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ALIGNMENT TEST ON PORTABLE TABLETOP MINI LATHE

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ABSTRACT

Tabletop mini lathes are preferred by some professional such as Locksmith, Goldsmith, Watch maker and prototyping Engineers. The idea of Table top lathe was initiated in the concept of Micro factory in Japan in 1990.The main Objectives of Miniature of lathes are greater saving of power, space, materials, Time and other resources. Micro machining is the foundation of technology to produce miniature of components with relative accuracy requirements in 3 dimensional features are made in the wide range of engineering applications. Usually three directional forces to improve the working accuracy are applied to micro machine parts such as Spindle, Bed and Cross slide of Tabletop mini lathe. In this experimental work deals with alignment test was conducted on various micro machine parts using dial test indicator. The maximum and minimum values of alignment tests are compared with mini machine tool guide. The alignment values of Machine bed, Spindle and Cross slide are within allowed limit of design of machine elements guide and Indicate table top mini lathe is suitable for micro machining process.

Keywords: *Table top Mini Lathe, Alignment test, Dial test Indicator, Accuracy, Micro machining*

1. Introduction

Micro factory is a small dimensioned factory which is capable for small production system. Micro factory was a concept of future Manufacturing system which was proposed in Japanese national R&D project in 1990.Microfactory was able to perform a series of Fabrication and assembly with a small table top machine [1,2] Metrology and Inspection system are the basis for ultra precision mini machines to be widely applied in Industry which is used to analyze performance of micro machines [3] Design Strategy is developed with the aim of getting a very high dynamic analysis of tabletop micro machines [4] The development of Precision manufacturing has greatly changed our lives in terms of increased living standards. High precision manufacturing offers quality and reliability for conventional products. Usually Table top mini lathe accuracy will improve by inherent reductions of machine component Inertia, Negligible thermal drift and larger Eigen frequencies[5] Spindle is a key component of precision machine tool because the spindle motion error will have significant effects on the surface quality and accuracy of machine component[6] Steel or Cast iron are most widely used material for the machine bed and slide ways because their good wear resistance, low stress caused deformation and vibration damping capacity[7,8] Three important principle parts like machine bed, cross slide and spindle performance are measured by dial test indicator. It indicates the errors and tolerance limit of alignment of small tabletop machines [9].The performance of micro machine was analyzed by Gap sensor method and finite element analysis method and then conduct experimental work on different materials [10] Previous researchers were conducted performance test in different conventional machines but we conduct performance test on tabletop mini lathe using dial test indicator and values are compared with design of machine elements data book.

2. Specifications

Net weight = 3.20 kg
Motor specification = 1/12 hp
Bed length = 165 mm
Centre height = 65mm
Spindle speed = 3000-9000 rpm
Longitudinal feed = 80mm
Cross feed = 30mm
Pitch of lead screw = 2mm
Distance between the centres = 92.5 mm
Mode of Operation – Manual

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3. Alignment test on Tabletop Mini lathe.

3.1. Rotational Accuracy of Chuck

Fig.1 Alignment test on chuck

Table 1. Alignment test result of chuck

Test Trial No	Chuck Alignment position (degrees)	Deviation division in Dial test indicator	Amount of Deviation (mm)
1	0	2	0.02
2	90	1	0.01
3	180	1	0.01
4	270	2	0.02

Table top mini lathe carryout machining by means of rotational force of Chuck. The accuracy of chuck affects the roundness and surface roughness of the work piece. The final product accuracy depends upon the chuck accuracy and spindle speed. In general the chuck accuracy is measured by Dial gauge at very low speed. This method is simple and easy to analyze the chuck alignment and also measure the performance of table top mini lathe.

The maximum and minimum values are tabulated in Table 1.The average value of chuck roundness is 0.015 mm and within allowable limit as per design of mini machine tool guide. Fig 2 shows that Deviation values of different position of rotation of spindle chuck through the Radar diagram.

