



Endmills for milling built-up of welding parts

# ADDITIVE MANUFACTURING

Volume 1



# KEY FEATURES: AM-EBT • AM-CRE

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● Ball nose type (AM-EBT)

● Radius type (AM-CRE)

**1** For milling of additive manufactured parts

**2** Durorey coating

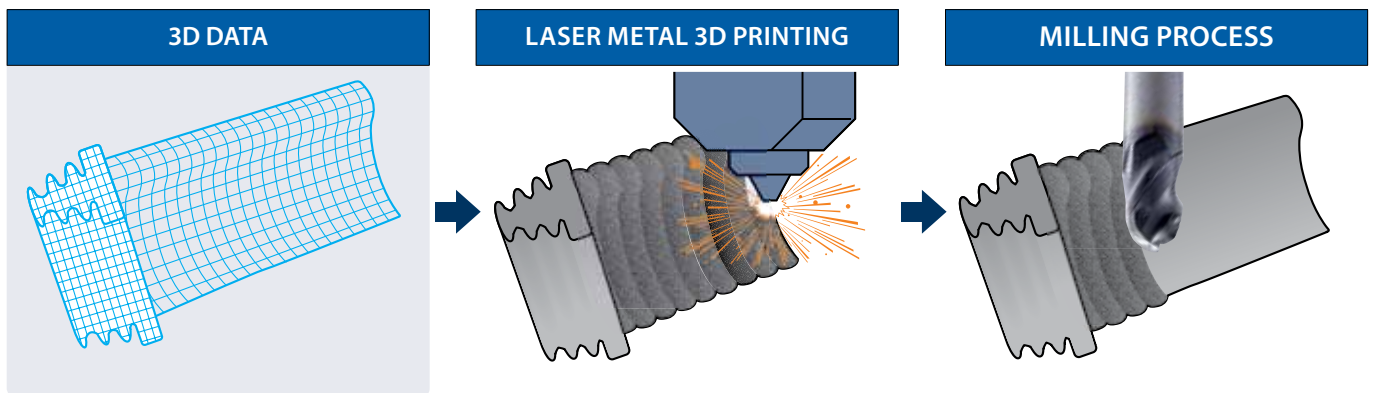
# ADDITIVE MANUFACTURING

## 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 utilizing 3D data, short delivery and low production cost are made possible.



## Suitable for milling of built-up welding parts



The name of Additive Manufacturing was established by the American Society for Testing and Materials (ASTM) in 2009.

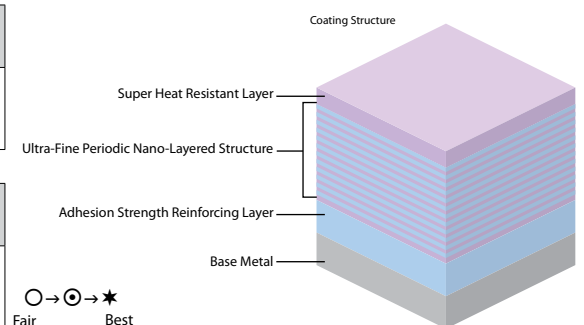
## DUROREY COATING

Super heat resistance and high toughness DUROREY coating

Super heat resistant layer and ultra-fine periodic nano-layered structure provide superior toughness while maintaining high heat resistance and abrasion resistance. Also suppresses chipping even in high hardness milling and achieves long tool life.

Coating Color	Coating Structure	Hardness	Oxidation Temperature	Heat Resistance
Black Gray	Ultra-Fine Periodic Nano-Layered	41	1.300	★

Adhesion Strength	Surface Roughness	Wear Resistance	Welding Resistance	Toughness
⊙	○	★	⊙	⊙





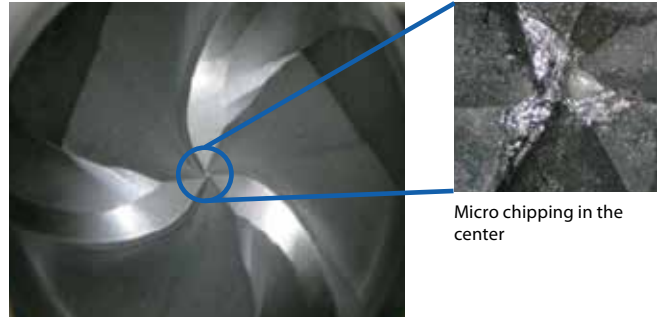


# CUTTING DATA

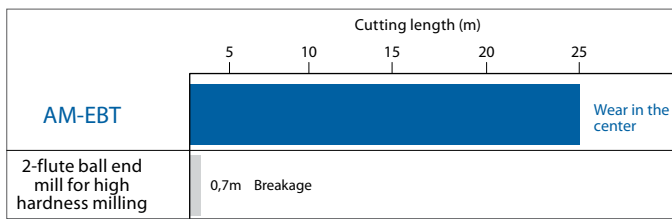
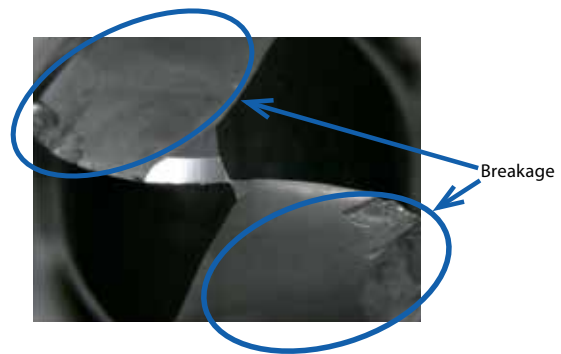
## Long tool life even in milling of built-up welding parts with large depth of cut

