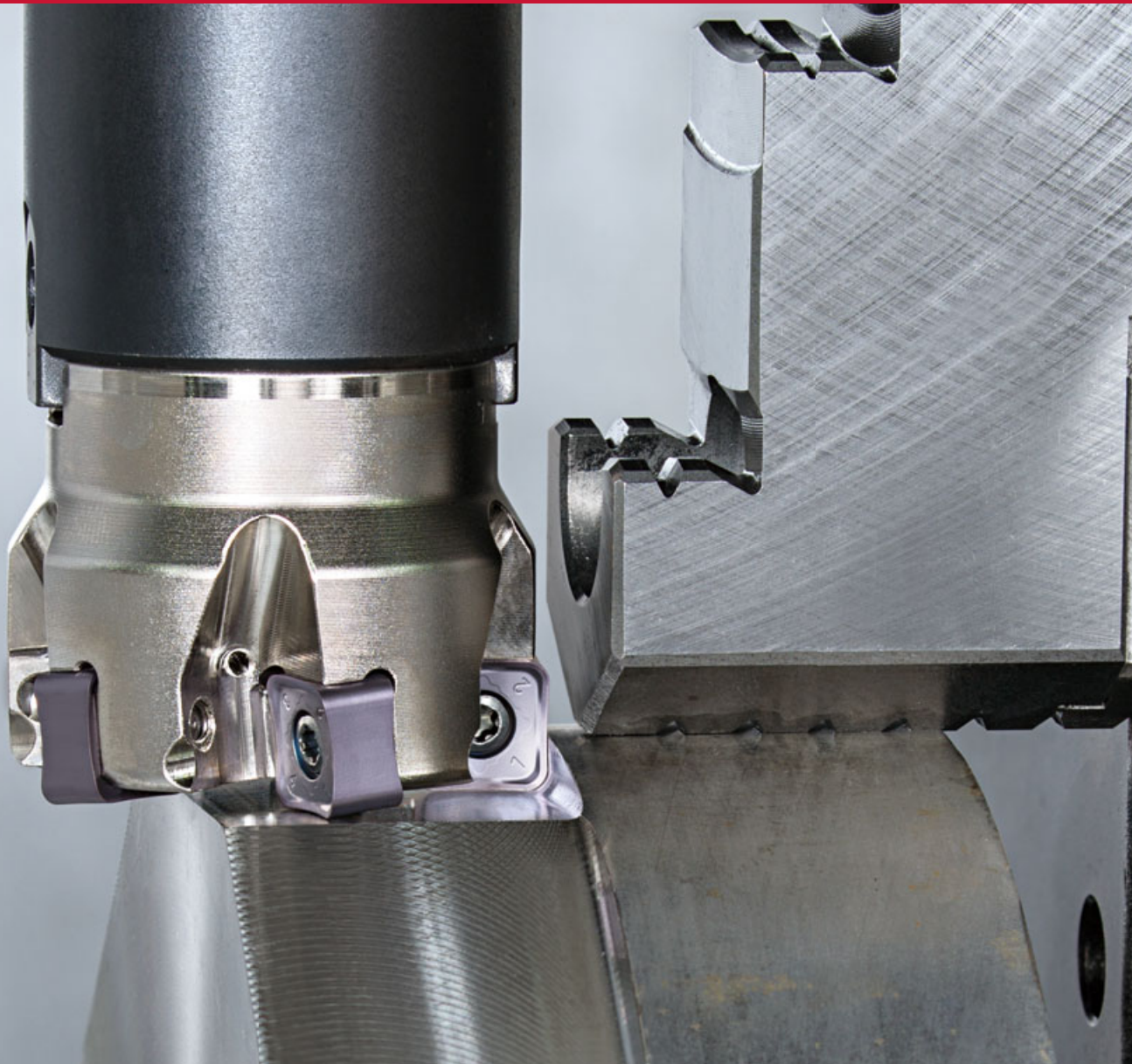


DOQ^{UAD}MILL

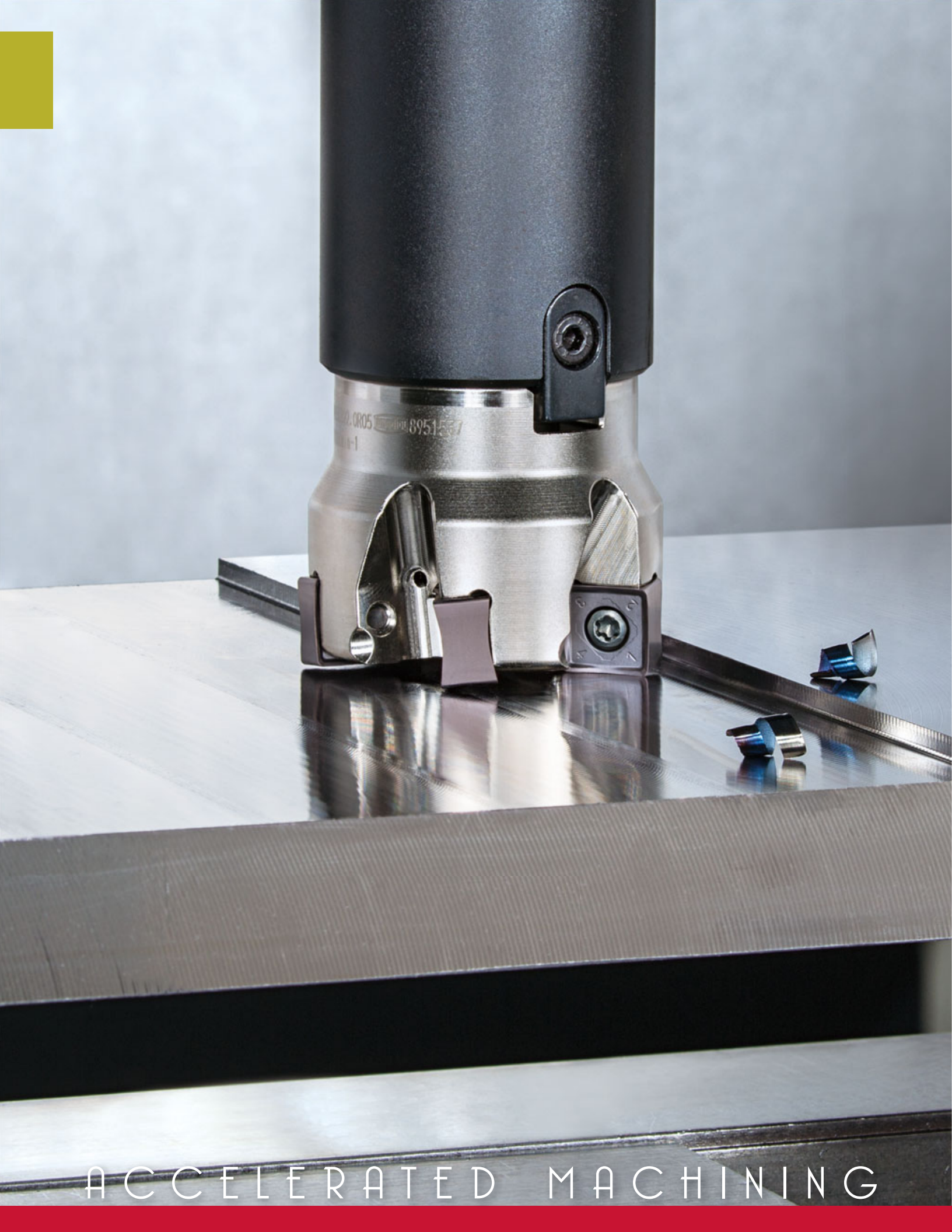
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Tungaloy Report No. 522-US

Face Milling Cutter with 8 Cutting Edge Insert for **Ultimate Clearance**



INDUSTRY 4.0
FEED the SPEED!



ACCELERATED MACHINING



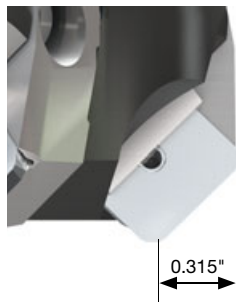
Milling cutter with 8 cornered insert for high utilization
in face milling operations

Improves surface finishing quality around fixtures, clamping systems, and side walls.

