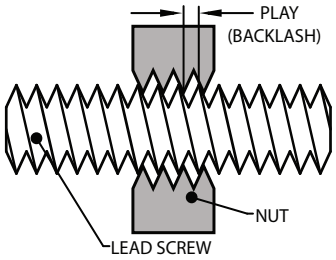
CONVENTIONAL MILLING VS. CLIMB MILLING

There are two distinct ways to cut materials when milling, conventional (up) milling and climb (down) milling. The difference between these two techniques is the relationship of the rotation of the cutter to the direction of feed. In conventional milling, the cutter rotates against the direction of the feed while during climb milling, the cutter rotates with the feed. Conventional milling is the traditional approach when cutting because the backlash **(Figure 1)**, the play between the lead screw and the nut in the machine table, is eliminated. Recently, climb milling has been recognized as the preferred way to approach a workpiece due to the fact that more and more machines compensate for backlash or have a backlash eliminator. Below are some key properties for both conventional and climb milling.

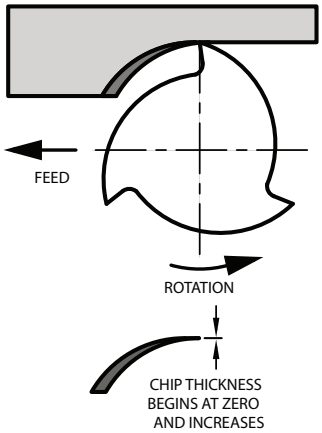
Figure 1: Backlash



Conventional Milling (Figure 2)

- Chip width starts from zero and increases which causes more heat to diffuse into the workpiece and produces work hardening
- Tool rubs more at the beginning of the cut causing faster tool wear and decreases tool life
- Chips are carried upward by the tooth and fall in front of cutter creating a marred finish and re-cutting of chips
- Upwards forces created in horizontal milling tend to lift the workpiece, more intricate and expansive work holdings are needed to lessen the lift created

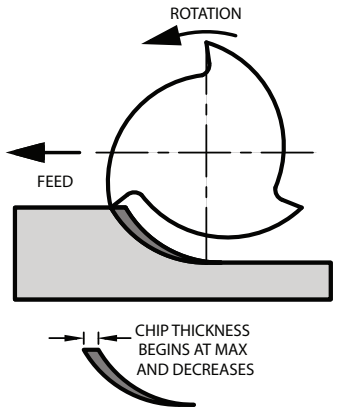
Figure 2: Conventional Milling



Climb Milling (Figure 3)

- Chip width starts from maximum and decreases so heat generated will more likely transfer to the chip
- Creates cleaner shear plane which causes the tool to rub less and increases tool life
- Chips are removed behind the cutter which reduces the chance of re-cutting
- Downwards forces in horizontal milling is created that helps hold the workpiece down, less complex work holdings are need when coupled with these forces

Figure 3: Climb Milling



When to Choose Conventional or Climb Milling

Climb milling is generally the best way to machine parts today since it reduces the load from the cutting edge, leaves a better surface finish, and improves tool life. During conventional milling, the cutter tends to dig into the workpiece and may cause the part to be cut out of tolerance.

Even though climb milling is the preferred way to machine parts, there are times when conventional milling is the recommended choice. Backlash, which is typically found in older and manual machines, is a huge concern with climb milling. If the machine does not counteract backlash, conventional milling should be implemented. Conventional milling is also suggested for use on casting or forgings or when the part is case hardened since the cut begins under the surface of the material.

