

Opening the future of small diameter milling with ϕ 3 mm shank tools.

V Series ϕ 3 mm Shank End Mills

HMGCOAT 4 Flutes Short Shank
Long Neck Radius End Mills for Hard Materials

VHGLRS

NEW



Eco-friendly and significant cost savings on tools

Recommended for improved milling quality and cost reduction!

φ3 mm Shank V series

φ3 mm Shank (h4 tolerance)
× Overall length 38* mm

Fixed size of φ3 Shank x Overall Length 38 mm
 φ3 shank is used to save valuable carbide material.
 h4 tolerance is compatible for both shrink fit and
 collet holders. More series to follow in the future.
 (*The overall length of VCBN series is 35 mm.)

Cost effective

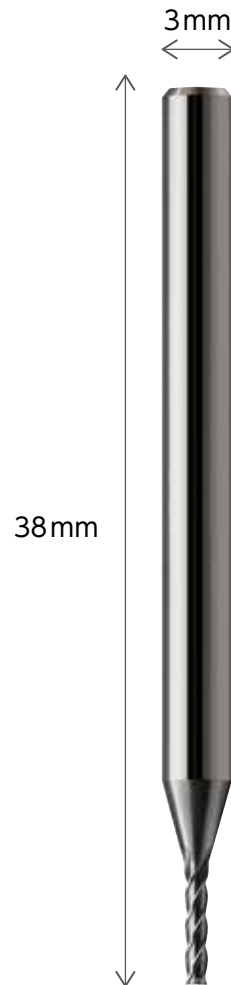
PCB drills mass production technology is applied to
 end mills

To attain affordable prices, we applied our existing
 and proven automatic mass production technology
 for blank rods, flute grinding, coating and inspection
 to these new end mills.

High quality

Small diameter V series are high-precision as a result
 of using the latest in-house technologies.

We developed new grinding machines specialized
 for small diameter end mills for high-precision milling
 that will innovate manufacturing technology for
 high-precision, high-efficiency milling.



Find the best coating for your material applications

	For Copper, Aluminum DLC	For Raw Materials ~ 55HRC UT COAT UTW COAT	For Hard Materials (40~65 HRC) HARD MAX HMW COAT	For Hard Materials (50~70 HRC) HMG COAT	For Hard Materials (50~70 HRC) CBN
Square		VCES2000 VCES4000			
Long Neck Square	VDLC-AZS VDLCLS		VHLS		
Long Neck Radius			VHLRS	VHGLRS	VCBN-LRF
Ball			VHWB	VHGB	
Long Neck Ball	VDLCLB	VCWLB VCSELB	VHSLB	VHGLB	VCBN-LBSF VCBN-LBF

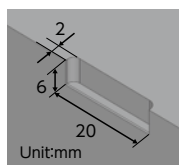
Comparison of VHGLRS ($\phi 3$ shank) and HGLRS ($\phi 6$ shank)

Half pocket shape Milling example

<Milling condition>

- Work material: HAP10 (63HRC)
- Tool used: 2pcs (1pc each for roughing and finishing)
- Tool size: $\phi 3 \times \text{CR0.1} \times \text{EL6}$

Milling shape image



Process	Coolant	n (min ⁻¹)	Vf (mm/min)	a _p (mm)	a _e (mm)	Allowance (mm)	Cycle time
Roughing	Air blow	8,400	1,080	0.02	0.2	0.01	36 min 13 sec
Finishing	Oil mist	8,400	1,080	0.02	0.01	0	13 min 13 sec