Face milling cutter with maximum clearance and economy

Designed to avoid tool interference in rough and finish face milling operations

Provides better clearance and economy



Conventional cutter
4 cutting edges



DOQ^{UAD}MILL
8 cutting edges

No interference with side walls, fixtures, and clamping systems



✓ Clear



✓ Clear

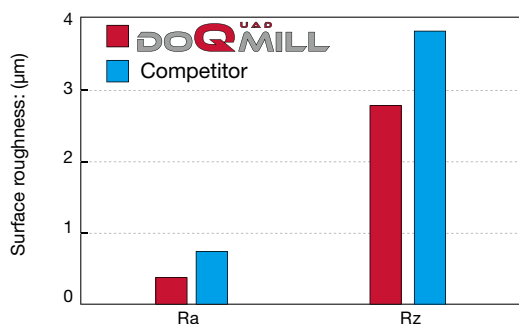
High accuracy

M4 clamp screw and optimized insert seat ensure secure insert retention



Wiper insert is also available for precision surface finish requirements

Available in R0.031" (with built-in wiper), R0.047", and R0.079"

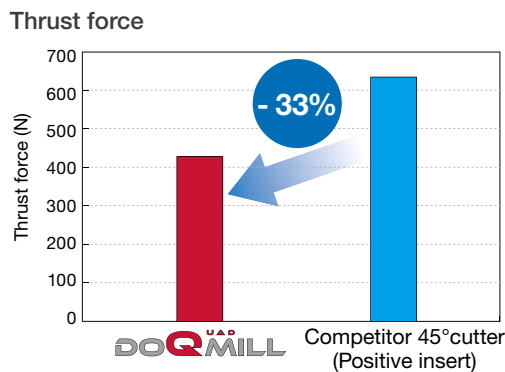
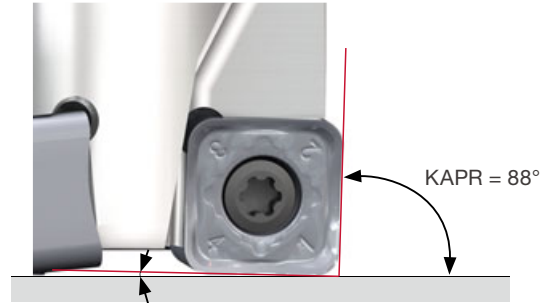


Cutter	: THSN12U2.00B0.75R05 ($\phi = 2"$, $z = 5$)
Insert	: SNMU120608HNEN-MM AH3135
Workpiece material	: 4140 (H)
Cutting speed	: $V_c = 656$ sfm
Feed per tooth	: $f_z = 0.006$ ipt
Depth of cut	: $a_p = 0.020"$
Width of cut	: $a_e = 1.2"$
Coolant	: Wet

Cutter design optimized for low cutting force and chattering prevention

- The insert's cutting edge features a large rake angle which generates low cutting load, while the large entering angle reduces lifting of the workpiece to ensure stability.

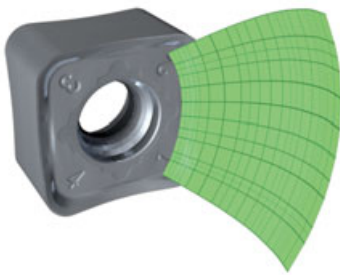
➔ Ideal for milling workpieces with thin wall/base or when the fixture is weak



P Steel Cutter : THSN12U2.00B0.75R05
 (ø = 2", z = 1)
 Insert : SNMU120608HNEN-MM AH3135
 Workpiece material : 1049
 Cutting speed : Vc = 492 sfm
 Feed per tooth : fz = 0.006 ipt
 Depth of cut : ap = 0.118"
 Width of cut : ae = 1.2"
 Coolant : Wet

Stable cutting performance due to the concave shape cutting edges

Creates barrel-shape chips for effective chip evacuation, eliminating re-cutting in all operations including slotting.



Chip formation (slotting)



P Steel Cutter : THSN12U2.00B0.75R05
 (ø = 2", z = 5)
 Insert : SNMU120620EN-MM AH3135
 Workpiece material: 4140 (270HB)
 Cutting speed : Vc = 656 sfm
 Feed per tooth : fz = 0.008 ipt
 Depth of cut : ap = 0.354"
 Width of cut : ae = 2"
 Coolant : Dry

Reinforced insert with resistance to fracture



Comparison of insert toughness

	Feed: fz (ipt)		
	0.004	0.008	0.012
DOQ MILL	OK	OK	OK
Competitor	OK	OK	Fractured

P Steel Cutter : THSN12U2.00B0.75R05
 (ø = 2", z = 5)
 Insert : SNMU120620EN-MM AH3135
 Workpiece material: 4140 (270HB)
 Cutting speed : Vc = 656 sfm
 Feed per tooth : fz = 0.004 - 0.012 ipt
 Depth of cut : ap = 0.197"
 Width of cut : ae = 1.2"
 Coolant : Dry

