Member IMC Group Tungaloy INDUSTRY 4.0

MillLine

AHB TOOLING & MACHINERY

COMPLETE METALWORKING SOLUTIONS

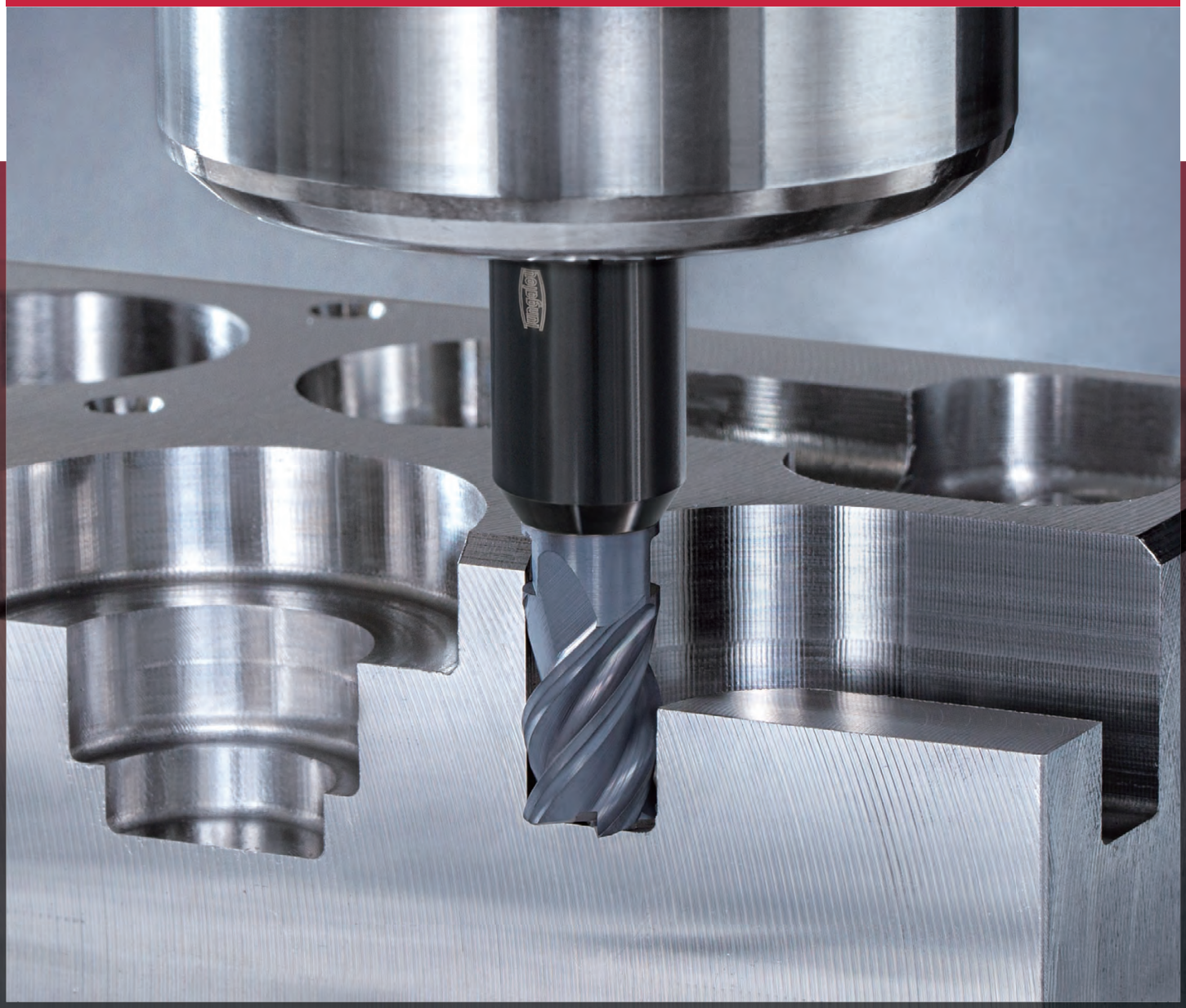
(800) 991-4225 www.ahbinc.com
ISO Certified customerservice@ahbinc.com

Exchangeable head endmill

TUNGMEISTER

Tungaloy Report No. 381-US

Exchangeable Head Endmill Series



TUNGALOY ADDFORCE ACCELERATED LINES


INDUSTRY 4.0
FEED the SPEED!

TUNGALOY

ADDFORCE MILL

ACCELERATED MILLING

TUNGMEISTER

13,000 combinations for optimal performance

TUNGMEISTER

Optimal tool combination for maximum productivity

Significantly reduced tool indexing time improves machining efficiency

1 Wide range of geometries

45 kinds of geometries are available. The head indexing is easy and highly accurate with the precision thread.

2 Three kinds of shank material

Users can choose the most suitable combination according to the machining parameters, length and application required.

Steel: For general purpose
Carbide: For highly accurate machining due to excellent rigidity
Tungsten: Reduced chattering due to high vibration damping capacity


Straight shank & neck


Straight shank & taper neck


Straight shank & neck (carbide)


Straight (for slotting)

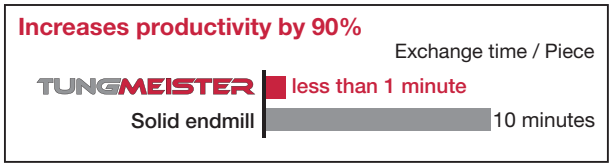

High rigidity shank


ER collet


Adaptor for TungFlex

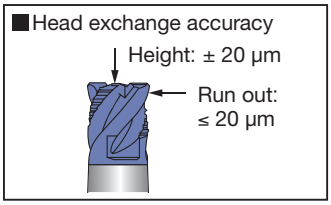
No setup time

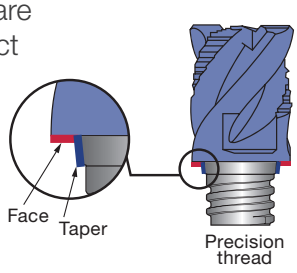
Machine downtime is decreased considerably. Simplified setup since only the head is indexed.



High accuracy and repeatability

Repeatability and accuracy are maintained due to full contact of both taper and face.



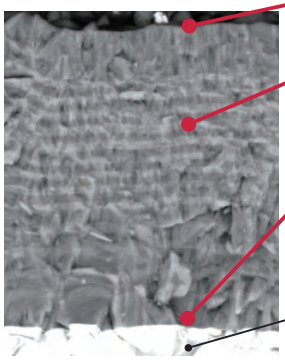


Constant and predictable tool life

Latest wear and fracture resistant grades

AH715 / AH735

Unique nano-multilayered coating using Tungaloy's latest technology providing 3 principal features.



1. Resistance to built-up edge
Coating layer to resist built-up edge

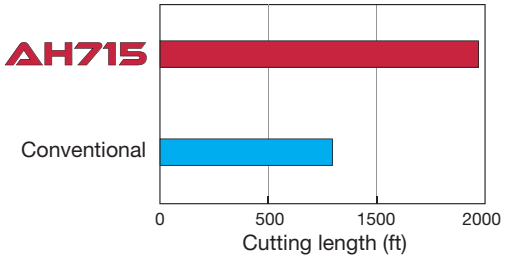
2. Resistance to wear, oxidation, and fracture
Two coating layers for wear and oxidation resistance. Layered alternatively to prevent crack from propagating to fracture

3. Strong coating-substrate adhesion
Coating is provided with strong adhesion between the coating layer and carbide substrate to prevent coating delamination

Carbide substrate
AH715: Provides a good balance of wear and fracture resistance
AH735: Chipping and fracture resistance

■ Tool life comparisons

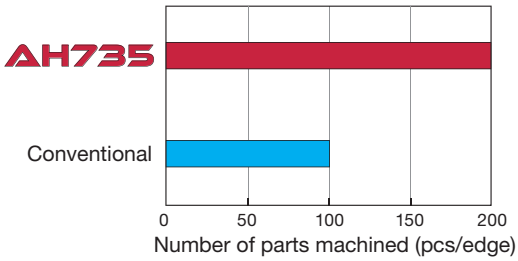
AH715 and AH735 provide better tool life performance in a wide group of materials.



P
Steel

Square

Shank	: VSSD16L100S10-S
Head	: VED160L12.0R05-04S10
Workpiece material	: 1055
Cutting speed	: *Vc* = 492 sfm
Feed per tooth	: *fz* = 0.005 ipt
Depth of cut	: *ap* = 0.197"
Width of cut	: *ae* = 0.059"
Machine	: V M/C, BT40

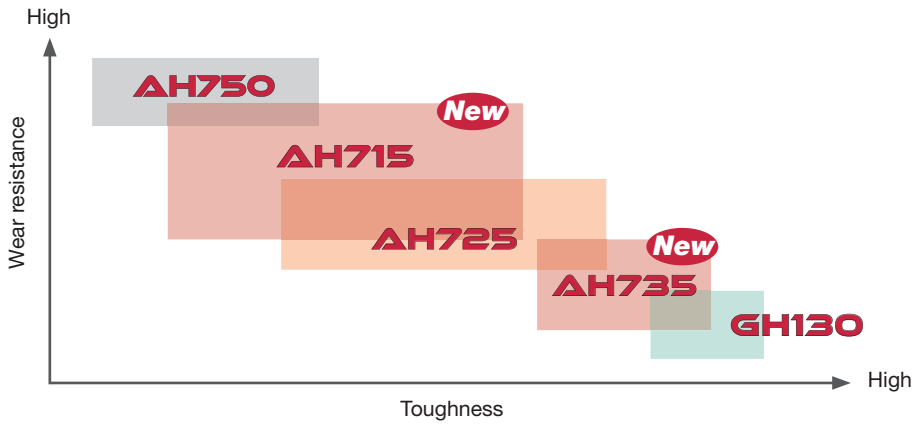


S
Superalloy

Slotting

Shank	: VSC120L100S08-C-A
Head	: VST217W2.50R020-4S08
Workpiece material	: Titanium alloy
Cutting speed	: *Vc* = 164 sfm
Feed per tooth	: *fz* = 0.004 ipt
Depth of cut	: *ap* = 0.157"
Width of cut	: *ae* = 0.098"
Machine	: Vertical M/C, HSK A63

■ Application range



Enhanced tool lineup expands the series' machining capabilities, also offering AH715 and AH735 grades

VFX

New high-feed milling head with coolant through

Optimized front internal coolant allows effective cooling of the cutting edge, while facilitating smooth chip evacuation from the cutting area.

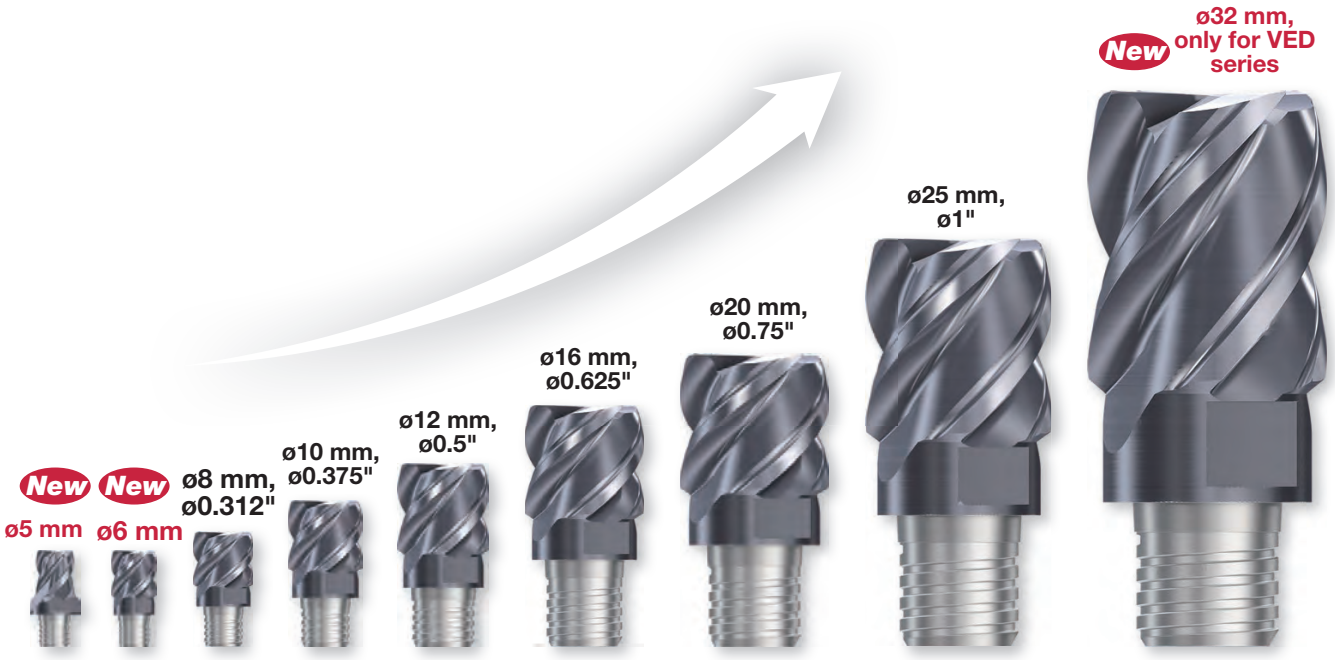
P.22 VFX**-04/06...

VEH, VEE, VED

Extensive tool diameter range from 5 to 32 mm, 0.312" to 1".

Covers a broad range of applications from precision machining to large size parts.

P.13 -



Square

VEH, VED

VEH...

VED**-07/09...

Roughing
VED**R...

Additional lineup for 1.5D long flute milling head series

New close-pitch milling head and serrated edge roughing head for expanded coverage.

P.13 -

Barrel

VBO

Lens

VBL

Bull nose

VBN

Taper barrel (long)
VBO...

Taper barrel (short)
VBO...

Lens
VBL...

Bull nose
VBN...

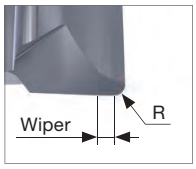
Additional lineup for 5-axis machine applications

Large radius cutting edge allows efficient finish machining of various contoured surfaces.

P.30 -

Face mill

VFM



New face milling head

The **VFM** cutting edge incorporates a built-in wiper that will provide better surface quality than standard solid carbide endmills.

P.22 VFM...

Center hole

VDP

Type A

Type B

Enhanced lineup of center drill heads for small diameter bar stocks

A center hole as small as 1.0 mm in diameter can now be created with **TungMeister**.
Now offering Type B drill.

P.37 VDP**-02...

TUNGMEISTER Quick Guide

Square, Face mill, High feed

★ : First choice ☆ : Second choice

Head geometry	Designation	Appearance	Application: Roughing	Application: Semifinishing	Application: Finishing	Tool dia.	No. of cutting edges	Cutting edge length: L/D	Cutting edge length: APMX	Feature	Corner geometry	Helix angle	CRKS	Workpiece material: P	M	K	N	S	H	Page
Square	VEH...		✓	✓	✓	ø8 mm - ø20 mm	4	0.6 - 0.8XD	5 mm - 15 mm	First choice for square head, General Variable helix, Variable pitch	Corner radius	Variable	S05 - S12	★	★	★	☆	★	☆	13
	VEH...		✓	✓	✓	ø8 mm - ø32 mm	4	1.2 - 1.5XD	12 mm - 38 mm	First choice for square head, General Variable helix, Variable pitch Long edge type (Max *ap* = 1.2 ~ 1.5XD)	Corner radius	Variable	S05 - S21	★	★	★	☆	★	☆	13
	VEE**-04... VED**-04...		✓	✓	✓	ø0.250" - ø0.750"	4	0.8XD	0.200" - 0.620"	General	Corner radius	30/45	S04 - S12	★	★	★	☆	★	☆	14
	VEE**I...		✓	✓	✓	ø0.312" - ø1"	4	0.6 - 0.8XD	0.220" - 0.860"	General Variable pitch	Corner radius/ Chamfered	38	S05 - S15	★	★	★	☆	★	☆	15
	VEE**-03...		✓	✓	✓	ø0.312" - ø5"	3	0.5XD	0.200" - 0.374"	General For key way	Corner radius	38/45	S05 - S12	★	★	★	☆	★	☆	15
	VEE**A02...		✓	✓	✓	ø0.375" - ϕ0.500"	2	0.7XD	0.270" - 0.374"	General For non-ferrous metal	Corner radius	45	S06 - S08			☆	★			16
	VEE**A03...		✓	✓	✓	ø0.312" - ϕ0.750"	3	0.6XD	0.200" - 0.470"	General For non-ferrous metal	Corner radius	45	S05 - S12			☆	★			16
	VEE**R...		✓			ø0.312" - ø1"	4, 5, 6	0.6 - 0.8XD	0.200" - 0.866"	Anti-chattering/ Serrated cutting edge	Chamfered	45	S05 - S15	★	★	★	☆	★	☆	17
	VED**R...		✓			ø8 mm - ø25 mm	4, 5, 6	1.5XD	12 mm - 37 mm	Anti-chattering/ Serrated cutting edge Long edge type (Max *ap* = 1.2 ~ 1.5XD)	Chamfered	47	S05 - S15	★	★	★	☆	★	☆	17
	VEE**C...		✓	✓		ø0.312" - ø1"	4	0.6 - 0.8XD	0.200" - 0.866"	Anti-chattering Roughing and Finishing edge combination	Chamfered	45	S05 - S15	★	★	★	☆	★	☆	18
	VED**-06..., VEE**-06...		✓	✓	✓	ø0.312" - ø5"	6	0.6 - 0.8XD	0.200" - 0.374"	Small width of cut (*ae* = 0.02XD)	Corner radius/ Chamfered	30/45/ 50	S05 - S08	☆	☆	☆		★	★	18
	VED**-08/10..., VEE**-08/10...		✓	✓	✓	ø0.625" - ø1"	8, 10	0.8XD	0.470" - 0.866"	Small width of cut (*ae* = 0.02XD)	Corner radius/ Chamfered	30/50	S10 - S15	☆	☆	☆		★	★	19
	VED**-07/09...		✓	✓	✓	ø8 mm - ø25 mm	7, 9	1.5XD	12 mm - 37 mm	Variable helix, Variable pitch Small width of cut (*ae* = 0.02XD) Long edge type (Max *ap* = 1.5XD)	Corner radius	Variable	S05 - S15	☆	☆	☆		★	★	19
Face mill	VFM...		✓	✓	✓	ø12 mm - ø25 mm	6	0.3XD	3.6 mm - 7.5 mm	Face milling	Corner radius	-	S05 - S10	★	★	★	☆	★	☆	22
High feed	VFX**-02...		✓			ø0.375" - ϕ0.750"	2	0.06XD	0.020" - 0.059"	High feed	-	-	S06 - S12	★	★	★	☆	★	★	23
	VFX**-04/06...		✓			ø12 mm, ø16 mm	4, 6	0.05XD	0.6 mm - 1.05 mm	High feed With coolant hole	-	-	S08- S10	★	★	★	☆	★	★	23

Profiling (ball, radius, barrel)

★ : First choice ☆ : Second choice

Head geometry	Designation	Appearance	Application			Tool dia.	No. of cutting edges	Feature	Helix angle	CRKS	Workpiece material						Page
			Roughing	Semifinishing	Finishing						P	M	K	N	S	H	
Ball	VBB**-BM...		✓	✓		ø0.312" - ø0.625"	2	Economical type	0	S05 - S10	★	★	★	☆	★	★	25
	VBB**-BG...				✓	ø0.312" - ø0.625"	2	High accuracy h7 For hardenened material	0	S05 - S10	★	★	★	☆	★	★	25
	VBD**-BG...			✓	✓	ø0.312" - ø0.625"	2	Low cutting force Helix cutting edge	30	S05 - S10	★	★	★	☆	★	★	25
	VBD**-BG-04... VBE**-BG-04...		✓	✓	✓	ø5 mm - ø25 mm	4	Low cutting force Helix cutting edge	30/38	S04 - S15	★	★	★	☆	★	★	25
	VBB**-SG...		✓	✓	✓	ø0.375" - ø0.750"	2	High accuracy h7 Sphere cutting edge	0	S05 - S10	★	★	★	☆	★	★	26
	VBE**-BGA...		✓	✓	✓	ø0.312" - ø0.750"	2	For non-ferrous metal	45	S05 - S12			☆	★			26
Radius	VRB**-02... VRC**-02...		✓	✓		ø0.625" - ø0.750" ø10 mm - ø20 mm	2	Economical type	0/15	S06 - S12	★	★	★	☆	★	☆	28
	VRD**-06...			✓	✓	ø0.312" - ø0.625"	6	High productivity High No.of cutting edge	30	S05 - S10	★	★	★	☆	★	☆	28
Barrel	VBO...			✓	✓	ø8 mm - ø16 mm	4, 5	High productive profiling Long edge type	30	S05 - S10	★	★	★	☆	★	☆	30
	VBO...			✓	✓	ø10 mm - ø16 mm	4	High productive profiling Short edge type	30	S06 - S10	★	★	★	☆	★	☆	30
Bull nose	VBN...			✓	✓	ø10 mm - ø16 mm	6	High productive profiling	35	S06 - S10	★	★	★	☆	★	☆	30
Lens	VBL...			✓	✓	ø8 mm - ø16 mm	6	High productive profiling	30	S05 - S10	★	★	★	☆	★	☆	31

TUNGMEISTER Quick Guide

Multi-function (chamfering, spot drill, center hole, counterboring)

★ : First choice ☆ : Second choice

Head geometry	Designation	Appearance	Center edge (Z-feed capability)	Tool dia.	No. of cutting edges	Feature	Helix angle	CRKS	Workpiece material P	M	K	N	S	H	Page
Chamfering	VCA**-04/06...		Without	ø0.375"	4, 6	Chamfering angle: 45°	0	S06 - S12	★	★	★	☆	★	☆	33
	VCW**-02...		Without	ø11.8 mm	2	Chamfering angle:45° Back chamfering capability	0	S06	★	★	★	☆	★	☆	33
	VCR**-02...		Without	ø8 mm - ø20 mm	2	Radius chamfering	0	S05 - S12	★	★	★	☆	★	☆	33
Chamfering Spot drill	VCP**-02...		With	ø8 mm - ø16.5 mm	2	Chamfering angle: 30°, 45°, 60°	0	S05 - S10	★	★	★	☆	★	☆	35
	VDS...		With	ø8 mm - ø16 mm	2	Chamfering angle: 45° Low cutting force Helix cutting edge	10	S05 - S10	★	★	★	☆	★	☆	35
Center hole	VDP**-02...		With	ø1.07 mm - ø6.46 mm	2	For center hole	0	S04 - S12	★	★	★	☆	★	☆	37
Counterboring	VGC**-02...		With	ø0.312" - ø0.625"	2	For counterboring	10	S05 - S10	★	★	★	☆	★	☆	38

Slotting

★ : First choice ☆ : Second choice

Head geometry	Designation	Appearance	Groove width	Tool dia.	No. of cutting edges	Feature	Edge shape	Helix angle	CRKS	Workpiece material P	M	K	N	S	H	Page
Slotting	VST**-3...		1.2 mm - 3.17 mm	ø15.7 mm - ø17.7 mm	3	Slotting	Corner radius	0	S06	★	★	★	☆	★	☆	39
	VST**-4/6...		0.76 mm - 10 mm	ø21.7 mm - ø27.7 mm	4, 6	Slotting	Corner radius	0	S08, S10	★	★	★	☆	☆	☆	40
	VST**A45...		3.4 mm - 5.5 mm	ø17.7 mm - ø21.7 mm	3, 4	Slotting with 45° chamfer	Chamfered	0	S06, S08	★	★	★	☆	★	☆	40
	VTB**-06...		0.125" - 0.250"	ø0.500" - ø0.875"	6	T-slotting	Corner radius	0	S05 - S10	★	★	★	☆	★	☆	41
	VTB**C15-06...		2 mm	ø13.5 mm	6	T-slotting with 45° chamfer	Chamfered	0	S05	★	★	★	☆	★	☆	41

