

Number 0004 - May 2015

Tung TECH

Tungaloy Technical Articles

DrillLine

TUNGSIX-DRILL

TUNGALOY

Revolutionary Solution for Setup with Low Rigidity

by Kedar Bhagath (Rotate Product Manager)



Holemaking is one of the major operations in machining today, and almost 30% of the cutting tools are used for drilling. On an average, at least 1 hole is drilled for every machined component, which means that the market potential for drilling tools is very high.

"Over the years, drilling has undergone a lot of changes in design - from HSS drilling tools to indexable insert types, then head-replaceable drills recently, such as Tungaloy's DrillMeister."

Drills with indexable inserts are the most economical for mass production when the cycle time for drilling a component is fixed or when the machines are not rigid enough to use DrillMeister that is capable of machining at 3 times higher feed rate compared to its counterparts.



DESIGN REVOLUTION: SINGLE SIDE TO DOUBLE SIDES

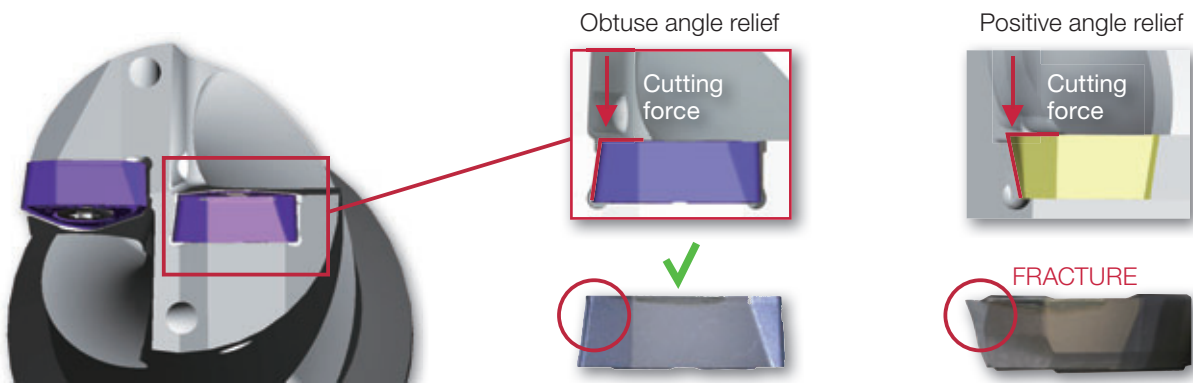
Improvement in the indexable drills is found mainly in the insert geometry and grade. Also, the number of cutting edges has changed from 3 (ISO type, WCMT insert) to 4 (square or parallelogram insert). It is a revolution that Tungaloy has created TungSix-Drill – the world's first indexable drill that features double-sided insert with 6 cutting edges to reduce tooling cost.



"TungSix-Drill broke the myth that double-sided inserts are not suitable for drilling, and the insert has dedicated and optimized chipbreakers for the central and peripheral positions on the tool body."

RESISTANCE TO PREMATURE BREAKAGE: MORE CONFIDENCE IN MACHINING

In the center of the rotating drill head, the cutting speed is zero, and cutting occurs mainly as a result of shearing. Under such situation, the force at the center is mostly impact. Conventional single-sided inserts have flank clearance, resulting in included angle between the cutting edge and the flank to be acute (i.e. less than 90°). That makes the inserts weak and susceptible to premature breakage and reduced tool life, which leads to damages on the drill body. TungSix-Drill's insert has an obtuse-shaped flank, resulting in the included angle between the cutting edge and flank to be greater than 90° , which increases resistance to premature breakage in drilling.



CUTTING FORCE: BETTER THAN THE BEST

The rake geometry of TungSix-Drill's insert is designed to achieve similar or even lower cutting force compared to the conventional single-sided inserts, which reduces the spindle load and power consumption of the machine. TungSix-Drill eliminates the apprehension of having higher cutting force in drilling due to its double-sided shape. An example of this fact is shown below in the drilling of piston hole on connecting rod.

Connecting rod is a component that is known to be tricky for drilling since its clamping is not very rigid for machining. In drilling of the piston hole, the unstable clamping with the component makes the workpiece and tool susceptible to vibration and, in case of the conventional inserts, subject to chipping on the cutting edge and breakage at the corner. Hence, it is important to keep the cutting force low in order to avoid lift-up or movement of the component due to its weak clamping.

As cited in the following case story, TungSix-Drill has proved to be the best and economical tool even under such circumstances. The DJ chipbreaker of the insert has strong geometry which avoids chipping. Also, the AH9030 grade with PremiumTec, Tungaloy's special surface technology, reduces friction between chips and rake face, thereby extending tool life.



"The strong geometry and resistance to corner breakage make TungSix-Drill the best choice for setup with low rigidity. Needless to say, it also has six cutting edges for reduced tooling cost."

CASE STORY: AUTOMOTIVE INDUSTRY

Workpiece: Connecting rod (forged)

Material: S50C / C55

TungSix-Drill:

Drill: TDS235F25-2 ($\phi D_c = 23.5$ mm)

Insert: WWMU05X205R-DJ AH9030

Cutting condition:

$V_c = 180$ m/min (590 sfm)

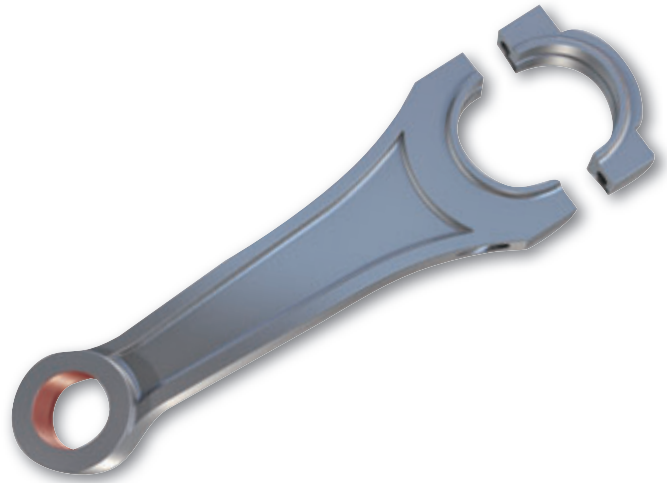
$f = 0.07$ mm/rev (0.0028 ipr)

$V_f = 171$ mm/min (6.73 ipm)

$H = 35$ mm (1.38")

Machine: Special designed machine (Vertical type)

Coolant: Wet (Internal supply)



Result: TungSix-Drill had usual wear on cutting edges and no chipping occurred after machining 1000 pcs. The competitor had chipping on the central cutting edge after machining 800 pcs.

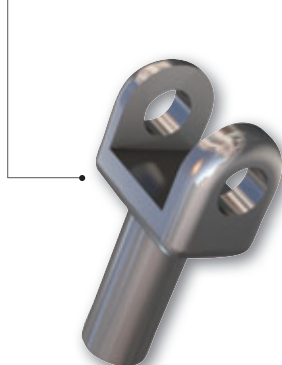
"TungSix-Drill provides highly efficient machining and helps customers increase their productivity for not only the automotive parts but also for a wide range of drilling applications in other industries."

TYPICAL PARTS:

• Knuckle arm



• Yoke



• Rail