Insert grades selection for various materials

- A total of four grades, including two CVD grades

AH3135

P

M

Steel Stainless

- PVD grade for high fracture resistance
- Most suitable for steel and stainless steel in general cutting parameters

AH120

P

K

Steel Cast iron

- PVD grade with a well-balanced wear and fracture resistance
- Ideal for general machining of steel and stainless steel

T1215

K

Cast iron

- CVD grade with outstanding wear and chipping resistance
- Best for cast iron at high-speed machining

T3225

P

M

Steel Stainless

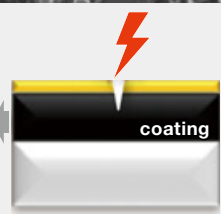
- CVD grade with excellent chipping and fracture resistance
- Most suited for steel and stainless steel at high-speed machining

Special Surface Technology

PREMIUMTEC
TUNGALOY



Indentation test on coating

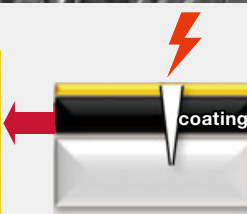


PremiumTec controls tensile residual stress and improves crack resistance.

Conventional item

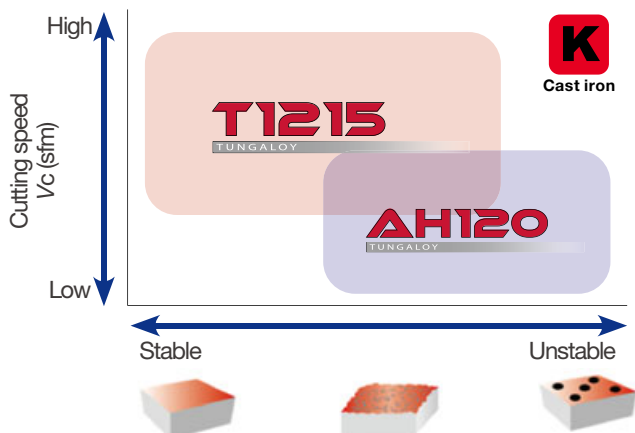
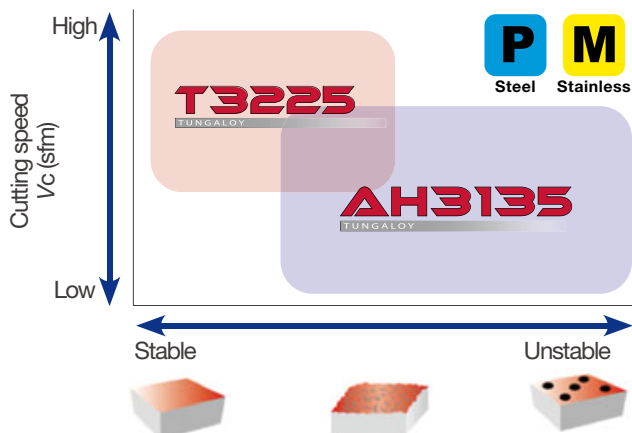


Indentation test on coating



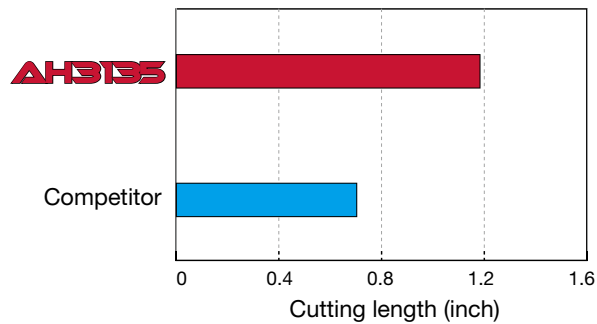
CVD coat by nature has high tensile residual stress allowing crack propagation easily.

PremiumTec technology enhances both smoothness and toughness on coating surface, improving resistance to chipping, built-up edge, and fracture.



Tool life

- Tool life comparison in machining carbon steel



P Steel

Cutter : THSN12U2.00B0.75R05
($\phi = 2"$, $z = 5$)

Insert : SNMU120620EN-MM AH3135

Workpiece material: 4140 (270HB)

Cutting speed : $V_c = 656$ sfm

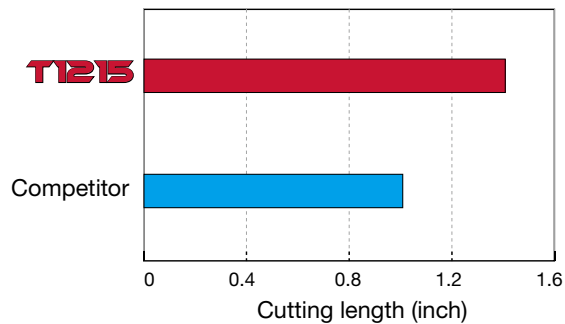
Feed per tooth : $f_z = 0.007$ ipt

Depth of cut : $a_p = 0.118"$

Width of cut : $a_e = 1.2"$

Coolant : Dry

- Tool life comparison in machining ductile cast iron



K Cast iron

Cutter : THSN12U2.00B0.75R05
($\phi = 2"$, $z = 5$)

Insert : SNMU120620EN-MM T1215

Workpiece material: 80-55-06 (160HB)

Cutting speed : $V_c = 1148$ sfm

Feed per tooth : $f_z = 0.005$ ipt

Depth of cut : $a_p = 0.118"$

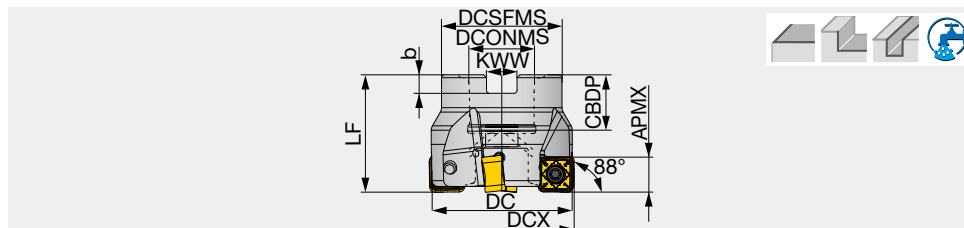
Width of cut : $a_e = 1.2"$

Coolant : Dry

THSN12

88° face mills with double sided square inserts

GAMP = +3°, GAMF = -11°



Designation	APMX	DC	DCX	CICT	DCSFMS	LF	DCONMS	CDBP	KWW	b	WT(lb)	Air hole	Insert
THSN12U2.00B0.75R04	0.374	2	2.024	4	1.85	1.575	0.75	0.75	0.315	0.197	0.92	with	SNMU1206...
THSN12U2.00B0.75R05	0.374	2	2.024	5	1.85	1.575	0.75	0.75	0.315	0.197	0.91	with	SNMU1206...
THSN12U2.50B0.75R04	0.374	2.5	2.524	4	1.85	1.575	0.75	0.75	0.315	0.197	1.22	with	SNMU1206...
THSN12U2.50B0.75R06	0.374	2.5	2.524	6	1.85	1.575	0.75	0.75	0.315	0.197	1.22	with	SNMU1206...
THSN12U3.00B1.00R05	0.374	3	3.024	5	1.969	1.969	1	1.024	0.374	0.236	2.12	with	SNMU1206...
THSN12U3.00B1.00R08	0.374	3	3.024	8	1.969	1.969	1	1.024	0.374	0.236	2.09	with	SNMU1206...
THSN12U4.00B1.50R06	0.374	4	4.024	6	3.15	1.969	1.5	1.299	0.626	0.394	3.64	without	SNMU1206...
THSN12U4.00B1.50R08	0.374	4	4.024	8	3.15	1.969	1.5	1.299	0.626	0.394	3.55	without	SNMU1206...

