

TungTech

Tungaloy Technical Articles

MillLine
DO FORCE TRI
TUNGALOY

As powerful as it looks, a perfect solution for accelerated machining

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TUNG FORCE
TUNGALOY ACCELERATED MACHINING

Shoulder milling has become one of the most popular forms of milling, amounting to more than 30% of all milling operations worldwide.

“Over the years, shoulder milling has seen multiple phases of technological advancements.”

Dating back to the beginning with HSS endmills to brazed endmills and followed by solid carbide endmills to indexable milling cutters, shoulder milling has always been the most popular style for not only milling a shoulder or a wall but also milling close to a jig or a fixture to avoid interference. Generally, in machining automotive components, the first operation OP10 for machining datums is done by the shoulder mills.

Starting with a 2-cornered single-sided indexable insert, the design changed to a 4-cornered single-sided insert in a square shape which was popular for a long time. This square insert had a very small clearance at the bottom when positioned at 90 degrees and was unable to use all four cutting edges as secondary cutting edges were often damaged during use. Ramping was also impossible with this design. Countering this challenge and with advancements in design and manufacturing technology of pressing and sintering, Tungaloy developed a 4 cornered, high helical, double sided insert - Dorec.



TungTech "DoForce-Tri: As powerful as it looks, a perfect solution for accelerated machining"

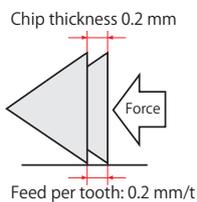
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PRESSING THE PEDAL OF ACCELERATION

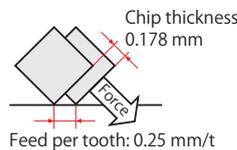
In continuation to the development, Tungaloy has recently launched a new 6-cornered, double-sided insert in its TUNGFORCE MillLine; DoForce-Tri, an economical shoulder mill with outstanding productivity. The key of the design philosophy behind the development of DoForce-Tri was offering Accelerated Machining to customers while adding flexibility and prolonging tool life.

In shoulder milling, chip thickness (hm) is directly proportional to the feed per tooth, unlike the operation by 45° cutters where the hm is 70% of the feed or high-feed cutters where the hm is 30% of the feed per tooth. Moreover, the cutting force due to the feed is perpendicular to the axis, which may result in bending the spindle. These factors increase the vibrations and reduce productivity.

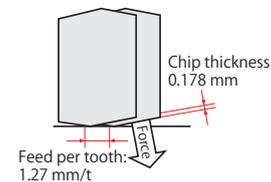
90-degree Cutter



45-degree Cutter

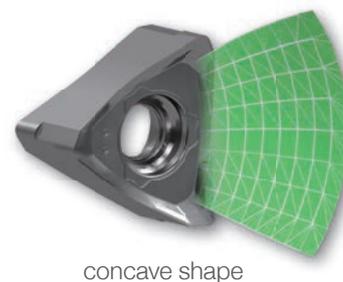
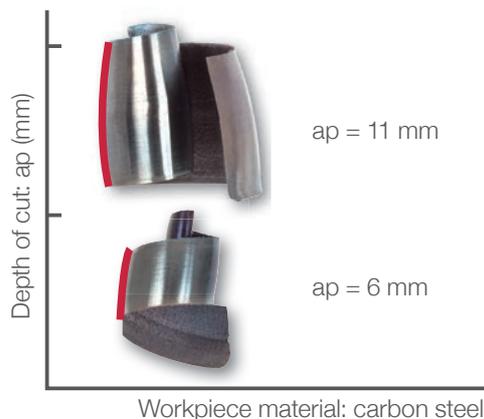


High-Feed Milling



DoForce-Tri's cutting edge is designed with a high positive rake face and an optimized cutting edge geometry which reduce cutting force while preventing fracture or other damages. This allows higher feed rates with less worry.

"Another key aspect of the cutting edge design is its concave shape, designed to form barrel-shaped chips, which is a sign of smooth curling and easy evacuation."





The unique corner geometry of the DoForce-Tri insert features a dedicated wiper and corner radius for each cutting edge without compromise on the length of the cutting edge. Unlike other 6-cornered inserts, DoForce-Tri has the ability to use the full cutting edge length of the insert. The wiper edge was also designed with a large radius, delivering a smooth finish. Its barrel-shaped chips ensure that, even at full depth, there is no chip jamming in the gullet. It also prevents chips from hitting on the work surface, maintaining a clean end result.

"These advantages make DoForce-Tri an ideal choice for shoulder milling, not only as an economical solution but also as a complete package for Accelerated Machining."

The case story below is one of the many cases where DoForce-Tri has been able to improve productivity and work surface due to the advantages of its low cutting force and modern design optimizations.



CASE STORY: AUTOMOTIVE

Workpiece: Part of offroad equipment

Material: C40 – Non-alloy steel

DoForce-Tri:

Cutter: TPTN12M080B27.0R06

Insert: TNGU120708PER-MJ AH3135

Cutting conditions:

$V_c = 181$ m/min (603 sfm)

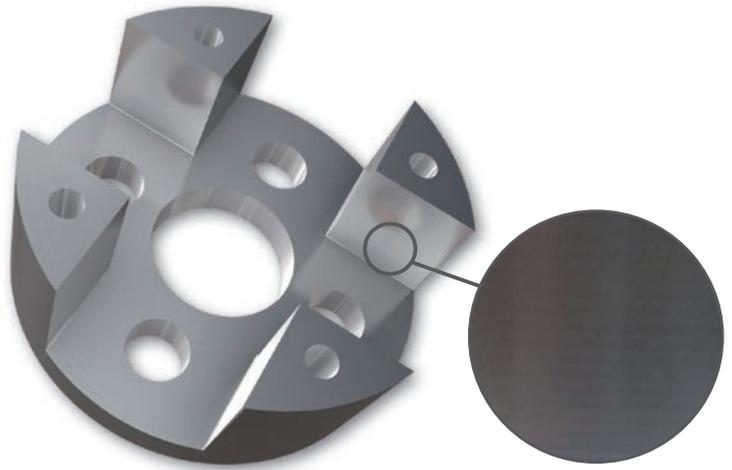
$a_p = 4$ mm (0.16") Vs. 1.5 mm (competitor)

$f = 0.15$ mm/tooth (0.006 ipt)

$V_f = 650$ mm/min (25.6 ipm)

Machine: Horizontal M/C

Coolant: Dry



Result: Larger machining depth required longer overhang of the tool which caused competitors insert chipping, forcing the customer to maintain lower depth of cut. Moreover achieving better wall surface finish in multiple passes was also a key factor.

"DoForce-Tri was able to improve productivity and also achieve better wall surface finish."

TYPICAL PARTS:

