



# TUNGMEISTER

TUNGALOY



MILLLINE

Tungaloy Report No. 381-E

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New endmilling  
innovation!!







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**TUNGMEISTER**  
TUNGALOY

The most effective tooling solution with the option of hundreds of tools!  
Tool changeover times can be measurably reduced!

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# TUNGMEISTER

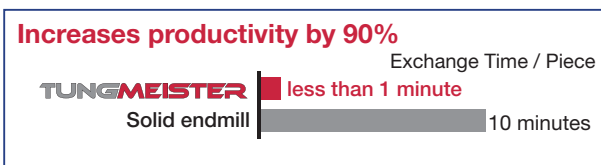
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 Tool changeover times can be measurably reduced!

## Features

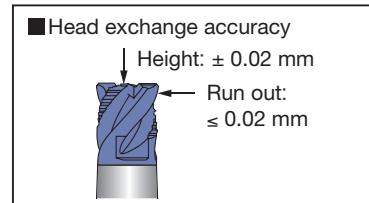
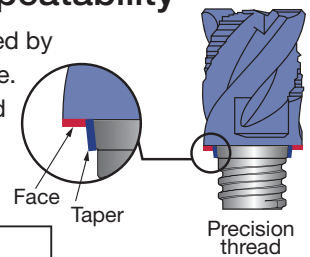
### ► Reduces tool changeover times drastically!!

- Machine downtime is decreased considerably.
- Enables users to only change cutting head, simplifying set-ups.



### ► Highly accurate repeatability

- Accuracy can be maintained by touching the taper and face.
- Repeatability is guaranteed and is not a concern for machine operators.



### ► The weight of the tool to be disposed is reduced

- Reduces tool disposal

For example:  $\varnothing 12$  mm / square endmill

TUNGMEISTER: OAL 20 mm → weight 20 g

conventional solid endmill: OAL 80 mm → weight 140 g

### ► No regrinding cost

- No laborious endmill regrinding required.
- Easily replaceable heads eliminate the use of worn cutting edges.
- All tools can be used to breakage point or maximum wear point as no regrinding is necessary.

## 1 Wide range of cutting heads

23 kinds of cutting heads are available. The head exchange is easy and highly accurate with the precision thread.

### Flexible combinations

TungMeister can be applied to all kinds of endmill machining applications.

## 2 Three kinds of shank material

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

Power Up



Straight shank & neck



Straight shank & taper neck



Straight shank & neck (carbide)



Straight (for grooving)






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

# ● Overview

## ■ Head

Head	Square	Toroidal	Ball	Drilling (Centering drill)	Chamfering	Slotting
Appearance						
Page	P. 4 ~ 7	P. 8 ~ 10	P.11 ~ 13	P. 14 ~ 16	P. 17, 18	P. 19 ~ 22

## ■ Shank

Shank	Straight	Weldon	Straight	Straight	Adaptor for TungFlex
Neck	Straight	Straight	Taper	(Grooving)	
Appearance					
Steel	●	●	●	●	●
Carbide	●	-	●	●	-
Carbide (with coolant hole)	-	-	-	●	-
Tungsten (with coolant hole)	●	-	●	-	-
Page	P. 22, 23	P. 23	P. 24	P. 25	P. 25

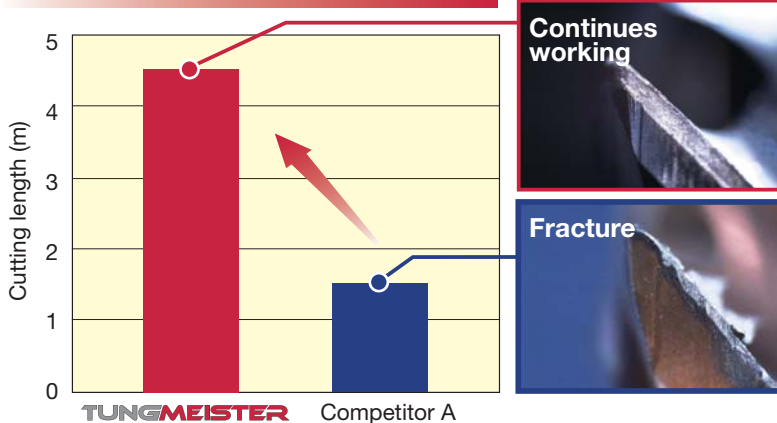
# ● Cutting performance

Workpiece : SUS304 / X5CrNi18-10 (200HB)  
 Head : VEE100L07.0R05-04S06  
 (ø10 mm, square type, 4 flutes)

Grade: AH725  
 Shank: VSSD10L075S06-S  
 (Straight shank & neck, steel)

Machine: Horizontal M/C BT40  
 Holder : Collet chuck  
 Coolant : Dry

### Comparison of milling for stainless steels



Cutting speed :  $V_c = 100$  m/min  
 Feed per tooth:  $f_z = 0.07$  mm/t  
 Depth of cut :  $a_p = 5$  mm  
 Width of cut :  $a_e = 1.5$  mm

- Competitor A cutting edges fractured after 1.7 minutes machining and 1.5 m cutting length.
- The TungMeister cutting edges maintain operation after 5 minutes machining.

### Comparison of milling surface on stainless steels



Cutting speed :  $V_c = 130$  m/min  
 Feed per tooth:  $f_z = 0.05$  mm/t  
 Depth of cut :  $a_p = 5$  mm  
 Width of cut :  $a_e = 2$  mm

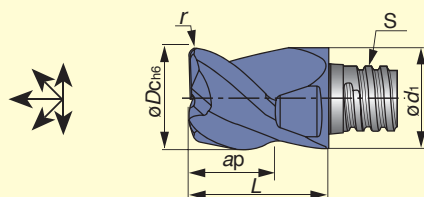
- When machining tough stainless steel the burr with the TungMeister is minimal. However, competitor A has a large burr when working under the same conditions.



## Heads

### Square

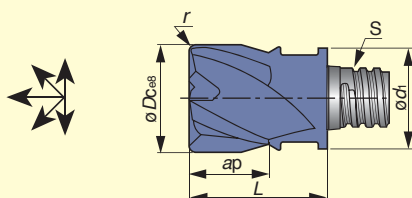
#### VEE 3 flutes, 45° helix (for general purpose)



ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N-m)
				øDc	ød1	ap	r	S	L		
VEE080L05.0R00-03S05	●	3	45°	8	7.7	5	0	S05	10.0	KEYV-S05	7
VEE100L07.0R00-03S06	●	3	45°	10	9.7	7	0	S06	13.0	KEYV-S06	10
VEE120L09.0R00-03S08	●	3	45°	12	11.7	9	0	S08	16.5	KEYV-S08	15

#### VED / VEE 4 flutes, 30° & 45° helix (for general purpose, corner radii: 0 - 4.0 mm)



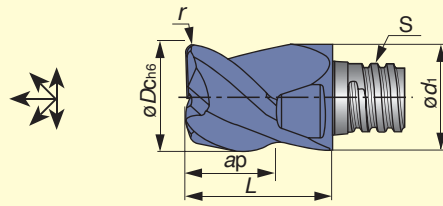
ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N-m)
				øDc	ød1	ap	r	S	L		
VEE060L05.0R00-04S05	●	4	45°	6	8	5	0	S05	10.0	KEYV-S05	7
VEE080L05.0R00-04S05	●	4	45°	8	7.7	5	0	S05	10.0	KEYV-S05	7
VED080L05.0R05-04S05	●	4	30°	8	7.7	5	0.5	S05	10.0	KEYV-S05	7
VED080L05.0R10-04S05	●	4	30°	8	7.7	5	1.0	S05	10.0	KEYV-S05	7
VED080L05.0R15-04S05	●	4	30°	8	7.7	5	1.5	S05	10.0	KEYV-S05	7
VEE100L07.0R00-04S06	●	4	45°	10	9.7	7	0	S06	13.0	KEYV-S06	10
VED100L07.0R05-04S06	●	4	30°	10	9.7	7	0.5	S06	13.0	KEYV-S06	10
VEE100L07.0R05-04S06	●	4	45°	10	9.7	7	0.5	S06	13.0	KEYV-S06	10
VED100L07.0R10-04S06	●	4	30°	10	9.7	7	1.0	S06	13.0	KEYV-S06	10
VEE100L07.0R10-04S06	●	4	45°	10	9.7	7	1.0	S06	13.0	KEYV-S06	10
VEE120L09.0R00-04S08	●	4	45°	12	11.7	9	0	S08	16.5	KEYV-S08	15
VED120L09.0R05-04S08	●	4	30°	12	11.7	9	0.5	S08	16.5	KEYV-S08	15
VEE120L09.0R05-04S08	●	4	45°	12	11.7	9	0.5	S08	16.5	KEYV-S08	15
VED120L09.0R10-04S08	●	4	30°	12	11.7	9	1.0	S08	16.5	KEYV-S08	15
VEE120L09.0R10-04S08	●	4	45°	12	11.7	9	1.0	S08	16.5	KEYV-S08	15
VEE160L12.0R00-04S10	●	4	45°	16	15.3	12	0	S10	20.5	KEYV-S10	28
VED160L12.0R05-04S10	●	4	30°	16	15.3	12	0.5	S10	20.5	KEYV-S10	28
VEE160L12.0R05-04S10	●	4	45°	16	15.3	12	0.5	S10	20.5	KEYV-S10	28
VED160L12.0R10-04S10	●	4	30°	16	15.3	12	1.0	S10	20.5	KEYV-S10	28
VEE160L12.0R10-04S10	●	4	45°	16	15.3	12	1.0	S10	20.5	KEYV-S10	28
VED160L12.0R15-04S10	●	4	30°	16	15.3	12	1.5	S10	20.5	KEYV-S10	28
VEE160L12.0R15-04S10	●	4	45°	16	15.3	12	1.5	S10	20.5	KEYV-S10	28
VED160L12.0R20-04S10	●	4	30°	16	15.3	12	2.0	S10	20.5	KEYV-S10	28
VEE160L12.0R20-04S10	●	4	45°	16	15.3	12	2.0	S10	20.5	KEYV-S10	28
VED160L12.0R30-04S10	●	4	30°	16	15.3	12	3.0	S10	20.5	KEYV-S10	28
VEE160L12.0R30-04S10	●	4	45°	16	15.3	12	3.0	S10	20.5	KEYV-S10	28
VED160L12.0R40-04S10	●	4	30°	16	15.3	12	4.0	S10	20.5	KEYV-S10	28
VEE160L12.0R40-04S10	●	4	45°	16	15.3	12	4.0	S10	20.5	KEYV-S10	28
VEE200L15.0R00-04S12	●	4	45°	20	18.3	15	0	S12	25.5	KEYV-S12	28
VED200L15.0R05-04S12	●	4	30°	20	18.3	15	0.5	S12	25.5	KEYV-S12	28
VED200L15.0R10-04S12	●	4	30°	20	18.3	15	1.0	S12	25.5	KEYV-S12	28
VED200L15.0R20-04S12	●	4	30°	20	18.3	15	2.0	S12	25.5	KEYV-S12	28
VED200L15.0R30-04S12	●	4	30°	20	18.3	15	3.0	S12	25.5	KEYV-S12	28

● : Stocked items  
Packing Quantity = 2 pcs.

