Part preparation & operating parameters for roller burnishing

Note

The following instructions are intended for use with standard Cogsdill Roll-a-Finish tools. If your tool is a special design, please refer to your tool drawing for special operating parameters.

Machines

Cogsdill Roll-a-Finish tools are extremely versatile. The tool can be used on any type of shop machinery, including lathes, drill presses, machining centers, or any rotating spindle. Standard tools are designed for right-hand rotation, with either tool or part rotating.

Material

Almost any metal, particularly any ductile or malleable metal, such as steel, stainless, alloy, cast iron, aluminum, copper, brass, bronze, etc., may be successfully roller burnished. Hardness should normally be less than 40 on the Rockwell "C" scale. (If hardness exceeds Rc 40 consult Cogsdill's Engineering Department.)

Part preparation

Proper part preparation is essential to obtain optimum results from roller burnishing. Due to the fact that no metal is removed in the process, finish depends upon the existence of a uniform and tearfree surface which will be caused to flow under the pressure exerted through the rolls

An 80-120 microinch surface (2 - 3 micrometers), which is typical of boring or turning, is considered an ideal surface for roller burnishing. This relatively rough prefinish allows the Roll-a-Finish tool to displace a greater amount of material on the surface of the workpiece. It also allows the prefinish tolerance to be much greater than with a smoother prefinish. A smoother prefinish reduces the roller burnishing effect, which means the prefinished size must be much closer to the acceptable tolerance

The ideal prefinish prior to roller burnishing is related to such variables as material, hardness, and tolerance requirements. Final part requirements of size, finish, and hardness will dictate preparation requirements, and some trial runs may be necessary in order to determine the ideal prefinish.

Final size of a workpiece depends upon its initial dimension and surface preparation. A very smooth prefinish cannot be reduced in size as much as a rougher prefinish. Successful results from roller burnishing depend upon the prefinish operation and will vary as shown in the Stock Displacement chart on page 31. The displacement column in the chart shows how much change in size may be expected for each starting or prefinished condition.

If sizing, finishing, and work hardening are to be optimized for a particular application, initial part preparation is critical and fine tool adjustment is necessary.

