MITSUBISHI
MITSUBISHI MATERIALS

TOOLS NEWS 2007.10 Update B075G

İMPACT MIRACLE
End Mill Series

Newly developed "Impact Miracle Coating".

Single phase nano crystal coating technology for higher film hardness and heat resistance.

İMPACT

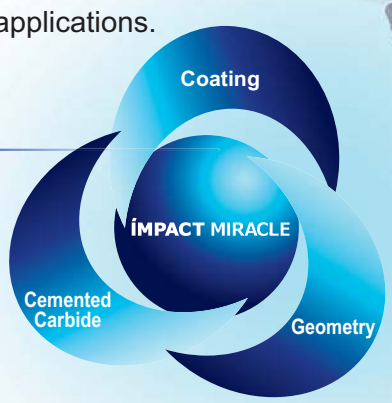
İMPACT MIRACLE

Miracle end mills for increased cutting speeds, efficiency and tool life when milling high hardness materials.

Solid carbide end mills using a combination of Impact Miracle coating, new micro-grain cemented carbide and optimized geometry.

- For hardened steels over 60HRC, pre-hardened steels through to general steels.
- For high-speed & high efficiency machining.
- For unstable applications with long overhang machining through to precision machining.

New end mill series covering a wide range of machining applications.



New coating, cemented carbide and geometry.
New generation of IMPACT MIRACLE end mills !

Features

All Impact Miracle end mills are coated using the latest Single phase nano crystal coating technology for higher film hardness and heat resistance.

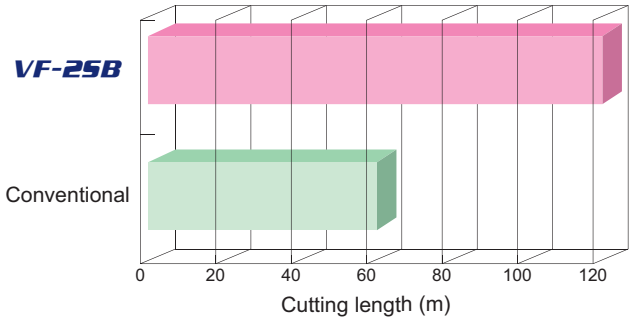
Characteristics of Impact Miracle coating

	İMPACT MIRACLE	(Al,Ti,Si)N	(Al,Ti)N
Hardness	**3700HV**	3200HV	2800HV
Adhesion	**100N**	80N	80N
Oxidation temperature	**1300°C**	1100°C	840°C
Friction coefficient	**0.48**	0.53	0.58

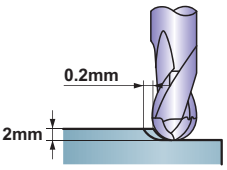
Improved cutting edge geometry.
The superior chipping resistance allows higher speeds for reliable milling of high hardness materials.

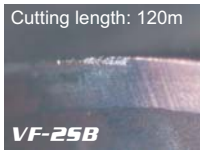
For reduced friction resistance and high quality surface finishes!

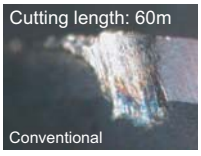
When machining die casting mould steel tool life was doubled when compared to the conventional product.



End mill	VF-2SB R3
Workpiece	DH31S (52HRC)
Revolution	16,000min^{-1} (284m/min)
Feed rate	1,600mm/min (0.05mm/t)
Machining method	Climb cut, Air blow

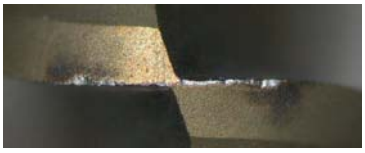




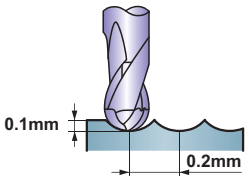


Excellent cutting performance even when machining pre-hardened steels !

Cutting length: 1200m



End mill	VF-2XLB R1.5x8
Workpiece	NAK80 (43HRC)
Revolution	20,000min^{-1} (68m/min)
Feed rate	2,000mm/min (0.05mm/t)
Machining method	Water soluble coolant



IMPACT MIRACLE END MILL

VF-2SSB
Ball nose, Short cut length, 2 flute,
For hardened materials

R0.5-R6mm
12 different sizes available.

VF-2SB
Ball nose, Short cut length, 2 flute,
For hardened materials

R0.1-R10mm
36 different sizes available.

VF-2XLB
Ball nose, Long cut length, 2 flute,
For hardened materials

R0.1-R3mm
198 different sizes available.

VF-2SDB
Ball nose, Short cut length,
2 flute, Strong geometry type

R0.5-R10mm
14 different sizes available.

VF-2SDBL
Ball nose, Short cut length, 2 flute,
Strong geometry type, Long shank

R0.5-R10mm
11 different sizes available.

VF-3XB
Ball nose, 3 flute, Taper neck,
For hardened materials

R0.4-R2.5mm
89 different sizes available.

VF-SD
End mill, Short cut length,
4/6 flute, For hardened materials

ø1-ø12mm
12 different sizes available.

VF-MD
End mill, Medium cut length,
4/6 flute, For hardened materials

ø1-ø25mm
18 different sizes available.

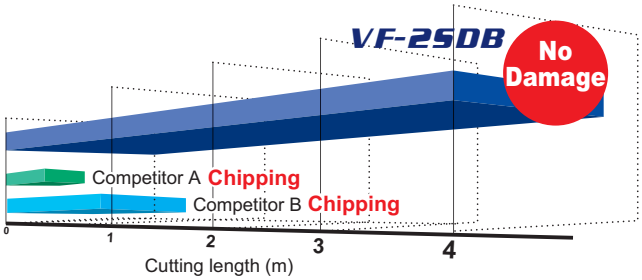
VF-SDRB
Corner radius, Short cut length,
6 flute, For hardened materials

ø3-ø12mm
13 different sizes available.

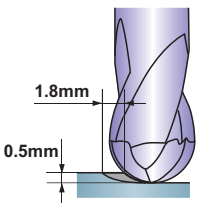
VF-MDRB
Corner Radius, Medium cut length,
6 flute, For hardened materials

ø3-ø20mm
21 different sizes available.

Higher feed rates and 4 times longer tool life compared to competitor end mills !



End mill	VF-2SDB R3
Workpiece	SKD61(52HRC)
Revolution	16,000min^{-1}
Feed rate	9,600mm/min (0.3mm/t)
Machining method	Air blow



Overhang
21mm

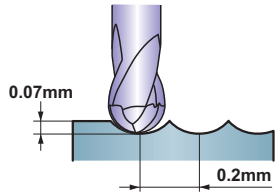
Powder high speed steel machining

Tool life doubled compared to competitors end mills when machining hardened steels over 65 HRC.

<Geometry>

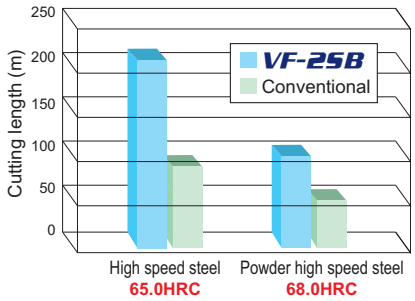
VF-2SB

<Depth of cut>



End mill	VF-2SB R1
Workpiece	Powder high speed steel
Revolution	8,000min^{-1} (18m/min)
Feed rate	1,260mm/min (0.08mm/t)
Machining method	Climb cut, Air blow

<Result>



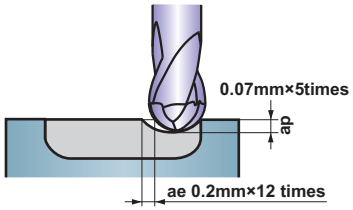
High speed steel machining

Triple tool life compared to competitors end mills when pocket machining hardened steels !

<Geometry>

VF-2SB

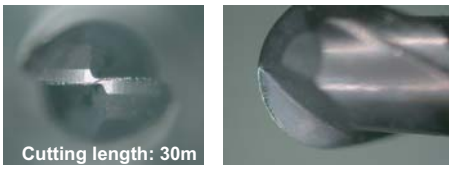
<Depth of cut>



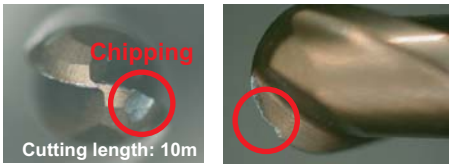
End mill	VF-2SB R1
Workpiece	SKH51 (65HRC)
Revolution	20,000min^{-1} (126m/min)
Feed rate	6,000mm/min (0.15mm/t)
Machining method	Up and down cut milling, Air blow

<Result>

VF-2SB



Competitor



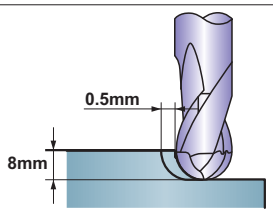
Machining of hardened steels

Triple tool life compared to competitors end mills when machining at large depths of cut.

<Geometry>

VF-2SB

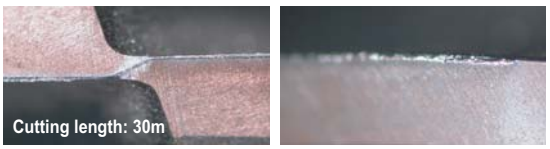
<Depth of cut>



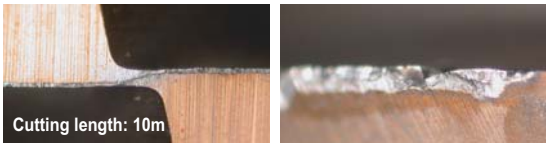
End mill	VF-2SB R10
Workpiece	SKD11 (60HRC)
Revolution	1,200min^{-1} (74m/min)
Feed rate	240mm/min (0.1mm/t)
Machining method	Climb cut, Air blow

<Result>

VF-2SB



Competitor



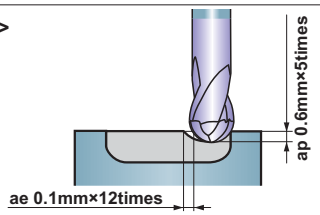
High load machining of pre-hardened steels

Excellent chipping resistance compared to competitors end mills !

<Geometry>

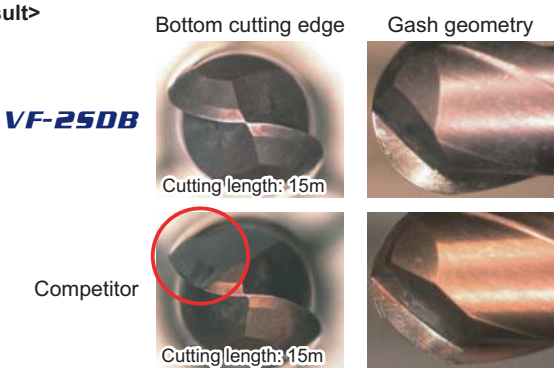
VF-2SDB

<Depth of cut>



End mill	VF-2SDB R3
Workpiece	SKD61 (52HRC)
Revolution	12,000min^{-1} (226m/min)
Feed rate	4,500mm/min (0.18mm/t)
Machining method	Air blow

<Result>



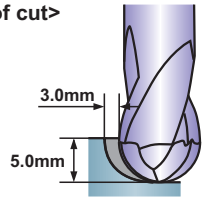
Deep and high feed machining comparison

Excellent fracture resistance even with long overhang (7D) and large depths of cut !

<Geometry>

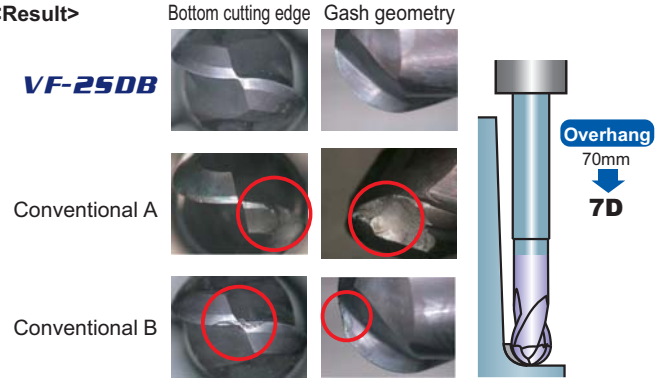
VF-2SDB

<Depth of cut>



End mill	VF-2SDB R5
Workpiece	SKD61(52HRC)
Revolution	6,000min^{-1} (188m/min)
Feed rate	500mm/min (0.04mm/t)
Machining method	Air blow

<Result>



Pre-hardened steel machining

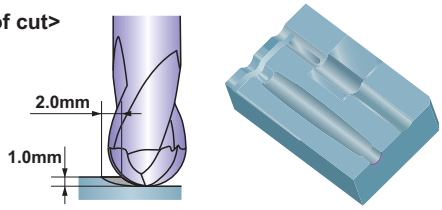
Roughing on mould

1) No chipping after the 2 hour's machining.
2) Minimum tool wear, further machining possible.

<Geometry>

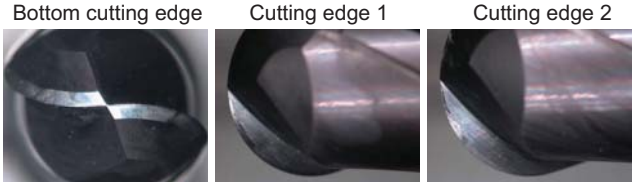
VF-2SDB

<Depth of cut>



End mill	VF-2SDB R5
Workpiece	PX5 (40HRC)
Revolution	5,000min^{-1} (157m/min)
Feed rate	2,000mm/min (0.2mm/t)
Machining method	Non water soluble coolant

<Result>



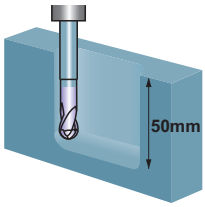
Alloy tool steel for hot moulding

Roughing on mould
1) No chipping at long overhang machining (5D).
2) Conventional end mill had chipping.

<Geometry>

VF-2SDB

<Depth of cut>



Overhang
50mm
5D

End mill	VF-2SDB R5
Workpiece	SKD61 (52HRC)
Revolution	8,000min^{-1} (251m/min)
Feed rate	4,800mm/min (0.3mm/t)
Machining method	Climb cut, Air blow

<Result>

VF-2SDB | Conventional

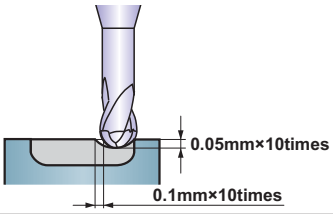
Pocket machining of hardened steels

Longer tool life without chipping compared to competitors end mills !

<Geometry>

VF-2XLB

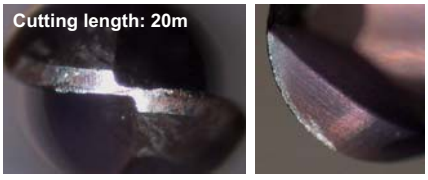
<Depth of cut>



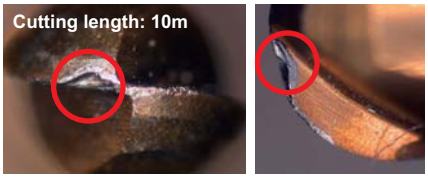
End mill	VF-2XLB R1x20
Workpiece	SKD11 (60HRC)
Revolution	10,000min^{-1} (63m/min)
Feed rate	1,000mm/min (0.05mm/t)
Machining method	Up and down cut milling, Air blow

<Result>

VF-2XLB
2×component



Competitor
1×component



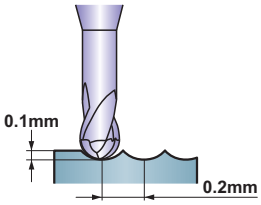
Pre-hardened steel machining

Long tool life compared to competitors end mills when pocket machining hardened steels !

