DREX®-TOOLS

AND GROUP ITALIA SRL

ROLLER BURNISHING FOR INTERNAL DIAMETERS
TH - TB

INSTRUCTIONS

MANUAL MID121006-1-

ING

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The roller burnishing tool "DREX-TOOLS" for internal diameters must be set up before starting the job.
Loosen the lock nut, turn the cage on the external diameter, adjust by widening or tightening the tool as required.
To effect the adjustment, the body should be rotated in respect to the spindle. Turn clockwise to reduce the diameter, counterclockwise to increase it.
Insert the tool into the workpiece and slide it back and forth to ensure that it flows freely.
Adjust the tool until the rollers encounter a slight resistance against the surface to roller burnish. Remove the roller burnishing tool from the workpiece and rotate the body of about 1/8th of a turn. After this adjustment tighten the lock nut.
The tool is now ready to work. The workpiece can be held stationary while the tool rotates, or vice versa. The tool can now advance on the workpiece with the number of revolutions required for the desired length.

Aligning the roller burnishing tool

The tool and workpiece must be accurately aligned . A minimum offset of 0.08 to 0.10 mm. will have no negative effect on the tool or on the surface finish. However, if the alignment is more than 0.10 mm. from the axis of the workpiece, this can cause sharp downturns. In this case the spindle could break due to fatigue as the tool deflection is greater than that of the workpiece. A correct alignment is even more important if it's the tool to be in rotation. The tool shank must be rigidly mounted on the spindle to prevent an axial movement during the release cycle. This is particularly important in the case of large tools working in a vertical position. On multi spindle automatic lathes, the roller burnishing tool should be mounted on a high station to minimize the inconvenience of transporting chips from the other stations.

Length of internal roller burnishing

The maximum lengths obtainable by the roller burnishing tools " DREX-TOOLS" for internal diameters are shown in the table below. The values are for both through and blind-end holes.

Hole diam. mm.	Max.Rolling length mm.
Ø4 ÷ Ø5	50
Ø6 ÷ Ø8	100
Ø9 ÷ Ø14	150
Ø15 ÷ Ø21	250
Ø22 ÷ Ø34	300
Ø35 ÷ Ø350	Illimited

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Preparing the workpiece

In general, any material with a hardness not exceeding 40HRC can be roller burnished. One of the keys to successful roller burnishing is the appropriate pre-finishing of the workpiece. Workpieces should be prepared with a finish tolerance with a stock allowance on the diameter to be roller burnished.

Stock allowance for internal roller burnishing

Dimension of workpiece mm		Internal surfaces					
		Stock allowance mm	Ra surface finish				
			Preparation		Roll Burnishing		
			Ra	(Rt)	Ra	(Rt)
Material high ductility	6 ÷ 12	0,010÷0,017	2,0 ÷ 3,1	8,0 ÷ 12	0.2	(1)
	12 ÷ 25	0,017÷0,040	1,5 ÷ 3,1	6,0 ÷ 12	0.2	(1)
	25 ÷ 50	0,025÷0,050	1,5 ÷ 3,1	6,0 ÷ 12	0.2	(1)
	50 ÷ 165	0,040÷0,075	0,8 ÷ 4,8	3,0 ÷ 20	0.2	(1)
	165 ÷ 350	0,040÷0,075	0,8 ÷ 4,8	3,0 ÷ 20	0.2	(1)
Material low ductility	3 ÷ 12	0,010÷0,017	2,0 ÷ 2,5	8,0 ÷ 10	0.4	(2)
	12 ÷ 25	0,017÷0,025	2,2 ÷ 3,1	9,0 ÷ 12	0.4	(2)
	25 ÷ 50	0,025÷0,040	3,1 ÷ 4,5	12,0 ÷ 18	0.4	(2)
	50 ÷ 165	0,040÷0,050	3,0 ÷ 5,0	12,0 ÷ 20	0.4	(2)
	165 ÷ 350	0,040÷0,050	3,0 ÷ 5,0	12,0 ÷ 20	0.4	(2)

Stock allowance for the internal roller burnishing

The stock allowances shown in the table are the starting point for the preparation of the workpiece. The stock allowances are based on a roughness of 2-3 μm and must have a uniformity of peaks and valleys before roller burnishing.

For example, to roller burnish a hole with a tolerance on the diameter of 12.7 ÷ 12.73, a roughness of 0.25 μm is required.

Prepare the hole for roller burnishing with a tolerance of 12,67 ÷ 12,70 with a surface roughness of 2 to 3 μm. Passing the roller burnishing tool just once will bring the hole tolerance to a roughness of 0.25 μm. In general, the best finish is obtained if the workpiece has a lower roughness. The rougher the finish, the more material that must be removed.

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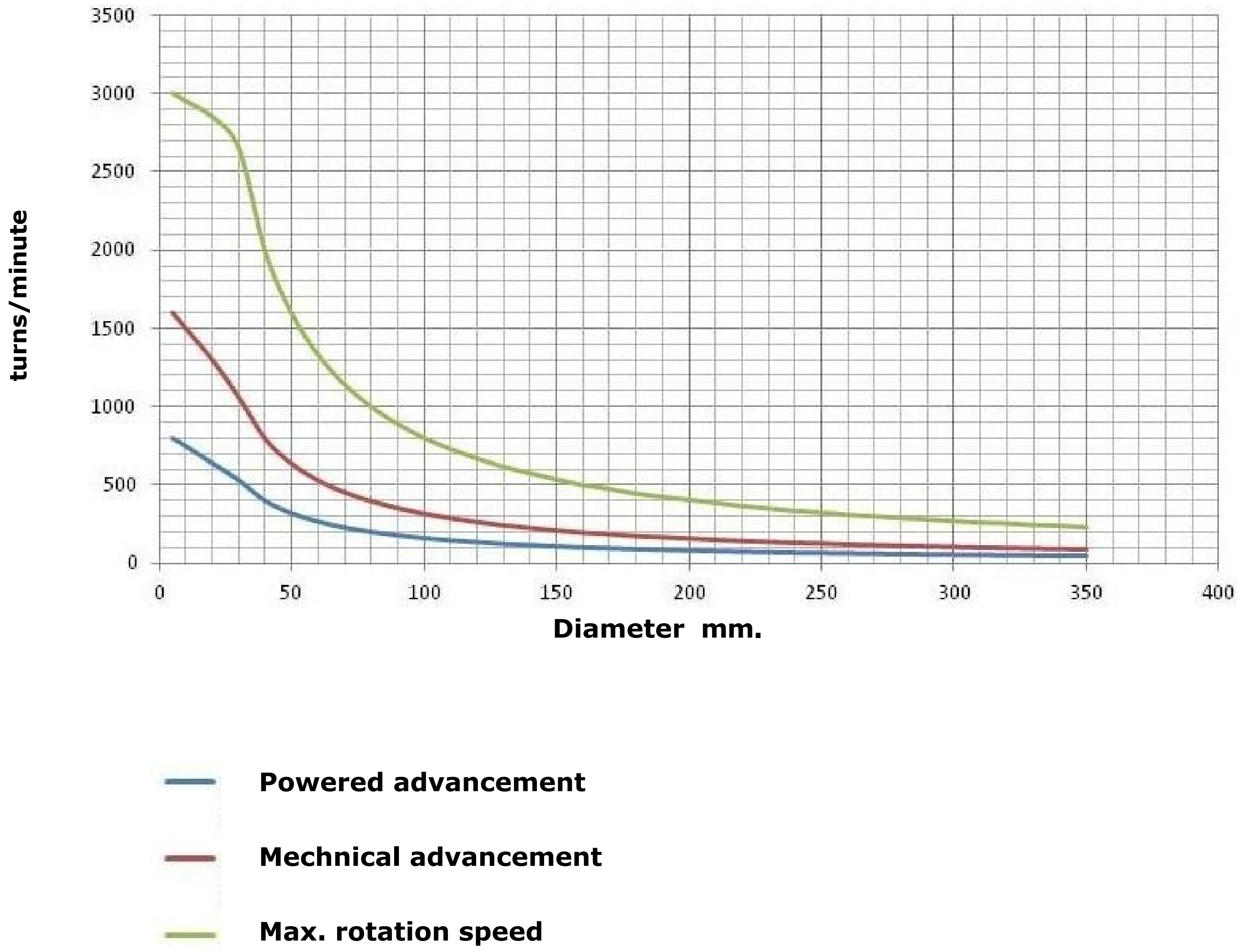
Recommended rotation speed



