Drake

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FINISH REPORT – BALL SCREW SUPER FINISHING

ABSTRACT

Drake Manufacturing has recently developed a process to super finish ball screws to sub 100 nanometer Ra in a single pass. We were able to improve the surface finish of parts from an average of 0.34 micron Ra to an average of 0.06 micron Ra. Utilizing a conventional grind process along with a super finish process on Drake's newly designed Dual Spindle Grinder, manufacturers now have a viable alternative to super finish without the need to purchase additional equipment.
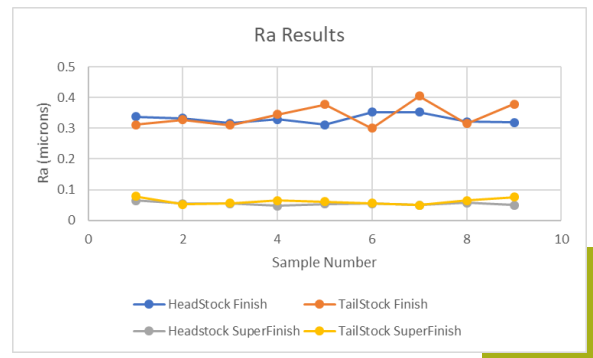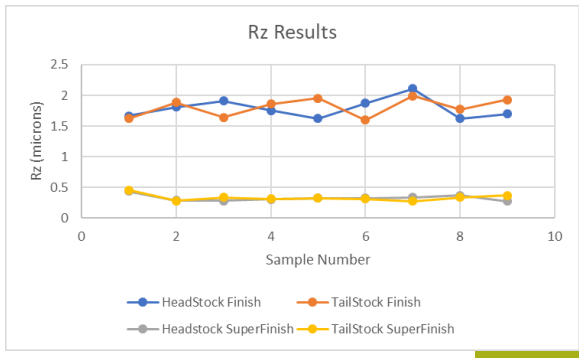
INPUTS		RESULTS	
# OF PIECES PER WHEEL	~6500	GRIND TIME	32 seconds
WHEEL TYPE	Thermosetting Resin Bond	DRESS	0.025mm every 10 pieces
THREAD LENGTH	87mm	# OF GRIND PASSES	1
Ra	0.336 micron	Ra	0.058 micron
Rz	1.795 micron	Rz	0.328 micron
Rk	1.040 micron	Rk	0.181 micron

Rz Results

Ra Results

TESTING

A small trial was performed to identify the condition of incoming parts in order to super finish in one pass. The results of the trial showed that incoming Ra's should be less than 0.40 micron.

To super finish, a thermosetting resin bond wheel with elastic characteristics was dressed using Drake's contour dressing solution. The trial consisted of grinding a sample to obtain a surface finish less than 0.40 micron Ra, and then super finish with a single pass. A total of 9 parts were ground and super finished, and the super finish wheel was dressed only at the start of the trial. We saw only minimal changes to the size, profile and lead after the super finish pass on all of the parts. Further testing on a larger sample is necessary to confirm the number of pieces between dress.

It can immediately be seen that the GS:DS Dual Spindle Grinder opens a new door to roughing and finishing in a single setup. It is possible to optimize grinding and super finishing processes using a single machine.

All profile and surface finish data were collected using a Zeiss Surfcom 2900 SD2.
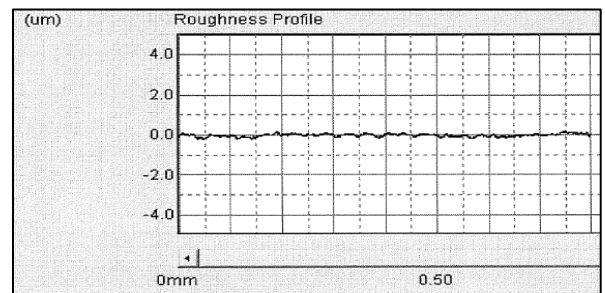
BEFORE SUPER FINISH
Ra=0.317 micron Rz=1.912 micron
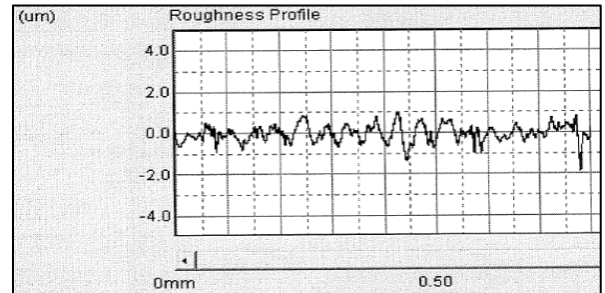
AFTER SUPER FINISH
Ra=0.055 micron Rz=0.284 micron

DETAILS

Drake Thread Grinders

The GS:DS Dual Spindle Grinder is the newest addition to Drake's world-class machine tool product line. With the ability to grind multiple operations in one fixture setup, the GS:DS increases the accuracy and repeatability of critical dimensions, assuring proper alignment of threads. The use of linear and torque motors virtually eliminates mechanical backlash. The machine used in this case was a Drake GS:DS Dual Spindle Grinder with two external grinding spindles.

PARTSMART™ MENU-DRIVEN SCREENS
Simplifies setup and ensures accuracy. The operator simply enters part-specific values into the control and the software does the rest.

AUTOMATION
Drake offers a variety of automation options unique to your specific application. With Drake automation solutions, you will maximize the productivity from your investment.

LINEAR MOTORS
Machine is built with linear motors and linear roller ways for maximum acceleration and contouring.

CAST-POLYMER BASE
Machine is built on a cast polymer base for vibration damping and thermal stability. Compact, high-mass base allows for high accelerations for minimizing cycle time.

MACHINE SPECIFICATIONS

	GS:DS EXTERNAL	GS:DS INTERNAL
Length Between Centers (0° helix)	360mm	
Max Swing Diameter Over Table	580mm	560mm
Lead Angle (from horizontal)	±30°	+25° / -30°
Wheel Spindle Power	12kW/16kW	various
Wheel Spindle Speed	8,000 rpm	various
Standard Wheel Range (outside diameter)	≤400mm	≤100mm
Standard Wheel Range (width)	10 to 25mm, Optional: ≤60mm	5 to 20mm
Standard Wheel Range (bore)	160mm	various
Workhead Spindle Nose	A2-8	A2-8
Rapid Return Speed	Up to 40m/min	Up to 40m/min
Number of CNC Axes	5	5

Discover Drake

Drake Manufacturing is a full service, turnkey manufacturer of precision CNC machines and provider of engineered solutions. Founded in 1972, Drake is headquartered in Warren, Ohio. The premium Drake brand is known around the world for innovation and process expertise throughout the thread grinding industry.