<Geometry>

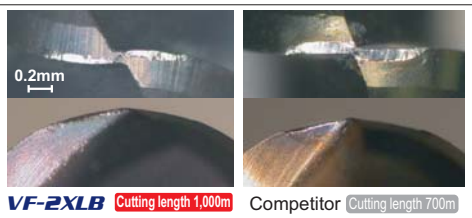
VF-2XLB

<Depth of cut>

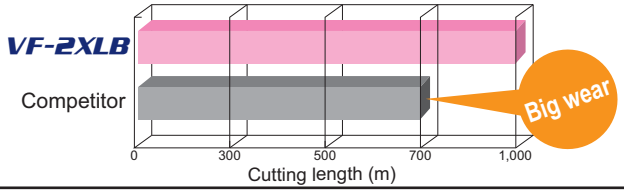


End mill	VF-2XLB R1.5x8
Workpiece	STAVAX (52HRC)
Revolution	20,000min^{-1} (68m/min)
Feed rate	4,000mm/min (0.1mm/t)
Machining method	Climb cut, Water soluble coolant

<Result>



VF-2XLB Cutting length 1,000m | Competitor Cutting length 700m



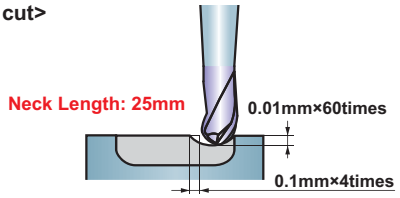
Hardened steel machining

Comparison with conventional 2 flute end mill, VF-3XB shows high fracture resistance.

<Geometry>

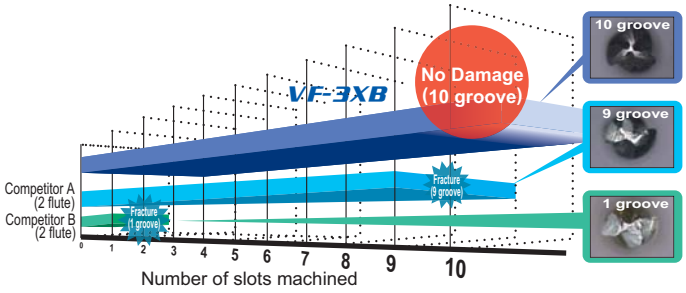
VF-3XB

<Depth of cut>



End mill	VF-3XB R0.5 x 1.5° x 25
Workpiece	SKD61 (52HRC)
Revolution	13,000min^{-1} (40.8m/min)
Feed rate	1,500mm/min (0.038mm/t)
Machining method	Air blow

<Result>



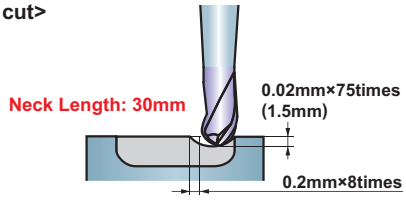
Hardened steel machining

Feed rate increased by 60%.

<Geometry>

VF-3XB

<Depth of cut>

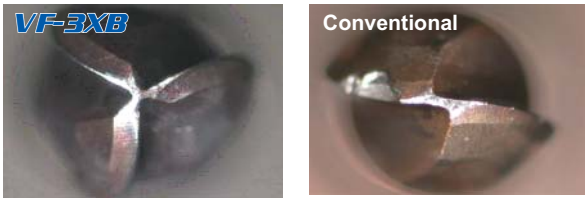


End mill	VF-3XB R1 x 0.9° x 30
Workpiece	SKD61 (52HRC)
Revolution	16,000min^{-1} (100m/min)
Feed rate	2,600mm/min (0.054mm/t)
Machining method	Coolant mist

<Result>

Previous feed rate: 1600mm/min

VF-3XB: 2,600mm/min



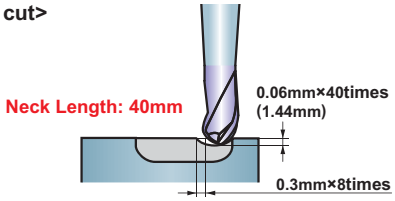
Hardened steel machining

Feed rate increased by 50%.

<Geometry>

VF-3XB

<Depth of cut>

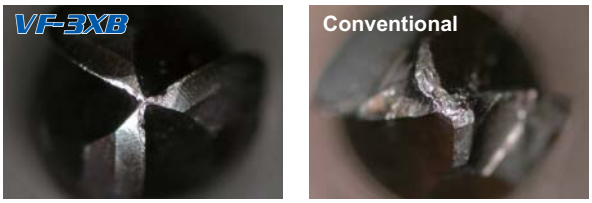


End mill	VF-3XB 1.5R x 0.9° x 40
Workpiece	SKD61(52HRC)
Revolution	14,000min^{-1} (131m/min)
Feed rate	3,400mm/min (0.08mm/t)
Machining method	Coolant mist

<Result>

Previous feed rate: 2500mm/min

VF-3XB: 3,400mm/min



STAVAX (Copy turning)

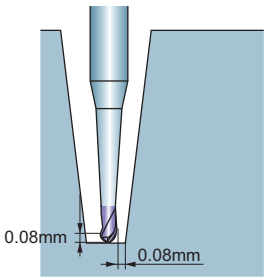
1) 30% increase in efficiency!
2) Surface finish improved and longer tool life.

<Geometry>

VF-3XB

<Depth of cut>

Machining the bottom of the slot.



<Result>

End mill	VF-3XB R1 x 1.5° x 25
Workpiece	STAVAX (40HRC)
Revolution	12,000min^{-1} (75m/min)
Feed rate	850mm/min (0.024mm/t)
Machining method	Climb cut, Non water soluble coolant

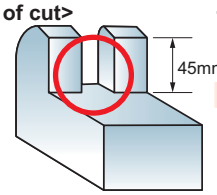
SKD61 (Rib processing)

Conventional end mill: damage at the cutting edge
VF3XB : damage was reduced

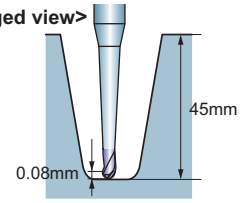
<Geometry>

VF-3XB

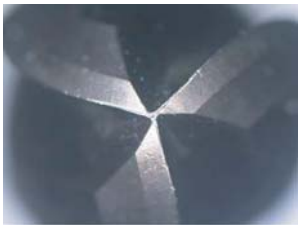
<Depth of cut>



<Enlarged view>



<Result>



End mill	VF-3XB R2 x 0.9° x 40
Workpiece	SKD61 (45HRC)
Revolution	10,000min^{-1} (MAX 125m/min)
Feed rate	Roughing: 2,000mm/min (0.067mm/t), Finshing: 720mm/min (0.024mm/t)
Machining method	Water soluble coolant

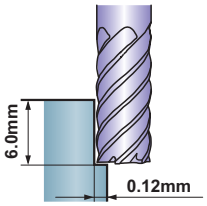
Side machining of hardened mould steels

Excellent wear resistance without fracturing at the end cutting edge !

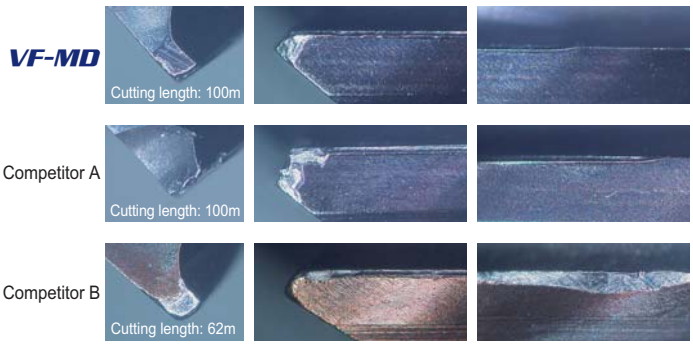
<Geometry>

VF-MD

<Depth of cut>



<Result>



End mill	VF-MD ø6
Workpiece	SKD11 (60HRC)
Revolution	8,000min^{-1} (151m/min)
Feed rate	2,160mm/min (0.045mm/t)
Machining method	Climb cut, Air blow

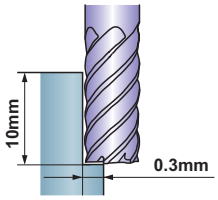
Machining of hardened mould steels

VF-MD : Stable cutting conditions and superior surface finish.
Competitor: Not suitable for finishing due to excessive waviness of the machined surface. Chips were burnt.

<Geometry>

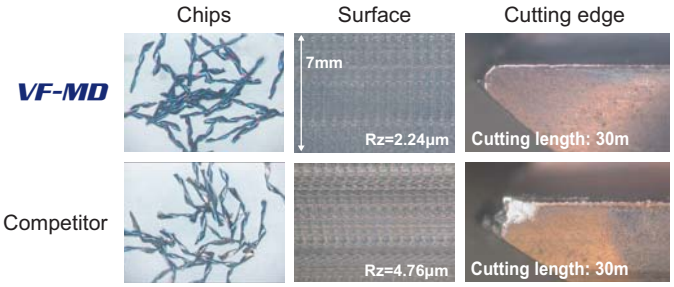
VF-MD

<Depth of cut>



End mill	VF-MD ø10
Workpiece	SKD11 (60HRC)
Revolution	4,800min^{-1} (151m/min)
Feed rate	2,900mm/min (0.1mm/t)
Machining method	Climb cut, Air blow

<Result>



Rz=Maximum height of roughness

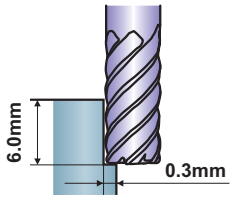
Side machining of hardened mould steels

Excellent fracture and wear resistance.

<Geometry>

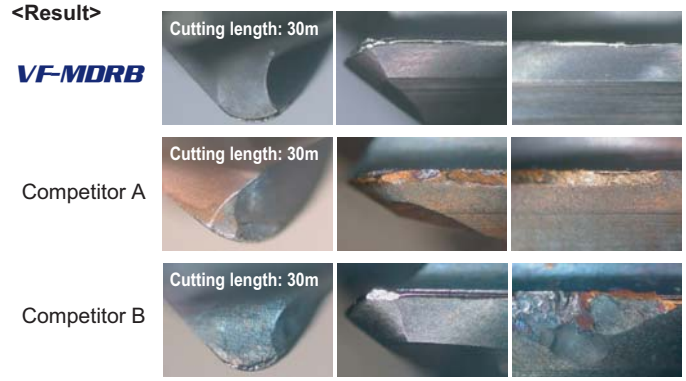
VF-MDRB

<Depth of cut>



End mill	VF-MDRB ø6xR0.5
Workpiece	SKD11 (60HRC)
Revolution	8,000min^{-1} (151m/min)
Feed rate	2,400mm/min (0.05mm/t)
Machining method	Climb cut, Air blow

<Result>



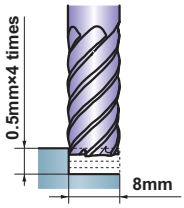
End face machining of hardened mould steels

Stable machining with minimum tool wear and no corner breakage.

<Geometry>

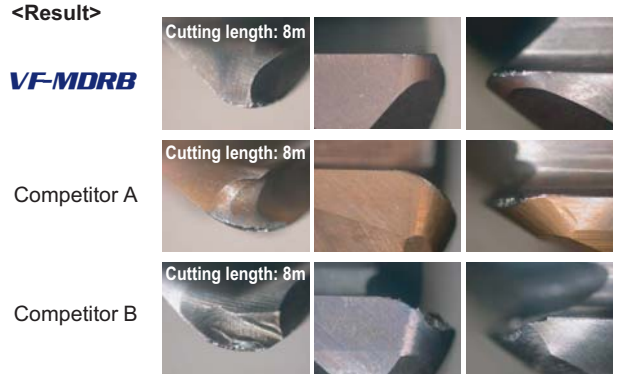
VF-MDRB

<Depth of cut>



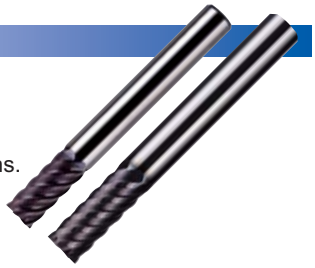
End mill	VF-MDRB ø10xR1
Workpiece	SKD11(60HRC)
Revolution	1,600min^{-1} (50m/min)
Feed rate	480mm/min (0.05mm/t)
Machining method	Climb cut, Air blow

<Result>



From rough milling to finishing ! IMPACT MIRACLE end mill series for a wide range of workpiece materials !

Square Series



VF-SD
VF-MD

- Short and medium cutting lengths.
- 30 sizes available.
- Chip-resistant cutting edge and flute geometry.

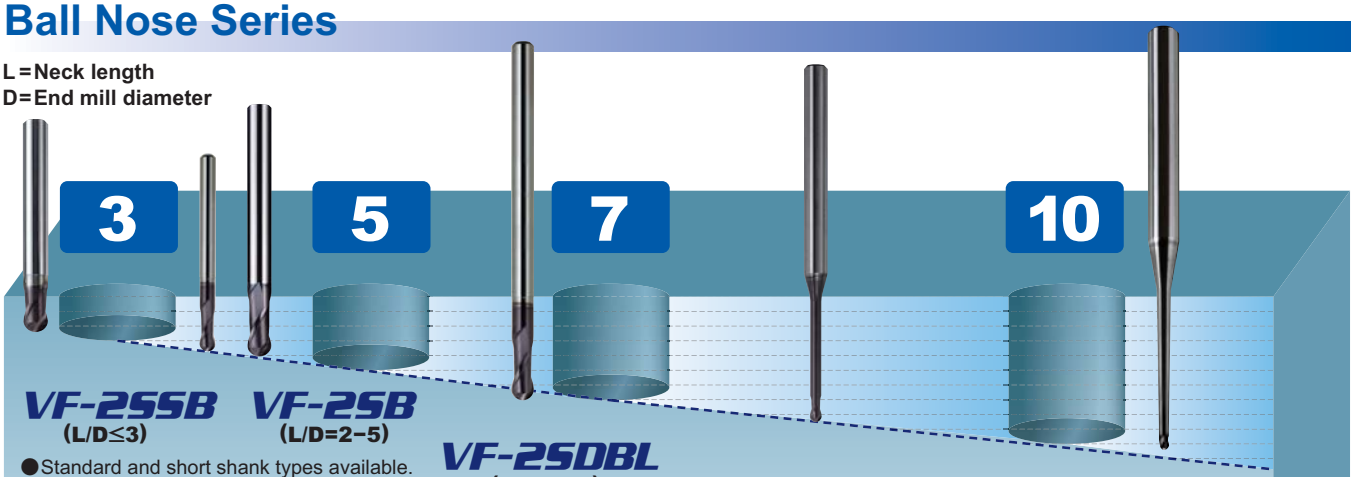
Corner Radius Series

VF-SDRB
VF-MDRB

- Short and medium cutting lengths.
- 34 sizes available.
- Corner radius type for high efficiency machining.

Ball Nose Series

L=Neck length
D=End mill diameter



VF-2SSB
(L/D≤3)

VF-2SB
(L/D=2-5)

- Standard and short shank types available.
- Short shank type is suitable for shrink fit chucks.
- 48 sizes available for standard and short shank types.

VF-2SDBL
(L/D=2-7)

- VF-2SDB with long shank.

VF-2XLB
(L/D=3-10)

- Long neck type suitable for deep slotting.
- 198 sizes available.

VF-2SDB
(L/D=2-5)

- Improved chipping resistance.
- Excellent fracture resistance even with long overhang, high feeds and large depths of cut.
- High efficiency roughing and semi-roughing.

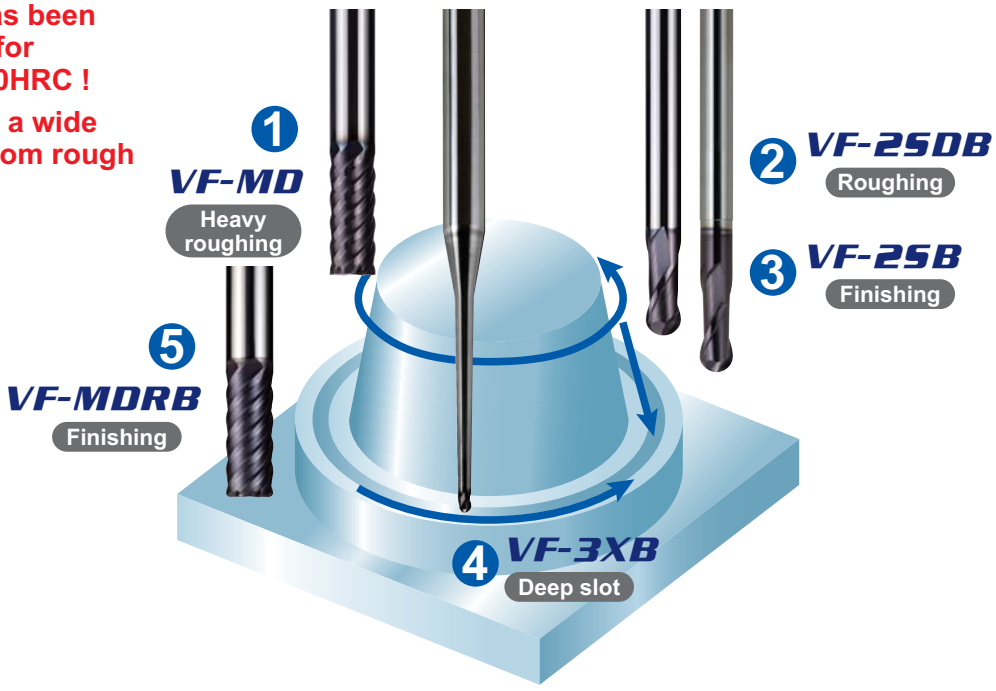
VF-3XB
(L/D≥8)

- Taper neck type for stable deep slotting.
- Suitable for machining for depths over 2D.
- 89 different sizes covering R0.4-R2.5.

IMPACT MIRACLE Tooling Example

Workpiece: SKD61(HRC52) 80x80x70

- **Machining efficiency has been greatly improved even for hardened steels over 50HRC !**
- **Wide selection to cover a wide range of applications from rough to finish milling !**

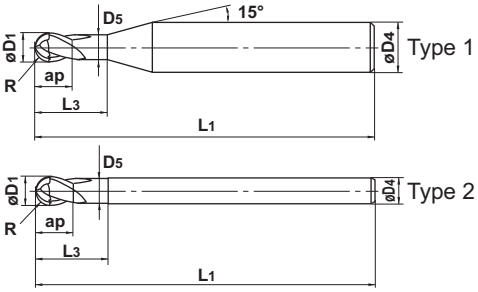


VF-2SSB

Ball nose, Short cut length, 2 flute, For hardened materials

±0.005

0 — -0.01



● Suitable for shrink fit chucks.

Unit : mm

Order Number	Radius of Ball Nose R	Dia. D1	Length of Cut ap	Neck Length L3	Neck Dia D5	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
VF2SSBR0050S04	0.5	1	1	2	0.94	40	4	2	●	1
R0050	0.5	1	1	2	0.94	40	6	2	●	1
R0075S04	0.75	1.5	1.5	3	1.44	40	4	2	●	1
R0075	0.75	1.5	1.5	3	1.44	40	6	2	●	1
R0100	1	2	2	4	1.9	45	6	2	●	1
R0150	1.5	3	3	6	2.9	45	6	2	●	1
R0200	2	4	4	8	3.9	45	6	2	●	1
R0250	2.5	5	5	10	4.9	50	6	2	●	1
R0300	3	6	6	12	5.85	50	6	2	●	2
R0400	4	8	8	14	7.85	60	8	2	●	2
R0500	5	10	10	18	9.7	70	10	2	●	2
R0600	6	12	12	22	11.7	75	12	2	●	2

● : Inventory maintained.

IMPACT MIRACLE END MILL

VF-2SB

Ball nose, Short cut length, 2 flute, For hardened materials

R	
R≤6	±0.005
6<R	±0.010

D1	
D1≤12	0 — -0.01
12<D1	0 — -0.02

UWC VF

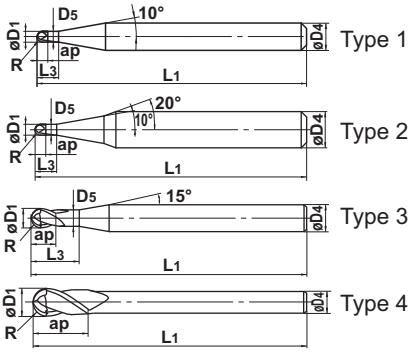
R<0.3

0.3≤R


R<0.3


0.3≤R

- 2 flute ball nose end mills with Impact Miracle coating for high hardness materials.



Unit : mm

Order Number	Radius of Ball Nose R	Dia. D1	Length of Cut ap	Neck Length L3	Neck Dia D5	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
VF2SBR0010S04	0.1	0.2	0.2	0.4	0.17	45	4	2	●	1
R0010S06	0.1	0.2	0.2	0.4	0.17	50	6	2	●	2
R0015S04	0.15	0.3	0.3	0.6	0.27	45	4	2	●	1
R0015S06	0.15	0.3	0.3	0.6	0.27	50	6	2	●	2
R0020S04	0.2	0.4	0.4	0.8	0.36	45	4	2	●	1
R0020S06	0.2	0.4	0.4	0.8	0.36	50	6	2	●	2
R0030S04	0.3	0.6	0.6	1.2	0.56	45	4	2	●	3
R0030S06	0.3	0.6	0.6	1.2	0.56	50	6	2	●	3
R0040S04	0.4	0.8	0.8	1.6	0.76	45	4	2	●	3
R0040S06	0.4	0.8	0.8	1.6	0.76	50	6	2	●	3
R0050S04	0.5	1	1	2	0.94	45	4	2	●	3
R0050S06	0.5	1	1	2	0.94	50	6	2	●	3
R0060S04	0.6	1.2	1.2	2.4	1.14	45	4	2	●	3
R0060S06	0.6	1.2	1.2	2.4	1.14	50	6	2	●	3
R0070S04	0.7	1.4	1.4	2.8	1.34	45	4	2	●	3
R0070S06	0.7	1.4	1.4	2.8	1.34	50	6	2	●	3
R0075S04	0.75	1.5	1.5	3	1.44	45	4	2	●	3
R0075S06	0.75	1.5	1.5	3	1.44	50	6	2	●	3
R0080S04	0.8	1.6	1.6	3.2	1.54	45	4	2	●	3
R0080S06	0.8	1.6	1.6	3.2	1.54	50	6	2	●	3
R0090S04	0.9	1.8	1.8	3.6	1.74	45	4	2	●	3
R0090S06	0.9	1.8	1.8	3.6	1.74	50	6	2	●	3
R0100S04	1	2	2	4	1.9	50	4	2	●	3
R0100S06	1	2	2	4	1.9	60	6	2	●	3
R0125S06	1.25	2.5	2.5	5	2.4	60	6	2	●	3
R0150S03	1.5	3	3	—	—	60	3	2	●	4
R0150S06	1.5	3	3	6	2.9	70	6	2	●	3
R0200S04	2	4	4	—	—	60	4	2	●	4
R0200S06	2	4	4	8	3.9	70	6	2	●	3
R0250S06	2.5	5	5	10	4.9	80	6	2	●	3
R0300S06	3	6	12	—	—	80	6	2	●	4
R0400S08	4	8	14	—	—	90	8	2	●	4
R0500S10	5	10	18	—	—	100	10	2	●	4
R0600S12	6	12	22	—	—	110	12	2	●	4
R0800S16	8	16	30	—	—	140	16	2	●	4
R1000S20	10	20	38	—	—	160	20	2	●	4

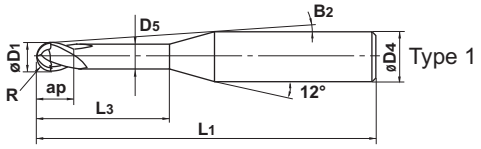
● : Inventory maintained.

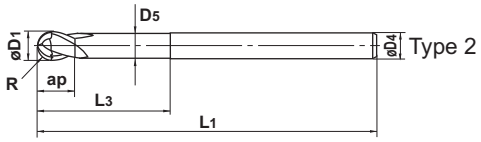
VF-2XLB

Ball nose, Long cut length, 2 flute, For hardened materials

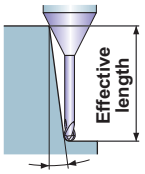
R≤1 ±0.007
1<R ±0.010

0 — -0.02





Effective length for inclined angle



- 2 flute long neck ball nose end mill with Impact Miracle coating for high hardened materials.

Unit : mm

Order Number	Radius of Ball Nose R	Dia. D1	Length of Cut ap	Neck Length L3	Cutting Edge to Shank Angle B2	Neck Dia D5	Overall Length L1	Shank Dia. D4	No. of Flutes N	Stock	Type	Effective Length for Inclined Angle 30'	1°	2°	3°
VF2XLBR0010N005S04	0.1	0.2	0.16	0.5	11.2°	0.17	50	4	2	●	1	0.7	0.8	0.9	1.0
R0010N005S06	0.1	0.2	0.16	0.5	11.5°	0.17	50	6	2	●	1	0.7	0.8	0.9	1.0
R0010N008S04	0.1	0.2	0.16	0.75	10.9°	0.17	50	4	2	●	1	1.0	1.1	1.2	1.3
R0010N010S04	0.1	0.2	0.16	1	10.7°	0.17	50	4	2	●	1	1.3	1.3	1.5	1.6
R0010N010S06	0.1	0.2	0.16	1	11.1°	0.17	50	6	2	●	1	1.3	1.3	1.5	1.6
R0010N013S04	0.1	0.2	0.16	1.25	10.4°	0.17	50	4	2	●	1	1.5	1.6	1.8	1.9
R0010N015S04	0.1	0.2	0.16	1.5	10.2°	0.17	50	4	2	●	1	1.8	1.9	2.1	2.3
R0010N015S06	0.1	0.2	0.16	1.5	10.8°	0.17	50	6	2	●	1	1.8	1.9	2.1	2.3
R0010N018S04	0.1	0.2	0.16	1.75	10.0°	0.17	50	4	2	●	1	2.1	2.2	2.4	2.6
R0010N020S04	0.1	0.2	0.16	2	9.7°	0.17	50	4	2	●	1	2.3	2.4	2.7	2.9
R0010N025S04	0.1	0.2	0.16	2.5	9.3°	0.17	50	4	2	●	1	2.8	3.0	3.3	3.6
R0015N010S04	0.15	0.3	0.24	1	10.7°	0.27	50	4	2	●	1	1.3	1.3	1.5	1.6
R0015N010S06	0.15	0.3	0.24	1	11.1°	0.27	50	6	2	●	1	1.3	1.3	1.5	1.6
R0015N013S04	0.15	0.3	0.24	1.25	10.4°	0.27	50	4	2	●	1	1.5	1.6	1.8	1.9
R0015N015S04	0.15	0.3	0.24	1.5	10.2°	0.27	50	4	2	●	1	1.8	1.9	2.1	2.3
R0015N015S06	0.15	0.3	0.24	1.5	10.8°	0.27	50	6	2	●	1	1.8	1.9	2.1	2.3
R0015N018S04	0.15	0.3	0.24	1.75	10.0°	0.27	50	4	2	●	1	2.1	2.1	2.4	2.6
R0015N020S04	0.15	0.3	0.24	2	9.7°	0.27	50	4	2	●	1	2.3	2.4	2.7	2.9
R0015N020S06	0.15	0.3	0.24	2	10.4°	0.27	50	6	2	●	1	2.3	2.4	2.7	2.9
R0015N025S04	0.15	0.3	0.24	2.5	9.3°	0.27	50	4	2	●	1	2.8	3.0	3.2	3.6
R0015N030S04	0.15	0.3	0.24	3	8.9°	0.27	50	4	2	●	1	3.4	3.5	3.8	4.3
R0015N040S04	0.15	0.3	0.24	4	8.2°	0.27	50	4	2	●	1	4.4	4.6	5.0	5.6
R0020N010S04	0.2	0.4	0.32	1	10.7°	0.36	50	4	2	●	1	1.3	1.4	1.5	1.6
R0020N010S06	0.2	0.4	0.32	1	11.1°	0.36	50	6	2	●	1	1.3	1.4	1.5	1.6
R0020N015S04	0.2	0.4	0.32	1.5	10.2°	0.36	50	4	2	●	1	1.8	1.9	2.1	2.3
R0020N015S06	0.2	0.4	0.32	1.5	10.8°	0.36	50	6	2	●	1	1.8	1.9	2.1	2.3
R0020N020S04	0.2	0.4	0.32	2	9.7°	0.36	50	4	2	●	1	2.3	2.4	2.7	2.9
R0020N020S06	0.2	0.4	0.32	2	10.4°	0.36	50	6	2	●	1	2.3	2.4	2.7	2.9
R0020N025S04	0.2	0.4	0.32	2.5	9.3°	0.36	50	4	2	●	1	2.9	3.0	3.3	3.6
R0020N025S06	0.2	0.4	0.32	2.5	10.1°	0.36	50	6	2	●	1	2.9	3.0	3.3	3.6
R0020N030S04	0.2	0.4	0.32	3	8.9°	0.36	50	4	2	●	1	3.4	3.5	3.9	4.3
R0020N030S06	0.2	0.4	0.32	3	9.8°	0.36	50	6	2	●	1	3.4	3.5	3.9	4.3
R0020N040S04	0.2	0.4	0.32	4	8.2°	0.36	50	4	2	●	1	4.4	4.6	5.1	5.6
R0020N050S04	0.2	0.4	0.32	5	7.6°	0.36	50	4	2	●	1	5.5	5.7	6.3	6.9
R0025N015S04	0.25	0.5	0.4	1.5	10.2°	0.46	50	4	2	●	1	1.8	1.9	2.1	2.3
R0025N015S06	0.25	0.5	0.4	1.5	10.8°	0.46	50	6	2	●	1	1.8	1.9	2.1	2.3
R0025N020S04	0.25	0.5	0.4	2	9.7°	0.46	50	4	2	●	1	2.3	2.4	2.7	2.9
R0025N020S06	0.25	0.5	0.4	2	10.4°	0.46	50	6	2	●	1	2.3	2.4	2.7	2.9

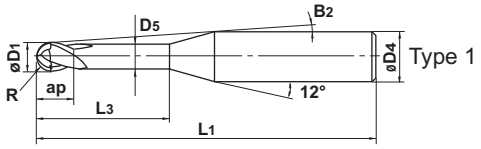
IMPACT MIRACLE END MILL

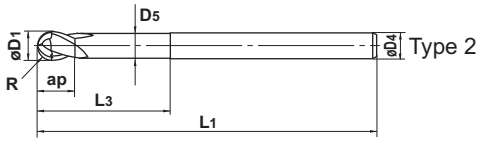
VF-2XLB

Ball nose, Long cut length, 2 flute, For hardened materials

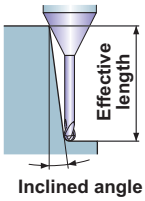
R≤1 ±0.007
1<R ±0.010

0 – -0.02





Effective length for inclined angle



- 2 flute long neck ball nose end mill with Impact Miracle coating for high hardened materials.

Unit : mm

Order Number	Radius of Ball Nose R	Dia. D1	Length of Cut ap	Neck Length L3	Cutting Edge to Shank Angle B2	Neck Dia D5	Overall Length L1	Shank Dia. D4	No. of Flutes N	Stock	Type	Effective Length for Inclined Angle 30'	1°	2°	3°
VF2XLBR0025N025S04	0.25	0.5	0.4	2.5	9.2°	0.46	50	4	2	●	1	2.9	3.0	3.3	3.6
R0025N030S04	0.25	0.5	0.4	3	8.8°	0.46	50	4	2	●	1	3.4	3.5	3.9	4.3
R0025N030S06	0.25	0.5	0.4	3	9.8°	0.46	50	6	2	●	1	3.4	3.5	3.9	4.3
R0025N035S04	0.25	0.5	0.4	3.5	8.5°	0.46	50	4	2	●	1	3.9	4.1	4.5	4.9
R0025N040S04	0.25	0.5	0.4	4	8.1°	0.46	50	4	2	●	1	4.4	4.6	5.1	5.6
R0025N040S06	0.25	0.5	0.4	4	9.2°	0.46	50	6	2	●	1	4.4	4.6	5.1	5.6
R0025N050S04	0.25	0.5	0.4	5	7.5°	0.46	50	4	2	●	1	5.5	5.7	6.2	6.9
R0025N050S06	0.25	0.5	0.4	5	8.7°	0.46	50	6	2	●	1	5.5	5.7	6.2	6.9
R0025N060S04	0.25	0.5	0.4	6	7.0°	0.46	50	4	2	●	1	6.5	6.8	7.4	8.2
R0025N060S06	0.25	0.5	0.4	6	8.3°	0.46	60	6	2	●	1	6.5	6.8	7.4	8.2
R0030N020S04	0.3	0.6	0.48	2	9.6°	0.56	50	4	2	●	1	2.4	2.5	2.8	3.1
R0030N020S06	0.3	0.6	0.48	2	10.4°	0.56	50	6	2	●	1	2.4	2.5	2.8	3.1
R0030N025S04	0.3	0.6	0.48	2.5	9.1°	0.56	50	4	2	●	1	3.0	3.1	3.4	3.7
R0030N030S04	0.3	0.6	0.48	3	8.7°	0.56	50	4	2	●	1	3.5	3.6	4.0	4.4
R0030N030S06	0.3	0.6	0.48	3	9.7°	0.56	50	6	2	●	1	3.5	3.6	4.0	4.4
R0030N035S04	0.3	0.6	0.48	3.5	8.4°	0.56	50	4	2	●	1	4.0	4.2	4.6	5.0
R0030N040S04	0.3	0.6	0.48	4	8.0°	0.56	50	4	2	●	1	4.5	4.7	5.2	5.7
R0030N040S06	0.3	0.6	0.48	4	9.2°	0.56	50	6	2	●	1	4.5	4.7	5.2	5.7
R0030N050S04	0.3	0.6	0.48	5	7.4°	0.56	50	4	2	●	1	5.6	5.8	6.4	7.0
R0030N050S06	0.3	0.6	0.48	5	8.7°	0.56	50	6	2	●	1	5.6	5.8	6.4	7.0
R0030N060S04	0.3	0.6	0.48	6	6.9°	0.56	50	4	2	●	1	6.6	6.9	7.6	8.4
R0030N060S06	0.3	0.6	0.48	6	8.2°	0.56	50	6	2	●	1	6.6	6.9	7.6	8.4
R0030N070S04	0.3	0.6	0.48	7	6.5°	0.56	50	4	2	●	1	7.7	8.0	8.8	9.7
R0030N080S04	0.3	0.6	0.48	8	6.1°	0.56	50	4	2	●	1	8.7	9.1	10.0	11.0
R0030N080S06	0.3	0.6	0.48	8	7.4°	0.56	60	6	2	●	1	8.7	9.1	10.0	11.0
R0040N020S04	0.4	0.8	0.64	2	9.5°	0.76	50	4	2	●	1	2.4	2.5	2.8	3.0
R0040N020S06	0.4	0.8	0.64	2	10.4°	0.76	50	6	2	●	1	2.4	2.5	2.8	3.0
R0040N030S04	0.4	0.8	0.64	3	8.7°	0.76	50	4	2	●	1	3.5	3.6	4.0	4.3
R0040N030S06	0.4	0.8	0.64	3	9.7°	0.76	50	6	2	●	1	3.5	3.6	4.0	4.3
R0040N040S04	0.4	0.8	0.64	4	7.9°	0.76	50	4	2	●	1	4.5	4.7	5.1	5.7
R0040N040S06	0.4	0.8	0.64	4	9.1°	0.76	50	6	2	●	1	4.5	4.7	5.1	5.7
R0040N050S04	0.4	0.8	0.64	5	7.3°	0.76	50	4	2	●	1	5.6	5.8	6.3	7.0
R0040N060S04	0.4	0.8	0.64	6	6.8°	0.76	50	4	2	●	1	6.6	6.9	7.5	8.3
R0040N060S06	0.4	0.8	0.64	6	8.1°	0.76	50	6	2	●	1	6.6	6.9	7.5	8.3
R0040N070S04	0.4	0.8	0.64	7	6.3°	0.76	50	4	2	●	1	7.7	8.0	8.7	9.7
R0040N080S04	0.4	0.8	0.64	8	5.9°	0.76	50	4	2	●	1	8.7	9.1	9.9	11.0
R0040N080S06	0.4	0.8	0.64	8	7.4°	0.76	50	6	2	●	1	8.7	9.1	9.9	11.0
R0040N100S04	0.4	0.8	0.64	10	5.3°	0.76	50	4	2	●	1	10.8	11.3	12.3	13.6

● : Inventory maintained.

Unit : mm

Order Number	Radius of Ball Nose R	Dia. D_1	Length of Cut ap	Neck Length L_3	Cutting Edge to Shank Angle B_2	Neck Dia D_5	Overall Length L_1	Shank Dia. D_4	No. of Flutes N	Stock	Type	Effective Length for Inclined Angle 30'	1°	2°	3°
VF2XLBR0040N100S06	0.4	0.8	0.64	10	6.7°	0.76	60	6	2	●	1	10.8	11.3	12.3	13.6
R0050N030S04	0.5	1	0.8	3	8.3°	0.94	50	4	2	●	1	3.8	4.0	4.4	4.8
R0050N030S06	0.5	1	0.8	3	9.5°	0.94	50	6	2	●	1	3.8	4.0	4.4	4.8
R0050N040S04	0.5	1	0.8	4	7.6°	0.94	50	4	2	●	1	4.9	5.1	5.6	6.1
R0050N040S06	0.5	1	0.8	4	8.9°	0.94	50	6	2	●	1	4.9	5.1	5.6	6.1
R0050N050S04	0.5	1	0.8	5	7.0°	0.94	50	4	2	●	1	5.9	6.2	6.8	7.5
R0050N050S06	0.5	1	0.8	5	8.4°	0.94	50	6	2	●	1	5.9	6.2	6.8	7.5
R0050N060S04	0.5	1	0.8	6	6.5°	0.94	50	4	2	●	1	7.0	7.3	8.0	8.8
R0050N060S06	0.5	1	0.8	6	7.9°	0.94	50	6	2	●	1	7.0	7.3	8.0	8.8
R0050N070S04	0.5	1	0.8	7	6.0°	0.94	50	4	2	●	1	8.0	8.4	9.2	10.1
R0050N080S04	0.5	1	0.8	8	5.6°	0.94	50	4	2	●	1	9.1	9.5	10.3	11.4
R0050N080S06	0.5	1	0.8	8	7.2°	0.94	50	6	2	●	1	9.1	9.5	10.3	11.4
R0050N090S04	0.5	1	0.8	9	5.3°	0.94	50	4	2	●	1	10.1	10.6	11.5	12.8
R0050N100S04	0.5	1	0.8	10	5.0°	0.94	50	4	2	●	1	11.2	11.6	12.7	14.1
R0050N100S06	0.5	1	0.8	10	6.5°	0.94	50	6	2	●	1	11.2	11.6	12.7	14.1
R0050N120S04	0.5	1	0.8	12	4.5°	0.94	50	4	2	●	1	13.2	13.8	15.1	16.7
R0050N120S06	0.5	1	0.8	12	6.0°	0.94	60	6	2	●	1	13.2	13.8	15.1	16.7
R0050N140S04	0.5	1	0.8	14	4.1°	0.94	60	4	2	●	1	15.3	16.0	17.5	19.4
R0050N160S04	0.5	1	0.8	16	3.7°	0.94	60	4	2	●	1	17.4	18.2	19.9	22.1
R0050N160S06	0.5	1	0.8	16	5.1°	0.94	70	6	2	●	1	17.4	18.2	19.9	22.1
R0050N180S04	0.5	1	0.8	18	3.4°	0.94	60	4	2	●	1	19.5	20.4	22.3	24.7
R0050N200S04	0.5	1	0.8	20	3.2°	0.94	60	4	2	●	1	21.6	22.5	24.7	27.4
R0050N200S06	0.5	1	0.8	20	4.5°	0.94	70	6	2	●	1	21.6	22.5	24.7	27.4
R0060N060S04	0.6	1.2	0.96	6	6.3°	1.14	50	4	2	●	1	7.0	7.3	7.9	8.7
R0060N060S06	0.6	1.2	0.96	6	7.9°	1.14	50	6	2	●	1	7.0	7.3	7.9	8.7
R0060N080S04	0.6	1.2	0.96	8	5.5°	1.14	50	4	2	●	1	9.1	9.5	10.3	11.4
R0060N080S06	0.6	1.2	0.96	8	7.1°	1.14	50	6	2	●	1	9.1	9.5	10.3	11.4
R0060N100S04	0.6	1.2	0.96	10	4.8°	1.14	50	4	2	●	1	11.2	11.6	12.7	14.1
R0060N100S06	0.6	1.2	0.96	10	6.4°	1.14	50	6	2	●	1	11.2	11.6	12.7	14.1
R0060N120S04	0.6	1.2	0.96	12	4.3°	1.14	50	4	2	●	1	13.2	13.8	15.1	16.7
R0060N120S06	0.6	1.2	0.96	12	5.9°	1.14	50	6	2	●	1	13.2	13.8	15.1	16.7
R0060N140S04	0.6	1.2	0.96	14	3.9°	1.14	60	4	2	●	1	15.3	16.0	17.5	19.4
R0060N160S04	0.6	1.2	0.96	16	3.6°	1.14	60	4	2	●	1	17.4	18.2	19.9	22.0
R0060N160S06	0.6	1.2	0.96	16	5.0°	1.14	70	6	2	●	1	17.4	18.2	19.9	22.0
R0070N080S04	0.7	1.4	1.12	8	5.3°	1.34	50	4	2	●	1	9.1	9.4	10.3	11.4
R0070N120S04	0.7	1.4	1.12	12	4.1°	1.34	50	4	2	●	1	13.2	13.8	15.1	16.7
R0070N160S04	0.7	1.4	1.12	16	3.4°	1.34	60	4	2	●	1	17.4	18.2	19.9	22.0
R0075N060S04	0.75	1.5	1.2	6	6.0°	1.44	50	4	2	●	1	7.0	7.3	7.9	8.7
R0075N060S06	0.75	1.5	1.2	6	7.7°	1.44	50	6	2	●	1	7.0	7.3	7.9	8.7
R0075N080S04	0.75	1.5	1.2	8	5.2°	1.44	50	4	2	●	1	9.1	9.4	10.3	11.4
R0075N080S06	0.75	1.5	1.2	8	6.9°	1.44	50	6	2	●	1	9.1	9.4	10.3	11.4
R0075N100S04	0.75	1.5	1.2	10	4.5°	1.44	50	4	2	●	1	11.1	11.6	12.7	14.0
R0075N100S06	0.75	1.5	1.2	10	6.3°	1.44	50	6	2	●	1	11.1	11.6	12.7	14.0
R0075N120S04	0.75	1.5	1.2	12	4.0°	1.44	50	4	2	●	1	13.2	13.8	15.1	16.7
R0075N120S06	0.75	1.5	1.2	12	5.7°	1.44	50	6	2	●	1	13.2	13.8	15.1	16.7
R0075N140S04	0.75	1.5	1.2	14	3.6°	1.44	50	4	2	●	1	15.3	16.0	17.5	19.3
R0075N140S06	0.75	1.5	1.2	14	5.3°	1.44	50	6	2	●	1	15.3	16.0	17.5	19.3
R0075N160S04	0.75	1.5	1.2	16	3.3°	1.44	60	4	2	●	1	17.4	18.2	19.9	22.0

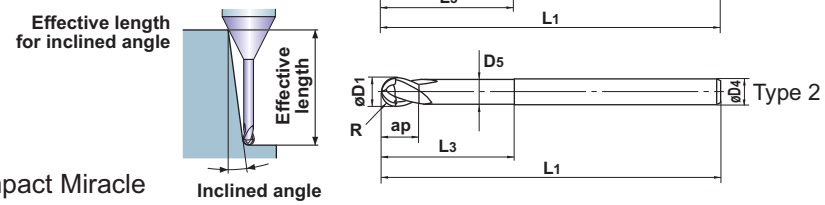
IMPACT MIRACLE END MILL

VF-2XLB

Ball nose, Long cut length, 2 flute, For hardened materials

R≤1 ±0.007
1<R ±0.010

0 – -0.02



- 2 flute long neck ball nose end mill with Impact Miracle coating for high hardened materials.

Unit : mm

Order Number	Radius of Ball Nose R	Dia. D1	Length of Cut ap	Neck Length L3	Cutting Edge to Shank Angle B2	Neck Dia D5	Overall Length L1	Shank Dia. D4	No. of Flutes N	Stock	Type	Effective Length for Inclined Angle 30'	1°	2°	3°
VF2XLBR0075N160S06	0.75	1.5	1.2	16	4.9°	1.44	60	6	2	●	1	17.4	18.2	19.9	22.0
R0075N180S04	0.75	1.5	1.2	18	3.0°	1.44	60	4	2	●	1	19.5	20.3	22.3	24.6
R0075N200S04	0.75	1.5	1.2	20	2.8°	1.44	60	4	2	●	1	21.6	22.5	24.7	No interference
R0075N200S06	0.75	1.5	1.2	20	4.3°	1.44	70	6	2	●	1	21.6	22.5	24.7	27.3
R0080N080S04	0.8	1.6	1.28	8	5.1°	1.54	50	4	2	●	1	9.1	9.4	10.3	11.3
R0080N120S04	0.8	1.6	1.28	12	3.9°	1.54	50	4	2	●	1	13.2	13.8	15.1	16.6
R0080N160S04	0.8	1.6	1.28	16	3.2°	1.54	60	4	2	●	1	17.4	18.2	19.9	22.0
R0080N200S04	0.8	1.6	1.28	20	2.7°	1.54	60	4	2	●	1	21.6	22.5	24.7	No interference
R0090N080S04	0.9	1.8	1.44	8	4.9°	1.74	50	4	2	●	1	9.0	9.4	10.3	11.3
R0090N120S04	0.9	1.8	1.44	12	3.7°	1.74	50	4	2	●	1	13.2	13.8	15.1	16.6
R0090N160S04	0.9	1.8	1.44	16	3.0°	1.74	60	4	2	●	1	17.4	18.1	19.8	No interference
R0090N200S04	0.9	1.8	1.44	20	2.6°	1.74	60	4	2	●	1	21.6	22.5	24.6	No interference
R0100N060S04	1	2	1.6	6	5.4°	1.9	50	4	2	●	1	7.1	7.3	8.0	8.7
R0100N060S06	1	2	1.6	6	7.5°	1.9	50	6	2	●	1	7.1	7.3	8.0	8.7
R0100N080S04	1	2	1.6	8	4.6°	1.9	50	4	2	●	1	9.2	9.5	10.4	11.4
R0100N080S06	1	2	1.6	8	6.6°	1.9	50	6	2	●	1	9.2	9.5	10.4	11.4
R0100N100S04	1	2	1.6	10	4.0°	1.9	50	4	2	●	1	11.2	11.7	12.8	14.1
R0100N100S06	1	2	1.6	10	6.0°	1.9	50	6	2	●	1	11.2	11.7	12.8	14.1
R0100N120S04	1	2	1.6	12	3.5°	1.9	50	4	2	●	1	13.3	13.9	15.2	16.7
R0100N120S06	1	2	1.6	12	5.4°	1.9	50	6	2	●	1	13.3	13.9	15.2	16.7
R0100N140S04	1	2	1.6	14	3.1°	1.9	50	4	2	●	1	15.4	16.1	17.5	19.4
R0100N140S06	1	2	1.6	14	5.0°	1.9	50	6	2	●	1	15.4	16.1	17.5	19.4
R0100N160S04	1	2	1.6	16	2.8°	1.9	60	4	2	●	1	17.5	18.2	19.9	No interference
R0100N160S06	1	2	1.6	16	4.6°	1.9	60	6	2	●	1	17.5	18.2	19.9	22.0
R0100N180S04	1	2	1.6	18	2.6°	1.9	60	4	2	●	1	19.6	20.4	22.3	No interference
R0100N180S06	1	2	1.6	18	4.2°	1.9	60	6	2	●	1	19.6	20.4	22.3	24.7
R0100N200S04	1	2	1.6	20	2.4°	1.9	60	4	2	●	1	21.7	22.6	24.7	No interference
R0100N200S06	1	2	1.6	20	4.0°	1.9	60	6	2	●	1	21.7	22.6	24.7	27.3
R0100N220S04	1	2	1.6	22	2.2°	1.9	60	4	2	●	1	23.8	24.8	27.1	No interference
R0100N250S04	1	2	1.6	25	2.0°	1.9	70	4	2	●	1	26.9	28.0	No interference	No interference
R0100N250S06	1	2	1.6	25	3.4°	1.9	70	6	2	●	1	26.9	28.0	30.7	34.0
R0100N300S04	1	2	1.6	30	1.7°	1.9	70	4	2	●	1	32.1	33.5	No interference	No interference
R0100N300S06	1	2	1.6	30	3.0°	1.9	80	6	2	●	1	32.1	33.5	36.7	No interference
R0100N350S04	1	2	1.6	35	1.5°	1.9	80	4	2	●	1	37.3	38.9	No interference	No interference
R0125N100S06	1.25	2.5	2	10	5.6°	2.4	60	6	2	●	1	11.2	11.7	12.7	14.0
R0125N150S06	1.25	2.5	2	15	4.4°	2.4	60	6	2	●	1	16.4	17.1	18.7	20.6
R0125N200S06	1.25	2.5	2	20	3.6°	2.4	70	6	2	●	1	21.7	22.6	24.7	27.2
R0125N250S06	1.25	2.5	2	25	3.1°	2.4	70	6	2	●	1	26.9	28.0	30.7	33.9

● : Inventory maintained.

Unit : mm

Order Number	Radius of Ball Nose R	Dia. D_1	Length of Cut ap	Neck Length L_3	Cutting Edge to Shank Angle B_2	Neck Dia D_5	Overall Length L_1	Shank Dia. D_4	No. of Flutes N	Stock	Type	Effective Length for Inclined Angle 30'	1°	2°	3°
VF2XLBR0125N300S06	1.25	2.5	2	30	2.7°	2.4	80	6	2	●	1	32.1	33.5	36.6	No interference
R0125N350S06	1.25	2.5	2	35	2.4°	2.4	80	6	2	●	1	37.3	38.9	42.6	No interference
R0150N080S06	1.5	3	2.4	8	6.0°	2.9	60	6	2	●	1	9.1	9.5	10.3	11.2
R0150N100S06	1.5	3	2.4	10	5.2°	2.9	60	6	2	●	1	11.2	11.7	12.7	13.9
R0150N120S06	1.5	3	2.4	12	4.7°	2.9	60	6	2	●	1	13.3	13.8	15.1	16.5
R0150N140S06	1.5	3	2.4	14	4.2°	2.9	60	6	2	●	1	15.4	16.0	17.4	19.2
R0150N160S06	1.5	3	2.4	16	3.9°	2.9	60	6	2	●	1	17.5	18.2	19.8	21.9
R0150N200S06	1.5	3	2.4	20	3.3°	2.9	70	6	2	●	1	21.6	22.5	24.6	27.2
R0150N250S06	1.5	3	2.4	25	2.8°	2.9	70	6	2	●	1	26.9	28.0	30.6	No interference
R0150N300S06	1.5	3	2.4	30	2.4°	2.9	70	6	2	●	1	32.1	33.4	36.6	No interference
R0150N350S06	1.5	3	2.4	35	2.1°	2.9	80	6	2	●	1	37.3	38.9	42.6	No interference
R0150N400S06	1.5	3	2.4	40	1.9°	2.9	90	6	2	●	1	42.5	44.3		No interference
R0175N160S06	1.75	3.5	2.8	16	3.4°	3.4	60	6	2	●	1	17.5	18.2	19.8	21.8
R0175N200S06	1.75	3.5	2.8	20	2.9°	3.4	70	6	2	●	1	21.6	22.5	24.6	No interference
R0175N250S06	1.75	3.5	2.8	25	2.4°	3.4	70	6	2	●	1	26.8	28.0	30.6	No interference
R0175N300S06	1.75	3.5	2.8	30	2.1°	3.4	80	6	2	●	1	32.1	33.4	36.5	No interference
R0175N350S06	1.75	3.5	2.8	35	1.8°	3.4	80	6	2	●	1	37.3	38.9		No interference
R0175N400S06	1.75	3.5	2.8	40	1.6°	3.4	90	6	2	●	1	42.5	44.3		No interference
R0200N100S06	2	4	3.2	10	4.2°	3.9	70	6	2	●	1	11.2	11.6	12.6	13.7
R0200N120S06	2	4	3.2	12	3.7°	3.9	70	6	2	●	1	13.3	13.8	15.0	16.4
R0200N140S06	2	4	3.2	14	3.3°	3.9	70	6	2	●	1	15.4	16.0	17.4	19.0
R0200N160S06	2	4	3.2	16	3.0°	3.9	70	6	2	●	1	17.5	18.1	19.7	No interference
R0200N200S06	2	4	3.2	20	2.5°	3.9	70	6	2	●	1	21.6	22.5	24.5	No interference
R0200N250S06	2	4	3.2	25	2.1°	3.9	70	6	2	●	1	26.8	28.0	30.5	No interference
R0200N300S06	2	4	3.2	30	1.8°	3.9	70	6	2	●	1	32.1	33.4	No interference	No interference
R0200N350S06	2	4	3.2	35	1.5°	3.9	80	6	2	●	1	37.3	38.8	No interference	No interference
R0200N400S06	2	4	3.2	40	1.4°	3.9	90	6	2	●	1	42.5	44.3	No interference	No interference
R0200N450S06	2	4	3.2	45	1.2°	3.9	90	6	2	●	1	47.7	49.7	No interference	No interference
R0200N500S06	2	4	3.2	50	1.1°	3.9	100	6	2	●	1	52.9	55.2	No interference	No interference
R0250N200S06	2.5	5	4	20	1.4°	4.9	70	6	2	●	1	21.6	22.5	No interference	No interference
R0250N250S06	2.5	5	4	25	1.2°	4.9	70	6	2	●	1	26.8	27.9	No interference	No interference
R0250N300S06	2.5	5	4	30	1.0°	4.9	80	6	2	●	1	32.0	No interference	No interference	No interference
R0250N350S06	2.5	5	4	35	0.9°	4.9	80	6	2	●	1	37.2	No interference	No interference	No interference
R0300N300S06	3	6	4.8	30	0.0°	5.85	80	6	2	●	2	No interference	No interference	No interference	No interference
R0300N400S06	3	6	4.8	40	0.0°	5.85	90	6	2	●	2	No interference	No interference	No interference	No interference
R0300N500S06	3	6	4.8	50	0.0°	5.85	100	6	2	●	2	No interference	No interference	No interference	No interference

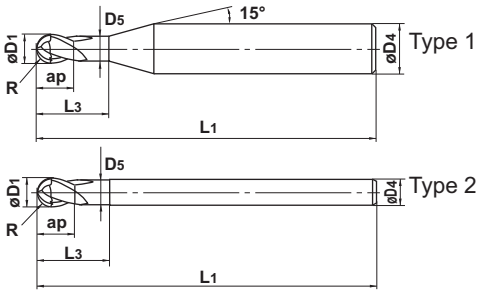
IMPACT MIRACLE END MILL

VF-2SDB

Ball nose, Short cut length, 2 flute, Strong geometry type

R≤6.5 ±0.01
6.5<R ±0.02

D1≤12 0 −-0.02
12<D1 0 −-0.03



● 2 flute ball nose end mills with Impact Miracle coating for high hardness materials and achieves excellent fracture resistance.

Unit : mm

Order Number	Radius of ball nose R	Dia. D1	Length of Cut ap	Neck Length L3	Neck Dia D5	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
VF2SDBR0050	0.5	1	1	2	0.94	45	4	2	●	1
R0100S04	1	2	2	4	1.9	50	4	2	●	1
R0100	1	2	2	4	1.9	60	6	2	●	1
R0150S03	1.5	3	3	6	2.9	60	3	2	●	2
R0150	1.5	3	3	6	2.9	70	6	2	●	1
R0200S04	2	4	4	8	3.9	60	4	2	●	2
R0200	2	4	4	8	3.9	70	6	2	●	1
R0250	2.5	5	5	10	4.9	80	6	2	●	1
R0300	3	6	12	22	5.85	80	6	2	●	2
R0400	4	8	14	27	7.85	90	8	2	●	2
R0500	5	10	18	31	9.7	100	10	2	●	2
R0600	6	12	22	35	11.7	110	12	2	●	2
R0800	8	16	30	50	15.5	140	16	2	●	2
R1000	10	20	38	58	19.5	160	20	2	●	2

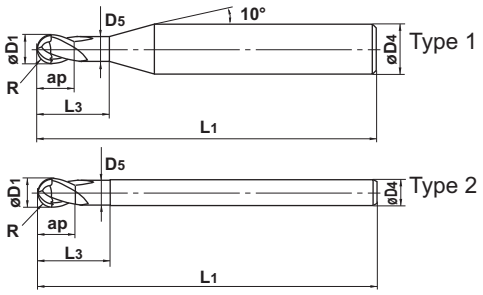
● : Inventory maintained.

VF-2SDBL

Ball nose, Short cut length, 2 flute, Strong geometry type, Long shank

R≤6.5 ±0.01
6.5<R ±0.02

D1≤12 0 −-0.02
12<D1 0 −-0.03



● VF-2SDB with long shank.

Unit : mm

Order Number	Radius of ball nose R	Dia. D1	Length of Cut ap	Neck Length L3	Neck Dia D5	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
VF2SDBLR0050	0.5	1	1	2	0.94	60	6	2	●	1
R0100	1	2	2	4	1.9	80	6	2	●	1
R0150	1.5	3	3	6	2.9	90	6	2	●	1
R0200	2	4	4	8	3.9	90	6	2	●	1
R0250	2.5	5	5	10	4.9	110	8	2	●	1
R0300	3	6	12	22	5.85	120	6	2	●	2
R0400	4	8	14	27	7.85	130	8	2	●	2
R0500	5	10	18	31	9.7	140	10	2	●	2
R0600	6	12	22	35	11.7	140	12	2	●	2
R0800	8	16	30	50	15.5	200	16	2	●	2
R1000	10	20	38	58	19.5	200	20	2	●	2

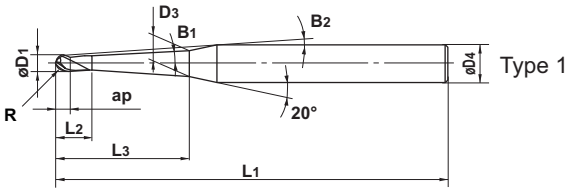
IMPACT MIRACLE END MILL

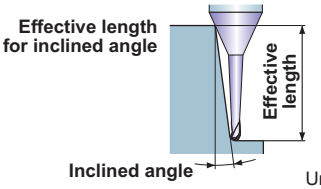
VF-3XB

Ball nose, 3 flute, Taper neck, For hardened materials

R ±0.01

0 — -0.02





UWC VF 30°

● 3 flute ball end mill, high rigidity taper neck type.