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Speed and Advancement

Internal diameter to roller burnish	Turns/min	Advancement mm/turn
5 ÷ 7	1.000	0,45
8 ÷ 14	1.000	0,60
15 ÷ 21	1.000	0,75
22 ÷ 31	1.000	0,75
32 ÷ 34	950	0,75
35 ÷ 40	800	0,90
41 ÷ 49	650	0,90
50 ÷ 60	530	1,20
61 ÷ 70	450	1,20
71 ÷ 80	400	1,20
81 ÷ 90	350	1,20
91 ÷ 100	320	1,20
101 ÷ 120	260	1,20
121 ÷ 140	230	1,50
141 ÷ 150	210	1,50
151 ÷ 160	200	1,80
161 ÷ 170	190	1,80
171 ÷ 200	160	2,10
201 ÷ 230	140	2,40
231 ÷ 260	120	2,70
261 ÷ 280	110	3,00
281 ÷ 310	100	3,30
311 ÷ 330	95	3,60
331 ÷ 350	90	3,90

Since the speed of rotation is not determining to the job quality, high speeds are used to achieve fast production cycles.

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Elongation due to roller burnishing

Materials with high ductility have an elongation of more than 18% and a hardness of less than HRC25. For example: low-carbon steel, annealed steel, stainless steel, aluminum, brass, malleable cast iron, copper, bronze.

Materials with low ductility have an elongation of less than 18% and a maximum hardness of d1 HRC45. Example: cast iron, steel, magnesium alloys, hard copper alloys.

TABLE OF CONVERSIONE HARDNESS

HRC	HV	HB	HRC	HV	HB	HRC	HV	HB
67.5	1.007		50	535	490	32.5	323	314
67	980		49.5	527	483	32	321	311
66.5	966		49	518	477	31.5	315	306
66	940		48.5	511	473	31	312	304
65.5	927		48	501	466	30.5	308	302
65	900		47.5	496	461	30	304	296
64.5	890		47	481	450	29.5	301	293
64	870		46.5	475	444	29	294	288
63.5	856		46	467	438	28.5	290	285
63	833		45.5	462	434	28	287	282
62.5	823		45	454	429	27.5	283	277
62	792		44.5	449	421	27	281	275
61.5	780		44	441	415	26.5	275	270
61	763		43.5	437	410	26	274	269
60.5	753	627	43	429	405	25.5	269	264
60	736	619	42.5	424	401	25	267	262
59.5	726	614	42	418	394	24.5	263	257
59	710	606	41.5	410	388	24	260	255
58.5	702	601	41	406	384	23.5	257	251
58	685	591	40.5	401	381	23	254	248
57.5	679	586	40	396	375	22.5	252	247
57	666	578	39.5	390	371	22	249	244
56.5	661	574	39	385	367	21.5	247	241
56	648	568	38.5	381	363	21	245	240
55.5	639	562	38	375	358	20.5	242	237
55	629	555	37.5	370	355	20	240	235
54.5	618	548	37	366	352		232	227
54	608	540	36.5	361	345		210	205
53.5	598	534	36	355	341		187	182
53	590	527	35.5	352	338		164	159
52.5	579	520	35	348	334		141	136
52	570	514	34.5	344	331		119	114
51.5	561	507	34	339	327		96	91
51	553	502	33.5	331	321			
50.5	543	495	33	328	318			

