



EXOCARB® Ball & Radius End Mills Designed for

Vol 1

Additive Manufacturing

AM-EBT • AM-CRE

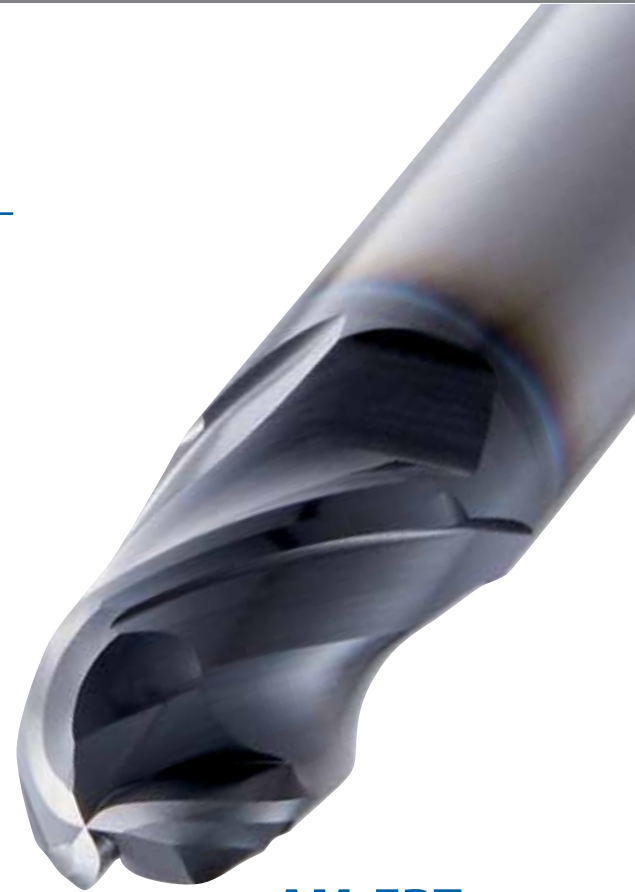
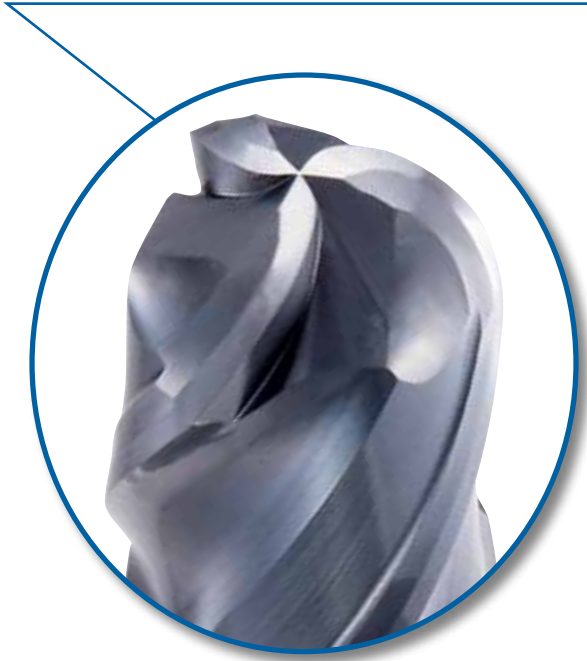


EXOCARB® AM-EBT & AM-CRE

Carbide End Mills Designed for Additive Manufacturing

3D Negative Robust Geometry

optimized for additive manufacturing, even applicable to large depth of cut.



AM-EBT

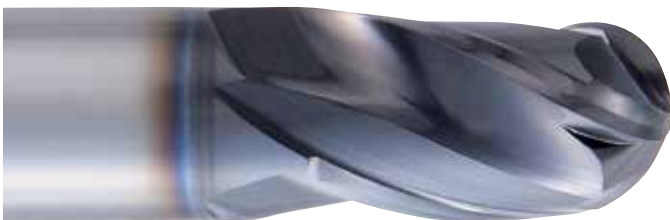
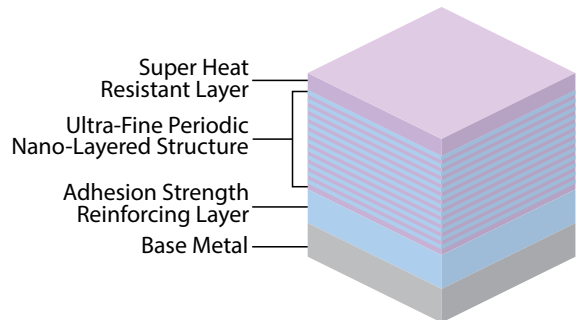
Ball Type

