MOLDINO
The Edge To Innovation

3 Flute Ball End Mill for High Efficient Deep Machining

EMBE-ATH/EMBPE-ATH

Epoch Mega Feed Ball Evolution

MOLDINO Tool Engineering, Ltd.

New Product News | No. H2001A-1 | 2020-1

Employs a strong, helical edge to reduce the cutting force and improve chip removal!

Features of EMB(P)E-ATH

01 Newly developed high helix geometry with a variable pitch flute.

Newly developed Ball end geometry greatly improves cutting performance. Cutting force is reduced, vibrations are suppressed, and chip removal is improved. Tool damage is reduced when performing deep cutting. Provides good cutting capabilities even difficult to machine materials.

02 Improved heat resistance and wear resistance (ATH Coating)

Employs ATH coating to provide even more improved heat resistance and wear resistance compared to conventional products. Achieves long tool life even in high-efficiency conditions.

03 Broad lineup

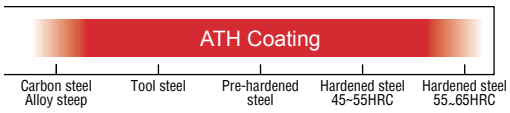
Large selection of sizes and lengths to meet the requirements of deep mold geometry.

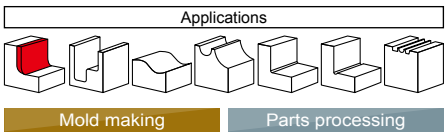
04 Capable of high-accuracy machining

Radius accuracy is improved compared to conventional 3-flute products. (R accuracy is ±0.005mm for small diameters of below ϕ4mm.)

05 Capable of high speed machining tool paths.

Smooth connection between ball end and high helix allows for high-efficiency peripheral cutting edge to be used with todays new machining methods.



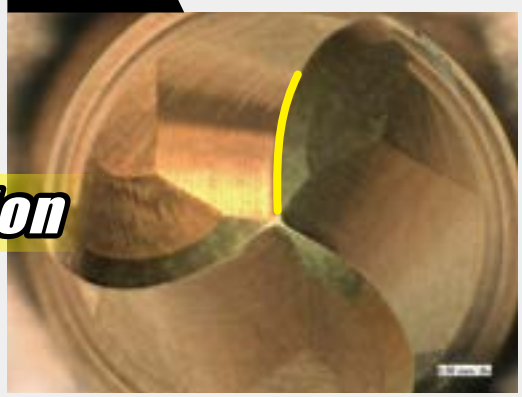


EMBE-ATH	R0.5～R10 [21 Items]
EMBPE-ATH	R0.5～R6 [96 Items]

Features High helix edge geometry and improved chip disposal

EMBE-ATH

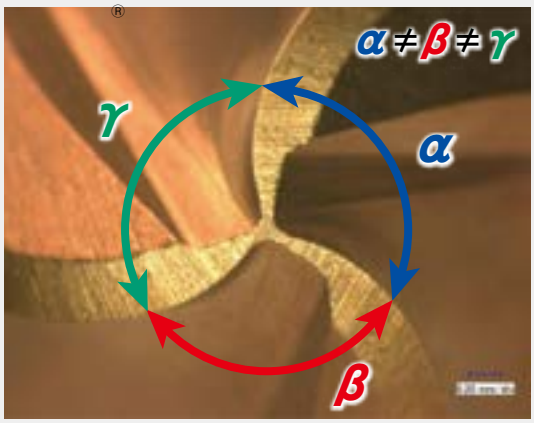
Conventional

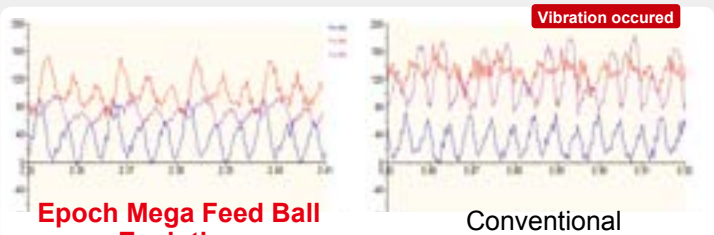


Evolution

The High helix geometry pared with the newly designed chip pocket, reduces cutting forces and improves chip removal.

Features　Vibrations are suppressed via the variable pitch design on the end of the tool





Epoch Mega Feed Ball Evolution　　Conventional

<Cutting conditions>

Work material：H13 Premium (45HRC)　Tool dia.：ϕ6×3flutes
n=4,000min^{-1} (v_c=75m/min)　v_f=1,150㎜/min(f_z=0.096㎜/t)
a_p=0.3㎜　a_e=1㎜　Water base coolant　OH=30mm
Vertical High Speed M/C (HSK-F63)　Bottom slotting

The Variable pitch geometry reduces

- **Chattering and vibration when deep cutting or corner processing.**
  Especially effective when high speed machining to improve efficiency

Features　Improved heat-resistant coating　ATHcoating

Features and characteristics

- Improved Hardness and oxidation of the TH coatings enables longer tool life and high efficiency when cutting hard materials.
  (Si nano composite coating with finer crystal particles)
- Exhibits amazing performance when cutting hard materials (55HRC or higher)
  Cold-worked die steel, HSS, tool steel.
- Long tool life for both dry and wet cutting.

Back Draft Shape

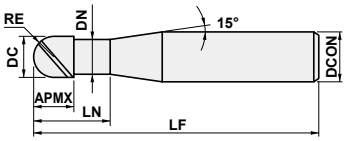
By implementing our backdraft design, similar to the Epoch Deep series, chattering and vibrations are suppressed when machining deep areas. Allowing for a great machined surface to be achieved.

Note: Adopted as the pencil neck type of less than 4 millimeters of tool diameter.

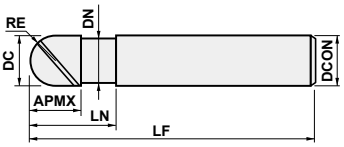
Line up

Straight Type

3Flutes



A type



B type

(mm)

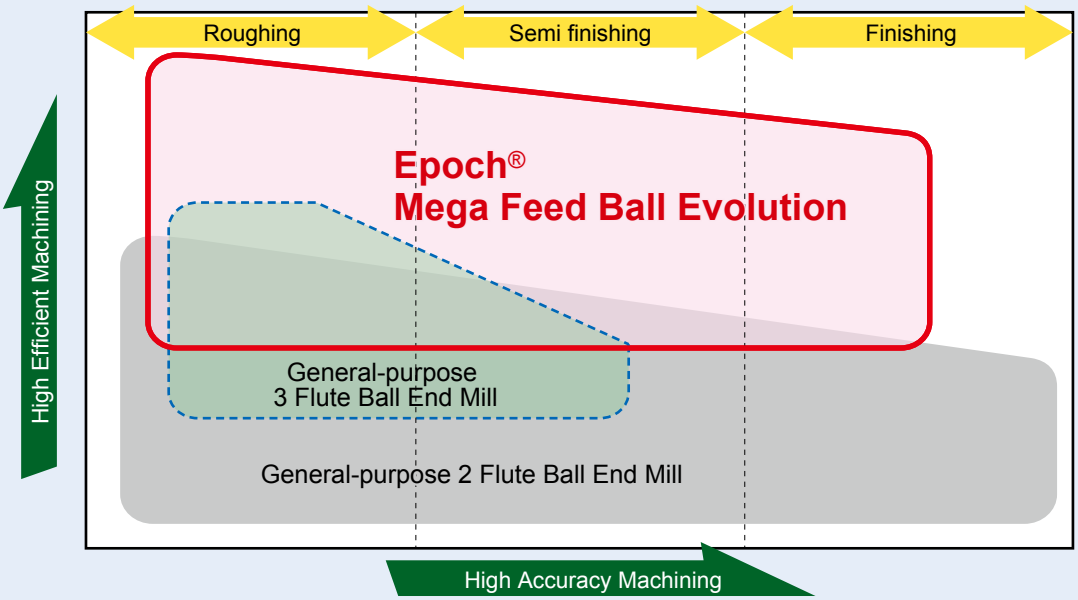
Ball Radius RE	Tolerance on RE	Tolerance on dia.
R0.5~R1.75	±0.005	0~−0.010
R2~R3	±0.007	0~−0.014
R4~R6	±0.010	0~−0.020
R8~R10	±0.015	0~−0.030

EMBE3○○○ (-S○)-ATH

Carbide | ATH Coated | 65 HRC | Helix 40° | Variable Pitch | h5

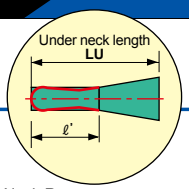
Item Code	Stock	Size(mm) Ball radius RE	Tool dia. DC	Flute length APMX	Under neck length LN	Neck dia. DN	Overall length LF	Shank dia. DCON	Type
EMBE3010-S4-ATH	●	0.5	1	1.5	3	0.95	50	4	A
EMBE3010-S6-ATH	●			1.5	3	0.95	50	6	A
EMBE3015-S4-ATH	●	0.75	1.5	2.5	4.5	1.43	50	4	A
EMBE3015-S6-ATH	●			2.5	4.5	1.43	50	6	A
EMBE3020-S4-ATH	●	1	2	3	6	1.9	50	4	A
EMBE3020-S6-ATH	●			3	6	1.9	50	6	A
EMBE3025-S4-ATH	●	1.25	2.5	4	7.5	2.38	50	4	A
EMBE3025-S6-ATH	●			4	7.5	2.38	50	6	A
EMBE3030-S4-ATH	●	1.5	3	4.5	9	2.9	70	4	A
EMBE3030-S6-ATH	●			4.5	9	2.9	70	6	A
EMBE3035-S4-ATH	★	1.75	3.5	5.5	10.5	3.4	70	4	A
EMBE3035-S6-ATH	★			5.5	10.5	3.4	70	6	A
EMBE3040-S4-ATH	●	2	4	6	12	3.9	70	4	B
EMBE3040-S6-ATH	●			6	12	3.9	70	6	A
EMBE3050-ATH	●	2.5	5	7.5	15	4.7	80	6	A
EMBE3060-ATH	●	3	6	9	18	5.7	90	6	B
EMBE3080-ATH	●	4	8	12	24	7.6	100	8	B
EMBE3100-ATH	●	5	10	15	30	9.5	100	10	B
EMBE3120-ATH	●	6	12	18	36	11.5	110	12	B
EMBE3160-ATH	★	8	16	24	48	15	140	16	B
EMBE3200-ATH	★	10	20	30	60	19	160	20	B

Performance and positioning



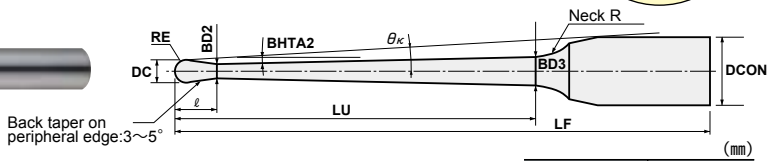
● : Inventory maintained in US ★ : Inventory maintained in Japan

Pencil Neck Type



3Flutes

【Note】※：*R*2 or higher does not have backdraft shape.



(mm)

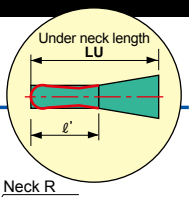
Ball Radius RE	Tolerance on RE
R0.5～R1.75	±0.005
R2～R3	±0.007
R4～R6	±0.010

