SURFACE CHARACTERSTICS OF BRASS BY BURNISHING PROCESS

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Abstract
Burnishing is a post machining forming process, which imparts plastic deformation under cold working conditions by pressing a hard tool against the work piece surface. Burnishing offers certain specific advantages, most notably, the high improvements in surface smoothness and Hardness. Surface characteristics like Surface Hardness and Roughness of roller burnished components are studied experimentally by considering different parameters Speed, Force and Passes. This project deals with an experimental study on roller burnishing process of Brass. Burnishing is done on them in order to find out the surface hardness and surface roughness of the work pieces by varying burnishing parameters. A microstructure is then depicted for the burnished work pieces.
Keywords: burnishing, surface characterstics, speed, force, passes.

I INTRODUCTION

In manufacturing engineering, it is imperative to improve the surface quality of the machine parts, which ensures their durability and reliability.

In today's production of machines and instrument components, finishing processes are becoming more and more important. Increasing attention is being paid to the quality of the surface finish obtained. Surface finish is important not only as an appearance it also has a positive and prolonged effect on the functioning of machine parts. Surface finish is a characteristic of any machined surface. It is sometimes called as surface texture or roughness.

The surfaces of engineering components will provide link between manufacturing and their function in use. The main causes of machine failures are wear of contact surfaces in mating parts. Wear resistance of rubbing parts can be improved by reducing the initial wear of components. In this line, it is better practice to make the sliding surfaces with a roughness equal to that of worn-in parts.

II COMPARISON OF SURFACE ROUGHNESS WITH MANUFACTURING PROCESS.

Table 1: Comparison of Surface Roughness with manufacturing process

Sl. No	Manufacturing Process	Surface Roughness (Microns)
1	Turning	0.43 – 26.0
2	Drilling	1.60 - 21.0
3	Grinding	0.6 - 5.0
4	Broaching	0.4 – 3.4
5	Burnishing	0.35 - 0.8
6	Honing	0.25 - 0.4
7	Super Finishing	0.016 – 0.32
8	Lapping	0.12 – 0.16

III. PRINCIPLE OF ROLLER BURNISHING

Roller Burnishing is a cold working process which produces a fine surface finish by the planetary rotation of hardened rolls over a bored or turned metal surface. Roller Burnishing

involves cold working the surface of the work piece to improve surface structure.

In the burnishing process, the pressure generated by the rolls exceeds the yield point of the softer piece part surface at the point of contact, resulting a small plastic deformation of the surface structure of the piece part.

Table 2: Material Dimensions

Element	C	Cr	Mn	Si	P	S
%	1.10	1.60	0.50	0.35	0.025	0.025

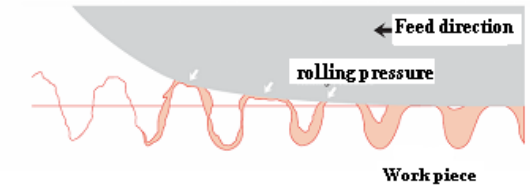


Figure 1: Burnishing operation

Since all machined surfaces consist of a series of peaks and valleys of irregular height and spacing, the plastic deformation created by roller burnishing is a displacement of the material in the peaks which cold flows under pressure into the valleys. The result is a mirror-like finish with a tough, work hardened, wear and corrosion resistant surface. The roller burnishing pressure required depends on number of factors like ductility and tensile strength of the material, surface roughness before and after roll**.**

IV. EXPERIMENTAL SET-UP

The experimental set up consists of the following for carrying out the roller burnishing process

1.Lathe machine
2.Dial gauge
3.Burnishing Tool (Roller)
4.Burnishing tool post assembly
5.Work pieces
6.Coolants.
7.Surface finish measuring instrument(Handy surf)
8.Micro Hardness testing instrument (Vickers Hardness).

V. BURNISHING TOOL & WORK PIECE

The burnishing tool (Roller) was made up of high carbon high chromium (HCHC) Steel and having hardness of 60 (Rockwell C grade) and its composition is shown in Table below.

Table 4: Tool Composition

S. No	Material	Length	Diameter
1	Brass	60mm	29 mm

- A solid cylinder is chosen of HCHCR material this material is high carbon and high chromium alloy of seal, which has good hardness and is used for operations including “BURNISHING”.
- The dim of job is Ø 30 ×10 thick.
- Job turned on lathe and a chamfer is made of dim 0.5×45° on both sides of job.
- Job internally turned with Ø 21×10 and chamfered 0.5×45° on both ends of the surface.