DUROREY Coating (PAT. P)

Superior Heat Resistance and Toughness

OSG's newly developed DUROREY coating, with its unique coating structure, provides superior heat resistance and toughness for high-hardness steel milling. DUROREY coating also suppresses chipping and achieves longer tool life.

Coating Structure



Coating Color	Coating Structure	Hardness (GPa)	Oxidation Temperature (°C)	Heat Resistance	Adhesion Strength	Surface Roughness	Wear Resistance	Welding Resistance	Toughness
Black Gray	Ultra-Fine Periodic Nano-Layered	41	1,300	⊙	○	Fair	⊙	○	○

○ good ⊙ best

DUROREY is a registered trademark of OSG Corporation.





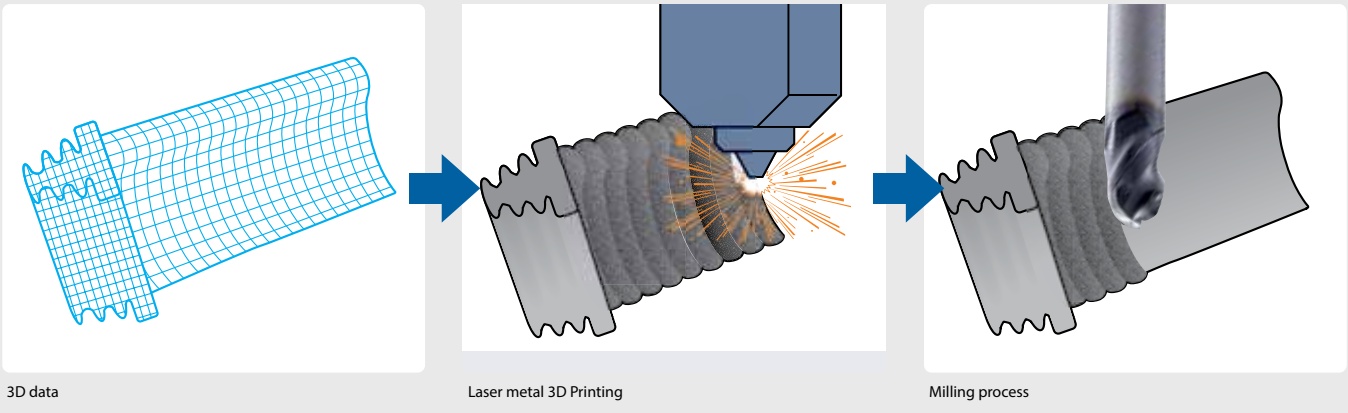
AM-CRE

Radius Type (6-Flute/8-Flute)

Suitable for milling of built-up welding parts

What is Additive Manufacturing?

Unlike conventional processing, where an object is formed by removing excessive materials, additive manufacturing deposits materials layer upon layer to create an object, which is a process similar to 3D printing. By using technology such as 3D printing, on demand parts can be made with low production costs and short delivery times.