Unit : mm

Order Number	Radius of Ball Nose	Dia.	Taper Angle One Side	Length of Cut	Neck Length	Length of Straight Neck	Cutting Edge to Shank Angle	Neck Dia.	Overall Length	Shank Dia.	No. of Flutes	Stock	Type	Effective Length for Inclined Angle			
	R	D1	B1	ap	L3	L2	B2	D3	L1	D4	N			30'	1°	2°	3°
VF3XBR0040T0024L006	0.4	0.8	0.4°	0.5	6	1.5	8.9°	0.82	60	4	3	●	1	6.3	6.6	6.9	7.3
R0040T0024L008	0.4	0.8	0.4°	0.5	8	1.5	7.5°	0.85	60	4	3	●	1	8.4	8.6	9.1	9.5
R0040T0024L012	0.4	0.8	0.4°	0.5	12	1.5	5.7°	0.91	60	4	3	●	1	12.4	12.7	13.4	14.1
R0040T0054L008	0.4	0.8	0.9°	0.5	8	1.5	7.6°	0.96	60	4	3	●	1	—	8.4	8.9	9.3
R0040T0054L012	0.4	0.8	0.9°	0.5	12	1.5	5.8°	1.09	60	4	3	●	1	—	12.4	13.1	13.8
R0040T0054L016	0.4	0.8	0.9°	0.5	16	1.5	4.7°	1.22	60	4	3	●	1	—	16.5	17.3	18.3
R0050T0024L008	0.5	1	0.4°	0.8	8	2.3	9.6°	1.02	60	6	3	●	1	8.5	8.8	9.3	9.8
R0050T0024L010	0.5	1	0.4°	0.8	10	2.3	8.5°	1.05	60	6	3	●	1	10.5	10.9	11.4	12.1
R0050T0024L012	0.5	1	0.4°	0.8	12	2.3	7.6°	1.08	60	6	3	●	1	12.6	13.0	13.6	14.4
R0050T0024L016	0.5	1	0.4°	0.8	16	2.3	6.3°	1.13	70	6	3	●	1	16.6	17.1	18.0	18.9
R0050T0024L020	0.5	1	0.4°	0.8	20	2.3	5.4°	1.19	70	6	3	●	1	20.6	21.2	22.3	23.5
R0050T0024L025	0.5	1	0.4°	0.8	25	2.3	4.6°	1.26	70	6	3	●	1	25.7	26.3	27.7	29.3
R0050T0024L030	0.5	1	0.4°	0.8	30	2.3	4.0°	1.33	80	6	3	●	1	30.7	31.5	33.1	35.0
R0050T0024L035	0.5	1	0.4°	0.8	35	2.3	3.5°	1.40	80	6	3	●	1	35.7	36.6	38.6	40.7
R0050T0054L008	0.5	1	0.9°	0.8	8	2.3	9.7°	1.12	60	6	3	●	1	—	8.6	9.1	9.6
R0050T0054L012	0.5	1	0.9°	0.8	12	2.3	7.7°	1.24	60	6	3	●	1	—	12.6	13.3	14.1
R0050T0054L016	0.5	1	0.9°	0.8	16	2.3	6.4°	1.37	70	6	3	●	1	—	16.7	17.6	18.5
R0050T0054L020	0.5	1	0.9°	0.8	20	2.3	5.5°	1.50	70	6	3	●	1	—	20.7	21.8	23.0
R0050T0054L025	0.5	1	0.9°	0.8	25	2.3	4.7°	1.65	70	6	3	●	1	—	25.7	27.1	28.6
R0050T0054L030	0.5	1	0.9°	0.8	30	2.3	4.0°	1.81	80	6	3	●	1	—	30.8	32.4	34.2
R0050T0054L035	0.5	1	0.9°	0.8	35	2.3	3.6°	1.97	80	6	3	●	1	—	35.8	37.7	39.8
R0050T0054L040	0.5	1	0.9°	0.8	40	2.3	3.2°	2.12	80	6	3	●	1	—	40.8	43.0	45.4
R0050T0054L050	0.5	1	0.9°	0.8	50	2.3	2.7°	2.44	110	6	3	●	1	—	50.9	53.6	No interference
R0050T0054L060	0.5	1	0.9°	0.8	60	2.3	2.3°	2.75	110	6	3	●	1	—	60.9	64.1	No interference
R0050T0054L070	0.5	1	0.9°	0.8	70	2.3	2.0°	3.07	110	6	3	●	1	—	71.0	74.7	No interference
R0050T0130L012	0.5	1	1.5°	0.8	12	2.3	7.9°	1.45	60	6	3	●	1	—	—	13.0	13.7
R0050T0130L016	0.5	1	1.5°	0.8	16	2.3	6.5°	1.66	70	6	3	●	1	—	—	17.1	18.0
R0050T0130L020	0.5	1	1.5°	0.8	20	2.3	5.6°	1.87	70	6	3	●	1	—	—	21.2	22.4
R0050T0130L025	0.5	1	1.5°	0.8	25	2.3	4.8°	2.13	70	6	3	●	1	—	—	26.3	27.8
R0050T0130L030	0.5	1	1.5°	0.8	30	2.3	4.1°	2.39	80	6	3	●	1	—	—	31.5	33.2
R0050T0130L035	0.5	1	1.5°	0.8	35	2.3	3.7°	2.65	80	6	3	●	1	—	—	36.6	38.6
R0075T0024L010	0.75	1.5	0.4°	1.3	10	2.8	8.1°	1.54	60	6	3	●	1	10.6	10.9	11.4	12.0
R0075T0024L015	0.75	1.5	0.4°	1.3	15	2.8	6.2°	1.61	60	6	3	●	1	15.6	16.0	16.9	17.8
R0075T0024L020	0.75	1.5	0.4°	1.3	20	2.8	5.0°	1.68	70	6	3	●	1	20.6	21.2	22.3	23.5
R0075T0024L030	0.75	1.5	0.4°	1.3	30	2.8	3.7°	1.82	80	6	3	●	1	30.7	31.5	33.1	35.0
R0075T0054L015	0.75	1.5	0.9°	1.3	15	2.8	6.3°	1.82	60	6	3	●	1	—	15.7	16.5	17.4
R0075T0054L020	0.75	1.5	0.9°	1.3	20	2.8	5.1°	1.98	70	6	3	●	1	—	20.7	21.8	23.0
R0075T0054L030	0.75	1.5	0.9°	1.3	30	2.8	3.7°	2.29	80	6	3	●	1	—	30.8	32.4	34.2

● : Inventory maintained.

Unit : mm

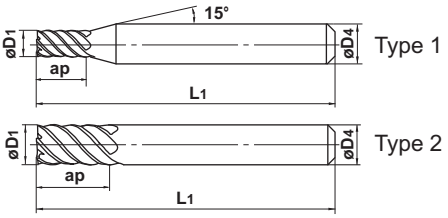
Order Number	Radius of Ball Nose	Dia.	Taper Angle One Side	Length of Cut	Neck Length	Length of Straight Neck	Cutting Edge to Shank Angle	Neck Dia.	Overall Length	Shank Dia.	No. of Flutes	Stock	Type	Effective Length for Inclined Angle			
	R	D_1	B_1	ap	L_3	L_2	B_2	D_3	L_1	D_4	N			30'	1°	2°	3°
VF3XBR0075T0054L040	0.75	1.5	0.9°	1.3	40	2.8	3.0°	2.61	80	6	3	●	1	–	40.8	43.0	45.3
R0075T0130L015	0.75	1.5	1.5°	1.3	15	2.8	6.4°	2.08	60	6	3	●	1	–	–	16.1	17.0
R0075T0130L020	0.75	1.5	1.5°	1.3	20	2.8	5.2°	2.34	70	6	3	●	1	–	–	21.2	22.4
R0075T0130L030	0.75	1.5	1.5°	1.3	30	2.8	3.8°	2.86	80	6	3	●	1	–	–	31.5	33.2
R0100T0024L016	1	2	0.4°	1.6	16	3.6	5.5°	2.07	70	6	3	●	1	16.7	17.1	18.0	19.0
R0100T0024L020	1	2	0.4°	1.6	20	3.6	4.6°	2.13	70	6	3	●	1	20.7	21.3	22.3	23.5
R0100T0024L025	1	2	0.4°	1.6	25	3.6	3.9°	2.20	70	6	3	●	1	25.8	26.4	27.8	29.3
R0100T0024L030	1	2	0.4°	1.6	30	3.6	3.4°	2.27	80	6	3	●	1	30.8	31.6	33.2	35.0
R0100T0024L035	1	2	0.4°	1.6	35	3.6	2.9°	2.34	80	6	3	●	1	35.8	36.7	38.6	No interference
R0100T0024L040	1	2	0.4°	1.6	40	3.6	2.6°	2.41	80	6	3	●	1	40.8	41.9	44.0	No interference
R0100T0054L020	1	2	0.9°	1.6	20	3.6	4.7°	2.42	70	6	3	●	1	–	20.8	21.9	23.0
R0100T0054L025	1	2	0.9°	1.6	25	3.6	4.0°	2.57	70	6	3	●	1	–	25.8	27.2	28.6
R0100T0054L030	1	2	0.9°	1.6	30	3.6	3.4°	2.73	80	6	3	●	1	–	30.9	32.5	34.2
R0100T0054L035	1	2	0.9°	1.6	35	3.6	3.0°	2.89	80	6	3	●	1	–	35.9	37.7	39.8
R0100T0054L040	1	2	0.9°	1.6	40	3.6	2.7°	3.04	80	6	3	●	1	–	40.9	43.0	No interference
R0100T0054L050	1	2	0.9°	1.6	50	3.6	2.2°	3.36	110	6	3	●	1	–	51.0	53.6	No interference
R0100T0054L060	1	2	0.9°	1.6	60	3.6	1.9°	3.67	110	6	3	●	1	–	61.0	No interference	No interference
R0100T0054L070	1	2	0.9°	1.6	70	3.6	1.6°	3.99	110	6	3	●	1	–	71.1	No interference	No interference
R0100T0130L025	1	2	1.5°	1.6	25	3.6	4.1°	3.02	70	6	3	●	1	–	–	26.4	27.9
R0100T0130L030	1	2	1.5°	1.6	30	3.6	3.5°	3.28	80	6	3	●	1	–	–	31.6	33.3
R0100T0130L035	1	2	1.5°	1.6	35	3.6	3.1°	3.54	80	6	3	●	1	–	–	36.7	38.7
R0100T0130L040	1	2	1.5°	1.6	40	3.6	2.7°	3.81	80	6	3	●	1	–	–	41.8	No interference
R0125T0054L020	1.25	2.5	0.9°	2	20	4.5	4.3°	2.89	60	6	3	●	1	–	20.8	21.9	23.1
R0125T0054L030	1.25	2.5	0.9°	2	30	4.5	3.1°	3.20	80	6	3	●	1	–	30.9	32.5	34.2
R0125T0054L040	1.25	2.5	0.9°	2	40	4.5	2.4°	3.52	80	6	3	●	1	–	40.9	43.1	No interference
R0125T0130L020	1.25	2.5	1.5°	2	20	4.5	4.4°	3.21	60	6	3	●	1	–	–	21.4	22.5
R0125T0130L030	1.25	2.5	1.5°	2	30	4.5	3.1°	3.74	80	6	3	●	1	–	–	31.6	33.3
R0125T0130L040	1.25	2.5	1.5°	2	40	4.5	2.5°	4.26	80	6	3	●	1	–	–	41.9	No interference
R0150T0024L020	1.5	3	0.4°	2	20	5	3.8°	3.11	60	6	3	●	1	20.7	21.3	22.3	23.5
R0150T0024L025	1.5	3	0.4°	2	25	5	3.1°	3.18	80	6	3	●	1	25.8	26.4	27.7	29.2
R0150T0024L030	1.5	3	0.4°	2	30	5	2.7°	3.25	80	6	3	●	1	30.8	31.6	33.2	No interference
R0150T0024L040	1.5	3	0.4°	2	40	5	2.1°	3.39	80	6	3	●	1	40.9	41.9	44.0	No interference
R0150T0024L050	1.5	3	0.4°	2	50	5	1.7°	3.53	100	6	3	●	1	50.9	52.2	No interference	No interference
R0150T0054L020	1.5	3	0.9°	2	20	5	3.8°	3.37	60	6	3	●	1	–	20.9	21.9	23.0
R0150T0054L030	1.5	3	0.9°	2	30	5	2.7°	3.69	80	6	3	●	1	–	30.9	32.5	No interference
R0150T0054L040	1.5	3	0.9°	2	40	5	2.1°	4.00	80	6	3	●	1	–	41.0	43.1	No interference
R0150T0054L050	1.5	3	0.9°	2	50	5	1.7°	4.31	100	6	3	●	1	–	51.0	No interference	No interference
R0150T0054L060	1.5	3	0.9°	2	60	5	2.3°	4.63	110	8	3	●	1	–	61.1	64.2	No interference
R0150T0054L070	1.5	3	0.9°	2	70	5	2.0°	4.94	120	8	3	●	1	–	71.1	74.8	No interference
R0150T0130L040	1.5	3	1.5°	2	40	5	2.2°	4.73	80	6	3	●	1	–	–	41.9	No interference
R0150T0130L050	1.5	3	1.5°	2	50	5	2.8°	5.26	110	8	3	●	1	–	–	52.2	No interference
R0150T0130L060	1.5	3	1.5°	2	60	5	2.4°	5.78	110	8	3	●	1	–	–	62.4	No interference
R0150T0130L070	1.5	3	1.5°	2	70	5	2.1°	6.30	120	8	3	●	1	–	–	72.7	No interference
R0200T0054L030	2	4	0.9°	3	30	6	3.5°	4.65	90	8	3	●	1	–	30.9	32.5	34.2
R0200T0054L040	2	4	0.9°	3	40	6	2.7°	4.97	90	8	3	●	1	–	41.0	43.0	No interference
R0200T0054L050	2	4	0.9°	3	50	6	2.2°	5.28	110	8	3	●	1	–	51.0	53.6	No interference
R0200T0054L060	2	4	0.9°	3	60	6	1.9°	5.60	110	8	3	●	1	–	61.1	No interference	No interference
R0250T0054L035	2.5	5	0.9°	3.5	35	6.5	2.4°	5.80	90	8	3	●	1	–	35.9	37.7	No interference
R0250T0054L040	2.5	5	0.9°	3.5	40	6.5	2.2°	5.95	90	8	3	●	1	–	41.0	43.0	No interference
R0250T0054L050	2.5	5	0.9°	3.5	50	6.5	1.8°	6.27	110	8	3	●	1	–	51.0	No interference	No interference
R0250T0054L060	2.5	5	0.9°	3.5	60	6.5	1.5°	6.58	110	8	3	●	1	–	61.1	No interference	No interference

IMPACT MIRACLE END MILL

VF-SD

End mill, Short cut length, 4/6 flute, For hardened materials

0 – -0.02



UWC VF 30° 45°

D1<3 3≤D1 D1<3 3≤D1

● End mill with Impact Miracle coating for high hardened materials.

Unit : mm

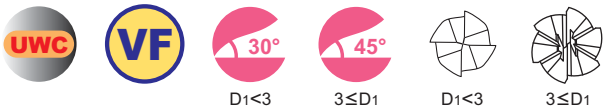
Order Number	Dia. D1	Length of Cut ap	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
VFSDD0100	1	2	45	6	4	●	1
D0150	1.5	3	45	6	4	●	1
D0200	2	4	45	6	4	●	1
D0250	2.5	5	45	6	4	●	1
D0300	3	6	45	6	6	●	1
D0350	3.5	7	45	6	6	●	1
D0400	4	8	45	6	6	●	1
D0500	5	10	50	6	6	●	1
D0600	6	12	50	6	6	●	2
D0800	8	16	60	8	6	●	2
D1000	10	20	70	10	6	●	2
D1200	12	24	75	12	6	●	2

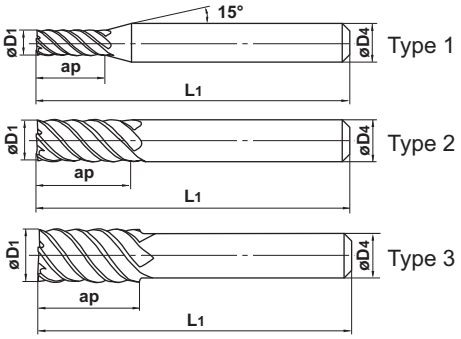
● : Inventory maintained.

VF-MD

End mill, Medium cut length, 4/6 flute, For hardened materials

D1≤12 0 −-0.02
12<D1 0 −-0.03





● End mill with Impact Miracle coating for high hardened materials.

Unit : mm

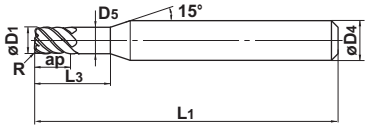
Order Number	Dia. D1	Length of Cut ap	Overall Length L1	Shank Dia. D4	No. of Flute N	Stock	Type
VFMDD0100	1	3.5	60	6	4	●	1
D0150	1.5	5	60	6	4	●	1
D0200	2	7	60	6	4	●	1
D0250	2.5	8	60	6	4	●	1
D0300	3	10	60	6	6	●	1
D0400	4	12	60	6	6	●	1
D0500	5	15	60	6	6	●	1
D0600	6	15	60	6	6	●	2
D0800	8	20	75	8	6	●	2
D1000	10	25	80	10	6	●	2
D1200	12	30	100	12	6	●	2
D1400	14	35	105	12	6	●	3
D1500	15	40	110	16	6	●	1
D1600	16	40	110	16	6	●	2
D1800	18	40	120	16	6	●	3
D2000	20	45	125	20	6	●	2
D2200	22	45	135	20	6	●	3
D2500	25	60	160	25	6	●	2

IMPACT MIRACLE END MILL

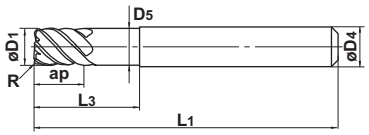
VF-SDRB

Corner radius, Short cut length, 6 flute, For hardened materials

0 – -0.02



Type 1



Type 2

- 6 flute end mill with Impact Miracle coating for high hardened materials.