EMBPE3○○○-○○○-○○-ATH

Carbide | ATH Coated | 65 HRC | Helix 40 | Variable Pitch | h5

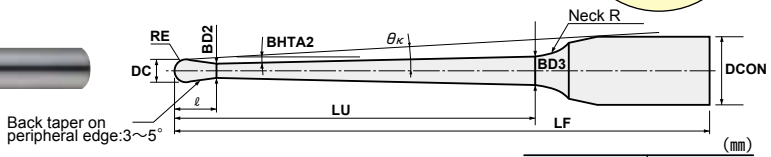
Item Code	Stock	Size(mm) Ball radius RE	Tool dia. DC	Neck angle BHTA2	Under neck length LU	Flute length ℓ	Neck dia. BD2	Under neck dia. BD3	Overall length LF	Shank dia. DCON	Style	Approx neck length ℓ'	Interference Angle θκ	The effective under-neck length for the various draft angles. 0.75°	1°	1.5°	2°	3°
EMBPE3010-6-09-ATH	●	0.5	1	0.9	6	0.8	0.94	1.103	50	6	A	2.70	8.36	6.45	6.66	6.96	7.19	7.56
EMBPE3010-8-09-ATH	●			0.9	8	0.8	0.94	1.166	55	6	A	2.70	7.55	8.4	8.68	9.05	9.32	9.93
EMBPE3010-10-09-ATH	●			0.9	10	0.8	0.94	1.229	55	6	A	2.70	6.88	10.33	10.71	11.13	11.43	12.39
EMBPE3010-12-09-ATH	●			0.9	12	0.8	0.94	1.291	60	6	A	2.70	6.32	12.25	12.73	13.2	13.54	14.85
EMBPE3010-14-09-ATH	●			0.9	14	0.8	0.94	1.354	60	6	A	2.70	5.85	13.77	14.75	15.27	15.65	17.31
EMBPE3010-16-09-ATH	●			0.9	16	0.8	0.94	1.417	60	6	A	2.70	5.44	13.77	16.77	17.34	17.87	19.77
EMBPE3010-18-09-ATH	●			0.9	18	0.8	0.94	1.480	65	6	A	2.70	5.08	13.77	18.79	19.4	20.08	22.23
EMBPE3010-20-09-ATH	★			0.9	20	0.8	0.94	1.543	65	6	A	2.70	4.77	13.77	20.81	21.46	22.3	24.68
EMBPE3010-22-09-ATH	★			0.9	22	0.8	0.94	1.606	70	6	A	2.70	4.5	13.77	22.82	23.51	24.52	27.14
EMBPE3010-24-09-ATH	★			0.9	24	0.8	0.94	1.668	70	6	A	2.70	4.25	13.77	24.84	25.57	26.73	29.6
EMBPE3010-26-09-ATH	●			0.9	26	0.8	0.94	1.731	70	6	A	2.70	4.03	13.77	26.86	27.62	28.95	32.06
EMBPE3010-28-09-ATH	★			0.9	28	0.8	0.94	1.794	75	6	A	2.70	3.83	13.77	28.88	29.73	31.17	34.52
EMBPE3010-30-09-ATH	★			0.9	30	0.8	0.94	1.857	75	6	A	2.70	3.65	13.77	30.89	31.84	33.38	36.98
EMBPE3010-32-09-ATH	★			0.9	32	0.8	0.94	1.920	80	6	A	2.70	3.49	13.77	32.91	33.95	35.6	39.43
EMBPE3010-34-09-ATH	★			0.9	34	0.8	0.94	1.983	80	6	A	2.70	3.34	13.77	34.92	36.07	37.82	41.89
EMBPE3010-36-09-ATH	●			0.9	36	0.8	0.94	2.045	80	6	A	2.70	3.2	13.77	36.94	38.18	40.03	44.35
EMBPE3015-8-09-ATH	★	0.75	1.5	0.9	8	1.35	1.42	1.628	55	6	A	3.89	7.32	8.54	8.77	9.1	9.35	9.97
EMBPE3015-10-09-ATH	★			0.9	10	1.35	1.42	1.691	55	6	A	3.89	6.63	10.5	10.79	11.17	11.46	12.43
EMBPE3015-14-09-ATH	★			0.9	14	1.35	1.42	1.817	60	6	A	3.89	5.57	14.39	14.83	15.31	15.71	17.35
EMBPE3015-16-09-ATH	★			0.9	16	1.35	1.42	1.880	60	6	A	3.89	5.16	16.33	16.84	17.37	17.93	19.8
EMBPE3015-18-09-ATH	★			0.9	18	1.35	1.42	1.943	65	6	A	3.89	4.81	18.24	18.86	19.43	20.14	22.26
EMBPE3015-20-09-ATH	★			0.9	20	1.35	1.42	2.005	65	6	A	3.89	4.5	19.64	20.88	21.49	22.36	24.72
EMBPE3015-22-09-ATH	★			0.9	22	1.35	1.42	2.068	70	6	A	3.89	4.22	19.64	22.89	23.55	24.57	27.18
EMBPE3015-24-09-ATH	★			0.9	24	1.35	1.42	2.131	70	6	A	3.89	3.98	19.64	24.91	25.6	26.79	29.64
EMBPE3015-26-09-ATH	★			0.9	26	1.35	1.42	2.194	70	6	A	3.89	3.77	19.64	26.93	27.68	29.01	32.1
EMBPE3015-28-09-ATH	★			0.9	28	1.35	1.42	2.257	75	6	A	3.89	3.58	19.64	28.94	29.79	31.22	34.55
EMBPE3015-30-09-ATH	★			0.9	30	1.35	1.42	2.320	75	6	A	3.89	3.4	19.64	30.96	31.91	33.44	37.01
EMBPE3015-32-09-ATH	★			0.9	32	1.35	1.42	2.382	80	6	A	3.89	3.24	19.64	32.97	34.02	35.66	39.47
EMBPE3015-34-09-ATH	★			0.9	34	1.35	1.42	2.445	80	6	A	3.89	3.1	19.64	34.99	36.13	37.87	41.93
EMBPE3015-36-09-ATH	★			0.9	36	1.35	1.42	2.508	80	6	A	3.89	2.97	19.64	37	38.24	40.09	No interference
EMBPE3015-38-09-ATH	★			0.9	38	1.35	1.42	2.571	85	6	A	3.89	2.85	19.64	39.02	40.36	42.3	No interference
EMBPE3015-40-09-ATH	★			0.9	40	1.35	1.42	2.634	85	6	A	3.89	2.74	19.64	41.03	42.47	44.52	No interference
EMBPE3020-10-09-ATH	●	1	2	0.9	10	1.7	1.92	2.180	55	6	A	4.24	6.35	10.52	10.8	11.17	11.45	12.38
EMBPE3020-16-09-ATH	●			0.9	16	1.7	1.92	2.369	60	6	A	4.24	4.86	16.36	16.85	17.37	17.91	19.76
EMBPE3020-20-09-ATH	●			0.9	20	1.7	1.92	2.494	65	6	A	4.24	4.2	20.16	20.88	21.49	22.34	24.68
EMBPE3020-24-09-ATH	●			0.9	24	1.7	1.92	2.620	65	6	A	4.24	3.7	20.5	24.92	25.6	26.77	29.59
EMBPE3020-30-09-ATH	●			0.9	30	1.7	1.92	2.809	70	6	A	4.24	3.14	20.5	30.96	31.9	33.42	36.97
EMBPE3020-36-09-ATH	●			0.9	36	1.7	1.92	2.997	80	6	A	4.24	2.73	20.5	37.01	38.24	40.07	No interference
EMBPE3020-40-09-ATH	●			0.9	40	1.7	1.92	3.123	80	6	A	4.24	2.51	20.5	41.03	42.46	44.5	No interference
EMBPE3020-46-09-ATH	★			0.9	46	1.7	1.92	3.311	90	6	A	4.24	2.24	20.5	47.08	48.8	51.15	No interference
EMBPE3020-60-09-ATH	★			0.9	60	1.7	1.92	3.751	100	6	A	4.24	1.79	20.5	61.16	63.59	No interference	No interference
EMBPE3025-16-09-ATH	●	1.25	2.5	0.9	16	2	2.4	2.839	60	6	A	5.18	4.52	16.48	16.9	17.4	17.94	19.77
EMBPE3025-24-09-ATH	●			0.9	24	2	2.4	3.091	65	6	A	5.18	3.39	24.19	24.96	25.62	26.81	29.6
EMBPE3025-30-09-ATH	●			0.9	30	2	2.4	3.279	70	6	A	5.18	2.86	24.88	31.01	31.94	33.46	No interference
EMBPE3025-40-09-ATH	●			0.9	40	2	2.4	3.593	80	6	A	5.18	2.26	24.88	41.07	42.51	44.54	No interference
EMBPE3025-50-09-ATH	★			0.9	50	2	2.4	3.908	90	6	A	5.18	1.87	24.88	51.14	53.07	No interference	No interference
EMBPE3030-16-09-ATH	●	1.5	3	0.9	16	2.5	2.86	3.284	55	6	A	6.95	4.11	16.67	17	17.46	18.05	19.87
EMBPE3030-20-09-ATH	●			0.9	20	2.5	2.86	3.409	60	6	A	6.95	3.5	20.59	21.03	21.57	22.48	24.78
EMBPE3030-24-09-ATH	★			0.9	24	2.5	2.86	3.535	65	6	A	6.95	3.04	24.51	25.06	25.72	26.92	29.7
EMBPE3030-30-09-ATH	★			0.9	30	2.5	2.86	3.724	70	6	A	6.95	2.54	30.35	31.1	32.06	33.56	No interference
EMBPE3030-40-09-ATH	★			0.9	40	2.5	2.86	4.038	80	6	A	6.95	2	34.28	41.16	42.62	No interference	No interference
EMBPE3030-50-09-ATH	★			0.9	50	2.5	2.86	4.352	90	6	A	6.95	1.65	34.28	51.22	53.18	No interference	No interference
EMBPE3030-60-09-ATH	★			0.9	60	2.5	2.86	4.666	100	6	A	6.95	1.4	34.28	61.28	No interference	No interference	No interference

Pencil Neck Type



3Flutes

【Note】※：*R2* or higher does not have backdraft shape.



(mm)

Ball Radius RE	Tolerance on RE
R0.5～R1.75	±0.005
R2～R3	±0.007
R4～R6	±0.010

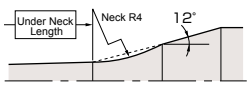
EMBPE3○○○-○○○-○○-ATH

Carbide | ATH Coated | 65 HRC | Helix 40° | Variable Pitch | h5

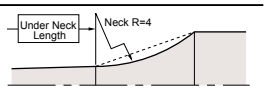
Item Code	Stock	Size(mm) Ball radius RE	Tool dia. DC	Neck angle BHTA2	Under neck length LU	Flute length ℓ	Neck dia. BD2	Under neck dia. BD3	Overall length LF	Shank dia. DCON	Style	Approx neck length ℓ'	Interference Angle θκ	The effective under-neck length for the various draft angles. 0.75°	1°	1.5°	2°	3°
EMBPE3035-20-09-ATH	★	1.75	3.5	0.9	20	2.75	3.36	3.901	60	6	A	7.20	3.09	20.6	21.03	21.56	22.46	24.73
EMBPE3035-30-09-ATH	★			0.9	30	2.75	3.36	4.216	70	6	A	7.20	2.21	30.36	31.1	32.05	33.54	No interference
EMBPE3035-40-09-ATH	★			0.9	40	2.75	3.36	4.530	80	6	A	7.20	1.72	34.53	41.16	42.61	No interference	No interference
EMBPE3035-50-09-ATH	★			0.9	50	2.75	3.36	4.844	90	6	A	7.20	1.41	34.53	51.22	No interference	No interference	No interference
EMBPE3035-60-09-ATH	★			0.9	60	2.75	3.36	5.158	100	6	B	7.20	1.19	34.53	61.27	No interference	No interference	No interference
EMBPE3040-20-09-ATH	●	2	4	0.9	20	6	3.9	4.339	70	6	A	—	2.62	20.77	21.13	21.62	22.58	No interference
EMBPE3040-30-09-ATH	●			0.9	30	6	3.9	4.654	80	6	A	—	1.84	30.61	31.19	32.18	No interference	No interference
EMBPE3040-40-09-ATH	●			0.9	40	6	3.9	4.968	90	6	B	—	1.42	40.38	41.25	No interference	No interference	No interference
EMBPE3040-50-09-ATH	●			0.9	50	6	3.9	5.282	100	6	B	—	1.16	45.15	51.3	No interference	No interference	No interference
EMBPE3040-60-09-ATH	●			0.9	60	6	3.9	5.596	110	6	B	—	0.97	45.15	No interference	No interference	No interference	No interference
EMBPE3040-70-09-ATH	★			0.9	70	6	3.9	5.910	120	8	A	—	1.58	45.15	71.4	74.43	No interference	No interference
EMBPE3040-80-09-ATH	★			0.9	80	6	3.9	6.224	130	8	A	—	1.4	45.15	81.45	No interference	No interference	No interference
EMBPE3050-30-09-ATH	●	2.5	5	0.9	30	7.5	4.9	5.606	80	8	A	—	2.6	30.72	31.24	32.24	33.7	No interference
EMBPE3050-40-09-ATH	●			0.9	40	7.5	4.9	5.921	90	8	A	—	2.03	40.54	41.29	42.8	44.78	No interference
EMBPE3050-50-09-ATH	●			0.9	50	7.5	4.9	6.235	100	8	A	—	1.67	50.24	51.35	53.36	No interference	No interference
EMBPE3050-60-09-ATH	●			0.9	60	7.5	4.9	6.549	110	8	A	—	1.42	51.67	61.4	No interference	No interference	No interference
EMBPE3050-70-09-ATH	●			0.9	70	7.5	4.9	6.863	120	8	A	—	1.23	51.67	71.45	No interference	No interference	No interference
EMBPE3050-80-09-ATH	★			0.9	80	7.5	4.9	7.177	130	8	B	—	1.09	51.67	81.49	No interference	No interference	No interference
EMBPE3060-30-09-ATH	●	3	6	0.9	30	9	5.9	6.559	80	8	A	—	1.89	30.81	31.29	32.29	No interference	No interference
EMBPE3060-40-09-ATH	●			0.9	40	9	5.9	6.873	90	8	B	—	1.45	40.66	41.34	No interference	No interference	No interference
EMBPE3060-50-09-ATH	●			0.9	50	9	5.9	7.188	100	8	B	—	1.18	50.46	51.39	No interference	No interference	No interference
EMBPE3060-60-09-ATH	●			0.9	60	9	5.9	7.502	110	8	B	—	0.99	58.18	No interference	No interference	No interference	No interference
EMBPE3060-70-09-ATH	●			0.9	70	9	5.9	7.816	120	10	A	—	1.59	58.18	71.48	74.54	No interference	No interference
EMBPE3060-80-09-ATH	●			0.9	80	9	5.9	8.130	130	10	A	—	1.41	58.18	81.53	No interference	No interference	No interference
EMBPE3060-100-09-ATH	●			0.9	100	9	5.9	8.759	150	10	A	—	1.15	58.18	101.61	No interference	No interference	No interference
EMBPE3060-120-09-ATH	★			0.9	120	9	5.9	9.387	200	10	B	—	0.97	58.18	No interference	No interference	No interference	No interference
EMBPE3080-40-09-ATH	●	4	8	0.9	40	12	7.9	8.779	100	10	A	—	1.48	40.85	41.42	No interference	No interference	No interference
EMBPE3080-50-09-ATH	●			0.9	50	12	7.9	9.093	110	10	B	—	1.2	50.71	51.47	No interference	No interference	No interference
EMBPE3080-60-09-ATH	●			0.9	60	12	7.9	9.408	120	10	B	—	1	60.53	No interference	No interference	No interference	No interference
EMBPE3080-70-09-ATH	●			0.9	70	12	7.9	9.722	130	10	B	—	0.86	70.22	No interference	No interference	No interference	No interference
EMBPE3080-80-09-ATH	●			0.9	80	12	7.9	10.036	140	12	A	—	1.43	71.21	81.6	No interference	No interference	No interference
EMBPE3080-100-09-ATH	●			0.9	100	12	7.9	10.664	160	12	A	—	1.16	71.21	101.76	No interference	No interference	No interference
EMBPE3080-120-09-ATH	★			0.9	120	12	7.9	11.293	200	12	B	—	0.98	71.21	No interference	No interference	No interference	No interference
EMBPE3100-50-09-ATH	●	5	10	0.9	50	15	9.9	10.999	120	12	B	—	1.21	50.89	51.55	No interference	No interference	No interference
EMBPE3100-60-09-ATH	●			0.9	60	15	9.9	11.313	130	12	B	—	1.02	60.76	61.59	No interference	No interference	No interference
EMBPE3100-75-09-ATH	●			0.9	75	15	9.9	11.785	140	12	B	—	0.81	75.49	No interference	No interference	No interference	No interference
EMBPE3100-81-09-ATH	●			0.9	81	15	9.9	12.000	150	12	C	—	0.76	81.04	No interference	No interference	No interference	No interference
EMBPE3100-100-09-ATH	●			0.9	100	15	9.9	12.570	170	16	D	—	1.73	84.25	101.07	103.56	No interference	No interference
EMBPE3100-120-09-ATH	●			0.9	120	15	9.9	13.198	200	16	D	—	1.45	84.25	121.17	No interference	No interference	No interference
EMBPE3120-60-09-ATH	●	6	12	0.9	60	18	11.9	13.219	140	16	D	—	1.99	60.27	60.96	62.38	No interference	No interference
EMBPE3120-80-09-ATH	●			0.9	80	18	11.9	13.847	160	16	D	—	1.49	80.12	81.06	No interference	No interference	No interference
EMBPE3120-100-09-ATH	●			0.9	100	18	11.9	14.476	180	16	D	—	1.2	97.28	101.16	No interference	No interference	No interference
EMBPE3120-120-09-ATH	●			0.9	120	18	11.9	15.104	200	16	D	—	1	97.28	No interference	No interference	No interference	No interference