Tool	AM-EBT R6X12	2-flute ball end mill for high hardness milling
Work Material	BK-660R	
Milling Method	Linear Machining	
Cutting Speed	37 m/min (1.000 min <sup>-1</sup> )	
Feed	1.000 mm/min (0,33 mm/t)	666 mm/min (0,33 mm/t)
Depth of Cut	ap=3 mm ae=0,5 mm	
Coolant	Air Blow	
Machine	Vertical Machining Center	

AM-EBT After milling 25m



2 flutes ball end mill for high hardness milling After milling 0,7m

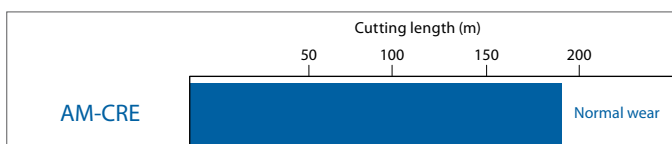


## Milling example in Stellite Alloys

Tool	AM-CRE Ø8XR2 (6FL)
Work Material	Stellite (48HRC)
Milling Method	Contour Line Operation
Cutting Speed	50 m/min (2.000 min <sup>-1</sup> )
Feed	600 mm/min (0,05 mm/t)
Depth of Cut	ap=0,5 mm ae=0,5 mm
Coolant	Air Blow
Machine	Vertical Machining Center



AM-CRE • After milling 190 m



# CUTTING CONDITIONS

Milling | Cutting conditions

## AM-EBT

Ball type

Vc	Prehardened Steel • Hardened Steel ~45HRC		Hardened Steel ~65HRC		Stainless Steel ≤200HB		Cobalt Chromium Based Alloy (Stellite)		Titanium Alloy		Ni based Alloy (Inconel 718)								
	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)							
3	3.200	960	2.700	800	3.700	1.120	3.200	960	2.700	800	1.600	480							
4	2.400	860	2.000	720	2.800	1.000	2.400	860	2.000	720	1.200	430							
5	1.900	860	1.600	720	2.200	1.000	1.900	860	1.600	720	960	430							
6	1.600	960	1.300	800	1.900	1.120	1.600	960	1.300	800	800	480							
8	1.200	790	1.000	660	1.400	920	1.200	790	1.000	660	600	390							
10	1.000	720	800	600	1.100	840	1.000	720	800	600	480	360							
Depth of cut	<table border="1"> <tr> <td>Dc</td> <td>ap</td> <td>pf</td> </tr> <tr> <td>R≤6</td> <td>Max:0,15D</td> <td rowspan="2">0,05D</td> </tr> <tr> <td>8≤R</td> <td>Max:3mm</td> </tr> </table>											Dc	ap	pf	R≤6	Max:0,15D	0,05D	8≤R	Max:3mm
Dc	ap	pf																	
R≤6	Max:0,15D	0,05D																	
8≤R	Max:3mm																		

- 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 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.

## AM-CRE

Radius type

Vc	Prehardened Steel • Hardened Steel ~45HRC		Hardened Steel ~65HRC		Stainless Steel ≤200HB		Cobalt Chromium Based Alloy (Stellite)		Titanium Alloy		Ni based Alloy (Inconel 718)				
	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)	S (min <sup>-1</sup> )	F (mm/min)			
6xR1,5	3.200	960	2.700	800	3.700	1.120	3.200	960	2.700	800	1.600	480			
8xR2	2.400	720	2.000	600	2.800	840	2.400	720	2.000	600	1.200	360			
10xR2	1.900	920	1.600	760	2.200	1.070	1.900	920	1.600	760	960	460			
12xR2	1.600	1.270	1.300	1.060	1.900	1.490	1.600	1.270	1.300	1.060	800	640			
16xR3	1.200	1.430	1.000	1.190	1.400	1.670	1.200	1.430	1.000	1.190	600	720			
20xR3	1.000	1.530	800	1.270	1.100	1.780	1.000	1.530	800	1.270	480	760			
Depth of cut	<table border="1"> <tr> <td>ae</td> <td>ap</td> </tr> <tr> <td>Max:0,5mm</td> <td>Max:0,5mm</td> </tr> </table>											ae	ap	Max:0,5mm	Max:0,5mm
ae	ap														
Max:0,5mm	Max:0,5mm														

- 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

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