

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Special Issue 13, December 2015

Reduction of Cycle Time of Ashok Leyland Steering Hydraulic Cylinder (AL) By Using Honing Sticks

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ABSTRACT: Honing is an abrasive machining process that produces a precision surface on a metal work piece by scrubbing 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. Typical applications are the finishing of cylinders for internal combustion engines, spindles and gears. There are many types of hones but all consist of one or more abrasive stones that are held under pressure against the surface they are working on. In terms of sharpening knives, a honing steel does not actually hone knives, but simply realigns the metal along the edge. Other similar processes are lapping and super finishing. By increasing the sticks on honing tool, the number of stroke reduce on the abrasive spindle and also the cycle time reduces 20% of normal operation. The overall production efficiency increases and reduces the lead time of the process.

KEYWORDS: abrasive; surface;spindel ; sticks

I. INTRODUCTION

Honing is a low velocity abrasive 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. 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:

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

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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, fixturing 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

Sunnen Diamond plated honing tools are available for precision bore finishing in industrial application using sunnen, Nagel, Belden, Accucut and other types of high-production honing equipment virtually any type of equipment.

The plated sleeves, mandrels and pilots of sunnen single stroke honing tools are designed for maximum accuracy and fast cycle times.

III. SPECIFICATION FOR AL COMPONENT (ASHOK LEYLAND)

Grade - ST52Grade

Composition of AL component

CARBON	C	0.22 max
MAGNESIUM	Mn	1.60 max
SILICON	Si	0.55 max
SULPHUR	S	0.025 max
PHOSPORUS	P	0.025 max

Mechanical Property

Ultimate Strength	520 N/mm ²
% of elongation	14% min

Defects of component

Crack	Bending	Damage
Rusting	Laps	Tears
Silver folds		

Component Dimension

Diameter (mm)		Tolerance (mm)
Outer diameter (OD)	82	(0.6 / -0.0)
Inner diameter (ID)	69	(0.0 / -0.3)

IV. WORKING

The honing process is used to obtain precise dimension and surfaces in cylindrical shapes with a wide range of diameters applied to parts such as Hydraulic cylinders, piston, bearing bores, pin holes and to some external cylindrical surfaces as shown in the figure 4.1.

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Figure.4.1

The Honing process offers advantages of low capital equipment cost, high metal removal rates, and extreme accuracy of 0.001mm (0.00004') in a wide Variety of materials.

The abrasive action of the honing tool remove material from the workpiece's inside diameter. The tool rotates and expands while the workpiece reciprocates back and forth .To achieves such close tolerances, the workpiece must be allowed to "float" or move in three axes.

This movement is the single most important point in achieving the closer tolerance required in industry today. This, of course, reduce one of the three axes of movement, thus reducing the amount of movement or "float"

These machines hold the work as well as the tool in vertical position. They are available in single and multiple spindle type as shown in figure 4.2. The spindle head and hence, tools reciprocate and not the work piece. Suitable fixtures are employed to hold the work piece in position.



Figure.4.2

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Most of the modern machines carry a hydraulic drive for the spindle heads and the tools. Thus machine is best for shorter jobs. In appearance, thus machines resemble the drilling machine. In Honing work, the vertical machine are widely used than the horizontal ones. A Honing tools head used on it as shown in figure 4.3.

In vertical honing machine the Ashok Leyland component is fixed between the bar and the jaw, the flexible spindle is placed at the top the bar. The spindle moves in a longitudinal direction due to the spindle motion the internal surfaces are machined. It gives high surface finish to the component.



Figure.4.3

CALCULATION

Component Details:

Ashok Leyland Steering Hydraulic Cylinder (AL)

Specification:

Diameter	= 70 + (0.025 to 0.065) mm
Surface Finish	= 0.4 RA
Total Length	= 400 mm

1. Normal operating cycle time

Honing Procedure for Roughing:

Honing sticks width	= 6mm
Thickness	= 6mm
Length	= 75mm

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No of sticks = 4 nos

Using Stick Grid D151

Machining Size = 69.85mm
Honing Cycle Time = 30.00mins
Honing Size = 70.02 mm
Surface Value = 2.2RA

Honing Finishing:

Honing stick width = 6mm
Thickness = 6mm
Length = 75mm
No of Sticks = 4nos
Honing size = 70.04mm

Using Stick Grid D107

Cycle time = 03.00mins
Diameter = 70.02mm
Surface Value = 1.8RA

Honing Fine Finishing:

Honing sticks width = 6mm
Thickness = 6mm
Length = 75mm
No of sticks = 4 nos.

Using Sticks Grid D64

Cycle time = 05mins
Surface Finish Value = 0.4RA

Final output:

Component size = 70.04mm
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 = 6nos

Using Stick grid D151

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Machining size =69.8mm
Honing cycle time =20.00mins
Honing size =70.02mm
Surface Values =2.2RA

Honing Fine Finishing:

Honing stick width =10mm
Thickness =6mm
Length =100mm
No of stick =6nos

Using Stick grid D64

Cycle time = 8mins
Surface Value =0.4RA

Final output:

Component size =70.04mm
Total cycle time =28min

V. APPLICATION

Honing surface has excellent tribological properties, high bearing area ratio, low surface roughness and defined cross hatch patten 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.

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

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 implementing additional sticks to the working tool instead of using only four sticks. While machining the internal surface using honing machine the tool is designed containing four 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 design helps in leading stages to

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increase the performance of the honing process. Finally through the tool design production efficiency is partially improved and cycle time is reduced.

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