After this process is done the tool is heat treated and it hardness reaches up to 54 HRC.

Figure 2: Burnishing Tool.

The work pieces used for the present study are solid shafts. Burnishing operation is carried out on two materials. These materials are Brass and Copper. The properties of these materials are given in below table.

Table 3: Material Properties

Material	Young’s modulus (GPa)	Poison’s ratio	Density Kg/m^3
Brass	97 GPa	0.31	8430 - 8730

VI. EXPERIMENTAL WORK

OPERATION OF BURNISHING UNDER DIFFERENT CONDITIONS:

1) Speed
2) Load
3) Passes

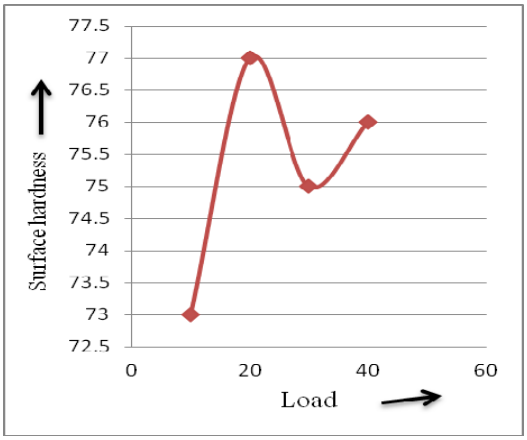
The operation is carried out to obtain the readings for burnishing tool operations

- After fixing the tool post to lathe, then lathe is set in to a configuration of different feeds, speeds and loads required.
- At first the work piece is turned on lathe machine to get desired diameter.
- After the turning is completed, the specimen is marked at a length of 25mm equally and using the lathe, slots are made at equal distance as marked on the work piece to test each specimen individually under different parameters.
- The work piece is held in between the chuck of the lathe and tailstock center.
- Gears of the lathe are adjusted using the gear box engage levers, for the required RPM of the spindle.
- There are eight variable speeds on the lathe which can be varied by using the gear engage lever which in turn is divided in to two gear shafts which consists of four individual speeds respectively.
- After engaging the speed lever, feed is given to the carriage by using feed lever at certain speed, which is given by the engagement of lead screw to the carriage.
- This experiment is carried out for different values of speed, feed and number of passes and the hardness & surface roughness values are calibrated.
- The burnishing tool post if fitted on the lathe and the roller is made in contact with the work piece.
- The tool is given certain pressurized load by moving the tool post towards the work piece and the amount of load is calculated accordingly by the displacement of the dial indicator pointer.
- This load gives the work piece a stress which is generally termed as the contact stresses and as the lathe spindle is turned on the centrifugal force acting tangentially on the roller component will make the roller to rotate on its own
- This gives the surface a cold working process and the surface finish gets improved and also the hardness gets improved.

VII. GRAPHS & DISCUSSIONS

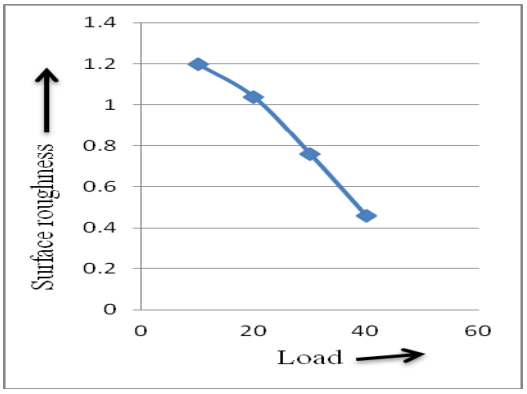
Condition 1: Speed 62rpm constant.

Load vs Surface Hardness (Speed = 62rpm)



As the load increases, the surface hardness Increases and decreases.

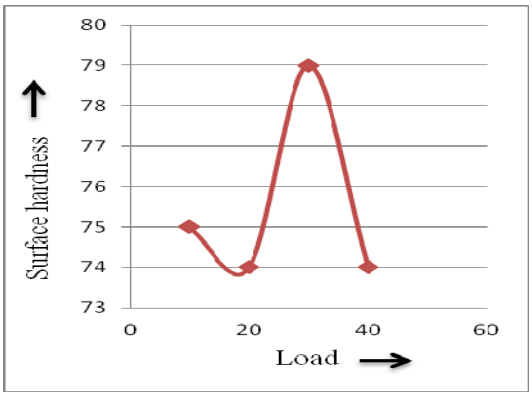
Load vs Surface Roughness (Speed = 62rpm)



As the load increases, the surface Roughness decreases.