DESIGNATION SYSTEM

Shank

V	SS	037	L300	S	06	U	S
①	②	③	④	⑤	⑥	⑦	⑧

① Series	
V	TungMeister

② Shank type	
SS	Straight neck
TS	Taper neck
SC	Slotting
ST	for T-Slotting
AD	TungFlex adapter

③ Shank diameter (in)	
031	ø0.315
037	ø0.375
050	ø0.500
062	ø0.625
075	ø0.750
100	ø1.000

④ Length (in)	
L300	3.000

⑤ Shape of shank	
S	Cylindrical
W	Weldon

⑥ Connection screw size	
05	S05
06	S06
08	S08
10	S10
12	S12
15	S15

⑦ Additional feature	
U	Inch

⑧ Shank material	
S	Steel
C	Carbide
W	Tungsten

Head

- Square endmill

V	E	E	031	L20	R000	-	U	03	S05
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

- Ball nose endmill

V	B	D	075	L62	-	BG	-	U	04	S12
①	②	③	④	⑤		⑥	⑦	⑧	⑨	⑩

① Series	
V	TungMeister

② Cutting edge	
E	Square
B	Ball
R	Radius
FX	for high feed
CA	for chamfering
CP	Spot drilling
CW	for chamfering (front and back)
CR	for R chamfering
GC	for counter boring
DP	for center drilling
S	for slotting
T	for T-slot milling

③ Helix angle / Rake face	
B	0°
C	15°
D	30°
E	38° ~ 50°
F	60°
T	Land
H	Variable helix

④ Diameter (in)	
050	ø0.500
100	ø1.000

⑤ Cutting edge length (in)	
Length	
L37	0.375
L87	0.875

⑥ Corner shape / Angle	
Chamfer type	
C006	0.006 x 45°
C012	0.012 x 45°
C024	0.024 x 45°
Chamfering head	
A30	30°
A60	60°
Ball nose	
SG	Sphere / high precision
BM	Ball / general purpose
BG	Ball / high precision

⑦ Additional feature	
I	Irregular pitch
A	for aluminum
R	for roughing
C	Combined edge

⑧ Additional feature	
U	Inch

⑨ The number of flutes	
General	
02	2
06	6

⑩ Connection screw size	
S05	S05
S06	S06
S08	S08
S10	S10
S12	S12
S15	S15

TUNGMEISTER

Indexable modular head

★ : First choice ☆ : Second choice

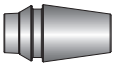
Head geometry	Designation	Appearance	Application: Roughing	Application: Semifinishing	Application: Finishing	Tool dia.	No. of cutting edges	Cutting edge length: APMX	Feature	Corner geometry	CRKS	Workpiece material: P	M	K	N	S	H	Page
Indexable modular head	HPAV06-S		✓	✓		ø10 mm - ø16 mm	2, 3, 4	6 mm	Economical indexable insert type	Corner radius	S05 - S10	★	★	★	★	★	★	43

Threading

★ : First choice ☆ : Second choice

Head geometry	Designation	Appearance	Feature	Wiper edge	No. of cutting edges	Tool dia.	Internal/ External	Thread type	Min. thread size	CRKS	Workpiece material: P	M	K	N	S	H	Page
Threading	VMT***IS		Full profile	With	3 - 6	ø0.3937" - ø0.6299"	Internal	ISO metric	M12X0.75	S05 - S08	★	★	★	☆	★	☆	45
	VMT***UN		Full profile	With	3, 4, 5	ø0.3937" - ø0.6299"	Internal	Unified	9/16-24 UNEF	S05 - S08	★	★	★	☆	★	☆	45
	VMT***W		Full profile	With	4	ø0.3937", ø0.6299"	Internal	Whitworth	G1/4	S05, S08	★	★	★	☆	★	☆	46
	VTR***IS		Partial profile	Without	3, 4	ø0.6181" - ø0.8543"	Internal/ External	60° partial profile	M20X0.5	S06, S08	★	★	★	☆	★	☆	46
	VTR***W		Partial profile	Without	4	ø0.8543"	Internal/ External	55° partial profile	G3/4	S08	★	★	★	☆	★	☆	46

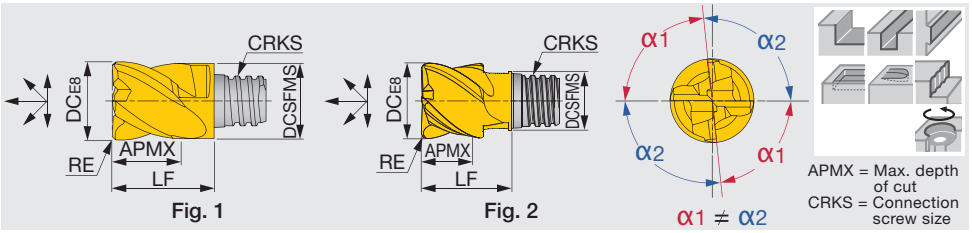
Shank

Shank	Neck	Appearance	Material: Steel	Material: Carbide	Material: Carbide (with coolant hole)	Material: Tungsten (with coolant hole)	Page
Straight	Straight		✓	✓	✓	✓	49, 50
Weldon	Straight		✓	-	-	-	51
Straight	Taper		✓	✓	-	✓	51, 52
High rigidity shank			✓	✓	-	-	49
Straight (slotting)			✓	✓	✓	-	52
Adaptor for TungFlex			✓	-	-	-	53
ER collet			✓	-	-	-	53

VEH...

4 flute, roughing - finishing, variable helix and pitch

Square



Metric	AH715	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*	Fig.
VEH080L05.0R05I04S05		●	4	41° - 45°	8	7.7	5	0.5	S05	10	KEYV-S05	7	1
VEH080L05.0R10I04S05		●	4	41° - 45°	8	7.7	5	1	S05	10	KEYV-S05	7	1
VEH100L07.0R10I04S05	●		4	41° - 45°	10	7.7	7	1	S05	12.8	KEYV-S05	7	2
VEH100L07.0R05I04S06		●	4	41° - 45°	10	9.7	7	0.5	S06	13	KEYV-S06	10	1
VEH100L07.0R10I04S06		●	4	41° - 45°	10	9.7	7	1	S06	13	KEYV-S06	10	1
VEH120L09.0R10I04S06	●		4	41° - 45°	12	9.3	9	1	S06	14.3	KEYV-S06	10	2
VEH120L09.0R05I04S08		●	4	41° - 45°	12	11.7	9	0.5	S08	16.5	KEYV-S08	15	1
VEH120L09.0R10I04S08		●	4	41° - 45°	12	11.7	9	1	S08	16.5	KEYV-S08	15	1
VEH160L12.0R10I04S08	●		4	41° - 45°	16	11.7	12	1	S08	20	KEYV-S08	15	2
VEH160L12.0R05I04S10		●	4	41° - 45°	16	15.3	12	0.5	S10	20.5	KEYV-S10	28	1
VEH160L12.0R10I04S10		●	4	41° - 45°	16	15.3	12	1	S10	20.5	KEYV-S10	28	1
VEH200L15.0R05I04S12		●	4	41° - 45°	20	18.3	15	0.5	S12	25.5	KEYV-S12	28	1
VEH200L15.0R10I04S12		●	4	41° - 45°	20	18.3	15	1	S12	25.5	KEYV-S12	28	1

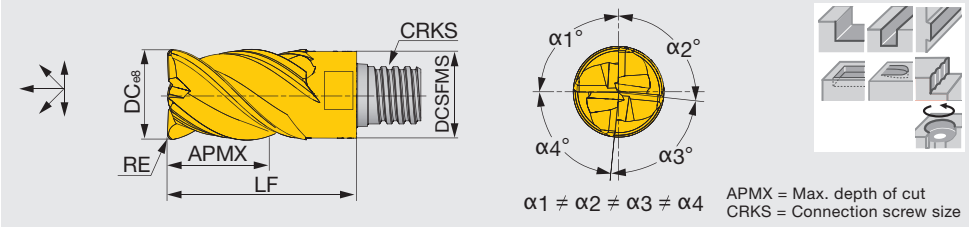
* Recommended clamping torque (N·m)
2 pieces per package

● : New product
● : Line up

VEH...

4 flute, roughing - finishing, variable helix and pitch

Square



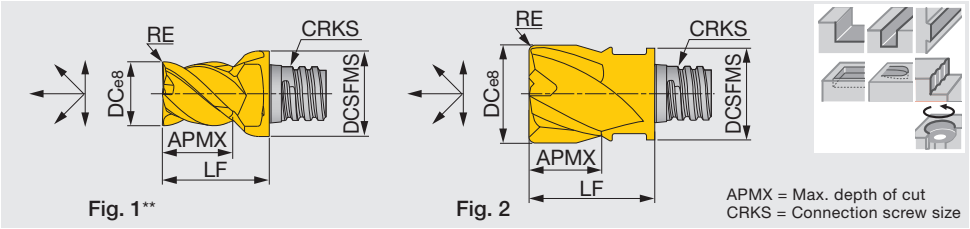
Metric	AH715	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*
VEH080L12.0R05I04S05	●	4	41° - 45°	8	7.7	12	0.5	S05	18	KEYV-S05	7
VEH080L12.0R10I04S05	●	4	41° - 45°	8	7.7	12	1	S05	18	KEYV-S05	7
VEH100L15.0R05I04S06	●	4	41° - 45°	10	9.7	15	0.5	S06	22	KEYV-S06	10
VEH100L15.0R10I04S06	●	4	41° - 45°	10	9.7	15	1	S06	22	KEYV-S06	10
VEH120L18.0R05I04S08	●	4	41° - 45°	12	11.7	18	0.5	S08	27	KEYV-S08	15
VEH120L18.0R10I04S08	●	4	41° - 45°	12	11.7	18	1	S08	27	KEYV-S08	15
VEH160L24.0R05I04S10	●	4	41° - 45°	16	15.3	24	0.5	S10	33.5	KEYV-S10	28
VEH160L24.0R10I04S10	●	4	41° - 45°	16	15.3	24	1	S10	33.5	KEYV-S10	28
VEH200L30.0R05I04S12	●	4	41° - 45°	20	18.45	30	0.5	S12	41	KEYV-S12	28
VEH200L30.0R10I04S12	●	4	41° - 45°	20	18.45	30	1	S12	41	KEYV-S12	28
VEH250L37.0R05I04S15	●	4	41° - 45°	25	23.9	37	0.5	S15	52.5	KEYV-W20	40
VEH250L37.0R10I04S15	●	4	41° - 45°	25	23.9	37	1	S15	52.5	KEYV-W20	40
VEH320L38.0R00I04S21	●	4	41° - 45°	32	30	38	-	S21	55	KS-24	110
VEH320L38.0R10I04S21	●	4	41° - 45°	32	30	38	1	S21	55	KS-24	110

* Recommended clamping torque (N·m)
VEH080 ~ VEH160: 2 pieces per package
VEH200 ~ VEH320: 1 piece per package

● : New product
● : Line up

VEE**-04..., VED**-04...

4 flute, roughing - finishing, general



Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*	Fig.
VEE025L20R000-U04S05	●	4	45°	0.250	0.300	0.200	-	S05	0.390	KEYV-S05	5.16	1
VED031L20R015-U04S05	●	4	30°	0.312	0.300	0.200	0.015	S05	0.390	KEYV-S05	5.16	2
VED031L20R031-U04S05	●	4	30°	0.312	0.300	0.200	0.031	S05	0.390	KEYV-S05	5.16	2
VED031L20R062-U04S05	●	4	30°	0.312	0.300	0.200	0.062	S05	0.390	KEYV-S05	5.16	2
VEE031L20R000-U04S05	●	4	45°	0.312	0.300	0.200	-	S05	0.390	KEYV-S05	5.16	2
VEE031L20R015-U04S05	●	4	45°	0.312	0.300	0.200	0.015	S05	0.390	KEYV-S05	5.16	2
VEE031L20R031-U04S05	●	4	45°	0.312	0.300	0.200	0.031	S05	0.390	KEYV-S05	5.16	2
VEE031L20R062-U04S05	●	4	45°	0.312	0.300	0.200	0.062	S05	0.390	KEYV-S05	5.16	2
VED037L27R015-U04S06	●	4	30°	0.375	0.370	0.275	0.015	S06	0.512	KEYV-S06	7.38	2
VED037L27R031-U04S06	●	4	30°	0.375	0.370	0.275	0.031	S06	0.512	KEYV-S06	7.38	2
VEE037L27R000-U04S06	●	4	45°	0.375	0.370	0.275	-	S06	0.512	KEYV-S06	7.38	2
VEE037L27R015-U04S06	●	4	45°	0.375	0.370	0.275	0.015	S06	0.512	KEYV-S06	7.38	2
VEE037L27R030-U04S06	●	4	45°	0.375	0.370	0.275	0.031	S06	0.512	KEYV-S06	7.38	2
VEE037L27R062-U04S06	●	4	45°	0.375	0.370	0.275	0.062	S06	0.512	KEYV-S06	7.38	2
VEE037L47R000-U04S06	●	4	45°	0.375	0.370	0.470	-	S06	0.748	KEYV-S06	7.38	2
VED050L37R015-U04S08	●	4	30°	0.500	0.488	0.374	0.015	S08	0.650	KEYV-S08	11.06	2
VED050L37R031-U04S08	●	4	30°	0.500	0.488	0.374	0.031	S08	0.650	KEYV-S08	11.06	2
VEE050L37R000-U04S08	●	4	45°	0.500	0.488	0.374	-	S08	0.650	KEYV-S08	11.06	2
VEE050L37R015-U04S08	●	4	45°	0.500	0.488	0.374	0.015	S08	0.650	KEYV-S08	11.06	2
VEE050L37R031-U04S08	●	4	45°	0.500	0.488	0.374	0.031	S08	0.650	KEYV-S08	11.06	2
VEE050L37R062-U04S08	●	4	45°	0.500	0.488	0.374	0.062	S08	0.650	KEYV-S08	11.06	2
VED062L47R015-U04S10	●	4	30°	0.625	0.600	0.470	0.015	S10	0.810	KEYV-S10	20.65	2
VED062L47R031-U04S10	●	4	30°	0.625	0.600	0.470	0.031	S10	0.810	KEYV-S10	20.65	2
VED062L47R062-U04S10	●	4	30°	0.625	0.600	0.470	0.062	S10	0.810	KEYV-S10	20.65	2
VEE062L47R000-U04S10	●	4	45°	0.625	0.600	0.470	-	S10	0.810	KEYV-S10	20.65	2
VEE062L47R031-U04S10	●	4	45°	0.625	0.600	0.470	0.031	S10	0.810	KEYV-S10	20.65	2
VED075L62R015-U04S12	●	4	30°	0.750	0.720	0.620	0.015	S12	1.000	KEYV-S12	20.65	2
VED075L62R031-U04S12	●	4	30°	0.750	0.720	0.620	0.031	S12	1.000	KEYV-S12	20.65	2
VED075L62R062-U04S12	●	4	30°	0.750	0.720	0.620	0.062	S12	1.000	KEYV-S12	20.65	2
VEE075L62R000-U04S12	●	4	45°	0.750	0.720	0.620	-	S12	1.000	KEYV-S12	20.65	2
VEE075L62R031-U04S12	●	4	45°	0.750	0.720	0.620	0.031	S12	1.000	KEYV-S12	20.65	2

* Torque: Recommended clamping torque: lbs·ft

● : Line-up

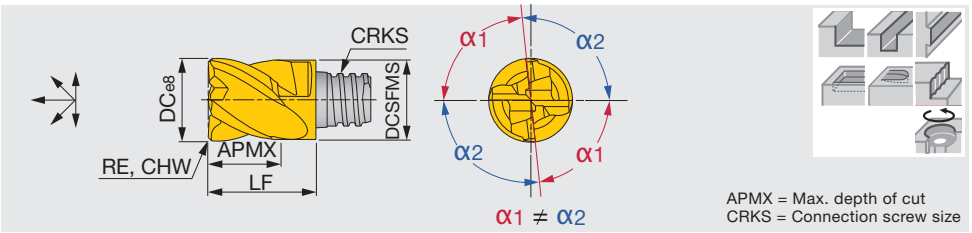
**Fig. 1: Avoid interference with workpiece when using this cutting head. The shank diameter is larger than the cutter diameter when assembled.

2 pieces per package

VEE**-I...

4 flute, roughing - finishing, variable pitch

Square



APMX = Max. depth of cut
CRKS = Connection screw size

Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CHW	CRKS	LF	Wrench	Torque*
VEE031L22C012IU04S05	●	4	38°	0.312	0.303	0.220	-	0.012	S05	0.393	KEYV-S05	5.16
VEE037L29C016IU04S06	●	4	38°	0.375	0.370	0.299	-	0.016	S06	0.512	KEYV-S06	7.38
VEE050L37C020IU04S08	●	4	38°	0.500	0.488	0.374	-	0.020	S08	0.650	KEYV-S08	11.06
VEE062L50C024IU04S10	●	4	38°	0.625	0.602	0.500	-	0.024	S10	0.810	KEYV-S10	20.65
VEE075L62C024IU04S12	●	4	38°	0.750	0.726	0.629	-	0.024	S12	1.004	KEYV-S12	20.65
VEE100L86C024IU04S15	●	4	38°	1.000	0.94	0.863	-	0.024	S15	1.456	KEYV-W20	29.5
VEE100L86R000IU04S15	●	4	38°	1.000	0.941	0.866	-	-	S15	1.457	KEYV-W20	29.5
VEE100L86R015IU04S15	●	4	38°	1.000	0.941	0.866	0.015	-	S15	1.457	KEYV-W20	29.5
VEE100L86R031IU04S15	●	4	38°	1.000	0.941	0.866	0.031	-	S15	1.457	KEYV-W20	29.5
VEE100L86R062IU04S15	●	4	38°	1.000	0.941	0.866	0.062	-	S15	1.457	KEYV-W20	29.5
VEE100L86R125IU04S15	●	4	38°	1.000	0.941	0.866	0.125	-	S15	1.457	KEYV-W20	29.5

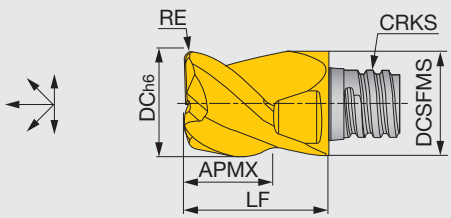
* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

● : Line-up

VEE**-03...

3 flute, roughing - finishing, general, for key way

Square



APMX = Max. depth of cut
CRKS = Connection screw size

Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque
VEE031L20R000-U03S05	●	3	45°	0.312	0.300	0.200	-	S05	0.390	KEYV-S05	5.16
VEE037L27R000-U03S06	●	3	45°	0.375	0.370	0.275	-	S06	0.512	KEYV-S06	7.38
VEE050L37R000-U03S08	●	3	45°	0.500	0.488	0.374	-	S08	0.650	KEYV-S08	11.06

Metric	AH715	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*
VEE077L04.0R02-03S05		●	3	38°	7.7	7.7	4	0.2	S05	10	KEYV-S05	7
VEE080L05.0R00-03S05		●	3	45°	8	7.7	5	-	S05	10	KEYV-S05	7
VEE097L05.0R03-03S06		●	3	38°	9.7	9.7	5	0.3	S06	13	KEYV-S06	10
VEE100L07.0R00-03S06		●	3	45°	10	9.7	7	-	S06	13	KEYV-S06	10
VEE117L07.0R03-03S08	●	●	3	38°	11.7	11.7	7	0.3	S08	16.5	KEYV-S08	15
VEE120L09.0R00-03S08		●	3	45°	12	11.7	9	-	S08	16.5	KEYV-S08	15
VEE157L08.0R03-03S10	●	●	3	38°	15.7	15.3	8	0.3	S10	20.5	KEYV-S10	28
VEE197L12.0R04-03S12		●	3	38°	19.7	18.3	12	0.4	S12	25.5	KEYV-S12	28

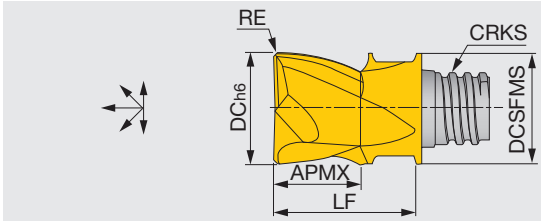
* Torque: Recommended clamping torque: lbs·ft (N·m*)
2 pieces per package

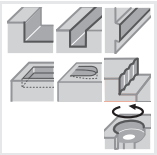
● : New product
● : Line up

VEE**A02...

2 flute, roughing - finishing, for non-ferrous metal, general

Square





APMX = Max. depth of cut
CRKS = Connection screw size

Inch	KS15F	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*
VEE037L27R000AU02S06	●	2	45°	0.375	0.360	0.270	-	S06	0.510	KEYV-S06	7.38
VEE037L27R020AU02S06	●	2	45°	0.375	0.360	0.270	0.02	S06	0.512	KEYV-S06	7.38
VEE050L37R000AU02S08	●	2	45°	0.500	0.488	0.374	-	S08	0.650	KEYV-S08	11.06
VEE050L37R020AU02S08	●	2	45°	0.500	0.488	0.374	0.02	S08	0.650	KEYV-S08	11.06

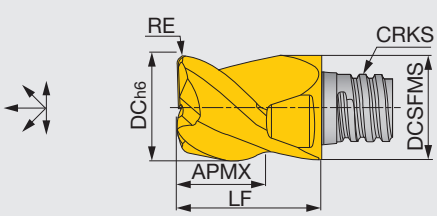
* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

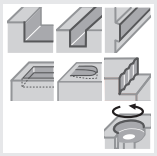
●: Line up

VEE**A03...

3 flute, roughing - finishing, for non-ferrous metal, general

Square





APMX = Max. depth of cut
CRKS = Connection screw size

Inch	KS15F	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*
VEE031L20R020AU03S05	●	3	45°	0.312	0.300	0.200	0.020	S05	0.390	KEYV-S05	5.16
VEE037L23R031AU03S06	●	3	45°	0.375	0.360	0.230	0.031	S06	0.510	KEYV-S06	7.38
VEE037L23R062AU03S06	●	3	45°	0.375	0.360	0.230	0.062	S06	0.510	KEYV-S06	7.38
VEE050L31R031AU03S08	●	3	45°	0.500	0.488	0.315	0.031	S08	0.650	KEYV-S08	11.06
VEE050L31R062AU03S08	●	3	45°	0.500	0.488	0.315	0.062	S08	0.650	KEYV-S08	11.06
VEE050L31R094AU03S08	●	3	45°	0.500	0.488	0.315	0.094	S08	0.650	KEYV-S08	11.06
VEE050L31R125AU03S08	●	3	45°	0.500	0.488	0.315	0.125	S08	0.650	KEYV-S08	11.06
VEE062L39R000AU03S10	●	3	45°	0.625	0.600	0.390	-	S10	0.810	KEYV-S10	20.65
VEE062L39R031AU03S10	●	3	45°	0.625	0.600	0.390	0.031	S10	0.810	KEYV-S10	20.65
VEE062L39R062AU03S10	●	3	45°	0.625	0.600	0.390	0.062	S10	0.810	KEYV-S10	20.65
VEE062L39R094AU03S10	●	3	45°	0.625	0.600	0.390	0.094	S10	0.810	KEYV-S10	20.65
VEE062L39R125AU03S10	●	3	45°	0.625	0.600	0.390	0.125	S10	0.810	KEYV-S10	20.65
VEE075L47R062AU03S12	●	3	45°	0.750	0.720	0.470	0.062	S12	1.000	KEYV-S12	20.65
VEE075L47R094AU03S12	●	3	45°	0.750	0.720	0.470	0.094	S12	1.000	KEYV-S12	20.65
VEE075L47R125AU03S12	●	3	45°	0.750	0.720	0.470	0.125	S12	1.000	KEYV-S12	20.65
VEE075L50R008AU03S12	●	3	45°	0.750	0.720	0.500	0.008	S12	1.000	KEYV-S12	20.65
VEE075L50R020AU03S12	●	3	45°	0.750	0.720	0.500	0.020	S12	1.000	KEYV-S12	20.65

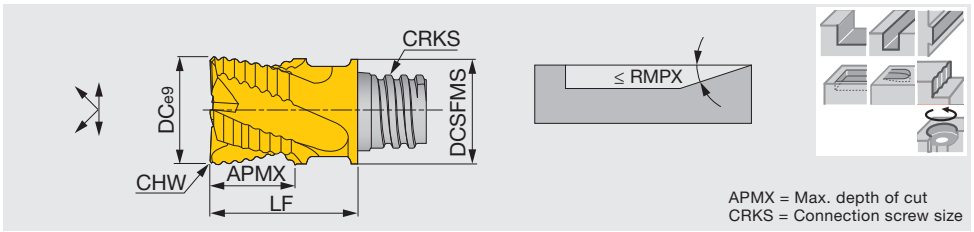
* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

●: Line up

VEE**R...