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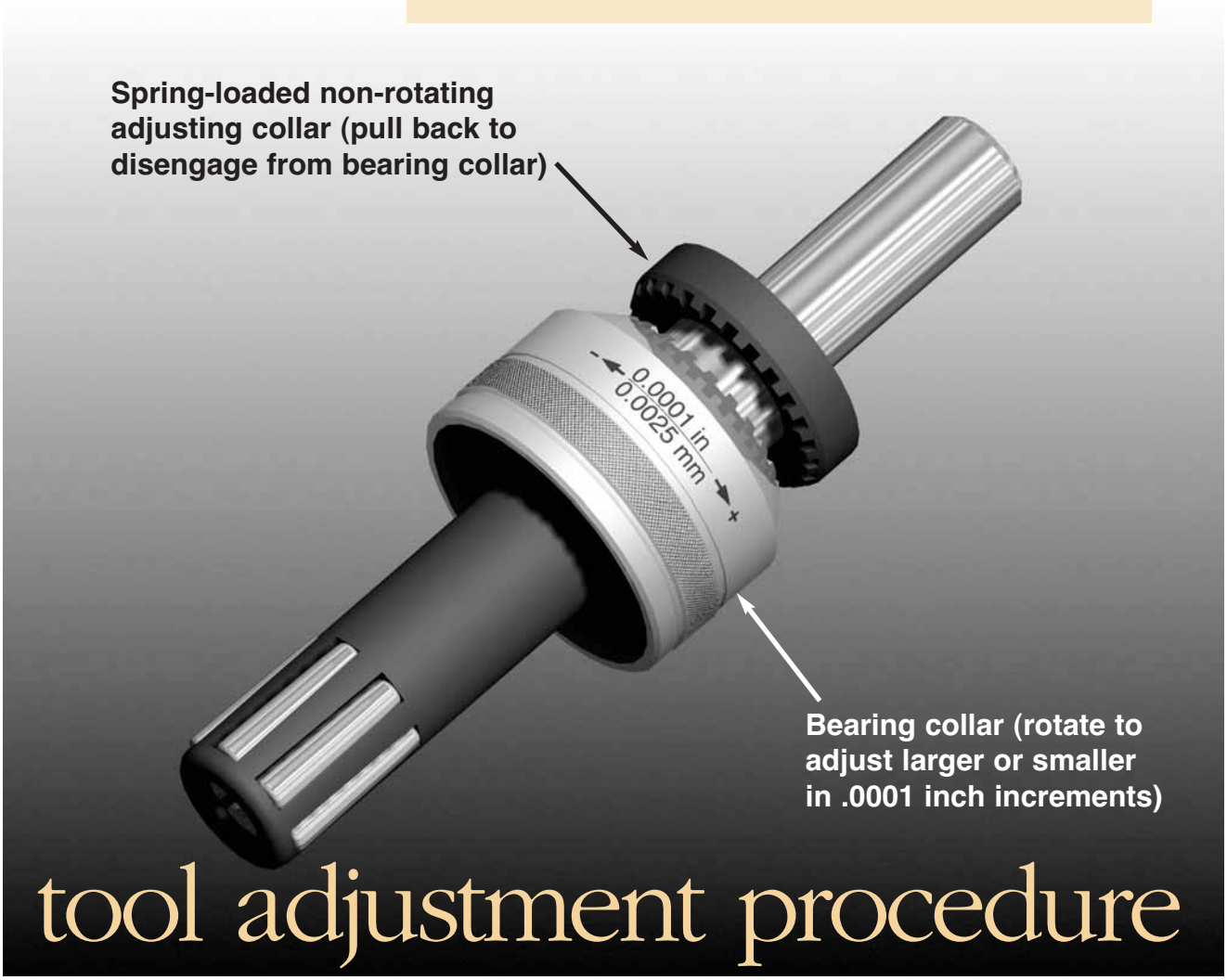
Tool adjustment procedure

Cogsdill Tool Products manufactures a variety of standard Roll-a-Finish Tools. Although the detail numbers and nomenclature for the adjustment components differ somewhat for the various tool series, the adjustment procedure for all Roll-a-Finish tools is basically the same.

For all SR, R, U, and AEX-1 tools, a rear castellated adjusting collar interlocks with a threaded and castellated bearing collar to keep the tool in adjustment. In order to adjust the tool, retract the spring-loaded adjusting collar and rotate the threaded bearing collar. This will alter the position of the tapered mandrel or race in relation to the tapered rolls, thereby changing the effective tool diameter within the specified diameter range. AEX-2 and AEX-3 tools have a locking ring instead of a castellated adjusting collar; tool adjustment requires the use of an Allen wrench. SR, R and AEX series tools adjust in increments of .0001 inch (.002mm). U series tools adjust in increments of .0002 inch (.005mm.)



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Follow these steps when adjusting a Roll-a-Finish® tool:

1. The first step is to rotate the adjustment collar assembly in a plus or minus direction as marked on the tool until the workpiece will just slip over the rolls. This procedure is similar to plug or ring gaging a part. This will set tool working diameter the same as prepared part diameter.
2. Retract the tool from the part and increase tool working diameter by approximately .0005 to .001 inch (.01 to .02mm) over the prepared part diameter. On SR, R, and AEX tools, a one-notch change equals .0001 inch (.002mm) diameter change. On U series tools, which are tools over 2.500 inches (63.5mm) in diameter, calibrations are in .0002 inch (.005mm) increments.
3. Now, run the first part and check for finish. Readjust tool diameter as necessary to obtain desired surface finish. Several trial runs may be necessary; however, once properly adjusted, only one pass of the tool is required for roller burnishing.
4. Measure finished parts for size. The difference between the prefinished and roller burnished sizes represents actual stock displacement. If necessary, modify the prefinished size to allow for more or less stock displacement.
5. If the prefinished size is changed, the burnishing tool must be adjusted by the same amount as the cutting tool to produce the desired finish.