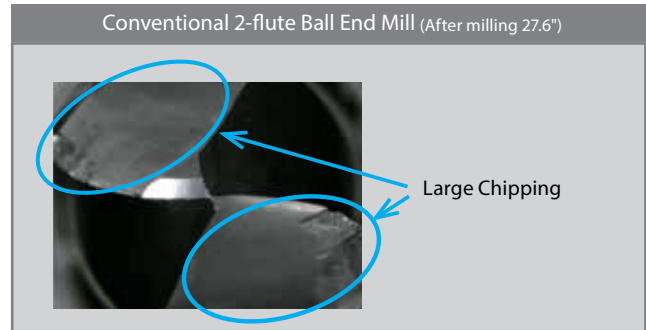
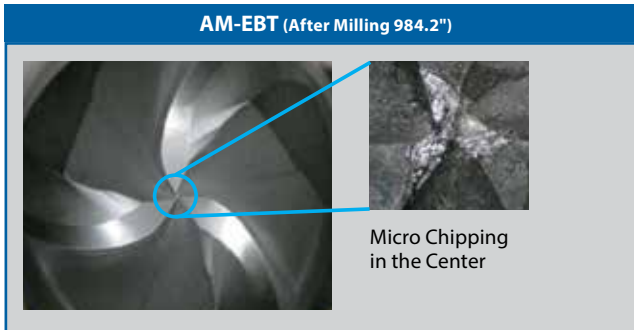
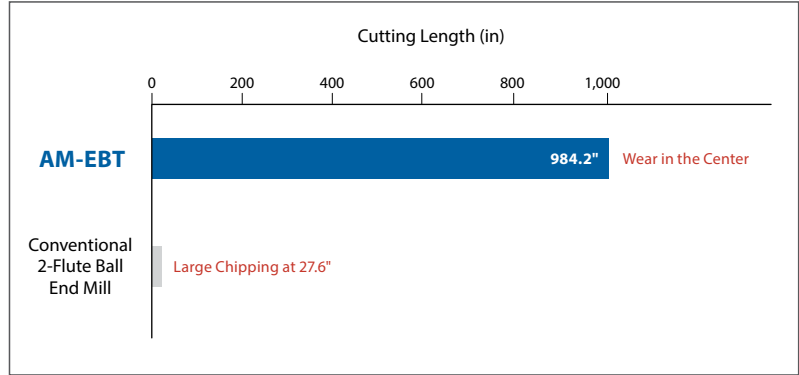


Long Tool Life Milling Built-up Welding Parts

BK-660R

The AM-EBT performed exceptionally even in milling of built-up welding parts with large depth of cut.

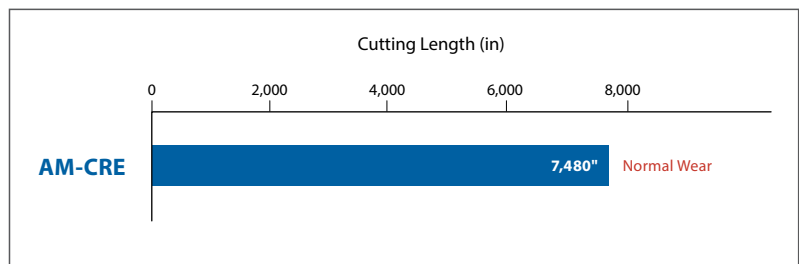
Tool	AM-EBT (R6x12)	Conventional (2-Flute Ball End Mill)
Work Material	BK-660R	
Milling Method	Linear Machining	
Cutting Speed	122 SFM (1,000 RPM)	
Feed	39.3 IPM (0.013 IPT)	
Depth of Cut	Aa = 0.12", Ar = 0.20"	
Coolant	Air Blow	
Machine	Vertical Machining Center	



Milling Example in Stellite Alloys

Stellite Alloys (48HRC)

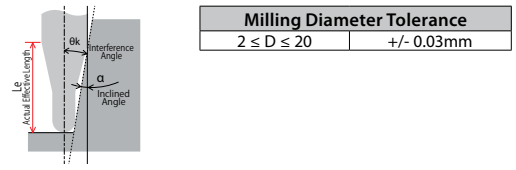
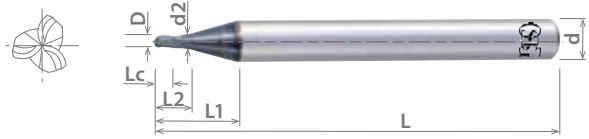
Tool	AM-CRE (Ø8xR2 - 6-Flute)
Work Material	Stellite (48HRC)
Milling Method	Contour Line Operation
Cutting Speed	164 SFM (2,000 RPM)
Feed	23.6 IPM (0.002 IPT)
Depth of Cut	Aa = 0.002", Ar = 0.002"
Coolant	Air Blow
Machine	Vertical Machining Center