## VEE

3 flutes, 38° helix, for roughing before keyways (corner radii: 0.2 - 0.4 mm)

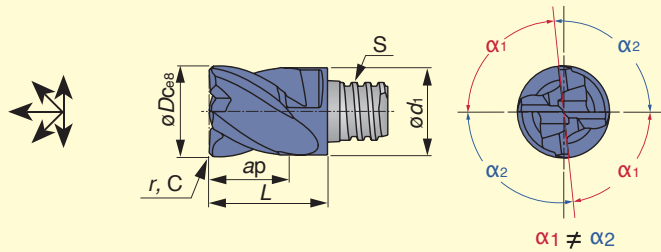


ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				øDc	ød1	ap	r	S	L		
VEE077L04.0R02-03S05	●	3	38°	7.7	7.7	4	0.2	S05	10.0	KEYV-S05	7
VEE097L05.0R03-03S06	●	3	38°	9.7	9.7	5	0.3	S06	13.0	KEYV-S06	10
VEE117L07.0R03-03S08	●	3	38°	11.7	11.7	7	0.3	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

## VEE-I

4 flutes, 38° helix, irregular-pitch flutes (chatter free)

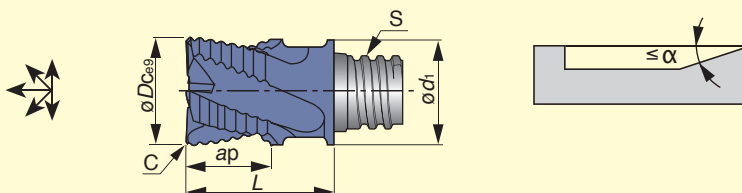


ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)	
				øDc	ød1	ap	r	C	S			L
VEE080L05.0C30I04S05	●	4	38°	8	7.7	5	-	0.3	S05	10.0	KEYV-S05	7
VEE100L07.0C40I04S06	●	4	38°	10	9.7	7	-	0.4	S06	13.0	KEYV-S06	10
VEE120L09.0C50I04S08	●	4	38°	12	11.7	9	-	0.5	S08	16.5	KEYV-S08	15
VEE160L12.0C60I04S10	●	4	38°	16	15.3	12	-	0.6	S10	20.5	KEYV-S10	28
VEE200L15.0C60I04S12	●	4	38°	20	18.3	15	-	0.6	S12	25.5	KEYV-S12	28
<b>New</b> VEE250L22.0C60I04S15	●	4	38°	25	23.9	22	-	0.6	S15	37.0	KEYV-W20	40
<b>New</b> VEE250L22.0R00I04S15	●	4	38°	25	23.9	22	0.0	-	S15	37.0	KEYV-W20	40
<b>New</b> VEE250L22.0R05I04S15	●	4	38°	25	23.9	22	0.5	-	S15	37.0	KEYV-W20	40
<b>New</b> VEE250L22.0R10I04S15	●	4	38°	25	23.9	22	1.0	-	S15	37.0	KEYV-W20	40
<b>New</b> VEE250L22.0R20I04S15	●	4	38°	25	23.9	22	2.0	-	S15	37.0	KEYV-W20	40
<b>New</b> VEE250L22.0R30I04S15	●	4	38°	25	23.9	22	3.0	-	S15	37.0	KEYV-W20	40

## VEE-R

4 / 5 / 6 flutes, 45° helix, for roughing



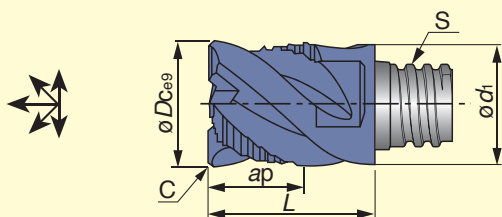
ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)	
				øDc	ød1	ap	C	S	L			α
VEE080L05.0C25R04S05	●	4	45°	8	7.7	5	0.25	S05	10.0	90°	KEYV-S05	7
VEE100L07.0C30R04S06	●	4	45°	10	9.7	7	0.3	S06	13.0	90°	KEYV-S06	10
VEE120L09.0C35R04S08	●	4	45°	12	11.7	9	0.35	S08	16.5	90°	KEYV-S08	15
VEE160L12.0C40R05S10	●	5	45°	16	15.3	12	0.4	S10	20.5	7°	KEYV-S10	28
VEE200L15.0C40R06S12	●	6	45°	20	18.3	15	0.4	S12	25.5	3°	KEYV-S12	28
<b>New</b> VEE250L22.0C50R06S15	●	6	45°	25	23.9	22	0.5	S15	37.0	3°	KEYV-W20	40

## Square

### VEE-C

4 flutes, 45° helix (combined edges for finishing & roughing)

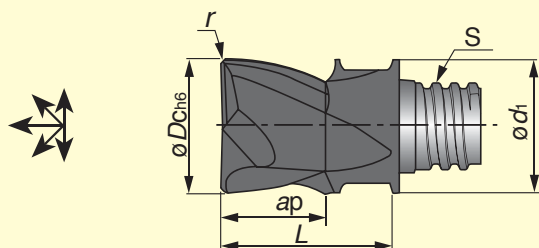


$a_p$  = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				$\varnothing D_c$	$\varnothing d_1$	$a_p$	C	S	L		
VEE080L05.0C30C04S05	●	4	45°	8	7.7	5	0.3	S05	10.0	KEYV-S05	7
VEE100L07.0C30C04S06	●	4	45°	10	9.7	7	0.3	S06	13.0	KEYV-S06	10
VEE120L09.0C40C04S08	●	4	45°	12	11.7	9	0.4	S08	16.5	KEYV-S08	15
VEE160L12.0C60C04S10	●	4	45°	16	15.3	12	0.6	S10	20.5	KEYV-S10	28
VEE200L15.0C60C04S12	●	4	45°	20	18.3	15	0.6	S12	25.5	KEYV-S12	28
<b>New</b> VEE250L22.0C60C04S15	●	4	45°	25	23.9	22	0.6	S15	37.0	KEYV-W20	40

### VEE-A

2 flutes, 45° helix, for aluminium machining (corner radii: 0.5 - 1.0 mm)

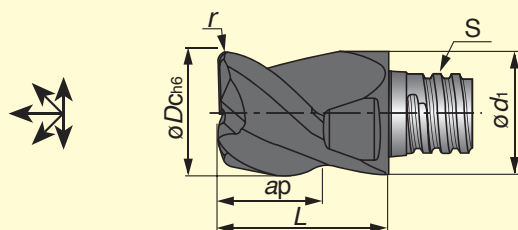


$a_p$  = Max. depth of cut  
S = Connection screw size

Cat. No.	KS15F	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				$\varnothing D_c$	$\varnothing d_1$	$a_p$	r	S	L		
VEE100L07.0R05A02S06	●	2	45°	10	9.7	7	0.5	S06	13.0	KEYV-S06	10
VEE100L07.0R10A02S06	●	2	45°	10	9.7	7	1.0	S06	13.0	KEYV-S06	10
VEE120L09.0R05A02S08	●	2	45°	12	11.7	9	0.5	S08	16.5	KEYV-S08	15

### VEE-A

3 flutes, 45° helix, for aluminium machining (corner radii: 0 - 2.0 mm)



$a_p$  = Max. depth of cut  
S = Connection screw size

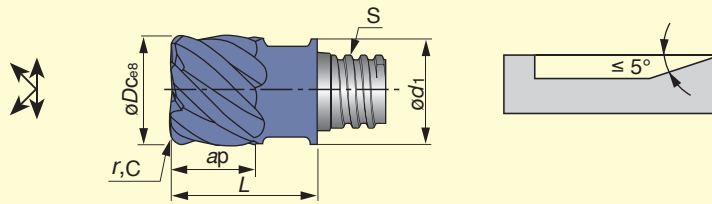
Cat. No.	KS15F	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				$\varnothing D_c$	$\varnothing d_1$	$a_p$	r	S	L		
VEE080L05.0R05A03S05	●	3	45°	8	7.7	5	0.5	S05	10.0	KEYV-S05	7
VEE100L06.0R05A03S06	●	3	45°	10	9.7	6	0.5	S06	13.0	KEYV-S06	10
VEE100L06.0R10A03S06	●	3	45°	10	9.7	6	1.0	S06	13.0	KEYV-S06	10
VEE120L08.0R05A03S08	●	3	45°	12	11.7	8	0.5	S08	16.5	KEYV-S08	15
VEE120L08.0R10A03S08	●	3	45°	12	11.7	8	1.0	S08	16.5	KEYV-S08	15
VEE160L10.0R00A03S10	●	3	45°	16	15.3	10	0	S10	20.5	KEYV-S10	28
VEE160L10.0R10A03S10	●	3	45°	16	15.3	10	1.0	S10	20.5	KEYV-S10	28
VEE160L10.0R20A03S10	●	3	45°	16	15.3	10	2.0	S10	20.5	KEYV-S10	28
VEE200L12.0R05A03S12	●	3	45°	20	18.3	12	0.5	S12	25.5	KEYV-S12	28
VEE200L12.0R10A03S12	●	3	45°	20	18.3	12	1.0	S12	25.5	KEYV-S12	28
VEE200L12.0R20A03S12	●	3	45°	20	18.3	12	2.0	S12	25.5	KEYV-S12	28

● : Stocked items  
Packing Quantity = 2 pcs.



## VEE / VED

6 flutes, 30°, 45° & 50° helix (without central edge, corner radii: 0 - 1.5 mm)

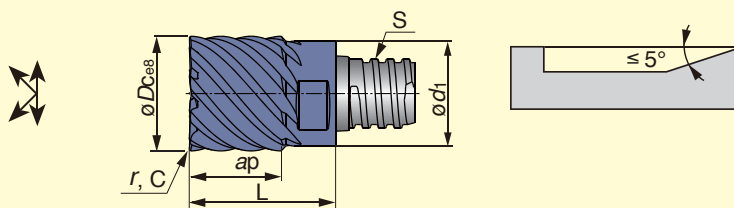


ap = Max. depth of cut  
S = Connection screw size

Cat. No.	Grades		No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N-m)	
	AH725	AH750			øDc	ød1	ap	r	C	S			L
VEE080L05.0R05-06S05	●		6	45°	8	7.7	5	0.5	-	S05	10.0	KEYV-S05	7
VEE080L05.0R10-06S05	●		6	45°	8	7.7	5	1.0	-	S05	10.0	KEYV-S05	7
VEE080L05.0R15-06S05	●		6	45°	8	7.7	5	1.5	-	S05	10.0	KEYV-S05	7
VEE080L05.0C10-06S05		●	6	50°	8	7.7	5	-	0.1	S05	10.0	KEYV-S05	7
VEE100L07.0R00-06S06	●		6	45°	10	9.7	7	0	-	S06	13.0	KEYV-S06	10
VED100L07.0R05-06S06	●		6	30°	10	9.7	7	0.5	-	S06	13.0	KEYV-S06	10
VEE100L07.0R05-06S06	●		6	45°	10	9.7	7	0.5	-	S06	13.0	KEYV-S06	10
VED100L07.0R10-06S06	●		6	30°	10	9.7	7	1.0	-	S06	13.0	KEYV-S06	10
VEE100L07.0R10-06S06	●		6	45°	10	9.7	7	1.0	-	S06	13.0	KEYV-S06	10
VED100L07.0R15-06S06	●		6	30°	10	9.7	7	1.5	-	S06	13.0	KEYV-S06	10
VEE100L07.0R15-06S06	●		6	45°	10	9.7	7	1.5	-	S06	13.0	KEYV-S06	10
VEE100L07.0C10-06S06		●	6	50°	10	9.7	7	-	0.1	S06	13.0	KEYV-S06	10
VEE120L09.0R00-06S08	●		6	45°	12	11.7	9	0	-	S08	16.5	KEYV-S08	15
VED120L09.0R05-06S08	●		6	30°	12	11.7	9	0.5	-	S08	16.5	KEYV-S08	15
VED120L09.0R10-06S08	●		6	30°	12	11.7	9	1.0	-	S08	16.5	KEYV-S08	15
VEE120L09.0R10-06S08	●		6	45°	12	11.7	9	1.0	-	S08	16.5	KEYV-S08	15
VEE120L09.0R15-06S08	●		6	45°	12	11.7	9	1.5	-	S08	16.5	KEYV-S08	15
VEE120L09.0C10-06S08		●	6	50°	12	11.7	9	-	0.1	S08	16.5	KEYV-S08	15

## VEE / VED

8 / 10 flutes, 30° & 50° helix (without central edge, corner radii: 0.5 - 2.0 mm)



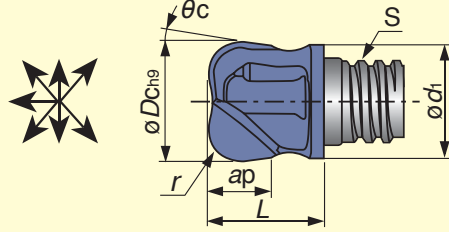
ap = Max. depth of cut  
S = Connection screw size

Cat. No.	Grades		No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N-m)	
	AH725	AH750			øDc	ød1	ap	r	C	S			L
VED160L12.0R05-08S10	●		8	30°	16	15.3	12	0.5	-	S10	20.5	KEYV-S10	28
VED160L12.0R10-08S10	●		8	30°	16	15.3	12	1.0	-	S10	20.5	KEYV-S10	28
VED160L12.0R16-08S10	●		8	30°	16	15.3	12	1.6	-	S10	20.5	KEYV-S10	28
VED160L12.0R20-08S10	●		8	30°	16	15.3	12	2.0	-	S10	20.5	KEYV-S10	28
VEE160L12.0C20-08S10		●	8	50°	16	15.3	12	-	0.2	S10	20.5	KEYV-S10	28
VED200L15.0R10-10S12	●		10	30°	20	18.3	15	1.0	-	S12	25.5	KEYV-S12	28
VED200L15.0R20-10S12	●		10	30°	20	18.3	15	2.0	-	S12	25.5	KEYV-S12	28
VEE200L15.0C20-10S12		●	10	50°	20	18.3	15	-	0.2	S12	25.5	KEYV-S12	28
<b>New</b> VED250L22.0R10-10S15	●		10	30°	25	23.9	22	1.0	-	S15	37.0	KEYV-W20	40
<b>New</b> VED250L22.0R20-10S15	●		10	30°	25	23.9	22	2.0	-	S15	37.0	KEYV-W20	40

● : Stocked items  
Packing Quantity = 2 pcs.

