

The Evolution of Fastener Sorting

by:

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There aren't machines that can do every sorting task, but there are machines that are nearly flawless for specific types of parts.

SWD Inc. Fastener Sorting Corp. has been sorting parts for our customers since 1981 and was one of the first companies to offer that service. It has been interesting to watch the changes that have taken place since we began.

We purchased **Fastener Sorting Corp.**, which included two roll sorters and two Precision machines manufactured by **Elco Industries**. The roll sorters would sort for foreign material and mixed parts via the head diameter of the parts. The Precision machines were the first machines capable of detecting shank length, head height and shank diameter. These machines used micrometer-controlled touch gauges and limit switches for their measurements, so the accuracy was at best, ± 0.010 ", but was state-of-the-art.

SWD had exclusive rights to Precision technology, but other machinery was being developed in England (commonly known as a **Pace** machine) that would sort for several defects at the same time and did not require multiple passes through the equipment for each defect.

Optical Sorting Technology

In the mid-1980s, SWD purchased its first Pace sorting machines. Instead of limit switches actually touching the parts, these machines used optical screens to magnify an image of the part and light sensors to detect shank length, major diameter and presence of threads. Pace machines also utilized the mechanical capabilities of a roll sorter incorporated right from the feeder bowl, which gave you the ability to remove foreign material that would potentially jam the machine as well as provided the ability to check basic head diameter. They could also have a recess carousel attached for mechanical recess depth verification.

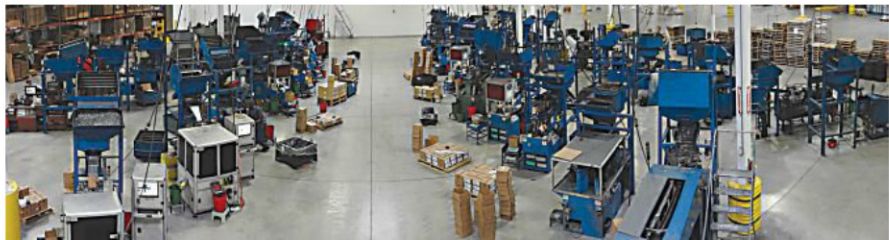
The Pace machine became the workhorse of the industry for the next 20 years. Interestingly, this was also the machine and technology that started the terms "100% Sort" or "Sort for Automation". The optics of the Pace machine and similar machines were accurate to about ± 0.010 ". It was at this point that sorting went from simply separation of foreign material and mixed parts, to guaranteeing quality. At that point in time, 50 PPM was an acceptable standard.

Ultrasonic Sorting Technology

SWD Inc. was constantly looking to stay current with



SWD, Inc. facility in Addison, IL, USA (above) and panorama view of sorting machines on the shop floor at SWD, Inc. (below).



technology, and in the late 1980s purchased **Cochlea** machines, which brought ultrasonic technology to sorting. These unique machines used sound waves and a receiver to check parts for missing characteristics and overall structure (missing thru-holes, internal thread presence, bent or damaged parts, etc.), and were some of the first truly computerized sorting machines available on the market. Sadly, like so many machines both before and since, the company no longer exists and the technology is no longer used.

Laser & Vision Sorting

In the early 1990s, the latest technology to come to market was laser sorting. Both **Mectron** and **Retina Systems** developed machines that utilized lasers to measure parts and not long after, customers started to request that their parts be laser sorted. It was quite funny to see the quote requests that would specify "Laser Sort 100%". It didn't matter that the part configuration might be better suited for and more accurately sorted by a different machine, "Laser Sorting" was considered state-of-the-art. That same laser technology still exists today and certainly has a place for specific parts, but is not a be all, end all.

At about the same time, Pace started to add the first "Vision" cameras to its machines. The first vision cameras had basic analog CCD cameras, but were able to accurately detect dimensions like major diameter, minor diameter and thread pitch. As vision and laser sorting took over the market, machine accuracy also improved. We were able to

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hold tolerances of ± 0.003 " in most cases, and we were able to guarantee 25 to 30 PPM for most parts.

Laser and vision machines have continued to be used for fastener sorting throughout the past 20 years, although the technology has continued to improve with each new generation. The laser arrays, software and machine capabilities have gotten faster and more accurate. Every few years, new companies emerge and some fade away.

There is nothing worse than spending over US\$100,000 on a machine that promises to be capable of sorting nearly every defect only to have the company disappear and lose technical support.