Unit : mm

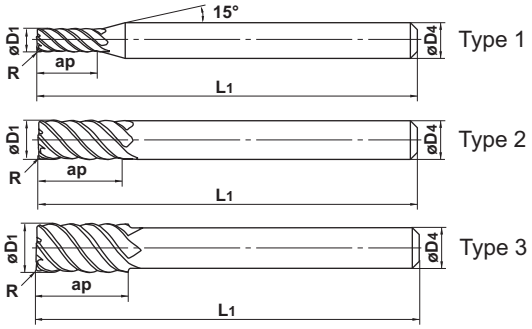
Order Number	Dia. D1	Length of Cut ap	Neck Length L3	Neck Dia D5	Overall Length L1	Shank Dia. D4	Corner R R	No. of Flute N	Stock	Type
VFSDRBD0300R030	3	3	9	2.9	45	6	0.3	6	●	1
D0400R030	4	4	12	3.9	45	6	0.3	6	●	1
D0500R030	5	5	15	4.9	50	6	0.3	6	●	1
D0600R030	6	6	18	5.85	50	6	0.3	6	●	2
D0600R050	6	6	18	5.85	50	6	0.5	6	●	2
D0600R100	6	6	18	5.85	50	6	1	6	●	2
D0800R030	8	8	24	7.85	60	8	0.3	6	●	2
D0800R050	8	8	24	7.85	60	8	0.5	6	●	2
D0800R100	8	8	24	7.85	60	8	1	6	●	2
D1000R050	10	10	30	9.7	70	10	0.5	6	●	2
D1000R100	10	10	30	9.7	70	10	1	6	●	2
D1200R050	12	12	36	11.7	75	12	0.5	6	●	2
D1200R100	12	12	36	11.7	75	12	1	6	●	2

● : Inventory maintained.

VF-MDRB

Corner radius, Medium cut length, 6 flute, For hardened materials

D1≤12 0 −-0.02
12<D1 0 −-0.03



- 6 flute corner radius end mill with Impact Miracle coating for high hardened materials.

Unit : mm

Order Number	Dia. D1	Length of Cut ap	Overall Length L1	Shank Dia. D4	Corner R R	No. of Flute N	Stock	Type
VFMDRBD0300R030	3	10	60	6	0.3	6	●	1
D0400R030	4	12	60	6	0.3	6	●	1
D0500R030	5	15	60	6	0.3	6	●	1
D0600R030	6	15	60	6	0.3	6	●	2
D0600R050	6	15	60	6	0.5	6	●	2
D0600R100	6	15	60	6	1	6	●	2
D0800R030	8	20	75	8	0.3	6	●	2
D0800R050	8	20	75	8	0.5	6	●	2
D0800R100	8	20	75	8	1	6	●	2
D1000R030	10	25	80	10	0.3	6	●	2
D1000R050	10	25	80	10	0.5	6	●	2
D1000R100	10	25	80	10	1	6	●	2
D1200R050	12	30	100	12	0.5	6	●	2
D1200R100	12	30	100	12	1	6	●	2
D1600R100	16	40	110	16	1	6	●	2
D1600R150	16	40	110	16	1.5	6	●	2
D1800R100	18	40	120	16	1	6	●	3
D1800R150	18	40	120	16	1.5	6	●	3
D2000R100	20	45	125	20	1	6	●	2
D2000R150	20	45	125	20	1.5	6	●	2
D2000R200	20	45	125	20	2	6	●	2

VF-2SSB

Ball nose, Short cut length, 2 flute, For hardened materials

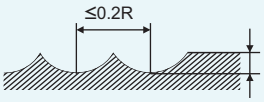
VF-2SB

Ball nose, Short cut length, 2 flute, For hardened materials

Work material	Hardened steel (−55HRC) NAK, JIS SKD61, JIS SUS420					Hardened steel (55−62HRC) JIS SKD11					Hardened steel (62−70HRC) JIS SKS, JIS SKH				
R (mm)	α≤15°		α>15°		Depth of cut (mm)	α≤15°		α>15°		Depth of cut (mm)	α≤15°		α>15°		Depth of cut (mm)
	Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)		Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)		Revolution (min^{-1})	Feed rate (mm/min)	Revolution (min^{-1})	Feed rate (mm/min)	
R 0.1	40,000	320	40,000	240	0.003	40,000	320	40,000	160	0.003	40,000	320	40,000	160	0.002
R 0.15	40,000	640	40,000	560	0.01	40,000	640	40,000	400	0.007	40,000	640	40,000	400	0.005
R 0.2	40,000	1,600	40,000	1,200	0.02	40,000	1,400	40,000	1,000	0.015	40,000	1,200	40,000	1,000	0.01
R 0.3	40,000	3,200	40,000	1,600	0.03	40,000	2,800	40,000	1,200	0.025	40,000	2,000	40,000	1,200	0.02
R 0.4	40,000	6,400	40,000	2,400	0.05	40,000	4,000	40,000	1,600	0.04	40,000	2,800	40,000	1,600	0.03
R 0.5	40,000	8,000	40,000	3,200	0.06	40,000	5,600	40,000	2,400	0.05	40,000	3,600	32,000	1,300	0.04
R 0.75	40,000	9,600	40,000	4,000	0.09	40,000	7,200	32,000	2,500	0.075	32,000	4,500	21,000	1,200	0.05
R 1	40,000	9,600	39,000	4,700	0.11	40,000	8,000	24,000	2,400	0.1	24,000	3,800	16,000	1,000	0.07
R 1.25	40,000	10,400	32,000	4,500	0.12	37,000	8,100	19,000	2,300	0.11	19,000	3,400	13,000	1,000	0.08
R 1.5	40,000	12,000	27,000	4,300	0.13	32,000	7,700	16,000	2,200	0.12	16,000	3,200	11,000	880	0.09
R 2	32,000	10,880	20,000	3,600	0.15	24,000	6,200	12,000	1,900	0.13	12,000	2,400	8,000	800	0.1
R 2.5	25,000	9,000	16,000	2,900	0.2	19,000	5,300	9,600	1,700	0.15	9,600	2,100	6,000	600	0.1
R 3	21,000	8,400	13,000	2,600	0.25	16,000	4,800	8,000	1,600	0.2	8,000	1,700	5,000	600	0.11
R 4	16,000	6,400	10,000	2,000	0.3	12,000	3,600	6,000	1,200	0.2	6,000	1,400	4,000	480	0.11
R 5	13,000	5,200	8,000	1,700	0.5	10,000	3,200	4,800	960	0.2	4,800	1,100	3,000	420	0.12
R 6	9,000	3,600	6,000	1,300	0.5	7,000	2,200	3,600	720	0.3	3,600	860	2,200	310	0.12
R 8	6,000	2,400	4,000	1,000	0.5	5,000	1,600	2,500	500	0.3	2,500	650	1,500	240	0.15
R10	4,500	1,800	3,000	780	0.5	4,000	1,300	1,800	360	0.3	1,800	470	1,000	160	0.15

Depth of cut

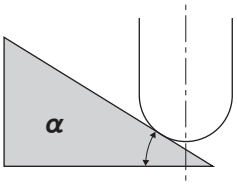
Pick feed rates should be chosen according to the surface finish required.The table above should be used as a reference start point.



≤Please refer to the list above for depth of cut.

R:Radius

1) If the rigidity of the machine or the workpiece installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.
2) If the depth of cut is shallow, the revolution and feed rate can be increased. If accuracy is important, please reduce the feed rate.
3) α is the inclination angle of the machined surface.



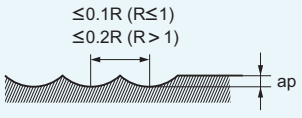
VF-2XLB

Ball nose, Long cut length, 2 flute, For hardened materials

Work material		Hardened steel (40—55HRC) NAK, JIS SKD61, STAVAX			Hardened steel (55—62HRC) JIS SKD11, HSS		
R (mm)	Neck length (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut ap (mm)
R 0.1	0.5	40,000	300	0.003	40,000	300	0.002
	1	40,000	300	0.002	40,000	300	0.002
	1.5	40,000	300	0.001	40,000	200	0.001
R 0.15	1	40,000	500	0.007	40,000	500	0.005
	1.5	40,000	500	0.005	40,000	500	0.003
	2	40,000	500	0.003	40,000	500	0.002
R 0.2	1	40,000	1,400	0.015	40,000	1,400	0.01
	1.5	40,000	1,000	0.01	40,000	1,000	0.006
	2	40,000	1,000	0.01	40,000	1,000	0.006
	2.5	40,000	700	0.005	40,000	700	0.003
	3	40,000	700	0.005	40,000	700	0.003
R 0.25	1.5	40,000	2,000	0.02	40,000	2,000	0.015
	2	40,000	2,000	0.02	40,000	2,000	0.015
	3	40,000	1,200	0.015	40,000	1,200	0.01
	4	36,000	900	0.01	36,000	900	0.007
	5	36,000	700	0.007	36,000	700	0.005
R 0.3	2	40,000	2,800	0.03	40,000	2,800	0.02
	3	40,000	2,800	0.03	40,000	2,800	0.02
	4	35,000	2,000	0.02	35,000	2,000	0.015
	5	30,000	1,000	0.01	30,000	1,000	0.007
	6	30,000	800	0.008	30,000	800	0.005
R 0.4	2	40,000	3,500	0.04	40,000	3,500	0.03
	3	40,000	3,000	0.04	40,000	3,000	0.03
	4	40,000	3,000	0.02	40,000	3,000	0.015
	6	30,000	1,600	0.02	30,000	1,600	0.01
	8	25,000	1,000	0.01	25,000	1,000	0.007
R 0.5	3	40,000	4,000	0.05	40,000	4,000	0.04
	4	40,000	4,000	0.05	40,000	4,000	0.04
	5	40,000	3,000	0.03	40,000	3,000	0.02
	6	35,000	2,000	0.03	35,000	2,000	0.02
	8	30,000	1,600	0.02	30,000	1,600	0.01
	10	20,000	1,000	0.01	20,000	1,000	0.01
R 0.6	6	40,000	4,000	0.05	40,000	4,000	0.04
	8	40,000	3,000	0.05	27,000	2,000	0.04
	10	27,000	1,900	0.03	24,000	1,700	0.02
	12	16,000	1,000	0.03	16,000	1,000	0.02

Work material		Hardened steel (40—55HRC) NAK, JIS SKD61, STAVAX			Hardened steel (55—62HRC) JIS SKD11, HSS		
R (mm)	Neck length (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut ap (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut ap (mm)
R 0.75	6	40,000	5,000	0.07	32,000	4,000	0.06
	8	40,000	5,000	0.07	28,000	3,500	0.06
	10	40,000	4,500	0.06	21,000	2,400	0.04
	12	32,000	3,400	0.04	19,000	2,000	0.03
	14	15,000	1,400	0.04	13,000	1,200	0.03
R 1	6	40,000	6,000	0.1	24,000	3,400	0.1
	8	40,000	5,000	0.1	24,000	3,000	0.1
	10	40,000	5,000	0.08	24,000	3,000	0.07
	12	40,000	5,000	0.08	24,000	2,600	0.05
	14	40,000	5,000	0.06	21,000	2,300	0.05
	16	32,000	3,500	0.05	16,000	1,700	0.03
	18	24,000	2,400	0.04	13,000	1,300	0.03
	20	10,000	1,000	0.04	10,000	1,000	0.03
R 1.5	8	32,000	6,400	0.15	16,000	3,000	0.15
	10	32,000	5,100	0.15	16,000	2,200	0.15
	12	32,000	5,100	0.13	16,000	2,200	0.13
	14	32,000	4,500	0.13	16,000	2,200	0.1
	16	32,000	4,500	0.1	14,000	1,600	0.1
	20	27,000	3,800	0.1	14,000	1,600	0.06
	25	21,000	2,700	0.08	11,000	1,200	0.06
	30	6,000	700	0.08	6,000	600	0.05
R 2	10	24,000	4,800	0.2	12,000	2,200	0.2
	12	24,000	4,800	0.2	12,000	2,200	0.2
	14	24,000	3,800	0.15	12,000	1,500	0.15
	16	24,000	3,800	0.15	12,000	1,500	0.15
	20	24,000	3,800	0.15	12,000	1,500	0.15
	25	24,000	3,800	0.15	8,000	900	0.1
	30	20,000	3,000	0.1	7,000	800	0.1
	35	12,000	1,700	0.1	6,000	700	0.08
R 2.5	20	19,000	3,400	0.2	10,000	1,400	0.2
	25	19,000	3,400	0.2	10,000	1,400	0.2
	30	19,000	3,200	0.15	8,000	1,000	0.15
	35	16,000	2,700	0.1	6,000	700	0.1
R 3	30	16,000	3,500	0.2	8,000	1,000	0.2

Depth of cut



R:Radius

1) If the inclination of machining surface is very big,or cutting load is big,please reduce the revolution and the feed rate proportionately.
2) If using the small size,we recommend coolant mist.
3) If the depth of cut is shallow,the feed rate can be increased.

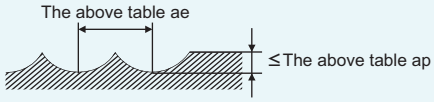
VF-2SDB

Ball nose, Short cut length, 2 flute, Strong geometry type

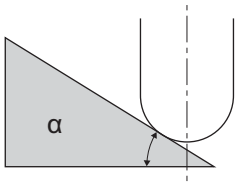
VF-2SDBL

Ball nose, Short cut length, 2 flute, Strong geometry type, Long shank

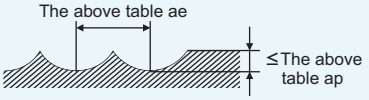
Overhang below 5D (D is end mill diameter)

Work material	Thermal refining steel, Pre-hardened steel (−45HRC) NAK, HPM						Hardened steel, Thermal refining steel (45−55HRC) HPM, JIS SKD61, JIS SUS420						Hardened steel (55−62HRC) JIS SKD11					
	α≤15°		α>15°				α≤15°		α>15°				α≤15°		α>15°			
R 0.5	40,000	5,200	36,000	2,300	0.10	0.25	40,000	5,200	36,000	2,300	0.10	0.25	40,000	5,000	40,000	2,400	0.05	0.10
R 1	40,000	6,000	36,000	3,500	0.20	0.50	40,000	6,000	36,000	3,500	0.20	0.50	36,000	5,000	24,000	2,400	0.10	0.20
R 1.5x3	29,000	4,600	19,000	2,400	0.20	0.50	25,000	4,000	16,000	2,000	0.20	0.50	17,000	2,400	11,000	1,000	0.12	0.30
R 1.5	37,000	7,000	24,000	3,000	0.30	0.75	37,000	7,000	24,000	3,000	0.30	0.75	25,000	6,000	16,000	2,200	0.12	0.30
R 2x4	24,000	4,300	15,000	2,200	0.25	0.70	19,000	3,400	13,000	1,700	0.25	0.70	12,000	1,900	8,200	900	0.13	0.40
R 2	30,000	6,500	19,000	2,800	0.40	1.00	28,000	6,000	19,000	2,600	0.40	1.00	18,000	4,800	12,000	2,000	0.13	0.40
R 2.5	25,000	6,000	16,000	2,600	0.50	1.30	22,000	5,000	16,000	2,300	0.50	1.25	15,000	4,200	9,500	1,700	0.15	0.50
R 3	22,000	6,000	14,000	2,400	0.60	1.80	18,000	4,500	12,000	1,900	0.60	1.50	12,000	3,500	8,000	1,600	0.20	0.60
R 4	19,000	5,200	12,000	2,200	0.80	2.40	15,000	3,800	9,500	1,700	0.80	2.00	9,800	3,000	6,500	1,300	0.20	0.80
R 5	15,000	4,300	9,500	2,000	1.00	3.00	11,000	3,000	7,000	1,500	1.00	2.50	7,500	2,400	5,000	1,000	0.20	1.00
R 6	12,000	3,400	8,000	1,800	1.20	3.60	9,000	2,400	6,000	1,400	1.20	3.00	6,000	1,900	4,000	800	0.30	1.20
R 8	9,000	2,600	6,000	1,500	1.60	4.80	7,000	1,900	4,500	1,100	1.60	4.00	4,500	1,500	3,000	600	0.30	1.60
R10	7,500	2,200	4,800	1,200	2.00	6.00	5,500	1,500	3,600	900	2.00	5.00	3,600	1,200	2,500	500	0.30	2.00
Depth of cut	Pick feed rates should be chosen according to the surface finish required.The table above should be used as a reference start point. 																	