## Toroidal

### VRB / VRC 2 flutes, 0° / 15° helix, 5° / 7° relief angle

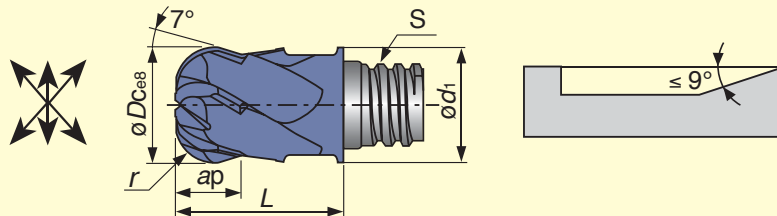


ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)							Wrench	Torque (N·m)
				$\phi Dc$	$\phi d1$	ap	r	$\theta c$	S	L		
VRC100L07.0R05-02S06	●	2	15°	10	9.5	7	0.5	5°	S06	12.4	KEYV-S06	10
VRC100L07.0R10-02S06	●	2	15°	10	9.5	7	1.0	5°	S06	12.4	KEYV-S06	10
VRB100L06.0R20-02S06	●	2	0°	10	9.2	6	2.0	7°	S06	12.4	KEYV-S06	10
VRB120L05.7R30-02S06	●	2	0°	12	9.5	5.7	3.0	7°	S06	9.1	*KEYV-S08	10
VRB120L05.4R40-02S06	●	2	0°	12	9.5	5.4	4.0	7°	S06	9.1	*KEYV-S08	10
VRB120L06.3R16-02S08	●	2	0°	12	11.5	5.9	1.6	7°	S08	11.1	KEYV-S08	15
VRB120L06.2R20-02S08	●	2	0°	12	11.5	6.2	2.0	7°	S08	11.1	KEYV-S08	15
VRB120L06.1R25-02S08	●	2	0°	12	11.5	5.8	2.5	7°	S08	11.1	KEYV-S08	15
VRB120L06.1R30-02S08	●	2	0°	12	11.5	5.7	3.0	7°	S08	11.1	KEYV-S08	15
VRB120L05.9R40-02S08	●	2	0°	12	11.5	5.5	4.0	7°	S08	11.1	KEYV-S08	15
VRB160L08.0R50-02S10	●	2	0°	16	15.2	8	5.0	7°	S10	20.2	KEYV-S10	28
VRB200L11.1R30-02S12	●	2	0°	20	18.3	11	3.0	7°	S12	17.0	KEYV-S12	28
VRB200L11.5R40-02S12	●	2	0°	20	18.3	11.3	4.0	7°	S12	17.3	KEYV-S12	28
VRB200L11.5R50-02S12	●	2	0°	20	18.3	11.3	5.0	7°	S12	17.3	KEYV-S12	28
VRB200L11.4R60-02S12	●	2	0°	20	18.3	11.2	6.0	7°	S12	17.3	KEYV-S12	28
VRB200L11.3R80-02S12	●	2	0°	20	18.3	11.1	8.0	7°	S12	17.3	KEYV-S12	28

- Suitable for contouring operation
- \* Some heads require different size of wrench.

### VRD 6 flutes, 30° helix, 7° back taper sided



ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				$\phi Dc$	$\phi d1$	ap	r	S	L		
VRD080L04.0R20-06S05	●	6	30°	8	7.7	4	2.0	S05	10.0	KEYV-S05	7
VRD100L05.0R30-06S06	●	6	30°	10	9.7	5	3.0	S06	13.0	KEYV-S06	10
VRD120L07.0R40-06S08	●	6	30°	12	11.7	7	4.0	S08	16.5	KEYV-S08	15
VRD160L09.0R50-06S10	●	6	30°	16	15.3	9	5.0	S10	20.5	KEYV-S10	28

**Standard cutting conditions: Shoulder milling**  
**(VEE: 3 flutes, VED/VEE: 4 flutes, VEE-A, VEE-I, VEE-R, VEE-C, VRB, VRC, VRD)**

ISO	Workpiece materials	Hardness	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/t)							Depth of cut ap (mm)	Pick feed Pf (mm)
				Tool diameter: øDc (mm)								
				6	8	10	12	16	20	25		
<b>P</b>	Low carbon steels S45C, S55C etc (C45, C55 etc)	- 300 HB	80 - 180	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.25 x øDc
	High carbon steels SCM440, SCr415 etc (42CrMo4, 15Cr3 etc)	- 300 HB	60 - 140	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.25 x øDc
	Prehardened steel PX5, NAK80 etc	30 - 40 HRC	60 - 120	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.25 x øDc
<b>M</b>	Stainless steels SUS304, SUS316 etc (X5CrNi18-9, X5CrNiMo17-12-2 etc)	- 200 HB	40 - 100	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.25 x øDc
<b>K</b>	Grey cast irons FC250, FC300 etc (GG25, GG30 etc)	150 - 250 HB	80 - 200	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.25 x øDc
	Ductile cast irons FCD400 etc (GGG40 etc)	150 - 250 HB	80 - 200	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x Dc	0.25 x øDc
<b>N</b>	Aluminium alloys (Si < 13%)	-	200 - 700	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.25 x øDc
	Aluminium alloys (Si ≥ 13%)	-	100 - 300	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.25 x øDc
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	40 - 80	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.05 x øDc
	Heat-resistant alloys Inconel 718 etc	-	20 - 40	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.05 x øDc
<b>H</b>	Hardened steel SKD61, SKT4 etc (X40CrMoV5 1, 55NiCrMoV6 etc)	40 - 50 HRC	40 - 80	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.05 x øDc
	Hardened steel SKD11, SKH etc (X153CrMoV12, HS18-0-1 etc)	50 - 60 HRC	20 - 60	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x øDc	0.05 x øDc

**Standard cutting conditions: Slot milling**  
**(VEE: 3 flutes, VED/VEE: 4 flutes, VEE-A, VEE-I, VEE-R, VEE-C, VRB, VRC, VRD)**

ISO	Workpiece materials	Hardness	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/t)							Depth of cut ap (mm)
				Tool diameter: øDc (mm)							
				6	8	10	12	16	20	25	
<b>P</b>	Low carbon steels S45C, S55C etc (C45, C55 etc)	- 300 HB	80 - 180	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
	High carbon steels SCM440, SCr415 etc (42CrMo4, 15Cr3 etc)	- 300 HB	60 - 140	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
	Prehardened steel PX5, NAK80 etc	30 - 40 HRC	60 - 120	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
<b>M</b>	Stainless steels SUS304, SUS316 etc (X5CrNi18-9, X5CrNiMo17-12-2 etc)	- 200 HB	40 - 100	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
<b>K</b>	Grey cast irons FC250, FC300 etc (GG25, GG30 etc)	150 - 250 HB	80 - 200	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
	Ductile cast irons FCD400 etc (GGG40 etc)	150 - 250 HB	80 - 200	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
<b>N</b>	Aluminium alloys (Si < 13%)	-	200 - 700	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
	Aluminium alloys (Si ≥ 13%)	-	100 - 300	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	40 - 80	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
	Heat-resistant alloys Inconel 718 etc	-	20 - 40	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
<b>H</b>	Hardened steel SKD61, SKT4 etc (X40CrMoV5 1, 55NiCrMoV6 etc)	40 - 50 HRC	40 - 80	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc
	Hardened steel SKD11, SKH etc (X153CrMoV12, HS18-0-1 etc)	50 - 60 HRC	20 - 60	0.03 - 0.07	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.07 - 0.10	0.6 x øDc



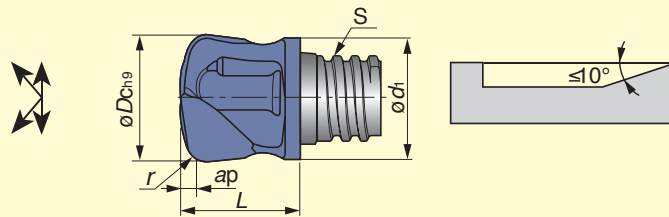
## Standard cutting conditions: Shoulder milling (VED / VEE: 6 flutes, VED / VEE: 8, 10 flutes)

ISO	Workpiece materials	Hardness	Cutting speed $V_c$ (m/min)	Feed per tooth: $f_z$ (mm/t)						Depth of cut $a_p$ (mm)	Pick feed $P_f$ (mm)
				Tool diameter: $\varnothing D_c$ (mm)							
				8	10	12	16	20	25		
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	60 - 120	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x $\varnothing D_c$	0.02 x $\varnothing D_c$
	Heat-resistant alloys Inconel 718 etc	-	30 - 60	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x $\varnothing D_c$	0.02 x $\varnothing D_c$
<b>H</b>	Hardened steel SKD61, SKT4 etc (X40CrMoV5 1, 55NiCrMoV6 etc)	40 - 50	80 - 160	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x $\varnothing D_c$	0.02 x $\varnothing D_c$
	Hardened steel SKD11, SKH etc (X153CrMoV12, HS18-0-1 etc)	50 - 60	40 - 90	0.05 - 0.09	0.07 - 0.12	0.08 - 0.13	0.09 - 0.15	0.10 - 0.17	0.10 - 0.17	0.6 x $\varnothing D_c$	0.02 x $\varnothing D_c$

# Toroidal

## VFX

2 flutes, 0° helix, for high feed milling



$ap$  = Max. depth of cut  
 $S$  = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				$\phi D_c$	$\phi d_1$	$ap$	$r^{(1)}$	$S$	$L$		
VFX100L00.6R20-02S06	●	2	0°	10	9.6	0.6	2.0	S06	12.5	KEYV-S06	10
VFX120L01.0R25-02S08	●	2	0°	12	11.5	1.0	2.5	S08	11.1	KEYV-S08	15
VFX160L01.1R30-02S10	●	2	0°	16	15.2	1.1	3.0	S10	20.0	KEYV-S10	28
VFX200L01.5R33-02S12	●	2	0°	20	18.3	1.5	3.3	S12	17.5	KEYV-S12	28

(1) Corner radius for CAM programming

Note: For VFX head, taper neck shank or Tungsten shank should be recommended.

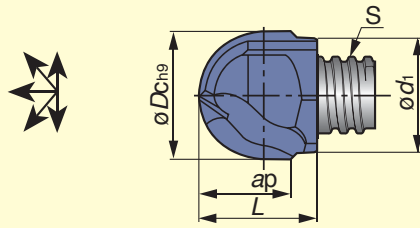
● : Stocked items  
 Packing Quantity = 2 pcs.

## Standard cutting conditions: Pocketing with high feed (VFX)

ISO	Workpiece materials	Hardness	Cutting speed $V_c$ (m/min)	$\phi 10$		$\phi 12$		$\phi 16$		$\phi 20$		Width of cut $ae$ (mm)
				Feed per tooth $f_z$ (mm/t)	Depth of cut $ap$ (mm)	Feed per tooth $f_z$ (mm/t)	Depth of cut $ap$ (mm)	Feed per tooth $f_z$ (mm/t)	Depth of cut $ap$ (mm)	Feed per tooth $f_z$ (mm/t)	Depth of cut $ap$ (mm)	
<b>P</b>	Low carbon steels S45C, S55C etc (C45, C55 etc)	- 300 HB	100 - 200	0.3 - 0.7	0.5	0.4 - 0.8	0.5	0.5 - 0.9	0.75	0.6 - 1.0	1.0	0.6 x $\phi D_c$
	High carbon steels SCM440, SCr415 etc (42CrMo4, 15Cr3 etc)	- 300 HB	80 - 180	0.2 - 0.6	0.5	0.3 - 0.7	0.5	0.4 - 0.8	0.75	0.5 - 0.9	1.0	0.6 x $\phi D_c$
	Prehardened steel PX5, NAK80 etc	30 - 40 HRC	80 - 160	0.2 - 0.5	0.4	0.2 - 0.5	0.4	0.3 - 0.6	0.5	0.3 - 0.6	0.75	0.6 x $\phi D_c$
<b>M</b>	Stainless steels SUS304, SUS316 etc (X5CrNi18-9, X5CrNiMo17-12-2 etc)	- 200 HB	60 - 100	0.2 - 0.6	0.4	0.2 - 0.6	0.4	0.3 - 0.7	0.5	0.3 - 0.7	0.75	0.6 x $\phi D_c$
<b>K</b>	Grey cast irons FC250, FC300 etc (GG25, GG30 etc)	150 - 250 HB	100 - 220	0.3 - 0.7	0.5	0.4 - 0.8	0.75	0.5 - 0.9	0.75	0.6 - 1.0	1.0	0.6 x $\phi D_c$
	Ductile cast irons FCD400 etc (GGG40 etc)	150 - 250 HB	100 - 220	0.2 - 0.6	0.5	0.3 - 0.7	0.75	0.4 - 0.8	0.75	0.5 - 0.9	1.0	0.6 x $\phi D_c$
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	40 - 80	0.2 - 0.5	0.4	0.2 - 0.5	0.4	0.2 - 0.6	0.5	0.2 - 0.6	0.5	0.25 x $\phi D_c$
	Heat-resistant alloys Inconel 718 etc	-	20 - 40	0.1 - 0.3	0.3	0.1 - 0.3	0.3	0.1 - 0.3	0.4	0.1 - 0.3	0.4	0.25 x $\phi D_c$
<b>H</b>	Hardened steel SKD61, SKT4 etc (X40CrMoV5 1, 55NiCrMoV6 etc)	40 - 50 HRC	40 - 80	0.2 - 0.4	0.3	0.2 - 0.4	0.3	0.3 - 0.5	0.4	0.3 - 0.5	0.4	0.45 x $\phi D_c$
	Hardened steel SKD11, SKH etc (X153CrMoV12, HS18-0-1 etc)	50 - 60 HRC	20 - 60	0.1 - 0.2	0.2	0.1 - 0.2	0.2	0.1 - 0.3	0.3	0.1 - 0.3	0.3	0.25 x $\phi D_c$