4, 5, 6 flute, roughing, serrated cutting edge

Square



APMX = Max. depth of cut
CRKS = Connection screw size

Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	CHW	CRKS	LF	RMPX	Wrench	Torque*
VEE031L20C012RU04S05	●	4	45°	0.312	0.300	0.200	0.010	S05	0.390	-	KEYV-S05	5.16
VEE037L27C012RU04S06	●	4	45°	0.375	0.360	0.270	0.012	S06	0.512	-	KEYV-S06	7.38
VEE050L37C016RU04S08	●	4	45°	0.500	0.488	0.374	0.014	S08	0.650	-	KEYV-S08	11.06
VEE062L47C024RU05S10	●	5	45°	0.625	0.600	0.470	0.016	S10	0.800	-	KEYV-S10	20.65
VEE075L59C024RU06S12	●	6	45°	0.750	0.720	0.590	0.016	S12	1.000	3°	KEYV-S12	20.65
VEE100L86C020RU06S15	●	6	45°	1.000	0.941	0.866	0.020	S15	1.457	3°	KEYV-W15	29.50

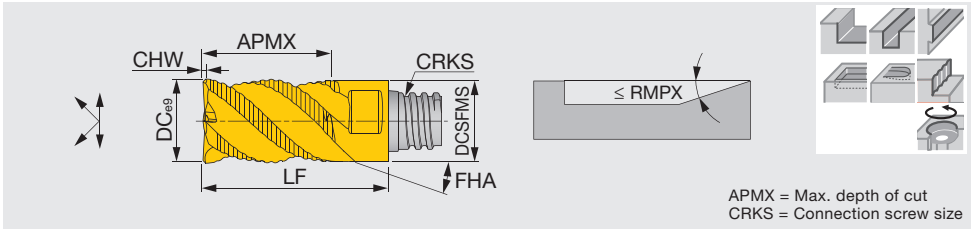
* Torque: Recommended clamping torque: lbs·ft
VEE031 ~ VEE075: 2 pieces per package
VEE100: 1 piece per package

●: Line up

VED**R...

4, 5, 6 flute, roughing, long cutting edge, serrated cutting edge

Square



APMX = Max. depth of cut
CRKS = Connection screw size

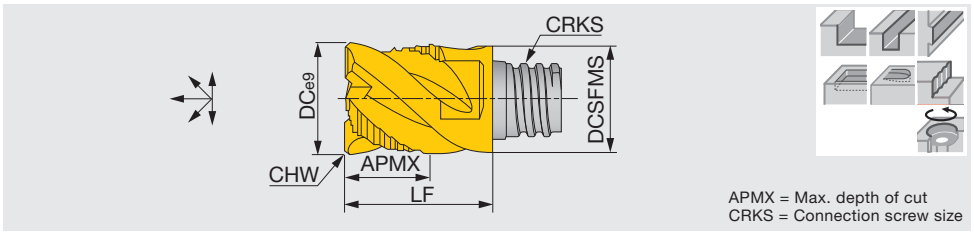
Metric	AH725	NOF	FHA	DC	DCSFMS	APMX	CHW	CRKS	LF	RMPX	Wrench	Torque*
VED080L12.0C25R04S05	●	4	47°	8	7.7	12	0.25	S05	18	5°	KEYV-S05	7
VED100L15.0C30R04S06	●	4	47°	10	9.6	15	0.3	S06	22	5°	KEYV-S06	10
VED120L18.0C35R04S08	●	4	47°	12	11.7	18	0.35	S08	27	5°	KEYV-S08	15
VED160L24.0C40R05S10	●	5	47°	16	15.3	24	0.4	S10	33.5	5°	KEYV-S10	28
VED200L30.0C40R06S12	●	6	47°	20	18.45	30	0.4	S12	41	3°	KEYV-S12	28
VED250L37.0C50I06S15	●	6	47°	25	23.9	37	0.5	S15	52.5	3°	KEYV-W20	40

* Recommended clamping torque (N·m)
VED080 ~ VED160: 2 pieces per package
VED200, VED250: 1 piece per package

● : New product

VEE**C...

4 flute, roughing - semi finishing, roughing and finishing edge combination



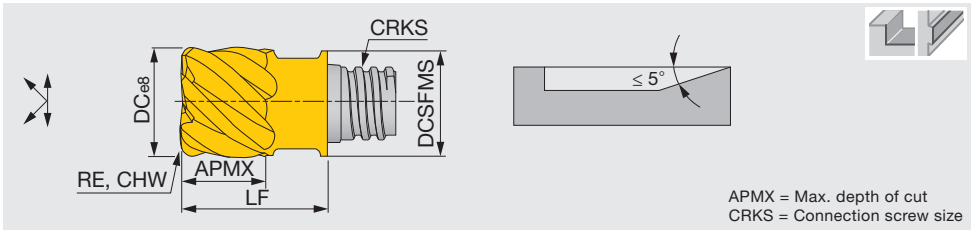
Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	CHW	CRKS	LF	Wrench	Torque*
VEE031L20C012CU04S05	●	4	45°	0.312	0.300	0.200	0.012	S05	0.390	KEYV-S05	5.16
VEE037L27C012CU04S06	●	4	45°	0.375	0.360	0.275	0.012	S06	0.510	KEYV-S06	7.38
VEE050L36C016CU04S08	●	4	45°	0.500	0.488	0.369	0.016	S08	0.650	KEYV-S08	11.06
VEE062L47C024CU04S10	●	4	45°	0.625	0.600	0.470	0.024	S10	0.800	KEYV-S10	20.65
VEE075L62C024CU04S12	●	4	45°	0.750	0.720	0.620	0.024	S12	1.000	KEYV-S12	20.65
VEE100L86C024CU04S15	●	4	45°	1.000	0.941	0.866	0.024	S15	1.457	KEYV-W15	29.50

* Torque: Recommended clamping torque: lbs·ft
VEE031 ~ VEE075: 2 pieces per package
VEE100: 1 piece per package

●: Line up

VED**-06..., VEE**-06...

6 flute, roughing - finishing, small width of cut



Inch	AH725	AH750	NOF	FHA	DC	DCSFMS	APMX	RE	CHW	CRKS	LF	Wrench	Torque*
VED031L20R015-U06S05	●		6	30°	0.312	0.300	0.200	0.015	-	S05	0.390	KEYV-S05	5.16
VEE031L20R000-U06S05	●		6	45°	0.312	0.300	0.200	-	-	S05	0.390	KEYV-S05	5.16
VEE031L20R031-U06S05	●		6	45°	0.312	0.300	0.200	0.031	-	S05	0.390	KEYV-S05	5.16
VEE031L20C004-U06S05		●	6	50°	0.312	0.300	0.200	-	0.004	S05	0.390	KEYV-S05	5.16
VED037L27R015-U06S06	●		6	30°	0.375	0.370	0.275	0.015	-	S06	0.512	KEYV-S06	7.38
VED037L27R031-U06S06	●		6	30°	0.375	0.370	0.275	0.031	-	S06	0.512	KEYV-S06	7.38
VEE037L27R000-U06S06	●		6	45°	0.375	0.370	0.275	-	-	S06	0.512	KEYV-S06	7.38
VEE037L27R015-U06S06	●		6	45°	0.375	0.370	0.275	0.015	-	S06	0.512	KEYV-S06	7.38
VEE037L27R031-U06S06	●		6	45°	0.375	0.370	0.275	0.031	-	S06	0.512	KEYV-S06	7.38
VEE037L27R062-U06S06	●		6	45°	0.375	0.370	0.275	0.062	-	S06	0.512	KEYV-S06	7.38
VEE037L27C004-U06S06		●	6	50°	0.375	0.370	0.270	-	0.004	S06	0.510	KEYV-S06	7.38
VED050L37R015-U06S08	●		6	30°	0.500	0.488	0.374	0.016	-	S08	0.650	KEYV-S08	11.06
VED050L37R031-U06S08	●		6	30°	0.500	0.488	0.374	0.031	-	S08	0.650	KEYV-S08	11.06
VEE050L37R000-U06S08	●		6	45°	0.500	0.488	0.374	-	-	S08	0.650	KEYV-S08	11.06
VEE050L37R015-U06S08	●		6	45°	0.500	0.488	0.374	0.016	-	S08	0.650	KEYV-S08	11.06
VEE050L37R031-U06S08	●		6	45°	0.500	0.488	0.374	0.031	-	S08	0.650	KEYV-S08	11.06
VEE050L37R062-U06S08	●		6	45°	0.500	0.488	0.374	0.059	-	S08	0.650	KEYV-S08	11.06
VEE050L37C004-U06S08		●	6	50°	0.500	0.488	0.374	-	0.004	S08	0.650	KEYV-S08	11.06

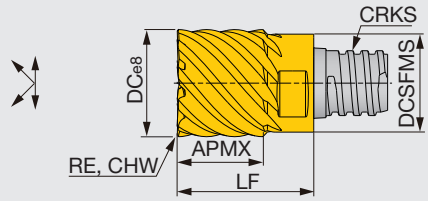
* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

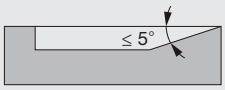
●: Line up

VED**-08/10..., VEE**-08/10...

8, 10 flute, roughing - finishing, small width of cut

Square





APMX = Max. depth of cut
CRKS = Connection screw size

Inch	AH725	AH750	NOF	FHA	DC	DCSFMS	APMX	RE	CHW	CRKS	LF	Wrench	Torque*
VED062L47R000-U08S10	●		8	30°	0.625	0.600	0.470	-	-	S10	0.810	KEYV-S10	20.65
VED062L47R015-U08S10	●		8	30°	0.625	0.600	0.470	0.015	-	S10	0.810	KEYV-S10	20.65
VED062L47R031-U08S10	●		8	30°	0.625	0.600	0.470	0.031	-	S10	0.810	KEYV-S10	20.65
VED062L47R062-U08S10	●		8	30°	0.625	0.600	0.470	0.062	-	S10	0.810	KEYV-S10	20.65
VEE062L47C008-U08S10		●	8	50°	0.625	0.600	0.470	-	0.008	S10	0.810	KEYV-S10	20.65
VED075L62R031-U10S12	●		10	30°	0.750	0.720	0.620	0.031	-	S12	1.000	KEYV-S12	20.65
VED075L62R062-U10S12	●		10	30°	0.750	0.720	0.620	0.062	-	S12	1.000	KEYV-S12	20.65
VEE075L62C008-U10S12		●	10	50°	0.750	0.720	0.620	-	0.008	S12	1.000	KEYV-S12	20.65
VED100L86R031-U10S15	●		10	30°	1.000	0.941	0.866	0.031	-	S15	1.457	KEYV-W20	29.50
VED100L86R062-U10S15	●		10	30°	1.000	0.941	0.866	0.062	-	S15	1.457	KEYV-W20	29.50

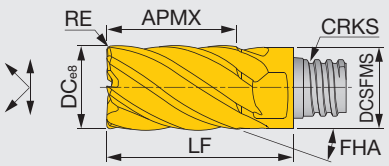
* Torque: Recommended clamping torque: lbs·ft
VED/VEE062~ VED/VEE075: 2 pieces per package
VED100: 1 piece per package

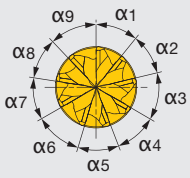
●: Line up

VED**-07/09...

7, 9 flute, roughing - finishing, long edge, variable helix and pitch, small width of cut

Square





α1 ≠ α2 ≠ α3 ≠ α4 ≠ α5 ≠ α6 ≠ α7 ≠ α8 ≠ α9

APMX = Max. depth of cut
CRKS = Connection screw size

Metric	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*
VED080L12.0R05I07S05	●	7	34° - 40°	8	7.7	12	0.5	S05	18	KEYV-S05	7
VED100L15.0R05I07S06	●	7	34° - 40°	10	9.6	15	0.5	S06	22	KEYV-S06	10
VED120L18.0R05I07S08	●	7	34° - 40°	12	11.7	18	0.5	S08	27	KEYV-S08	15
VED160L24.0R08I09S10	●	9	34° - 40°	16	15.3	24	0.8	S10	33.5	KEYV-S10	28
VED200L30.0R10I09S12	●	9	34° - 40°	20	18.45	30	1	S12	41	KEYV-S12	28
VED250L37.0R10I09S15	●	9	34° - 40°	25	23.9	37	1	S15	52.5	KEYV-W20	40

* Recommended clamping torque (N·m)
VED080 ~ VED160: 2 pieces per package
VED200, VED250: 1 piece per package

● : New product

TUNGMEISTER

STANDARD CUTTING CONDITIONS

Shoulder milling

VEH, VEE: 3 flutes, VED / VEE: 4 flutes, VEE-A, VEE-I, VEE-R, VED-R, VEE-C

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed per tooth: *fz* (ipt) Tool diameter: DC (in) 0.250"	0.312"	0.375"	0.500"	0.625"	0.750"	1.000"	Depth of cut *ap* (in)	Width of cut *ae* (in)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	260 - 590	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.25 x øDc
	High carbon steels 4140, 5120, etc.	- 300 HB	200 - 460	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.25 x øDc
	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	200 - 400	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.25 x øDc
M	Stainless steels S30400, S31600, etc.	- 200 HB	130 - 330	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.25 x øDc
K	Grey cast irons No.250B, No.300B, etc.	150 - 250 HB	260 - 660	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.25 x øDc
	Ductile cast irons 60-40-18, etc.	150 - 250 HB	260 - 660	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x Dc	0.25 x øDc
N	Aluminum alloys Si < 13%	-	660 - 2297	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.25 x øDc
	Aluminum alloys Si ≥13%	-	330 - 980	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.25 x øDc
S	Titanium alloys Ti-6Al-4V, etc.	-	130 - 260	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.05 x øDc
	Heat-resistant alloys Inconel 718, etc.	-	66 - 130	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.05 x øDc
H	Hardened steel H13, etc.	40 - 50 HRC	130 - 260	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.05 x øDc
	Hardened steel D2, etc.	50 - 60 HRC	66 - 200	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x øDc	0.05 x øDc

VED / VEE: 6 flutes, VED / VEE: 8, 10 flutes, VED: 7, 9 flutes

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed per tooth: *fz* (ipt) Tool diameter: DC (in) 0.312"	0.375"	0.500"	0.625"	0.750"	1.000"	Depth of cut *ap* (in)	Width of cut *ae* (in)
S	Titanium alloys Ti-6Al-4V, etc.	-	200 - 400	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x DC	0.02 x DC
	Heat-resistant alloys Inconel 718, etc.	-	100 - 200	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x DC	0.02 x DC
H	Hardened steel H13, etc.	40 - 50 HRC	260 - 530	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x DC	0.02 x DC
	Hardened steel D2, etc.	50 - 60 HRC	130 - 300	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.6 x DC	0.02 x DC

Slotting

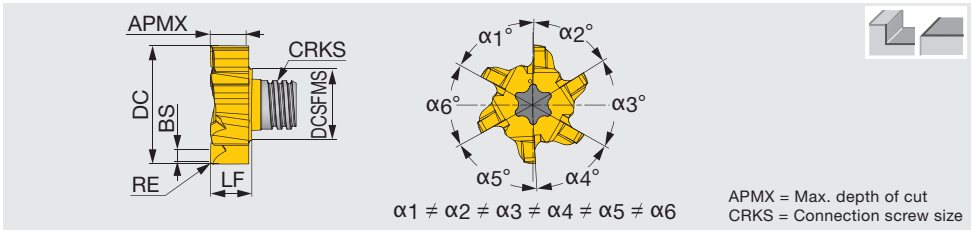
VEH, VEE: 3 flutes, VED/VEE: 4 flutes, VEE-A, VEE-I, VEE-R, VEE-C

ISO	Workpiece material	Hard-ness	Cutting speed *Vc* (sfm)	Feed per tooth: *fz* (ipt) Tool diameter: DC (in) 0.250"	0.312"	0.375"	0.500"	0.625"	0.750"	1.000"	Depth of cut *ap* (in)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	260 - 590	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
	High carbon steels 4140, 5120, etc.	- 300 HB	200 - 460	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	200 - 400	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
M	Stainless steels S30400, S31600, etc.	- 200 HB	130 - 330	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
K	Grey cast irons No.250B, No.300B, etc.	150 - 250 HB	260 - 660	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
	Ductile cast irons 60-40-18, etc.	150 - 250 HB	260 - 660	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
N	Aluminum alloys Si < 13%	-	660 - 2297	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
	Aluminum alloys Si ≥13%	-	330 - 980	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
S	Titanium alloys Ti-6Al-4V, etc.	-	130 - 260	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
	Heat-resistant alloys Inconel 718, etc.	-	66 - 130	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.5 x øDc
H	Hardened steel H13, etc.	40 - 50 HRC	130 - 260	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.2 x øDc
	Hardened steel D2, etc.	50 - 60 HRC	66 - 200	0.001 - 0.003	0.001 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.003 - 0.004	0.2 x øDc

HEADS

VFM...

6 flute, roughing - finishing, for face milling



Metric	AH715	NOF	FHA	DC	DCSFMS	APMX	RE	BS	CRKS	LF	Wrench	Torque*
VFM120L03.6R02I06S05	●	6	10°	12	7.7	3.6	0.2	1.2	S05	4.4	KEYV-T20	7
VFM160L04.8R04I06S06	●	6	10°	16	9.7	4.8	0.4	2	S06	5.6	KEYV-T25	10
VFM200L06.0R04I06S08	●	6	10°	20	11.7	6	0.4	2	S08	7	KEYV-T40L	15
VFM250L07.5R04I06S10	●	6	10°	25	15.3	7.5	0.4	2	S10	8.55	KEYV-T50L	28

* Recommended clamping torque (N·m)
2 pieces per package

● : New product
● : Line up

STANDARD CUTTING CONDITIONS

Face milling

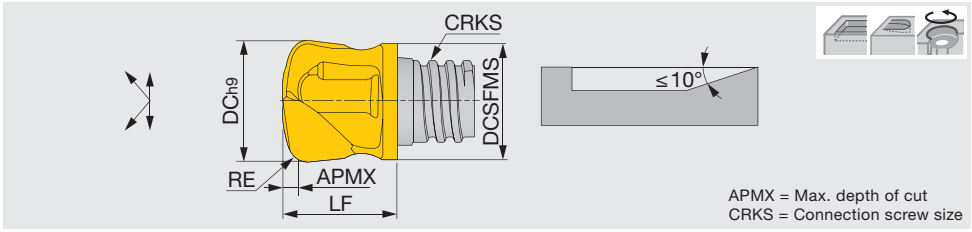
VFM

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed per tooth: *fz* (ipt) Tool diameter: DC ø12 mm	ø16 mm	ø20 mm	ø25 mm	Depth of cut *ap* (in)	Width of cut *ae* (in)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	262 - 591	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
P	High carbon steels 4140, 5120, etc.	- 300 HB	197 - 459	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
P	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	197 - 394	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
M	Stainless steels S30400, S31600, etc.	- 200 HB	131 - 328	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
K	Grey cast irons No.250B, No.300B, etc.	150 - 250 HB	262 - 656	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
K	Ductile cast irons 60-40-18, etc.	150 - 250 HB	262 - 656	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
N	Aluminum alloys Si < 13%	-	656 - 2297	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
N	Aluminum alloys Si ≥ 13%	-	328 - 984	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
S	Titanium alloys Ti-6Al-4V, etc.	-	131 - 262	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
S	Heat-resistant alloys Inconel 718, etc.	-	66 - 131	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
H	Hardened steel H13, etc.	40 - 50 HRC	131 - 262	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC
H	Hardened steel D2, etc.	50 - 60 HRC	66 - 197	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.004 - 0.007	0.039	0.7 x DC

HEADS

VFX**-02...

2 flute, roughing



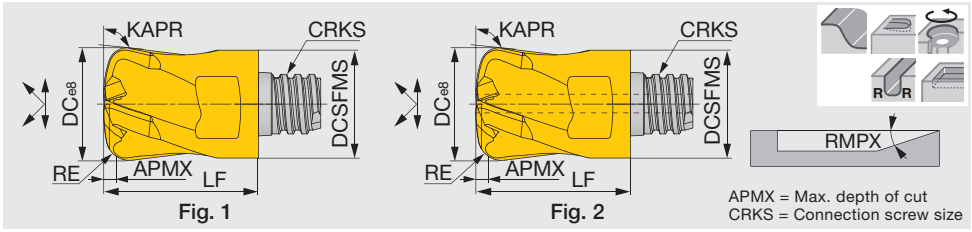
Metric	AH725	NOF	FHA	DC	DCSFMS	APMX	RE(1)	CRKS	LF	Wrench	Torque*	*fz*(mm/t)
VFX100L00.6R20-02S06	●	2	0°	10	9.6	0.6	2	S06	12.5	KEYV-S06	10	0.3 - 0.6
VFX120L01.0R25-02S08	●	2	0°	12	11.5	1.0	2.5	S08	11.1	KEYV-S08	15	0.5 - 1
VFX160L01.1R30-02S10	●	2	0°	16	15.2	1.1	3	S10	13.5	KEYV-S10	28	0.55 - 1.1
VFX200L01.5R33-02S12	●	2	0°	20	18.3	1.5	3.3	S12	17.5	KEYV-S12	28	0.75 - 1.5

(1) Corner radius for CAM programming
For VFX head, taper neck shank or Tungsten shank should be recommended.
* Recommended clamping torque (N·m)
2 pieces per package

● : Line up

VFX**-04/06...