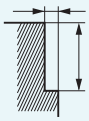
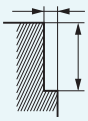
1) If the rigidity of the machine or the workpiece installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.
2) If the depth of cut is shallow, the revolution and feed rate can be increased. If accuracy is important, please reduce the feed rate.
3) α is the inclination angle of the machined surface.



Overhang 7D (D is end mill diameter)

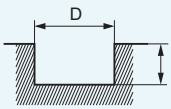
Work material	Thermal refining steel, Pre-hardened steel (−45HRC) NAK, HPM				Hardened steel, Thermal refining steel (45−55HRC) HPM, JIS SKD61, JIS SUS420			
R 1.5x3	16,000	2,000	0.10	0.30	13,000	1,500	0.10	0.30
R 2x4	13,000	2,000	0.15	0.50	10,000	1,500	0.15	0.50
R 3	10,000	2,000	0.20	1.00	8,000	1,600	0.20	0.80
R 4	8,000	1,800	0.30	1.50	6,400	1,400	0.40	1.20
R 5	6,000	1,600	0.40	2.00	4,800	1,200	0.40	1.60
R 6	5,000	1,300	0.45	2.40	4,000	1,000	0.45	2.00
R 8	3,800	1,000	0.60	3.00	3,100	800	0.60	2.50
R10	3,000	800	0.80	4.00	2,500	650	0.80	3.00
Depth of cut	Pick feed rates should be chosen according to the surface finish required.The table above should be used as a reference start point. 							

1) The cutting conditions above are guide only end mills which outer diameter as same as shank diameter.
2) If the rigidity of the machine or the workpiece installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.
   If the depth of cut is shallow, the revolution and feed rate can be increased. If accuracy is important, please reduce the feed rate.
3) The above table should not be applied to hardened steels (over 55 HRC hardness)

Work material	Alloy steel, Hardened steel (−55HRC) NAK, JIS SKD61, JIS SUS420			Hardened steel (55−62HRC) JIS SKD11			Hardened steel (62−70HRC) JIS SKS, JIS SKH		
Dia. (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)
1	40,000	1,200	0.05	40,000	800	0.03	32,000	500	0.02
2	40,000	2,000	0.1	24,000	1,000	0.05	16,000	600	0.05
3	32,000	3,800	0.2	16,000	1,900	0.1	11,000	1,200	0.05
4	24,000	4,400	0.2	12,000	2,200	0.1	8,000	1,300	0.05
6	16,000	5,800	0.3	8,000	2,900	0.2	5,300	1,800	0.1
8	12,000	5,800	0.4	6,000	2,900	0.2	4,000	1,800	0.1
10	9,600	5,800	0.5	4,800	2,900	0.3	3,200	1,800	0.2
12	8,000	4,800	0.6	4,000	2,400	0.3	2,700	1,500	0.2
16	6,000	3,600	0.8	3,000	1,800	0.5	2,000	1,100	0.3
20	4,800	2,900	1.0	2,400	1,400	0.5	1,600	880	0.3
25	3,800	2,300	1.0	1,900	1,100	0.5	1,300	720	0.3
Depth of cut	 Please refer to the list above for depth of cut. ≤1.5D			 Please refer to the list above for depth of cut. ≤1.0D					

D:Dia.

Slot milling with small diameter tools

Work material	Alloy steel, Hardened steel (−55HRC) NAK, JIS SKD61			Hardened steel (55−65HRC) JIS SKD11, JIS SKH		
Dia. (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)
1	15,000	300	0.1	9,500	110	0.05
2	8,000	320	0.2	4,800	190	0.1
Depth of cut	 Please refer to the list above for depth of cut.					

D:Dia.

1) If the rigidity of the machine or the workpiece installation is very low, or chattering and noise are generated, please reduce the revolution and the feed rate proportionately.
2) Climb cutting is recommended for side milling.
3) Air blow recommended to disperse chips effectively.

IMPACT MIRACLE END MILL

VF-3XB

Ball nose, 3 flute, Taper neck, For hardened materials

Work material			Carbon steel, Alloy steel (−30HRC) JIS S55C			Alloy steel, Pre-hardened steel (30−45HRC) PX5, NAK			Hardened steel (45−55HRC) JIS SKD61, STAVAX			Hardened steel (55−62HRC) JIS SKD11		
R (mm)	Taper angle one side	Neck length (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)
R0.4	0.4°	6	34,000	2,700	0.03	31,000	2,200	0.025	24,000	1,700	0.02	19,000	1,400	0.015
		8	31,000	2,100	0.02	29,000	1,700	0.02	22,000	1,300	0.015	18,000	1,000	0.01
		12	28,000	2,000	0.015	26,000	1,600	0.01	20,000	1,200	0.01	16,000	960	0.007
	0.9°	8	31,000	2,200	0.02	29,000	1,800	0.02	22,000	1,400	0.015	18,000	1,100	0.01
		12	28,000	2,100	0.015	26,000	1,700	0.01	20,000	1,300	0.01	16,000	1,000	0.007
		16	25,000	1,100	0.01	23,000	910	0.01	18,000	700	0.008	14,000	560	0.006
R0.5	0.4°	8	27,000	2,700	0.04	25,000	2,200	0.04	19,000	1,700	0.03	15,000	1,400	0.02
		10	24,000	2,200	0.03	22,000	1,800	0.025	17,000	1,400	0.02	14,000	1,100	0.015
		12	24,000	2,200	0.03	22,000	1,800	0.025	17,000	1,400	0.02	14,000	1,100	0.015
		16	22,000	2,100	0.03	21,000	1,700	0.025	16,000	1,300	0.02	13,000	1,000	0.015
		20	20,000	1,400	0.015	18,000	1,200	0.01	14,000	900	0.01	11,000	720	0.007
		25	18,000	1,300	0.015	17,000	1,000	0.01	13,000	800	0.009	10,000	640	0.006
		30	15,000	960	0.01	14,000	780	0.01	11,000	600	0.008	8,800	480	0.006
		35	14,000	800	0.008	13,000	650	0.007	10,000	500	0.006	8,000	400	0.004
	0.9°	8	27,000	2,900	0.04	25,000	2,300	0.04	19,000	1,800	0.03	15,000	1,400	0.02
		12	24,000	2,400	0.03	22,000	2,000	0.025	17,000	1,500	0.02	14,000	1,200	0.015
		16	22,000	2,200	0.03	21,000	1,800	0.025	16,000	1,400	0.02	13,000	1,100	0.015
		20	20,000	1,600	0.015	18,000	1,300	0.01	14,000	1,000	0.01	11,000	800	0.007
		25	18,000	1,400	0.015	17,000	1,200	0.01	13,000	900	0.009	10,000	720	0.006
		30	15,000	1,100	0.01	14,000	910	0.009	11,000	700	0.008	8,800	560	0.006
		35	14,000	960	0.008	13,000	780	0.007	10,000	600	0.006	8,000	480	0.004
		40	11,000	800	0.007	11,000	650	0.006	8,000	500	0.005	6,400	400	0.003
		50	8,400	610	0.006	7,800	490	0.005	6,000	380	0.004	4,800	300	0.003
		60	7,000	510	0.004	6,500	400	0.004	5,000	320	0.003	4,000	260	0.002
		70	7,000	480	0.003	6,500	390	0.002	5,000	300	0.002	4,000	240	0.001
	1.5°	12	24,000	2,600	0.03	22,000	2,100	0.025	17,000	1,600	0.02	14,000	1,300	0.015
		16	22,000	2,400	0.03	21,000	2,000	0.025	16,000	1,500	0.02	13,000	1,200	0.015
		20	20,000	1,800	0.015	18,000	1,400	0.01	14,000	1,100	0.01	11,000	880	0.007
		25	18,000	1,600	0.015	17,000	1,300	0.01	13,000	1,000	0.009	11,000	800	0.006
		30	15,000	1,300	0.01	14,000	1,000	0.01	11,000	800	0.008	8,800	640	0.006
		35	14,000	1,100	0.008	13,000	910	0.007	10,000	700	0.006	8,000	560	0.004
R0.75	0.4°	10	18,000	2,700	0.06	17,000	2,200	0.05	13,000	1,700	0.04	10,000	1,400	0.03
		15	17,000	2,200	0.04	16,000	1,800	0.04	12,000	1,400	0.03	9,600	1,100	0.02
		20	17,000	2,100	0.03	16,000	1,700	0.025	12,000	1,300	0.02	9,600	1,000	0.015
		30	14,000	1,600	0.015	13,000	1,300	0.01	10,000	1,000	0.01	8,000	800	0.007
	0.9°	15	17,000	2,400	0.04	16,000	2,000	0.04	12,000	1,500	0.03	9,600	1,200	0.02
		20	17,000	2,200	0.03	16,000	1,800	0.025	12,000	1,400	0.02	9,600	1,100	0.015
		30	14,000	1,800	0.015	13,000	1,400	0.01	10,000	1,100	0.01	8,000	880	0.007
		40	13,000	1,300	0.01	12,000	1,000	0.01	9,000	800	0.008	7,200	640	0.006
	1.5°	15	17,000	2,600	0.04	16,000	2,100	0.04	12,000	1,600	0.03	9,600	1,300	0.02
		20	17,000	2,400	0.03	16,000	2,000	0.025	12,000	1,500	0.02	9,600	1,200	0.015
		30	14,000	2,000	0.015	13,000	1,600	0.01	10,000	1,200	0.01	8,000	960	0.007

Work material			Carbon steel, Alloy steel (−30HRC) JIS S55C			Alloy steel, Pre-hardened steel (30−45HRC) PX5, NAK			Hardened steel (45−55HRC) JIS SKD61, STAVAX			Hardened steel (55−62HRC) JIS SKD11		
R (mm)	Taper angle one side	Neck length (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)	Revolution (min^{-1})	Feed rate (mm/min)	Depth of cut (mm)
R1	0.4°	16	15,000	3,200	0.07	14,000	2,600	0.06	11,000	2,000	0.05	8,800	1,600	0.03
		20	14,000	2,400	0.06	13,000	2,000	0.05	10,000	1,500	0.04	8,000	1,200	0.03
		25	14,000	2,100	0.04	13,000	1,700	0.04	10,000	1,300	0.03	8,000	1,000	0.02
		30	13,000	1,800	0.03	12,000	1,400	0.03	9,000	1,100	0.025	7,200	880	0.02
		35	13,000	1,600	0.03	12,000	1,300	0.025	9,000	1,000	0.02	7,200	800	0.015
		40	12,000	1,400	0.015	11,000	1,200	0.01	8,500	900	0.01	6,800	720	0.007
	0.9°	20	14,000	2,600	0.06	13,000	2,100	0.05	10,000	1,600	0.04	8,000	1,300	0.03
		25	14,000	2,200	0.05	13,000	1,800	0.04	10,000	1,400	0.03	8,000	1,100	0.025
		30	13,000	1,900	0.04	12,000	1,600	0.04	9,000	1,200	0.03	7,200	960	0.02
		35	13,000	1,800	0.04	12,000	1,400	0.03	9,000	1,100	0.025	7,200	880	0.02
		40	12,000	1,600	0.03	11,000	1,300	0.025	8,500	1,000	0.02	6,800	800	0.015
		50	11,000	1,400	0.015	10,000	1,200	0.01	8,000	900	0.01	6,400	720	0.007
		60	9,800	1,100	0.007	9,100	910	0.006	7,000	700	0.005	5,600	560	0.003
		70	8,400	960	0.004	7,800	780	0.004	6,000	600	0.003	4,800	480	0.002
	1.5°	25	14,000	2,400	0.05	13,000	2,000	0.04	10,000	1,500	0.03	8,000	1,200	0.025
		30	12,600	2,100	0.04	12,000	1,700	0.04	9,000	1,300	0.03	7,200	1,000	0.02
		35	13,000	1,900	0.04	12,000	1,600	0.03	9,000	1,200	0.025	7,200	960	0.02
		40	12,000	1,800	0.03	11,000	1,400	0.025	8,500	1,100	0.02	6,800	880	0.015
R1.25	0.9°	20	13,000	2,900	0.06	12,000	2,300	0.05	9,000	1,800	0.04	7,200	1,400	0.03
		30	12,000	2,600	0.05	11,000	2,100	0.04	8,500	1,600	0.03	6,800	1,300	0.025
		40	11,000	2,200	0.04	9,800	1,800	0.04	7,500	1,400	0.03	6,000	1,100	0.02
	1.5°	20	13,000	3,000	0.06	12,000	2,500	0.05	9,000	1,900	0.04	7,200	1,500	0.03
		30	12,000	2,700	0.05	11,050	2,200	0.04	8,500	1,700	0.03	6,800	1,400	0.025
		40	11,000	2,400	0.04	9,800	2,000	0.04	7,500	1,500	0.03	6,000	1,200	0.02
R1.5	0.4°	20	12,000	3,700	0.13	11,000	3,000	0.1	8,500	2,300	0.09	6,800	1,800	0.06
		30	11,000	2,900	0.07	10,000	2,300	0.06	8,000	1,800	0.05	6,400	1,400	0.03
		40	11,000	2,400	0.06	10,000	2,000	0.05	8,000	1,500	0.04	6,400	1,200	0.03
		50	11,000	2,000	0.04	9,800	1,600	0.04	7,500	1,200	0.03	6,000	960	0.02
	0.9°	20	12,000	3,800	0.13	11,000	3,100	0.1	8,500	2,400	0.09	6,800	1,900	0.06
		30	11,000	3,000	0.07	10,000	2,500	0.06	8,000	1,900	0.05	6,400	1,500	0.03
		40	11,000	2,600	0.06	10,000	2,100	0.05	8,000	1,600	0.04	6,400	1,300	0.03
		50	11,000	2,100	0.04	9,800	1,700	0.04	7,500	1,300	0.03	6,000	1,000	0.02
		60	9,800	2,000	0.03	9,100	1,600	0.025	7,000	1,200	0.02	5,600	960	0.015
		70	9,800	1,800	0.015	9,100	1,400	0.01	7,000	1,100	0.01	5,600	880	0.007
	1.5°	50	11,000	2,200	0.04	9,800	1,800	0.04	7,500	1,400	0.03	6,000	1,100	0.02
		60	9,800	2,100	0.03	9,100	1,700	0.025	7,000	1,300	0.02	5,600	1,000	0.015
		70	9,800	2,000	0.015	9,100	1,600	0.01	7,000	1,200	0.01	5,600	960	0.007
R2	0.9°	30	10,000	3,200	0.3	9,400	2,600	0.25	7,200	2,000	0.2	5,800	1,600	0.15
		40	9,500	2,400	0.15	8,800	2,000	0.12	6,800	1,500	0.1	5,400	1,200	0.07
		50	9,500	2,100	0.1	8,800	1,700	0.1	6,800	1,300	0.08	5,400	1,000	0.06
		60	9,000	1,900	0.07	8,300	1,600	0.06	6,400	1,200	0.05	5,100	960	0.03
R2.5	0.9°	35	8,000	3,500	0.3	7,400	2,900	0.25	5,700	2,200	0.2	4,600	1,800	0.15
		40	8,000	3,200	0.2	7,400	2,600	0.18	5,700	2,000	0.15	4,600	1,600	0.1
		60	7,600	2,400	0.15	7,000	2,000	0.12	5,400	1,500	0.1	4,300	1,200	0.07

1) The above table shows depth of cut. Please control the pick feed (ae) according to machining conditions, up to a maximum of R x 1.5.
2) It is recommend to use high accuracy type machines and holders wherever possible.
3) Please reduce the depth of cut if chattering and noise are generated and reduce the feed rate proportionately.