## Ball

### VBB-BM 2 flutes, 0° helix (for general purpose)

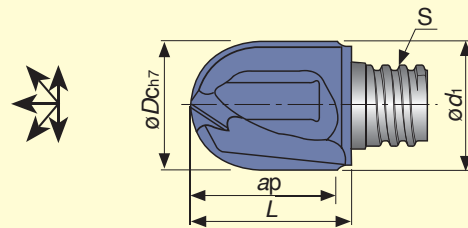


$a_p$  = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)					Wrench	Torque (N·m)
				$\varnothing D_c$	$\varnothing d_1$	$a_p$	S	L		
VBB080L08.0-BM-02S05	●	2	0°	8	7.6	8	S05	10.0	KEYV-S05	7
VBB100L10.0-BM-02S06	●	2	0°	10	9.5	10	S06	12.4	KEYV-S06	10
VBB120L12.0-BM-02S08	●	2	0°	12	11.5	11.5	S08	15.3	KEYV-S08	15
VBB160L16.0-BM-02S10	●	2	0°	16	15.2	16	S10	19.1	KEYV-S10	28

● For roughing

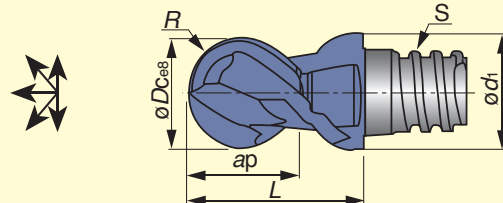
### VBB-BG 2 flutes, 0° helix (for high precision)



$a_p$  = Max. depth of cut  
S = Connection screw size

Cat. No.	AH750	No. of flutes	Helix angle	Dimensions (mm)					Wrench	Torque (N·m)
				$\varnothing D_c$	$\varnothing d_1$	$a_p$	S	L		
VBB080L08.0-BG-02S05	●	2	0°	8	7.6	8	S05	10.0	KEYV-S05	7
VBB100L10.0-BG-02S06	●	2	0°	10	9.6	10	S06	12.4	KEYV-S06	10
VBB120L12.0-BG-02S08	●	2	0°	12	11.5	12	S08	15.3	KEYV-S08	15
VBB160L16.0-BG-02S10	●	2	0°	16	15.2	16	S10	19.1	KEYV-S10	28

### VBD-BG 2 flutes, 30° helix (for high precision)



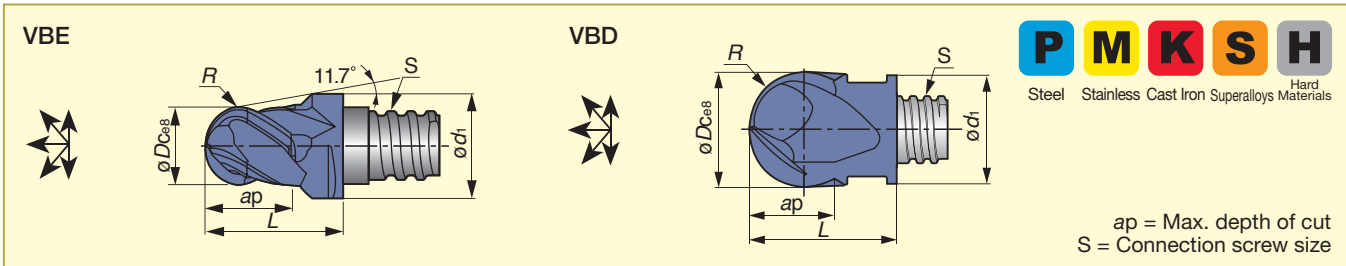
$a_p$  = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				$\varnothing D_c$	$\varnothing d_1$	$a_p$	R	S	L		
VBD080L05.0-BG-02S05	●	2	30°	8	7.7	5	3.982 <sup>(1)</sup>	S05	10.0	KEYV-S05	7
VBD100L07.0-BG-02S06	●	2	30°	10	9.7	7	4.982 <sup>(1)</sup>	S06	13.0	KEYV-S06	10
VBD120L09.0-BG-02S08	●	2	30°	12	11.7	9	5.978 <sup>(2)</sup>	S08	16.5	KEYV-S08	15
VBD160L09.5-BG-02S10	●	2	30°	16	15.3	9	7.978 <sup>(2)</sup>	S10	20.5	KEYV-S10	28

● The tolerance of R : (1)  $\pm 0.010$  (2)  $\pm 0.012$



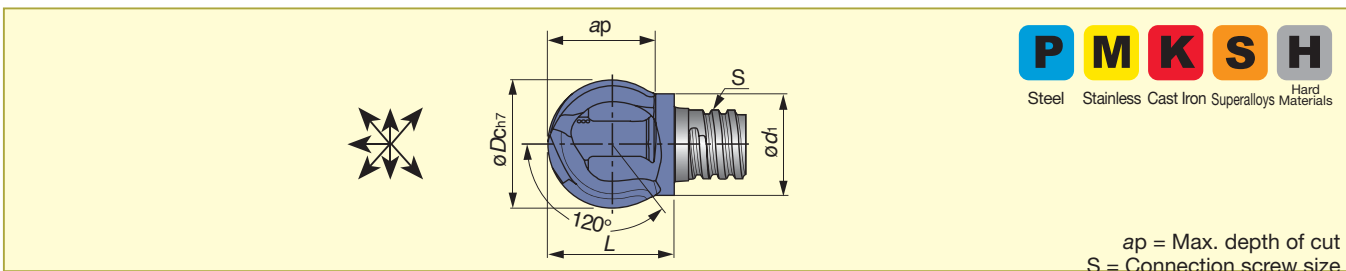
## VBD / VBE-BG 4 flutes, 30° & 45° helix (for high precision)



Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				øDc	ød1	ap	R	S	L		
VBE060L05.5-BG-04S05	●	4	38°	6	8.0	5.5	2.987 <sup>(1)</sup>	S05	10.0	KEYV-S05	7
VBD080L05.0-BG-04S05	●	4	30°	8	7.7	5	3.982 <sup>(1)</sup>	S05	10.0	KEYV-S05	7
VBD100L07.0-BG-04S06	●	4	30°	10	9.7	7	4.982 <sup>(1)</sup>	S06	13.0	KEYV-S06	10
VBD120L09.0-BG-04S08	●	4	30°	12	11.7	9	5.978 <sup>(2)</sup>	S08	16.5	KEYV-S08	15
VBD160L12.0-BG-04S10	●	4	30°	16	15.3	12	7.978 <sup>(2)</sup>	S10	20.5	KEYV-S10	28
VBD200L15.0-BG-04S12	●	4	30°	20	18.3	15	9.972 <sup>(2)</sup>	S12	25.5	KEYV-S12	28
<b>New</b> VBD250L22.0-BG-04S15	●	4	30°	25	23.9	22	12.470 <sup>(3)</sup>	S15	37.0	KEYV-W20	40

● The tolerance of R : (1) ± 0.010 (2) ± 0.012 (3) ± 0.02

## VBB-SG 2 flutes, 0° helix, spherical designed edge

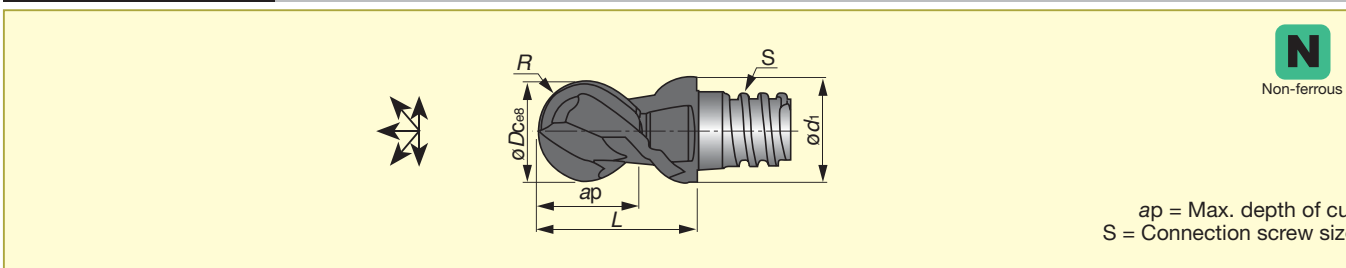


Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)					Wrench	Torque (N·m)
				øDc	ød1	ap	S	L		
VBB100L08.0-SG-02S05	●	2	0°	10	7.6	7.5	S05	10.0	KEYV-S05	7
VBB120L09.6-SG-02S06	●	2	0°	12	9.5	9.0	S06	11.6	*KEYV-S08	10
VBB160L12.9-SG-02S08	●	2	0°	16	12.2	12.0	S08	15.4	*KEYV-S10	15
VBB200L16.1-SG-02S10	●	2	0°	20	15.2	15.0	S10	18.4	KEYV-S10	28

● For pull-cutting on the vertical wall

\* Some heads require different size of wrench.

## VBE-BGA 2 flutes, 45° helix, for aluminium machining



Cat. No.	KS15F	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				øDc	ød1	ap	R	S	L		
VBE080L05.0-BGA02S05	●	2	45°	8	7.7	5	3.982 <sup>(1)</sup>	S05	10.0	KEYV-S05	7
VBE100L07.0-BGA02S06	●	2	45°	10	9.7	7	4.982 <sup>(1)</sup>	S06	13.0	KEYV-S06	10
VBE120L09.0-BGA02S08	●	2	45°	12	11.7	9	5.987 <sup>(2)</sup>	S08	16.5	KEYV-S08	15
VBE160L12.0-BGA02S10	●	2	45°	16	15.3	12	7.978 <sup>(2)</sup>	S10	20.5	KEYV-S10	28
VBE200L15.0-BGA02S12	●	2	45°	20	18.3	15	9.972 <sup>(2)</sup>	S12	25.5	KEYV-S12	28

● The tolerance of R : (1) ± 0.010 (2) ± 0.012

● : Stocked items  
Packing Quantity = 2 pcs.

## Standard cutting conditions: Profiling for roughing (VBB-BM / BG / SG, VBD-BG, VBE-BGA)

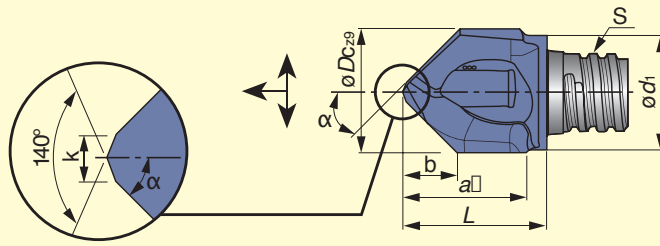
ISO	Workpiece materials	Hardness	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/t)						Depth of cut ap (mm)	Pick feed Pf (mm)	
				Tool diameter: øDc (mm)								
				6	8	10	12	16	20	25		
<b>P</b>	Low carbon steels S45C, S55C etc (C45, C55 etc)	- 300 HB	100 - 200	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.4 x øDc
	High carbon steels SCM440, SCr415 etc (42CrMo4, 15Cr3 etc)	- 300 HB	80 - 180	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.4 x øDc
	Prehardened steel PX5, NAK80 etc	30 - 40 HRC	80 - 160	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.4 x øDc
<b>M</b>	Stainless steels SUS304, SUS316 etc (X5CrNi18-9, X5CrNiMo17-12-2 etc)	- 200 HB	60 - 100	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.4 x øDc
<b>K</b>	Grey cast irons FC250, FC300 etc (GG25, GG30 etc)	150 - 250 HB	100 - 220	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.4 x øDc
	Ductile cast irons FCD400 etc (GGG40 etc)	150 - 250 HB	100 - 220	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.4 x øDc
<b>N</b>	Aluminium alloys (Si < 13%)	-	200 - 700	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.4 x øDc
	Aluminium alloys (Si ≥ 13%)	-	100 - 300	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.4 x øDc
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	40 - 80	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.2 x øDc
	Heat-resistant alloys Inconel 718 etc	50 - 60 HRC	20 - 40	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.2 x øDc
<b>H</b>	Hardened steel SKD61, SKT4 etc (X40CrMoV5 1, 55NiCrMoV6 etc)	-	40 - 80	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.2 x øDc
	Hardened steel SKD11, SKH etc (X153CrMoV12, HS18-0-1 etc)	50 - 60 HRC	20 - 60	0.03 - 0.07	0.04 - 0.08	0.05 - 0.10	0.06 - 0.11	0.07 - 0.13	0.08 - 0.15	0.08 - 0.15	0.3 x øDc	0.2 x øDc