4, 6 flute, roughing, with coolant hole (2 items do not have coolant hole)



Metric	AH715	AH725	AH750	NOF	FHA	DC	DCSFMS	APMX	RE	KAPR	CRKS	LF	RMPX	Wrench	Torque*	*fz*(mm/t)	Fig.
VFX120L0.60R18E04S08	●			4	20°	12	11.5	0.6	1.8	97°	S08	16.5	5°	KEYV-S08	15	0.16 - 0.67	2
VFX120L0.60R18H04S08		●		4	20°	12	11.5	0.6	1.8	97°	S08	16.5	5°	KEYV-S08	15	0.16 - 0.67	1
VFX120L0.65R12E06S08			●	6	20°	12	11.5	0.65	0.6	97°	S08	12	3°	KEYV-S08	15	0.16 - 0.54	2
VFX160L0.80R22E04S10	●			4	20°	16	15.4	0.8	2.2	97°	S10	20.5	5°	KEYV-S10	28	0.2 - 0.75	2
VFX160L0.80R22H04S10		●		4	20°	16	15.4	0.8	2.2	97°	S10	20.5	5°	KEYV-S10	28	0.2 - 0.75	1
VFX160L1.05R20E06S10			●	6	20°	16	15.4	1.05	1	97°	S10	16	3°	KEYV-S10	28	0.2 - 0.65	2

Slot milling not recommended. Also max. ae < 0.4D.
* Recommended clamping torque (N·m)
2 pieces per package

● : New product
● : Line up

TUNGMEISTER

STANDARD CUTTING CONDITIONS

High feed milling

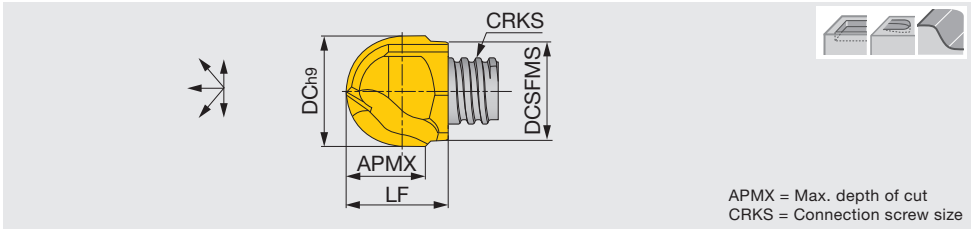
VFX: 2, 4, 6 flutes

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	ø10 mm		ø12 mm		ø16 mm		ø20 mm		Width of cut
				Feed per tooth *fz* (ipt)	Depth of cut *ap* (in)	Feed per tooth *fz* (ipt)	Depth of cut *ap* (in)	Feed per tooth *fz* (ipt)	Depth of cut *ap* (in)	Feed per tooth *fz* (ipt)	Depth of cut *ap* (in)	*ae* (in)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	328 - 656	0.012 - 0.028	0.020	0.016 - 0.031	0.020	0.020 - 0.035	0.030	0.024 - 0.039	0.039	0.6 x DC
	Alloy steel 4140, 8620, etc.	- 300 HB	262 - 591	0.008 - 0.024	0.020	0.012 - 0.028	0.020	0.016 - 0.031	0.030	0.020- 0.035	0.039	0.6 x DC
	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	262 - 525	0.008 - 0.020	0.016	0.008 - 0.020	0.016	0.012 - 0.024	0.020	0.012 - 0.024	0.030	0.6 x DC
M	Stainless steels S30400, S31600, etc.	- 200 HB	197 - 328	0.008 - 0.024	0.016	0.008 - 0.024	0.016	0.012 - 0.028	0.020	0.012 - 0.028	0.030	0.6 x DC
K	Grey cast irons No.250B, No.300B, etc.	150 - 250 HB	328 - 722	0.012 - 0.028	0.020	0.016 - 0.031	0.030	0.020 - 0.035	0.030	0.024 - 0.039	0.039	0.6 x DC
	Ductile cast irons 60-40-18, etc.	150 - 250 HB	328 - 722	0.008 - 0.024	0.020	0.012 - 0.028	0.030	0.016 - 0.031	0.030	0.020 - 0.035	0.039	0.6 x DC
S	Titanium alloys Ti-6Al-4V, etc.	-	131 - 262	0.008 - 0.020	0.016	0.008 - 0.020	0.016	0.008 - 0.024	0.020	0.008 - 0.024	0.020	0.25 x DC
	Heat-resistant alloys Inconel 718, etc.	-	66 - 131	0.004 - 0.012	0.012	0.004 - 0.012	0.012	0.004 - 0.012	0.016	0.004 - 0.012	0.016	0.25 x DC
H	Hardened steel H13, etc.	40 - 50 HRC	131 - 262	0.008 - 0.016	0.012	0.008 - 0.016	0.012	0.012 - 0.020	0.016	0.012 - 0.020	0.016	0.45 x DC
	Hardened steel D2, etc.	50 - 60 HRC	66 - 197	0.004 - 0.008	0.008	0.004 - 0.008	0.008	0.004 - 0.012	0.012	0.004 - 0.012	0.012	0.25 x DC

Please note that the feed per tooth should not exceed the maximum feed per tooth for each product.

VBB**-BM...

2 flute, roughing - semi finishing, economical



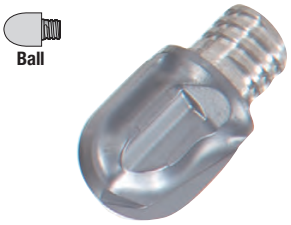
Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	CRKS	LF	Wrench	Torque*
VBB0312L31-BM-U02S05	●	2	0°	0.312	0.300	0.310	S05	0.390	KEYV-S05	5.16
VBB0375L38-BM-U02S06	●	2	0°	0.375	0.360	0.380	S06	0.478	KEYV-S06	7.38
VBB0500L50-BM-U02S08	●	2	0°	0.500	0.480	0.508	S08	0.646	KEYV-S08	11.06
VBB0625L63-BM-U02S10	●	2	0°	0.625	0.600	0.630	S10	0.750	KEYV-S10	20.65

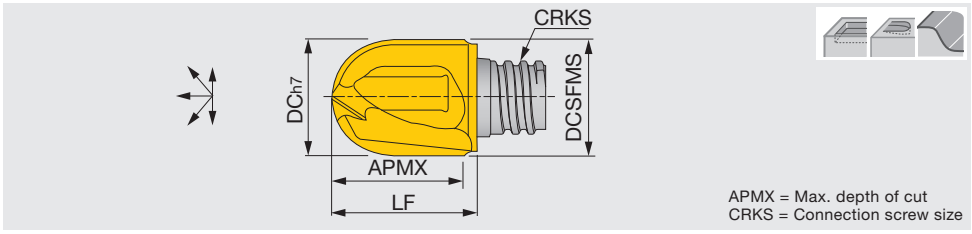
* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

● : Line up

VBB**-BG...

2 flute, finishing, high accuracy h7, for hardened material





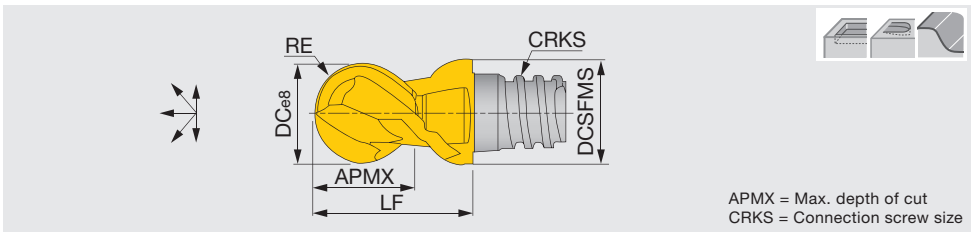
Inch	AH750	NOF	FHA	DC	DCSFMS	APMX	CRKS	LF	Wrench	Torque*
VBB0312L31-BG-U02S05	●	2	0°	0.312	0.300	0.312	S05	0.390	KEYV-S05	5.16
VBB0375L38-BG-U02S06	●	2	0°	0.375	0.360	0.380	S06	0.480	KEYV-S06	7.38
VBB0500L50-BG-U02S08	●	2	0°	0.500	0.480	0.500	S08	0.640	KEYV-S08	11.06
VBB0625L63-BG-U02S10	●	2	0°	0.625	0.598	0.630	S10	0.752	KEYV-S10	20.65

* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

● : Line up

VBD**-BG...

2 flute, semi finishing - finishing, helix cutting edge



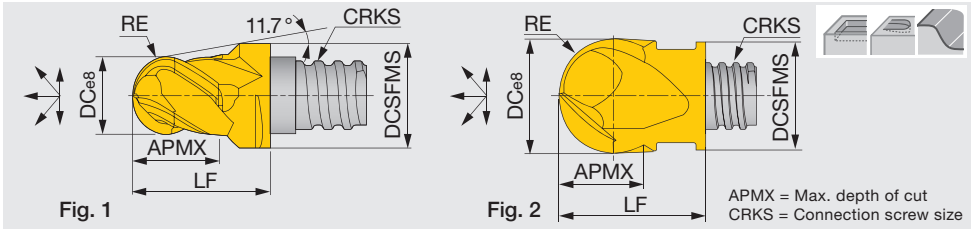
Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*
VBD0312L20-BG-U02S05	●	2	30°	0.312	0.300	0.200	0.156	S05	0.350	KEYV-S05	5.16
VBD0375L27-BG-U02S06	●	2	30°	0.375	0.360	0.275	0.188	S06	0.512	KEYV-S06	7.38
VBD0500L37-BG-U02S08	●	2	30°	0.500	0.488	0.374	0.249	S08	0.650	KEYV-S08	11.06
VBD0625L47-BG-U02S10	●	2	30°	0.625	0.600	0.470	0.313	S10	0.800	KEYV-S10	20.65

The tolerance of R: (1) ± 0.0004" (2) ± 0.0005"
* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

● : Line up

VBD**-BG-04..., VBE**-BG-04...

4 flute, roughing - finishing, helix cutting edge



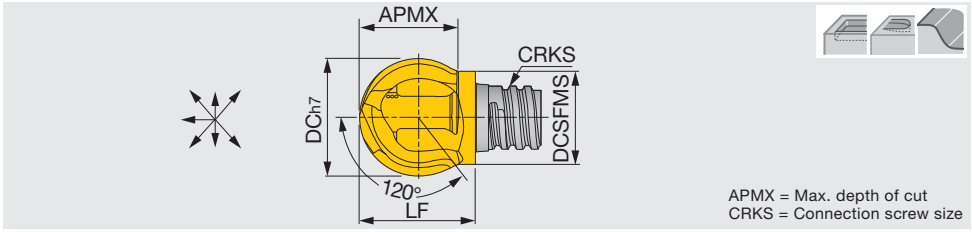
Inch	AH715	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*	Fig.
VBE0250L20-BG-U04S05		●	4	38°	0.250	0.300	0.200	0.124	S05	0.390	KEYV-S05	5.16	1
VBE0312L20-BG-U04S05		●	4	38°	0.312	0.300	0.200	0.156	S05	0.350	KEYV-S05	5.16	2
VBD0375L27-BG-U04S06		●	4	38°	0.375	0.360	0.275	0.188	S06	0.512	KEYV-S06	7.38	2
VBD0500L37-BG-U04S08		●	4	30°	0.500	0.488	0.374	0.249	S08	0.650	KEYV-S08	11.06	2
VBD0625L47-BG-U04S10		●	4	30°	0.625	0.600	0.470	0.313	S10	0.800	KEYV-S10	20.65	2
VBD0750L62-BG-U04S12	●	●	4	30°	0.750	0.720	0.620	0.374	S12	1.000	KEYV-S12	20.65	2
VBD100L86-BG-U04S15		●	4	30°	1.000	0.940	0.860	0.500	S15	1.450	KEYV-W20	29.5	2

The tolerance of R: (1) ± 0.0004" (2) ± 0.0005" (3) ± 0.0008"
* Torque: Recommended clamping torque: lbs·ft
VBE060/VBD080 ~ VBD200: 2 pieces per package, VBD250: 1 piece per package

● : Line up

VBB**-SG...

2 flute, roughing - finishing, sphere cutting edge, high accuracy h7



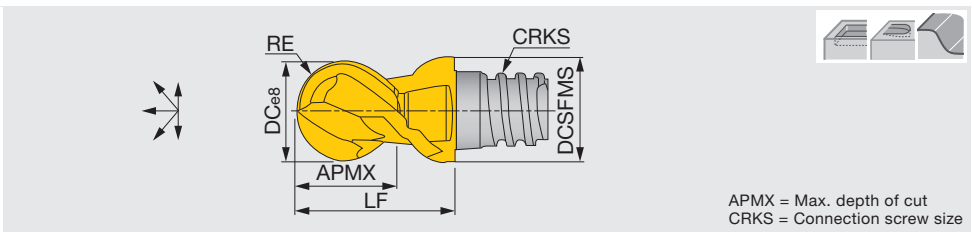
Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	CRKS	LF	Wrench	Torque*
VBB0375L31-SG-U02S05	●	2	0°	0.375	0.300	0.315	S05	0.389	KEYV-S05	5.16
VBB0500L37-SG-U02S06	●	2	0°	0.500	0.378	0.378	S06	0.482	KEYV-S06	7.38
VBB0625L50-SG-U02S08	●	2	0°	0.625	0.480	0.508	S08	0.606	KEYV-S08	11.06
VBB0750L63-SG-U02S10	●	2	0°	0.750	0.600	0.634	S10	0.710	KEYV-S10	20.65

Also capable of pull cutting on the vertical wall
** The wrench size for these heads is different from the ones for the other head types.
* Torque: Recommended clamping torque: lbs·ft.
2 pieces per package

● : Line up

VBE**-BGA...

2 flute, roughing - finishing, for non-ferrous metal, helix cutting edge



Inch	KS15F	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*
VBE0312L20-BGAU02S05	●	2	45°	0.312	0.300	0.200	0.156(1)	S05	0.390	KEYV-S05	5.16
VBE0375L27-BGAU02S06	●	2	45°	0.375	0.360	0.270	0.187(1)	S06	0.510	KEYV-S06	7.38
VBE0500L37-BGAU02S08	●	2	45°	0.500	0.488	0.374	0.250(2)	S08	0.650	KEYV-S08	11.06
VBE0625L47-BGAU02S10	●	2	45°	0.625	0.600	0.470	0.312(2)	S10	0.800	KEYV-S10	20.65
VBE0750L50-BGAU02S12	●	2	45°	0.750	0.720	0.500	0.374(2)	S12	1.000	KEYV-S12	20.65

RE tolerance: (1) ± 0.0004" (2) ± 0.0005"
* Torque: Recommended clamping torque: lbs·ft.
2 pieces per package

● : Line up

STANDARD CUTTING CONDITIONS

Profiling for roughing

VBB-BM / BG / SG, VBD-BG, VBE-BGA

ISO	Workpiece material	Hard-ness	Cutting speed *Vc* (sfm)	Feed per tooth: *fz* (ipt) Tool diameter: DC (in) 0.250"	0.312"	0.375"	0.500"	0.625"	0.750"	1.000"	Depth of cut *ap* (in)	Pick feed *Pf* (in)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	328 - 656	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.4 x DC
	High carbon steels 4140, etc.	- 300 HB	262 - 591	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.4 x DC
	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	262 - 525	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.4 x DC
M	Stainless steels 304, 316, etc.	- 200 HB	197 - 328	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.4 x DC
K	Grey cast irons 250, 300, etc.	150 - 250 HB	328 - 722	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.4 x DC
	Ductile cast irons 400-15S, etc.	150 - 250 HB	328 - 722	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.4 x DC
N	Aluminum alloys Si < 13%	-	656 -2297	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.4 x DC
	Aluminum alloys Si ≥13%	-	328 - 984	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.4 x DC
S	Titanium alloys Ti-6Al-4V, etc.	-	131 - 262	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.2 x DC
	Heat-resistant alloys Inconel 718, etc.	50 - 60 HRC	66 - 131	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.2 x DC
H	Hardened steel SKD61, SKT4, etc. H13, etc.	-	131 - 262	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.2 x DC
	Hardened steel SKD11, SKH, etc. D2, etc.	50 - 60 HRC	66 - 197	0.001 - 0.003	0.002 - 0.003	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.003 - 0.006	0.003 - 0.006	0.3 x DC	0.2 x DC

Profiling for semi-finishing and finishing

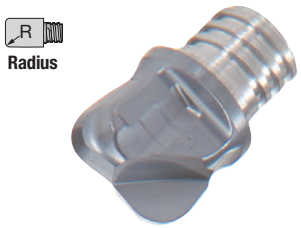
VBB-BM / BG / SG, VBD-BG, VBE-BGA

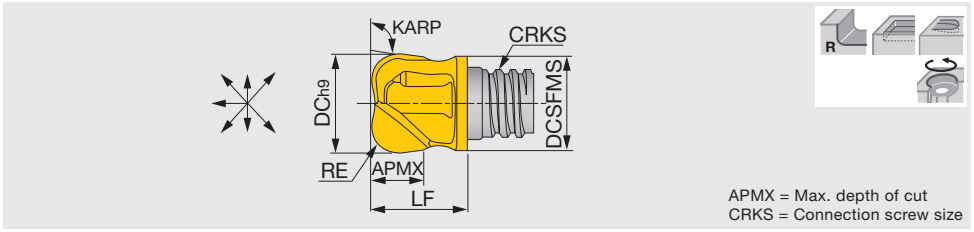
ISO	Workpiece material	Hard-ness	Cutting speed *Vc* (sfm)	Feed per tooth: *fz* (ipt) Tool diameter: DC (in) 0.250"	0.312"	0.375"	0.500"	0.625"	0.750"	1.000"	Depth of cut *ap* (in)	Pick feed *Pf* (in)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	394 - 820	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.1 x DC	0.15 x DC
	High carbon steels 4140, etc.	- 300 HB	328 - 722	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.1 x DC	0.15 x DC
	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	328 - 656	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.1 x DC	0.15 x DC
M	Stainless steels 304, 316, etc.	- 200 HB	262 - 394	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.1 x DC	0.15 x DC
K	Grey cast irons 250, 300, etc.	150 - 250 HB	394 - 919	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.1 x DC	0.15 x DC
	Ductile cast irons 400-15S, etc.	150 - 250 HB	394 -919	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.1 x DC	0.15 x DC
N	Aluminum alloys Si < 13%	-	984 - 3281	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.1 x DC	0.15 x DC
	Aluminum alloys Si ≥13%	-	492 - 1312	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.1 x DC	0.15 x DC
S	Titanium alloys Ti-6Al-4V, etc.	-	164 - 328	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.08 x DC	0.1 x DC
	Heat-resistant alloys Inconel 718, etc.	50 - 60 HRC	98 - 164	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.08 x DC	0.1 x DC
H	Hardened steel SKD61, SKT4, etc. H13, etc.	-	164 - 328	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.08 x DC	0.1 x DC
	Hardened steel SKD11, SKH, etc. D2, etc.	50 - 60 HRC	98 - 262	0.001 - 0.003	0.001 - 0.004	0.002 - 0.004	0.002 - 0.004	0.002 - 0.005	0.002 - 0.007	0.004 - 0.007	0.08 x DC	0.1 x DC

HEADS

VRB**-02..., VRC**-02...

2 flute, roughing - semi finishing, economical





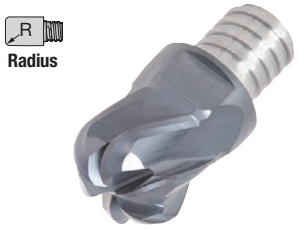
Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	KARP	CRKS	LF	Wrench	Torque*
VRB062L31R187-U02S10	●	2	-	0.625	0.600	0.310	0.190	97°	S10	0.580	KEYV-S10	20.65
VRB075L45R250-U02S12	●	2	-	0.750	0.720	0.450	0.250	97°	S12	0.680	KEYV-S12	20.65
VRB075L45R312-U02S12	●	2	-	0.750	0.720	0.450	0.312	97°	S12	0.680	KEYV-S12	20.65

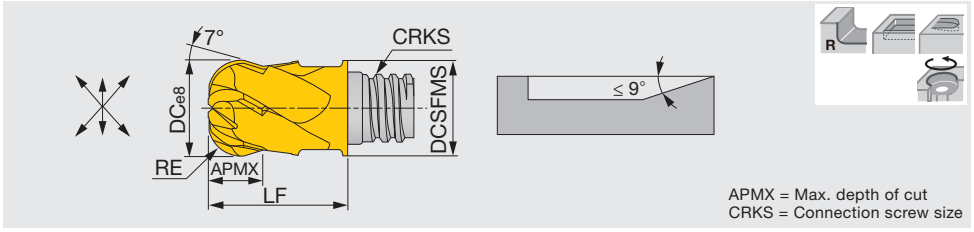
Suitable for contouring operation.
* Torque: Recommended clamping torque: lbs·ft
*** The wrench size for these heads is different from the ones for the other head types.
2 pieces per package

● : Line up

VRD**-06...

6 flute, semi finishing - finishing, helix cutting edge





Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*
VRD031L16R078-U06S05	●	6	30°	0.312	0.300	0.160	0.078	S05	0.390	KEYV-S05	5.16
VRD037L19R031-U06S06	●	6	30°	0.375	0.360	0.190	0.031	S06	0.510	KEYV-S06	7.38
VRD037L19R062-U06S06	●	6	30°	0.375	0.360	0.190	0.062	S06	0.510	KEYV-S06	7.38
VRD037L19R125-U06S06	●	6	30°	0.375	0.360	0.190	0.125	S06	0.510	KEYV-S06	7.38
VRD050L27R062-U06S08	●	6	30°	0.500	0.480	0.270	0.062	S08	0.650	KEYV-S08	11.06
VRD050L27R125-U06S08	●	6	30°	0.500	0.480	0.270	0.125	S08	0.650	KEYV-S08	11.06
VRD050L27R156-U06S08	●	6	30°	0.500	0.480	0.270	0.156	S08	0.650	KEYV-S08	11.06
VRD062L35R200-U06S10	●	6	30°	0.625	0.600	0.350	0.200	S10	0.807	KEYV-S10	20.65

* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

● : Line up

STANDARD CUTTING CONDITIONS

Shoulder milling

VRB, VRC, VRD

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed per tooth: *fz* (ipr) Tool diameter: DC (in) 0.312"	0.375"	0.500"	0.625"	0.750"	Depth of cut *ap* (in)	Width of cut *ae* (in)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	262 - 591	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
P	High carbon steels 4140, etc.	- 300 HB	197 - 459	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
P	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	197 - 394	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
M	Stainless steels 304, 316, etc.	- 200 HB	131 - 328	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
K	Grey cast irons 250, 300, etc.	150 - 250 HB	262 - 656	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
K	Ductile cast irons 400-15S, etc.	150 - 250 HB	262 - 656	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
N	Aluminum alloys Si < 13%	-	656 - 2297	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
N	Aluminum alloys Si ≥13%	-	328 - 984	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
S	Titanium alloys Ti-6Al-4V, etc.	-	131 - 262	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
S	Heat-resistant alloys Inconel 718, etc.	-	66 - 131	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
H	Hardened steel SKD61, SKT4, etc. H13, etc.	40 - 50 HRC	131 - 262	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC
H	Hardened steel SKD11, SKH, etc. D2, etc.	50 - 60 HRC	66 - 197	0.002 - 0.004	0.003 - 0.005	0.003 - 0.005	0.004 - 0.006	0.004 - 0.007	0.6 x DC	0.25 x DC

Slotting

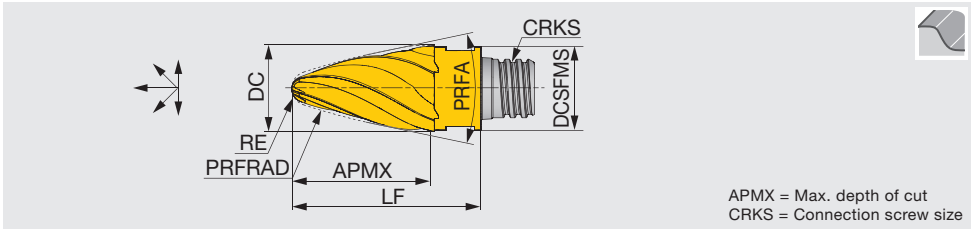
VRB, VRC, VRD

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed per tooth: *fz* (ipr) Tool diameter: DC (in) 0.312"	0.375"	0.500"	0.625"	0.750"	Depth of cut *ap* (in)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	164 - 230	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
P	High carbon steels 4140, etc.	- 300 HB	131 - 262	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
P	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	131 - 230	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
M	Stainless steels 304, 316, etc.	- 200 HB	98 - 197	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
K	Grey cast irons 250, 300, etc.	150 - 250 HB	164 - 394	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
K	Ductile cast irons 400-15S, etc.	150 - 250 HB	164 - 394	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
N	Aluminum alloys Si < 13%	-	427 - 1312	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
N	Aluminum alloys Si ≥13%	-	230 - 656	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
S	Titanium alloys Ti-6Al-4V, etc.	-	66 - 131	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
S	Heat-resistant alloys Inconel 718, etc.	-	33 - 66	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
H	Hardened steel SKD61, SKT4, etc. H13, etc.	40 - 50 HRC	82 - 197	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC
H	Hardened steel SKD11, SKH, etc. D2, etc.	50 - 60 HRC	33 - 98	0.001 - 0.002	0.0016 - 0.002	0.002 - 0.0024	0.0024 - 0.0031	0.0028 - 0.0039	0.5 x DC

HEADS

VBO...