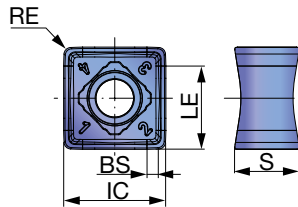
SPARE PARTS



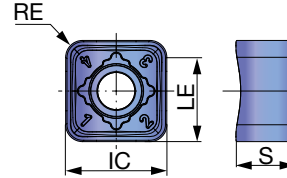
Designation	Clamping screw	Torx bit	Grip
THSN12U...	CSPB-4	BLDIP15/S7	H-TB2W

INSERT

SNMU120608HNEN-MM



SNMU120612/20EN-MM



P	Steel	☆	★	★
M	Stainless		★	★
K	Cast iron	★		★
N	Non-ferrous			
S	Superalloys	★	☆	
H	Hard materials			

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated				LE	S	IC	BS
			AH120	AH3135	T1215	T3225				
*SNMU120608HNEN-MM	0.031	0.374	●	●	●	●	0.386	0.295	0.472	0.055
*SNMU120612EN-MM	0.047	0.374		●	●		0.425	0.285	0.472	-
SNMU120620EN-MM	0.079	0.374		●	●		0.394	0.276	0.472	-

*To be released in 2019 January

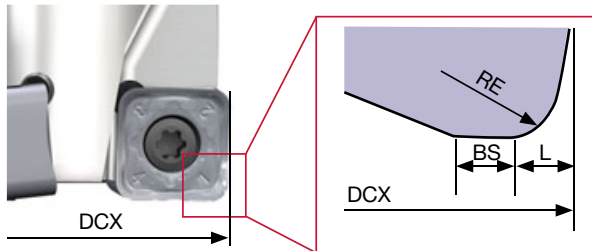
●: Line up

STANDARD CUTTING CONDITIONS

ISO	Workpiece materials	Hardness HB	Selection criteria	Recommended grade	Chip-breaker	Cutting speed Vc (sfm)	Feed per tooth fz (ipt)
P	Low carbon steels (1015, etc.)	- 200 HB	First choice	AH3135	MJ	328 - 820	0.002 - 0.012
		- 200 HB	Priority on wear resistance	T3225	MJ	656 - 1148	0.002 - 0.010
	High carbon steels, alloyed steels (1055, 4140(H), etc.)	- 300 HB	First choice	AH3135	MJ	328 - 820	0.002 - 0.012
		- 300 HB	Priority on wear resistance	T3225	MJ	591 - 984	0.002 - 0.010
	Prehardened steel (NAK80, PX5, etc.)	30 - 40 HRC	First choice	AH3135	MJ	328 - 656	0.002 - 0.010
		30 - 40 HRC	Priority on wear resistance	T3225	MJ	492 - 820	0.002 - 0.008
M	Austenitic stainless steel (304,316, etc.)	- 200 HB	First choice	AH3135	MJ	328 - 656	0.002 - 0.010
		- 200 HB	Priority on wear resistance	T3225	MJ	328 - 820	0.002 - 0.008
	Stainless cast steel (Hu etc.)	-	First choice	T3225	MJ	197 - 394	0.002 - 0.008
		-	Priority on fracture resistance	AH3135	MJ	197 - 394	0.002 - 0.008
K	Grey cast iron (No.250, etc.)	150 - 250 HB	First choice	T1215	MJ	328 - 1148	0.002 - 0.012
		150 - 250 HB	Priority on fracture resistance	AH120	MJ	328 - 820	0.002 - 0.012
	Ductile cast iron (65-45-12, etc.)	150 - 250 HB	First choice	T1215	MJ	328 - 1148	0.002 - 0.010
		150 - 250 HB	Priority on fracture resistance	AH120	MJ	262 - 656	0.002 - 0.012
S	Titanium alloy (Ti-6Al-4V, etc.)	- 40 HRC	First choice	AH3135	MJ	98 - 197	0.002 - 0.008
	Heat resistant alloy (Inconel718, etc.)	- 40 HRC	First choice	AH120	MJ	33 - 131	0.002 - 0.006
H	Hardened steel (H13)	40 - 50 HRC	First choice	AH3135	MJ	262 - 427	0.002 - 0.006
	Hardened steel (D2, etc.)	50 - 60 HRC	First choice	AH120	MJ	164 - 230	0.001 - 0.003

Tool offset

To eliminate uncut amount in face milling operation, adjust the programming according to the offset (L) listed below.