## Standard cutting conditions: Profiling for semi-finishing and finishing (VBB-BM / BG / SG, VBD-BG, VBE-BGA)

ISO	Workpiece materials	Hardness	Cutting speed Vc (m/min)	Feed per tooth: fz (mm/t)						Depth of cut ap (mm)	Pick feed Pf (mm)	
				Tool diameter: øDc (mm)								
				6	8	10	12	16	20	25		
<b>P</b>	Low carbon steels S45C, S55C etc (C45, C55 etc)	- 300 HB	120 - 250	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.1 x øDc	0.15 x øDc
	High carbon steels SCM440, SCr415 etc (42CrMo4, 15Cr3 etc)	- 300 HB	100 - 220	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.1 x øDc	0.15 x øDc
	Prehardened steel PX5, NAK80 etc	30 - 40 HRC	100 - 200	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.1 x øDc	0.15 x øDc
<b>M</b>	Stainless steels SUS304, SUS316 etc (X5CrNi18-9, X5CrNiMo17-12-2 etc)	- 200 HB	80 - 120	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.1 x øDc	0.15 x øDc
<b>K</b>	Grey cast irons FC250, FC300 etc (GG25, GG30 etc)	150 - 250 HB	120 - 280	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.1 x øDc	0.15 x øDc
	Ductile cast irons FCD400 etc (GGG40 etc)	150 - 250 HB	120 - 280	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.1 x øDc	0.15 x øDc
<b>N</b>	Aluminium alloys (Si < 13%)	-	300 - 1000	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.1 x øDc	0.15 x øDc
	Aluminium alloys (Si ≥ 13%)	-	150 - 400	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.1 x øDc	0.15 x øDc
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	50 - 100	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.08 x øDc	0.1 x øDc
	Heat-resistant alloys Inconel 718 etc	50 - 60 HRC	30 - 50	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.08 x øDc	0.1 x øDc
<b>H</b>	Hardened steel SKD61, SKT4 etc (X40CrMoV5 1, 55NiCrMoV6 etc)	-	50 - 100	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.08 x øDc	0.1 x øDc
	Hardened steel SKD11, SKH etc (X153CrMoV12, HS18-0-1 etc)	50 - 60 HRC	30 - 80	0.04 - 0.09	0.06 - 0.11	0.07 - 0.12	0.08 - 0.13	0.09 - 0.16	0.10 - 0.18	0.10 - 0.18	0.08 x øDc	0.1 x øDc

# Drilling

## VCP 2 flutes, 0° helix, for spot drilling, chamfering and countersinking



b = Max. hole depth  
ap = Max. depth of cut  
S = Connection screw size

### Point angle = 60°

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)								Wrench	Torque (N·m)
				$\phi Dc$	$\phi d_1$	ap	b	S	L	k	$\alpha$		
VCP100L09.5A30-02S06	●	2	0°	10.0	9.5	8.5	7.5	S06	11.75	1.5	30°	KEYV-S06	10
VCP120L12.0A30-02S08	●	2	0°	12.0	11.5	11	9.2	S08	15.4	1.5	30°	KEYV-S08	15
VCP160L15.0A30-02S10	●	2	0°	16.0	15.2	16	12.0	S10	20.2	2.5	30°	KEYV-S10	28

• Min. chamfering:  $\phi 1.5$  mm

### Point angle = 90°

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)								Wrench	Torque (N·m)
				$\phi Dc$	$\phi d_1$	ap	b	S	L	k	$\alpha$		
VCP080L07.7A45-02S05	●	2	0°	8.0	7.6	7.5	3.7	S05	9.75	1.0	45°	KEYV-S05	7
VCP083L07.9A45-02S05	●	2	0°	8.3	7.6	7.5	3.8	S05	10.0	1.0	45°	KEYV-S05	7
VCP100L09.0A45-02S06	●	2	0°	10.0	9.5	9.5	4.4	S06	11.75	1.5	45°	KEYV-S06	10
VCP104L09.0A45-02S06	●	2	0°	10.4	9.5	9.5	4.6	S06	11.75	1.5	45°	KEYV-S06	10
VCP120L12.0A45-02S08	●	2	0°	12.0	11.5	11.5	5.4	S08	15.4	1.5	45°	KEYV-S08	15
VCP124L12.0A45-02S08	●	2	0°	12.4	11.5	11.5	5.6	S08	15.4	1.5	45°	KEYV-S08	15
VCP160L15.0A45-02S10	●	2	0°	16.0	15.2	15	7.1	S10	18.8	1.5	45°	KEYV-S10	28
VCP165L15.0A45-02S10	●	2	0°	16.5	15.2	15	7.1	S10	18.8	1.5	45°	KEYV-S10	28

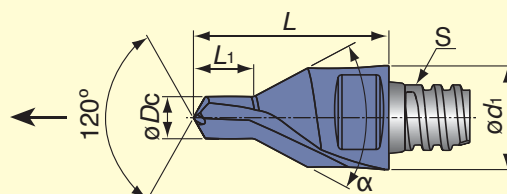
• Min. chamfering:  $\phi 1.5$  mm

### Point angle = 120°

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)								Wrench	Torque (N·m)
				$\phi Dc$	$\phi d_1$	ap	b	S	L	k	$\alpha$		
VCP100L09.5A60-02S06	●	2	0°	10.0	9.5	9.5	2.7	S06	12.7	1.5	60°	KEYV-S06	10
VCP120L12.0A60-02S08	●	2	0°	12.0	11.5	11.5	3.3	S08	15.2	1.5	60°	KEYV-S08	15
VCP160L15.5A60-02S10	●	2	0°	16.0	15.2	16	4.4	S10	19.9	1.5	60°	KEYV-S10	28

• Min. chamfering:  $\phi 1.5$  mm

## VDP 2 flutes, for center drilling (DIN332)



ap = Max. depth of cut  
S = Connection screw size

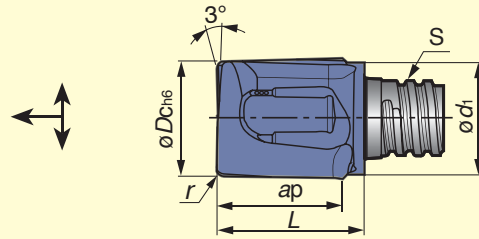
Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				$\phi Dc$	$\phi d_1$	L <sub>1</sub>	S	L	$\alpha$		
VDP328L04.6A30-02S05	●	2	-	3.28	8	4.6	S05	15.0	60°	KEYV-S05	7
VDP412L05.9A30-02S06	●	2	-	4.12	10	5.9	S06	19.0	60°	KEYV-S06	10
VDP513L07.2A30-02S08	●	2	-	5.13	12	7.2	S08	23.0	60°	KEYV-S08	15
VDP646L08.9A30-02S10	●	2	-	6.46	16	8.9	S10	28.0	60°	KEYV-S10	28

● : Stocked items  
Packing Quantity = 2 pcs.



## Standard cutting conditions: Drilling (VCP, VDP)

ISO	Workpiece materials	Hardness	Cutting speed Vc (m/min)	Feed: f (mm/rev)				
				VDP328	VDP412	VDP513	VDP646	VCP
<b>P</b>	Low carbon steels S45C, S55C etc (C45, C55 etc)	- 300 HB	40 - 80	0.04 - 0.08	0.05 - 0.10	0.05 - 0.10	0.06 - 0.12	0.06 - 0.12
	High carbon steels SCM440, SCr415 etc (42CrMo4, 15Cr3 etc)	- 300 HB	30 - 50	0.04 - 0.08	0.05 - 0.10	0.05 - 0.10	0.06 - 0.12	0.06 - 0.12
	Prehardened steel PX5, NAK80 etc	30 - 40 HRC	20 - 30	0.04 - 0.08	0.05 - 0.10	0.05 - 0.10	0.06 - 0.12	0.06 - 0.12
<b>M</b>	Stainless steels SUS304, SUS316 etc (X5CrNi18-9, X5CrNiMo17-12-2 etc)	- 200 HB	15 - 25	0.04 - 0.08	0.05 - 0.10	0.05 - 0.10	0.06 - 0.12	0.06 - 0.12
<b>K</b>	Grey cast irons FC250, FC300 etc (GG25, GG30 etc)	150 - 250 HB	60 - 100	0.05 - 0.09	0.07 - 0.12	0.07 - 0.12	0.12 - 0.18	0.12 - 0.18
	Ductile cast irons FCD400 etc (GGG40 etc)	150 - 250 HB	60 - 100	0.04 - 0.08	0.05 - 0.10	0.05 - 0.10	0.10 - 0.15	0.10 - 0.15
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	15 - 25	0.04 - 0.07	0.04 - 0.07	0.04 - 0.07	0.04 - 0.07	0.04 - 0.07
	Heat-resistant alloys Inconel 718 etc	-	10 - 20	0.03 - 0.06	0.03 - 0.06	0.03 - 0.06	0.03 - 0.06	0.03 - 0.06
<b>H</b>	Hardened steel SKD61, SKT4 etc (X40CrMoV5 1, 55NiCrMoV6 etc)	40 - 50 HRC	15 - 25	0.04 - 0.07	0.04 - 0.07	0.04 - 0.07	0.04 - 0.07	0.04 - 0.07
	Hardened steel SKD11, SKH etc (X153CrMoV12, HS18-0-1 etc)	50 - 60 HRC	10 - 20	0.03 - 0.06	0.03 - 0.06	0.03 - 0.06	0.03 - 0.06	0.03 - 0.06



$ap$  = Max. depth of cut  
 $S$  = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				$\phi D_c$	$\phi d_1$	$ap$	$r$	$S$	$L$		
VGC078L08.0R02-02S05	●	2	10°	7.8	7.6	8	0.2	S05	10.0	KEYV-S05	7
VGC080L08.0R04-02S05	●	2	10°	8.0	7.6	8	0.4	S05	10.0	KEYV-S05	7
VGC080L08.0R10-02S05	●	2	10°	8.0	7.6	8	1.0	S05	10.0	KEYV-S05	7
VGC080L08.0R20-02S05	●	2	10°	8.0	7.6	8	2.0	S05	10.0	KEYV-S05	7
VGC098L09.0R03-02S06	●	2	10°	9.8	9.5	9.5	0.3	S06	12.4	KEYV-S06	10
VGC100L09.0R04-02S06	●	2	10°	10.0	9.5	9.5	0.4	S06	12.4	KEYV-S06	10
VGC100L09.0R10-02S06	●	2	10°	10.0	9.5	9.5	1.0	S06	12.4	KEYV-S06	10
VGC100L09.0R20-02S06	●	2	10°	10.0	9.5	9.5	2.0	S06	12.4	KEYV-S06	10
VGC117L10.0R03-02S08	●	2	10°	11.7	11.5	10	0.3	S08	14.2	KEYV-S08	15
VGC120L10.0R04-02S08	●	2	10°	12.0	11.5	10	0.4	S08	14.2	KEYV-S08	15
VGC120L10.0R10-02S08	●	2	10°	12.0	11.5	10	1.0	S08	14.2	KEYV-S08	15
VGC120L10.0R20-02S08	●	2	10°	12.0	11.5	10	2.0	S08	14.2	KEYV-S08	15
VGC157L15.0R03-02S10	●	2	10°	15.7	15.2	15	0.3	S10	19.0	KEYV-S10	28
VGC160L15.0R04-02S10	●	2	10°	16.0	15.2	15	0.4	S10	19.0	KEYV-S10	28
VGC160L15.0R08-02S10	●	2	10°	16.0	15.2	15	0.8	S10	19.0	KEYV-S10	28

● Can drill with step feed

● : Stocked items  
 Packing Quantity = 2 pcs.

