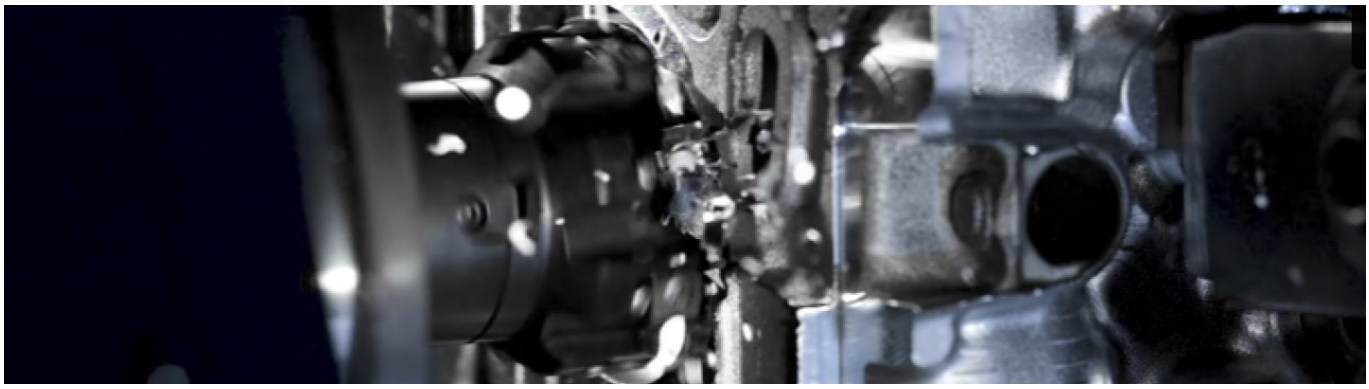
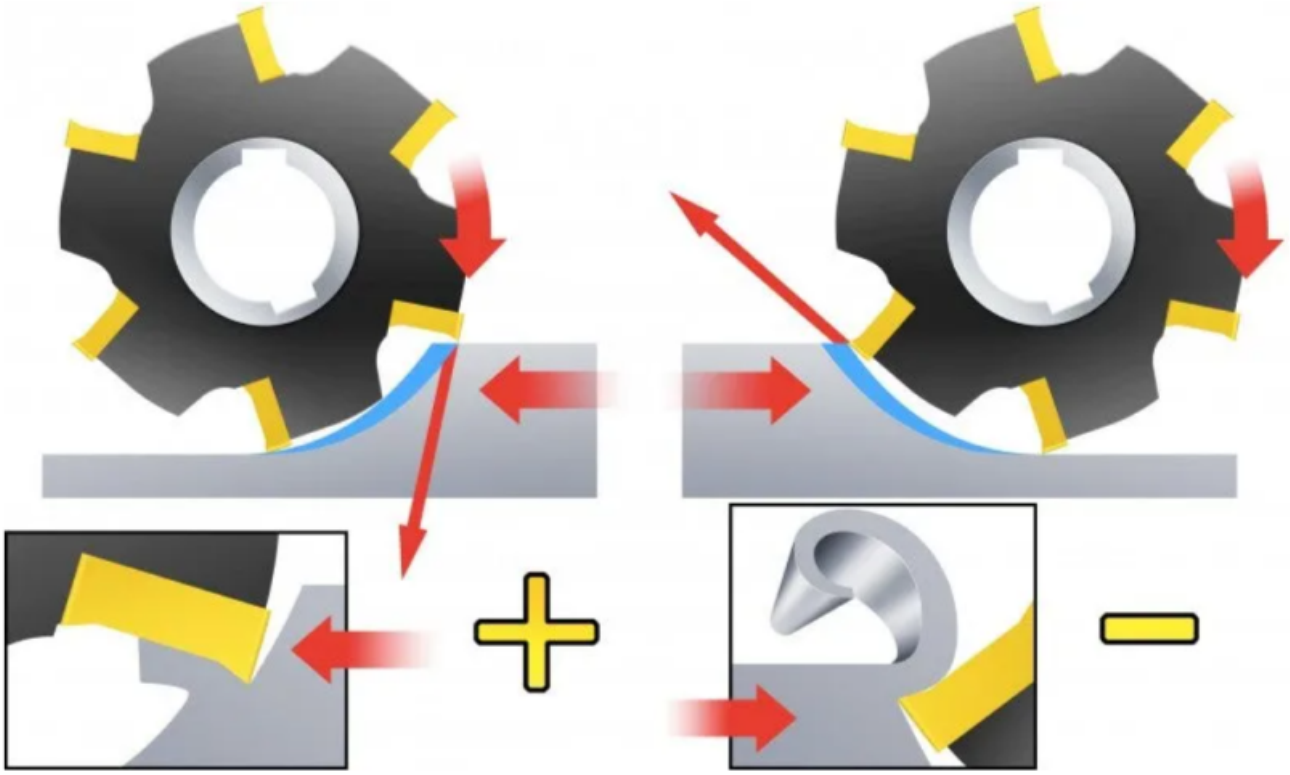


Milling

Down Milling vs. Up Milling

Brought To You by Sandvik Coromant | Nov 26, 2024



Each time a milling edge enters a cut, it is subjected to a shock load. The right type of contact between the edge and material at the entry and the exit of a cut must be considered for successful milling. In a milling operation, the workpiece is fed either along or against the direction of the cutter rotation, which affects the start and finish of the cut, as well as if down milling or up milling method is used.