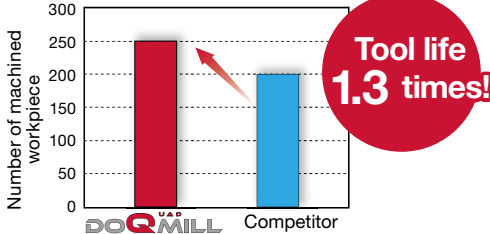
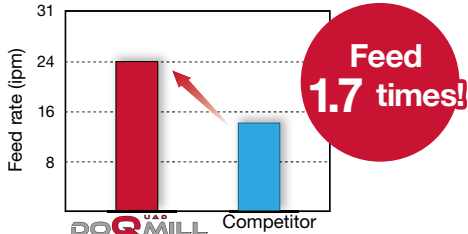


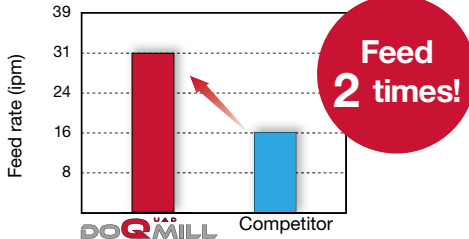
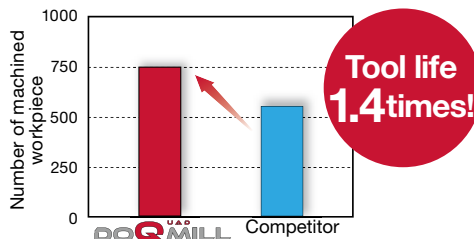


Designation	RE	BS	L
SNMU120608HNEN-MM	0.031	0.055	0.051
SNMU120612EN-MM	0.047	-	0.067
SNMU120620EN-MM	0.079	-	0.098

The following table shows the amount overcut (t) when the cutter is used as a shoulder milling cutter.

Designation / ap (inch)	0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354	0.374
SNMU120608HNEN-MM	0.0004	0.0016	0.0020	0.0020	0.0028	0.0035	0.0055	0.0079	0.0106	0.0106
SNMU120612EN-MM	-	0	0	0.0004	0.0008	0.0020	0.0035	0.0059	0.0087	0.0098
SNMU120620EN-MM	-	0	0	0	0.0008	0.0020	0.0035	0.0059	0.0087	0.0098

PRACTICAL EXAMPLES

Workpiece type		Steering knuckle	Shaft
Cutter		THSN12U2.00B0.75R04 ($\phi 2"$, $z = 4$)	THSN12U2.00B0.75R04 ($\phi 2"$, $z = 4$)
Insert		SNMU120620EN-MM	SNMU120620EN-MM
Grade		AH3135	AH3135
Workpiece material		65-45-12	Alloy steel (35HRC)
		 K	 P
Cutting conditions	Cutting speed : V_c (sfm)	466	774
	Feed per tooth : f_z (ipr)	0.009	0.004
	Feed speed : V_f (ipm)	31.496	23.622
	Depth of cut : a_p (inch)	0.079	0.079
	Cutting width : a_e (inch)	1.181	1.378
	Method of machining	Face milling	Face milling
	Coolant	External	External
	Machine	Vertical M/C	Vertical M/C
Results		 <p>Despite poor workpiece rigidity, DoQuad-Mill provided low cutting load and tool life predictability.</p>	 <p>Robust DoQuad-Mill improved machining efficiency over the competitor's shoulder milling cutter.</p>
Workpiece type		Shaft	Connecting rod
Cutter		THSN12U2.00B0.75R04 ($\phi 2"$, $z = 4$)	Special designed endmill ($\phi 40\text{mm}$, $z = 3$)
Insert		SNMU120620EN-MM	SNMU120620EN-MM
Grade		AH3135	AH3135
Workpiece material		Alloy steel	Forged steel (28HRC)
		 P	 P
Cutting conditions	Cutting speed : V_c (sfm)	515	525
	Feed per tooth : f_z (ipr)	0.008	0.004
	Feed speed : V_f (ipm)	31.496	15.039
	Depth of cut : a_p (inch)	0.079	0.079
	Cutting width : a_e (inch)	1.575	1.575
	Method of machining	Shoulder milling	Shoulder milling
	Coolant	External supply	External supply
	Machine	Vertical M/C	Vertical M/C
Results		 <p>Conventional shoulder mill could not improve feed due to insert fracture. DoQuad-Mill doubled feed thanks to its high cutting edge integrity.</p>	 <p>Short insert life due to fracture was more common with conventional shoulder mill. DoQuad-Mill improved tool life thanks to its high cutting edge integrity.</p>

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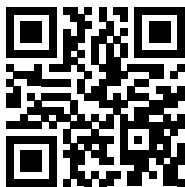
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