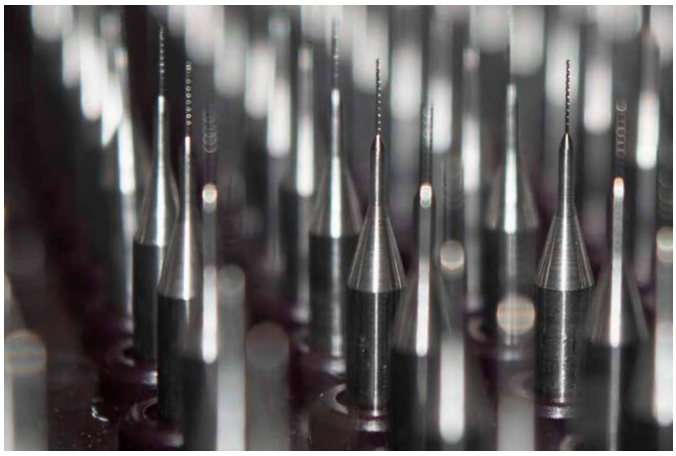
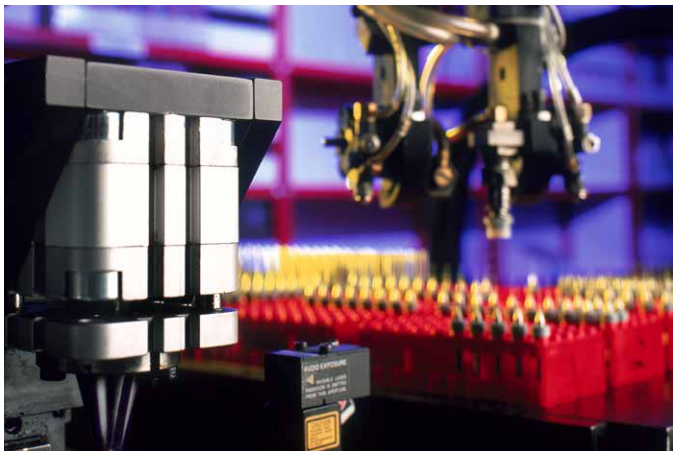
PRINTED CIRCUIT BOARD RESHARPENING

Kyocera Precision Tools was founded on the commitment to deliver the highest quality printed circuit board (PCB) tooling solutions at a lower cost to our customers. We deliver on that commitment by achieving the longest tool life in the industry. Kyocera Precision Tools was the first drill manufacturer to commit to resharpening as part of its core business. Since 1990, we have been the largest resharpener of PCB drills in the world. More than 70% of all tools used by our customers are resharpened tools.

Kyocera has developed innovations that have significantly improved the life of our resharpened tools including Kyocera pointing machines (TPM), Kyocera automated sharp point system (VISIONARE), and efficient ringsetting systems (Rodica Jr.). U.S. Patents have been awarded for Rodica Jr. and for VISIONARE.





VISIONARE SYSTEM™
ADVANCED REPOINT ENGINEERING

U.S. Patent Number 6,030,276

100% Robotic Handling
"from box to box" on a single machine, eliminating handling damage and ensuring precision at every step.

100% Screening of Every Tool Before Resharpening
to ensure proper geometry and confirm sufficient remaining flute length.

100% Inspection of Every Tool After Resharpening
for 11 critical attributes prior to repackaging.

100% Stock Removal Measurement
to ensure that the specified amount has been removed. Ensures quality of point while maximizing tool life.

100% Sharp Tools
ensured by an automatic 2nd pass resharp with variable stock removal in cases where the initial specified stock removal was insufficient to achieve the desired cutting edge sharpness.

100% SPC Data Collection
with real time, machine adjustments automatically made based on trends. Extensive reporting of all data.

RESHARPENING OVERVIEW

The operator variation of a manual resharpening system when processing drills of less than 0.020" diameter has been replaced with an optical image recognition and analysis system. The VISIONARE patented optical system achieves the industry's best Gage R&R results.

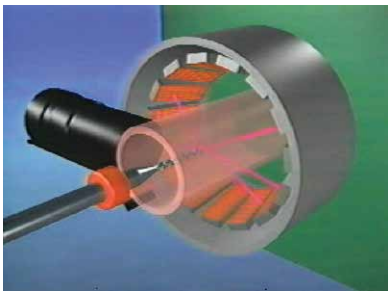
The patented optical image capture and measurement system is used at two key process points.

Prior to grinding, each tool is confirmed for diameter, "Box to Box" Robotic Handling geometry, and to have sufficient remaining flute length. Digital images from the tip and flute align the drill bit into position.

"Box to Box" Robotic Handling

PRE-GRIND SCREENING AND ALIGNMENT

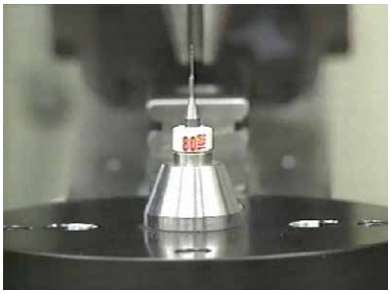
Prior to grinding, each tool is confirmed for diameter, "Box to Box" Robotic Handling geometry, and to have sufficient remaining flute length. Digital images from the tip and flute align the drill bit into position.



Patented Digital Optics

POST-GRIND POINT GEOMETRY INSPECTION

Each tool receives 100% point geometry inspection for 11 attributes to ensure compliance to the specification prior to repackaging packaging.



Patented Ringset Technology

OPTICAL IMAGE CAPTURE AND ANALYSIS OF EACH TOOL

Each tool receives 100% point geometry inspection for 11 attributes to ensure compliance to the specification prior to repackaging packaging.

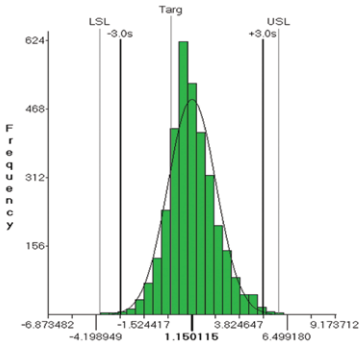
Pre-Grind

- Diameter
- Point Angle
- Margin Width
- Helix Angle
- Overall Length

Post-Grind

- Diameter
- Gap/Overlap
- Flare/Negative
- Offcenter
- Offset
- Cutting Edge Chips
- Round Corner
- Stock Removal
- Overall Length

Measured data is collected and analyzed using real time SPC logic control. The closed loop quality system, exclusive to VISIONARE, is programmed to stop the process in reaction to trend data or out-of-control data points, consistent with traditional rules of statistical process control.



SPC Data Control

KYOCERA

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