If you're lucky, the machine can be adapted with standard off-the-shelf equipment, or in the worst case scenario you are stuck with a very large paperweight. We have seen machine resolution improve to the point where some machines can hold tolerances of ± 0.001 ", and some dedicated equipment is capable of even tighter tolerances.

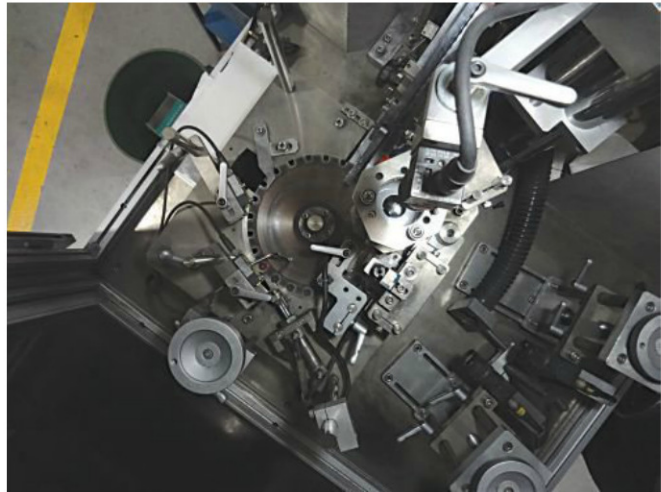
The Hunt for 0 PPM Continues

While most customers demand 0 PPM, it is still nearly impossible to guarantee. The biggest issue with guaranteeing a specific PPM level is knowing what issues need to be sorted for and making sure these imperfections are found every time.

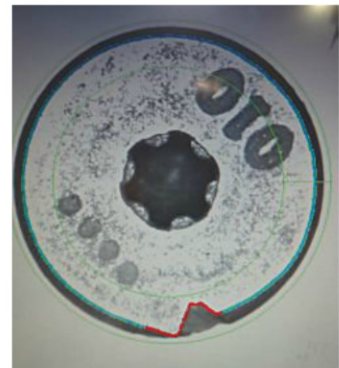
Many times customers quote sorting prior to manufacturing, in which case the types of defects you might see are completely unknown. Even with the most advanced machine available, if there are no actual samples of the different defects you are forced to create defective samples to mimic potential bad parts. These samples are helpful, but not necessarily truly representative. Even when you have actual defective parts, they might not represent the extremes that can exist and an unacceptable part can get through. Differences from part-to-part in the color of the finish or even how shiny or dull a part is, can effect even the best systems. Anyone that has setup a vision camera can tell you that if you can't get the lighting right, then you can't accurately sort for specific defects. In some cases, it may take two different machines to be able to detect all the potential defects on a specific part. Each lot of parts can have different defects that appear because of variations in the manufacturing process. Some parts have been headed or rolled on multiple different machines. Each variation can be a cause for a bad part to escape.

SWD currently runs over 40 different pieces of sorting equipment. From roll sorters to V-track laser systems and machines with as many as five vision cameras. Over the past three years SWD has reinvested nearly US\$750,000 to purchase the latest technology from around the world. From new custom automated sorting equipment to machines that have been upgraded with the latest vision systems, we have forged partnerships with companies in Germany, Taiwan and the USA helping to develop equipment that can detect defects that were impossible to catch with machine sorting technology just a few years ago.

We have yet to find a machine that can do everything,



Sorting machine at SWD, Inc. (above) and example of cracked head detected (right).



but we have found machines that are nearly flawless for specific types of parts. Along with the systems, procedures and expertise that we have developed, SWD has been able to help our customers deliver defect-free parts for the past three decades.

To learn more about the fastener sorting capabilities available at SWD, Inc., contact the authors or visit the company's website listed below.

www.swdinc.com

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Company Profile:

SWD, Inc. is a premier metal finishing, dip spin coatings and fastener sorting facility. SWD specializes in working with stampings and fasteners such as screws, nuts, bolts and washers. SWD is located less than 30 minutes from Chicago, IL, USA. SWD, Inc. has created a tradition of exceptional production quality, complete customer satisfaction and continuing commitment to environmental conservation. The company was the first metal finishing and fastener sorting company in the USA to receive ISO 14001 certification. SWD Inc. is the largest Black Oxide shop in the Continental USA, and has specialized in Black Oxide for over 25 years.

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