■ Detail of neck shape

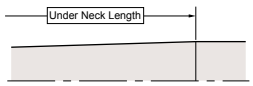
Neck shape A
Compound neck shape



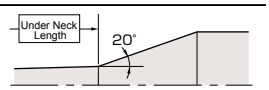
Neck shape B
Without taper

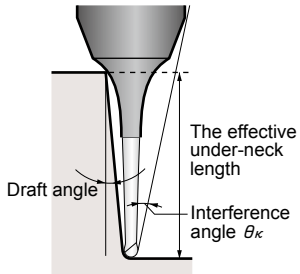


Neck shape C



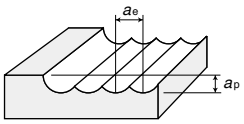
Neck shape D
Taper 20°





●：Inventory maintained in US ★：Inventory maintained in Japan

EMBE-ATH Straight type



〈Roughing〉

Work material		Carbon steel, Alloy steel (180～250HB)					Alloy steel, Tool steel (25～40HRC) P20 or equivalent					Pre-hardened steel, Hardened steel (40～50HRC) Tool steel Regular H13 or equivalent					Pre-hardened steel, Hardened steel (40～50HRC) Premium Tool Steel Dievar, DH31 or equivalent				
Ball radius **RE** (mm)	Tool dia. **DC** (mm)	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm
0.5	**1**	50,000	2,360	93	0.100	0.300	50,000	2,360	93	0.100	0.300	50,000	2,230	88	0.100	0.300	28,700	1,160	46	0.060	0.180
0.75	**1.5**	46,700	3,530	139	0.150	0.450	42,500	3,210	126	0.150	0.450	38,200	2,720	107	0.150	0.450	19,100	1,240	49	0.090	0.270
1	**2**	35,000	3,750	148	0.200	0.600	31,800	3,410	134	0.200	0.600	28,700	2,900	114	0.200	0.600	14,300	1,310	52	0.120	0.360
1.25	**2.5**	28,000	3,810	150	0.250	0.750	25,500	3,470	137	0.250	0.750	22,900	2,940	116	0.250	0.750	11,500	1,340	53	0.150	0.450
1.5	**3**	23,400	3,890	153	0.300	0.900	21,200	3,530	139	0.300	0.900	19,100	3,000	118	0.300	0.900	9,600	1,370	54	0.180	0.540
1.75	**3.5**	20,000	4,010	158	0.350	1.050	18,200	3,650	144	0.350	1.050	16,400	3,100	122	0.350	1.050	8,200	1,410	56	0.210	0.630
2	**4**	17,500	4,100	161	0.400	1.200	15,900	3,730	147	0.400	1.200	14,300	3,160	124	0.400	1.200	7,200	1,450	57	0.240	0.720
2.5	**5**	14,000	4,280	169	0.500	1.500	12,700	3,880	153	0.500	1.500	11,500	3,310	130	0.500	1.500	5,700	1,490	59	0.300	0.900
3	**6**	11,700	4,420	174	0.600	1.800	10,600	4,010	158	0.600	1.800	9,600	3,420	135	0.600	1.800	4,800	1,560	61	0.360	1.080
4	**8**	8,800	4,660	184	0.800	2.400	8,000	4,230	167	0.800	2.400	7,200	3,590	141	0.800	2.400	3,600	1,630	64	0.480	1.440
5	**10**	7,000	4,850	191	1.000	3.000	6,400	4,440	175	1.000	3.000	5,700	3,720	147	1.000	3.000	2,900	1,720	68	0.600	1.800
6	**12**	5,800	4,600	181	1.200	3.600	5,300	4,210	166	1.200	3.600	4,800	3,590	141	1.200	3.600	2,400	1,630	64	0.720	2.160
8	**16**	4,400	4,440	175	1.600	4.800	4,000	4,030	159	1.600	4.800	3,600	3,420	135	1.600	4.800	1,800	1,560	61	0.960	2.880
10	**20**	3,500	3,880	153	2.000	6.000	3,200	3,550	140	2.000	6.000	2,900	3,030	119	2.000	6.000	1,400	1,330	52	1.200	3.600

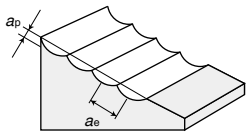
Work material		Hardened steels (50～55HRC)					Hardened steels (55～65HRC)				
Ball radius **RE** (mm)	Tool dia. **DC** (mm)	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm
0.5	**1**	50,000	1,870	74	0.070	0.210	44,600	1,250	49	0.050	0.150
0.75	**1.5**	34,000	2,030	80	0.105	0.315	29,700	1,340	53	0.075	0.225
1	**2**	25,500	2,160	85	0.140	0.420	22,300	1,420	56	0.100	0.300
1.25	**2.5**	20,400	2,200	87	0.175	0.525	17,800	1,440	57	0.125	0.375
1.5	**3**	17,000	2,240	88	0.210	0.630	14,900	1,480	58	0.150	0.450
1.75	**3.5**	14,600	2,320	91	0.245	0.735	12,700	1,520	60	0.175	0.525
2	**4**	12,700	2,350	93	0.280	0.840	11,100	1,550	61	0.200	0.600
2.5	**5**	10,200	2,460	97	0.350	1.050	8,900	1,620	64	0.250	0.750
3	**6**	8,500	2,540	100	0.420	1.260	7,400	1,670	66	0.300	0.900
4	**8**	6,400	2,680	106	0.560	1.680	5,600	1,760	69	0.400	1.200
5	**10**	5,100	2,790	110	0.700	2.100	4,500	1,860	73	0.500	1.500
6	**12**	4,200	2,640	104	0.840	2.520	3,700	1,750	69	0.600	1.800
8	**16**	3,200	2,550	100	1.120	3.360	2,800	1,680	66	0.800	2.400
10	**20**	2,500	2,190	86	1.400	4.200	2,200	1,450	57	1.000	3.000

【Note】

① Use the appropriate coolant for the work material and machining shape.
② Use as highly rigid and accurate machine as possible.
③ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
④ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.

Recommended Cutting Conditions

EMBE-ATH Straight type



〈Finishing〉

Work material		Carbon steel, Alloy steel (180～250HB)					Tool steels (25～40HRC) P20 or equivalent					Pre-hardened steels Hardened steels (40～50HRC)				
Ball radius **RE** (mm)	Tool dia. **DC** (mm)	Revolution *n* min-1	Feed rate *vf* mm/min	IPM inch/min	*ap* mm	*ae* mm	Revolution *n* min-1	Feed rate *vf* mm/min	IPM inch/min	*ap* mm	*ae* mm	Revolution *n* min-1	Feed rate *vf* mm/min	IPM inch/min	*ap* mm	*ae* mm
0.5	**1**	**50,000**	**1,640**	65	0.02～0.05	0.02	**50,000**	**1,640**	65	0.02～0.05	0.02	**50,000**	**1,550**	61	0.02～0.05	0.02
0.75	**1.5**	**50,000**	**2,630**	104	0.02～0.07	0.03	**50,000**	**2,630**	104	0.02～0.07	0.03	**50,000**	**2,480**	98	0.02～0.07	0.03
1	**2**	**47,800**	**3,560**	140	0.02～0.10	0.04	**44,600**	**3,320**	131	0.02～0.10	0.04	**41,400**	**2,910**	115	0.02～0.10	0.04
1.25	**2.5**	**38,200**	**3,680**	145	0.05～0.12	0.05	**35,700**	**3,440**	135	0.05～0.12	0.05	**33,100**	**3,010**	119	0.05～0.12	0.05
1.5	**3**	**31,800**	**3,840**	151	0.05～0.15	0.06	**29,700**	**3,590**	141	0.05～0.15	0.06	**27,600**	**3,150**	124	0.05～0.15	0.06
1.75	**3.5**	**27,300**	**3,890**	153	0.05～0.15	0.07	**25,500**	**3,640**	143	0.05～0.15	0.07	**23,700**	**3,190**	126	0.05～0.15	0.07
2	**4**	**23,900**	**3,940**	155	0.05～0.20	0.08	**22,300**	**3,670**	145	0.05～0.20	0.08	**20,700**	**3,220**	127	0.05～0.20	0.08
2.5	**5**	**19,100**	**4,060**	160	0.05～0.25	0.10	**17,800**	**3,780**	149	0.05～0.25	0.10	**16,600**	**3,330**	131	0.05～0.25	0.10
3	**6**	**15,900**	**4,180**	165	0.05～0.3	0.12	**14,900**	**3,920**	154	0.05～0.3	0.12	**13,800**	**3,430**	135	0.05～0.3	0.12
4	**8**	**11,900**	**4,380**	172	0.05～0.4	0.16	**11,100**	**4,080**	161	0.05～0.4	0.16	**10,400**	**3,620**	143	0.05～0.4	0.16
5	**10**	**9,600**	**4,330**	171	0.05～0.5	0.20	**8,900**	**4,020**	158	0.05～0.5	0.20	**8,300**	**3,540**	139	0.05～0.5	0.20
6	**12**	**8,000**	**4,290**	169	0.05～0.6	0.24	**7,400**	**3,970**	156	0.05～0.6	0.24	**6,900**	**3,500**	138	0.05～0.6	0.24
8	**16**	**6,000**	**3,990**	157	0.05～0.8	0.32	**5,600**	**3,730**	147	0.05～0.8	0.32	**5,200**	**3,270**	129	0.05～0.8	0.32
10	**20**	**4,800**	**3,700**	146	0.05～1.0	0.40	**4,500**	**3,470**	137	0.05～1.0	0.40	**4,100**	**2,990**	118	0.05～1.0	0.40

Work material		Hardened steels (50～55HRC)					Hardened steels (55～65HRC)				
Ball radius **RE** (mm)	Tool dia. **DC** (mm)	Revolution *n* min-1	Feed rate *vf* mm/min	IPM inch/min	*ap* mm	*ae* mm	Revolution *n* min-1	Feed rate *vf* mm/min	IPM inch/min	*ap* mm	*ae* mm
0.5	**1**	**50,000**	**1,320**	52	0.02～0.05	0.02	**50,000**	**990**	39	0.02～0.05	0.02
0.75	**1.5**	**44,600**	**1,880**	74	0.02～0.07	0.03	**38,200**	**1,210**	48	0.02～0.07	0.03
1	**2**	**33,400**	**1,990**	78	0.02～0.10	0.04	**28,700**	**1,290**	51	0.02～0.10	0.04
1.25	**2.5**	**26,800**	**2,070**	82	0.05～0.12	0.05	**22,900**	**1,330**	52	0.05～0.12	0.05
1.5	**3**	**22,300**	**2,160**	85	0.05～0.15	0.06	**19,100**	**1,390**	55	0.05～0.15	0.06
1.75	**3.5**	**19,100**	**2,180**	86	0.05～0.15	0.07	**16,400**	**1,410**	56	0.05～0.15	0.07
2	**4**	**16,700**	**2,200**	87	0.05～0.20	0.08	**14,300**	**1,420**	56	0.05～0.20	0.08
2.5	**5**	**13,400**	**2,280**	90	0.05～0.25	0.10	**11,500**	**1,470**	58	0.05～0.25	0.10
3	**6**	**11,100**	**2,340**	92	0.05～0.3	0.12	**9,600**	**1,520**	60	0.05～0.3	0.12
4	**8**	**8,400**	**2,480**	98	0.05～0.4	0.16	**7,200**	**1,600**	63	0.05～0.4	0.16
5	**10**	**6,700**	**2,420**	95	0.05～0.5	0.20	**5,700**	**1,550**	61	0.05～0.5	0.20
6	**12**	**5,600**	**2,410**	95	0.05～0.6	0.24	**4,800**	**1,550**	61	0.05～0.6	0.24
8	**16**	**4,200**	**2,240**	88	0.05～0.8	0.32	**3,600**	**1,440**	57	0.05～0.8	0.32
10	**20**	**3,300**	**2,040**	80	0.05～1.0	0.40	**2,900**	**1,350**	53	0.05～1.0	0.40

【Note】
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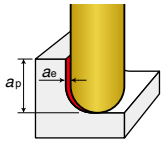
④ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.



