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MECH-INDIA

OPERATION MANUAL

ROLLER BURNISHING TOOLS

CHAPTER - V

CARE AND MAINTENANCE

1) When processing work is finished, disassemble the burnishing tool and clean with light oil e.g. kerosene.
2) The burnishing tool must be cleaned by regular intervals. (say after approx. 500-5000 operations)
3) Store the tool in a dry condition, well oiled, greased and covered in order to prevent it from rust.

CHAPTER - VI

SOME HINTS

The following information may be useful

- a) Surface Finish obtainable : 0.4 µ Ra and better.
- b) Life of the tool - Normally, for Low Carbon Steel 25 ID X 25 long with 25 microns stocks, a tool works for thousands of components, only by changing rollers after 5000 operations, and cage after 10000 / 14000 operations.
- c) The abovementioned figures are taken into account some working precautions. The life could be affected adversely by some of the following factors :
  1) If preburnished surface is rougher than 3 micron Ra
  2) If material is not homogeneous.
  3) If workpiece hardness is more than 25 Rc.
  4) If speed of burnishing deviates far from recommendations.
  5) If tool rotates off-centre by more than 0.3 mm.
  6) If Coolant / Lubricant supply is not adequate (an ample and continuous supply recommended)
  7) If Chips from previous operation get trapped between workpiece surface and burnishing rollers.
- d) The Mandrel needs to be reground and polished after a few thousands of operations.

CONTENTS Page

CHAPTER - I

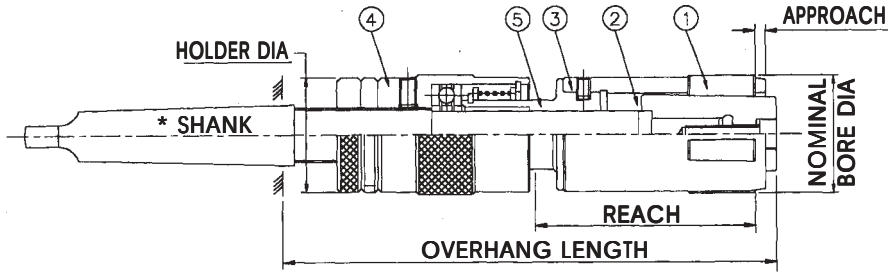
TOOLS & PARTS, CONSTRUCTION

I/J/SH/U/LR/SO Series ..... For THROUGH-HOLES / SHAFTS
IB/JB/SB/UB/LRB/SA Series ..... For BLIND-HOLES / STEPPED SHAFTS

MECH-INDIA Roller Burnishing Tool is a cold working tool for metal surface.

A mirror like surface can be obtained by a single pass of the tool. At the same time hardness of the surface is increased.

Fig. : 1



PART LIST

1) ROLLER
2) MANDREL
3) CAGE
4) HOLDER = SHANK + ADJUSTING MECHANISM
5) SLEEVE

ASSEMBLY & PARTS

SPEED AND FEED RATE CHART - II

	INTERNAL		EXTERNAL	
Burnishing Diameter	* Speed (RPM)	** Feed (mm/rev)	*Speed (RPM)	** Feed (mm/rev)
5	1500	0.12	1000	0.15
12	1000	0.32	700	0.3
40	600	1.3	400	1.0
65	300	1.5	250	1.8
95	250	1.8	200	2.7
165	200	3.4	---	---

* Speed may be increased or decreased by 50% to suit special requirements.
** Feed may be increased by 30% to suit special requirement.

Since the rotation speed of the tool is not critical to performance, high surface speed will produce the same burnishing result as low speed; therefore rapid production cycles for the burnishing operation yield the most economical piece-part cost when compared with other types of finishing operation.

4.1 FEEDS

The thru style tool (IH series) is self - feeding, that is the tool feeds itself into or onto the work. It will feed itself independently of machine feed or any external power. All that is required is rotation. The tool should be allowed to feed at its natural rate without being forced or retarded. On machine equipped with automatic feeds, the machine feed should be slightly more (10-20 %) than the natural feed rate of the tool so there will be no possibility of retarding the tool, thereby causing it to release prematurely. In applications on automatic machines where the feed rate of the tool exceeds that of the machine, non-feed cages should be specified (IT series).

Full bottoming style tools (IB series) are supplied with non-feed cages and must be machine feed. With this non-feed design, minimum clearance are required to obtain the closest approach to bottom. Feed rate from 30 to 100% as charted for thru style tools are generally satisfactory for all bottoming applications. The exact feed rate of the tool is therefore governed by the specific machine set-up. If under some circumstances, the feed and speeds shown on subsequent pages are not suitable for the application, a high helix angle cage may help. This fast feed tool is not recommended except in special cases.

4.2 SPEEDS

The tool is designed for conventional right hand rotation, and either the tool or the workpiece can be rotated. Rotational speed is not critical, but higher than recommended speeds will reduce tool life. If long-length tools, or tools with extension drive are used, speed should be reduced to prevent excessive whip.