List 4730

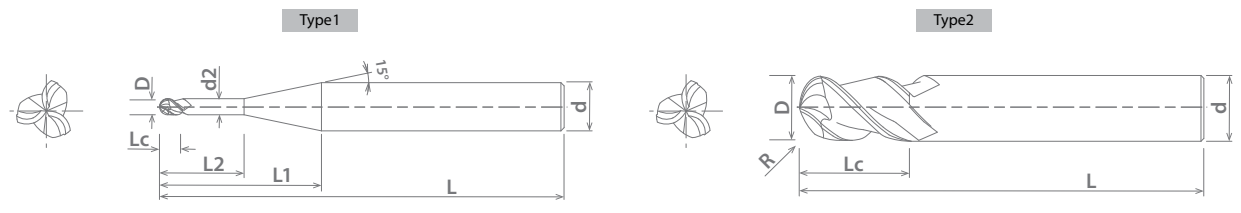
AM-EBT, 3-Flute, Stub Length, Ball End

NEW	SPEED FEED P7	CARBIDE	DUROREY	± 0.01		STUB	30°	SHANK h4
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EDP	Mill Dia.	OAL	Length of Cut	Neck Length	Non-Tapered Neck Length	Neck Dia	Interference Angle	Effective Neck Length (Le) by Incline Angle (α)					Shank Dia.	Type	
	D	L	Lc	L1	L2	d2	θk	0.5°	1.0°	1.5°	2.0°	3.0°	d		
3187240	2	60	2	11.9	4	1.95	10.64	4.19	4.33	4.42	4.55	4.85	6	1	
3187280				15.9	8	1.95	7.79	8.33	5.58	8.86	9.15	9.82			
3187360	3		3	11.8	6	2.85	8.15	6.44	6.61	6.79	7	7.45			
3187392				17.8	12	2.85	5.22	12.64	13.03	13.44	13.89	14.91			
3187408	4		4	4	12	8	3.85	5.65	8.49	8.71	8.96	9.22			9.81
3187416					20	16	3.85	3.17	16.76	17.27	17.82	18.42			19.76
3187510	5	5	5	12.1	10	4.85	2.95	10.54	10.82	11.12	11.45	-			
3187520				22.1	20	4.85	1.46	20.87	21.52	-	-	-			
3188060	6	9	-	-	-	-	-	-	-	-	-	-			
3188080	8	70	12	-	-	-	-	-	-	-	-	-	8		
3188100	10	80	15	-	-	-	-	-	-	-	-	-	10		
3188120	12	90	18	-	-	-	-	-	-	-	-	-	12		
3188160	16	105	24	-	-	-	-	-	-	-	-	-	16		
3188200	20	110	30	-	-	-	-	-	-	-	-	-	20		

Packed: 1 pc.
Available DUOREY coating only.



List No.	Work Material															
	P				M			K	N		S		H			
	Carbon Steels			Alloy Steels	Die Steels	Stainless Steels ≤200HB			Cast Iron	Aluminum		Nickel Alloy	Titanium	Hardened Steels		
	Low	Med.	High	4140 4340		300	400	17-4 PH			6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC
4730					○	○	○				⊗	⊗		⊗	⊗	○

○ good ⊗ best



List 4770

AM-CRE, Multi-Flute, Stub Length, Corner Radius

NEW	SPEED FEED P7	CARBIDE	DUROREY	± 0.03	0 ± 0.01		STUB	60°	SHANK h4
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Milling Diameter Tolerance	
$6 \leq D \leq 20$	+/- 0.01mm



Units: mm

EDP	Mill Diameter	Corner Radius	OAL	Length of Cut	Shank Diameter	No. of Flutes
	D	R	L	Lc	d	
3183010	6	1	60	9	6	6
3183015	6	1.5				
3183018	8	1	70	12	8	
3183020	8	2				
3183110	10	1	80	15	10	
3183120	10	2				
3183210	12	1	90	18	12	8
3183220	12	2				
3183226	16	1	105	24	16	
3183230	16	3				
3183310	20	1	110	30	20	
3183330	20	3				

Packed: 1 pc.
Available DUOREY coating only.



Inch Sizes Coming Soon!