**Standard cutting conditions: Counter boring (VGC)**

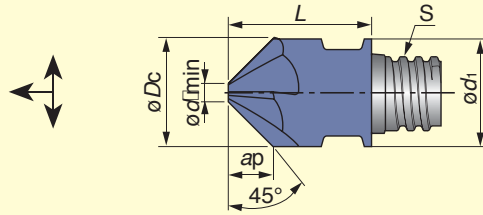
ISO	Workpiece materials	Hardness	Cutting speed $V_c$ (m/min)	Feed $f$ (mm/rev)
<b>P</b>	Low carbon steels S45C, S55C etc (C45, C55 etc)	- 300 HB	40 - 80	0.04 - 0.08
	High carbon steels SCM440, SCr415 etc (42CrMo4, 15Cr3 etc)	- 300 HB	30 - 50	0.04 - 0.08
	Prehardened steel PX5, NAK80 etc	30 - 40 HRC	20 - 30	0.04 - 0.08
<b>M</b>	Stainless steels SUS304, SUS316 etc (X5CrNi18-9, X5CrNiMo17-12-2 etc)	- 200 HB	15 - 25	0.04 - 0.08
<b>K</b>	Grey cast irons FC250, FC300 etc (GG25, GG30 etc)	150 - 250 HB	60 - 100	0.05 - 0.09
	Ductile cast irons FCD400 etc (GGG40 etc)	150 - 250 HB	60 - 100	0.04 - 0.08
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	15 - 25	0.04 - 0.07
	Heat-resistant alloys Inconel 718 etc	-	10 - 20	0.03 - 0.06
<b>H</b>	Hardened steel SKD61, SKT4 etc (X40CrMoV5 1, 55NiCrMoV6 etc)	40 - 50 HRC	15 - 25	0.04 - 0.07
	Hardened steel SKD11, SKH etc (X153CrMoV12, HS18-0-1 etc)	50 - 60 HRC	10 - 20	0.03 - 0.06

·When drilling, the step feed (woodpeckering feed) operation should be applied with the depth of 0.3 - 0.5 mm per step.  
 ·Apply the same cutting conditions as the VEE type head when conducting shoulder milling or slotting operations.

## Chamfering

### VCA

4 / 6 flutes, 0° helix, chamfering and countersinking (without center edge)

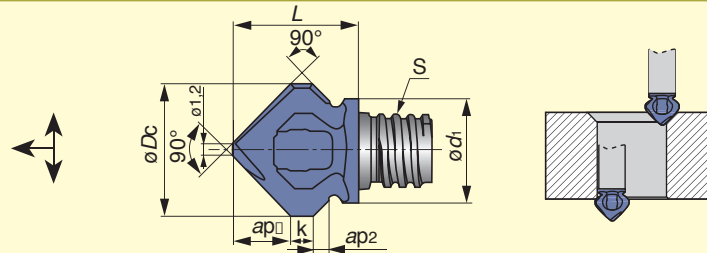


ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)
				øDc	ød1	ap	ødmin	S	L		
VCA100L04.0A45-04S06	●	4	0°	10.0	10.0	4	1.95	S06	13.00	KEYV-S06	10
VCA120L05.0A45-04S08	●	4	0°	12.0	12.0	5	1.95	S08	16.50	KEYV-S08	15
VCA127L05.3A45-04S08	●	4	0°	12.7	12.7	5.3	1.98	S08	16.50	KEYV-S08	15
VCA160L06.5A45-06S10	●	6	0°	16.0	16.0	6.5	3.00	S10	20.30	KEYV-S10	28
VCA200L07.5A45-06S12	●	6	0°	20.0	18.3	7.5	5.00	S12	25.50	KEYV-S12	28

### VCW

2 flutes, 0° helix, for double chamfering



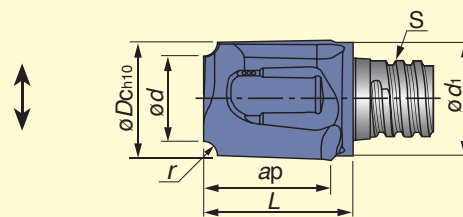
ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)	
				øDc	ød1	ap1	ap2	k	S			L
VCW118L05.0A45-02S06	●	2	0°	11.8	9.3	5.0	1.2	2.0	S06	11.20	*KEYV-S08	10

- Available for chamfering of reverse side
- \* Some heads require different size of wrench.

### VCR

2 flutes, 0° helix, for concave radius milling



ap = Max. depth of cut  
S = Connection screw size

Cat. No.	AH725	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N·m)	
				øDc	ød1	ød	ap	r	S			L
VCR080L07.5R10-02S05	●	2	0°	8.0	7.6	5.8	7.5	1.0	S05	10.5	KEYV-S05	7
VCR100L09.5R16-02S06	●	2	0°	10.0	9.5	6.8	9.5	1.6	S06	12.5	KEYV-S06	10
VCR100L09.5R25-02S06	●	2	0°	10.0	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	3.0	S08	15.6	KEYV-S08	15
VCR127L12.0R40-02S08	●	2	0°	12.7	12.2	4.7	12	4.0	S08	15.6	KEYV-S08	15
VCR160L15.0R50-02S10	●	2	0°	16.0	15.2	6.2	15	5.0	S10	19.1	KEYV-S10	28
VCR200L07.0R60-02S12	●	2	0°	20.0	18.3	8.0	7.0	6.0	S12	17.4	KEYV-S12	28

● : Stocked items  
Packing Quantity = 2 pcs.



## Standard cutting conditions: Chamfering and countersinking (VCA, VCW, VCR, VCP)

ISO	Workpiece materials	Hardness	Cutting speed Vc (m/min)	Feed f (mm/rev)
<b>P</b>	Low carbon steels S45C, S55C etc (C45, C55 etc)	- 300 HB	60 - 100	0.06 - 0.12
	High carbon steels SCM440, SCr415 etc (42CrMo4, 15Cr3 etc)	- 300 HB	50 - 80	0.06 - 0.12
	Prehardened steel PX5, NAK80 etc	30 - 40 HRC	40 - 70	0.06 - 0.12
<b>M</b>	Stainless steels SUS304, SUS316 etc (X5CrNi18-9, X5CrNiMo17-12-2 etc)	- 200 HB	30 - 50	0.06 - 0.12
<b>K</b>	Grey cast irons FC250, FC300 etc (GG25, GG30 etc)	150 - 250 HB	80 - 120	0.06 - 0.12
	Ductile cast irons FCD400 etc (GGG40 etc)	150 - 250 HB	80 - 120	0.06 - 0.12
<b>N</b>	Aluminium alloys	-	100 - 200	0.08 - 0.15
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	30 - 50	0.05 - 0.10
	Heat-resistant alloys Inconel 718 etc	-	20 - 40	0.04 - 0.08
<b>H</b>	Hardened steel SKD61, SKT4 etc (X40CrMoV5 1, 55NiCrMoV6 etc)	40 - 50 HRC	30 - 50	0.05 - 0.10
	Hardened steel SKD11, SKH etc (X153CrMoV12, HS18-0-1 etc)	50 - 60 HRC	20 - 40	0.04 - 0.08

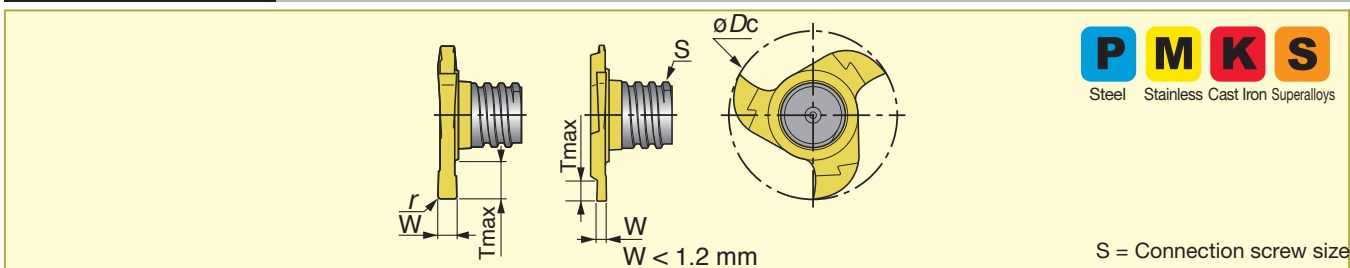
## Tolerance of tool diameter

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

## Slotting

### VST 3 flutes, for slotting



Cat. No.	GH130	No. of flutes	Helix angle	Dimensions (mm)					Wrench	Torque (N-m)
				$\varnothing D_c$	$W^{\pm 0.02}$	$r$	S	Tmax		
VST157W1.50R010-3S06	●	3	-	15.7	1.50	0.10	S06	2.8	KEYV-177	10
VST157W1.57R020-3S06	●	3	-	15.7	1.57	0.20	S06	2.8	KEYV-177	10
VST157W2.00R020-3S06	●	3	-	15.7	2.00	0.20	S06	2.8	KEYV-177	10
VST157W2.39R020-3S06	●	3	-	15.7	2.39	0.20	S06	2.8	KEYV-177	10
VST157W2.50R020-3S06	●	3	-	15.7	2.50	0.20	S06	2.8	KEYV-177	10
VST157W3.00R020-3S06	●	3	-	15.7	3.00	0.20	S06	2.8	KEYV-177	10
VST157W3.17R020-3S06	●	3	-	15.7	3.17	0.20	S06	2.8	KEYV-177	10
VST177W1.20R005-3S06	●	3	-	17.7	1.20 <sup>(1)</sup>	0.05	S06	3.8	KEYV-177	10
VST177W1.40R005-3S06	●	3	-	17.7	1.40 <sup>(1)</sup>	0.05	S06	3.8	KEYV-177	10
VST177W1.50R010-3S06	●	3	-	17.7	1.50	0.10	S06	3.8	KEYV-177	10
VST177W1.57R020-3S06	●	3	-	17.7	1.57	0.20	S06	3.8	KEYV-177	10
VST177W1.70R005-3S06	●	3	-	17.7	1.70 <sup>(1)</sup>	0.05	S06	3.8	KEYV-177	10
VST177W2.00R020-3S06	●	3	-	17.7	2.00	0.20	S06	3.8	KEYV-177	10
VST177W2.20R110-3S06	●	3	-	17.7	2.20	1.10	S06	3.8	KEYV-177	10
VST177W2.39R020-3S06	●	3	-	17.7	2.39	0.20	S06	3.8	KEYV-177	10
VST177W2.50R020-3S06	●	3	-	17.7	2.50	0.20	S06	3.8	KEYV-177	10
VST177W3.00R020-3S06	●	3	-	17.7	3.00	0.20	S06	3.8	KEYV-177	10
VST177W3.17R020-3S06	●	3	-	17.7	3.17	0.20	S06	3.8	KEYV-177	10

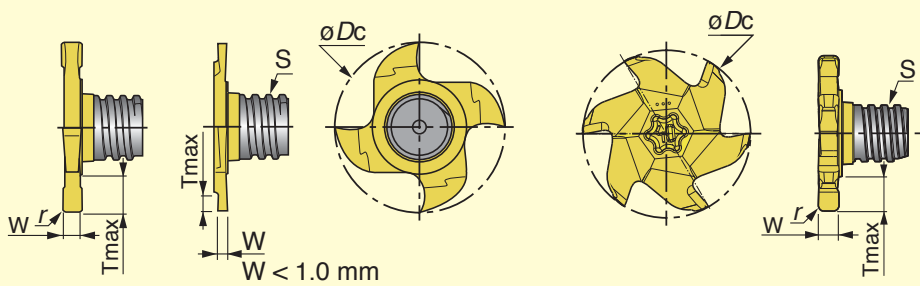
(1) W is based on DIN471 / 472

● : Stocked items  
Packing Quantity = 2 pcs.

