

What You Should Know About Your Own Quality?

by:

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Many in the fastener industry ask: "Is the non-conformity rate really high for my product?" The analysis in this article points out just how much risk a fastener company might shoulder, and then explains the benefits of optical sorting.

For the sake of this article, we use a sampling inspection method for QC control. Also, let us assume that the conformity rate for each 100,000-piece batch of screws is 97%. Relative to the MIL-STD-105E standard, the general inspection demand (II) sampling size is 500 pieces, and the actual sampling inspection in a fastener factory would not go over this sampling size level. To facilitate easier calculations, for the sake of the following analysis, we will minimize the sampling size to 100 pieces, and the probability of nonconforming fasteners is 1 or 0:

By means of BINOMIAL DISTRIBUTION analysis:
 $N = 100000, n = 100, n/N = 0.001 < 0.1$

1. Hence we use BINOMIAL DISTRIBUTION analysis to get the answer:

While $p = 3\% = 0.03, n/N = 0.001 < 0.1$

(1.) asking $d = 0$ probability

$$p_0 = \binom{100}{0} (0.97)^{100} (0.03)^0 = 0.04787 = 4.787\%$$

(2.) asking $d = 1$ probability

$$p_1 = \binom{100}{1} (0.97)^{99} (0.03)^1 = 0.1479 = 14.79\%$$

2. Hence, we use POISSON DISTRIBUTION analysis to get the answer:

(1.) asking $d = 0$ probability

$$p_0 = \frac{3^0}{0!} e^{-3} = e^{-3} = 0.04979 = 4.979\%$$

(2.) asking $d = 1$ probability

$$p_1 = \frac{3^1}{1!} e^{-3} = 3 \times 0.04979 = 0.14937 = 14.937\%$$

Regardless of the answer from BINOMIAL DISTRIBUTION or POISSON DISTRIBUTION, the fastener manufacturer runs a nonconformity rate of 4% to 5% to be passed to the customer, which indeed represents a risk. In addition, if the chance for one nonconformity is 14% to 15%, then each 10 samples will get a 1.5 possibility among 100 pieces.

Relative to the analysis above, there exists a really high call back rate for the fastener manufacturer to shoulder. In response to this, CHUN CHAN Technology now presents the benefits of using optical sorting machine technology.

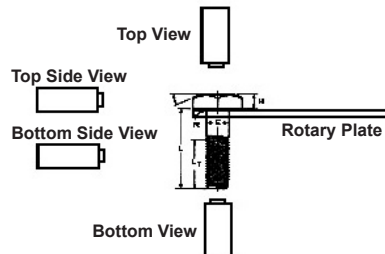
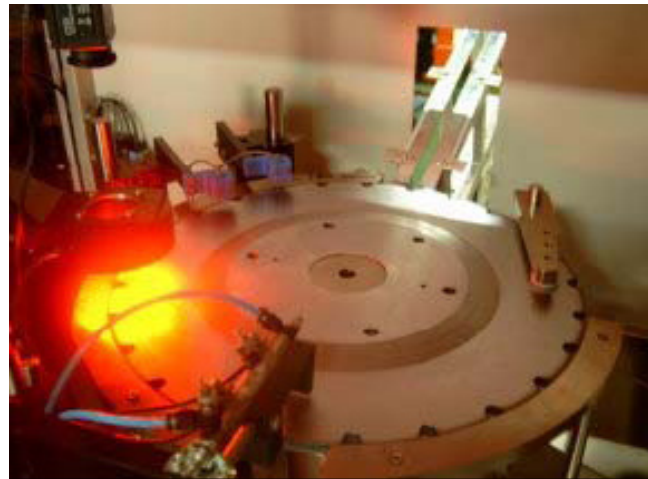
The Benefits of Optical Sorting Technology

In terms of optical sorting machine function, every part measurable on a fastener or pass-through sorting examination, could be referred to as conformity.

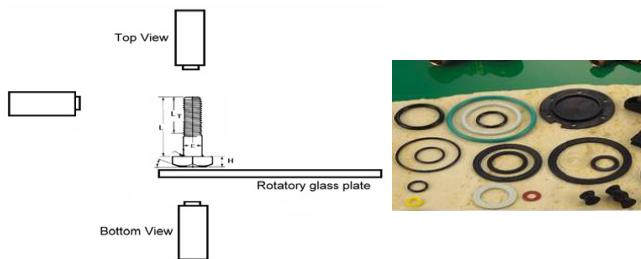
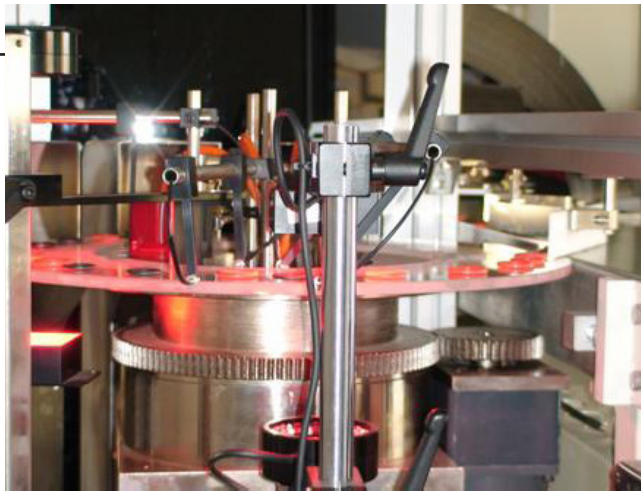
In general usage, the Automatic Optical Inspection System can offer a 100% examination to quality product, provided that the sorting machine has been correctly calibrated. The CHUN CHAN machine was designed based on the concept of Image Contrast, which compares camera views to the images of a correct fastener part and then contrasts any differences in terms of length, width or concentricity. The pixels on the screen are transformed into a value, and unless the original calibrations and numbers were erroneously set, the actual part measurements are considered to be wrong.

