JIGS AND FIXTURES

Jigs and fixtures are special purpose tools which are used to facilitate production (machining, assembling and inspection operations) when workpieces are to be produced on a mass scale. The mass production of workpieces is based on the concept of interchangeability according to which every part will be produced within an established tolerance. Jigs and fixtures provide a means of manufacturing interchangeable parts since they establish a relation, with predetermined tolerances, between the work and the cutting tool. They eliminate the necessity of a special set up for each individual part. Once a jig or fixture is properly set up, any number of duplicate parts may be readily produced without additional set up. Hence jigs and fixtures are used:

i. To reduce the cost of production, as their use eliminates the laying out of wiork and setting up of tools.
ii. To increase the production.
iii. To assure high accuracy of the parts.
iv. To provide for interchangeability.
v. To enable heavy and complex-shaped parts to be machined by being held rigidly to a machine.
vi. Reduce quality control expenses.
vii. Increased versatility of machine tool.
viii. Less skilled labour.
ix. Saving labour.
x. Their use partially automates the machine tool.
xi. Their use improves the safety at work, thereby lowering the rate of accidents.

A jig may be defined as a device which holds and positions the work, locates or guides the cutting tool relative to the workpiece and usually is not fixed to the machine table. It is usually lighter in construction.

A fixture is a work holding device which only holds and positions the work, but does not in itself guide, locate or position the cutting tool. The setting of the tool is done by machine adjustment and a setting block or by using slip gauges. A fixture is bolted or clamped to the machine table. It is usually heavy in construction.

Jigs are used on drilling, reaming, tapping and counterboring operations, while fixtures are used in connection with turning, milling, grinding, shaping, planning and boring operations.

Jigs and fixtures are called production devices because of their functions and advantages.

In order for jigs and fixtures to both fulfill their basic functions, they should possess the following components or elements:

1. A sufficiently rigid body (plate, box or frame structure) into which the workpieces are loaded.
2. Locating elements.

3. Clamping elements.
4. Tool guiding elements (for jigs) or tool setting elements (for fixtures).
5. Elements for positioning or fastening the jig or fixture on the machine on which it is used.

Locating pins are stops or pins which are inserted in the body of jig or fixture, against which the workpiece is pushed to establish the desired relationship between the workpiece and the jig or fixture. To assure interchangeability, the locating elements are made from hardened steel. The purpose of clamping elements is to exert a force to press a workpiece against the locating elements and hold it there in opposition to the action of the cutting forces. In the case of jig, a hardened bushing is fastened on one or more sides of the jig to guide the tool to its proper location in the work. In the case of fixture, a target or set block is used to set the location of the tool with respect to the workpiece within the fixture. Most jigs use standard parts such as drill bushings, screws, jig bodies and many other parts. Fixtures are made from grey cast iron or steel by welding or bolting. Fixtures are usually massive bodies because they have to withstand large dynamic forces. Because the fixtures are in between the machine and the workpiece, their rigidity and the rigidity of their fastening to the machine table are most important. Jigs are positioned or supported on the machine table with the help of feet which slide or rest on the machine table. If the drill size is quite large, either r stops are provided or the jig is clamped to the machine table to withstand the high drilling torque. Fixtures are clamped or bolted to the machine table.

REVIEW QUESTIONS

1. What are the functions of jigs and fixtures?
2. Define a jig and a fixture
3. Differentiate between jigs and fixtures
4. Name the essential elements that make up a jig or fixture.