Tool condition after the roughing process

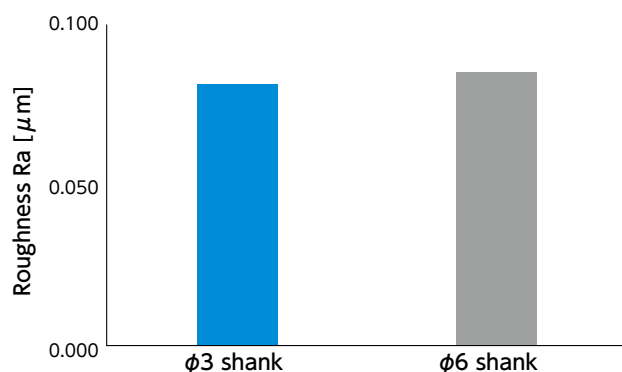
$\phi 3$ shank



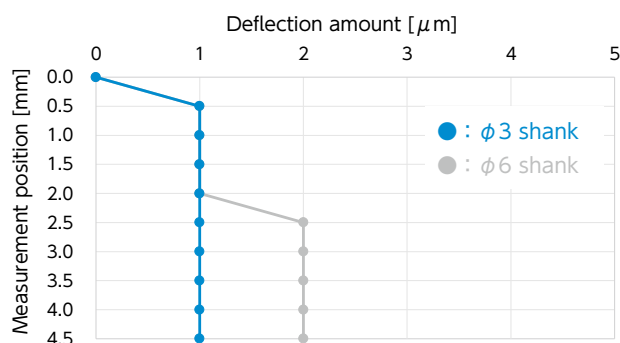
$\phi 6$ shank



Surface roughness (Ra)



Wall deflection after the finishing process

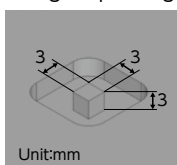


Residual island Milling example

<Milling condition>

- Work material: HAP10 (63HRC)
- Tool used: 2pcs (1pc each for roughing and finishing)
- Tool size: $\phi 3 \times \text{CR0.1} \times \text{EL6}$
- Milling place: Bottom and peripheral surface (roughing)
Residual island surface (finishing)

Milling shape image



Process	Coolant	n (min ⁻¹)	Vf (mm/min)	a _p (mm)	a _e (mm)	Allowance (mm)	Cycle time
Roughing	Air blow	8,400	1,080	0.02	0.2	0.2	43 min 54 sec
Finishing	Air blow	8,400	1,080	0.02	0.2	0	3 min 4 sec

Tool condition after the roughing process

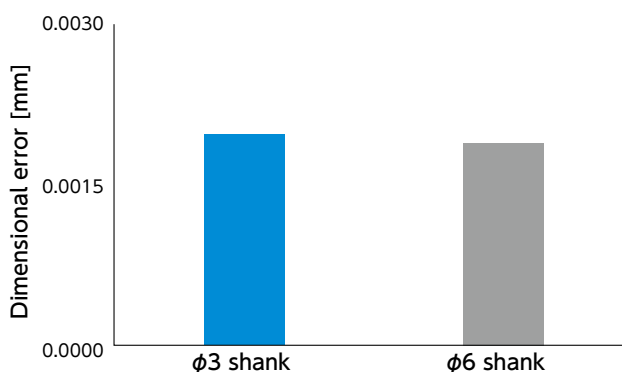
$\phi 3$ shank



$\phi 6$ shank



Dimensional accuracy



VHGLRS

HMGC OAT

4 Flutes Short Shank Long Neck Radius End Mills for Hard Materials

V Series HMGC OAT Long Neck Radius

NEW

Super
MG

HMG
COAT

30°

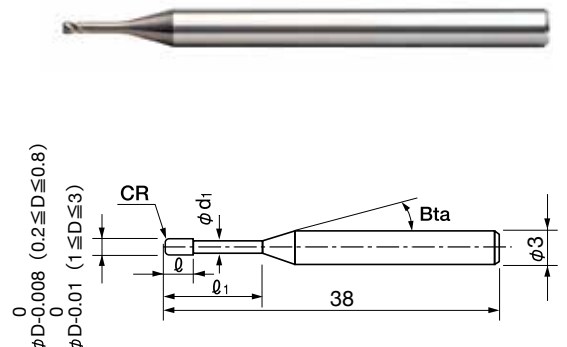
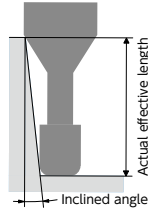
Shank Dia
0/-0.003

R

R
±0.003

Back Taper
Geometry

Variable
Pitch



The shank taper angle shown is not an exact value.

