

# Implementation of Metal Removal Rate in Honing Process

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**ABSTRACT:** This paper presents a details of cycle time reduction in the honing process. The honing is the abrasive machining process along its controlled path to machining the internal bore of the hydraulic cylinder by using the vertical honing machine. During the machining operation of the hydraulic cylinder rack tube in the part to take more time for machining the internal bore diameter. Due to that increase the feed pressure and feed rate of the operation so that increasing the metal removal rate of the honing operation. In the honing process to have an rough honing and finish honing by using an super abrasive materials using like the diamond tips. The operation to increasing the metal removal rate in the honing operation by changing the metal bonded diamond honing sticks grit size of the abrasive material. By increasing the grit size of abrasive material to reduce the cycle time of the honing operation.

**KEYWORDS:** abrasive, hydraulic cylinder, grit size, feed pressure and feed rate.

## I. INTRODUCTION

The honing process is a slow operation. Honing is a low velocity abrasive process in which stock is removed from metallic or non-metallic surfaces by metal bonded diamond 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. Depending on size and shape of work pieces honing can be performed by following two methods.

### Manual Stroking

Manual stroking may be used in preference to power stroking for large varieties when tolerances are extremely close and when the size and shape of the work piece permit the operation. The main advantage of manual stroking as shown in the figure1.1:

- The work pieces need not be fixture and this reduces
- Tooling investment and permits immediate changeover from one job to another.
- The techniques used to obtain the required accuracy during manual stroking include end to end reversal of work pieces, change of stroke length and quick 'hone and try'.
- Differing degrees of correction because of bell mouth, taper or other irregularities, the operator can make the necessary corrections as stroking proceeds.

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Figure.1.1

- Manual stroking is employed sometimes as a 'final Touch' for tolerance and finish, after power stroking is employed.

## Power Stroking

Power stroking can be used for honing virtually all types and sizes of work-pieces. In mass production power stroking is better than manual stroking. In power stroking as shown in figure1.2.



Fixture is required for work pieces that exceed the size or weight that can be handled manually. A typical example of this category is the long bore hydraulic cylinder.

## II. DIAMOND HONING TOOLS

The vertical honing machine manufactured by the Nagel by using a metal bonded diamond honing sticks. The hone should be 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.

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**Figure.2.1**

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.

### III. SPECIFICATION OF COMPONENTS:(RENAULT) Grade - SAE 1020

#### COMPOSTION OF COMPONENT: CHEMICAL COMPOSITION:

#### MECHANICAL PROPERTIES:

Tensile strength=410N/mm<sup>2</sup>

#### COMPONENT DETAILS:

Total length	334mm (tolerance + or -0.2)
Slip diameter	54mm (tolerance + or -0.1)
Flaring diameter	52mm (tolerance + or -0.1)
Tube outer diameter	45mm (tolerance + or -0.1)
Raw material inner diameter	39.90mm(tolerance + or -0.1)
Fish diameter	40mm (tolerance + or -0.06)
Locust inner diameter	48mm (tolerance + or -0.1)
Groove diameter	50mm (tolerance + or -0.1)

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## IV. WORKING

The honing process is used to obtain the precise dimension and surfaces in cylindrical shapes with a wide range of diameters applied to parts such as hydraulics cylinders, liners and pin holes.

The honing process having the low capital equipment cost, high metal removal rates and honing process has high accuracy of one micron in various metals machining as shown in figure.4.1.



**Figure.4.1**

The honing process is abrasive machining process that machines the inner surface of the materials. The tool rotates in one direction and reciprocating in linear motion of the tool in back and forth. The tool will expands inside of cylinder while during the feed is given tool workpiece.

ELEMENT	CONTENT
Carbon(C)	0.17-0.23%
Iron(Fe)	99.08-99.53%
Manganese(Mn)	0.3-0.6%
Phosphorus(P)	0.04%
Sulfur(S)	0.05%

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These honing machines hold the workpiece and tool in vertical position as shown in figure.4.2. The spindle is attached by using rigid coupling and universal joints. During the machining the workpiece will be stable and tool is dynamic. The suitable fixture is used to hold the work material with certain position.