〈Side cutting〉

Work material		Carbon steel, Alloy steel (180～250HB)					Alloy steels, Tool steels (25～40HRC) P20 or equivalent					Pre-hardened steel, Hardened steel (40～50HRC) Tool steel Regular H13 or equivalent					Pre-hardened steel, Hardened steel (40～50HRC) Premium Tool Steel Dievar, DH31or equivalent				
Ball radius **RE** (mm)	Tool dia. **DC** (mm)	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm
0.5	**1**	50,000	2,700	106	1.0	0.100	50,000	2,480	98	1.0	0.075	50,000	2,230	88	1.0	0.050	28,700	1,160	46	1.0	0.050
0.75	**1.5**	38,200	3,300	130	1.5	0.150	38,200	3,030	119	1.5	0.113	38,200	2,720	107	1.5	0.075	19,100	1,240	49	1.5	0.075
1	**2**	28,700	3,510	138	2.0	0.200	28,700	3,220	127	2.0	0.150	28,700	2,900	114	2.0	0.100	14,300	1,310	52	2.0	0.100
1.25	**2.5**	22,900	3,570	141	2.5	0.250	22,900	3,270	129	2.5	0.188	22,900	2,940	116	2.5	0.125	11,500	1,340	53	2.5	0.125
1.5	**3**	19,100	3,630	143	3.0	0.300	19,100	3,330	131	3.0	0.225	19,100	3,000	118	3.0	0.150	9,600	1,370	54	3.0	0.150
1.75	**3.5**	16,400	3,760	148	3.5	0.350	16,400	3,450	136	3.5	0.263	16,400	3,100	122	3.5	0.175	8,200	1,410	56	3.5	0.175
2	**4**	14,300	3,830	151	4.0	0.400	14,300	3,510	138	4.0	0.300	14,300	3,160	124	4.0	0.200	7,200	1,450	57	4.0	0.200
2.5	**5**	11,500	4,020	158	5.0	0.500	11,500	3,680	145	5.0	0.375	11,500	3,310	130	5.0	0.250	5,700	1,490	59	5.0	0.250
3	**6**	9,600	4,150	163	6.0	0.600	9,600	3,800	150	6.0	0.450	9,600	3,420	135	6.0	0.300	4,800	1,560	61	6.0	0.300
4	**8**	7,200	4,350	171	8.0	0.800	7,200	3,990	157	8.0	0.600	7,200	3,590	141	8.0	0.400	3,600	1,630	64	8.0	0.400
5	**10**	5,700	4,510	178	10.0	1.000	5,700	4,140	163	10.0	0.750	5,700	3,720	147	10.0	0.500	2,900	1,720	68	10.0	0.500
6	**12**	4,800	4,350	171	12.0	1.200	4,800	3,990	157	12.0	0.900	4,800	3,590	141	12.0	0.600	2,400	1,630	64	12.0	0.600
8	**16**	3,600	4,150	163	16.0	1.600	3,600	3,800	150	16.0	1.200	3,600	3,420	135	16.0	0.800	1,800	1,560	61	16.0	0.800
10	**20**	2,900	3,670	145	20.0	2.000	2,900	3,370	133	20.0	1.500	2,900	3,030	119	20.0	1.000	1,400	1,330	52	20.0	1.000

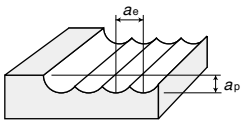
Work material		Hardened steels (50～55HRC)					Hardened steels (55～65HRC)				
Ball radius **RE** (mm)	Tool dia. **DC** (mm)	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm	Revolution n min-1	Feed rate v_f mm/min	IPM inch/min	a_p mm	a_e mm
0.5	**1**	50,000	1,870	74	1.0	0.050	44,600	1,210	48	1.0	0.020
0.75	**1.5**	34,000	2,030	80	1.5	0.075	29,700	1,290	51	1.5	0.030
1	**2**	25,500	2,160	85	2.0	0.100	22,300	1,380	54	2.0	0.040
1.25	**2.5**	20,400	2,200	87	2.5	0.125	17,800	1,400	55	2.5	0.050
1.5	**3**	17,000	2,240	88	3.0	0.150	14,900	1,430	56	3.0	0.060
1.75	**3.5**	14,600	2,320	91	3.5	0.175	12,700	1,470	58	3.5	0.070
2	**4**	12,700	2,350	93	4.0	0.200	11,100	1,500	59	4.0	0.080
2.5	**5**	10,200	2,460	97	5.0	0.250	8,900	1,570	62	5.0	0.100
3	**6**	8,500	2,540	100	6.0	0.300	7,400	1,610	63	6.0	0.120
4	**8**	6,400	2,680	106	8.0	0.400	5,600	1,710	67	8.0	0.160
5	**10**	5,100	2,790	110	10.0	0.500	4,500	1,800	71	10.0	0.200
6	**12**	4,200	2,640	104	12.0	0.600	3,700	1,690	67	12.0	0.240
8	**16**	3,200	2,550	100	16.0	0.800	2,800	1,630	64	16.0	0.320
10	**20**	2,500	2,190	86	20.0	1.000	2,200	1,410	56	20.0	0.400

	～62HRC	62～65HRC
Slant angle for helical boring	**1°**	**0.5°**
Feed rate for Helical interpolation	70% of side cutting conditions	

※Set the hole diameter for helical interpolation to between 1.6 and 2.0 times the tool diameter.
※Set the maximum depth for helical interpolation to the tool diameter or smaller (≤ 1D).

Recommended Cutting Conditions

EMBPE-ATH Pencil type



〈Roughing〉

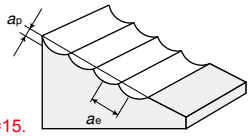
Work material			Carbon steel Alloy steel (180～250HB)					Alloy steel Tool steel (25～40HRC) P20 or equivalent					Pre-hardened steel, Hardened steel (40～50HRC) Tool steel Regular H13 or equivalent					Pre-hardened steel, Hardened steel (40～50HRC) Premium Tool Steel Dievar, DH31or equivalent					Hardened steels (50～55HRC)					Hardened steels (55～65HRC)				
Ball radius RE (mm)	Tool dia. DC (mm)	Under neck Length LU (mm)	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm
0.5	1	6	50,000	2,160	85	0.090	0.270	50,000	2,160	85	0.090	0.270	48,000	1,940	76	0.090	0.270	26,700	1,080	43	0.081	0.243	42,600	1,380	54	0.063	0.189	37,300	910	36	0.045	0.135
		8	50,000	2,160	85	0.090	0.270	50,000	2,160	85	0.090	0.270	48,000	1,940	76	0.090	0.270	26,700	1,080	43	0.081	0.243	42,600	1,380	54	0.063	0.189	37,300	910	36	0.045	0.135
		10	50,000	2,160	85	0.080	0.240	48,700	2,100	83	0.080	0.240	43,900	1,780	70	0.080	0.240	24,400	990	39	0.072	0.216	39,000	1,260	50	0.056	0.168	34,100	830	33	0.040	0.120
		12	49,700	1,910	75	0.070	0.210	44,700	1,720	68	0.070	0.210	40,200	1,450	57	0.070	0.210	22,400	810	32	0.063	0.189	35,800	1,030	41	0.049	0.147	31,300	680	27	0.035	0.105
		14	44,600	1,710	67	0.060	0.180	40,100	1,540	61	0.060	0.180	36,100	1,300	51	0.060	0.180	20,100	720	28	0.054	0.162	32,100	920	36	0.042	0.126	28,100	610	24	0.030	0.090
		16	44,600	1,710	67	0.060	0.180	40,100	1,540	61	0.060	0.180	36,100	1,300	51	0.060	0.180	20,100	720	28	0.054	0.162	32,100	920	36	0.042	0.126	28,100	610	24	0.030	0.090
		18	40,100	1,540	61	0.050	0.150	36,100	1,390	55	0.050	0.150	32,500	1,170	46	0.050	0.150	18,100	650	26	0.045	0.135	28,900	830	33	0.035	0.105	25,300	550	22	0.025	0.075
		20	40,100	1,540	61	0.050	0.150	36,100	1,390	55	0.050	0.150	32,500	1,170	46	0.050	0.150	18,100	650	26	0.045	0.135	28,900	830	33	0.035	0.105	25,300	550	22	0.025	0.075
		22	35,000	1,340	53	0.040	0.120	31,500	1,210	48	0.040	0.120	28,400	1,020	40	0.040	0.120	15,800	570	22	0.036	0.108	25,200	730	29	0.028	0.084	22,100	480	19	0.020	0.060
		24	30,600	1,180	47	0.030	0.090	27,500	1,060	42	0.030	0.090	24,800	890	35	0.030	0.090	13,800	500	20	0.027	0.081	22,000	630	25	0.021	0.063	19,300	420	17	0.015	0.045
		26	30,600	1,180	47	0.030	0.090	27,500	1,060	42	0.030	0.090	24,800	890	35	0.030	0.090	13,800	500	20	0.027	0.081	22,000	630	25	0.021	0.063	19,300	420	17	0.015	0.045
		28	25,500	860	34	0.020	0.060	22,900	770	30	0.020	0.060	20,600	650	26	0.020	0.060	11,500	360	14	0.018	0.054	18,300	460	18	0.014	0.042	16,100	300	12	0.010	0.030
		30	25,500	860	34	0.020	0.060	22,900	770	30	0.020	0.060	20,600	650	26	0.020	0.060	11,500	360	14	0.018	0.054	18,300	460	18	0.014	0.042	16,100	300	12	0.010	0.030
		32	21,000	710	28	0.010	0.030	18,900	640	25	0.010	0.030	17,000	540	21	0.010	0.030	9,500	300	12	0.009	0.027	15,100	380	15	0.007	0.021	13,200	250	10	0.005	0.015
		34	15,900	530	20.9	0.005	0.015	14,300	480	18.9	0.005	0.015	12,900	410	16.1	0.005	0.015	7,200	230	9.1	0.005	0.014	11,500	290	11.4	0.004	0.011	10,000	190	7.5	0.003	0.008
		36	15,900	530	20.9	0.005	0.015	14,300	480	18.9	0.005	0.015	12,900	410	16.1	0.005	0.015	7,200	230	9.1	0.005	0.014	11,500	290	11.4	0.004	0.011	10,000	190	7.5	0.003	0.008
0.75	1.5	8	39,500	2,670	105	0.135	0.405	35,500	2,400	95	0.135	0.405	32,000	2,070	82	0.135	0.405	17,800	1,150	45	0.122	0.365	28,400	1,530	60	0.095	0.284	24,900	1,010	40	0.068	0.203
		10	39,500	2,670	105	0.135	0.405	35,500	2,400	95	0.135	0.405	32,000	2,070	82	0.135	0.405	17,800	1,150	45	0.122	0.365	28,400	1,530	60	0.095	0.284	24,900	1,010	40	0.068	0.203
		14	36,100	2,440	96	0.120	0.360	32,500	2,190	86	0.120	0.360	29,200	1,890	74	0.120	0.360	16,200	1,050	41	0.108	0.324	26,000	1,400	55	0.084	0.252	22,700	920	36.2	0.060	0.180
		16	33,100	1,990	78	0.105	0.315	29,800	1,790	71	0.105	0.315	26,800	1,540	61	0.105	0.315	14,900	860	33.9	0.095	0.284	23,800	1,140	45	0.074	0.221	20,900	750	29.5	0.053	0.158
		18	33,100	1,990	78	0.105	0.315	29,800	1,790	71	0.105	0.315	26,800	1,540	61	0.105	0.315	14,900	860	33.9	0.095	0.284	23,800	1,140	45	0.074	0.221	20,900	750	29.5	0.053	0.158
		20	29,700	1,780	70	0.090	0.270	26,800	1,610	63	0.090	0.270	24,100	1,390	55	0.090	0.270	13,400	770	30.3	0.081	0.243	21,400	1,030	41	0.063	0.189	18,700	670	26.4	0.045	0.135
		22	29,700	1,780	70	0.090	0.270	26,800	1,610	63	0.090	0.270	24,100	1,390	55	0.090	0.270	13,400	770	30.3	0.081	0.243	21,400	1,030	41	0.063	0.189	18,700	670	26.4	0.045	0.135
		24	29,700	1,780	70	0.090	0.270	26,800	1,610	63	0.090	0.270	24,100	1,390	55	0.090	0.270	13,400	770	30.3	0.081	0.243	21,400	1,030	41	0.063	0.189	18,700	670	26.4	0.045	0.135
		26	26,800	1,610	63	0.075	0.225	24,100	1,450	57	0.075	0.225	21,700	1,250	49	0.075	0.225	12,000	690	27.2	0.068	0.203	19,300	930	36.6	0.053	0.158	16,900	610	24	0.038	0.113
		28	26,800	1,610	63	0.075	0.225	24,100	1,450	57	0.075	0.225	21,700	1,250	49	0.075	0.225	12,000	690	27.2	0.068	0.203	19,300	930	36.6	0.053	0.158	16,900	610	24	0.038	0.113
		30	26,800	1,610	63	0.075	0.225	24,100	1,450	57	0.075	0.225	21,700	1,250	49	0.075	0.225	12,000	690	27.2	0.068	0.203	19,300	930	36.6	0.053	0.158	16,900	610	24	0.038	0.113
		32	23,400	1,400	55	0.060	0.180	21,000	1,260	50	0.060	0.180	18,900	1,090	43	0.060	0.180	10,500	600	23.6	0.054	0.162	16,800	810	31.9	0.042	0.126	14,700	530	20.9	0.030	0.090
		34	23,400	1,400	55	0.060	0.180	21,000	1,260	50	0.060	0.180	18,900	1,090	43	0.060	0.180	10,500	600	23.6	0.054	0.162	16,800	810	31.9	0.042	0.126	14,700	530	20.9	0.030	0.090
		36	20,400	1,220	48	0.045	0.135	18,300	1,100	43	0.045	0.135	16,500	950	37.4	0.045	0.135	9,200	530	20.9	0.041	0.122	14,700	710	28	0.032	0.095	12,800	460	18.1	0.023	0.068
		38	20,400	1,220	48	0.045	0.135	18,300	1,100	43	0.045	0.135	16,500	950	37.4	0.045	0.135	9,200	530	20.9	0.041	0.122	14,700	710	28	0.032	0.095	12,800	460	18.1	0.023	0.068
		40	17,000	890	35	0.030	0.090	15,300	800	31.5	0.030	0.090	13,800	700	27.6	0.030	0.090	7,600	380	15	0.027	0.081	12,200	510	20.1	0.021	0.063	10,700	340	13.4	0.015	0.045
1	2	10	31,800	3,430	135	0.200	0.600	28,700	3,100	122	0.200	0.600	25,800	2,630	104	0.200	0.600	14,300	1,460	58	0.180	0.540	22,900	1,920	76	0.140	0.420	20,100	1,270	50	0.100	0.300
		16	29,600	2,880	113	0.180	0.540	26,700	2,600	102	0.180	0.540	24,000	2,200	87	0.180	0.540	13,300	1,220	48	0.162	0.486	21,300	1,610	63	0.126	0.378	18,700	1,060	42	0.090	0.270
		20	27,100	2,630	104	0.120	0.360	24,400	2,370	93	0.120	0.360	21,900	2,010	79	0.120	0.360	12,200	1,120	44	0.108	0.324	19,500	1,470	58	0.084	0.252	17,100	970	38.2	0.060	0.180
		24	24,800	2,140	84	0.110	0.330	22,400	1,940	76	0.110	0.330	20,100	1,640	65	0.110	0.330	11,200	910	35.8	0.099	0.297	17,900	1,200	47	0.077	0.231	15,600	790	31.1	0.055	0.165
		30	22,300	1,930	76	0.100	0.300	20,100	1,740	69	0.100	0.300	18,100	1,480	58	0.100	0.300	10,000	820	32.3	0.090	0.270	16,100	1,080	43	0.070	0.210	14,000	710	28	0.050	0.150
		36	20,100	1,740	69	0.080	0.240	18,100	1,560	61	0.080	0.240	16,300	1,330	52	0.080	0.240	9,000	730	28.7	0.072	0.216	14,400	970	38.2	0.056	0.168	12,600	640	25.2	0.040	0.120
		40	20,100	1,740	69	0.080	0.240	18,100	1,560	61	0.080	0.240	16,300	1,330	52	0.080	0.240	9,000	730	28.7	0.072	0.216	14,400	970	38.2	0.056	0.168	12,600	640	25.2	0.040	0.120
		46	17,500	1,510	59	0.060	0.180	15,800	1,370	54	0.060	0.180	14,200	1,160	46	0.060	0.180	7,900	640	25.2	0.054	0.162	12,600	850	33.5	0.042	0.126	11,000	550	21.7	0.030	0.090
		60	12,700	960	37.8	0.044	0.132	11,500	870	34.3	0.044	0.132	10,300	740	29.1	0.044	0.132	5,700	410	16.1	0.040	0.119	9,200	540	21.3	0.031	0.092	8,000	350	13.8	0.022	0.066
1.25	2.5	16	23,700	2,880	113	0.225	0.675	21,300	2,590	102	0.225	0.675	19,200	2,230	88	0.225	0.675	10,700	1,240	49	0.203	0.608	17,100	1,660	65	0.158	0.473	14,900	1,090	43	0.113	0.338
		24	21,700	2,640	104	0.150	0.450	19,500	2,370	93	0.150	0.450	17,500	2,030	80	0.150	0.450	9,700	1,130	45	0.135	0.405	15,600	1,520	60	0.105	0.315	13,600	990	39	0.075	0.225
		30	19,900	2,150	85	0.138	0.413	17,900	1,930	76	0.138	0.413	16,100	1,660	65	0.138	0.413	8,900	920	36.2	0.124	0.371	14,300	1,240	49	0.096	0.289	12,500	810	31.9	0.069	0.206
		40	17,800	1,920	76	0.125	0.375	16,100	1,740	69	0.125	0.375	14,400	1,490	59	0.125	0.375	8,000	830	32.7	0.113	0.338	12,800	1,110	44	0.088	0.263	11,200	730	28.7	0.063	0.188
		50	16,100	1,740	69	0.100	0.300	14,400	1,560	61	0.100	0.300	13,000	1,340	53	0.100	0.300	7,200	740	29.1	0.090	0.270	11,600	1,000	39	0.070	0.210	10,100	650	25.6	0.050	0.150
1.5	3	16	19,700	2,930	115	0.270	0.810	17,800	2,640	104	0.270	0.810	16,000	2,250	89	0.270	0.810	8,900	1,250	49	0.243	0.729	14,200	1,690	67	0.189	0.567	12,400	1,100	43	0.135	0.405
		20	19,700	2,930	115	0.270	0.810	17,800	2,640	104	0.270	0.810	16,000	2,250	89	0.270	0.810	8,900	1,250	49	0.243	0.729	14,200	1,690	67	0.189	0.567	12,400	1,100	43	0.135	0.405
		24	19,700	2,930	115	0.270	0.810	17,800	2,640	104	0.270	0.810	16,000	2,250	89	0.270	0.810	8,900	1,250	49	0.243	0.729	14,200	1,690	67	0.189	0.567	12,400	1,100	43	0.135	0.405
		30	18,000	2,670	105	0.180	0.540	16,200	2,410	95	0.180	0.540	14,600	2,050	81	0.180	0.540	8,100	1,140	45	0.162	0.486	13,000	1,540	61	0.126	0.378	11,400	1,020	40	0.090	0.270
		40	14,900	1,970	78	0.150	0.450	13,400	1,770	70	0.150	0.450	12,000	1,500	59	0.150	0.450	6,700	840	33.1	0.135	0.405	10,700	1,130	45	0.105	0.315	9,400	740	29.1	0.075	0.225
		50	13,400	1,770	70	0.120	0.360	12,000	1,580	62	0.120	0.360	10,800	1,350	53	0.120	0.360	6,000	750	29.5	0.108	0.324	9,600	1,010	40	0.084	0.252	8,400	670	26.4	0.060	0.180
		60	13,400	1,770	70	0.120	0.360	12,000	1,580	62	0.120	0.360	10,800	1,350	53	0.120	0.360	6,000	750	29.5	0.108	0.324	9,600	1,010	40	0.084	0.252	8,400	670	26.4	0.060	0.180