4, 5 flute, semi finishing - finishing, long edge, high productive profiling



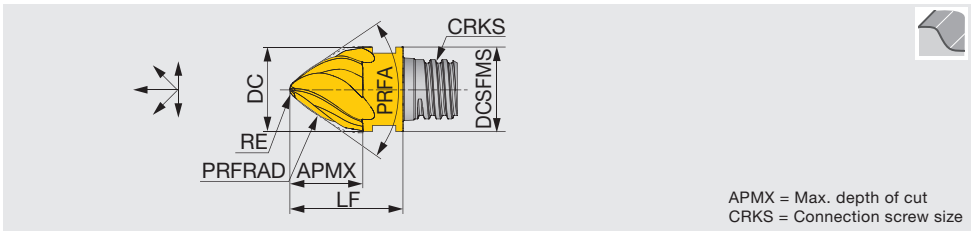
Metric	AH715	NOF	FHA	DC	DCSFMS	APMX	RE	PRFRAD	PRFA	CRKS	LF	Wrench	Torque*
VBO080L12.0R900-4S05	●	4	30°	8	7.7	12	1	90	33.6°	S05	18	KEYV-S05	7
VBO100L15.0R850-5S06	●	5	30°	10	9.7	15	2	85	27.3°	S06	22	KEYV-S06	10
VBO120L19.0R800-5S08	●	5	30°	12	11.7	19	2	80	29.3°	S08	27	KEYV-S08	15
VBO160L25.0R750-5S10	●	5	30°	16	15.3	25	3	75	26.7°	S10	33.5	KEYV-S10	28

* Recommended clamping torque (N·m)
2 pieces per package

● : New product
● : Line up

VBO...

4 flute, semi finishing - finishing, short edge, high productive profiling



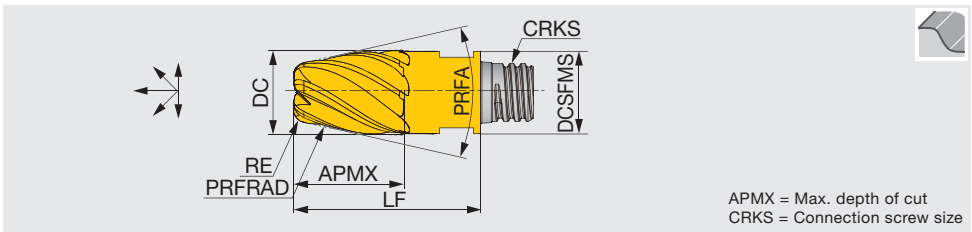
Metric	AH715	NOF	FHA	DC	DCSFMS	APMX	RE	PRFRAD	PRFA	CRKS	LF	Wrench	Torque*
VBO100L08.0R250-4S06	●	4	30°	10	9.7	8	0.8	25	70.8°	S06	13	KEYV-S06	10
VBO120L09.0R300-4S08	●	4	30°	12	11.7	9	1.2	30	71.6°	S08	16.5	KEYV-S08	15
VBO160L13.0R400-4S10	●	4	30°	16	15.3	13	1.6	40	70.3°	S10	20.5	KEYV-S10	28

* Recommended clamping torque (N·m)
2 pieces per package

● : Line up

VBN...

6 flute, semi finishing - finishing, high productive profiling



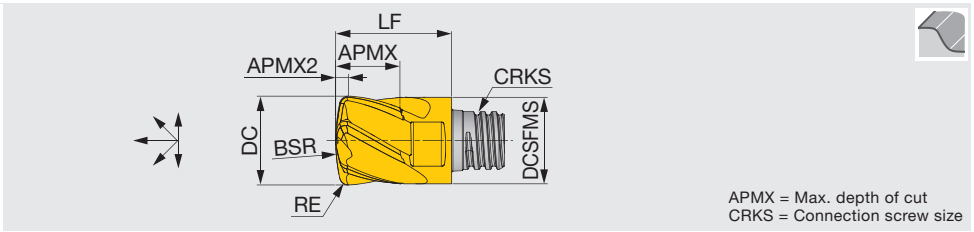
Metric	AH715	NOF	FHA	DC	DCSFMS	APMX	RE	PRFRAD	PRFA	CRKS	LF	Wrench	Torque*
VBN100L13.0R450-6S06	●	6	35°	10	9.7	13	1.5	45	15.1°	S06	22	KEYV-S06	10
VBN120L15.0R500-6S08	●	6	35°	12	11.7	15	2	50	15.1°	S08	27	KEYV-S08	15
VBN160L18.0R600-6S10	●	6	35°	16	15.3	18	2	60	15.1°	S10	33.5	KEYV-S10	28

* Recommended clamping torque (N·m)
2 pieces per package

● : Line up

VBL...

6 flute, semi finishing - finishing, high productive profiling



APMX = Max. depth of cut
CRKS = Connection screw size

Metric	AH715	NOF	FHA	DC	DCSFMS	APMX	APMX2	RE	BSR	CRKS	LF	Wrench	Torque*
VBL080L0.90R160-6S05	●	6	30°	8	7.7	5.5	0.9	0.5	16	S05	10	KEYV-S05	7
VBL100L1.40R200-6S06	●	6	30°	10	9.7	7.5	1.42	1	20	S06	13	KEYV-S06	10
VBL120L1.50R240-6S08	●	6	30°	12	11.7	9	1.55	1	24	S08	16.5	KEYV-S08	15
VBL160L1.80R320-6S10	●	6	30°	16	15.3	12	1.8	1	32	S10	20.5	KEYV-S10	28

* Recommended clamping torque (N·m)
2 pieces per package

● : New product

TARGET APPLICATIONS

VBO-short

Convex-curved surfaces, tapered surfaces, and surfaces consisting of combinations of a small corner radius and walls (the corner radius must be larger than the tool's nose radius).

VBO-long

Convex-curved and tapered surfaces in gentler profile than those of VBO-short.

VBN

Impellers, blisks, blades, and other aerospace parts.

TUNGMEISTER

STANDARD CUTTING CONDITIONS

Profiling

VBO, VBN, VBL

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed per tooth: *fz* (ipt) Tool diameter: DC (in) 10 mm	12 mm	16 mm	Cusp height (in)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	328 - 656	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
P	High carbon steel 4140, etc.	- 300 HB	262 - 591	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
P	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	262 - 525	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
M	Stainless steels 304, 316, etc.	- 200 HB	197 - 328	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
K	Gray cast irons 250, 300, etc.	150 - 250 HB	328 - 722	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
K	Ductile cast irons 400-15S, etc.	150 - 250 HB	328 - 722	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
N	Aluminum alloys Si < 13%	-	656 - 2297	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
N	Aluminum alloys Si ≥13%	-	328 - 984	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
S	Titanium alloys Ti-6Al-4V, etc.	-	131 - 262	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
S	Heat-resistant alloys Inconel718, etc.	-	66 - 131	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
H	Hardened steel H13, etc.	40 - 50 HRC	131 - 262	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004
H	Hardened steel D2, etc.	50 - 60 HRC	66 - 197	0.002 - 0.004	0.002 - 0.004	0.003 - 0.005	0.004

TIPS FOR USING ON 3-AXIS MACHINES

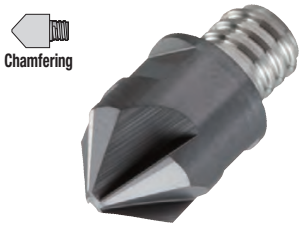
The VBO/VBN milling heads are designed for the use on 5-axis machines. However, they are also effective on 3-axis machining centers when either of the following conditions is satisfied.

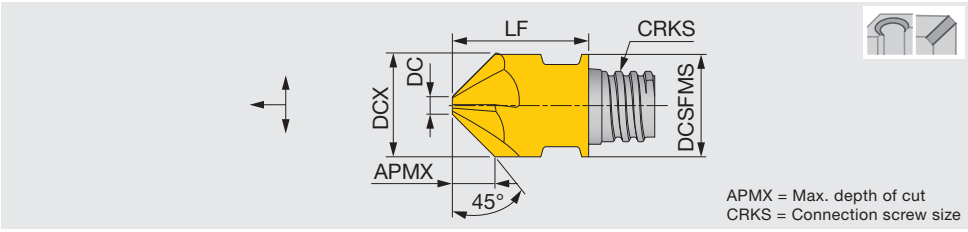
1. The angled walls or curved surfaces to be machined have tilt angles within the range specified in the chart on the right.
2. Use as a regular tapered ball mill with only the nose radius of the tool tip, and not the radius on the tool side, to be used. Please note that the working diameter will be smaller that those of a ball mill of the same working diameter.

	Designation	Applicable ranges of tilt angles on workpiece Min.	Mean	Max.
VBO-short	VBO100L08.0R250-4S06	56°	70.8°	85°
	VBO120L09.0R300-4S08	58°	71.6°	85°
	VBO160L13.0R400-4S10	56°	70.3°	85°
VBO-long	VBO100L15.0R850-5S06	20°	27.3°	35°
	VBO120L19.0R800-5S08	19°	29.3°	40°
	VBO160L25.0R750-5S10	10°	26.7°	43°
VBN	VBN100L13.0R450-6S06	0°	15.1°	29°
	VBN120L15.0R500-6S08	0°	15.1°	29°
	VBN160L18.0R600-6S10	0°	15.1°	29°

VCA**-04/06...

4, 6 flute, chamfering angle: 45°





Inch	AH725	NOF	FHA	DCX	DCSFMS	APMX	DC	CRKS	LF	Wrench	Torque*
VCA0375L16A45-U04S06	●	4	0°	0.375	0.375	0.150	0.073	S06	0.512	KEYV-S06	7.38

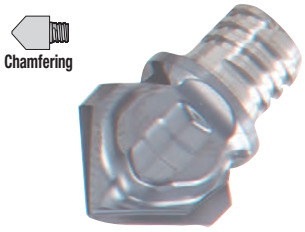
Metric	AH715	AH725	NOF	FHA	DCX	DCSFMS	APMX	DC	CRKS	LF	Wrench	Torque*
VCA100L04.0A45-04S06	●	●	4	0°	10	10	4	1.95	S06	13	KEYV-S06	10
VCA120L05.0A45-04S08	●	●	4	0°	12	12	5	1.95	S08	16.5	KEYV-S08	15
VCA127L05.3A45-04S08		●	4	0°	12.7	12.7	5.3	1.98	S08	16.5	KEYV-S08	15
VCA160L06.5A45-06S10	●	●	6	0°	16	16	6.5	3	S10	20.3	KEYV-S10	28
VCA200L07.5A45-06S12		●	6	0°	20	18.3	7.5	5	S12	25.5	KEYV-S12	28

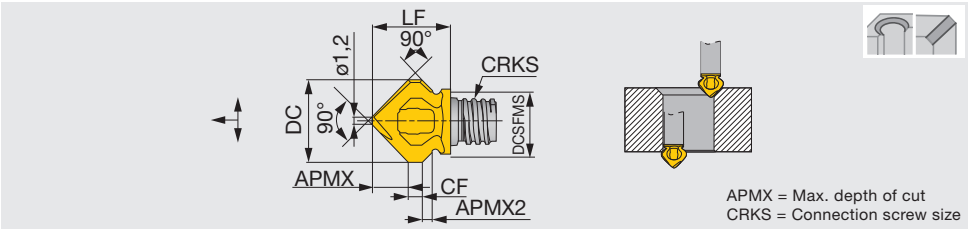
* Torque: Recommended clamping torque: lbs·ft (*N·m)
2 pieces per package

● : New product
● : Line up

VCW**-02...

2 flute, chamfering angle: 45°, back chamfering capability





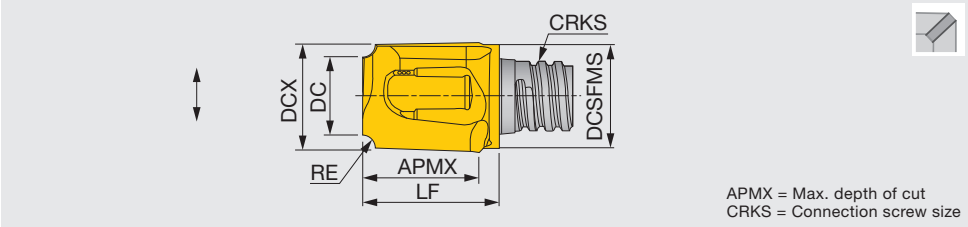
Metric	AH715	AH725	NOF	FHA	DC	DCSFMS	APMX	APMX2	CF	CRKS	LF	Wrench	Torque*
VCW118L05.0A45-02S06	●	●	2	0°	11.8	9.3	5	1.2	2	S06	11.2	***KEYV-S08	10

Available for chamfering of reverse side.
* Recommended clamping torque (N·m)
*** The wrench size for these heads is different from the ones for the other head types.
2 pieces per package

● : Line up

VCR**-02...

2 flute, radius chamfering



Metric	AH725	NOF	FHA	DCX	DCSFMS	DC	APMX	RE	CRKS	LF	Wrench	Torque*
VCR080L07.5R10-02S05	●	2	0°	8	7.6	5.8	7.5	1	S05	10.5	KEYV-S05	7
VCR100L09.5R16-02S06	●	2	0°	10	9.5	6.8	9.5	1.6	S06	12.5	KEYV-S06	10
VCR100L09.5R25-02S06	●	2	0°	10	9.5	5.1	9.5	2.5	S06	12.5	KEYV-S06	10
VCR127L12.0R30-02S08	●	2	0°	12.7	12.2	6.5	12	3	S08	15.6	KEYV-S08	15
VCR127L12.0R40-02S08	●	2	0°	12.7	12.2	4.7	12	4	S08	15.6	KEYV-S08	15
VCR160L15.0R50-02S10	●	2	0°	16	15.2	6.2	15	5	S10	19.1	KEYV-S10	28
VCR200L07.0R60-02S12	●	2	0°	20	18.3	8	7	6	S12	17.4	KEYV-S12	28

* Recommended clamping torque (N·m)
2 pieces per package

● : Line up

STANDARD CUTTING CONDITIONS

Chamfering and countersinking (Milling, Z-feed chamfering)

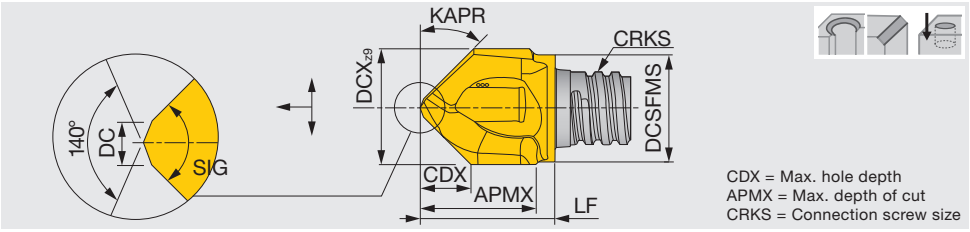
VCA, VCW, VCR

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed per tooth *fz* (ipt)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	197 - 328	0.0024 - 0.0047
P	High carbon steels 4140,etc.	- 300 HB	164 - 262	0.0024 - 0.0047
P	Prehardened steel PX5, NAK80 etc	30 - 40 HRC	131 - 230	0.0024 - 0.0047
M	Stainless steels SUS304, SUS316, etc. 304, 316, etc.	- 200 HB	98 - 164	0.0024 - 0.0047
K	Grey cast irons 250, 300, etc.	150 - 250 HB	262 - 394	0.0024 - 0.0047
K	Ductile cast irons 400-15S, etc.	150 - 250 HB	262 - 394	0.0024 - 0.0047
N	Aluminum alloys	-	328 - 656	0.0031 - 0.0059
S	Titanium alloys Ti-6Al-4V, etc.	-	98 - 164	0.0020 - 0.0039
S	Heat-resistant alloys Inconel 718, etc.	-	66 - 131	0.0016 - 0.0031
H	Hardened steel H13, etc.	40 - 50 HRC	98 - 164	0.0020 - 0.0039
H	Hardened steel D2, etc.	50 - 60 HRC	66 - 131	0.0016 - 0.0031

VCP**-02...

2 flute, chamfering angle: 30°, 45°, 60°

Chamfering
Spot drill



CDX = Max. hole depth
APMX = Max. depth of cut
CRKS = Connection screw size

Metric	AH715	AH725	SIG	NOF	FHA	DCX	DCSFMS	APMX	CDX	CRKS	LF	DC	KAPR	Wrench	Torque*
VCP100L09.5A30-02S06		●	60°	2	0°	10	9.5	8.5	7.5	S06	11.75	1.5	60°	KEYV-S06	10
VCP120L12.0A30-02S08		●	60°	2	0°	12	11.5	11	9.2	S08	15.4	1.5	60°	KEYV-S08	15
VCP160L15.0A30-02S10		●	60°	2	0°	16	15.2	16	12	S10	20.2	2.5	60°	KEYV-S10	28
VCP080L07.7A45-02S05	●	●	90°	2	0°	8	7.6	7.5	3.7	S05	9.75	1	45°	KEYV-S05	7
VCP083L07.9A45-02S05		●	90°	2	0°	8.3	7.6	7.5	3.8	S05	10	1	45°	KEYV-S05	7
VCP100L09.0A45-02S06	●	●	90°	2	0°	10	9.5	9.5	4.4	S06	11.75	1.5	45°	KEYV-S06	10
VCP104L09.0A45-02S06		●	90°	2	0°	10.4	9.5	9.5	4.6	S06	11.75	1.5	45°	KEYV-S06	10
VCP120L12.0A45-02S08		●	90°	2	0°	12	11.5	11.5	5.4	S08	15.4	1.5	45°	KEYV-S08	15
VCP124L12.0A45-02S08		●	90°	2	0°	12.4	11.5	11.5	5.6	S08	15.4	1.5	45°	KEYV-S08	15
VCP160L15.0A45-02S10	●	●	90°	2	0°	16	15.2	15	7.1	S10	18.8	1.5	45°	KEYV-S10	28
VCP165L15.0A45-02S10		●	90°	2	0°	16.5	15.2	15	7.1	S10	18.8	1.5	45°	KEYV-S10	28
VCP100L09.5A60-02S06		●	120°	2	0°	10	9.5	9.5	2.7	S06	12.7	1.5	30°	KEYV-S06	10
VCP120L12.0A60-02S08		●	120°	2	0°	12	11.5	11.5	3.3	S08	15.2	1.5	30°	KEYV-S08	15
VCP160L15.5A60-02S10		●	120°	2	0°	16	15.2	16	4.4	S10	19.9	1.5	30°	KEYV-S10	28

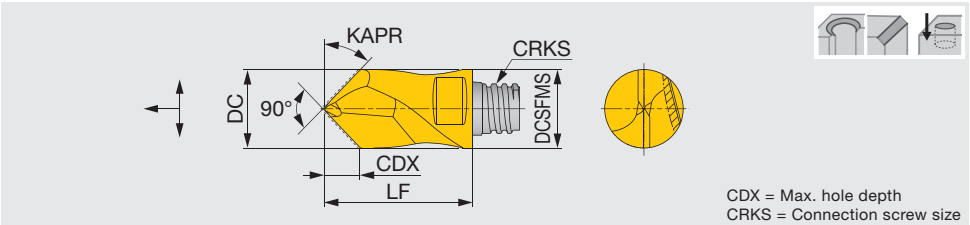
* Recommended clamping torque (N·m)
2 pieces per package

● : Line up

VDS...

2 flute, chamfering angle: 45°, helix cutting edge

Chamfering
Spot drill



CDX = Max. hole depth
CRKS = Connection screw size

Metric	AH725	NOF	FHA	DC	DCSFMS	CDX	KAPR	CRKS	LF	Wrench	Torque*
VDS080A45-02S05	●	2	10°	8	7.7	3.7	45°	S05	15	KEYV-S05	7
VDS100A45-02S06	●	2	10°	10	9.7	4.4	45°	S06	19	KEYV-S06	10
VDS120A45-02S08	●	2	10°	12	11.7	5.4	45°	S08	23	KEYV-S08	15
VDS160A45-02S10	●	2	10°	16	15.3	7.1	45°	S10	28	KEYV-S10	28

* Recommended clamping torque (N·m)
2 pieces per package

● : New product

TUNGMEISTER

STANDARD CUTTING CONDITIONS

Spot drill

VCP, VDS

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed *f* (ipr)
P	Carbon steel 1045, 1055, etc.	- 300 HB	197 - 328	0.0024 - 0.0047
P	Alloy steel 4140, 8620, etc.	- 300 HB	164 - 262	0.0024 - 0.0047
P	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	131 - 230	0.0024 - 0.0047
M	Stainless steels 304, 316, etc.	- 200 HB	98 - 164	0.0024 - 0.0047
K	Gray cast irons 250, 300, etc.	150 - 250 HB	262 - 394	0.0024 - 0.0047
K	Ductile cast irons 400-15S, etc.	150 - 250 HB	262 - 394	0.0024 - 0.0047
N	Aluminum alloys	-	328 - 656	0.0031 - 0.0063
S	Titanium alloys Ti-6Al-4V, etc.	-	98 - 164	0.002 - 0.0039
S	Heat-resistant alloys Inconel 718, etc.	-	66 - 131	0.0016 - 0.0031
H	Hardened steel H13, etc.	40 - 50 HRC	98 - 164	0.002 - 0.0039
H	Hardened steel D2, etc.	50 - 60 HRC	66 - 131	0.0016 - 0.0031

HEADS

VDP**-02...

