

Elimination of Honing Stick Mark in Rack Tube

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ABSTRACT: The main objective of the project is to reduce the tool tip mark produced during honing process in rack tube manufacturing. Rack tube is used in power steering, the hydraulic fluid acts inside the cylinder walls. Honing is an internal finishing process that uses abrasive particles on a rotating tool to produce extremely accurate dimensions and smooth surface finish. Similar to grinding and lapping process the abrasive particles are mounted on the rotating tool. During machining process tool have the working motion (both rotating and reciprocating motion). Work piece does not perform any motion. By the application of pressure acting on the tool, the tip marks are produced inside the work piece. To overcome this draw back. By changing the grain size of the hone stone the tool tip mark has been reduced and productivity increased

KEYWORDS: honing machine, stick mark, spindle, abrasive stick

I. INTRODUCTION

Honing is an internal finishing process that uses abrasives on a rotating tool to produce extremely accurate holes that require a very smooth finish. Honing is a low velocity abrasive machining process in which a tool called hone carries out a combined rotary and reciprocating motion. In this the stock is removed from metallic or non-metallic surfaces by bonded abrasive sticks.

Here the work piece does not perform any working motion. An abrasive stone against it along a controlled path. Honing is primarily used to improve the geometric form of a surface, but may also improve the surface texture. It is a final finishing operation employed not only to produce high finish but also to correct out-of-roundness, taper and axial distortion in work piece. In honing, since a simultaneous rotating and reciprocating motion is given to the stick, the surface produced will have a characteristic cross-hatch lay pattern. In honing the small abrasive particles are mounted on tool according to the type of application the grid size can be varied. Honing is similar to lapping process in both work piece does not perform any working motion. The metal removal rate is depending upon the pressure applied on the work piece. Honing is used in many applications like automobile parts such as cylinders walls etc.,



Fig 1 Honing process

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Typical applications are the finishing of cylinders for internal combustion engines, Yokes for steering column, air bearing spindles and gears. Finish boring or internal grinding may do the job, machining a hole to within less than 0.001 in. in diameter and maintaining true roundness and straightness with finishes less than 20(mu) in. It is one of the more difficult jobs in manufacturing. It can remove as little as 0.0001 in. of stock or as much as 0.125 in. of stock. The metal removal rate per stroke is 0.007micron.

II. METHODOLOGY

2.1. Problem identification:

In honing process the abrasive tool have both rotation and reciprocating motion with high pressure

.Due to the tool tip movement inside the work piece, some stick marks are produced in the inner surface of the work piece. Due to this problem parts are rejected. By avoiding the stick mark, the rejection of piece can be decreased.

2.2. Stick mark controlled requirements

- Coolant oil tank cleaning in every week.
- Stick proper round up.
- Honing stick diameter (38-40-45) using properly.
- Every one honing box two piece checking to final inspection daily.
- Every one box once cleaning the edge oil stones.
- Don't change the pressure setting.
- Bore rework separately doing operation.
- Rework piece carefully doing operation in particular stroke.
- Hold the work piece centre to the fixture centre.
- To check the straightness of the work piece then before machining.
- Burr proper way to cleaning the operator.

2.3. Reason for stick marks produced

- The re circulating of bur mixed coolant oil.
- Due to high rotation of spindle speed.
- High reciprocating speed.
- High feed rate.
- Sharp edges of the abrasive particles.
- Arrangements of abrasive grid size.
- Misalignment of work piece.
- Improper cleaning of honing tool.

2.4. Spindle speed

The spindle speed is mainly depends on the diameter of the bore to be machined. It runs at 1440 rpm. The choice of spindle speed is influenced by the following factors:

- 1) Material being honed: - Higher speeds are used for heavy metals that shear easily such as cast iron and non-ferrous alloys.
- 2) Hardness: The honing speed is inversely proportional to the hardness, (harder the work piece, the lower is honing speed).
- 3) Surface finish: high speed with low pressure should give good surface finish.
- 4) Number and width of stones in a tool: - Speed should be decreased as the area of abrasive per unit area of bore increases.
- 5) Finish requirement: - Higher speeds usually

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result in finer finish. Excessive speeds contribute to decreased dimensional accuracy, overheating of the work piece changes the properties of the work piece

2.5. Reciprocating Speed:

The reciprocating speed, which depends mainly on the length of the honing tool and the depth of the bore, is expressed in meters per minute as the product of number of strokes per minute and twice the stroke length. Since reciprocating speed, rotary speed and cross-hatch angle are related functions, the cross-hatch angle can be controlled by varying the reciprocation speed when rotation is constant. Reciprocation speed has considerable influence on the finish of the job. If the reciprocating speed is high, the dressing action is greater and consequently results in a rougher finish on the job. (Reciprocating speed: 3 seconds per stroke)

2.6. Cross-hatch:

A “cross hatch” pattern is used to retain oil or grease to ensure proper lubrication and ring seal of pistons in cylinders. A smooth glazed cylinder wall can cause piston ring and cylinder scuffing. The “cross hatch” pattern is used on brake rotors, and flywheels. Abrasive grains are bonded in the Form of sticks by a vitreous or resin material and sticks are presented to the work. For cylindrical surfaces the abrasive grains are given a combination of two motion-rotation and reciprocation. The resultant motion of the grains is a Crosshatch lay pattern with included angle between 20 and 60.