Stock displacement

Approximate prefinishes resulting from common machining operations and the probable displacements produced by the roller burnishing process are listed below:

PREFINISH OPERATION	Prefinish surface Microinches	Prefinish surface Micrometers
Hone	10-20	.25-.50
Grind	20-40	.50-1.00
Ream	40-60	1.00-1.50
Bore, Turn (Medium)	80-100	2.00-3.00
Bore, Turn (Rough)	150-200	3.75-5.00

PREFINISH OPERATION	Expected displacement by burnishing Inches	Expected displacement by burnishing Millimeters
Hone	.0001-.0002	.002-.005
Grind	.0002-.0004	.005-.010
Ream	.0004-.0006	.010-.015
Bore, Turn (Medium)	.0008-.0012	.020-.030
Bore, Turn (Rough)	.0015-.0020	.038-.050

Surface finishes of 10 microinches (.25micrometers) Ra and below are obtainable provided that the prepared surface is uniform and tearfree.

Tool operation

Standard Roll-a-Finish tools are designed for right-hand rotation.

SRH, R, and U tools have cages with roll pockets that are positioned at a slight helix angle so that the tool is self-feeding. SR, AEX, and all bottoming-style tools (SRB, RB, UB, and AEXB) do *not* feature the helix angle on the roll pockets; these tools require machine-feeding.

When the Roll-a-Finish tool reaches the end of the desired roller burnishing length, pull the tool from the bore. This reverse action causes the rolls to collapse slightly in the cage to make withdrawal easy.

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Coolant

For most metals use any standard grade, light-weight, low-viscosity lubricating oil, or any mineral, sulphur, or soluble oil compatible with the metal or alloy to be burnished and recommended for fine surface finishing.

For aluminum or magnesium alloys use a highly refined oil-based coolant with low viscosity.

For cast iron a mineral seal oil is ideal. Flooding the part is recommended.

Filtration of the coolant is highly recommended to remove metal particles and grit.

Maintenance & repair

The Roll-a-Finish tool requires only routine maintenance. For long tool life and optimum performance, tool should be kept free of grit and other foreign matter. Rolls, cage, and mandrel should be examined at regular intervals and replaced when the desired size and finish are no longer obtainable. It is always advisable to replace a complete set of rolls, as there will be some sacrifice of tolerance and finish quality if new and used rolls are mixed.

Tools may be returned to Cogsdill for inspection and reconditioning to return them to original operating performance. Contact Cogsdill's Returns Department for a Return Material Authorization Number to assist us in processing your repair order. We will advise price and delivery before proceeding with the repair.

Interchangeability

Mandrel and race assemblies are interchangeable with tool adjustment assemblies within specified ranges. For example, the "R"-style tools from .500 to 1.000 inch (12.7 to 25.4mm) have a common adjustment assembly.

All standard Roll-a-Finish tools .500 inch and above can be changed from through-hole to bottoming by changing cage and rolls.

Speed and feed recommendations for internal Roll-a-Finish tools with self-feeding cages (1)