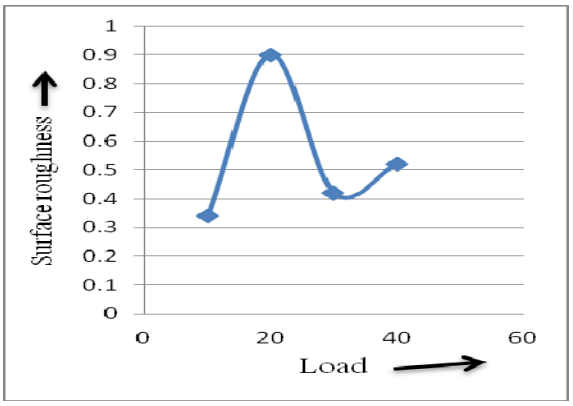
Condition 2: Speed 192 rpm constant.

Load vs Surface Hardness (Speed = 192rpm)



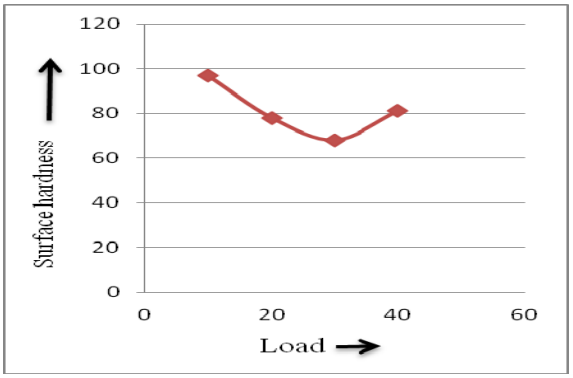
As the load increases, the surface hardness decrease and increase.

Load vs Surface Roughness (Speed = 192rpm)

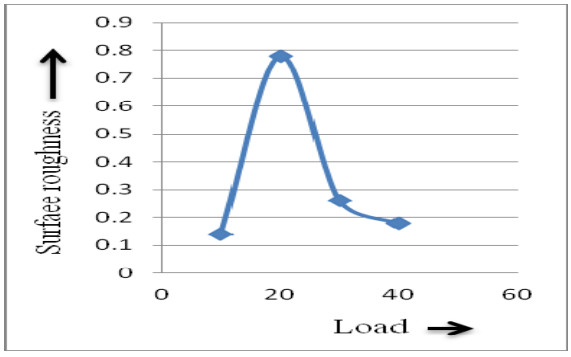


As the load increases, the surface Roughness Increase and decrease.

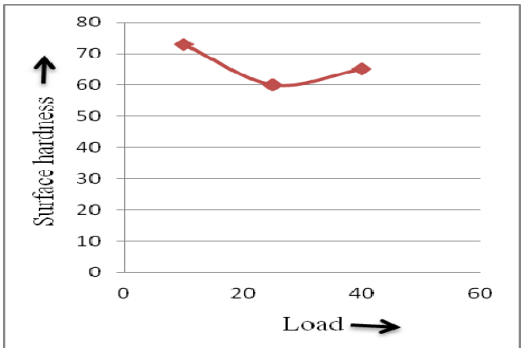
Condition 3: Speed 399 rpm constant.
Load vs Surface Hardness (Speed = 399rpm)



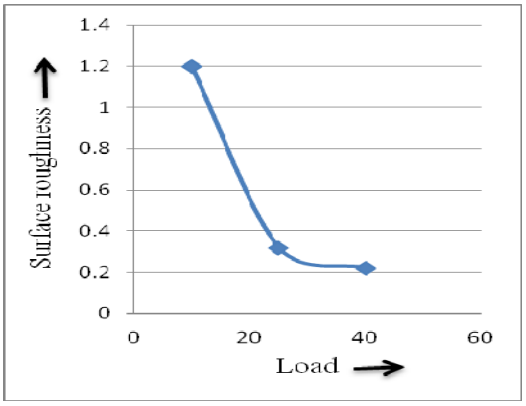
As the load increases, the surface hardness decrease and increase.
Load vs Surface Roughness (Speed = 399rpm)