Fig 2 cross batch

2.7. Honing Pressure:

A wide range of pressure is used to obtain higher rates of material overall and better results. In some of the equipment the hydraulic force for feed-out varied from 10 to 32 kg/cm^2 . However, honing is more often controlled by the rate feed-out than by gauge pressure. Insufficient pressure leads to a low rate of material removal. When the pressure is excessive, a rougher finish will result as the abrasive breaks down very fast. This increases the tooling cost as well as the machine own time for frequent interchange of the stones. The trial and error method is usually employed for determining the optimum pressure for honing. To start with, a low pressure is used and then gradually using work piece finish as the reference, the pressure can be increased. Honing pressure: 4 to 5 bar

2.8. Cutting fluid:

It can also be called machining oil, tool oil, cutting fluid, and cutting oil. In the context of hand blade sharpening stone to protect the stone, carry away the debris(swarf), and to more efficiently produce a keen edge on a metal blade such as knife. It is used to aid in the cutting or grinding of metal, typically by abrasive tools or stones, and may or may not contain oil.

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Fig 3: Cutting Fluid

2.9. Honing stone:

Honing stones sometimes known as honing stick. A honing stone is similar to a grinding wheel in many ways, but honing stones are usually more friable so that they conform to the shape of the work piece as they wear in. To counteract their friability, honing stones may be treated with wax, or sulfur to improve life; wax is usually preferred for environmental reasons



Fig 4: Honing stone

2.10. Abrasives

1. Selection of the abrasive depends mainly on the composition, hardness of the metal being honed, finish required and the cost.

2. Normal aluminum oxides for the steel and silicon carbide for CI and non ferrous materials are used as abrasives.

3. Diamond is used for honing extremely hard and wear resistant materials such as tungsten, carbide or ceramics.



Fig 4: Abrasives

III. NORMAL OPERATING TOOL

The stick marks are mainly produced due to large number of small abrasive particles strikes the work piece with high pressure. The vertical honing machine manufactured by the Nagel by using a metal bonded diamond honing sticks. The hone should be

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IV. IMPLEMENTED OPERATING TOOL

The implementation of tool have the same specification but the difference is increasing the grain size of the abrasive particles. It helps in more metal removal rate with low pressure. If the pressure of the tool is decreased the stick mark is reduced.



Fig 6: Finished component Implemented operating stick specification: Length = 100mm

reciprocating in linear motion and rotates in one direction to machining the hydraulic cylinder. The grain size of the diamond tip will be smaller to increase the accuracy of the dimension in hydraulic cylinder.



Fig.5: finished component

Radius = 19
Abrasive grain size = 151 μ m
Thickness = 3mm

V. CALCULATIONS: Normal (old) honing tool

Honing Procedure for Roughing: Honing sticks width = 10mm
Thickness = 6mm
Length = 100mm

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Using Stick Grid D107

Initial diameter = 39.95mm

Final diameter=40.03mm

Metal removal= (initial diameter-final diameter)
= (39.95-40.03) Metal removal=0.08mm

Metal removal per stroke= (Metal removal/no. of strokes)

Diamond honing stick specification: Length = 100mm

Width =10mm Height=6mm Radius = 19⁰

Abrasive grain size = 107 μ m

Thickness = 3mm

The WENDT India Company will manufacture the bonded abrasive honing sticks. The diamond honing sticks is high metal removal rate, less wear in honing sticks and maximum accuracy in cycle times.

= (0.08/112) Metal removal per stroke =0.0007mm Cycle time =

03.00mins

Surface Value = 1.8RA

Implementation of new tool

Machining size =39.90mm

Honing size =40.03mm

Metal removal= (initial diameter-final diameter)
= (39.95-40.03) Metal removal=0.08mm

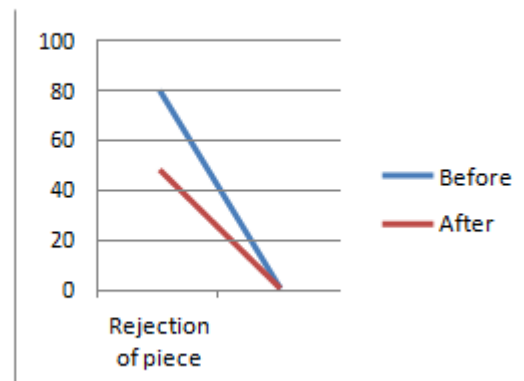
Metal removal per stroke= (Metal removal/no. of strokes)

= (0.08/80) Metal removal per stroke =0.001mm

Honing cycle time =02.00mins

Surface Values =2.2RA

Graph:



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VI. WORKING PRINCIPLE

Honing is a low velocity abrading process in which stock is removed from metallic or non-metallic surfaces by bonded abrasive sticks. It is a finishing operation employed not only to produce high finish but also to correct out-of-roundness, taper and axial distortion in work piece. In honing, since a simultaneous rotating and reciprocating motion is given to the stick, the surface produced will have a characteristic cross-hatch lay pattern. In this project we have replaced the fine abrasive partical with the bigger partical and by reducing the spindle pressure the stick mark on the tube get reduced



Fig 7: working

The main aim of this project is to minimize the part rejection due to high stick mark on the inner walls of the rack tube due to the abrasive particle.

VI.CONCLUSION

Now a day the major concept of all production industries are zero elimination and increasing the productivity. By applying the bigger abrasive partical with low pressure on the tool total rejection of rack tube per day can be reduced from 5 % to 3% per day. Rejection level of a product had decreases and simultaneously the productivity increases.

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