

AOI — Making Quality Fasteners

by:

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A discussion of how Automatic Optical Inspection (AOI) equipment applies to the fastener industry.

What is AOI? These days, with semiconductor chips and cell phone circuits getting smaller or with components made as tiny as silk or hair, there is no way to discern a good or bad part simply based upon eyesight. To inspect such tiny parts, we now have industrial-grade digital cameras that capture images much faster than conventional digital-cameras (CCD cameras). These industrial-grade cameras capture black and white images (grayscale images) and then use computer analysis in replace of the human brain to decide if the materials qualify as good or bad parts. In this way, we have computer programs replacing manpower examinations. This is known as machine vision, pattern recognition and Automatic Optical Inspection (AOI). An AOI inspection application is shown in **Figure 1**.

Importance of Image Identification Technology

For an application such as a cash-change machine, the most costly part of the technology is the image identification mode. Image identification technology is also typically used in applications ranging from fingerprint identification to cruise missile navigation.

The cell phones that we all own have passed over many stops of AOI examination procedures. In addition to the semiconductor other small parts industries, AOI technology is also now becoming the most valued part in automotive machinery. While digital control was at the competitive core of previous-generation industry, AOI is absolutely at the competitive core of today's industries.

Also, today's quality control is all about compliance with the standards of *ISO 9001*, *ISO/TS 16949*, *6 Sigma*, etc. The practice of compliance to these quality systems takes time. In general, it could take three to four years to develop such compliance. Compliance with these standards as well as the need to meet urgent delivery schedules and requirements for 100% quality control from input to product shipment inspection (for example in the automotive industry) all make AOI

an essential technology.

Manual examination often involve risks in terms of wrong judgments. And the use of analyses such as MSA can take a lot of time. As a result of these factors, AOI technology is increasingly being utilized by automotive fastener manufacturers to facilitate efficient quality control, for example in areas such as **Toyota's** management "Jidoka" management system or in Lean-6 Sigma production.

And in these days, with the cost of manpower continuously on the rise, many companies are turning to AOI as a cost saver for use in responding to 8D or CARs (Correcting Action Reports) requirements.

The AOI Sorting Machine Provides Efficiency & Economy

The double-belt conveyor AOI sorting machine that is shown in **Figure 2** provides fastener manufacturers with the efficiency and economy that is required in their quality control operations.

For most manufacturers of fastener products, especially mid-scale manufacturing enterprises, the customers are retail suppliers and not end users. In meeting the quality requirements of these retail suppliers, fastener manufacturers normally follow standard quality regulations and practices. Their main concern is the avoidance of nonconformities in the flow of products to their customers. AOI technology provides an ideal quality control system for these manufacturers to eliminate such nonconformities.

Until now, fastener manufacturers have misunderstood some of the concepts of quality control in their efforts to provide punctual deliveries to their customers. Some of these mistakes have included:

- The notion that to simply strengthen inspection will ensure quality.

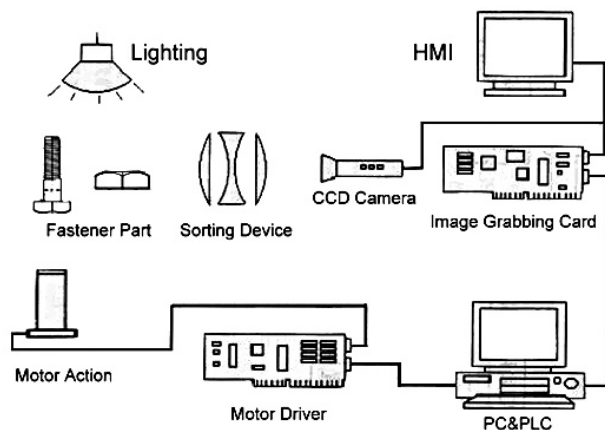


Fig. 1 — AOI inspection application.

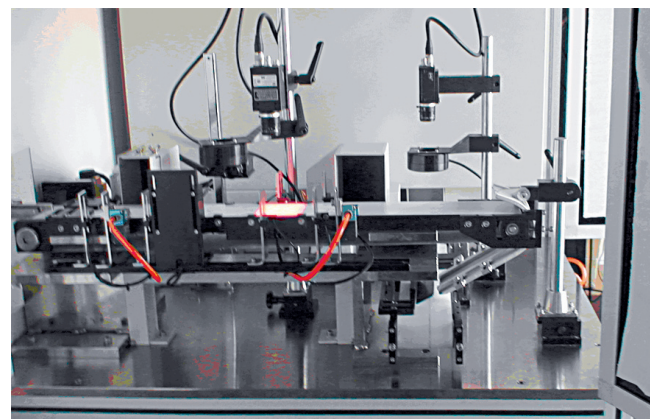


Fig. 2 — Inner structure of double-belt conveyor AOI sorting machine.

- The notion that sampling inspection only is sufficient to ensure quality.
- The notion that the use of sampling inspection is the most economical method of ensuring quality.

As a result of these mistaken notions, many manufacturers found themselves increasing costs involved with manual labor and manual inspection equipment. Such manufacturers often find that their productivity rates have actually been lowered through the use of these inspection notions. Increasingly, manufacturers of fastener products are finding that the concept of “check up to create quality” is not the best inspection method.

Additionally, according to the concept of ANPS (Advanced New Production Skills), in order to upgrade the level of its manufacturing operations, a company must turn the practice of manual parts examinations into automatic artificial intelligence examinations. The advantages of automotive artificial intelligence examination is saving manpower costs, better and more consistent quality judgments and an easier learning curve. This methodology is also a good method for meeting 100% inspection requirements.

The Difference Between Automation and Autonomation

Automation and autonomation are quite different concepts. Automation is a goal pursued by each company, which seeks only to replace manual operations. The concept of automation does not involve the checking out of mistakes, with inspection still requiring manpower for examination of finished part batches.

The concept of autonomation emphasizes on AOI technology and includes the detection of abnormal products during the automatic manufacturing operation. Autonomation involves the automatic stopping of the production line to sort out the defects and to prevent damaged parts from getting to the customer. Autonomation makes the machine operator aware of quality problems and provides corrective methods to remedy such problems.

Additional AOI sorting machines that provide the autonomation function in addition to simple automation, can be seen in **Figure 3**, **Figure 4** and **Figure 5**.

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Company Profile: Established in 2004, **Chun Chan Tech Co., Ltd.**, is devoted to the design and manufacture of precision inspection machines, automation equipment and vision system development. The company uses advanced technology in its products, especially in the optics, machine vision and mechatronics, in order to promote the quality and quantity of its customers' products. The company's products can be applied to many industries including the fastener industry, electronics industry, metals industry, plastics industry, etc. Chun Chan is looking for overseas sales agents. www.cctech.com.tw



Fig. 3 — Rotary disc AOI optical sorting machine.



Fig. 4 — Conveyor-type AOI sorting machine.



Fig. 5 — Glass disc-type AOI sorting machine with integral delicate feeding system.