MACHINE TOOL ALIGNMENT TESTS
MACHINE TOOL TESTING

INTRODUCTION:

The surface components produced by machining processes are mostly by generation. As a result, the quality of surface produced depends upon the accuracy of the various movements of the machine tool concerned. It therefore becomes important to know the capability of the machine tool by evaluating the accuracy of the various mechanisms that are directly responsible for generating the surface. For this purpose a large variety of tests have been designed.

MEASURING INSTRUMENTS USED FOR TESTING:

The accuracy of the machine tools employed should be higher than the accuracy of the components that it produces. Similarly the quality of the measuring equipment used for machine tool testing should be commensurate with the quality expected from such testing. A few commonly used equipments are

• Dial Indicators
• Test mandrels
• Straight edges
• Spirit levels

TEST PROCEDURES:

The major tests that are conducted on machine tool are:

• Testing the quality of the slide ways and the locating surfaces
• Testing the accuracy of the main spindle and its alignment with respect to other parts of the machine tool.
• Testing the accuracy of the parts produced by the machine tool.
ACCEPTANCE TESTS

LATHE MACHINE

Tests that can be conducted on Lathe machine:

1. **Quality of slide ways**: To test the quality of the slide ways it is necessary to mount the dial indicator on a good datum surface. Then the plunger is moved along the longitudinal direction of the slide ways which provides an indication of the undulations present on the surface of the slide ways.

2. **Accuracy of the spindle**:
   These tests are related to the true running of the spindle and the centre located in the spindle along with the alignment, parallelism and perpendicularity of the spindle with the other axes of the concerned machine tool.
   
   **True running of the centre**: The live centre may be loaded into the lathe spindle and a dial indicator mounted as shown in fig. This test is required only for machines where the work piece is held between centres. The readings of the dial indicator are taken while rotating the spindle through full rotation.

   **True running of the spindle**: the taper shank of the test mandrel of about 300 mm length is mounted into the spindle as shown in fig. The plunger of the dial indicator rests on the cylindrical surface of the mandrel. The spindle is rotated slowly and the readings of the dial indicator are noted. The deviation should normally be less than 0.01mm. The test is to be repeated with the dial indicator positioned close to the spindle bore as well as at the extreme end of the test mandrel.
**Squeness of the face:** this test is used to measure the squeness of the shoulder face with reference to the spindle axis. The plunger of the dial indicator rests on the extreme radial position of the shoulder face and the reading is taken. It is repeated by slowly rotating the spindle till the dial indicator comes to a point that is diametrically opposite to the reading taken earlier.

3. **Alignment tests:**

*Parallelism and perpendicularity:* Parallelism and perpendicularity between two axes or two surfaces is normally measured in two planes, horizontal and vertical. For this purpose the test mandrel is mounted in the spindle as shown in fig. with dial indicator mounted on the saddle or carriage. The plunger of the dial indicator touches the mandrel surface as shown in fig. the saddle is moved for a specified distance and the dial reading noted. The test is repeated in the horizontal direction as well.
**Parallelism between the outside diameter of the tail stock sleeve and the slide ways** as shown in fig.

![Test set-up for the parallelism of the tail stock sleeve](image1)

**Parallelism between the line of centres and the slide ways** shown in fig.

![Test set-up for parallelism of the line of centres in a lathe](image2)
MILLING MACHINE:
The following tests can be conducted:

1. True running of the spindle:

   ![Test set-up for true running of the spindle of a milling machine]

2. Spindle alignment:

   In this test dial indicator is mounted on one of the surfaces whose alignment is to be tested with another surface. In case of a horizontal milling machine the testing of the alignment between the spindle and the over arm support can be done as shown in fig.

   ![Mandrel]

Machine Tool Alignment Tests
The dial indicator is mounted on the spindle while a test mandrel is mounted in the over arm support with the plunger of the dial indicator resting on the cylindrical surface of the test mandrel. The spindle is rotated and readings are taken when it is at different positions on the periphery of the test mandrel. The test may be conducted at two extreme ends of the mandrel.

**Parallelism between the table and the spindle axis** shown in fig. A test mandrel 300mm long is mounted in the spindle axis and the dial indicator is mounted on the table. The reading of the dial indicator is taken at the two extreme positions with out the table movement.

Other tests that can be conducted are:

- Parallelism between the spindle axis and the transverse movement of the table.
- Perpendicularity between the spindle and the vertical column ways.
RADIAL DRILLING MACHINE:
Tests that can be conducted on Drilling Machine are:

1. True running of the spindle.

2. Perpendicularity between the spindle and the base plate.
3. Perpendicularity between the feed movement and the base plate.