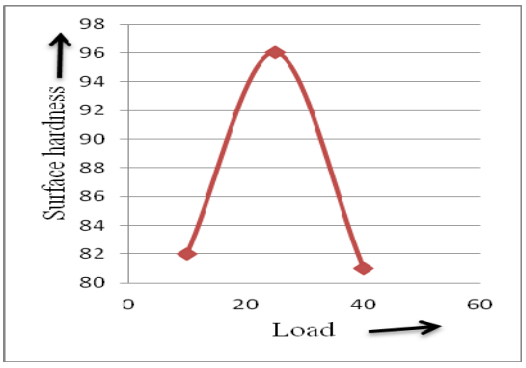
As the load increases, the surface Roughness Increase and decrease.
Condition 1: Pass 1 constant.
Taking load as low, medium and high with respect to the speed.
Load vs Surface Hardness (Pass = 1)



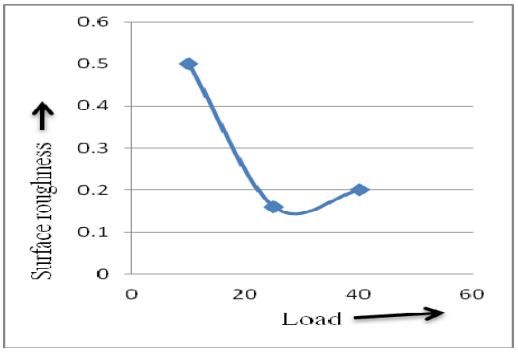
As the load increases, the surface hardness Decrease and increase.
Load vs Surface Roughness (Pass = 1)



As the load increases, the surface roughness Decreases
Condition 2: Pass 2 constant.
Taking load as low, medium and high with respect to the speed.
Load vs Surface Hardness (Pass = 2)



As the load increases, the surface hardness Increase and decrease.
Load vs Surface Roughness (Pass = 2)

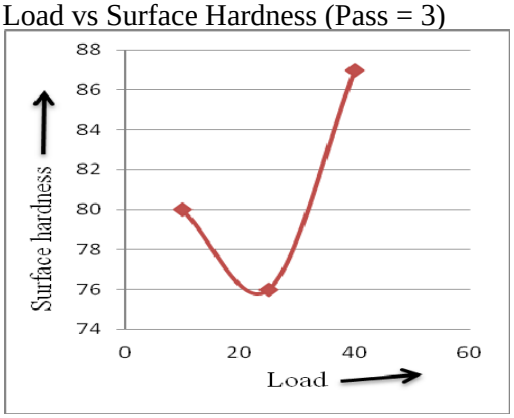


As the load increases, the surface roughness. Decrease and increase.

Condition 3: Pass 3 constant.

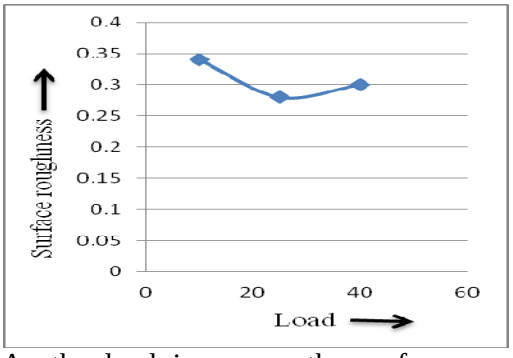
Taking load as low, medium and high with respect to the speed.

Load vs Surface Hardness (Pass = 3)



As the load increases, the surface hardness Decrease and increase.

Load vs Surface Roughness (Pass = 3)

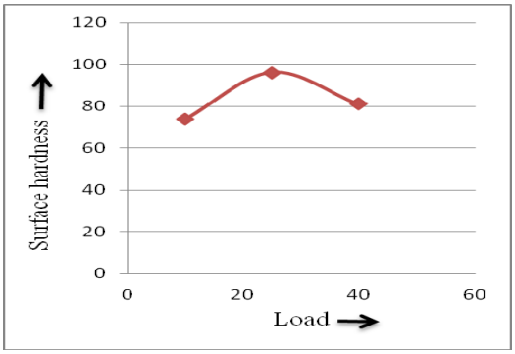


As the load increases, the surface roughness Decrease and increase.

Condition 4: Pass 4 constant.

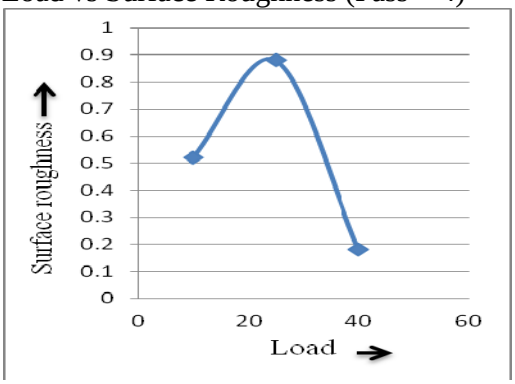
Taking load as low, medium and high with respect to the speed.

Load vs Surface Hardness (Pass = 4)



As the load increases, the surface hardness Increase and decrease.

Load vs Surface Roughness (Pass = 4)

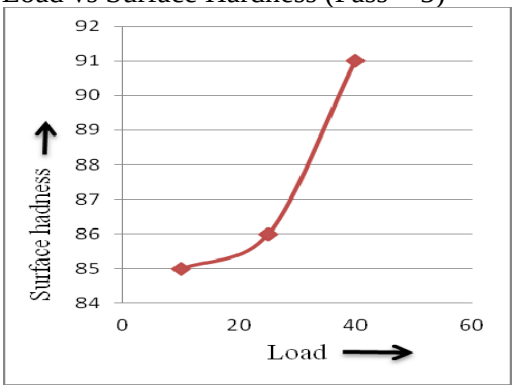


As the load increases, the surface roughness Increase and decrease.

Condition 5: Pass 5 constant.

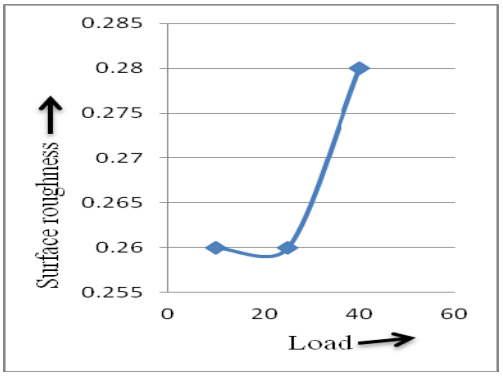
Taking load as low, medium and high with respect to the speed.

Load vs Surface Hardness (Pass = 5)



As the load increases, the Surface hardness increases.

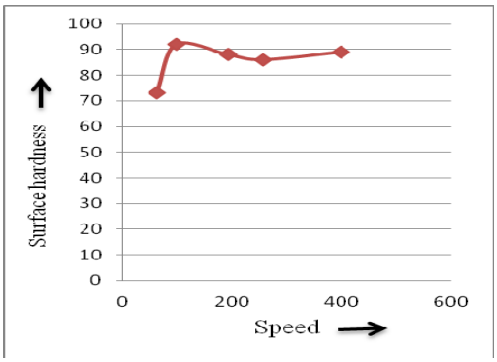
Load vs Surface Roughness (Pass = 5)



As the load increases, the Surface roughness increase.

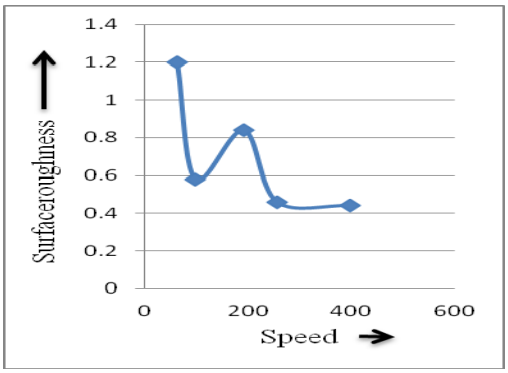
Condition 1: Load 10kg constant.

Speed vs surface hardness (Load = 10kg)



As the speed increases, the surface hardness Increase and decrease.

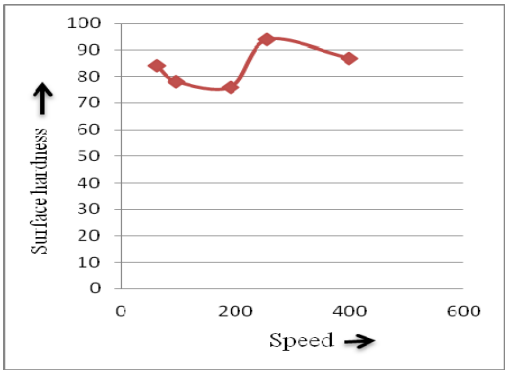
Speed vs surface roughness (Load = 10kg)



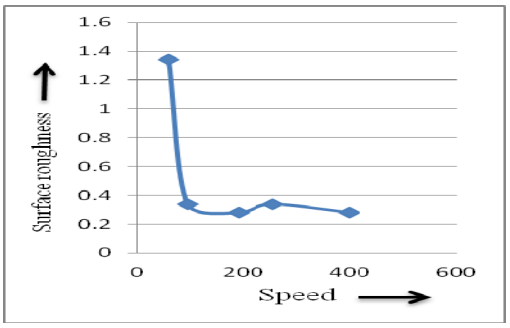
As the speed increases, the surface Roughness decrease and increase.