4.3 LUBRICATION

A fitter (max. 50mm) in the lube system is recommanded to prevent entering of chips and grit into the tool. The tool requires lubrication but cooling only in case of long workpiece as hydraulic cylinders. Therefore, any light lubricating oil or a rich, soluble oil mixture is recommanded. Lubricant should be fed to the tool in a steady ample volume to provide flushing and cleaning action.

NOTE : 1) The tool can be mounted on any standard Drill Machine, Lathes,Boring Machine and NC Machines etc.
2) The tool must be rotated clockwise, and not anti-clockwise.
3) For the correct rpm and feed rate please refer speed and feed rate chart.
4) Any light lubricating oil or rich soluble oil mixure is recommended. Lubricant should be fed to the tool in a steady ample volume to provide flushing and cleaning action.

CHAPTER - II

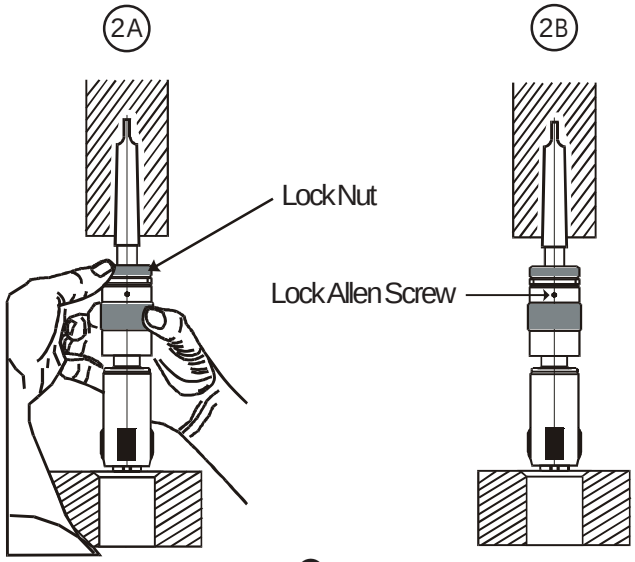
ADJUSTMENT OF TOOL DIAMETER

A) By loosening the lock nut, the adjusting mechanism (housing) can be turned to clockwise/anticlockwise. If turned clockwise, the tool diameter increases, if turned anticlockwise the tool diameter decreases.

B) To confirm the correct setting, adjust the tool diameter such that, it just clears the hole to be burnished for the first part. The increase in tool diameter after this will start sizing and burnishing the hole. Adjustment is made at the rate of 0.002 to 0.006 mm per graduation on scale, depending upon tool size.

C) Once the tool diameter is set, the tightening of lock nut and tightening of allen screw in the housing will lock the adjusting mechanism.

Fig. : 2



CHAPTER - III

PRE-REQUIREMENTS FOR BURNISHING

1) Surface finishing before burnishing process must be done by lathe or boring machine which have a regular feed rate. Processing surface by twist drill leaves recessed ridges which are difficult to clean with burnishing treatment. The ideal surface for Roller Burnishing is the uniformly machined peaks and vallies feed pattern generated by a single point cutting tool.

2) Surface roughness before burnishing must be 0.8 to 3.2 µRa . This condition will provide the best burnished surface.

3) STOCK ALLOWANCE - SURFACE FINISH CHART

a) STOCK ALLOWANCE

When machining a surface prior to Roller Burnishing, stock must be allowed for metal displacement. The amount of stock allowance varies with job conditions, material properties, wall thickness of the part, nature of the machined surface and the quality of the surface finish desired.

The accompanying table shows typical stock allowances for burnishing. However, because of the number of variables involved, these figures should be considered only approximate. An exact allowance can best be determined by roller burnishing an actual workpiece to the desired finish and measuring the amount of stock displaced.

Remember, you should displace only the amount of stock necessary for producing the desired surface finish. Excessive roller burnishing not only accelerate tool wear but also can produce flaking of the burnished surface. The chart is guideline only, derived from experiments. Under your own conditions the results may be slightly different. The chart indicate that, in the 25-50 mm range, a hole machined in a high ductile material to 3.1 µ Ra and 0.050 mm smaller than the burnishing tool size, will be burnished to 0.2 µ Ra. If the hole is finished to 1.5 µ Ra, before burnishing, 0.025 mm of stock need be left for burnishing to 0.2 µ Ra.

NOTE : Surface finish can be achieved upto 0.05 µ Ra by selecting Preburnishing Parameters.

High ductility Materials have more than 18 % elongation and less than Rc 25. They include: Anealed Steel, Aluminium, Brass Bronze, Malleable Iron.

Low Ductility Materials have less than 18 % elongation & a Max. hardness of Rc 40. They include: Gray C.I., Modular Iron, Heat Treated Steels, Mg. Alloys, Hard Cu Alloys.