Work material			Carbon steel Alloy steel (180～250HB)					Alloy steel Tool steel (25～40HRC) P20 or equivalent					Pre-hardened steel, Hardened steel (40～50HRC) Tool steel Regular H13 or equivalent					Pre-hardened steel, Hardened steel (40～50HRC) Premium Tool Steel Dievar, DH31or equivalent					Hardened steels (50～55HRC)					Hardened steels (55～65HRC)				
Ball radius RE (mm)	Tool dia. DC (mm)	Under neck Length LU (mm)	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm
1.75	3.5	20	16,900	3,060	121	0.315	0.945	15,200	2,750	108	0.315	0.945	13,700	2,330	92	0.315	0.945	7,600	1,290	51	0.284	0.851	12,200	1,750	69	0.221	0.662	10,700	1,160	46	0.158	0.473
		30	15,500	2,800	110	0.210	0.630	13,900	2,510	99	0.210	0.630	12,500	2,130	84	0.210	0.630	7,000	1,190	47	0.189	0.567	11,100	1,590	63	0.147	0.441	9,700	1,050	41	0.105	0.315
		40	14,200	2,280	90	0.193	0.578	12,800	2,060	81	0.193	0.578	11,500	1,740	69	0.193	0.578	6,400	970	38.2	0.173	0.520	10,200	1,300	51	0.135	0.404	8,900	850	33.5	0.096	0.289
		50	12,700	2,040	80	0.175	0.525	11,500	1,850	73	0.175	0.525	10,300	1,560	61	0.175	0.525	5,700	860	33.9	0.158	0.473	9,200	1,170	46	0.123	0.368	8,000	770	30.3	0.088	0.263
		60	11,500	1,850	73	0.140	0.420	10,300	1,660	65	0.140	0.420	9,300	1,410	56	0.140	0.420	5,200	790	31.1	0.126	0.378	8,300	1,060	42	0.098	0.294	7,200	690	27.2	0.070	0.210
2	4	20	15,900	3,720	147	0.400	1.200	14,300	3,350	132	0.400	1.200	12,900	2,860	113	0.400	1.200	7,200	1,600	63	0.360	1.080	11,500	2,140	84	0.280	0.840	10,000	1,410	56	0.200	0.600
		30	14,800	3,120	123	0.300	0.900	13,300	2,800	110	0.300	0.900	12,000	2,400	95	0.300	0.900	6,700	1,340	53	0.270	0.810	10,700	1,790	71	0.210	0.630	9,300	1,180	47	0.150	0.450
		40	13,500	2,840	112	0.260	0.780	12,200	2,570	101	0.260	0.780	11,000	2,200	87	0.260	0.780	6,100	1,220	48	0.234	0.702	9,700	1,620	64	0.182	0.546	8,500	1,080	43	0.130	0.390
		50	12,400	2,320	91	0.180	0.540	11,200	2,100	83	0.180	0.540	10,100	1,790	71	0.180	0.540	5,600	990	39	0.162	0.486	8,900	1,320	52	0.126	0.378	7,800	880	34.6	0.090	0.270
		60	11,100	2,080	82	0.120	0.360	10,000	1,870	74	0.120	0.360	9,000	1,600	63	0.120	0.360	5,000	890	35	0.108	0.324	8,000	1,190	47	0.084	0.252	7,000	790	31.1	0.060	0.180
		70	10,000	1,870	74	0.100	0.300	9,000	1,680	66	0.100	0.300	8,100	1,440	57	0.100	0.300	4,500	800	31.5	0.090	0.270	7,200	1,070	42	0.070	0.210	6,300	710	28	0.050	0.150
		80	10,000	1,870	74	0.100	0.300	9,000	1,680	66	0.100	0.300	8,100	1,440	57	0.100	0.300	4,500	800	31.5	0.090	0.270	7,200	1,070	42	0.070	0.210	6,300	710	28	0.050	0.150
2.5	5	30	11,800	3,250	128	0.375	1.125	10,700	2,950	116	0.375	1.125	9,600	2,490	98	0.375	1.125	5,300	1,370	54	0.338	1.013	8,500	1,860	73	0.263	0.788	7,500	1,240	49	0.188	0.563
		40	11,800	3,250	128	0.375	1.125	10,700	2,950	116	0.375	1.125	9,600	2,490	98	0.375	1.125	5,300	1,370	54	0.338	1.013	8,500	1,860	73	0.263	0.788	7,500	1,240	49	0.188	0.563
		50	10,800	2,970	117	0.325	0.975	9,700	2,670	105	0.325	0.975	8,800	2,280	90	0.325	0.975	4,900	1,270	50	0.293	0.878	7,800	1,710	67	0.228	0.683	6,800	1,120	44	0.163	0.488
		60	9,900	2,420	95	0.225	0.675	8,900	2,180	86	0.225	0.675	8,000	1,840	72	0.225	0.675	4,500	1,040	41	0.203	0.608	7,200	1,400	55	0.158	0.473	6,300	920	36.2	0.113	0.338
		70	8,900	2,180	86	0.150	0.450	8,000	1,960	77	0.150	0.450	7,200	1,660	65	0.150	0.450	4,000	920	36.2	0.135	0.405	6,400	1,240	49	0.105	0.315	5,600	820	32.3	0.075	0.225
		80	8,900	2,180	86	0.150	0.450	8,000	1,960	77	0.150	0.450	7,200	1,660	65	0.150	0.450	4,000	920	36.2	0.135	0.405	6,400	1,240	49	0.105	0.315	5,600	820	32.3	0.075	0.225
3	6	30	10,600	4,010	158	0.600	1.800	9,600	3,630	143	0.600	1.800	8,600	3,070	121	0.600	1.800	4,800	1,710	67	0.540	1.620	7,600	2,280	90	0.420	1.260	6,700	1,510	59	0.300	0.900
		40	9,900	3,370	133	0.420	1.260	8,900	3,030	119	0.420	1.260	8,000	2,570	101	0.420	1.260	4,400	1,410	56	0.378	1.134	7,100	1,920	76	0.294	0.882	6,200	1,260	50	0.210	0.630
		50	9,000	3,060	121	0.300	0.900	8,100	2,760	109	0.300	0.900	7,300	2,350	93	0.300	0.900	4,100	1,320	52	0.270	0.810	6,500	1,760	69	0.210	0.630	5,700	1,150	45	0.150	0.450
		60	9,000	3,060	121	0.300	0.900	8,100	2,760	109	0.300	0.900	7,300	2,350	93	0.300	0.900	4,100	1,320	52	0.270	0.810	6,500	1,760	69	0.210	0.630	5,700	1,150	45	0.150	0.450
		70	8,300	2,510	99	0.240	0.720	7,500	2,270	89	0.240	0.720	6,700	1,910	75	0.240	0.720	3,700	1,060	42	0.216	0.648	6,000	1,440	57	0.168	0.504	5,200	940	37	0.120	0.360
		80	7,400	2,240	88	0.180	0.540	6,700	2,030	80	0.180	0.540	6,000	1,710	67	0.180	0.540	3,300	940	37	0.162	0.486	5,400	1,300	51	0.126	0.378	4,700	850	33.5	0.090	0.270
		100	6,700	2,030	80	0.120	0.360	6,000	1,810	71	0.120	0.360	5,400	1,540	61	0.120	0.360	3,000	860	33.9	0.108	0.324	4,800	1,150	45	0.084	0.252	4,200	760	29.9	0.060	0.180
		120	6,700	2,030	80	0.120	0.360	6,000	1,810	71	0.120	0.360	5,400	1,540	61	0.120	0.360	3,000	860	33.9	0.108	0.324	4,800	1,150	45	0.084	0.252	4,200	760	29.9	0.060	0.180
4	8	40	8,000	4,220	166	0.800	2.400	7,200	3,800	150	0.800	2.400	6,400	3,190	126	0.800	2.400	3,600	1,790	71	0.720	2.160	5,700	2,380	94	0.560	1.680	5,000	1,580	62	0.400	1.200
		50	7,400	3,520	139	0.560	1.680	6,700	3,180	125	0.560	1.680	6,000	2,690	106	0.560	1.680	3,300	1,480	58	0.504	1.512	5,300	1,990	78	0.392	1.176	4,700	1,330	52	0.280	0.840
		60	7,400	3,520	139	0.560	1.680	6,700	3,180	125	0.560	1.680	6,000	2,690	106	0.560	1.680	3,300	1,480	58	0.504	1.512	5,300	1,990	78	0.392	1.176	4,700	1,330	52	0.280	0.840
		70	6,800	3,230	127	0.400	1.200	6,100	2,900	114	0.400	1.200	5,500	2,470	97	0.400	1.200	3,000	1,340	53	0.360	1.080	4,900	1,840	72	0.280	0.840	4,300	1,220	48	0.200	0.600
		80	6,800	3,230	127	0.400	1.200	6,100	2,900	114	0.400	1.200	5,500	2,470	97	0.400	1.200	3,000	1,340	53	0.360	1.080	4,900	1,840	72	0.280	0.840	4,300	1,220	48	0.200	0.600
		100	6,200	2,620	103	0.320	0.960	5,600	2,370	93	0.320	0.960	5,000	1,990	78	0.320	0.960	2,800	1,120	44	0.288	0.864	4,500	1,500	59	0.224	0.672	3,900	980	38.6	0.160	0.480
		120	5,600	2,370	93	0.240	0.720	5,000	2,110	83	0.240	0.720	4,500	1,790	71	0.240	0.720	2,500	1,000	39	0.216	0.648	4,000	1,330	52	0.168	0.504	3,500	880	34.6	0.120	0.360
5	10	50	6,400	4,440	175	1.000	3.000	5,700	3,950	156	1.000	3.000	5,200	3,400	134	1.000	3.000	3,200	2,090	82	0.900	2.700	4,600	2,530	100	0.700	2.100	4,000	1,660	65	0.500	1.500
		60	5,900	3,680	145	0.700	2.100	5,300	3,310	130	0.700	2.100	4,800	2,830	111	0.700	2.100	3,000	1,770	70	0.630	1.890	4,300	2,120	84	0.490	1.470	3,700	1,380	54	0.350	1.050
		75	5,900	3,680	145	0.700	2.100	5,300	3,310	130	0.700	2.100	4,800	2,830	111	0.700	2.100	3,000	1,770	70	0.630	1.890	4,300	2,120	84	0.490	1.470	3,700	1,380	54	0.350	1.050
		80	5,400	3,370	133	0.500	1.500	4,900	3,060	121	0.500	1.500	4,400	2,590	102	0.500	1.500	2,700	1,590	63	0.450	1.350	3,900	1,930	76	0.350	1.050	3,400	1,270	50	0.250	0.750
		100	5,400	3,370	133	0.500	1.500	4,900	3,060	121	0.500	1.500	4,400	2,590	102	0.500	1.500	2,700	1,590	63	0.450	1.350	3,900	1,930	76	0.350	1.050	3,400	1,270	50	0.250	0.750
		120	5,000	2,770	109	0.400	1.200	4,500	2,490	98	0.400	1.200	4,000	2,090	82	0.400	1.200	2,500	1,310	52	0.360	1.080	3,600	1,580	62	0.280	0.840	3,100	1,030	41	0.200	0.600
6	12	60	5,300	4,210	166	1.200	3.600	4,800	3,820	150	1.200	3.600	4,300	3,210	126	1.200	3.600	2,700	2,020	80	1.080	3.240	3,800	2,380	94	0.840	2.520	3,300	1,560	61	0.600	1.800
		80	4,900	3,510	138	0.840	2.520	4,400	3,150	124	0.840	2.520	4,000	2,690	106	0.840	2.520	2,500	1,680	66	0.756	2.268	3,600	2,030	80	0.588	1.764	3,100	1,320	52	0.420	1.260
		100	4,500	3,220	127	0.600	1.800	4,100	2,930	115	0.600	1.800	3,700	2,490	98	0.600	1.800	2,300	1,550	61	0.540	1.620	3,200	1,810	71	0.420	1.260	2,800	1,190	47	0.300	0.900
		120	4,500	3,220	127	0.600	1.800	4,100	2,930	115	0.600	1.800	3,700	2,490	98	0.600	1.800	2,300	1,550	61	0.540	1.620	3,200	1,810	71	0.420	1.260	2,800	1,190	47	0.300	0.900

【Note】
① Use the appropriate coolant for the work material and machining shape.
② Use as highly rigid and accurate machine as possible.
③ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
④ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.

Recommended Cutting Conditions

EMBPE-ATH Pencil type



〈Finishing〉

※The condition of "ap" and "ae" assumes finishing process. In actual machining conditions please adjust "ap" and "ae" . Please set up the condition of "ap" and "ae" for roughing process, in case of processing over L/D=15.

Work material			Carbon steel Alloy steel (180～250HB)					Tool steel (25～40HRC) P20 or equivalent					Pre-hardened steels Hardened steels (40～50HRC)					Hardened steels (50～55HRC)					Hardened steels (55～65HRC)				
Ball radius RE (mm)	Tool dia. DC (mm)	Under neck Length LU (mm)	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm
0.5	1	6	50,000	1,760	69	0.02~0.05	0.020	50,000	1,760	69	0.02~0.05	0.020	50,000	1,620	64	0.02~0.05	0.020	47,400	1,280	50	0.02~0.05	0.020	41,500	810	32	0.02~0.05	0.020
		8	50,000	1,760	69	0.02~0.05	0.020	50,000	1,760	69	0.02~0.05	0.020	50,000	1,620	64	0.02~0.05	0.020	47,400	1,280	50	0.02~0.05	0.020	41,500	810	32	0.02~0.05	0.020
		10	50,000	1,760	69	0.02~0.05	0.020	50,000	1,760	69	0.02~0.05	0.020	48,700	1,580	62	0.02~0.05	0.020	43,300	1,170	46	0.02~0.05	0.020	37,900	740	29	0.02~0.05	0.020
		12	50,000	1,560	61	0.02~0.05	0.020	49,700	1,550	61	0.02~0.05	0.020	44,700	1,290	51	0.02~0.05	0.020	39,700	950	37	0.02~0.05	0.020	34,800	600	24	0.02~0.05	0.020
		14	49,000	1,530	60	0.02~0.05	0.020	44,600	1,390	55	0.02~0.05	0.020	40,100	1,150	45	0.02~0.05	0.020	35,700	860	34	0.02~0.05	0.020	31,200	540	21	0.02~0.05	0.020
		16	49,000	1,530	60	0.02~0.05	0.020	44,600	1,390	55	0.02~0.05	0.020	40,100	1,150	45	0.02~0.05	0.020	35,700	860	34	0.02~0.05	0.020	31,200	540	21	0.02~0.05	0.020
		18	44,100	1,380	54	0.02~0.05	0.020	40,100	1,250	49	0.02~0.05	0.020	36,100	1,040	41	0.02~0.05	0.020	32,100	770	30	0.02~0.05	0.020	28,100	490	19	0.02~0.05	0.020
		20	44,100	1,380	54	0.02~0.05	0.020	40,100	1,250	49	0.02~0.05	0.020	36,100	1,040	41	0.02~0.05	0.020	32,100	770	30	0.02~0.05	0.020	28,100	490	19	0.02~0.05	0.020
		22	38,500	1,200	47	0.02~0.05	0.020	35,000	1,090	43	0.02~0.05	0.020	31,500	910	36	0.02~0.05	0.020	28,000	670	26	0.02~0.05	0.020	24,500	420	17	0.02~0.05	0.020
		24	33,600	1,050	41	0.02~0.05	0.020	30,600	950	37	0.02~0.05	0.020	27,500	790	31	0.02~0.05	0.020	24,500	590	23	0.02~0.05	0.020	21,400	370	15	0.02~0.05	0.020
		26	33,600	1,050	41	0.02~0.05	0.020	30,600	950	37	0.02~0.05	0.020	27,500	790	31	0.02~0.05	0.020	24,500	590	23	0.02~0.05	0.020	21,400	370	15	0.02~0.05	0.020
		28	28,000	760	30	0.02~0.05	0.020	25,500	700	28	0.02~0.05	0.020	22,900	580	23	0.02~0.05	0.020	20,400	430	17	0.02~0.05	0.020	17,800	270	11	0.02~0.05	0.020
		30	28,000	760	30	0.02~0.05	0.020	25,500	700	28	0.02~0.05	0.020	22,900	580	23	0.02~0.05	0.020	20,400	430	17	0.02~0.05	0.020	17,800	270	11	0.02~0.05	0.020
		32	23,100	630	25	0.02~0.05	0.020	21,000	570	22	0.02~0.05	0.020	18,900	480	19	0.02~0.05	0.020	16,800	350	14	0.02~0.05	0.020	14,700	220	9	0.02~0.05	0.020
		34	17,500	480	18.9	0.02~0.05	0.020	15,900	430	16.9	0.02~0.05	0.020	14,300	360	14.2	0.02~0.05	0.020	12,700	270	10.6	0.02~0.05	0.020	11,100	170	6.7	0.02~0.05	0.020
		36	17,500	480	18.9	0.02~0.05	0.020	15,900	430	16.9	0.02~0.05	0.020	14,300	360	14.2	0.02~0.05	0.020	12,700	270	10.6	0.02~0.05	0.020	11,100	170	6.7	0.02~0.05	0.020
0.75	1.5	8	43,400	2,340	92	0.02~0.07	0.030	39,500	2,130	84	0.02~0.07	0.030	35,500	1,820	72	0.02~0.07	0.030	31,600	1,370	54	0.02~0.07	0.030	27,600	890	35	0.02~0.07	0.030
		10	43,400	2,340	92	0.02~0.07	0.030	39,500	2,130	84	0.02~0.07	0.030	35,500	1,820	72	0.02~0.07	0.030	31,600	1,370	54	0.02~0.07	0.030	27,600	890	35	0.02~0.07	0.030
		14	39,700	2,140	84	0.02~0.07	0.030	36,100	1,950	77	0.02~0.07	0.030	32,500	1,670	66	0.02~0.07	0.030	28,900	1,250	49	0.02~0.07	0.030	25,300	820	32.3	0.02~0.07	0.030
		16	36,400	1,750	69	0.02~0.07	0.030	33,100	1,590	63	0.02~0.07	0.030	29,800	1,360	54	0.02~0.07	0.030	26,500	1,020	40	0.02~0.07	0.030	23,200	670	26.4	0.02~0.07	0.030
		18	36,400	1,750	69	0.02~0.07	0.030	33,100	1,590	63	0.02~0.07	0.030	29,800	1,360	54	0.02~0.07	0.030	26,500	1,020	40	0.02~0.07	0.030	23,200	670	26.4	0.02~0.07	0.030
		20	32,700	1,570	62	0.02~0.07	0.030	29,700	1,430	56	0.02~0.07	0.030	26,800	1,220	48	0.02~0.07	0.030	23,800	910	36	0.02~0.07	0.030	20,800	600	23.6	0.02~0.07	0.030
		22	32,700	1,570	62	0.02~0.07	0.030	29,700	1,430	56	0.02~0.07	0.030	26,800	1,220	48	0.02~0.07	0.030	23,800	910	36	0.02~0.07	0.030	20,800	600	23.6	0.02~0.07	0.030
		24	32,700	1,570	62	0.02~0.07	0.030	29,700	1,430	56	0.02~0.07	0.030	26,800	1,220	48	0.02~0.07	0.030	23,800	910	36	0.02~0.07	0.030	20,800	600	23.6	0.02~0.07	0.030
		26	29,400	1,410	56	0.02~0.07	0.030	26,800	1,290	51	0.02~0.07	0.030	24,100	1,100	43	0.02~0.07	0.030	21,400	820	32.3	0.02~0.07	0.030	18,700	540	21.3	0.02~0.07	0.030
		28	29,400	1,410	56	0.02~0.07	0.030	26,800	1,290	51	0.02~0.07	0.030	24,100	1,100	43	0.02~0.07	0.030	21,400	820	32.3	0.02~0.07	0.030	18,700	540	21.3	0.02~0.07	0.030
		30	29,400	1,410	56	0.02~0.07	0.030	26,800	1,290	51	0.02~0.07	0.030	24,100	1,100	43	0.02~0.07	0.030	21,400	820	32.3	0.02~0.07	0.030	18,700	540	21.3	0.02~0.07	0.030
		32	25,700	1,230	48	0.02~0.07	0.030	23,400	1,120	44	0.02~0.07	0.030	21,000	960	38	0.02~0.07	0.030	18,700	720	28.3	0.02~0.07	0.030	16,300	470	18.5	0.02~0.07	0.030
		34	25,700	1,230	48	0.02~0.07	0.030	23,400	1,120	44	0.02~0.07	0.030	21,000	960	38	0.02~0.07	0.030	18,700	720	28.3	0.02~0.07	0.030	16,300	470	18.5	0.02~0.07	0.030
		36	22,400	1,080	43	0.02~0.07	0.030	20,400	980	39	0.02~0.07	0.030	18,300	830	32.7	0.02~0.07	0.030	16,300	630	24.8	0.02~0.07	0.030	14,300	410	16.1	0.02~0.07	0.030
		38	22,400	1,080	43	0.02~0.07	0.030	20,400	980	39	0.02~0.07	0.030	18,300	830	32.7	0.02~0.07	0.030	16,300	630	24.8	0.02~0.07	0.030	14,300	410	16.1	0.02~0.07	0.030
		40	18,700	790	31.1	0.02~0.07	0.030	17,000	710	28	0.02~0.07	0.030	15,300	610	24	0.02~0.07	0.030	13,600	460	18.1	0.02~0.07	0.030	11,900	300	11.8	0.02~0.07	0.030
1	2	10	35,000	3,050	120	0.02~0.10	0.040	31,800	2,770	109	0.02~0.10	0.040	28,700	2,320	91	0.02~0.10	0.040	25,500	1,680	66	0.02~0.10	0.040	22,300	1,140	45	0.02~0.10	0.040
		16	32,600	2,550	100	0.02~0.10	0.040	29,600	2,320	91	0.02~0.10	0.040	26,700	1,950	77	0.02~0.10	0.040	23,700	1,410	56	0.02~0.10	0.040	20,700	950	37	0.02~0.10	0.040
		20	29,800	2,330	92	0.02~0.10	0.040	27,100	2,120	84	0.02~0.10	0.040	24,400	1,780	70	0.02~0.10	0.040	21,700	1,290	51	0.02~0.10	0.040	18,900	870	34.3	0.02~0.10	0.040
		24	27,300	1,900	75	0.02~0.10	0.040	24,800	1,730	68	0.02~0.10	0.040	22,400	1,450	57	0.02~0.10	0.040	19,900	1,050	41	0.02~0.10	0.040	17,400	710	28	0.02~0.10	0.040
		30	24,500	1,710	67	0.02~0.10	0.040	22,300	1,550	61	0.02~0.10	0.040	20,100	1,300	51	0.02~0.10	0.040	17,800	940	37	0.02~0.10	0.040	15,600	640	25.2	0.02~0.10	0.040
		36	22,100	1,540	61	0.02~0.10	0.040	20,100	1,400	55	0.02~0.10	0.040	18,100	1,170	46	0.02~0.10	0.040	16,100	850	33.5	0.02~0.10	0.040	14,000	570	22.4	0.02~0.10	0.040
		40	22,100	1,540	61	0.02~0.10	0.040	20,100	1,400	55	0.02~0.10	0.040	18,100	1,170	46	0.02~0.10	0.040	16,100	850	33.5	0.02~0.10	0.040	14,000	570	22.4	0.02~0.10	0.040
		46	19,300	1,340	53	0.02~0.10	0.040	17,500	1,220	48	0.02~0.10	0.040	15,800	1,020	40	0.02~0.10	0.040	14,000	740	29.1	0.02~0.10	0.040	12,300	500	19.7	0.02~0.10	0.040
		60	14,000	850	33.5	0.02~0.10	0.040	12,700	770	30.3	0.02~0.10	0.040	11,500	650	25.6	0.02~0.10	0.040	10,200	470	18.5	0.02~0.10	0.040	8,900	320	12.6	0.02~0.10	0.040
1.25	2.5	16	26,100	2,540	100	0.05~0.12	0.050	23,700	2,300	91	0.05~0.12	0.050	21,300	1,960	77	0.05~0.12	0.050	19,000	1,490	59	0.05~0.12	0.050	16,600	990	39	0.05~0.12	0.050
		24	23,800	2,310	91	0.05~0.12	0.050	21,700	2,110	83	0.05~0.12	0.050	19,500	1,790	71	0.05~0.12	0.050	17,300	1,350	53	0.05~0.12	0.050	15,200	900	35.4	0.05~0.12	0.050
		30	21,900	1,890	74	0.05~0.12	0.050	19,900	1,720	68	0.05~0.12	0.050	17,900	1,460	58	0.05~0.12	0.050	15,900	1,110	44	0.05~0.12	0.050	13,900	730	28.7	0.05~0.12	0.050
		40	19,600	1,690	67	0.05~0.12	0.050	17,800	1,540	61	0.05~0.12	0.050	16,100	1,310	52	0.05~0.12	0.050	14,300	1,000	39	0.05~0.12	0.050	12,500	660	26	0.05~0.12	0.050
		50	17,700	1,530	60	0.05~0.12	0.050	16,100	1,390	55	0.05~0.12	0.050	14,400	1,180	47	0.05~0.12	0.050	12,800	890	35	0.05~0.12	0.050	11,200	590	23.2	0.05~0.12	0.050
1.5	3	16	21,700	2,580	102	0.05~0.15	0.060	19,700	2,340	92	0.05~0.15	0.060	17,800	2,020	80	0.05~0.15	0.060	15,800	1,490	59	0.05~0.15	0.060	13,800	970	38	0.05~0.15	0.060
		20	21,700	2,580	102	0.05~0.15	0.060	19,700	2,340	92	0.05~0.15	0.060	17,800	2,020	80	0.05~0.15	0.060	15,800	1,490	59	0.05~0.15	0.060	13,800	970	38	0.05~0.15	0.060
		24	21,700	2,580	102	0.05~0.15	0.060	19,700	2,340	92	0.05~0.15	0.060	17,800	2,020	80	0.05~0.15	0.060	15,800	1,490	59	0.05~0.15	0.060	13,800	970	38	0.05~0.15	0.060
		30	19,900	2,360	93	0.05~0.15	0.060	18,000	2,140	84	0.05~0.15	0.060	16,200	1,840	72	0.05~0.15	0.060	14,400	1,360	54	0.05~0.15	0.060	12,600	880	35	0.05~0.15	0.060
		40	16,300	1,720	68	0.05~0.15	0.060	14,900	1,570	62	0.05~0.15	0.060	13,400	1,350	53	0.05~0.15	0.060	11,900	1,000	39	0.05~0.15	0.060	10,400	650	25.6	0.05~0.15	0.060
		50	14,700	1,550	61	0.05~0.15	0.060	13,400	1,420	56	0.05~0.15	0.060	12,000	1,210	48	0.05~0.15	0.060	10,700	900	35	0.05~0.15	0.060	9,400	590	23.2	0.05~0.15	0.060
		60	14,700	1,550	61	0.05~0.15	0.060	13,400	1,420	56	0.05~0.15	0.060	12,000	1,210	48	0.05~0.15	0.060	10,700	900	35	0.05~0.15	0.060	9,400	590	23.2	0.05~0.15	0.060

