CLAMPING DEVICES
What is Clamping?

• Once workpiece is located, it is necessary to press it against locating surfaces and hold it there against the force acting upon it. The tool designer refers to this action as **clamping** and the mechanisms used for this action are known as **clamps**.
Clamping Principles

- Clamp should **firmly hold** the workpiece without distorting it.
- Should overcome the **maximum possible force** exerted on workpiece by using **minimum clamping force**
- **Easy** to operate
- **Vibrations** should tighten the cams and wedges in the clamp design (if any) and not loosen them
Types Of Clamping

• Mechanical Actuation Clamps
• Pneumatic and Hydraulic Clamps
• Vacuum Clamping
• Magnetic Clamping
• Electrostatic Clamping
• Non Mechanical Clamping
• Special Clamping Operations
1. Screw Clamping

These are simple clamps where torque developed in a screw thread is used to hold the workpiece. It can be direct or indirect. There are different holding forces for different screw sizes.
<table>
<thead>
<tr>
<th>Screw size</th>
<th>Holding force (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M6</td>
<td>700</td>
</tr>
<tr>
<td>M8</td>
<td>1100</td>
</tr>
<tr>
<td>M10</td>
<td>1650</td>
</tr>
<tr>
<td>M12</td>
<td>3100</td>
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<tr>
<td>M16</td>
<td>4900</td>
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<tr>
<td>M20</td>
<td>7100</td>
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</table>
2. C-Clamps
3. Strap Clamps

The basic operation is same as that of a lever. It can be classified into 3 based on the position of workpiece(work), support(fulcrum) and fastener screw(effort).

Strap Clamp using

- First class lever action
- Second class lever action
- Third class lever action
3(a) Strap Clamp using first class lever action
Fulcrum is placed between work and effort
3(b) Strap Clamp using second class lever action
Work is placed between fulcrum and effort
3(c) Strap Clamp using third class lever action
Effort placed between work and fulcrum.
4. Swing Clamp

Swing clamp has a screw clamp with swinging arm that pivots on its mounting stud.
5. Swinging Strap Clamp

This is a combination of strap clamp and swinging clamp. It is used in cases where heavy clamping pressure is not required.
6. Pivoted Clamps

Clamps are often pivoted at the centre to simplify their operation. Tightening and loosening is done using knurled head screw.

**Figure 1.60 (a)**
Pivoted Strap Clamp

**Figure 1.60 (b)**
Pivoted Two Way Clamp
7. Hinged Clamp

This clamp provides rapid clearance for loading and unloading the workpiece. It has a hinged bolt and hinged strap/plate which when swung apart gives space to mount the workpiece.
8. **Wedge clamp:**

A plain wedge clamp consists of a movable inclined plane which forces the work piece against a fixed stop. These clamps tend to loosen under vibration. The taper end of the plain wedge ranges from 6-8 deg depending upon the coefficient of friction of the metal.
(a) Plain-Wedge Clamp

(b) Improved Plain-Wedge Clamp

(c) Pinch Clamp with Wedge

(d) Strap Clamps Employing the Wedge Principle
9. **Latch clamp:**
Latch clamp is known for its advantage in the speed of manipulation. It is limited to light work as it is difficult to secure rigidly.

Types of latch clamps are:

a) Simple latch clamp
b) Cam type latch
c) Self locking clamp
d) Thumb screw latch
**Simple Latch Clamp**

- Pivot
- Unlatch
- Pressure spring
- Pivot leaf
- Jig foot

**Cam-type Latch**

- Pivot
- Leaf
- Pin
- Cam face
- Jig frame

**Self-locking Latch**

- Unlock
- Pin
- Jig leaf
- Catch
- Pawl
- Spring

**Thumbscrew Latch (Quarter-turn Screw)**

- Leaf
- Frame