Using a reamer

The amount of metal to be removed from the hole should vary between 0.10 mm and 0.25 mm on diameter depending on the size of the hole.

Turn the reamer slowly in a clockwise direction and apply downward pressure. The reamer should move into the hole about one-quarter of the diameter for each turn. Do not turn the reamer in an anticlockwise direction as this will blunt the cutting edges.

Use a cutting lubricant where required, e.g. when reaming steel.

If keyways or oil grooves have been cut in the hole, a helical fluted reamer is more satisfactory than one with straight flutes. A helical fluted reamer is one on which the flutes have been cut on a helix and are then at an angle to the axis. This allows the teeth to bridge the keyway or oil groove.

Testing the lathe for accuracy

Lathe alignment test

When a lathe is manufactured, the machine is carefully adjusted and aligned in the assembly department. Alignment and performance tests are conducted and a test chart is compiled. This chart is issued with the machine and gives the degree of accuracy to which it conforms.

It is always possible that, during transport, shocks may occur and deformations may be set up, so that it is advisable to repeat the major tests when the machine is in the position which it will occupy.

Before any tests are carried out, the machine should be carefully levelled and checked by means of a sensitive spirit level of an accuracy of 0.04 mm per metre. Adjustments are made by using the screw jacks usually built into the base of the machine or by using levelling wedges. The bed should be levelled longitudinally and transversely until the accuracy indicated in the test chart is achieved.

A typical lathe test chart would appear as Table 13.2.

Methods of testing

Main spindle

Tests for the true running of the various features of the spindle nose are carried out with a dial indicator

Table 13.2 Test chart for lathes with up to 500 mm swing

Test applied	Figure	*Permissible error in millimetres* — General purpose lathes	*Permissible error in millimetres* — Tool room precision lathes
Bed			
Level longitudinally		0.015 per any 500	0.01 per any 500
Level transversely		0.04 per any 1000	0.03 per any 1000
Main spindle			
Run-out of centre	13.30	0.01	0.005
Run-out of spindle face	13.31	0.02	0.01
Spindle end play	13.32	0.02	0.01
Run-out of spindle taper	13.33		
(a) nearest to spindle nose		0.01	0.005
(b) at 300 mm from nose		0.03	0.015
Headstock alignment			
Spindle parallel with bed			
(a) in vertical plane	13.34	0.02 in 300	0.15 in 300
(b) in horizontal plane		0.02 in 300	0.01 in 300
Tailstock			
Tailstock spindle parallel with bed	13.35		
(a) in vertical plane		0.03 in 500	0.02 in 500
(b) in horizontal plane		0.02 in 500	0.01 in 500
Axis of centres parallel with bed at extremities of bed	13.36	0.04	0.02
Lathe faces hollow or concave within	13.37	0.02 in 300 diam.	0.01 in 300 diam.
Lead screw			
Accuracy of pitch generated by lead screw		±0.03 in any 300	±0.02 in any 300
Turning in chuck	13.38		
(a) round turning		0.015	0.007
(b) parallel turning		0.04 in 300	0.02 in 300

positioned as shown in Figures 13.30, 13.31 and 13.32.

To test for the true running of the headstock spindle tape, a test bar is placed in the taper hole (Fig. 13.33). The test bar is of hardened steel ground parallel for a length of 300 mm and having a tapered shank ground to fit the spindle taper. The test is taken by mounting the indicator on the carriage, testing the run-out close to the spindle nose and again at 300 mm from the nose. Readings should not exceed the permissible error as shown in the test chart.

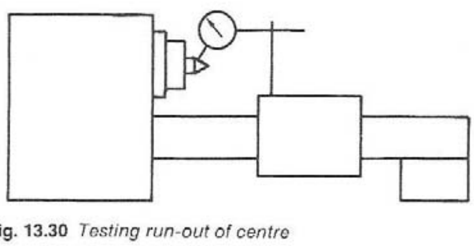

Fig. 13.30 *Testing run-out of centre*

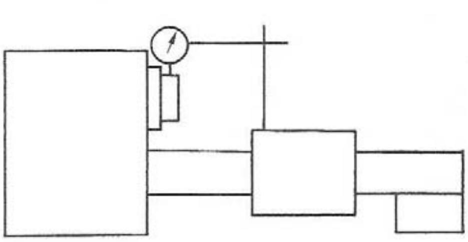

Fig. 13.31 *Testing spindle nose of run-out*

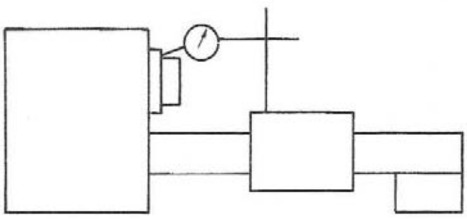

Fig. 13.32 *Testing spindle face run-out and end play*

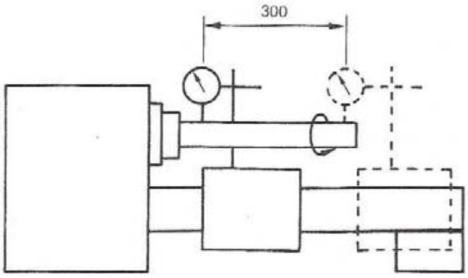

Fig. 13.33 *Testing run-out of spindle taper*

Headstock alignment

The headstock main spindle must be parallel with the ways of the bed in both the horizontal and vertical planes. The test bar is fitted into the spindle taper and a dial indicator mounted on the saddle in such a way that it can be passed under the test bar to obtain the height at each end (Fig. 13.34). The test bar is tested for run-out and the mean between the high and low points is marked on each end. The height readings are taken at these points.