**Figure.4.2**

The honing machine is drive by using hydraulic fluids to operate the spindle and feed pressure the tool. The honing machine appears like the slotting machine. The honing process using the vertical honing machines to machining the work materials, because accuracy of dimension will be close compare to horizontal honing machine.



**Figure.4.3**

In vertical honing machine the Renault rack tube components used in the hydraulic power steering in cars. The workpiece is fixed in the fixture to hold the material and the spindle is fixed in top of workpiece. The spindle moves longitudinal direction due to the internal surface is machined and gives the finish component after the honing operation as shown in figure4.3.

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## CALCULATIONS:

### 1. Normal operating cycle time

Honing Procedure for Roughing: Honing sticks width = 6mm Thickness = 6mm  
Length = 75mm

No of sticks = 2nos

**Using Stick Grid D151**

Machining Size = 39.90mm

Honing Cycle Time = 30.00mins

Honing Size = 40.03 mm Surface Value = 2.2RA Honing Finishing:

Honing stick width = 6mm

Thickness = 6mm

Length = 75mm

No of Sticks = 2nos Honing size = 70.04mm **Using Stick Grid D107**

Cycle time = 03.00mins

Diameter = 40.03mm Surface Value = 1.8RA Honing Fine Finishing: Honing sticks width = 6mm Thickness = 6mm

Length = 75mm

No of sticks = 2 nos.

**Using Sticks Grid D64**

Cycle time = 05mins

Surface Finish Value = 0.4RA Final output:

**Component size = 40.03mm**

**Total Cycle Time = 38.00 min**

### 2. Revised and modified operating cycle time

Roughing Process:

Honing stick width = 10mm

Thickness = 6mm Length = 100mm No of stick = 2 nos

**Using Stick grid D151**

Machining size = 39.90mm Honing cycle time = 20.00mins Honing size = 40.03mm

Surface Values = 2.2RA Honing Fine Finishing: Honing stick width = 10mm Thickness = 6mm

Length = 100mm No of stick = 2nos **Using Stick grid D64**

Cycle time = 8mins

Surface Value = 0.4RA Final output:

**Component size = 40.03mm**

**Total cycle time = 28min**

## V. APPLICATION

Honing surface has excellent tribological properties, high bearing area ratio, low surface roughness and defined crosshatch pattern for lubricant retention. Tight bore size and cylindricity control couple with enhanced tribological characteristics extends the life of bearing.

Nagel has successfully installed thousands of honing systems all across the globe in automotive, aerospace, hydraulic and lawn & garden, oil & natural gas, appliance, medical and other industries.

Engine cylinder bore, cylinder liner, crank bore, connecting rod, diesel fuel injection components, crankshafts pulley, rocker-arm, turbo charger valve, roller lifter and VVT components.

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Hydraulic axial flow pumps, rotary oil pumps, gear pumps, radial piston housing and valves. Transmission and chassis: pinion gear, differential gear, ABS control valve, steering housing, brake- drum, brake cylinder, brake-valve and stator.

## VI. CONCLUSION

Exposures of industrial based technical mechanisms are growing up by providing the way to implement the new designs in the machines and tools to enrich the standard. In this way, stroke length is reduced in the honing machine by changing the honing sticks to the working tool instead of using only two sticks. While machining the internal surface using honing machine the tool is designed containing two sticks in the tool diameter. Considering the design to reduce time, cost and to increase the quality a new design is made for the honing tool containing six diamond edged tools in which it performs the task by improved design structure. The improved design structure helps to reduce the cycle time up to 30% of the full process cycle. This changing methodology in a tool helps in leading stages to increase the performance of the honing process. Finally through the tool production efficiency is partially improved and cycle time is reduced.

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