# Slotting

## VST

4 / 6 flutes, for slotting



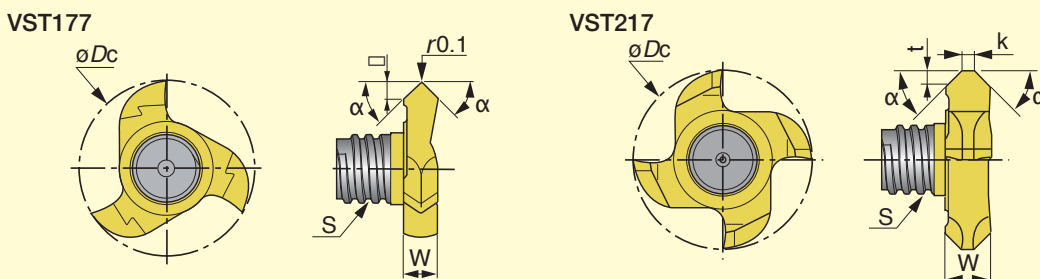
S = Connection screw size

Cat. No.	GH130	No. of flutes	Helix angle	Dimensions (mm)					Wrench	Torque (N-m)
				$\phi Dc$	$W \pm 0.02$	$r$	S	Tmax		
VST217W0.76R000-4S08	●	4	-	21.7	0.76 <sup>(1)</sup>	0.00	S08	1.5	KEYV-217	15
VST217W0.86R000-4S08	●	4	-	21.7	0.86 <sup>(1)</sup>	0.00	S08	1.7	KEYV-217	15
VST217W0.96R000-4S08	●	4	-	21.7	0.96 <sup>(1)</sup>	0.00	S08	1.9	KEYV-217	15
VST217W1.00R005-4S08	●	4	-	21.7	1.00	0.05	S08	2.0	KEYV-217	15
VST217W1.20R005-4S08	●	4	-	21.7	1.20 <sup>(1)</sup>	0.05	S08	4.5	KEYV-217	15
VST217W1.40R005-4S08	●	4	-	21.7	1.40 <sup>(1)</sup>	0.05	S08	4.5	KEYV-217	15
VST217W1.57R000-4S08	●	4	-	21.7	1.57	0.00	S08	4.5	KEYV-217	15
VST217W1.70R010-4S08	●	4	-	21.7	1.70 <sup>(1)</sup>	0.10	S08	4.5	KEYV-217	15
VST217W1.95R020-4S08	●	4	-	21.7	1.95 <sup>(1)</sup>	0.20	S08	4.5	KEYV-217	15
VST217W2.00R020-4S08	●	4	-	21.7	2.00	0.20	S08	4.5	KEYV-217	15
VST217W2.25R020-4S08	●	4	-	21.7	2.25 <sup>(1)</sup>	0.20	S08	4.5	KEYV-217	15
VST217W2.39R020-4S08	●	4	-	21.7	2.39	0.20	S08	4.5	KEYV-217	15
VST217W2.50R020-4S08	●	4	-	21.7	2.50	0.20	S08	4.5	KEYV-217	15
VST217W2.75R020-4S08	●	4	-	21.7	2.75 <sup>(1)</sup>	0.20	S08	4.5	KEYV-217	15
VST217W3.00R020-4S08	●	4	-	21.7	3.00	0.20	S08	4.5	KEYV-217	15
VST217W3.17R020-4S08	●	4	-	21.7	3.17	0.20	S08	4.5	KEYV-217	15
VST217W3.25R020-4S08	●	4	-	21.7	3.25 <sup>(1)</sup>	0.20	S08	4.5	KEYV-217	15
VST217W4.00R020-4S08	●	4	-	21.7	4.00	0.20	S08	4.5	KEYV-217	15
VST217W4.25R020-4S08	●	4	-	21.7	4.25 <sup>(1)</sup>	0.20	S08	4.5	KEYV-217	15
VST217W4.75R020-4S08	●	4	-	21.7	4.75	0.20	S08	4.5	KEYV-217	15
VST217W5.25R020-4S08	●	4	-	21.7	5.25 <sup>(1)</sup>	0.20	S08	4.5	KEYV-217	15
VST277W2.50R020-6S10	●	6	-	27.7	2.50	0.20	S10	6.0	KEYV-T40L	28
VST277W5.25R020-6S10	●	6	-	27.7	5.25	0.20	S10	6.0	KEYV-T40L	28
VST277W10.0R020-6S10	●	6	-	27.7	10.0	0.20	S10	6.0	KEYV-T40L	28

(1) W is based on DIN471 / 472

## VST-A45

3 / 4 flutes, for chamfering



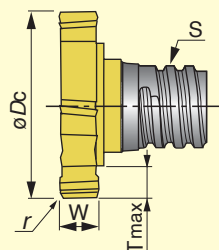
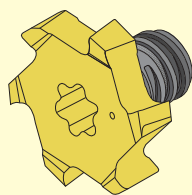
S = Connection screw size

Cat. No.	GH130	No. of flutes	Helix angle	Dimensions (mm)						Wrench	Torque (N-m)
				$\phi Dc$	W	$\alpha$	S	t	k		
VST177L01.40A45-3S06	●	3	-	17.7	3.40	45°	S06	1.4	-	KEYV-177	10
VST217L01.70A45-4S08	●	4	-	21.7	5.50	45°	S08	1.7	1.5	KEYV-217	15

● : Stocked items  
Packing Quantity = 2 pcs.

## Slotting

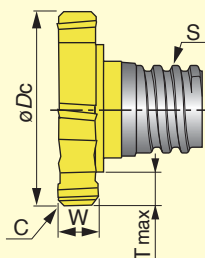
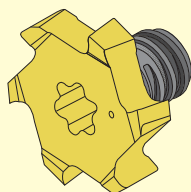
### VTB 6 flutes, for slotting



S = Connection screw size

Cat. No.	GH130	No. of flutes	Helix angle	Dimensions (mm)					Wrench	Torque (N-m)
				$\phi Dc_{-0.05}$	$W_{\pm 0.02}$	$T_{max}$	S	r		
VTB135W3.00R04-06S05	●	6	-	13.5	3	2.65	S05	0.4	KEYV-T20	7
VTB135W4.00R04-06S05	●	6	-	13.5	4	2.65	S05	0.4	KEYV-T20	7
VTB160W2.00R04-06S06	●	6	-	16.0	2	2.90	S06	0.4	KEYV-T20	10
VTB160W3.00R04-06S06	●	6	-	16.0	3	2.90	S06	0.4	KEYV-T25	10
VTB160W4.00R04-06S06	●	6	-	16.0	4	2.90	S06	0.4	KEYV-T25	10
VTB165W2.00R04-06S06	●	6	-	16.5	2	3.15	S06	0.4	KEYV-T20	10
VTB165W3.00R04-06S06	●	6	-	16.5	3	3.15	S06	0.4	KEYV-T25	10
VTB165W4.00R04-06S06	●	6	-	16.5	4	3.15	S06	0.4	KEYV-T25	10
VTB195W4.00R04-06S08	●	6	-	19.5	4	3.45	S08	0.4	KEYV-T30L	15
VTB195W5.00R04-06S08	●	6	-	19.5	5	3.45	S08	0.4	KEYV-T30L	15
VTB195W6.00R04-06S08	●	6	-	19.5	6	3.45	S08	0.4	KEYV-T30L	15
VTB225W5.00R04-06S08	●	6	-	22.5	5	4.95	S08	0.4	KEYV-T40L	15
VTB225W6.00R04-06S08	●	6	-	22.5	6	4.95	S08	0.4	KEYV-T40L	15
VTB225W8.00R04-06S08	●	6	-	22.5	8	4.95	S08	0.4	KEYV-T40L	15
VTB250W6.00R04-06S08	●	6	-	25.0	6	5.90	S08	0.4	KEYV-T50L	15
VTB250W8.00R04-06S08	●	6	-	25.0	8	5.90	S08	0.4	KEYV-T50L	15
VTB250W5.00R04-06S10	●	6	-	25.0	5	4.30	S10	0.4	KEYV-T50L	28
VTB250W6.00R04-06S10	●	6	-	25.0	6	4.30	S10	0.4	KEYV-T50L	28
VTB250W8.00R04-06S10	●	6	-	25.0	8	4.30	S10	0.4	KEYV-T50L	28

### VTB-15 6 flutes, for chamfered slotting



S = Connection screw size

Cat. No.	GH130	No. of flutes	Helix angle	Dimensions (mm)					Wrench	Torque (N-m)
				$\phi Dc_{-0.05}$	$W_{\pm 0.05}$	$T_{max}$	S	C		
VTB135W2.00C15-06S05	●	6	-	13.5	2.0	2.65	S05	0.15	KEYV-T20	7

● : Stocked items  
Packing Quantity = 2 pcs.

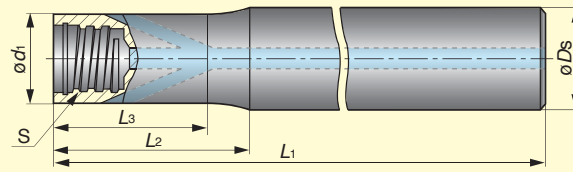


## Standard cutting conditions: Slotting (VST, VTB)

ISO	Workpiece materials	Hardness	VST type		VTB type	
			Cutting speed V <sub>c</sub> (m/min)	Feed per tooth f <sub>z</sub> (mm/t)	Cutting speed V <sub>c</sub> (m/min)	Feed per tooth f <sub>z</sub> (mm/t)
<b>P</b>	Low carbon steels S45C, S55C etc (C45, C55 etc)	- 300	80 - 180	0.05 - 0.15	80 - 180	0.08 - 0.18
	High carbon steels SCM440, SCr415 etc (42CrMo4, 15Cr3 etc)	- 300	60 - 120	0.04 - 0.12	60 - 120	0.05 - 0.15
<b>M</b>	Stainless steels SUS304, SUS316 etc (X5CrNi18-9, X5CrNiMo17-12-2 etc)	- 200	50 - 120	0.04 - 0.12	50 - 120	0.05 - 0.15
<b>K</b>	Grey cast irons FC250, FC300 etc (GG25, GG30 etc)	150 - 250	100 - 200	0.05 - 0.15	100 - 200	0.08 - 0.18
	Ductile cast irons FCD400 etc (GGG40 etc)	150 - 250	100 - 200	0.04 - 0.12	100 - 200	0.05 - 0.15
<b>N</b>	Aluminium alloys (Si < 13%)	-	200 - 600	0.05 - 0.15	200 - 600	0.08 - 0.18
	Aluminium alloys (Si ≥ 13%)	-	100 - 300	0.03 - 0.13	100 - 300	0.05 - 0.15
<b>S</b>	Titanium alloys Ti-6Al-4V etc	-	40 - 60	0.04 - 0.12	40 - 60	0.05 - 0.15
	Heat-resistant alloys Inconel 718 etc	-	15 - 35	0.02 - 0.10	15 - 35	0.02 - 0.10

## ● Shanks

### VSSD-W-A Straight shank and neck with coolant hole



S = Connection screw size

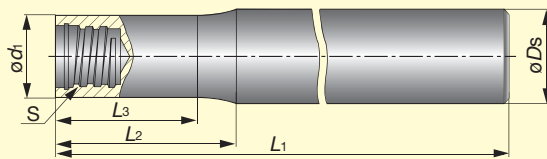
Cat. No.	Stock	Dimensions (mm)						Shank material
		$\varnothing D_s$	$\varnothing d_1$	$L_1$	$L_2$	$L_3$	S	
VSSD10L070S06-W-A	●	10	9.6	70	20	19	S06	Tungsten
VSSD10L090S06-W-A	●	10	9.6	90	40	39	S06	Tungsten
VSSD10L110S06-W-A	●	10	9.6	110	60	59	S06	Tungsten
VSSD12L070S08-W-A	●	12	11.5	70	20	19	S08	Tungsten
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

● : Stocked items

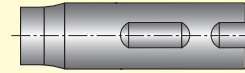
# VSSD

## Straight shank and neck

Cylindrical type



Weldon type



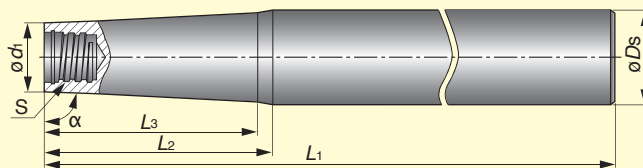
S = Connection screw size

Cat. No.	Stock	Dimensions (mm)						Shank style	Shank material
		$\varnothing D_s$	$\varnothing d_1$	$L_1$	$L_2$	$L_3$	S		
VSSD08L060S05-S	●	8	7.6	60	15	12.8	S05	cylindrical	Steel
VSSD08L070S05-C	●	8	7.6	70	20	19	S05	cylindrical	Carbide
VSSD08L090S05-C	●	8	7.6	90	40	39	S05	cylindrical	Carbide
VSSD08L110S05-C	●	8	7.6	110	60	59	S05	cylindrical	Carbide
VSSD10L070S06-C	●	10	9.6	70	20	18.5	S06	cylindrical	Carbide
VSSD10L075S06-S	●	10	9.6	75	20	17.7	S06	cylindrical	Steel
VSSD10L090S06-C	●	10	9.6	90	40	38.5	S06	cylindrical	Carbide
VSSD10L110S06-C	●	10	9.6	110	60	58.5	S06	cylindrical	Carbide
VSSD10L150S06-C	●	10	9.6	150	100	98.5	S06	cylindrical	Carbide
VSSD12L055W05-S	●	12	7.6	55	3.8	-	S05	weldon	Steel
VSSD12L070S08-C	●	12	11.5	70	20	17	S08	cylindrical	Carbide
VSSD12L090S08-C	●	12	11.5	90	40	37	S08	cylindrical	Carbide
VSSD12L090S08-S	●	12	11.5	90	16	13.6	S08	cylindrical	Steel
VSSD12L110S08-C	●	12	11.5	110	60	57	S08	cylindrical	Carbide
VSSD12L130S08-C	●	12	11.5	130	80	77	S08	cylindrical	Carbide
VSSD16L065W06-S	●	16	9.6	65	6	-	S06	weldon	Steel
VSSD16L065W08-S	●	16	11.5	65	4	-	S08	weldon	Steel
VSSD16L090S10-C	●	16	15.2	90	40	38	S10	cylindrical	Carbide
VSSD16L100S10-S	●	16	15.2	100	20	18	S10	cylindrical	Steel
VSSD16L110S10-C	●	16	15.2	110	60	58	S10	cylindrical	Carbide
VSSD16L130S10-C	●	16	15.2	130	80	78	S10	cylindrical	Carbide
VSSD16L150S10-C	●	16	15.2	150	100	98	S10	cylindrical	Carbide
VSSD20L070W10-S	●	20	15.2	70	4	-	S10	weldon	Steel
VSSD20L090S12-C	●	20	18.3	90	40	37	S12	cylindrical	Carbide
VSSD20L120S12-S	●	20	18.3	120	25	20.5	S12	cylindrical	Steel
VSSD20L130S12-C	●	20	18.3	130	80	77	S12	cylindrical	Carbide
VSSD20L200S12-C	●	20	18.3	200	120	117	S12	cylindrical	Carbide
VSSD25L075W12-S	●	25	18.3	75	6	-	S12	weldon	Steel
<b>New</b> VSSD25L120S15-C	●	25	23.9	120	60	58	S15	cylindrical	Carbide
<b>New</b> VSSD25L135S15-S	●	25	23.9	135	35	33	S15	cylindrical	Steel
<b>New</b> VSSD25L170S15-C	●	25	23.9	170	100	98	S15	cylindrical	Carbide
<b>New</b> VSSD25L250S15-C	●	25	23.9	250	150	148	S15	cylindrical	Carbide