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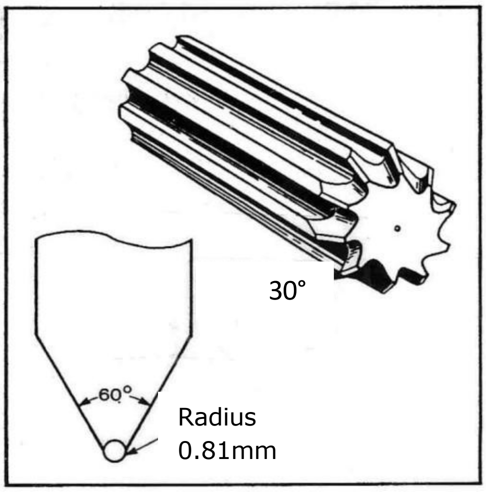
All machinable metals



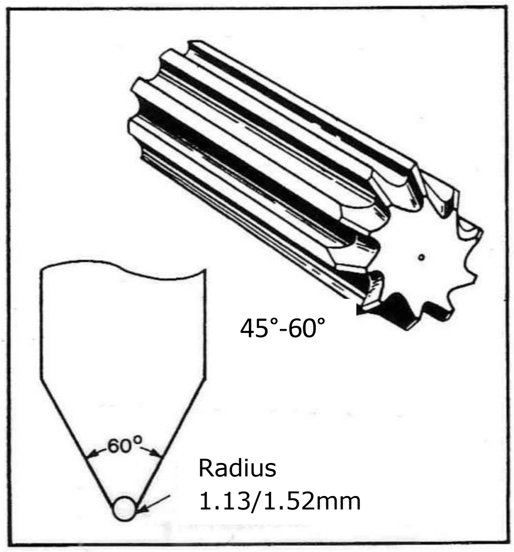
As a preliminary preparation to roller burnishing it's recommended to use a cutting tool with a radius of 0.8 mm. The head of the reamer should be sharpened to a lead angle of 30°. By using these parameters and advancing the cutting tool or reamer along the workpiece with a feed rate of 0.20 to 0.25 mm per revolution will create a surface with a roughness of 2.5 to 3.0 μm ready to be roller burnished.

Roll Burnishing of cast iron

For cast iron the following preparation is recommended use a cutting tool with a radius of 1.14 ÷ 1.52 mm. The end-cutting reamer should be sharpened to an angle of 45° to 60°.

The feed rate must be of 0.10 ÷ 0.13 mm per revolution, i.e. this is about half of the feed used for the other materials.

This tool geometry and the appropriate feed rate will provide a surface with a roughness of 2.5 to 3 μm ready to be roller burnished.



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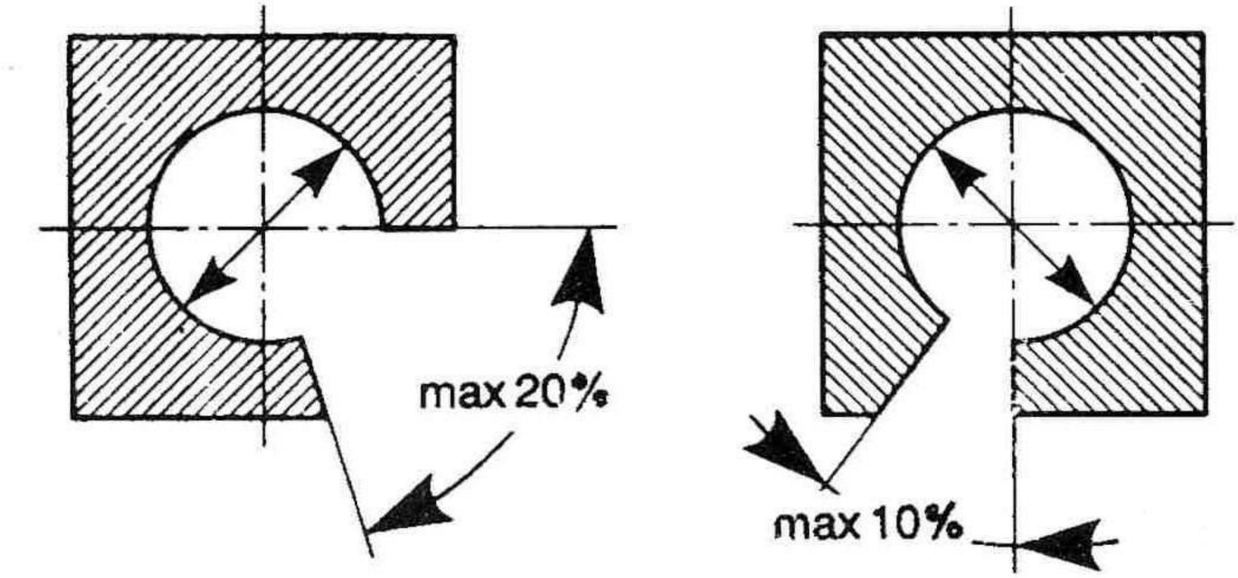
Rolling of thin-walled workpieces with holes or key settings.