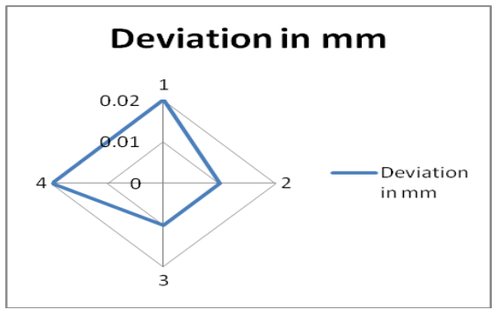

Fig 2 Radar diagram for chuck alignment values

3.2. Movement accuracy of cross slide

Fig.3 Alignment test on cross slide

Table 2. Alignment test results of Cross slide

Test Trial No	Alignment distance In mm	Deviation division in Dial test indicator	Amount of Deviation In mm
1	10	2	0.02
2	15	3	0.03
3	20	1	0.01
4	25	3	0.03

Cross slide movement of mini lathe is based on screw mechanism and adjusted by clamping nut. The final product accuracy, surface finish, metal removal rate, tool wear, heat generation and tool vibrations are controlled by correct alignment of cross slide. The cross slide movement accuracy is measured by dial gauge and values are tabulated in Table 2. It shows that average value of cross slide movement is 0.02 mm and also within allowable limit as per design of mini machine tool guide. Fig 3 shows that Amount of deviation of cross slide movement during alignment test on Mini

lathe and also give graphical representation through Scatter Diagram

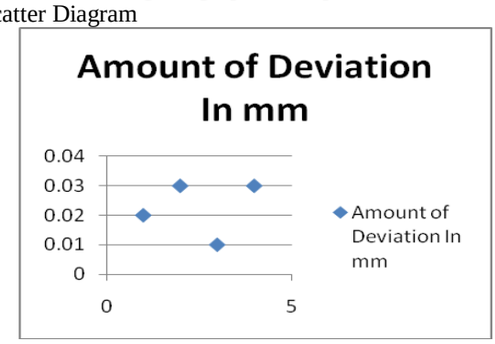

Fig.3 Scatter diagram for Cross slide alignment values

3.3 Alignment Test on Machine bed

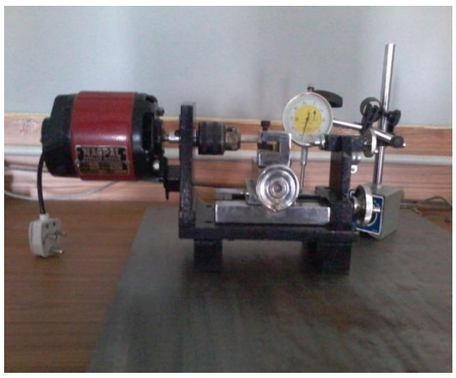

Fig 4 Alignment test on Machine bed

Carriage mechanism and tool post arrangement are placed on machine bed and allow moving between heat stock to tail stock by actuating lead screw. The accuracy of machine bed lead to observe cutting force vibration and tool vibrations developed during machining process. The machine bed alignment has been conducted on top surface of machine body by using dial gauge. The maximum and minimum values of Alignment test of machine bed are measured by dial gauge and tabulated in Table 3.

Table 3. Alignment test results of Lathe Bed.

Test Trial No	Chuck Alignment position (distance)	Deviation division in Dial test indicator	Amount of Deviation (mm)
1	10	2	0.02
2	20	2	0.02
3	40	1	0.01
4	60	2	0.02

It shows that average value of machine bed in 0.02 mm and also within allowable limit as per design of mini machine tool guide. Fig 3 shows that amount of deviation of machine bed during alignment test through Scatter Diagram. Fig 5 shows that deviation of machine bed of mini lathe which represent there is no deviation in alignment test. So the machine produces best accuracy in plain turning process.

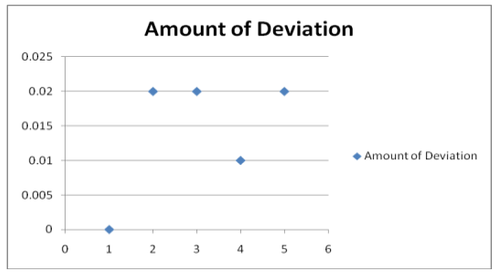

Fig 5 Scatter diagram for Alignment values of Bed

4. Conclusion

The performance test was conducted on various principle parts such as Machine spindle chuck, lathe bed and cross slide of Tabletop mini lathe. Dial gauge was used to check the values of Alignment test which the maximum and minimum values are within allowed limit. Hence Table top mini lathe is suitable for micro machining process and it can be implement the micro factory concept.

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