CHAPTER - IV

PROCESSING SEQUENCE

1) Attach the Burnishing tool to the driving equipment and set the tool diameter as illustrated in the previous page (Fig. : 2).
2) Set the speed and feed required as per the chart - I.
3) Align the tool to the center of the part to be burnished (Concentricity must be within 0.05 mm) (Fig. : 3).
4) Rotate the tool or the part and give feed as per chart shown. Provide the coolant in ample volume (Fig. : 4).
5) After completion of burnishing, withdraw the tool from the hole while it is still revolving (Fig. : 5).

Continuous operation 3) to 5) can be maintained while replacing the workpiece.

NOTE : The tool should be rotated clockwise, never anticlockwise. For the correct RPM and feed rate, please refer chart - II which shows, standard values.

Fig. : 3

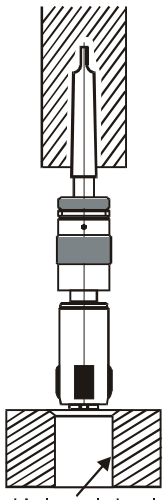


Fig. : 4

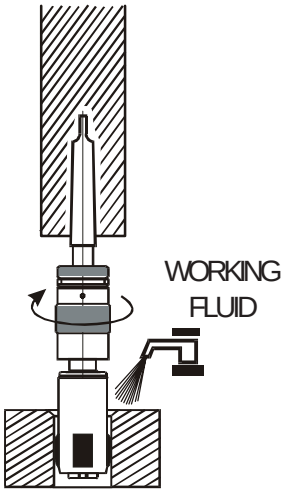
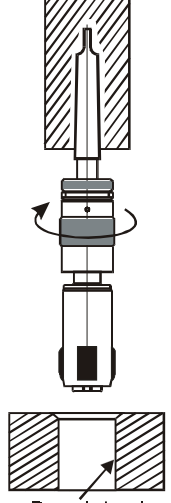


Fig. : 5



STOCK ALLOWANCES - SURFACE FINISH CHART - I

WORKPIECE SIZE RANGE mm	INTERNAL SURFACE				EXTERNAL SURFACE			
	STOCK ALLOWANCE mm	SURFACE FINISH µ m Ra (Rt)			STOCK ALLOWANCE mm	SURFACE FINISH µ m Ra (Rt)		
		MACHINED		ROLLER BURNISHED		MACHINED		ROLLER BURNISHED
High Ductility Material								
3 - 12	0.010 0.017	2.0 3.1	(8) (12)	0.2 0.2	(1) (1)	0.010 0.015	2.0 2.5	(8) (10)	0.2 0.2	(1) (1)
12 - 25	0.017 0.040	1.5 3.1	(6) (12)	0.2 0.2	(1) (1)	0.012 0.025	2.0 4.5	(8) (18)	0.2 0.2	(1) (1)
25 - 50	0.025 0.050	1.5 3.1	(6) (12)	0.2 0.2	(1) (1)	0.017 0.025	2.5 4.5	(10) (18)	0.2 0.2	(1) (1)
50 - 165	0.040 0.075	1.5 5.0	(6) (12)	0.2 0.2	(1) (1)	0.025 0.050	3.1 10.1	(12) (40)	0.2 0.2	(1) (1)
Low Ductility Material										
3 - 12	0.010 0.017	2.0 2.5	(8) (10)	0.4 0.4	(2) (2)	0.008 0.012	1.5 2.3	(6) (9)	0.4 0.4	(2) (2)
12 - 25	0.017 0.025	2.2 3.1	(9) (12)	0.4 0.4	(2) (2)	0.012 0.018	2.5 3.5	(10) (14)	0.4 0.4	(2) (2)
25 - 50	0.025 0.040	3.1 4.5	(12) (18)	0.4 0.4	(2) (2)	0.012 0.025	2.5 4.5	(10) (18)	0.4 0.4	(2) (2)
50 - 165	0.040 0.050	3.0 5.0	(12) (20)	0.4 0.4	(2) (3)	0.020 0.035	3.1 5.0	(12) (20)	0.4 0.4	(2) (2)

b) MACHINE CONSIDERATIONS

The tool must be properly aligned with the part in the machine to facilitate the engagement of the tool with the work. A slight misalignment (max. 0.15mm) dose not produce any adverse effect on the tool or surface finish produced in the workpiece. However, excessive misalignment in a rigid setup between tool and workpiece will cause bending stress in the tool, resulting in fatigue failure of the mandrel tip. Proper alignment is more important when the tool is rotating because tool whip is more likely than part whip. The tool should be rigidly mounted on the drive shank to prevent any axial movement during the release cycle. This is particularly important for large, heavy tools when operated in a vertical position. A keeper key or binding screw also eliminates any possibility of tool accidently coming out of the spindle.

In using the tool on multiple spindle automatics, it is best to mount the tool in a top position to minimize chip contamination from the other cutting operations.