For hard materials (~70HRC)
Super negative tip design

Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

CARBON STEELS S45C S55C	ALLOY STEELS SK / SCM SUS	PREHARDENED STEELS NAK HPM	HARDENED STEELS					CAST IRON	ALUMINUM ALLOYS	GRAPHITE	COPPER	PLASTICS	GLASS FILLED PLASTICS	TITANIUM ALLOYS	HEAT RESISTANT ALLOYS	CEMENTED CARBIDE	HARD BRITTLE (NON-METALLIC) MATERIALS
			~50HRC	~55HRC	~60HRC	~65HRC	~70HRC										
		○	●	●	●	★	★										

Total 30 models

Unit (mm)

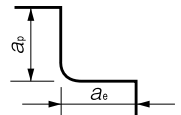
Model Number	Outside Diameter φD	Corner Radius CR	Effective Length ℓ ₁	Length of Cut ℓ	Neck Diameter φd ₁	Shank Taper Angle Bta	Effective Length by Inclined Angles				
							30°	1°	1° 30'	2°	3°
VHGLRS 4002-002-005	0.2	R0.02	0.5	0.12	0.19	16°	0.61	0.65	0.68	0.71	0.76
VHGLRS 4002-005-005	0.2	R0.05	0.5	0.12	0.19	16°	0.61	0.64	0.67	0.70	0.76
VHGLRS 4003-002-005	0.3	R0.02	0.5	0.18	0.28	16°	0.63	0.66	0.69	0.72	0.78
VHGLRS 4003-005-005	0.3	R0.05	0.5	0.18	0.28	16°	0.63	0.66	0.69	0.72	0.77
VHGLRS 4004-002-010	0.4	R0.02	1	0.24	0.38	16°	1.16	1.20	1.25	1.29	1.39
VHGLRS 4004-005-010	0.4	R0.05	1	0.24	0.38	16°	1.16	1.20	1.24	1.29	1.38
VHGLRS 4004-01-010	0.4	R0.1	1	0.24	0.38	16°	1.15	1.20	1.24	1.28	1.37
VHGLRS 4005-005-010	0.5	R0.05	1	0.3	0.48	16°	1.16	1.20	1.24	1.29	1.38
VHGLRS 4005-01-010	0.5	R0.1	1	0.3	0.48	16°	1.15	1.20	1.24	1.28	1.37
VHGLRS 4006-005-010	0.6	R0.05	1	0.36	0.58	16°	1.15	1.20	1.24	1.28	1.38
VHGLRS 4006-005-020	0.6	R0.05	2	0.36	0.58	16°	2.19	2.26	2.34	2.42	2.60
VHGLRS 4006-01-010	0.6	R0.1	1	0.36	0.58	16°	1.15	1.19	1.23	1.28	1.37
VHGLRS 4006-01-020	0.6	R0.1	2	0.36	0.58	16°	2.19	2.26	2.33	2.41	2.59
VHGLRS 4008-005-020	0.8	R0.05	2	0.48	0.77	16°	2.57	2.75	2.90	3.05	3.31
VHGLRS 4008-01-020	0.8	R0.1	2	0.48	0.77	16°	2.56	2.74	2.90	3.04	3.30
VHGLRS 4008-02-020	0.8	R0.2	2	0.48	0.77	16°	2.55	2.72	2.88	3.02	3.28
VHGLRS 4010-005-020	1	R0.05	2	0.8	0.96	16°	2.63	2.80	2.95	3.09	3.34
VHGLRS 4010-005-040	1	R0.05	4	0.8	0.96	16°	4.75	4.99	5.20	5.39	5.79
VHGLRS 4010-01-020	1	R0.1	2	0.8	0.96	16°	2.63	2.79	2.94	3.08	3.33
VHGLRS 4010-01-040	1	R0.1	4	0.8	0.96	16°	4.75	4.99	5.20	5.38	5.78
VHGLRS 4010-02-020	1	R0.2	2	0.8	0.96	16°	2.62	2.78	2.92	3.06	3.31
VHGLRS 4010-02-040	1	R0.2	4	0.8	0.96	16°	4.74	4.98	5.18	5.37	5.76
VHGLRS 4015-01-040	1.5	R0.1	4	1.2	1.46	16°	4.16	4.30	4.44	4.59	4.93
VHGLRS 4015-02-040	1.5	R0.2	4	1.2	1.46	16°	4.16	4.29	4.43	4.58	4.91
VHGLRS 4015-05-040	1.5	R0.5	4	1.2	1.46	16°	4.15	4.27	4.40	4.54	4.84
VHGLRS 4020-01-040	2	R0.1	4	1.6	1.93	16°	4.22	4.35	4.50	4.65	4.99
VHGLRS 4020-02-040	2	R0.2	4	1.6	1.93	16°	4.21	4.35	4.49	4.64	4.97
VHGLRS 4030-01-060	3	R0.1	6	2.4	2.83	-	No Interference	No Interference	No Interference	No Interference	No Interference
VHGLRS 4030-02-060	3	R0.2	6	2.4	2.83	-	No Interference	No Interference	No Interference	No Interference	No Interference
VHGLRS 4030-05-060	3	R0.5	6	2.4	2.83	-	No Interference	No Interference	No Interference	No Interference	No Interference