2 flute, A/B type center

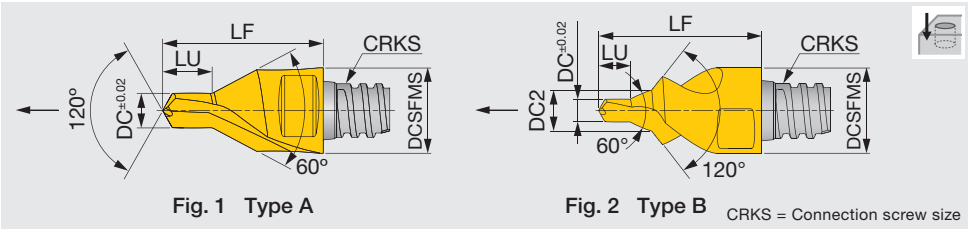


Fig. 1 Type A

Fig. 2 Type B

CRKS = Connection screw size

Metric	AH725	NOF	FHA	DC±0.02	DC2	DCSFMS	LU	CRKS	LF	Wrench	Torque*	Fig.
VDP107L1.60A30-02S04	●	2	0°	1.07	-	6	1.6	S04	10	KEYV-S05	4	1
VDP165L2.40A30-02S04	●	2	0°	1.65	-	6	2.4	S04	10	KEYV-S05	4	1
VDP207L2.90A30-02S04	●	2	0°	2.07	-	6	2.9	S04	10	KEYV-S05	4	1
VDP328L04.6A30-02S05	●	2	0°	3.28	-	8	4.6	S05	15	KEYV-S05	7	1
VDP412L05.9A30-02S06	●	2	0°	4.12	-	10	5.9	S06	19	KEYV-S06	10	1
VDP513L07.2A30-02S08	●	2	0°	5.13	-	12	7.2	S08	23	KEYV-S08	15	1
VDP646L08.9A30-02S10	●	2	0°	6.46	-	16	8.9	S10	28	KEYV-S10	28	1
VDP324L4.38B30-02S08	●	2	0°	3.24	6.77	12	4.4	S08	23	KEYV-S08	15	2
VDP409L5.60B30-02S08	●	2	0°	4.09	8.56	12.7	5.6	S08	23	KEYV-S08	15	2
VDP509L6.89B30-02S12	●	2	0°	5.09	10.69	18.45	6.9	S12	25.5	KEYV-S12	28	2
VDP641L8.63B30-02S12	●	2	0°	6.41	13.29	20	8.6	S12	25.5	KEYV-S12	28	2

* Recommended clamping torque (N·m)
2 pieces per package

● : New product
● : Line up

STANDARD CUTTING CONDITIONS

Center drill

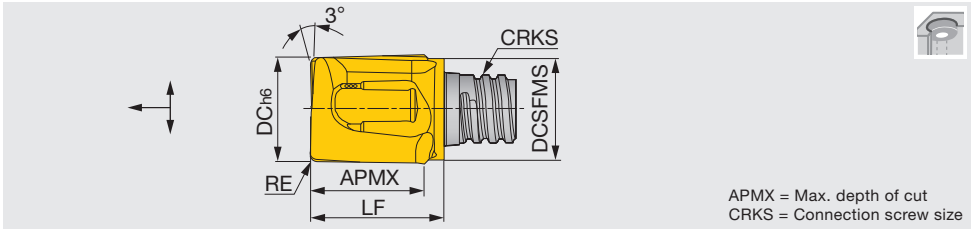
VDP

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed : *f* (ipt)						
				VDP107	VDP165	VDP207	VDP324 / VDP328	VDP409 / VDP412	VDP509 / VDP513	VDP641
P	Carbon steel 1045, 1055, etc.	- 300 HB	131 - 262	0.0008 - 0.0016	0.001 - 0.002	0.001 - 0.002	0.0016 - 0.0031	0.002 - 0.0039	0.002 - 0.0039	0.0024 - 0.0047
	Alloy steel 4140, 8620, etc.	- 300 HB	98 - 164	0.0008 - 0.0016	0.001 - 0.002	0.001 - 0.002	0.0016 - 0.0031	0.002 - 0.0039	0.002 - 0.0039	0.0024 - 0.0047
	Prehardened steel PX5, NAK80, etc.	30 - 40 HRC	66 - 98	0.0008 - 0.0016	0.001 - 0.002	0.001 - 0.002	0.0016 - 0.0031	0.002 - 0.0039	0.002 - 0.0039	0.0024 - 0.0047
M	Stainless steels 304, 316, etc.	- 200 HB	49 - 82	0.0006 - 0.0012	0.0008 - 0.0016	0.0008 - 0.0016	0.0016 - 0.0031	0.002 - 0.0039	0.002 - 0.0039	0.0024 - 0.0047
K	Gray cast irons 250, 300, etc.	150 - 250 HB	197 - 328	0.0008 - 0.0016	0.001 - 0.002	0.001 - 0.002	0.002 - 0.0035	0.0028 - 0.0005	0.0028 - 0.0047	0.0047 - 0.0071
	Ductile cast irons 400-15S, etc.	150 - 250 HB	197 - 328	0.0008 - 0.0016	0.001 - 0.002	0.001 - 0.002	0.0016 - 0.0031	0.002 - 0.0039	0.002 - 0.0039	0.0039 - 0.0059
S	Titanium alloys Ti-6Al-4V, etc.	-	49 - 82	0.0004 - 0.0008	0.0004 - 0.0008	0.0006 - 0.0012	0.0016 - 0.0028	0.0016 - 0.0028	0.0016 - 0.0028	0.0016 - 0.0028
	Heat-resistant alloys Inconel 718, etc.	-	33 - 66	0.0004 - 0.0008	0.0004 - 0.0008	0.0006 - 0.0012	0.0012 - 0.0024	0.0012 - 0.0024	0.0012 - 0.0024	0.0012 - 0.0024
H	Hardened steel H13, etc.	40 - 50 HRC	49 - 82	-	-	-	0.0016 - 0.0028	0.0016 - 0.0028	0.0016 - 0.0028	0.0016 - 0.0028
	Hardened steel D2, etc.	50 - 60 HRC	33 - 66	-	-	-	0.0012 - 0.0024	0.0012 - 0.0024	0.0012 - 0.0024	0.0012 - 0.0024

HEADS

VGC**-02...

2 flute, for counterboring (can be used for milling)



APMX = Max. depth of cut
CRKS = Connection screw size

Inch	AH725	NOF	FHA	DC	DCSFMS	APMX	RE	CRKS	LF	Wrench	Torque*
VGC031L31R016-U02S05	●	2	10°	0.312	0.297	0.310	0.016	S05	0.390	KEYV-S05	5.16
VGC037L38R016-U02S06	●	2	10°	0.375	0.360	0.380	0.016	S06	0.485	KEYV-S06	7.38
VGC050L43R016-U02S08	●	2	10°	0.500	0.453	0.433	0.016	S08	0.600	KEYV-S08	11.06
VGC056L46R016-U02S08	●	2	10°	0.562	0.450	0.460	0.016	S08	0.590	KEYV-S08	11.06
VGC062L60R016-U02S10	●	2	10°	0.625	0.600	0.600	0.016	S10	0.750	KEYV-S10	20.65
VGC062L60R032-U02S10	●	2	10°	0.625	0.600	0.600	0.032	S10	0.750	KEYV-S10	20.65

Also capable of drilling with step feed (Max. depth = ap x 0.020")
* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

STANDARD CUTTING CONDITIONS

Counterboring

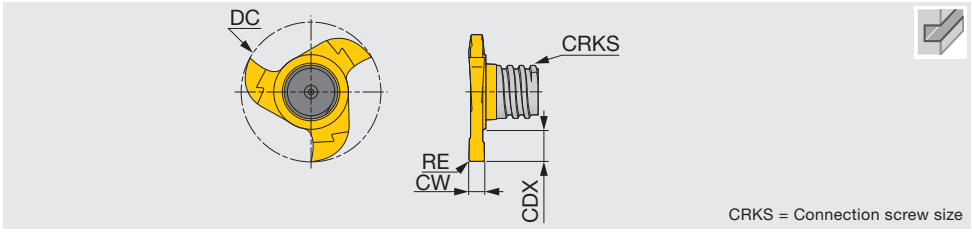
VGC

ISO	Workpiece material	Hardness	Cutting speed *Vc* (sfm)	Feed per tooth *fz* (ipt)
P	Low carbon steels 1045, 1055, etc.	HB 300 -	131 - 262	0.002 - 0.003
	High carbon steels 4140,etc.	HB 300 -	98 - 164	0.002 - 0.003
	Prehardened steel PX5, NAK80 etc	HRC 40 - 30	66 - 98	0.002 - 0.003
M	Stainless steels 304, 316, etc.	HB 200 -	49 - 82	0.002 - 0.003
K	Grey cast irons 250, 300, etc.	HB 250 - 150	197 - 328	0.002 - 0.004
	Ductile cast irons 400-15S, etc.	HB 250 - 150	197 - 328	0.002 - 0.003
S	Titanium alloys Ti-6Al-4V etc	-	49 - 82	0.002 - 0.003
	Heat-resistant alloys Inconel 718 etc	-	33 - 66	0.001 - 0.002
H	Hardened steel SKD61, SKT4 etc H13, etc.	HRC 50 - 40	49 - 82	0.002 - 0.003
	Hardened steel SKD11, SKH etc D2, etc.	HRC 60 - 50	33 - 66	0.001 - 0.002

- When drilling, the step feed (pecking) operation should be applied with the depth of 0.011" - 0.019" per step.
- Apply the same cutting conditions as the VEE type head when conducting shoulder milling or slotting operations.

VST**-3...

3 flute, for slotting



Metric	AH735	GH130	NOF	FHA	DC	CW$^{\pm 0.02}$	RE	CRKS	CDX	Wrench	Torque*
VST157W1.50R010-3S06		●	3	0°	15.7	1.5	0.1	S06	2.8	KEYV-177	10
VST157W1.57R020-3S06		●	3	0°	15.7	1.57	0.2	S06	2.8	KEYV-177	10
VST157W2.00R020-3S06		●	3	0°	15.7	2	0.2	S06	2.8	KEYV-177	10
VST157W2.39R020-3S06		●	3	0°	15.7	2.39	0.2	S06	2.8	KEYV-177	10
VST157W2.50R020-3S06		●	3	0°	15.7	2.5	0.2	S06	2.8	KEYV-177	10
VST157W3.00R020-3S06		●	3	0°	15.7	3	0.2	S06	2.8	KEYV-177	10
VST157W3.17R020-3S06		●	3	0°	15.7	3.17	0.2	S06	2.8	KEYV-177	10
VST177W1.20R005-3S06		●	3	0°	17.7	1.2(1)	0.05	S06	3.8	KEYV-177	10
VST177W1.40R005-3S06		●	3	0°	17.7	1.4(1)	0.05	S06	3.8	KEYV-177	10
VST177W1.50R010-3S06		●	3	0°	17.7	1.5	0.1	S06	3.8	KEYV-177	10
VST177W1.57R020-3S06		●	3	0°	17.7	1.57	0.2	S06	3.8	KEYV-177	10
VST177W1.70R005-3S06		●	3	0°	17.7	1.7(1)	0.05	S06	3.8	KEYV-177	10
VST177W2.00R020-3S06		●	3	0°	17.7	2	0.2	S06	3.8	KEYV-177	10
VST177W2.20R110-3S06		●	3	0°	17.7	2.20	1.1	S06	3.8	KEYV-177	10
VST177W2.39R020-3S06		●	3	0°	17.7	2.39	0.2	S06	3.8	KEYV-177	10
VST177W2.50R020-3S06		●	3	0°	17.7	2.5	0.2	S06	3.8	KEYV-177	10
VST177W3.00R020-3S06	●	●	3	0°	17.7	3	0.2	S06	3.8	KEYV-177	10
VST177W3.17R020-3S06		●	3	0°	17.7	3.17	0.2	S06	3.8	KEYV-177	10

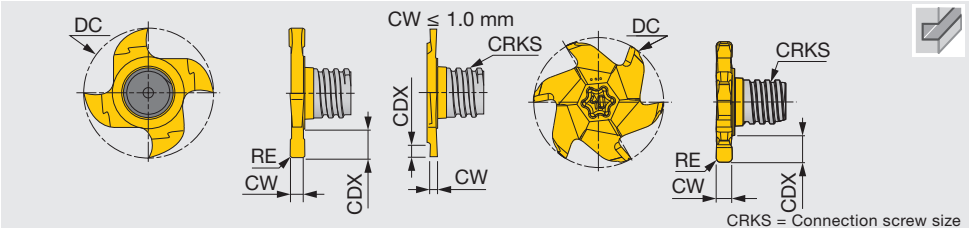
(1) CW is based on DIN471 / 472
* Recommended clamping torque (N·m)
2 pieces per package

● : Line up

VST**-4/6...

4, 6 flute, for slotting

Slotting



Metric	AH735	GH130	FHA	NOF	DC	CW±0.02	RE	CRKS	CDX	Wrench	Torque*
VST217W0.76R000-4S08		●	0°	4	21.7	0.76(1)	-	S08	1.5	KEYV-217	15
VST217W0.86R000-4S08		●	0°	4	21.7	0.86(1)	-	S08	1.7	KEYV-217	15
VST217W0.96R000-4S08		●	0°	4	21.7	0.96(1)	-	S08	1.9	KEYV-217	15
VST217W1.00R005-4S08		●	0°	4	21.7	1	0.05	S08	2	KEYV-217	15
VST217W1.20R005-4S08		●	0°	4	21.7	1.2(1)	0.05	S08	4.5	KEYV-217	15
VST217W1.40R005-4S08		●	0°	4	21.7	1.4(1)	0.05	S08	4.5	KEYV-217	15
VST217W1.57R000-4S08		●	0°	4	21.7	1.57	-	S08	4.5	KEYV-217	15
VST217W1.70R010-4S08		●	0°	4	21.7	1.7(1)	0.1	S08	4.5	KEYV-217	15
VST217W1.95R020-4S08		●	0°	4	21.7	1.95(1)	0.2	S08	4.5	KEYV-217	15
VST217W2.00R020-4S08		●	0°	4	21.7	2	0.2	S08	4.5	KEYV-217	15
VST217W2.25R020-4S08		●	0°	4	21.7	2.25(1)	0.2	S08	4.5	KEYV-217	15
VST217W2.39R020-4S08		●	0°	4	21.7	2.39	0.2	S08	4.5	KEYV-217	15
VST217W2.50R020-4S08	●	●	0°	4	21.7	2.5	0.2	S08	4.5	KEYV-217	15
VST217W2.75R020-4S08		●	0°	4	21.7	2.75(1)	0.2	S08	4.5	KEYV-217	15
VST217W3.00R020-4S08	●	●	0°	4	21.7	3	0.2	S08	4.5	KEYV-217	15
VST217W3.17R020-4S08		●	0°	4	21.7	3.17	0.2	S08	4.5	KEYV-217	15
VST217W3.25R020-4S08		●	0°	4	21.7	3.25(1)	0.2	S08	4.5	KEYV-217	15
VST217W4.00R020-4S08		●	0°	4	21.7	4	0.2	S08	4.5	KEYV-217	15
VST217W4.25R020-4S08		●	0°	4	21.7	4.25(1)	0.2	S08	4.5	KEYV-217	15
VST217W4.75R020-4S08		●	0°	4	21.7	4.75	0.2	S08	4.5	KEYV-217	15
VST217W5.25R020-4S08		●	0°	4	21.7	5.25(1)	0.2	S08	4.5	KEYV-217	15
VST277W2.50R020-6S10		●	0°	6	27.7	2.5	0.2	S10	6	KEYV-T40L	28
VST277W5.25R020-6S10		●	0°	6	27.7	5.25	0.2	S10	6	KEYV-T40L	28
VST277W10.0R020-6S10		●	0°	6	27.7	10	0.2	S10	6	KEYV-T40L	28

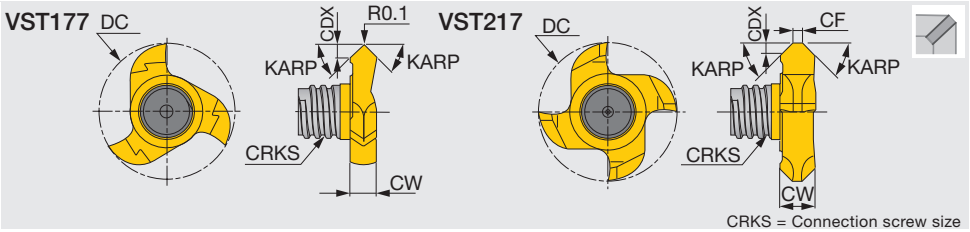
(1) CW is based on DIN471 / 472
* Recommended clamping torque (N·m)
2 pieces per package

● : Line up

VST**A45...

3, 4 flute, for slotting with 45°chamfer

Slotting



Metric	GH130	NOF	FHA	DC	CW	KARP	CRKS	CDX	CF	Wrench	Torque*
VST177L01.40A45-3S06	●	3	0°	17.7	3.4	45°	S06	1.4	-	KEYV-177	10
VST217L01.70A45-4S08	●	4	0°	21.7	5.5	45°	S08	1.7	1.5	KEYV-217	15

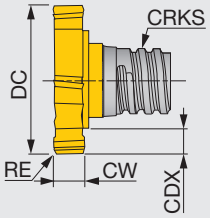
* Recommended clamping torque (N·m)
2 pieces per package

● : Line up

VTB**-06...

6 flute, for T-slotting

Slotting



CRKS = Connection screw size

Inch	GH130	NOF	FHA	DC -0.002" 0	CW ±0.0008"	CDX	CRKS	RE	Wrench	Torque*
VTB05W125R016-U06S05	●	6	0°	0.500	0.125	0.088	S05	0.016	KEYV-T20	5.16
VTB06W056R016-U06S06	●	6	0°	0.625	0.056	0.125	S06	0.016	KEYV-T20	7.38
VTB06W063R016-U06S06	●	6	0°	0.625	0.063	0.125	S06	0.016	KEYV-T20	7.38
VTB06W068R016-U06S06	●	6	0°	0.625	0.068	0.125	S06	0.016	KEYV-T20	7.38
VTB06W078R016-U06S06	●	6	0°	0.625	0.078	0.125	S06	0.016	KEYV-T20	7.38
VTB06W086R016-U06S06	●	6	0°	0.625	0.086	0.125	S06	0.016	KEYV-T25	7.38
VTB06W105R016-U06S06	●	6	0°	0.625	0.105	0.125	S06	0.016	KEYV-T25	7.38
VTB06W125R016-U06S06	●	6	0°	0.625	0.125	0.125	S06	0.016	KEYV-T25	7.38
VTB06W156R016-U06S06	●	6	0°	0.625	0.156	0.125	S06	0.016	KEYV-T25	7.38
VTB07W156R016-U06S08	●	6	0°	0.750	0.156	0.120	S08	0.016	KEYV-T30L	11.06
VTB07W187R016-U06S08	●	6	0°	0.750	0.187	0.120	S08	0.016	KEYV-T30L	11.06
VTB07W250R016-U06S08	●	6	0°	0.750	0.250	0.120	S08	0.016	KEYV-T30L	11.06
VTB08W187R016-U06S08	●	6	0°	0.875	0.187	0.190	S08	0.015	KEYV-T40L	11.06
VTB08W250R016-U06S08	●	6	0°	0.875	0.250	0.190	S08	0.015	KEYV-T40L	11.06
VTB08W312R016-U06S08	●	6	0°	0.875	0.312	0.190	S08	0.015	KEYV-T40L	11.06
VTB10W187R016-U06S10	●	6	0°	1.000	0.187	0.177	S10	0.015	KEYV-T50L	20.65
VTB10W250R016-U06S10	●	6	0°	1.000	0.250	0.177	S10	0.015	KEYV-T50L	20.65

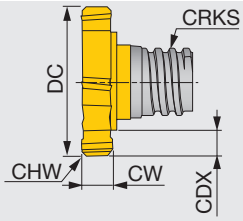
* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

●: Line up

VTB**-C006...

6 flute, for T-slotting with 45°chamfer

Slotting



CRKS = Connection screw size

Inch	GH130	NOF	FHA	DC -0.002" 0	CW ±0.0008"	CDX	CRKS	CHW	Wrench	Torque*
VTB05W062C006-U06S05	●	6	0°	0.500	0.062	0.089	S05	0.006	KEYV-T20	5.16
VTB05W078C006-U06S05	●	6	0°	0.500	0.078	0.089	S05	0.006	KEYV-T20	5.16

* Torque: Recommended clamping torque: lbs·ft
2 pieces per package

●: Line up

TUNGMEISTER

STANDARD CUTTING CONDITIONS

Slotting

VST, VTB

ISO	Workpiece material	Hardness	VST		VTB	
			Cutting speed *Vc* (sfm)	Feed per tooth *fz* (ipt)	Cutting speed *Vc* (sfm)	Feed per tooth *fz* (ipt)
P	Low carbon steels 1045, 1055, etc.	- 300 HB	262 - 591	0.002 - 0.006	262 - 591	0.003 - 0.007
	High carbon steels 4140,etc.	- 300 HB	197 - 394	0.002 - 0.005	197 - 394	0.002 - 0.006
M	Stainless steels 304, 316, etc.	- 200 HB	164 - 394	0.002 - 0.005	164 - 394	0.002 - 0.006
K	Grey cast irons 250, 300, etc.	150 - 250 HB	328 - 656	0.002 - 0.006	328 - 656	0.003 - 0.007
	Ductile cast irons 400-15S, etc.	150 - 250 HB	328 - 656	0.002 - 0.005	328 - 656	0.002 - 0.006
N	Aluminum alloys Si < 13%	-	656 - 1969	0.002 - 0.006	656 - 1969	0.003 - 0.007
	Aluminum alloys Si ≥13%	-	328 - 984	0.001 - 0.005	328 - 984	0.002 - 0.006
S	Titanium alloys Ti-6Al-4V, etc.	-	131 - 197	0.002 - 0.003	131 - 197	0.002 - 0.006
	Heat-resistant alloys Inconel 718, etc.	-	49 - 115	0.001 - 0.004	49 - 115	0.001 - 0.004

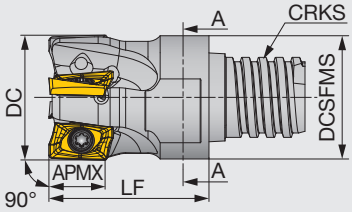
Tolerance of tool diameter

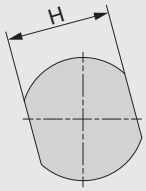
Basic dimensions (mm)		Permissible dimensional deviations (μm)						
>	≤	e8	e9	h6	h7	h9	h10	z9
6	10	-25 -47	-25 -61	0 -9	0 -15	0 -36	0 -58	+78 +42
10	14	-32 -59	-32 -75	0 -11	0 -18	0 -43	0 -70	+93 +50
14	18	-32 -59	-32 -75	0 -11	0 -18	0 -43	0 -70	+103 +60
18	30	-40 -73	-40 -92	0 -13	0 -21	0 -52	0 -84	-

JISB0401-2: 1998 (ISO286-2: 1988) extract

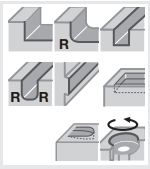
2, 3, 4 tooth, roughing - semi finishing, shoulder milling cutter

Indexable modular head





A-A cross section



Metric	APMX	DC	CICT	LF	H	DCSFMS	CRKS	WT (kg)	Air hole	Insert
HPAV06M010S05R02 ***	6	10	2	10	8	8	S05	0.01	Without	AVGT06...
HPAV06M010S06R02	6	10	2	16	8	9.8	S06	0.01	Without	AVGT06...
HPAV06M012S08R02	6	12	2	18	10	11.7	S08	0.02	Without	AVGT06...
HPAV06M012S08R03	6	12	3	18	10	11.7	S08	0.02	Without	AVGT06...
HPAV06M016S10R03	6	16	3	20	13	15.4	S10	0.03	Without	AVGT06...
HPAV06M016S10R04	6	16	4	20	13	15.4	S10	0.03	Without	AVGT06...

Applicable shank: VSSD, VTSD, VSC, VSTD, VER
Please use VAD-M adapter to connect TungMeister with a metric thread shank.
*** The wrench size for these heads is different from the ones for the other head types.