Work Material																		
List No.	P				Die Steels	M			K Cast Iron	N		S		H				
	Carbon Steels			Alloy Steels		Stainless Steels ≤200HB				Aluminum		Nickel Alloy	Titanium	Hardened Steels				
	Low	Med.	High	4140 4340		300	400	17-4 PH		6061 7075	Casting	Inconel	6Al4V (30 HRC)	~35 HRC	35-45 HRC	45-50 HRC	50-70 HRC	
4770																		

○ good ⊗ best



List 4730: 3-Flute, Stub Length, Ball End

Hardness		-	-	-	-	-	-	-	-	45 HRC	65 HRC	70 HRC						
Work Material		Stainless Steel	Colbalt-Chromium Alloys (Stellite)	Titanium Alloy	Ni-Based Alloy (Inconel 718)	Hardened Steel												
Cutting Speed		165-230 SFM	135-195 SFM	65-130 SFM	200-260 SFM	165-220 SFM	135-195 SFM	65-130 SFM										
Depth of Cut								<table border="1"> <tr> <th>Dia</th> <th>aa</th> <th>ar</th> </tr> <tr> <td>R≤6</td> <td>Max: 0.15D</td> <td rowspan="2">0.5D</td> </tr> <tr> <td>R>6</td> <td>Max: 3mm</td> </tr> </table>			Dia	aa	ar	R≤6	Max: 0.15D	0.5D	R>6	Max: 3mm
Dia	aa							ar										
R≤6	Max: 0.15D	0.5D																
R>6	Max: 3mm																	
Mill Dia.	Non-Tapered Neck Length	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min			
2	4	11,100	43.3	9,500	37.0	8,000	31.1	4,800	18.9	9,500	37.0	8,000	31.1	4,800	18.9			
	8	5,600	19.7	4,800	16.9	4,300	15.4	2,600	9.1	4,800	16.9	4,300	15.4	2,600	9.1			
3	6	7,400	43.3	6,400	37.8	5,300	31.5	3,200	18.9	6,400	37.8	5,300	31.5	3,200	18.9			
	12	4,400	23.2	3,800	20.1	3,300	17.7	2,000	10.6	3,800	20.1	3,300	17.7	2,000	10.6			
4	8	5,600	42.5	4,800	36.6	4,000	30.3	2,400	18.5	4,800	36.6	4,000	30.3	2,400	18.5			
	16	3,400	22.4	2,900	19.3	2,500	16.5	1,500	9.8	2,900	19.3	2,500	16.5	1,500	9.8			
5	10	4,500	42.5	3,800	35.8	3,200	30.3	1,900	18.1	3,800	35.8	3,200	30.3	1,900	18.1			
	20	2,800	23.6	2,400	20.5	2,000	16.9	1,200	11.0	2,400	21.7	2,000	16.9	1,200	11.0			
6	-	3,700	44.1	3,200	37.8	2,700	31.5	1,600	18.9	3,200	37.8	2,700	31.5	1,600	18.9			
8	-	2,800	39.4	2,400	33.9	2,000	28.3	1,200	16.9	2,400	33.9	2,000	28.3	1,200	16.9			
10	-	2,200	39.4	1,900	33.9	1,600	28.3	960	16.9	1,900	33.9	1,600	28.3	960	16.9			
12	-	1,900	44.1	1,600	37.8	1,300	31.5	800	18.9	1,600	37.8	1,300	31.5	800	18.9			
16	-	1,400	36.2	1,200	31.1	1,000	26.0	600	15.4	1,200	31.1	1,000	26.0	600	15.4			
20	-	1,100	33.1	1,000	28.3	800	23.6	480	14.2	1,000	28.3	800	23.6	480	14.2			

- This tool is recommended for the roughing of additive manufacturing and mold overlay surfaces.
- Please use machines and holders that are rigid and highly accurate.
- The values listed above are for reference. Please set the cutting condition in accordance with the actual machining environment.
- Please reduce the feed rate when the depth of cut is greater than specified.
- Please adjust the speed, feed and depth of cut accordingly when the overhang length is longer than specified.
- Please use a suitable fluid with high smoke retardant properties.
- During dry (no fluid) milling, please use air blow to remove disposable chips from the milling area and to eliminate chip packing.
- Please use water-soluble coolant when machining stainless steel, cobalt-chromium based alloy, titanium alloy, and Ni-based alloy.
- Tool runout should be kept to a minimum for maximum accuracy.
- When the cutting load fluctuates in areas such as the corners, please reduce the rotational speed.