VHGLRS Milling Conditions

WORK MATERIAL				PREHARDENED STEELS / HARDENED STEELS NAK / STAVAX (~55HRC)				HARDENED STEELS SKD11 (55~62HRC)				HARDENED STEELS HAP10 (62~66HRC)				HARDENED STEELS HAP72 (66~70HRC)			
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Effective Length (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a _p Axial Depth (mm)	a _e Radial Depth (mm)
4002-002-005	0.2	R0.02	0.5	27,000	500	0.004	0.05	27,000	260	0.003	0.02	27,000	280	0.003	0.01	27,000	250	0.003	0.01
4002-005-005	0.2	R0.05	0.5	27,000	590	0.004	0.05	27,000	260	0.003	0.02	27,000	280	0.003	0.01	27,000	250	0.003	0.01
4003-002-005	0.3	R0.02	0.5	25,500	600	0.008	0.09	25,500	460	0.003	0.04	25,500	480	0.003	0.03	25,000	440	0.003	0.03
4003-005-005	0.3	R0.05	0.5	25,500	700	0.008	0.09	25,500	460	0.003	0.04	25,500	480	0.004	0.03	25,000	440	0.004	0.03
4004-002-010	0.4	R0.02	1	23,000	720	0.01	0.13	18,300	700	0.004	0.07	20,500	720	0.003	0.05	20,000	650	0.003	0.05
4004-005-010	0.4	R0.05	1	23,000	840	0.015	0.13	18,300	700	0.004	0.07	20,500	720	0.004	0.05	20,000	650	0.004	0.05
4004-01-010	0.4	R0.1	1	23,000	840	0.015	0.13	18,300	700	0.006	0.07	20,500	720	0.007	0.05	20,000	650	0.007	0.05
4005-005-010	0.5	R0.05	1	22,500	1,080	0.017	0.17	17,900	880	0.009	0.09	20,000	900	0.007	0.07	19,500	820	0.007	0.07
4005-01-010	0.5	R0.1	1	22,500	1,080	0.017	0.17	17,900	880	0.009	0.09	20,000	900	0.007	0.07	19,500	820	0.007	0.07
4006-005-010	0.6	R0.05	1	22,000	1,070	0.021	0.2	17,450	720	0.015	0.12	19,500	740	0.007	0.1	19,000	670	0.007	0.1
4006-005-020	0.6	R0.05	2	21,500	1,050	0.021	0.2	17,000	710	0.015	0.12	19,000	730	0.007	0.1	18,500	660	0.007	0.1
4006-01-010	0.6	R0.1	1	22,000	1,070	0.021	0.2	17,450	720	0.015	0.12	19,500	740	0.007	0.1	19,000	670	0.007	0.1
4006-01-020	0.6	R0.1	2	21,500	1,050	0.021	0.2	17,000	710	0.015	0.12	19,000	730	0.007	0.1	18,500	660	0.007	0.1
4008-005-020	0.8	R0.05	2	20,500	1,330	0.028	0.26	15,700	830	0.02	0.16	17,500	850	0.01	0.15	15,500	770	0.01	0.15
4008-01-020	0.8	R0.1	2	20,500	1,330	0.028	0.26	15,700	830	0.02	0.16	17,500	850	0.01	0.15	15,500	770	0.01	0.15
4008-02-020	0.8	R0.2	2	20,500	1,330	0.028	0.26	15,700	830	0.02	0.16	17,500	850	0.015	0.15	15,500	770	0.015	0.15
4010-005-020	1	R0.05	2	15,300	1,200	0.01	0.068	10,300	710	0.005	0.006	8,900	800	0.004	0.004	8,600	780	0.004	0.004
4010-005-040	1	R0.05	4	12,000	1,070	0.008	0.061	8,500	640	0.004	0.005	8,100	730	0.004	0.003	7,900	710	0.004	0.003
4010-01-020	1	R0.1	2	15,300	1,200	0.04	0.27	10,300	710	0.03	0.27	8,900	800	0.02	0.27	8,600	780	0.02	0.26
4010-01-040	1	R0.1	4	12,000	1,070	0.03	0.24	8,500	640	0.02	0.24	8,100	730	0.01	0.23	7,900	710	0.01	0.22
4010-02-020	1	R0.2	2	15,300	1,200	0.04	0.27	10,300	710	0.03	0.27	8,900	800	0.02	0.27	8,600	780	0.02	0.26
4010-02-040	1	R0.2	4	12,000	1,070	0.03	0.24	8,500	640	0.02	0.24	8,100	730	0.01	0.23	7,900	710	0.01	0.22
4015-01-040	1.5	R0.1	4	13,200	1,280	0.04	0.5	8,600	740	0.02	0.62	8,500	840	0.02	0.39	8,300	820	0.02	0.38
4015-02-040	1.5	R0.2	4	13,200	1,280	0.04	0.5	8,600	740	0.02	0.62	8,500	840	0.02	0.39	8,300	820	0.02	0.38
4015-05-040	1.5	R0.5	4	13,200	1,280	0.04	0.5	8,600	740	0.02	0.62	8,500	840	0.02	0.39	8,300	820	0.02	0.38
4020-01-040	2	R0.1	4	14,300	1,460	0.033	0.405	8,600	860	0.013	0.18	8,500	930	0.013	0.134	8,300	900	0.013	0.13
4020-02-040	2	R0.2	4	14,300	1,460	0.07	0.81	8,600	860	0.03	0.9	8,500	930	0.03	0.54	8,300	900	0.03	0.52
4030-01-060	3	R0.1	6	13,300	2,500	0.038	0.36	8,600	1,110	0.02	0.277	8,400	1,080	0.021	0.206	8,200	1,050	0.02	0.2
4030-02-060	3	R0.2	6	13,300	2,500	0.08	0.72	8,600	1,110	0.04	1.38	8,400	1,080	0.04	0.82	8,200	1,050	0.04	0.8
4030-05-060	3	R0.5	6	13,300	2,500	0.08	0.72	8,600	1,110	0.04	1.38	8,400	1,080	0.04	0.82	8,200	1,050	0.04	0.8