When roller burnishing thin-walled workpieces or surfaces interrupted by holes, intersections or key settings, special tools should be used with many rolls placed closely. The pressure exerted cold must be distributed on a large number of rolls, and consequently the roundness and the finishing of the pieces rolled. An interrupted cut is the result of a non-uniform working finish. Such interruptions are major than the pressure exerted by the roller burnishing tool on the surface. In this case, every time a roll meets an empty space this will cause an oscillation of the roller burnishing tool. This determines a poor surface finish on the opposite side of the interruption. In these cases, set as follows: when tools are used with 5 rolls, the interruption should not exceed 10% of the circumference. If a tool is used with at least 7 rolls, the interruption can be up to 20%.



Lubrication

A continuous stream of lubricant, in a sufficient quantity to work and to keep the tool and the workpiece clean, must be provided during the roller burnishing operation. Use a lubricating oil with a standard grade of low viscosity for most of the metals. For aluminum alloys or magnesium, we recommend the use of a paraffin oil-based with a low viscosity and a highly refined oil which will give excellent results. Cast iron can be roller burnished without lubrication. However, it is suggested to have a sufficient stream to keep the tool free of foreign bodies. Water-soluble lubricants are acceptable.
To achieve a thrust finish, any sulfur based-oil, mineral or soluble oil, can be employed provided that it is compatible with the metal or alloy that must be roller burnished.
Important: All lubricants used should be filtered. Without filtration, chips or foreign bodies that are transported during roller burnishing can alter the hole and mark the finished surface. The more the finish is fine thrust –and the more it's important to filter the lubricant.

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Maintenance

When used properly roller burnishing DREX-TOOLS only require routine maintenance. Rolls, cage and spindle must be monitored periodically and replaced when necessary. It's advisable to always replace the complete set of rolls as you will have a drop in tolerance and finish quality if new and used rolls work together. In normal working conditions, the cages are not subject to severe stress. When working blind holes, prevent the body from knocking against the bottom of the hole to avoid breakage. If the tool will not be used for a long period of time dip it in oil and wrap it in a sheet of waxed paper or similar protective material to prevent rust. Before re-starting the tool, carefully check that the rollers and spindle haven't been attacked by rust and, if necessary, replace them.

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Check the roughness before and after roller burnishing.

If after roller burnishing you can see helical lines with constant pace on the workpiece this means the load is too low. If the surface shows signs of flaking of the material the load is too high.

Problems, causes and solutions

Problem	**Possible Causes**	**Possible solutions**
Poor finish	-Rolls are worn out -Feed Is too fast -Load is too light -Load is too high -Uneven surface	-Substitute the rolls -Slower the feed -Increase the load -Decrease the load -Reduce the rotation speed
Scratches on the surface	-Rolls's worn out -Cutting chips are on the surface before/during roll burnishing -Scratches present on the workpiece before	-Substitute the rolls -Always clean the workpiece before roller burnishing -Roller burnish pieces without scratches
Dimensional error after rolling - + Large - + Small	-Incorrect stock allowance	-Adjust the cutting tool with the correct parameters of pre-rolling. -Reset the roller burnishing Tool
Flared or tapered	-Problem in pre-rolling -Misalignment -Workpiece is thin walled Irregular geometry	-Correct the geometry before roller bursihing -Check the tool and the integrity of the spindle -Supply adequate support to avoid elastic deformation
The entire length isn't completely Roller burnished	-Roller burnishing Tool is too short -The spindle touches the bottom of the hole	-Use a roller burnishing tool with an appropriate length -Shorten the length of the spindle