Condition 2: Load 25kg constant

Speed vs surface hardness (Load = 25kg)



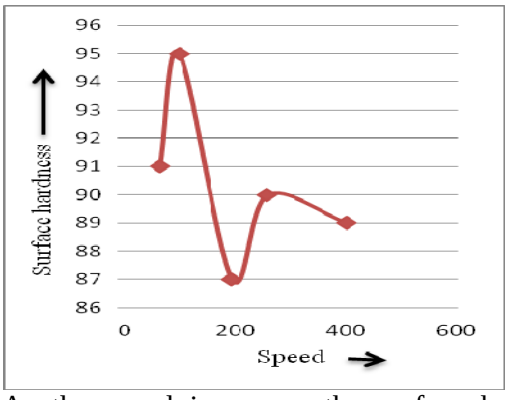
As the speed increases, the surface hardness Decrease and increase. Speed vs surface roughness (Load = 25kg)



As the speed increases, the surface Roughness decreases.

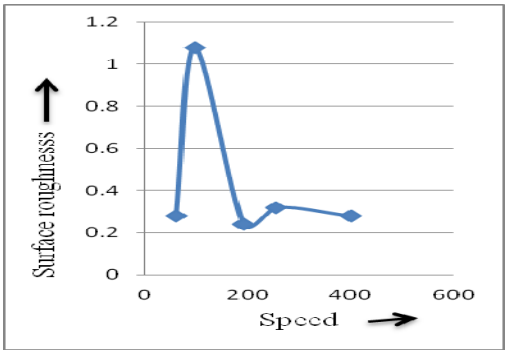
Condition 3: Load 40kg constant.

Speed vs surface hardness (Load = 40kg)



As the speed increases, the surface hardness Increase and decrease.

Speed vs surface roughness (Load = 40kg)



As the speed increases, the surface Roughness increase and decrease.

VIII. RESULTS

On the basis of Extensive Numerical and Experimental Investigations:

The surface roughness decreases with increase feed, burnishing speed force and number of passes, to a certain limit and then it starts to increase with the increase of each of the above mentioned burnishing parameters. Burnishing parameter values for surface roughness are: Speed 192rpm, Force 25Kgs and Passes 2 for Brass. Burnishing parameter for surface hardness are: Speed 192rpm, Force 25Kgs and Passes 4 for Brass. Investigation yields that Surface Hardness and Surface Roughness depends on Force, Passes and Speed for Brass.

IX. CONCLUSION

1) The Results Shows that improvement in Surface Roughness and increase in Surface Hardness are achieved by application of Roller burnishing for Brass Work piece.

2) Optimal values for surface roughness are: Speed 192rpm, Force 25Kgs and Passes 2 for Brass. Surface roughness 0.16µm.

3) Optimal values for surface hardness are: Speed 192rpm, Force 25Kgs and Passes 4 for Brass Surface hardness = 97 HRB.

4) Investigation yields that Surface Hardness and Surface Roughness depends on Force, Passes and Speed for Brass.

X. REFERENCES

1) C. S. Jawalkar and R. S. Walia., Study Of Roller Burnishing Process On En-8 Specimens Using Design Of Experiments Journal of Mechanical Engineering Research Vol. 1(1) pp. 038-045.
2) K.Eshwar Prasad, R.Murali Krishna., Experimental Investigation and Finite Element Analysis For The Study Of Residual Stresses In Roller Burnished Components. - International Journal of Applied Engineering Research ISSN0973-4562 Volume1.
3) M.H. El-Axir., An Investigation In To Roller Burnishing - International Journal of Machine Tools & Manufacture 40 (2000) 1603–1617.
4) J. Naga Malleswara Rao, A. Chenna Kesava Reddy and P.V. Rama Rao. Design And Fabrication Of New Type Of Dynamometer To Measure Radial Component Of Cutting Force And Experimental Investigation Of Optimum Burnishing Force In Roller Burnishing Process - Indian Journal of Science and Technology Vol. 3 No. 7 ISSN: 0974-6846.
5) Y. C. Lin Æ S. W. Wang Æ H.-Y. Lai .,The Relationship Between Surface Roughness And Burnishing Factor In Burnishing Process - Int J Adv Manuf Technol (2004) 23: 666–67