Note:

- Decrease the feed rate more than 50% from the milling parameters when slot milling.
- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed, or when chattering and red-hot occur.
- Every coolant offers stable milling.





Advisory for Safe Use of End Mills

Correct application and operation is strongly advised to avoid clogging, abrasion, etc, that could cause serious accidents or injuries. Ignition or sparks generated during milling could lead to fire or extreme damage to the work piece. End Mills are made with very sharp cutting edges and must be handled with extra care.

- Never touch the cutting edge with your bare hands, as this could cause serious injury. Special caution is required when opening the package.
- Dropping the tool could cause breakage or flying debris, leading to serious injury.
- During milling, unexpected impact or shock on the tool could cause breakage or flying debris. Ensure to use protective items such as safety glasses and a face guard.
- For best results, fine parameter adjustment may be required, depending on the materials; milling shape and strategy; machine rigidity and spindle capability.
- Use a machine that has high rigidity and generates a low level of vibration. Recommend setting the runout control value at $5\mu\text{m}$ or below for the small diameter tools $\phi 1$ or below.
- Do not use flammable cutting oils.

Advisory for regrinding UNIMAX Tungsten Carbide End Mills

- Never regrind the tool without wearing safety glasses and a face guard.



HEADQUARTERS

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Fax: 86-769-8884-8296

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140 Paya Lebar Road #08-17, AZ @ Paya Lebar,
SINGAPORE 409015
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<https://www.uniontool.co.jp/en/>

Price & Specifications are subject to change without notice.