When the headstock is correct in the vertical plane, it is then tested in the horizontal plane. The indicator is adjusted to centre height and moved along the bed and readings taken at each end of the test bar at the mean run-out position.

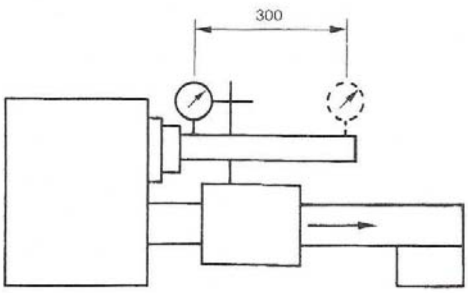

Fig. 13.34 *Testing headstock alignment*

The method of adjustment depends upon the design of the headstock. If vee ways are used, the headstock seat must be filed, scraped or machined to correct any errors. Headstocks having flat ways are often provided with adjusting screws which permit the sideways alignment to be made very easily.

The tailstock

The tailstock is tested in a similar manner to the headstock, the test bar now being held in the tailstock spindle (Fig. 13.35). Readings are taken in the horizontal and vertical planes with the spindle fully extended and again with the spindle fully withdrawn into the tailstock body.

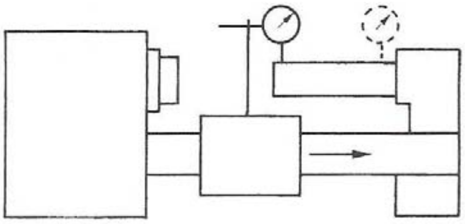

Fig. 13.35 *Testing tailstock alignment*

The axis of centres

The difference in height between the tailstock and headstock centres is tested by mounting an accurately ground test bar between centres. The test bar should be of sufficient length to permit the tailstock to be clamped at the extreme end of the bed. A dial indicator is mounted on the carriage and moved across the top of the test bar at each end (Fig. 13.36) and the difference in heights noted. The tailstock centre should not be lower than the headstock centre as the slightest wear will only increase the error.

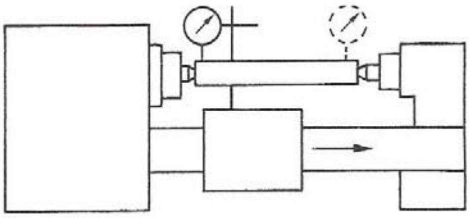

Fig. 13.36 *Testing the axis of centres*

Facing a flat surface

This test is usually performed by a practical test. A cylinder of mild steel or cast iron is mounted in a chuck and a facing cut taken across the surface (Fig. 13.37). The test cylinder should be of a diameter one-half of the swing of the lathe with a length of one-eighth of the swing. After a finishing cut has been taken, a straight edge is placed across the machined surface and feeler gauges used to test for a concave or convex face. Any major error in flatness indicates that the cross slide is not square with the headstock spindle axis and this fault can be corrected by scraping and re-fitting the cross slide ways.

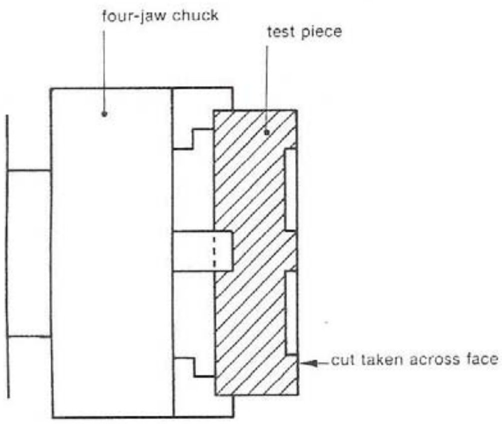

Fig. 13.37 *Testing for facing flat*

The lead screw

The lead screw can be tested practically by cutting a screw on a test piece. The test piece should be the same diameter as the lathe lead screw and the pitch of the test thread one-half of the pitch of the lead screw.

Turning workpiece held in a chuck

Roundness and parallel turning in the chuck is tested by mounting a test piece as shown in Figure 13.38. The diameter of the test piece should be one-half the swing of the lathe and the length also one-half of the swing. The tests are carried out by turning two bands each 25 mm distant from the ends and each 20 mm wide. Measurements are taken at various points around the circumference and variations in size and parallelism checked against the test chart.

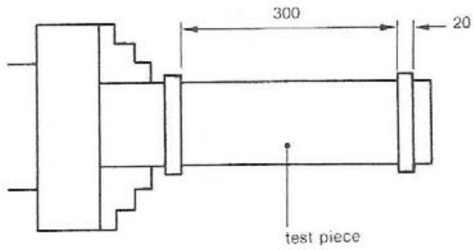

Fig. 13.38 *Roundness and parallel turning test*

The figures given in the test chart are a guide only as each machine tool builder manufactures to a particular standard to suit a particular need. The test chart supplied by the maker should be thoroughly examined to ensure that the machine can perform at the standard required for the job for which it is purchased.