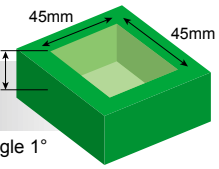
※The condition of "ap" and "ae" assumes finishing process. In actual machining conditions please adjust "ap" and "ae" . Please set up the condition of "ap" and "ae" for roughing process, in case of processing over L/D=15.

Work material			Carbon steel Alloy steel (180～250HB)					Tool steel (25～40HRC) P20 or equivalent					Pre-hardened steels Hardened steels (40～50HRC)					Hardened steels (50～55HRC)					Hardened steels (55～65HRC)				
Ball radius RE (mm)	Tool dia. DC (mm)	Under neck Length LU (mm)	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm	Revolution n min-1	Feed rate vf mm/min	IPM inch/min	ap mm	ae mm
1.75	3.5	20	18,600	2,710	107	0.05~0.15	0.070	16,900	2,460	97	0.05~0.15	0.070	15,200	2,050	81	0.05~0.15	0.070	13,500	1,530	60	0.05~0.15	0.070	11,800	1,020	40	0.05~0.15	0.070
		30	17,000	2,480	98	0.05~0.15	0.070	15,500	2,260	89	0.05~0.15	0.070	13,900	1,880	74	0.05~0.15	0.070	12,400	1,410	56	0.05~0.15	0.070	10,800	930	37	0.05~0.15	0.070
		40	15,600	2,020	80	0.05~0.15	0.070	14,200	1,840	72	0.05~0.15	0.070	12,800	1,540	61	0.05~0.15	0.070	11,400	1,150	45	0.05~0.15	0.070	9,900	760	29.9	0.05~0.15	0.070
		50	14,000	1,810	71	0.05~0.15	0.070	12,700	1,650	65	0.05~0.15	0.070	11,500	1,380	54	0.05~0.15	0.070	10,200	1,030	41	0.05~0.15	0.070	8,900	680	26.8	0.05~0.15	0.070
		60	12,600	1,630	64	0.05~0.15	0.070	11,500	1,490	59	0.05~0.15	0.070	10,300	1,240	49	0.05~0.15	0.070	9,200	930	37	0.05~0.15	0.070	8,000	610	24	0.05~0.15	0.070
2	4	20	17,500	3,260	128	0.05~0.20	0.080	15,900	2,960	117	0.05~0.20	0.080	14,300	2,530	100	0.05~0.20	0.080	12,700	1,910	75	0.05~0.20	0.080	11,100	1,270	50	0.05~0.20	0.080
		30	16,300	2,730	108	0.05~0.20	0.080	14,800	2,480	98	0.05~0.20	0.080	13,300	2,120	84	0.05~0.20	0.080	11,800	1,590	63	0.05~0.20	0.080	10,400	1,070	42	0.05~0.20	0.080
		40	14,900	2,490	98	0.05~0.20	0.080	13,500	2,260	89	0.05~0.20	0.080	12,200	1,940	76	0.05~0.20	0.080	10,800	1,460	58	0.05~0.20	0.080	9,500	970	38	0.05~0.20	0.080
		50	13,700	2,040	80	0.05~0.20	0.080	12,400	1,850	73	0.05~0.20	0.080	11,200	1,590	63	0.05~0.20	0.080	9,900	1,190	47	0.05~0.20	0.080	8,700	790	31.1	0.05~0.20	0.080
		60	12,300	1,830	72	0.05~0.20	0.080	11,100	1,650	65	0.05~0.20	0.080	10,000	1,420	56	0.05~0.20	0.080	8,900	1,070	42	0.05~0.20	0.080	7,800	710	28	0.05~0.20	0.080
		70	11,000	1,640	65	0.05~0.20	0.080	10,000	1,490	59	0.05~0.20	0.080	9,000	1,270	50	0.05~0.20	0.080	8,000	960	38	0.05~0.20	0.080	7,000	640	25.2	0.05~0.20	0.080
		80	11,000	1,640	65	0.05~0.20	0.080	10,000	1,490	59	0.05~0.20	0.080	9,000	1,270	50	0.05~0.20	0.080	8,000	960	38	0.05~0.20	0.080	7,000	640	25.2	0.05~0.20	0.080
2.5	5	30	13,000	2,880	113	0.05~0.25	0.100	11,800	2,610	103	0.05~0.25	0.100	10,700	2,220	87	0.05~0.25	0.100	9,500	1,670	66	0.05~0.25	0.100	8,300	1,100	43	0.05~0.25	0.100
		40	13,000	2,880	113	0.05~0.25	0.100	11,800	2,610	103	0.05~0.25	0.100	10,700	2,220	87	0.05~0.25	0.100	9,500	1,670	66	0.05~0.25	0.100	8,300	1,100	43	0.05~0.25	0.100
		50	11,900	2,630	104	0.05~0.25	0.100	10,800	2,390	94	0.05~0.25	0.100	9,700	2,020	80	0.05~0.25	0.100	8,700	1,530	60	0.05~0.25	0.100	7,600	1,010	40	0.05~0.25	0.100
		60	10,900	2,150	85	0.05~0.25	0.100	9,900	1,950	77	0.05~0.25	0.100	8,900	1,640	65	0.05~0.25	0.100	7,900	1,230	48	0.05~0.25	0.100	7,000	820	32.3	0.05~0.25	0.100
		70	9,800	1,930	76	0.05~0.25	0.100	8,900	1,750	69	0.05~0.25	0.100	8,000	1,480	58	0.05~0.25	0.100	7,100	1,110	44	0.05~0.25	0.100	6,200	730	28.7	0.05~0.25	0.100
		80	9,800	1,930	76	0.05~0.25	0.100	8,900	1,750	69	0.05~0.25	0.100	8,000	1,480	58	0.05~0.25	0.100	7,100	1,110	44	0.05~0.25	0.100	6,200	730	28.7	0.05~0.25	0.100
3	6	30	11,700	3,550	140	0.05~0.3	0.120	10,600	3,210	126	0.05~0.3	0.120	9,600	2,740	108	0.05~0.3	0.120	8,500	2,040	80	0.05~0.3	0.120	7,400	1,330	52	0.05~0.3	0.120
		40	10,900	2,970	117	0.05~0.3	0.120	9,900	2,700	106	0.05~0.3	0.120	8,900	2,280	90	0.05~0.3	0.120	7,900	1,710	67	0.05~0.3	0.120	6,900	1,120	44	0.05~0.3	0.120
		50	9,900	2,700	106	0.05~0.3	0.120	9,000	2,450	97	0.05~0.3	0.120	8,100	2,080	82	0.05~0.3	0.120	7,200	1,560	61	0.05~0.3	0.120	6,300	1,020	40	0.05~0.3	0.120
		60	9,900	2,700	106	0.05~0.3	0.120	9,000	2,450	97	0.05~0.3	0.120	8,100	2,080	82	0.05~0.3	0.120	7,200	1,560	61	0.05~0.3	0.120	6,300	1,020	40	0.05~0.3	0.120
		70	9,100	2,210	87	0.05~0.3	0.120	8,300	2,010	79	0.05~0.3	0.120	7,500	1,710	67	0.05~0.3	0.120	6,600	1,270	50	0.05~0.3	0.120	5,800	840	33.1	0.05~0.3	0.120
		80	8,200	1,990	78	0.05~0.3	0.120	7,400	1,790	71	0.05~0.3	0.120	6,700	1,530	60	0.05~0.3	0.120	5,900	1,130	45	0.05~0.3	0.120	5,200	750	29.5	0.05~0.3	0.120
		100	7,400	1,790	71	0.05~0.3	0.120	6,700	1,620	64	0.05~0.3	0.120	6,000	1,370	54	0.05~0.3	0.120	5,400	1,040	41	0.05~0.3	0.120	4,700	680	26.8	0.05~0.3	0.120
		120	7,400	1,790	71	0.05~0.3	0.120	6,700	1,620	64	0.05~0.3	0.120	6,000	1,370	54	0.05~0.3	0.120	5,400	1,040	41	0.05~0.3	0.120	4,700	680	26.8	0.05~0.3	0.120
4	8	40	8,800	3,720	147	0.05~0.4	0.160	8,000	3,380	133	0.05~0.4	0.160	7,200	2,870	113	0.05~0.4	0.160	6,400	2,130	84	0.05~0.4	0.160	5,600	1,410	56	0.05~0.4	0.160
		50	8,100	3,080	121	0.05~0.4	0.160	7,400	2,820	111	0.05~0.4	0.160	6,700	2,410	95	0.05~0.4	0.160	5,900	1,770	70	0.05~0.4	0.160	5,200	1,180	47	0.05~0.4	0.160
		60	8,100	3,080	121	0.05~0.4	0.160	7,400	2,820	111	0.05~0.4	0.160	6,700	2,410	95	0.05~0.4	0.160	5,900	1,770	70	0.05~0.4	0.160	5,200	1,180	47	0.05~0.4	0.160
		70	7,400	2,820	111	0.05~0.4	0.160	6,800	2,590	102	0.05~0.4	0.160	6,100	2,190	86	0.05~0.4	0.160	5,400	1,620	64	0.05~0.4	0.160	4,700	1,070	42	0.05~0.4	0.160
		80	7,400	2,820	111	0.05~0.4	0.160	6,800	2,590	102	0.05~0.4	0.160	6,100	2,190	86	0.05~0.4	0.160	5,400	1,620	64	0.05~0.4	0.160	4,700	1,070	42	0.05~0.4	0.160
		100	6,800	2,300	91	0.05~0.4	0.160	6,200	2,100	83	0.05~0.4	0.160	5,600	1,790	71	0.05~0.4	0.160	5,000	1,330	52	0.05~0.4	0.160	4,300	870	34.3	0.05~0.4	0.160
		120	6,100	2,060	81	0.05~0.4	0.160	5,600	1,900	75	0.05~0.4	0.160	5,000	1,600	63	0.05~0.4	0.160	4,500	1,200	47	0.05~0.4	0.160	3,900	790	31.1	0.05~0.4	0.160
5	10	50	7,000	3,890	153	0.05~0.5	0.200	6,400	3,550	140	0.05~0.5	0.200	5,700	2,980	117	0.05~0.5	0.200	5,100	2,230	88	0.05~0.5	0.200	4,500	1,490	59	0.05~0.5	0.200
		60	6,500	3,250	128	0.05~0.5	0.200	5,900	2,950	116	0.05~0.5	0.200	5,300	2,490	98	0.05~0.5	0.200	4,700	1,850	73	0.05~0.5	0.200	4,100	1,220	48	0.05~0.5	0.200
		75	6,500	3,250	128	0.05~0.5	0.200	5,900	2,950	116	0.05~0.5	0.200	5,300	2,490	98	0.05~0.5	0.200	4,700	1,850	73	0.05~0.5	0.200	4,100	1,220	48	0.05~0.5	0.200
		80	6,000	3,000	118	0.05~0.5	0.200	5,400	2,700	106	0.05~0.5	0.200	4,900	2,300	91	0.05~0.5	0.200	4,300	1,700	67	0.05~0.5	0.200	3,800	1,130	45	0.05~0.5	0.200
		100	6,000	3,000	118	0.05~0.5	0.200	5,400	2,700	106	0.05~0.5	0.200	4,900	2,300	91	0.05~0.5	0.200	4,300	1,700	67	0.05~0.5	0.200	3,800	1,130	45	0.05~0.5	0.200
		120	5,500	2,440	96	0.05~0.5	0.200	5,000	2,220	87	0.05~0.5	0.200	4,500	1,880	74	0.05~0.5	0.200	4,000	1,400	55	0.05~0.5	0.200	3,500	920	36	0.05~0.5	0.200
6	12	60	5,800	3,690	145	0.05~0.6	0.240	5,300	3,370	133	0.05~0.6	0.240	4,800	2,870	113	0.05~0.6	0.240	4,200	2,100	83	0.05~0.6	0.240	3,700	1,400	55	0.05~0.6	0.240
		80	5,400	3,090	122	0.05~0.6	0.240	4,900	2,800	110	0.05~0.6	0.240	4,400	2,360	93	0.05~0.6	0.240	3,900	1,760	69	0.05~0.6	0.240	3,500	1,190	47	0.05~0.6	0.240
		100	5,000	2,860	113	0.05~0.6	0.240	4,500	2,580	102	0.05~0.6	0.240	4,100	2,200	87	0.05~0.6	0.240	3,600	1,620	64	0.05~0.6	0.240	3,200	1,090	43	0.05~0.6	0.240
		120	5,000	2,860	113	0.05~0.6	0.240	4,500	2,580	102	0.05~0.6	0.240	4,100	2,200	87	0.05~0.6	0.240	3,600	1,620	64	0.05~0.6	0.240	3,200	1,090	43	0.05~0.6	0.240