The golden rule in milling – thick to thin

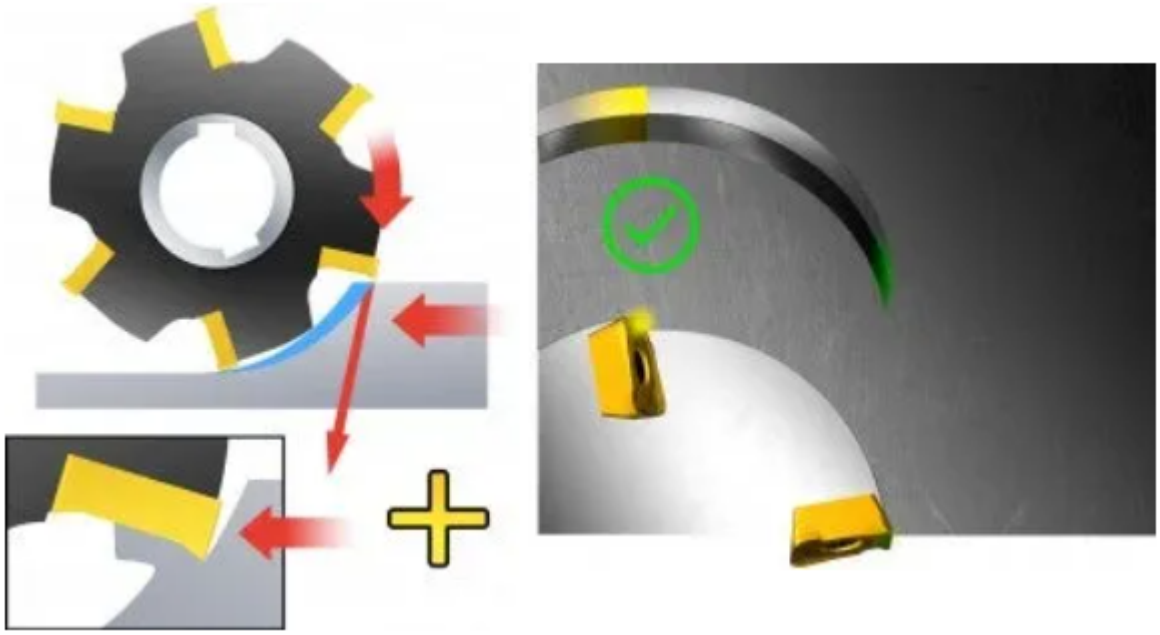
When milling, you always need to consider how the chips are being formed. The cutter position forms the chips, and you should always aim for thick chips upon entry and thin chips upon exit to ensure a stable milling process.

Remember the golden rule in milling – thick to thin – to ensure the lowest chip thickness possible when exiting a cut.

Down milling

In down milling (climb milling), the cutting tool is fed in the direction of rotation. Down milling is always the preferred method whenever the machine tool, fixture and workpiece will allow for it.

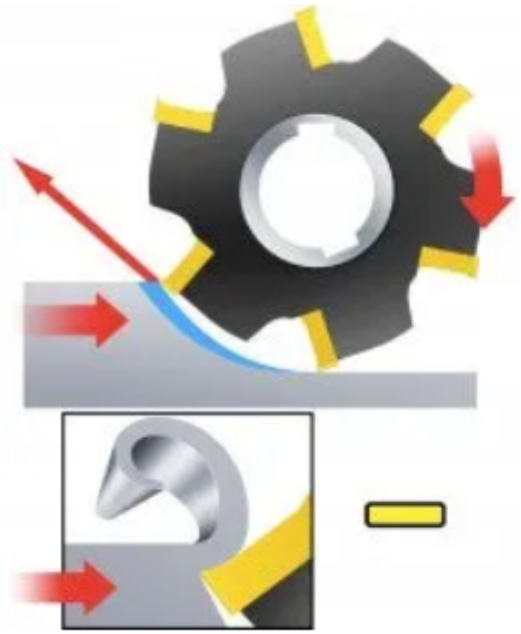
In peripheral down milling, the chip thickness decreases from the start of cut, gradually reaching zero by the end of cut. This prevents the edge from rubbing and burnishing against the surface before engaging in the cut.



Up milling

In up milling (conventional milling), the feed direction of the cutting tool is opposite to its rotation.

The chip thickness starts at zero and increases toward the end of the cut. The cutting edge has to be forced into the cut, creating a rubbing or burnishing effect due to friction, high temperatures and often contact with a work-hardened surface caused by the preceding edge. All this reduces tool life.



The thick chips and higher temperature at the exit from cut cause high tensile stress that reduces tool life and often results in rapid edge failure. It can also cause chips to stick or weld to the cutting edge, which will then carry them around to the start of the next cut or cause momentary edge frittering.

Cutting forces tend to push the cutter and workpiece away from each other and radial forces tend to lift the workpiece from the table.

Up milling may be advantageous when large variations in working allowance occur. It is also recommended to use up milling when using ceramic inserts in heat resistant alloys, because ceramics are sensitive to impact at workpiece entry.

Workpiece fixtures

Feed direction of the tool places different demands on the workpiece fixture. During up milling, it should resist lifting forces. During down milling, it should resist pulling forces.

Previously Featured on Sandvik Coromant's blog.