Designation	Wrench*
HPAV06M010S...	KEYV-S06
HPAV06M012S...	KEYV-S08
HPAV06M016S...	KEYV-S10

*sold separately

SPARE PARTS



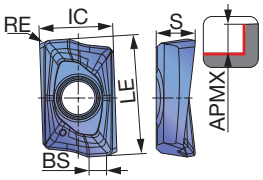
Designation	Clamping screw	Lubricant	Wrench
HPAV06M...	CSPB-2H	M-1000	IP-6DB

*Recommended clamping torque (N·m): CSPB-2H = 0.7

INSERTS

AVGT-MJ

AVGT-AJ



		AH120	AH130	AH3135	AH3225	KS05F
P	Steel	☆		☆	★	
M	Stainless		☆	★	☆	
K	Cast iron	★				
N	Non-ferrous					★
S	Superalloys	☆	★			
H	Hard materials	★				

★ : First choice
☆ : Second choice

Designation	RE	APMX	Coated				Carbide	LE	IC	S	BS
			AH120	AH130	AH3135	AH3225	KS05F				
AVGT060300PBER-MJ	0	0.236			●	●		0.315	0.197	0.106	0.063
AVGT060302PBER-MJ	0.008	0.236	●	●	●	●		0.315	0.197	0.106	0.059
AVGT060304PBER-MJ	0.016	0.236	●	●	●	●		0.315	0.197	0.106	0.051
AVGT060308PBER-MJ	0.031	0.236	●	●	●	●		0.315	0.197	0.102	0.035
AVGT060300PBFR-AJ	0	0.236					●	0.315	0.197	0.106	0.063
AVGT060302PBFR-AJ	0.008	0.236					●	0.315	0.197	0.106	0.059
AVGT060304PBFR-AJ	0.016	0.236					●	0.315	0.197	0.106	0.051
AVGT060308PBFR-AJ	0.031	0.236					●	0.315	0.197	0.102	0.035

● : New
● : Line up

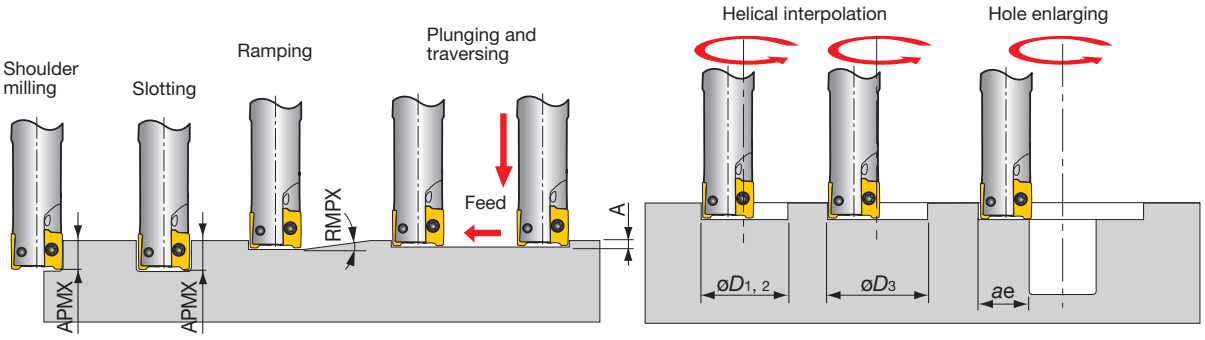
TUNGMEISTER

STANDARD CUTTING CONDITIONS

HPAV06-S

ISO	Workpiece materials		Hardness	Priority	Grades	Cutting speed *Vc* (sfm)	Feed per tooth *fz* (ipt)
P	Low carbon steels 1018, 1026, etc.		- 200 HB	First choice	AH3225	755 - 1410	0.003 - 0.005
P	Carbon steel and alloy steel 1055, 4140, etc.		- 300 HB	First choice	AH3225	490 - 1150	0.003 - 0.005
P	Prehardened steel H-13, P-20, etc.		30 - 40 HRC	First choice	AH3225	325 - 750	0.003 - 0.005
M	Stainless steel 304, 316, etc.		-	First choice	AH3135	490 - 720	0.003 - 0.004
K	Gray cast iron Class 25, Class 30, etc.		150 - 250 HB	First choice	AH120	655 - 1080	0.003 - 0.005
K	Ductile cast iron 60-40-12, 80-55-06, etc.		150 - 250 HB	First choice	AH120	490 - 785	0.003 - 0.005
N	Aluminum alloys Si < 13%		-	First choice	KS05F	2130 - 3280	0.003 - 0.005
N	Aluminum alloys Si ≥ 13%		-	First choice	KS05F	325 - 750	0.003 - 0.005
S	Titanium alloys Ti-6Al-4V, etc.		-	First choice	AH130	130 - 295	0.0016 - 0.004
S	Superalloys Inconel718, etc.		-	First choice	AH130	145 - 210	0.0016 - 0.004
H	Hardened steel	H13, etc.	40 - 50 HRC	First choice	AH120	145 - 225	0.002 - 0.004
H	Hardened steel	D2, etc.	50 - 60 HRC	First choice	AH120	130 - 210	0.0016 - 0.003

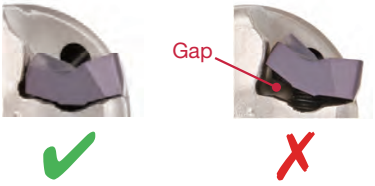
MACHINING APPLICATIONS



Designation	DC	Max. depth of cut APMX	Max. ramping angle RMPX	Max. plunging A	Min. machining øD1	Max. machining øD2	Max. machining øD3*	Max. cutting width in enlarging ae
EPAV06U0.31…	0.313	0 .236	-	-	-	-	-	-
EPAV06U0.37…	0.375	0 .236	3°	0.012	0.591	0.748	0.709	0.374
EPAV06U0.50…	0.500	0 .236	3°	0.012	0.709	0.906	0.866	0.453
EPAV06U0.62…	0.625	0 .236	2°	0.012	1.026	1.220	1.181	0.610
EPAV06U0.75…	0.750	0 .236	1.5°	0.012	1.276	1.460	1.421	0.730
EPAV06U1.00…	1.000	0 .236	1°	0.012	1.775	1.960	1.921	0.980

*Flat bottom hole

When clamping the insert, please confirm that there is no gap between the cutter body and the insert as shown in the picture.

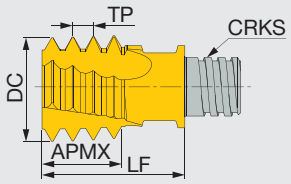


ISO metric

VMT***IS

3 - 6 flute, full profile, for internal thread

Threading



CRKS = Connection screw size

Metric	TP	Application range Coarse	Application range Fine	DC	NOF	APMX	LF	CRKS	Grade	Wrench	Torque*
VMT100L06IS07-4S05	0.75	-	≥M12	10	4	6	12.8	S05	AH725	KEYV-S05	7
VMT100L06IS10-4S05	1	-	≥M12	10	4	6	12.8	S05	AH725	KEYV-S05	7
VMT100L06IS15-4S05	1.5	-	≥M14	10	4	6	12.8	S05	AH725	KEYV-S05	7
VMT120L08IS15-4S06	1.5	-	≥M16	12	4	7.6	14.3	S06	AH725	KEYV-S06	10
VMT120L08IS20-4S06	2	M16	≥M17	12	4	8	14.3	S06	AH725	KEYV-S06	10
VMT160L12IS15-6S08	1.5	-	≥M20	16	6	12	19	S08	AH725	KEYV-T30L	15
VMT160L12IS20-5S08	2	-	≥M19	16	5	12	19	S08	AH725	KEYV-T30L	15
VMT154L13IS25-5S08	2.5	M20	≥M22	15.4	5	12.7	20	S08	AH725	KEYV-S08	15
VMT160L12IS30-3S08	3	M24	≥M25	16	3	12	19	S08	AH725	KEYV-T30L	15

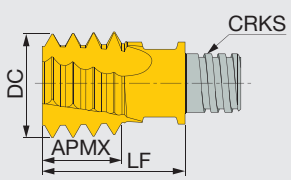
* Recommended clamping torque (N·m)
2 pieces per package

Unified

VMT***UN

3, 4, 5 flute, full profile, for internal thread

Threading



CRKS = Connection screw size

Metric	TPI	Application range UNC	Application range UNF	Application range UNEF	DC	NOF	APMX	LF	CRKS	Grade	Wrench	Torque*
VMT100L06UN24-4S05	24	-	-	9/16-5/8	10	4	5.3	12.8	S05	AH725	KEYV-S05	7
VMT100L06UN20-4S05	20	-	1/2	-	10	4	5.1	12.8	S05	AH725	KEYV-S05	7
VMT100L06UN18-4S05	18	-	9/16-5/8	1 1/8-1 5/8	10	4	5.6	12.8	S05	AH725	KEYV-S05	7
VMT120L08UN16-4S06	16	-	3/4	-	12	4	8	14.3	S06	AH725	KEYV-S06	10
VMT120L10UN14-4S06	14	-	7/8	-	12	4	9	14.3	S06	AH725	KEYV-T25	10
VMT160L13UN12-5S08	12	-	1-1 1/2	-	16	5	12.7	19	S08	AH725	KEYV-T30L	15
VMT150L13UN10-4S08	10	3/4	-	-	15.4	4	12.7	19	S08	AH725	KEYV-T30L	15
VMT160L11UN09-3S08	9	7/8	-	-	16	3	11.3	19	S08	AH725	KEYV-T30L	15
VMT160L13UN08-3S08	8	1	-	-	16	3	12.7	20	S08	AH725	KEYV-S08	15

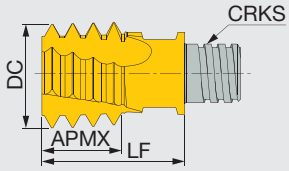
* Recommended clamping torque (N·m)
2 pieces per package

Whitworth

VMT***W

4 flute, full profile, for internal/external thread

Threading



CRKS = Connection screw size

Metric	TPI	Application range	DC	NOF	APMX	LF	CRKS	Grade	Wrench	Torque*
VMT100L06W19-4S05	19	1/4-3/8	10	4	5.3	12.8	S05	AH725	KEYV-S05	7
VMT160L13W14-4S08	14	1/2-7/8	16	4	12.7	20	S08	AH725	KEYV-S08	15
VMT160L11W11-4S08	11	≥1	16	4	11.6	19	S08	AH725	KEYV-T30L	15

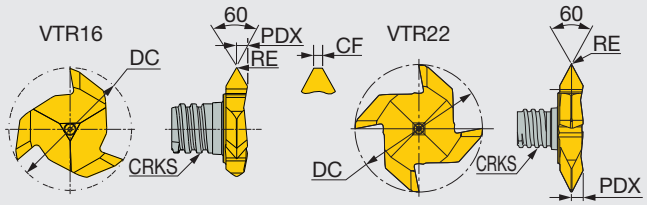
* Recommended clamping torque (N·m)
2 pieces per package

60° partial profile

VTR***IS

3, 4 flute, partial profile, for internal/external thread

Threading



CRKS = Connection screw size

Metric	TP		Smallest Possible thread	DC	NOF	RE	CF	PDX	CRKS	Grade	Wrench	Torque*
	TPN	TPX										
VTR160L12IS05-3S06	0.5	2	M20	15.7	3	-	0.05	1.4	S06	GH130	KEYV-177	10
VTR160L12IS15-3S06	1.5	2	M22	15.7	3	0.05	-	1.4	S06	GH130	KEYV-177	10
VTR220L28IS30-4S08	3	4.5	M36	21.7	4	0.2	-	2.8	S08	GH130	KEYV-217	15

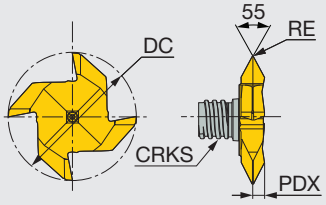
* Recommended clamping torque (N·m)
2 pieces per package

55° partial profile

VTR***W

4 flute, partial profile, for internal/external thread

Threading



CRKS = Connection screw size

Metric	TPI		Smallest Possible thread	DC	NOF	RE	PDX	CRKS	Grade	Wrench	Torque*
	TPIN	TPIX									
VTR220L24W14-4S08	14	11	3/4	21.7	4	0.2	2.4	S08	GH130	KEYV-217	15

* Recommended clamping torque (N·m)
2 pieces per package

STANDARD CUTTING CONDITIONS

Threading

VMT, VTR

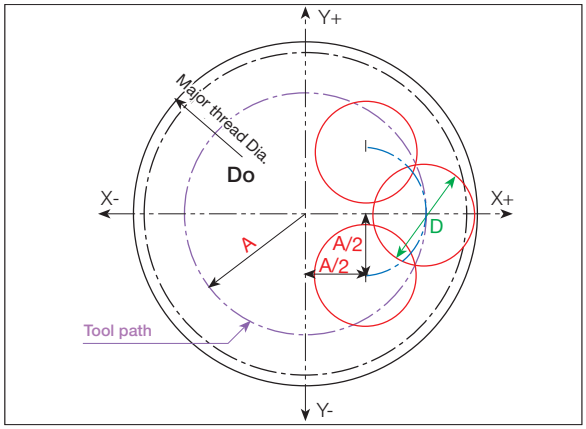
ISO	Material		Condition	Tensile strength [N/mm²]	Hardness HB	Cutting speed (sfm)	Tool dia. (in) Feed (ipt)			
						AH725	ø10 (0.394")	ø12 (0.472")	ø15.4 (0.606"), ø15.7 (0.618"), ø16 (0.630")	ø21.7 (0.787")
P	Non-alloy steel and cast steel, free cutting steel	< 0.25 %C	Annealed	420	125	328 - 820	0.0031	0.0035	0.0047	0.0059
		≥ 0.25 %C	Annealed	650	190	262 - 689	0.0031	0.0035	0.0047	0.0059
		< 0.55 %C	Quenched and tempered	850	250	213 - 558				
		≥ 0.55 %C	Annealed	750	220	361 - 591	0.0028	0.0031	0.0039	0.0047
			Quenched and tempered	1000	300	312 - 525	0.0028	0.0031	0.0039	0.0047
	Low alloy steel and cast steel (less than 5% of alloying elements)		Annealed	600	200	295 - 525	0.002	0.002	0.0028	0.0031
			Quenched and tempered	930	275	213 - 656	0.002	0.002	0.0028	0.0031
				1000	300	230 - 689	0.002	0.002	0.0028	0.0031
				1200	350	312 - 525	0.002	0.002	0.0028	0.0031
	High alloyed steel, cast steel, and tool steel		Annealed	680	200	427 - 558	0.002	0.002	0.0028	0.0031
			Quenched and tempered	1100	325	246 - 328	0.002	0.002	0.0028	0.0031
	Stainless steel and cast steel		Ferritic/martensitic	680	200	361 - 558	0.002	0.002	0.0028	0.0031
			Martensitic	820	240	230 - 509	0.002	0.002	0.0028	0.0031
M	Stainless steel		Annealed	600	180	279 - 328	0.002	0.002	0.0028	0.0031
K	Cast iron nodular (GGG)		Ferritic/martensitic		180	394 - 525	0.0031	0.0035	0.0047	0.0059
			Pearlitic		260	246 - 525	0.0031	0.0035	0.0047	0.0059
	Gray cast iron (GG)		Ferritic		160	230 - 492	0.0031	0.0035	0.0047	0.0059
			Pearlitic		250	361 - 459	0.0031	0.0035	0.0047	0.0059
	Malleable cast iron		Ferritic		130	394 - 525	0.0031	0.0035	0.0047	0.0059
			Pearlitic		230	361 - 459	0.0031	0.0035	0.0083	0.0059
N	Aluminum-wrought alloy		Not cureable		60	525 - 984	0.0031	0.0035	0.0047	0.0059
			Cured		100					
	Aluminum-cast, alloyed	≤12% Si	Not cureable		75	492 - 1148	0.0031	0.0035	0.0047	0.0059
			Cured		90					
		>12% Si	High temperature		130	328 - 820	0.002	0.002	0.0028	0.0031
	Copper alloys	>1% Pb	Free cutting		110					
			Brass		90					
			Electrolitic copper		100					
	Non-metallic		Duroplastics, fiber plastics			328 - 1312	0.0043	0.0047	0.0059	0.0071
			Hard rubber							
S	High temp. alloys	Fe based	Annealed		200					
			Cured		280					
		Ni or Co based	Annealed		250	66 - 262	0.0012	0.0012	0.0016	0.0016
			Cured		350					
			Cast		320					
	Titanium Ti alloys			RM 400						
			Alpha+beta alloys cured	RM 1050		66 - 262	0.0012	0.0012	0.0016	0.0016
H	Hardened steel		Hardened		55 HRC	180 - 213				
			Hardened		60 HRC	148 - 180				
	Chilled cast iron		Cast		400	295 - 344				
	Cast iron		Hardened		55 HRC	180 - 213				

Thread Milling CNC Program for Internal Thread

Right-hand thread (climb milling) from bottom up. Program is based on tool center.
This method of programming needs no tool radius compensation value, other than an offset for wear.

$$A = \frac{Do - D}{2}$$

A = Radius of tool path
Do = Major thread diameter
D = Cutting diameter



General Program

G90 G00 G54 G43 H1X0 Y0 Z10 S (n : Number of revolutions)
G00 Z-(to thread depth)
G01 G91 G41 D1 X (A/2) Y-(A/2) Z0 F (Center of tool)
G03 X(A/2) Y(A/2) R (A/2) Z(1/8 pitch) F (Cutting edge)
G03 X0 Y0 I -(A) J0 Z (pitch)
G03 X-(A/2) Y(A/2) R (A/2) Z(1/8 pitch)
G01 G40 X -(A/2) Y-(A/2) Z0
G90 X0 Y0 Z0

Internal Thread

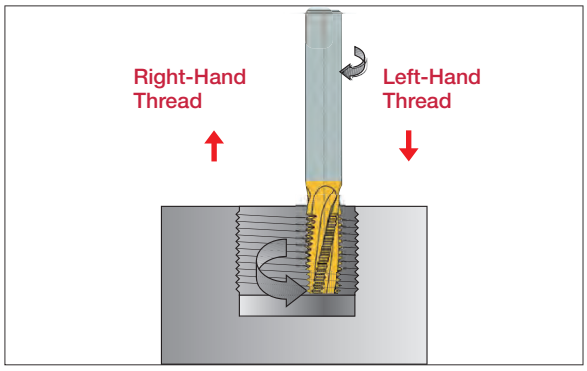
Example: M20x2.0 **IN-RH** (Thread depth 20 mm)
Tool : **MTEC1010C27 2.0ISO**
(Cutting dia. 10 mm)
A=(**Do**-**D**)/2=(20-10)/2=5
A/2=2.5
(Tool compensation of radius=0)
G90 G0 G54 G43 G17 **H1X0 Y0 Z10 S**4000
G0 **Z**-20
G01 G91 G41 **D1X** 2.5 **Y**-2.5 **Z0 F**840
G03 **X**2.5 **Y**2.5 **R**2.5 **Z**0.25 F420
G03 **X0 Y0 I**-5.0 **J0 Z**2.0
G03 **X**-2.5 **Y**2.5 **R**2.5 **Z**0.25
G01 G40 **X**-2.5 **Y**-2.5 **Z0**
G90 G0 **X0 Y0 Z0**
M30
%

$$F\ (\text{Center of tool}) = n \times f \times z$$

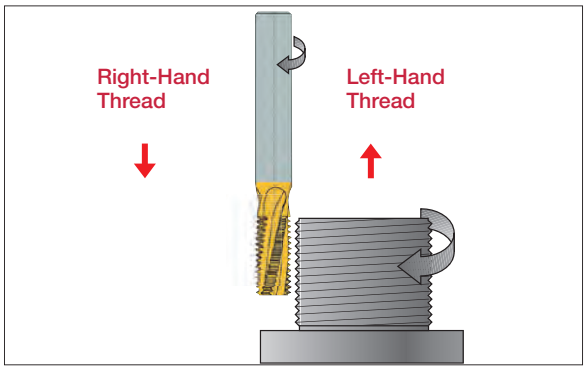
$$F\ (\text{Cutting edge}) = \frac{Do - D}{Do} \times n \times f \times z$$

n : Number of revolutions
f : rev / tooth
z : Number of edge

Internal Thread



External Thread



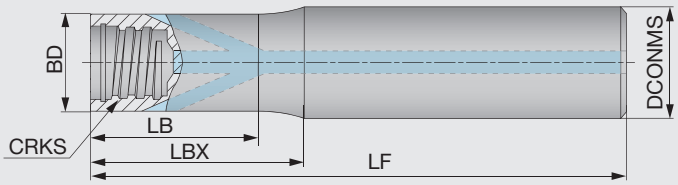
A thread milling operation is applicable for thread cutting in non-symmetrical parts utilizing the advantage of helical interpolation programs on modern machining centers.

For more details, please check ThreadMilling advisor.

SHANKS

VSSD**-W-A...

Straight shank and neck with coolant hole

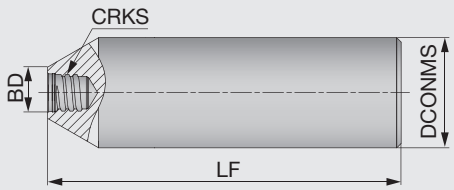


CRKS = Connection screw size

Metric	DCONMS	BD	LF	LBX	LB	CRKS	Shank material
VSSD10L070S06-W-A	10	9.6	70	20	19	S06	Tungsten
VSSD10L090S06-W-A	10	9.6	90	40	39	S06	Tungsten
VSSD10L110S06-W-A	10	9.6	110	60	59	S06	Tungsten
VSSD12L070S08-W-A	12	11.5	70	20	19	S08	Tungsten
VSSD12L090S08-W-A	12	11.5	90	40	39	S08	Tungsten
VSSD12L110S08-W-A	12	11.5	110	60	59	S08	Tungsten
VSSD12L130S08-W-A	12	11.5	130	80	79	S08	Tungsten
VSSD16L070S10-W-A	16	15.2	70	20	18.5	S10	Tungsten
VSSD16L090S10-W-A	16	15.2	90	40	36.5	S10	Tungsten
VSSD16L110S10-W-A	16	15.2	110	60	58.5	S10	Tungsten
VSSD16L130S10-W-A	16	15.2	130	80	78.5	S10	Tungsten
VSSD20L090S12-W-A	20	18.3	90	40	37	S12	Tungsten
VSSD20L130S12-W-A	20	18.3	130	80	77	S12	Tungsten

VSSD...

High rigidity shank



CRKS = Connection screw size

Metric	DCONMS	BD	LF	CRKS	Shank shape	Shank material
New VSSD06L050S04-S	6	5.8	50	S04	Cylindrical	Steel
New VSSD06L060S04-C	6	5.8	60	S04	Cylindrical	Carbide
New VSSD08L050S04-S	8	5.8	50	S04	Cylindrical	Steel
New VSSD08L060S04-C	8	5.8	60	S04	Cylindrical	Carbide
VSSD10L055S05-S	10	7.6	55	S05	Cylindrical	Steel
VSSD12L065S06-S	12	9.6	65	S06	Cylindrical	Steel
VSSD16L065S08-S	16	11.6	65	S08	Cylindrical	Steel
VSSD20L070S10-S	20	15.3	70	S10	Cylindrical	Steel
VSSD25L075S12-S	25	18.3	75	S12	Cylindrical	Steel
New VSSD32L100S15-S	32	23.9	100	S15	Cylindrical	Steel
New VSSD40L100S21-S	40	30	100	S21	Cylindrical	Steel

VSSD...