【Note】
① Use the appropriate coolant for the work material and machining shape.
② Use as highly rigid and accurate machine as possible.
③ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
④ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.

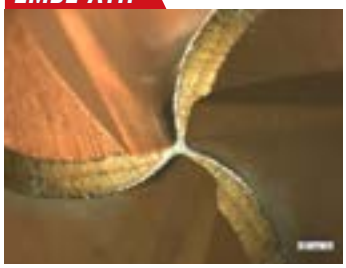
Application Example

Example of cutting high-toughness material [DH31, 45HRC]



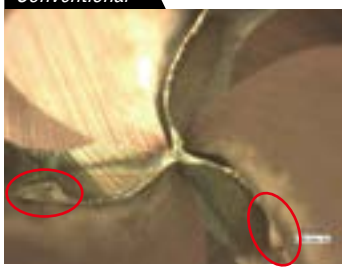
Tool：EMBE3060-ATH　ϕ6 (R3)
n=4,000min^{-1}(v_c=75m/min)
v_f=1,150mm/min(f_z=0.097mm/t)
a_p=0.36mm　a_e=1mm
Water base coolant
Machine：Vertical MC(HSK-F63)
Over hang：30mm(5D)
Number of Pocket milling：1pc.
Process time：75min

EMBE-ATH



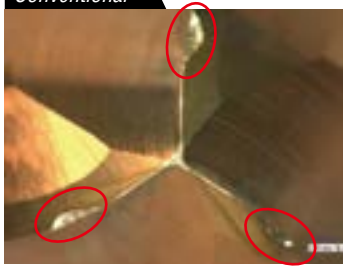
VB=0.05mm
Small wear width
(Continuous cutting is possible.)

Conventional



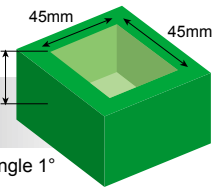
Tool life is ended due to heavy chipping on 2 edges.

Conventional

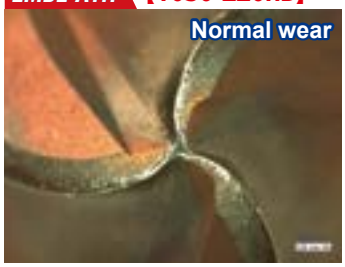


Tool life is ended due to chipping early of use.

Cutting performance of steel grade



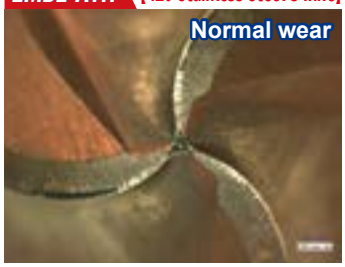
EMBE-ATH 【1050 220HB】



VB=0.09mm

Tool：EMBE3060-ATH　ϕ6 (R3)
n=11,700min^{-1}(v_c=220m/min)
v_f=4,390mm/min(f_z=0.125mm/t)
a_p=0.6mm, a_e=1.8mm
Dry air blow
Over hang：30mm(5D)
Machine：Vertical MC(HSK-F63)
Number of Pocket milling：2pcs.
Process time：40min

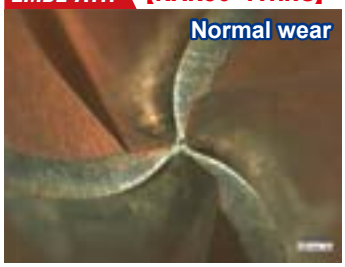
EMBE-ATH 【420 Stainless Steel 54HRC】



VB=0.06mm

Tool：EMBE3060-ATH　ϕ6 (R3)
n=8,500min^{-1}(v_c=160m/min)
v_f=2,550mm/min(f_z=0.1mm/t)
a_p=0.42mm, a_e=1.26mm
Dry air blow
Over hang：30mm(5D)
Machine：Vertical MC(HSK-F63)
Number of Pocket milling：1pc.
Process time：45min

EMBE-ATH 【NAK80 41HRC】

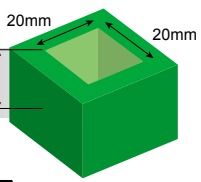


VB=0.04mm

Tool：EMBE3060-ATH　ϕ6 (R3)
n=9,500min^{-1}(v_c=179m/min)
v_f=3,380mm/min(f_z=0.118mm/t)
a_p=0.6mm, a_e=1.8mm
Dry air blow
Over hang：30mm(5D)
Machine：Vertical MC(HSK-F63)
Number of Pocket milling：4pcs.
Process time：90min

Achieves high-efficiency on kind of steel grade

Example of deep cutting (L/D=16) [DH31, 45HRC]



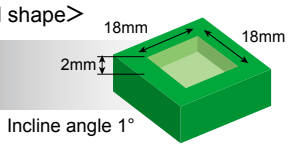
Tool：EMBPE3060-100-09-ATH
ϕ6(R3)×Under neck length 100mm×Neck angle 0.9°
n=1,500min^{-1} (v_c=28m/min)
v_f=360mm/min (f_z=0.08mm/t)
a_p=0.21mm　a_e=0.5mm
Water base coolant
Machine：Vertical MC (HSK-F63)
Over hang：105mm(17.5D)
Number of Pocket milling：1pc.
Process time：195min

EMBPE-ATH

Conventional

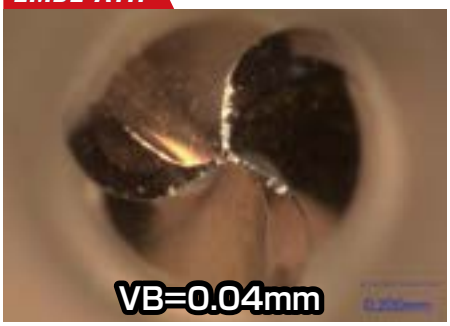
Example of maximum tool dia. φ1 [DH31, 45HRC]

<Model shape>



Tool：EMBE3010-S4-ATH ϕ1(R0.5)
n=18,000min^{-1}(v_c=57m/min)
v_f=900mm/min(f_z=0.025mm/t)
a_p=0.05mm a_e=0.16mm
Water base coolant
Machine：Vertical MC(HSK-F63)
Over hang：15mm
Number of Pocket milling：1pc.
Process time：45min

EMBE-ATH



Conventional

Recommended line up of ball end mills

4 flutes

ATH Coated

EHHB-ATH

Epoch High Hard Ball

- The performance is shown by direct milling of high hardened materials. (over 55HRC).
- In the case of process using material less than 55HRC we recommend two and three flute end mills.

More than 55HRC

3 flutes

ATH Coated

EMBE-ATH

Epoch Mega Feed Ball Evolution

- High efficiency processes for less than 55HRC material.
- Specialized edge shape for sticky material (DH31).
- Lineup with a total of 117 items.

Straight : 21 items
Pencil : 96 items

Less than 55HRC, Deep cutting

2 flutes

ATH Coated

EPBTS-TH

Epoch TH Hard Ball Strong

- Achieves long tool life by strong edge shape geometry and ATH coating.
- With negative cutting edge and high helix geometry the edge shape provides low cutting forces in hardened materials.

2 flutes

PN Coated

HGOB-PN

Epoch Panacea Ball

- Possible long life processing for less than 52HRC material
- Performance is shown in the welding material, for example carbon steel, alloy steel and stainless steel.

Safety notes

1. Cautions regarding handling
(1) When removing the tool from its case (packaging), be careful that the tool does not pop out or is dropped. Be particularly careful regarding contact with the tool flutes.
(2) When handling tools with sharp cutting flutes, be careful not to touch the cutting flutes directly with your bare hands.

2. Cautions regarding mounting
(1) Before use, check the outside appearance of the tool for scratches, cracks, etc. and that it is firmly mounted in the collet chuck, etc.
(2) If abnormal chattering, etc. occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Cautions during use
(1) Before use, confirm the dimensions and direction of rotation of the tool and milling work material.
(2) The numerical values in the standard cutting conditions table should be used as criteria when starting new work. The cutting conditions should be adjusted as appropriate when the cutting depth is large, the rigidity of the machine being used is low, or according to the conditions of the work material.
(3) Cutting tools are made of a hard material. During use, they may break and fly off. In addition, cutting chips may also fly off. Since there is a danger of injury to workers, fire, or eye damage from such flying pieces, a safety cover should be attached when work is performed and safety equipment such as safety goggles should be worn to create a safe environment for work.
(4) There is a risk of fire or inflammation due to sparks, heat due to breakage, and cutting chips. Do not use where there is a risk of fire or explosion. **Please caution of fire while using oil base coolant, fire prevention is necessary.**
(5) Do not use the tool for any purpose other than that for which it is intended.

4. Cautions regarding regrinding
(1) If regrinding is not performed at the proper time, there is a risk of the tool breaking. Replace the tool with one in good condition, or perform regrinding.
(2) Grinding dust will be created when regrinding a tool. When regrinding, be sure to attach a safety cover over the work area and wear safety clothes such as safety goggles, etc.
(3) This product contains the specified chemical substance cobalt and its inorganic compounds. When performing regrinding or similar processing, be sure to handle the processing in accordance with thelocal laws and regulations regarding prevention of hazards due to specified chemical substances.

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