Daily inspections using manpower involve inconsistencies, and result in measurements that can deviate from the manufacturing standard relative to dies, punches and equipment used. These inconsistencies in measurements are what cause the risks to both manufacturer and end user.

The Automatic Optical Inspection System applies Meas-



Optical sorting machine with parts on metal rotary plate and with cameras positioned at side, above and below (shown with sample parts).



Optical sorting machine with parts on glass rotary plate and with cameras positioned at side, above and below (shown with sample parts).

urement System Analysis (MSA ISO/TS 16949) by means of Gauge Repeatability and Reproducibility, GR&R function. And provided that all ranges and calculations are correct, 100% identical Repeatability and Reproducibility is the result, which means nearly 100% assurance of no risk of product call backs for the manufacturer.

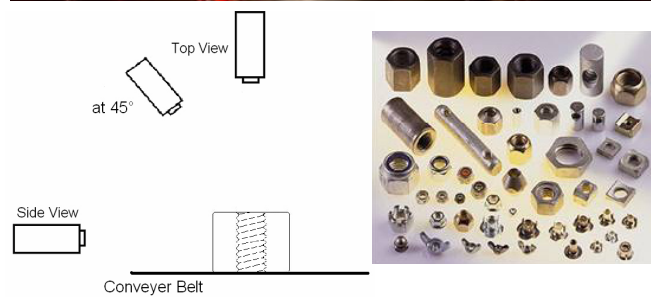
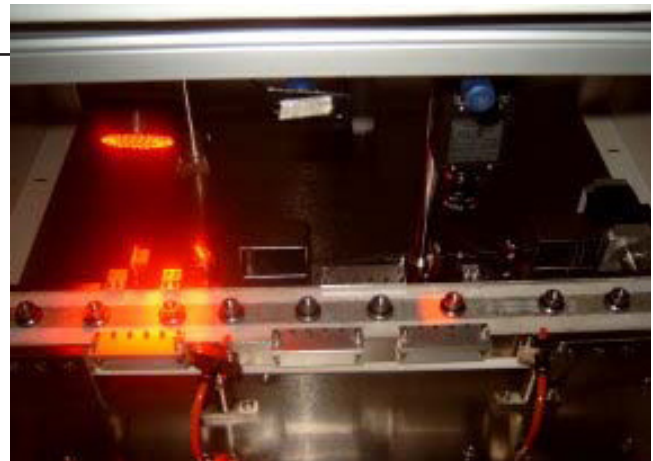
Some Risks Still Remain

The optical sorting machine provides accurate measurements based on the practice of Repeatability and Reproducibility. However there is still some subtle risks involved with optical sorting machine technology. These include:

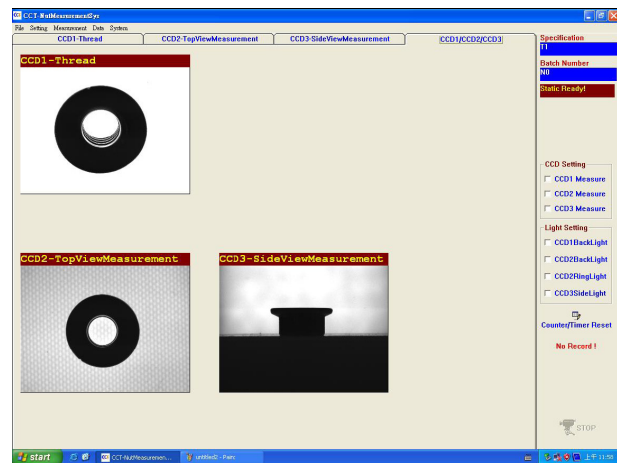
- Calculation risk.
- CCD camera adjustment risk.
- 45° contrast, where the opposite side of the part cannot be seen (basically acceptable as we theoretically suppose the other side of the thread is error-free).
- Wrong judgment due to parts running on stained belt where parts could be judged as being nonconforming.

As a supplier of optical sorting machines, some of the customers we meet still do not have much of an understanding about how the technology would upgrade their quality. Many of these customers still use manpower to examine the quality of their parts, which really takes a lot time. Sorting machine advantages include:

- Material Inspection (full/partial).
- Process Inspection – the resource control for the hardware and the production.
- Handling/Shipping Inspection – full or partial inspection for the products before shipping.
- Packing Inspection – inspection for missing or misplaced parts during the packing process.
- The flexibility, speed, accuracy and remote capability to replace the 2D/3D projector, the measurement data can be



Optical sorting machine with parts on conveyor belt and with cameras positioned above, at 45° and at side (shown with sample parts).



Sample measurement data screen generated by the Automatic Optical Inspection System.

easily calculated and transmitted to text files, Excel files or any kind of SPC (e.g., SPC XL, Minitab R14, etc.) widely used in the production industries for both CpK calculation and analytic reports of the production process.

CHUN CHAN Tech is very willing to be of assistance to fastener makers to update their products. The company welcomes the contact of any companies in need of assistance in ensuring their parts quality. **FTI**

Note: Thanks to Frank Tsai, General Manager of Shanghai Technology Norm Trade Co., Ltd., for supplying the probability data for this article.

Company Profile: Chun Chan Technology Co., Ltd. provides the Automatic Optical Inspection System by using machine, optical, computational and software engineering to enhance the efficiency and effectiveness of the production process. Integrated inspection equipment can be developed to provide flexibility and adaptability for many different production industries. www.cctech.com.tw