● : Stocked items

## VTSD

### Straight shank and taper neck

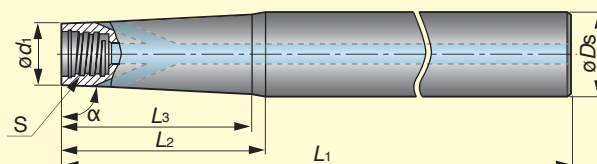


S = Connection screw size

Cat. No.	Stock	Dimensions (mm)							Shank material
		$\alpha$	$\varnothing D_s$	$\varnothing d_1$	$L_1$	$L_2$	$L_3$	S	
VTSD12L080S05-S	●	85	12	7.6	80	25	-	S05	Steel
VTSD12L100S05-S	●	89	12	7.6	100	35	31.0	S05	Steel
VTSD12L110S05-C	●	89	12	7.6	110	60	58.0	S05	Carbide
VTSD12L130S05-C	●	89	12	7.6	130	80	79.0	S05	Carbide
VTSD16L125S06-S	●	85	16	9.6	125	34	31.6	S06	Steel
VTSD16L130S08-C	●	89	16	11.5	130	80	78.8	S08	Carbide
VTSD16L140S08-S	●	85	16	11.5	140	22	19.3	S08	Steel
VTSD16L150S05-C	●	89	16	7.6	150	100	96.0	S05	Carbide
VTSD16L150S06-C	●	89	16	9.6	150	100	98.0	S06	Carbide
VTSD16L150S08-C	●	89	16	11.5	150	100	-	S08	Carbide
VTSD16L160S06-S	●	89	16	9.6	160	55	45.9	S06	Steel
VTSD16L170S06-C	●	89	16	9.6	170	120	119.0	S06	Carbide
VTSD20L140S10-S	●	85	20	15.2	140	27.5	-	S10	Steel
VTSD20L170S08-C	●	89	20	11.5	170	120	117.0	S08	Carbide
VTSD20L170S08-S	●	89	20	11.5	170	80	68.6	S08	Steel
VTSD20L170S10-C	●	89	20	15.2	170	120	-	S10	Carbide
VTSD20L190S10-C	●	89	20	15.2	190	140	-	S10	Carbide
VTSD20L190S10-S	●	89	20	15.2	190	80	73.0	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	-	S12	Carbide
VTSD25L210S12-S	●	89	25	18.3	210	100	91.0	S12	Steel
VTSD25L250S12-C	●	89	25	18.3	250	140	-	S12	Carbide
<b>New</b> VTSD32L155S15-S	●	85	32	23.9	155	45	40.0	S15	Steel
VTSD32L190S12-S	●	85	32	18.3	190	80	-	S12	Steel
<b>New</b> VTSD32L220S15-S	●	85	32	23.9	220	100	-	S15	Steel
<b>New</b> VTSD32L250S15-C	●	89	32	23.9	250	150	-	S15	Carbide
<b>New</b> VTSD32L300S15-C	●	89	32	23.9	300	200	-	S15	Carbide

## VTSD-W-A

### Straight shank and taper neck with coolant hole



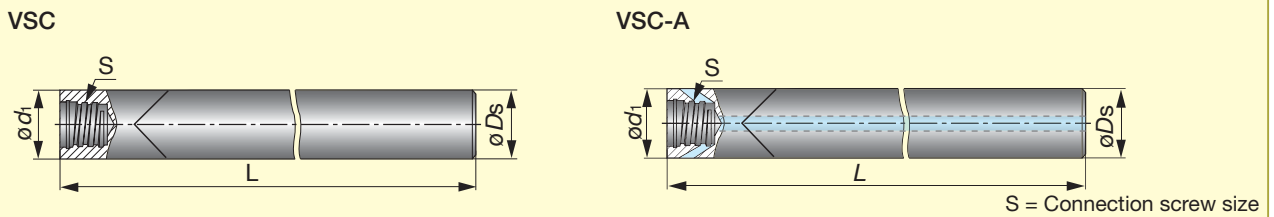
S = Connection screw size

Cat. No.	Stock	Dimensions (mm)							Shank material
		$\alpha$	$\varnothing D_s$	$\varnothing d_1$	$L_1$	$L_2$	$L_3$	S	
VTSD12L110S06-W-A	●	89°	12	9.6	110	60	59	S06	Tungsten
VTSD16L170S06-W-A	●	89°	16	9.6	170	120	116	S06	Tungsten

● : Stocked items

## VSC

### Straight shank for VST type slotting heads



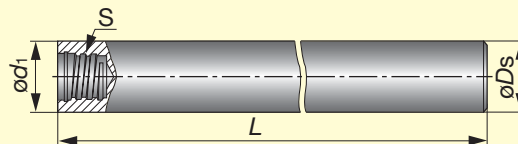
Cat. No.	Stock	Dimensions (mm)				Coolant hole	Shank material
		$\varnothing D_s$	$\varnothing d_1$	$L$	$S$		
VSC100L100S06-C	●	10	10	100	S06	Without	Carbide
VSC120L100S08-C-A	●	12	12	100	S08	With	Carbide

Note:

- 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 slotting heads



S = Connection screw size

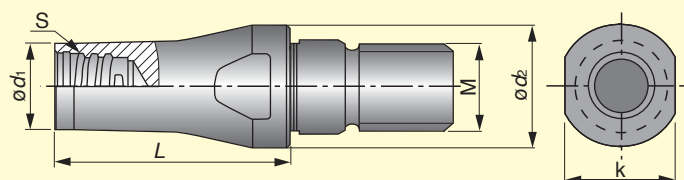
Cat. No.	Stock	Dimensions (mm)				Shank material
		$\varnothing D_s$	$\varnothing d_1$	$L$	$S$	
VSTD08L070S05-S	●	8	8	70	S05	Steel
VSTD10L080S06-S	●	10	10	80	S06	Steel
VSTD12L090S08-S	●	12	12	90	S08	Steel
VSTD16L100S10-S	●	16	16	100	S10	Steel

Note:

- For VSTD type shank, just VTB grooving 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

### Adapters of TungFlex



S = Connection screw size

Cat. No.	Stock	Dimensions (mm)						Shank material
		$\varnothing d_1$	$\varnothing d_2$	$L$	$S$	$M$	$k$	
VAD130L016S08-S-M8	●	11.7	13	16	S08	M8	11	Steel
VAD130L025S08-S-M8	●	11.7	13	25	S08	M8	11	Steel
VAD180L020S08-S-M10	●	11.7	18	20	S08	M10	13	Steel
VAD180L025S08-S-M10	●	11.7	18	25	S08	M10	11	Steel
VAD210L020S08-S-M12	●	11.7	21	20	S08	M12	12.75	Steel
VAD210L025S08-S-M12	●	11.7	21	25	S08	M12	12.75	Steel

● : Stocked items



## ● Designation system

### Shank

**V** **SS** **D10** **L070** **S** **06** - **W** - **A**

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 (mm)	
D08	ø8
D10	ø10
D12	ø12
D16	ø16
D20	ø20
D25	ø25
D32	ø32
VSC, VAD type	
100	ø10
120	ø12
130	ø13
180	ø18
210	ø21

4 Length (mm)	
L070	70

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 Shank material	
S	Steel
C	Carbide
W	Tungsten

8 Additional feature	
A	with coolant hole
M	Thread size (TungFlex adapters)

### Head

#### ● Square endmill

**V** **E** **E** **080** **L05.0** **R00** - **03** **S05**

1 2 3 4 5 6 7 8 9

#### ● Ball nose endmill

**V** **B** **D** **200** **L15.0** - **BG** - **04** **S12**

1 2 3 4 5 6 7 8 9

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

4 Diameter (mm)	
060	ø6
200	ø20

5 Cutting edge length (mm)	
Length	
L07.0	7
L15.0	15
Groove width	
W1.50	1.5
W1.57	1.57
W10.0	10




6 Corner shape / Angle	
Nose radius	
R00	Sharp edge
R005	R0.05
R01	R0.1
R05	R0.5
R10	R1.0
Chamfer type	
C15	0.15 x 45°
C30	0.3 x 45°
C60	0.6 x 45°
Chamfering head	
A30	30°
A60	60°
R chamfering head	
R10	R1.0
R16	R1.6
Ball nose	
SG	Sphere / high precision
BM	Ball / general purpose
BG	Ball / high precision

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

8 The number of flutes	
General	
02	2
06	6
Grooving head VST type	
3	3
4	4

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

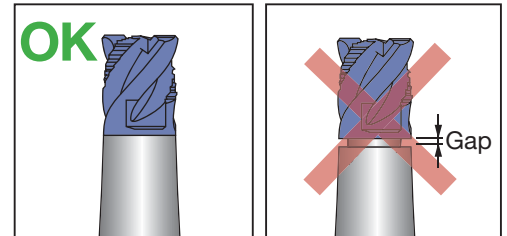
# Wrench

Appearance	Cat. No.	Stock	Connection screw size	Torque (N-m)	Applicable head
	KEYV-S05	●	S05	7	Square Ball Radius Drilling Chamfering Counter boring
	KEYV-S06	●	S06	10	
	KEYV-S08	●	S08	15	
	KEYV-S10	●	S10	28	
	KEYV-S12	●	S12	28	
	KEYV-W20	●	S15	40	
	KEYV-177	●	S06	10	Slotting VST type
	KEYV-217	●	S08	15	
	KEYV-T40L	●	S08 / S10	15	Slotting VST, VTB type
	KEYV-T20	●	S05	7	Slotting VTB type
			S06	10	
	KEYV-T25	●	S06	10	
	KEYV-T30L	●	S08	15	
	KEYV-T50L	●	S08	28	
S10					

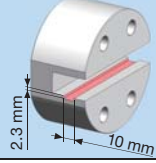
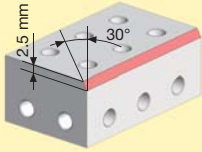
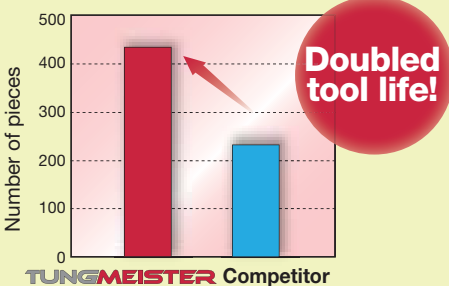
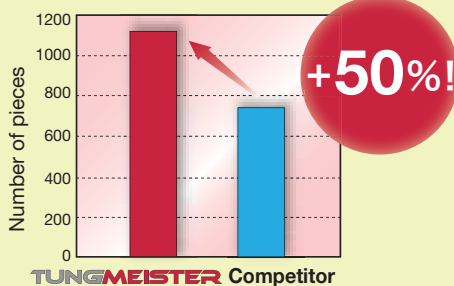
Note: Optional parts

## 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.) Re-tightening or over-tightening is not required. 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		Machine parts	Machine parts
Shank		VSTD10L080S06-S (Steel, ø10)	VSSD16L100S10-S (Steel, ø16)
Head		VTB160W4.00R04-06S06 GH130 (ø16)	VCP160L15.0A30-02S10 AH725 (ø16)
Workpiece material		Alloy steels SCM440 (42CrMo4)	Stainless steels SUS316 (X5CrNiMo17-12-2)
			
Cutting conditions	Cutting speed: $V_c$ (m/min)	110	160
	Feed per tooth: $f_z$ (mm/t)	0.07	0.1
	Depth of cut: $ap$ (mm)	2.3	2.5
	Width of cut: $ae$ (mm)	4 + 4 + 2	1.4
	Coolant	Dry	Dry
Results			
		TungMeister eliminates any need for regrinding.	TungMeister reduces changeover time to 1/10 compared to competitor's solid endmill.

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