser.
For example, on a 0.25 inch diameter part, a defect that falls between two inspection points may need to protrude at least 0.051 inch before it can be detected by either laser. A defect that is less than 0.051 inch on a 0.25 inch diameter may be missed by both lasers on this basic inspection system. The two lasers system is best applied for sorting mixed parts, over and under sized diameter detection and missing features. More detailed inspection requires more lasers.

The next step in sophistication is complete 360-degree inspection of a part. With the degree of an acceptable defect decreasing all the time, using a system that can detect small defects is becoming more necessary. A damaged thread may mean the difference between a successful assembly and a line stoppage.

For this level of inspection, Mectron makes a system that uses six or eight lasers to “see” defects on the part. The choice of six or eight depends on the part size. Both systems provide complete 360-degree inspection.

Mectron Engineering Company makes a line of high volume, laser driven, precision inspection equipment and automated packaging systems for use with the inspection equipment. The company’s machines are designed and built as systems to automate and consolidate the sorting and inspection process.

The company is tackling the 100 percent inspection issues from two directions. One is to supply proven inspection systems to the manufacturing companies to inspect their own product. The other is to use its own equipment to provide a high volume, automated inspection service.

Some companies have taken the human element out of sorting and run their products through inspection machines. However, they may still have issues in the packaging of the product after it has been inspected. It makes no sense to run product through an automated machine only to have foreign material introduced at a separate packaging operation. The way to run the inspection department is to inspect and package in the same operation. The correct way is for the product to go through the machine and into the box. Then the box is sealed and placed on a pallet for shipping.

Mectron is said to be the only company in North America that uses its own machines and technology to sort and inspect products to zero defect levels. With quantities exceeding 200 million pieces annually, the company has a documented PPM level of a remarkable 0.000000016. Since its inception, Mectron has sorted and inspected nearly 1 billion parts to this PPM level. As a proof, Mectron can demonstrate that this is the PPM level manufacturers can expect to achieve upon implementing a turnkey sorting, inspecting and packaging system.

Mectron Engineering Company, Inc. Contract Sorting Volumes 1993 - Present

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<th>Year</th>
<th>Part Volume</th>
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<td>Cum. Totals *</td>
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* Mectron Sorting: PPM level = .014

The key to this success is Mectron’s laser technology. By slicing the part into 16 points of inspection around 360 degrees of the entire length of the fastener, the Mectron system provides the complete measurement capability. With the addition of magnetic imagery for metallurgical defect detection, precision parts are inspected for both dimensional and metallurgical defects. This full capability system is the only one used in Mectron’s sorting facility.
Most manufacturers have collected a variety of different types of inspection systems that allow them to reduce PPM levels, but, based on their capabilities, they also have to absorb the associated costs by not achieving zero defects.

Mectron has been focusing only on the business of inspection. A full ISO compliant package can be supplied to Mectron customers to aid them in setting up an inspection department (work instructions, process flow diagrams, preventative maintenance, and so on). Maintaining process flow through the inspection department is critical in order to maintain zero defect levels.

The advantages of these sophisticated inspection services are directly transferred to the manufacturing community. By feeding and packaging millions of parts annually, the intricacies of handling and controlling large variations of manufacturers’ products can be fine-tuned and perfected. In a learning by doing environment, the entire system is continuously undergoing improvement, such as material handling, proper part separation, programming and controlling the product through the accept/reject gate.

With this experience, the shop has been able to eliminate potential catch points and areas that could cause damage. Mectron’s own in-house sorting department enables it to test new technologies and software upgrades in a controlled atmosphere.

As the part passes down the V-track, maximum coverage of the part is possible, resulting in tighter measurement of critical dimensions. With is system, a defect must protrude only 0.004 inch to be detected by one of the lasers. This compares with 0.051 inch on a two-laser array.

If six is good, eight is better. By slicing the part into 16 points of inspection around the 360-degree circumference, the detectable defect on our 0.25 inch diameter part goes to 0.002 inch.

Of course not all inspection requirements are about defects detection and dimensional verification. On some critical parts, metallurgical defects can also wreak havoc with a supplier’s zero defect PPM.

**Metallurgical Defects**

In a single inspection unit, Mectron integrates and automates the capability of multi-laser inspection and a magnetic imagery instrument and coil. The idea is to combine both dimensional verification and metallurgical defect detection into a single machine, reducing the cost of detailed inspection.

Magnetic imagery is an advanced eddy current technique that makes on-the-fly metallurgical inspection possible and integratable with dimensional laser measurement. As each part passes down the machine’s V-track, the coil develops a magnetic profile to create a part’s signature.

The full signature provides the opportunity to detect most critical metallurgical defects including cracks, material mixes, conductive platings and coatings, and hardness using a visual deviation of the magnetic image. The percentage of deviation is displayed on the machine’s monitor screen, and acceptable limits can be quickly defined using touch screen programming inputs.

Mectron cites two advantages of its magnetic imagery system. The first is full part signature detects more defects than many other techniques. The second is the coil design used on this system is free from sensitivity to speed and temperature fluctuations.

**Customer Driven Evolution**

Continuous improvements in machine design, laser implementation and software modifications have all been driven by specific customer applica-
R&D innovations driven by the needs of precision parts manufacturers.

**Where Do We Go From Here?**

Partial elimination of problems is not adequate in today’s market. Costs involved with shipping defective product are escalating daily. In the long run, economically, it makes sense to go with a product or service that produces ultimate cost savings (which means zero PPM) to both the precision parts manufacturer and the auto producer.

The combination of 360-degree laser inspection and metallurgical defect detection, in a continuous production system, is a step forward for precision parts producers striving to supply zero PPM defects. For Mectron customers, the ability to purchase the service of inspection or the system itself is a lower risk proposition than is usually available.

For more information about inspection and sorting systems from Mectron Engineering Company, call (734) 944-8777.
Can you afford not to inspect with the best?

Advantages
- 360° Detection
- Diameter Inspection to 5 Microns
- Chip Wraps
- Short Feeds
- Bar Ends
- Missed Operations
- Heat Treat
- Cracks