List 4770: Multi-Flute, Stub Length, Corner Radius

Hardness		-	-	-	-	-	-	-	-	45 HRC	65 HRC	70 HRC						
Work Material		Stainless Steel	Colbalt-Chromium Alloys (Stellite)	Titanium Alloy	Ni-Based Alloy (Inconel 718)	Hardened Steel												
Cutting Speed		195-260 SFM	165-230 SFM	135-190 SFM	70-130 SFM	165-230 SFM	135-190 SFM	70-130 SFM										
Depth of Cut								<table border="1"> <tr> <th>Dia</th> <th>aa</th> <th>ar</th> </tr> <tr> <td>R≤6</td> <td>Max: 0.2 x CR</td> <td rowspan="2">0.5D</td> </tr> <tr> <td>R>6</td> <td>Max: 0.5 x D</td> </tr> </table>			Dia	aa	ar	R≤6	Max: 0.2 x CR	0.5D	R>6	Max: 0.5 x D
Dia	aa							ar										
R≤6	Max: 0.2 x CR	0.5D																
R>6	Max: 0.5 x D																	
Size (Dia. x CR)	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min	Speed RPM	Feed in/min				
6xR1	4,240	60.2	3,700	52.4	3,200	45.3	1,910	27.2	3,700	52.4	3,200	45.3	1,910	27.2				
6xR1.5	3,700	44.1	3,200	37.8	2,700	31.5	1,600	18.9	3,200	37.8	2,700	31.5	1,600	18.9				
8xR1	3,180	56.3	2,780	49.2	2,400	42.5	1,430	25.2	2,780	49.2	2,400	42.5	1,430	25.2				
8xR2	2,800	33.1	2,400	28.3	2,000	23.6	1,200	14.2	2,400	28.3	2,000	23.6	1,200	14.2				
10xR1	2,540	72.0	2,220	63.0	1,900	53.9	1,150	32.7	2,220	63.0	1,900	53.9	1,150	32.7				
10xR2	2,200	42.1	1,900	36.2	1,600	29.9	960	18.1	1,900	36.2	1,600	29.9	960	18.1				
12xR1	2,120	100.0	1,850	87.4	1,600	75.6	960	45.3	1,850	87.4	1,600	75.6	960	45.3				
12xR2	1,900	58.7	1,600	50.0	1,300	41.7	800	25.2	1,600	50.0	1,300	41.7	800	25.2				
16xR1	1,590	110.2	1,380	95.7	1,200	83.1	720	50.0	1,380	95.7	1,200	83.1	720	50.0				
16xR3	1,400	65.7	1,200	56.3	1,000	46.9	600	28.3	1,200	56.3	1,000	46.9	600	28.3				
20xR1	1,270	111.8	1,110	98.0	1,000	88.2	570	50.4	1,110	98.0	1,000	88.2	570	50.4				
20xR3	1,100	70.1	1,000	60.2	800	50.0	480	29.9	1,000	60.2	800	50.0	480	29.9				

- This tool is recommended for the roughing of additive manufacturing and mold overlay surfaces.
- Please use machines and holders that are rigid and highly accurate.
- The values listed above are for reference. Please set the cutting condition in accordance with the actual machining environment.
- Please reduce the feed rate when the depth of cut is greater than specified.
- Please adjust the speed, feed and depth of cut accordingly when the overhang length is longer than specified.
- Please use a suitable fluid with high smoke retardant properties.
- During dry (no fluid) milling, please use air blow to remove disposable chips from the milling area and to eliminate chip packing.
- Please use water-soluble coolant when machining stainless steel, cobalt-chromium based alloy, titanium alloy, and Ni-based alloy.
- Tool runout should be kept to a minimum for maximum accuracy.
- When the cutting load fluctuates in areas such as the corners, please reduce the rotational speed.



shaping your dreams

 **Safe use of cutting tools**

- Use safety cover, safety glasses and safety shoes during operation.
- Do not touch cutting edges with bare hands.
- Do not touch cutting chips with bare hands. Chips will be hot after cutting.
- Stop cutting when the tool becomes dull.
- Stop cutting operation immediately if you hear any abnormal cutting sounds.
- Do not modify tools.
- Please use appropriate tools for the operation. Check dimensions to ensure proper selection.

osgtool.com

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