Straight neck and cylindrical shank

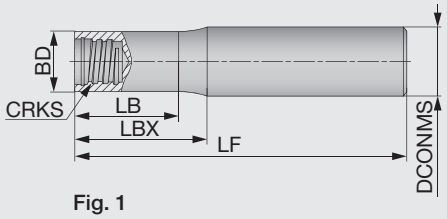


Fig. 1

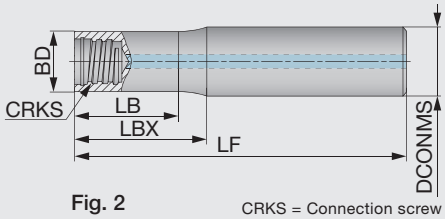


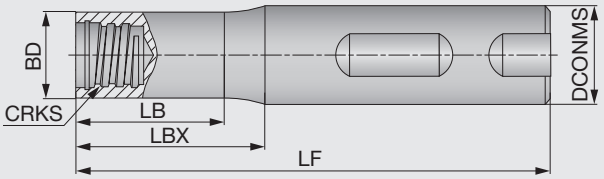
Fig. 2

CRKS = Connection screw size

Metric	DCONMS	BD	LF	LBX	LB	CRKS	Shank shape	Shank material	Fig.
VSSD08L060S05-S	8	7.6	60	15	12.8	S05	Cylindrical	Steel	1
VSSD08L070S05-C	8	7.6	70	20	19	S05	Cylindrical	Carbide	1
VSSD08L090S05-C	8	7.6	90	40	39	S05	Cylindrical	Carbide	1
VSSD08L110S05-C	8	7.6	110	60	59	S05	Cylindrical	Carbide	1
VSSD10L070S06-C	10	9.6	70	20	18.5	S06	Cylindrical	Carbide	1
VSSD10L075S06-S	10	9.6	75	20	19.4	S06	Cylindrical	Steel	1
VSSD10L090S06-C	10	9.6	90	40	38.5	S06	Cylindrical	Carbide	1
VSSD10L110S06-C	10	9.6	110	60	58.5	S06	Cylindrical	Carbide	1
VSSD10L150S06-C	10	9.6	150	100	98.5	S06	Cylindrical	Carbide	1
VSSD12L070S08-C	12	11.5	70	20	17	S08	Cylindrical	Carbide	1
New VSSD12L070S08-C-A	12	11.5	70	20	17	S08	Cylindrical	Carbide	2
VSSD12L090S08-C	12	11.5	90	40	37	S08	Cylindrical	Carbide	1
VSSD12L090S08-S	12	11.5	90	16	13.6	S08	Cylindrical	Steel	1
New VSSD12L090S08-S-A	12	11.5	90	16	13.6	S08	Cylindrical	Steel	2
New VSSD12L090LS08-C-A	12	11.5	90	40	37	S08	Cylindrical	Carbide	2
New VSSD12L090LS08-S-A	12	11.5	90	42	37	S08	Cylindrical	Steel	2
VSSD12L110S08-C	12	11.5	110	60	58	S08	Cylindrical	Carbide	1
New VSSD12L110S08-C-A	12	11.5	110	60	57	S08	Cylindrical	Carbide	2
VSSD12L130S08-C	12	11.5	130	80	78	S08	Cylindrical	Carbide	1
New VSSD12L130S08-C-A	12	11.5	130	80	77	S08	Cylindrical	Carbide	2
VSSD16L090S10-C	16	15.2	90	40	38	S10	Cylindrical	Carbide	1
New VSSD16L090S10-C-A	16	15.2	90	40	38	S10	Cylindrical	Carbide	2
VSSD16L100S10-S	16	15.2	100	20	18	S10	Cylindrical	Steel	1
New VSSD16L100S10-S-A	16	15.2	100	20	18	S10	Cylindrical	Steel	2
New VSSD16L100LS10-S-A	16	15.2	100	42	38	S10	Cylindrical	Steel	2
VSSD16L110S10-C	16	15.2	110	60	58	S10	Cylindrical	Carbide	1
New VSSD16L110S10-C-A	16	15.2	110	60	58	S10	Cylindrical	Carbide	2
VSSD16L130S10-C	16	15.2	130	80	78	S10	Cylindrical	Carbide	1
New VSSD16L130S10-C-A	16	15.2	130	80	78	S10	Cylindrical	Carbide	2
VSSD16L150S10-C	16	15.2	150	100	98	S10	Cylindrical	Carbide	1
VSSD20L090S12-C	20	18.3	90	40	37	S12	Cylindrical	Carbide	1
VSSD20L120S12-S	20	18.3	120	25	20.5	S12	Cylindrical	Steel	1
VSSD20L130S12-C	20	18.3	130	80	77	S12	Cylindrical	Carbide	1
VSSD20L200S12-C	20	18.3	200	120	117	S12	Cylindrical	Carbide	1
VSSD25L120S15-C	25	23.9	120	60	58	S15	Cylindrical	Carbide	1
VSSD25L135S15-S	25	23.9	135	35	33	S15	Cylindrical	Steel	1
VSSD25L170S15-C	25	23.9	170	100	98	S15	Cylindrical	Carbide	1
VSSD25L250S15-C	25	23.9	250	150	148	S15	Cylindrical	Carbide	1
New VSSD32L100S21-S	32	30	100	35	32	S21	Cylindrical	Steel	1
New VSSD32L150S21-S	32	30	150	54	50	S21	Cylindrical	Steel	1

VSSD**-W...

Straight neck and weldon shank



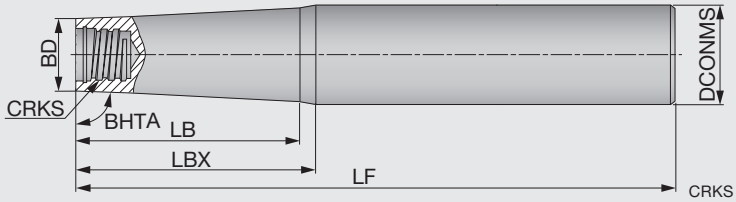
CRKS = Connection screw size

Inch	DCONMS	BD	LF	LBX	LB	CRKS	Type	Material
VSS050L218W05US	0.500	0.299	2.185	0.150	-	S05	Weldon	Steel
VSS062L258W06US	0.625	0.366	2.580	0.236	-	S06	Weldon	Steel
VSS062L258W08US	0.625	0.480	2.580	0.157	-	S08	Weldon	Steel
VSS075L275W10US	0.750	0.598	2.750	0.157	-	S10	Weldon	Steel
VSS100L300W12US	1.000	0.720	3.000	0.283	-	S12	Weldon	Steel

Metric	DCONMS	BD	LF	LBX	LB	CRKS	Shank shape	Shank material
VSSD12L055W05-S	12	7.6	55	3.8	-	S05	Weldon	Steel
VSSD16L065W06-S	16	9.6	65	6	-	S06	Weldon	Steel
VSSD16L065W08-S	16	11.5	65	4	-	S08	Weldon	Steel
VSSD20L070W10-S	20	15.2	70	4	-	S10	Weldon	Steel
VSSD25L075W12-S	25	18.3	75	6	-	S12	Weldon	Steel

VTSD...

Straight shank and taper neck

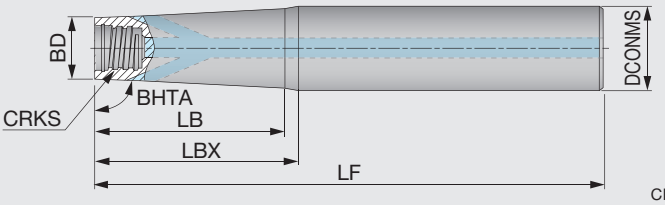


CRKS = Connection screw size

Metric	BHTA	DCONMS	BD	LF	LBX	LB	CRKS	Shank material
New VTSD08L080S04-S	87.4°	8	5.8	80	24	-	S04	Steel
VTSD12L080S05-S	85°	12	7.6	80	25	-	S05	Steel
VTSD12L100S05-S	89°	12	7.6	100	35	29	S05	Steel
VTSD12L110S05-C	89°	12	7.6	110	60	56	S05	Carbide
VTSD12L130S05-C	89°	12	7.6	130	80	77	S05	Carbide
VTSD16L125S06-S	85°	16	9.6	125	34	31	S06	Steel
VTSD16L130S08-C	89°	16	11.5	130	80	76.5	S08	Carbide
VTSD16L140S08-S	85°	16	11.5	140	22	19	S08	Steel
VTSD16L150S05-C	89°	16	7.6	150	100	91	S05	Carbide
VTSD16L150S06-C	89°	16	9.6	150	100	94.5	S06	Carbide
VTSD16L150S08-C	89°	16	11.5	150	100	98	S08	Carbide
VTSD16L160S06-S	89°	16	9.6	160	55	46.5	S06	Steel
VTSD16L170S06-C	89°	16	9.6	170	120	116.5	S06	Carbide
VTSD20L140S10-S	85°	20	15.2	140	27.5	-	S10	Steel
VTSD20L170S08-C	89°	20	11.5	170	120	112	S08	Carbide
VTSD20L170S08-S	89°	20	11.5	170	80	69.5	S08	Steel
VTSD20L170S10-C	89°	20	15.2	170	120	119	S10	Carbide
VTSD20L190S10-C	89°	20	15.2	190	140	-	S10	Carbide
VTSD20L190S10-S	89°	20	15.2	190	80	73	S10	Steel
VTSD20L210S10-C	89°	20	15.2	210	160	-	S10	Carbide
VTSD25L160S12-S	85°	25	18.3	160	40	-	S12	Steel
VTSD25L170S10-S	85°	25	15.2	170	56	-	S10	Steel
VTSD25L180S12-C	89°	25	18.3	180	120	115	S12	Carbide
VTSD25L210S12-S	89°	25	18.3	210	100	94.5	S12	Steel
VTSD25L250S12-C	89°	25	18.3	250	140	136.5	S12	Carbide
VTSD32L155S15-S	85°	32	23.9	155	45	-	S15	Steel
VTSD32L190S12-S	85°	32	18.3	190	80	-	S12	Steel
VTSD32L220S15-S	88°	32	23.9	220	100	-	S15	Steel
VTSD32L250S15-C	89°	32	23.9	250	150	145	S15	Carbide
VTSD32L300S15-C	89°	32	23.9	300	200	198	S15	Carbide
New VTSD40L150S21-S	85°	40	30	150	57	-	S21	Steel

VTSD**-W-A...

Straight shank and taper neck with coolant hole

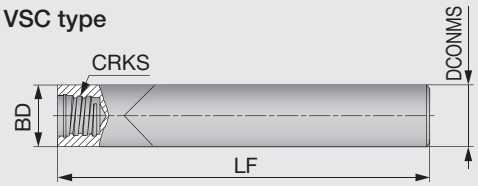


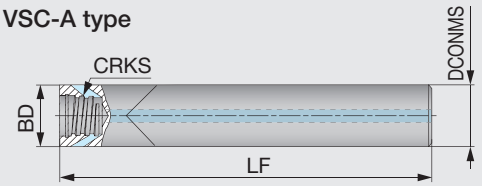
CRKS = Connection screw size

Metric	BHTA	DCONMS	BD	LF	LBX	LB	CRKS	Shank material
VTSD12L110S06-W-A	89°	12	9.6	110	60	59	S06	Tungsten
VTSD16L170S06-W-A	89°	16	9.6	170	120	116	S06	Tungsten

VSC...

Straight shank for VST type slotting heads





CRKS = Connection screw size

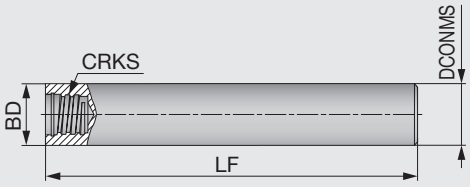
Inch	DCONMS	BD	LF	CRKS	Air hole	Material
VSC095L080S06-C	0.375	0.375	3.150	S06	without	CARBIDE
VSC127L120S08-C-A	0.500	0.500	4.724	S08	with	CARBIDE

Metric	DCONMS	BD	LF	CRKS	Air hole	Shank material
VSC100L100S06-C	10	10	100	S06	without	Carbide
VSC120L100S08-C-A	12	12	100	S08	with	Carbide

For VSC-C type shank, just VST slotting head is recommended.
If other heads are used on the VSC-C shank, the depth of cut must be smaller than the max. *ap* in each head.
The VSC-C type shank does not have external clearance, so the shank may interfere with the work piece.

VSTD...

Straight shank for VTB type T-slotting heads



CRKS = Connection screw size

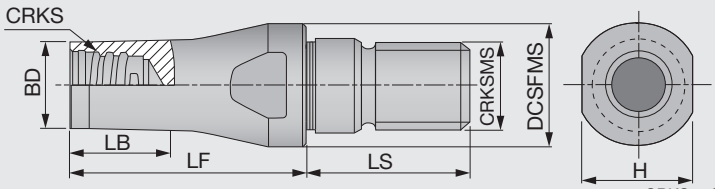
Inch	DCONMS	BD	LF	CRKS	Material
VST031L275S05US	0.312	0.312	2.750	S05	STEEL
VST037L325S06US	0.375	0.375	3.250	S06	STEEL
VST050L375S08US	0.500	0.500	3.750	S08	STEEL
VST062L400S10US	0.625	0.625	4.000	S10	STEEL

Metric	DCONMS	BD	LF	CRKS	Shank material
New VSTD06L070S04-S	6	6	70	S04	Steel
VSTD08L070S05-S	8	8	70	S05	Steel
VSTD10L080S06-S	10	10	80	S06	Steel
VSTD12L090S08-S	12	12	90	S08	Steel
VSTD16L100S10-S	16	16	100	S10	Steel

For VSTD type shank, just VTB T-slotting head is recommended.
If other heads are used on the VSTD shank, the depth of cut must be smaller than the max. *ap* in each head.
The VSTD type shank does not have external clearance, so the shank may interfere with the work piece.

VAD**-M...

TungFlex conversion adaptor

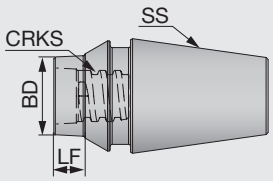


CRKS = Connection screw size

Metric	BD	DCSFMS	LF	LS	LB	CRKS	CRKSMS	H	Shank material
VAD130L016S08-S-M8	11.7	13	16	17.5	6	S08	M8	11	Steel
VAD130L025S08-S-M8	11.7	13	25	17.5	20	S08	M8	11	Steel
VAD180L020S08-S-M10	11.7	18	20	20	12	S08	M10	13	Steel
VAD180L025S08-S-M10	11.7	18	25	20	15	S08	M10	11	Steel
VAD210L020S08-S-M12	11.7	21	20	20	10	S08	M12	12.75	Steel
VAD210L025S08-S-M12	11.7	21	25	20	13	S08	M12	12.75	Steel

VER...

Straight neck with ER11/16 collet



CRKS = Connection screw size

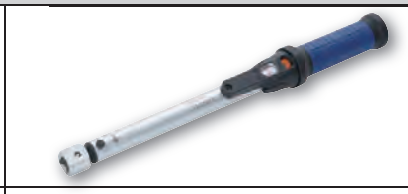
Inch	SS	BD	LF	CRKS	Shank material
VER11AL006S04-S	ER11	0.228	0.236	S04	Steel
VER11AL006S05-S	ER11	0.311	0.236	S05	Steel
VER11AL020S05-S	ER11	0.311	0.787	S05	Steel
VER16AL012S05-S	ER11	0.311	0.472	S05	Steel
VER16AL020S05-S	ER11	0.311	0.787	S05	Steel
VER16AL010S06-S	ER16	0.390	0.394	S05	Steel
VER16AL020S06-S	ER16	0.390	0.787	S05	Steel
VER16AL006S08-S	ER16	0.457	0.236	S05	Steel
VER16AL020S08-S	ER16	0.457	0.787	S05	Steel

WRENCH

Appearance	Designation	Connection screw size	Torque (lb·ft)	Applicable head
	KEYV-S05	S05	5.16	Square Ball Radius Drilling Chamfering Counter boring
	KEYV-S06	S06	7.38	
	KEYV-S08	S08	11.06	
	KEYV-S10	S10	20.65	
	KEYV-S12	S12	20.65	
	KEYV-W20	S15	29.50	
	KEYV-177	S06	7.38	Slotting VST type
	KEYV-217	S08	11.06	
	KEYV-T40L	S08	11.06	Slotting VST, VTB type
		S10	20.65	
	KEYV-T20	S05	5.16	Slotting VTB type
		S06	7.38	
	KEYV-T25	S06	7.38	
	KEYV-T30L	S08	11.06	
	KEYV-T50L	S08	11.06	
		S10	20.65	

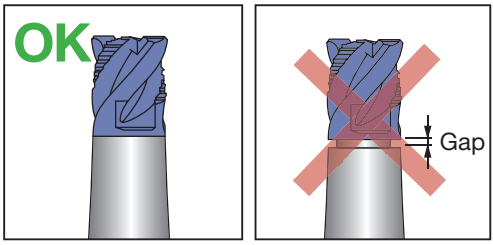
Note: Wrenches are sold separately.

TORQUE WRENCHES

Appearance		Description	Stock	Connection screw size	TM Head description	Torque (lb·ft)
Handle		TORQUEWRENCH5-50NM9x12	●	-	-	-
Open wrenches for cylindrical heads		TM-WRENCH-6-05	●	S05	VED, VEE VEE-I, VEE-R VEE-C, VEE-A VRD, VBD-BG VBE-BGA VDP, VCA	5.16
		TM-WRENCH-8-06	●	S06		7.38
		TM-WRENCH-10-08	●	S08		11.06
		TM-WRENCH-13-10	●	S10		20.65
		TM-WRENCH-16-12	●	S12		20.65
		TM-WRENCH-20-15	●	S15		29.50
Open wrenches for 2 flute heads		TM-WRENCH-4E-05	●	S05	VRB, VRC VFX, VBB-BM VBB-BG VCP, VGC VCW, VCR	5.16
		TM-WRENCH-5E-06	●	S06		7.38
		TM-WRENCH-7E-08	●	S08		11.06
		TM-WRENCH-8E-10	●	S10		20.65
		TM-WRENCH-9E-12	●	S12		20.65
90° adaptor for Torx bits		INSERT-TOOL-9X12MM	●	-	-	-
Torx bits sockets		BIT-SOCKET-T20-DRIVE	●	S05, S06	VTB135 VTB160W2.00 VTB165W2.00	5.16, 7.38
		BIT-SOCKET-T25-DRIVE	●	S06	VTB160W3.00 VTB160W4.00	7.38
		BIT-SOCKET-T30-DRIVE	●	S08	VTB165W3.00	11.06
		BIT-SOCKET-T40-DRIVE	●	S08, S10	VTB165W4.00 VTB195	11.06, 20.65
		BIT-SOCKET-T50-DRIVE	●	S08, S10	VST277 VTB225 VTB250	11.06, 20.65

CAUTIONARY POINTS IN USE

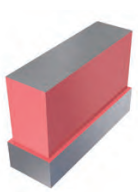
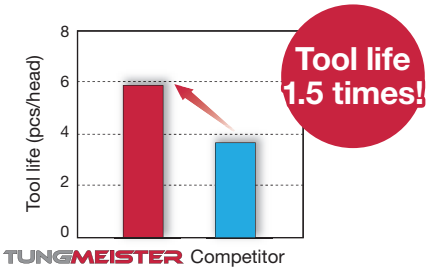
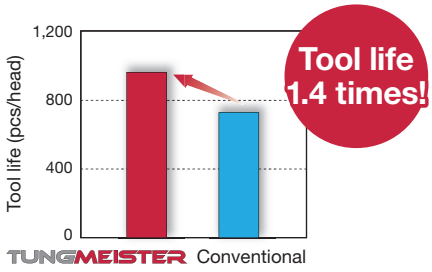
· The cutting heads specified by Tungaloy must be used. Avoid using alternate heads that are not Tungaloy products as this will damage the shank and can cause severe accident or injury.
· Before setting the head, clean the connection screw with an air blast or a wiping cloth to remove chips and other foreign matter that may remain.
· Do not apply the lubricant to the connection screw.
· Please use the correct wrench with the correct cutting head. Tighten the head slowly until the face of the head contacts the shank. (Please refer to the picture shown on the right.) Do not re-tightening or over-tightening. Excessive tightening may cause the cutting head to break.
· Do not apply excessive force or a hammer when tightening or exchanging the cutting heads.

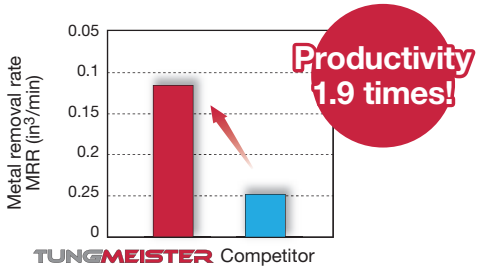
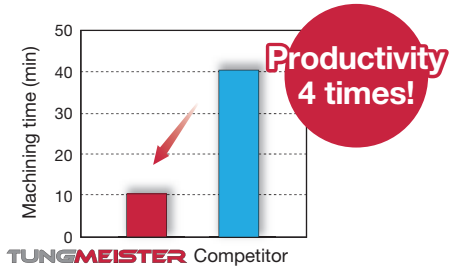


PRACTICAL EXAMPLES

Workpiece type		CVJ	Gear
Shank		VSSD12L070S08-C (Carbide, ø0.472")	VSSD16L100S10-S (Steel, ø0.630")
Head		VBD120L09.0-BG-04S08 (ø0.472")	VEE160L12.0C60I04S10 (ø0.630")
Grade		AH715	AH715
Workpiece material		High carbon steel	Low carbon alloy steel
		Ball, P	Square, P
Cutting conditions	Cutting speed : *Vc* (sfm)	135	328
	Feed per tooth: *fz* (ipt)	0.001	0.004
	Depth of cut : *ap* (in)	-	0.394
	Width of cut : *ae* (in)	0.118	0.004
	Coolant	Wet	Wet
Results		Tool life 3.4 times!	Tool life 2 times!
		The latest wear-resistant PVD grade, AH715 provided 3.4 times increase in tool life. With minimal flank wear, as well as less burr formation, AH715 could still have continued cutting.	AH715, the latest PVD coating grade improved the insert's wear resistance, providing 2 times increase in tool life.

Workpiece type		Shaft	Rack
Shank		VSSD10L075S06-S (Steel, ø0.394")	VSSD25L075S12-S (Steel, ø0.984")
Head		VEH100L15.0R10I04S06 (ø0.394")	VEH200L30.0R05I04S12 (ø0.787")
Grade		AH715	AH715
Workpiece material		1045	4140
		Square, P	Square, P
Cutting conditions	Cutting speed : *Vc* (sfm)	328	459
	Feed per tooth: *fz* (ipt)	0.002	0.003
	Depth of cut : *ap* (in)	0.039	0.945
	Width of cut : *ae* (in)	0.236	0.217
	Coolant	Wet	Wet
Results		Productivity 2 times!	Productivity 10 times!
		VEH milling head enabled the applications of elevated cutting speed and feed rate thanks to its excellent anti-vibration design.	**VEH** milling head enabled the use of wider cutting width (*ae*), thanks to excellent anti-vibration design, reducing the number of passes for improved cycle time.

Workpiece type		Housing	Machine part
Shank		VSTD10L080S06-S (Carbide, ø0.349")	VSSD16L130S10-C (Carbide, ø0.630")
Head		VFM160L04.8R04I06S06 (ø0.630")	VEH160L24.0R05I04S10 (ø0.630")
Grade		AH715	AH715
Workpiece material		Low carbon steel Face mill  P	60-40-18 Square  K
Cutting conditions	Cutting speed : *Vc* (sfm)	413	328
	Feed per tooth: *fz* (ipt)	0.005	0.002
	Depth of cut : *ap* (in)	0.008	0.591
	Width of cut : *ae* (in)	0.630	0.039
	Coolant	Wet	Wet
Results		 With a larger cutting head diameter, **VFM** milling head increased radial cutting width (*ae*), improving cycle time with reduced number of passes.	 AH715, the latest PVD coating grade improved the insert's wear resistance, providing 1.4 times increase in tool life and better surface finish.

Workpiece type		Shaft	Test piece
Shank		VER11CL020S05-S (Steel, ø0.315")	VSSD10L090S06-C (Carbide, ø0.349")
Head		VFM120L03.6R02I06S05 (ø0.472")	VBO100L15.0R850-5S06 (ø0.349")
Grade		AH715	AH715
Workpiece material		1045 Face mill  P	1045 Barrel  P
Cutting conditions	Cutting speed : *Vc* (sfm)	197	984
	Feed per tooth: *fz* (ipt)	0.002	0.001
	Depth of cut : *ap* (in)	0.039	0.002
	Width of cut : *ae* (in)	0.236	0.020
	Coolant	Wet	Wet
Results		 **VFM** reduced the number of passes and vibration thanks to its larger cutting head diameter. As a result, productivity increased by 1.9 times.	 Thanks to barrel shape cutting edges suited for the use on 5-axis machine, **VBO** head provided 4 times increase in productivity over ball endmill without compromising surface quality.

MEMO

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Tungaloy America, Inc.

3726 N Ventura Drive, Arlington Heights, IL 60004, U.S.A.
Inside Sales: +1-888-554-8394
Technical Support: +1-888-554-8391
Fax: +1-888-554-8392
www.tungaloy.com/us

Tungaloy Canada

432 Elgin St. Unit 3, Brantford, Ontario N3S 7P7, Canada
Phone: +1-519-758-5779 Fax: +1-519-758-5791
www.tungaloy.com/ca

Tungaloy de Mexico S.A.

C Los Arellano 113, Parque Industrial Siglo XXI
Aguascalientes, AGS, Mexico 20290
Phone:+52-449-929-5410 Fax:+52-449-929-5411
www.tungaloy.com/mx

Scan for instant web access

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