DIAMETER		RPM	FEED PER REVOLUTION	
INCHES	MM		INCHES	MM
.187	4.76	1500-4300	.010-.012	.2540-.3048
.250	6.35	1500-4300	.010-.012	.2540-.3048
.312	7.94	1300-3700	.012-.014	.3048-.3556
.375	9.52	1020-3100	.016-.020	.4064-.5080
.437	11.11	875-2600	.018-.023	.4572-.5842
.500	12.70	765-2300	.018-.023	.4572-.5842
.562	14.28	675-2000	.018-.023	.4572-5842
.625	15.87	610-1800	.030-.036	.7620-.9144
.750	19.05	505-1500	.030-.036	.7620-.9144
.875	22.22	335-1300	.034-.039	.8636-.9906
1.000	25.40	380-1100	.048-.052	1.219-1.321
1.125	28.57	340-1000	.051-.056	1.295-1.422
1.250	31.75	305-900	.064-.069	1.625-1.752
1.375	34.92	275-825	.077-.082	1.956-2.083
1.500	38.10	255-750	.090-.095	2.286-2.413
1.625	41.27	235-700	.084-.088	2.133-2.235
1.750	44.45	215-650	.097-.101	2.464-2.565
1.875	47.62	205-610	.110-.114	2.794-2.895
2.000	50.80	190-575	.123-.127	3.124-3.226
2.125	53.97	180-540	.136-.141	3.454-3.581
2.250	57.15	170-510	.149-.154	3.785-3.912
2.375	60.32	160-485	.162-.167	4.115-4.242
2.500	63.50	150-460	.175-.180	4.445-4.572
2.625	66.67	145-435	.088-.090	2.235-2.286
2.750	69.85	140-415	.095-.097	2.413-2.464
2.875	73.02	130-400	.101-.102	2.565-2.591
3.000	76.20	125-380	.101-.103	2.565-2.616
3.500	88.90	110-325	.128-.130	3.251-3.302
4.000	101.60	95-285	.154-.156	3.912-3.962

(1) When the self-feeding tool is used with power feed, the feed rate MUST exceed the maximum feed rate (shown at left) for a given size. This prevents the rolls from collapsing in the cage and eliminating the burnishing action.

POWER FEEDING CAGES: The feed rate for "SR" and bottoming-style "B" tools with power-feeding cages must be from .010 IPR (.25mm/rev.) up to the maximum rate (shown at left) for the self-feeding tools for the same diameter.

Through-Hole (No Helix)

Through-Hole (Helix)

Bottoming* (No Helix)

**Mandrel may be cut off if it does not allow full bottoming.*

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TROUBLE-SHOOTING GUIDE		
PROBLEM	**POSSIBLE CAUSE**	**SOLUTION**
1. FINISH		
A. Scratches	Foreign material Worn rolls.	Clean filter coolant. Inspect – Replace if discolored or marred.
B. Flaking.	Too much interference. Too much friction.	Adjust for less interference More lubricity in coolant.
C. Spiral marks. Residual tool marks.	Premachining too smooth, or not uniform.	Sharper radius cutting tool, replace or sharpen. Increase feed of cutting tool.
	Not enough burnishing.	Increase tool diameter, pressure support part wall if thin, or consider Bearingizing.
	Roll stuck, or foreign matter stuck in pocket.	Inspect and clean cage, replace if necessary.
	Roll paths not overlapping.	Decrease feed rate.
	Chips left in bore.	Flush prior to burnishing.
2. SIZE		
A. Too small or large after burnishing.	Incorrect stock allowance.	Adjust cutting tool (presize) and Roll-a-Finish tool.
B. Bell mouth or taper.	Premachining problem	Check **before** burnishing.
	Misalignment.	Correct or use floating holder.
	Tool runout.	Indicate mandrel-repair.
	Part has thin wall, irregular geometry, or no support.	Support by fixture or consider Bearingizing.
3. (MISC.)		
A. Rolls hit on entry.	Misalignment.	Correct alignment.
		Chamfer part-if possible.
	Too much roll projection.	Retain with O'Ring or similar device if a short bore. Use smaller cage, if interchangeable. Or, select a tool with your part size on the higher end of the adjustment range.
B. Can't burnish entire length of bore.	Tool too short.	Use R-style or consider special tool.
	Mandrel hits bottom of bore or fixture.	Grind mandrel tip off, use larger tool size, or consider special tool.

Effects of poorly machined surfaces on burnishing