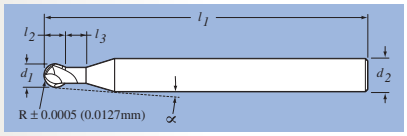
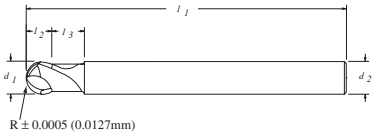
Solid Carbide High Performance End Mills for machining complex, contour shapes in tough and hardened mold & die steels.

- Designed for high speed rough and finish milling of mold and die steels up to 60 Rc
- Application specific carbide improves wear resistance and toughness
- Ti-NAMITE-A (AlTiN) coated for maximum heat and wear resistance
- Helical ball gashing for improved shearing action
- Extended reach capability
- Rigid construction

Suggestions for using Turbo-Carb® End Mills

- Pressurized air with oil extends tool life in materials <40 Rc
- Use dry air when finish milling or rouging materials harder than 40 Rc
- Flood coolant is not recommended
- The Z-level cutting method and climb milling extend tool life in rouging applications
- Helical interpolation is the preferred entry method. Avoid direct plunging
- Attention to programming details, tool holders, TIR, & balance contribute to additional tool life
- Speed and feed recommendations are based on using the tool tip





Fractional

Turbo-Carb® - Series 56B - 2 Flute - Ball End - Extended Reach

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	α	Neck l_3	Ti-NAMITE-A (ALiN) EDP No.
1/32	1/32	3	1/4	8º 20′	1/32	93272
1/16	1/16	3	1/4	7º 40′	1/16	93273
3/32	3/32	3	1/4	6º 50′	3/32	93274
1/8	1/8	3	1/4	6º	1/8	93275
3/16	3/16	3	1/4	3º 35′	3/16	93276
1/4	1/4	3 1/2	1/4	–	1/4	93277
5/16	5/16	4	5/16	–	5/16	93278
3/8	3/8	4	3/8	–	3/8	93279
1/2	1/2	4 1/2	1/2	–	1/2	93280
5/8	5/8	5 1/2	5/8	–	5/8	93281
3/4	3/4	6 1/2	3/4	–	3/4	93282

d_1 TOLERANCES

1/32-3/32 = +0 / -.0010
>3/32-1/4 = +0 / -.0012
>1/4 - 3/8 = +0 / -.0016
>3/8 - 3/4 = +0 / -.0020

d_2 TOLERANCES

1/4 - 3/8 = -.0001 / -.0003
>3/8 - 3/4 = -.0001 / -.0004

Metric

Turbo-Carb® - Series 56MB - 2 Flute - Ball End - Extended Reach

Cutting Diameter d_1 mm	Length of Cut l_2 mm	Overall Length l_1 mm	Shank Diameter d_2 mm	α	Neck l_3 mm	Ti-NAMITE-A (ALiN) EDP No.
1	1	76	6	8º 10′	1	91349
1.5	1.5	76	6	7º 45′	1.5	91350
2	2	76	6	7º 10′	2	91351
2.5	2.5	76	6	6º 35′	2.5	91352
3	3	76	6	6º	3	91353
4	4	76	6	4º 30′	4	91354
5	5	89	6	2º 30′	5	91355
6	6	89	6	–	6	91356
8	8	102	8	–	8	91357
10	10	102	10	–	10	91358
12	12	114	12	–	12	91359
16	16	140	16	–	16	91360
20	20	165	20	–	20	91361

d_1 TOLERANCES

1 - 2.5 = +0 / -0.025
> 2.5 - 6 = +0 / -0.030
> 6 - 10 = +0 / -0.040
>10 - 20 = +0 / -0.050

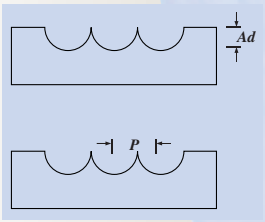
d_2 TOLERANCES

6 - 10 = -0.0025 / -0.0075
>10 - 20 = -0.0025 / -0.0100

Roughing - Fractional

Diameter	Steels < 40 Rc Ad = 10% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 40 - 50 Rc Ad = 5% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 50 - 60 Rc Ad = 4% dia Axial Depth[1]	rpm[2]	Feed / Tooth
1/32	.0031	76,740	.0006	.0016	90,200	.0005	.0013	61,270	.0004
1/16	.0063	38,065	.0015	.0031	45,745	.0011	.0025	31,190	.0008
3/32	.0094	25,430	.0020	.0047	30,335	.0015	.0038	20,655	.0011
1/8	.0125	19,100	.0030	.0063	22,700	.0023	.0050	15,595	.0017
3/16	.0188	12,720	.0040	.0094	15,170	.0030	.0075	10,395	.0023
1/4	.0250	9,550	.0050	.0125	11,395	.0038	.0100	7,800	.0029
5/16	.0313	7,635	.0060	.0156	9,120	.0050	.0125	6,240	.0038
3/8	.0375	6,365	.0080	.0188	7,585	.0060	.0150	5,200	.0045
1/2	.0500	4,775	.0100	.0250	5,695	.0075	.0200	3,900	.0057
5/8	.0625	3,820	.0110	.0312	4,560	.0080	.0250	3,120	.0060
3/4	.0750	3,185	.0120	.0375	3,800	.0085	.0300	2,600	.0063

P (pitch) = up to 40% of dia



FORMULAS – FRACTIONAL

sfm = rpm x .262 x cutting diameter

rpm = sfm x 3.82 / cutting diameter

feed (inches / minute) = feed per tooth x number of teeth x rpm

cusp height* = (tool diameter / 2) - $\sqrt{\text{tool diameter}^2 - \text{pitch}^2) / 4}$

pitch = $\sqrt{4 \times (\text{cusp height} \times \text{tool diameter}) - 4 \times (\text{cusp height}^2)}$

Finishing - Fractional

Diameter	Steels < 40 Rc Ad = 3% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 40 - 50 Rc Ad = 2% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 50 - 60 Rc Ad = 1% dia Axial Depth[1]	rpm[2]	Feed / Tooth
1/32	.0010	116,925	.0007	.0006	144,870	.0006	.0003	125,465	.0005
1/16	.0019	58,370	.0017	.0013	69,595	.0012	.0006	62,680	.0009
3/32	.0030	38,890	.0022	.0019	46,975	.0017	.0010	39,655	.0012
1/8	.0040	29,185	.0033	.0025	35,470	.0025	.0013	30,125	.0019
3/16	.0060	19,455	.0044	.0038	23,495	.0033	.0019	20,340	.0025
1/4	.0075	14,590	.0055	.0050	17,735	.0042	.0025	15,355	.0032
5/16	.0095	11,675	.0066	.0063	14,135	.0055	.0031	12,335	.0042
3/8	.0110	9,730	.0088	.0075	11,825	.0066	.0038	10,170	.0050
1/2	.0150	7,295	.0110	.0100	8,870	.0082	.0050	7,680	.0063
5/8	.0200	5,835	.0120	.0125	7,095	.0090	.0063	6,120	.0067
3/4	.0230	4,865	.0130	.0150	5,645	.0100	.0075	5,120	.0071

P (pitch) = dependent on finish requirement (see formulas)

* on flat surface

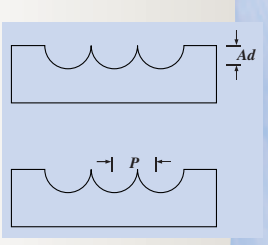
[1] suggested maximum

[2] if recommendation exceeds your machine limit use the maximum available

Roughing - Metric

Diameter	Steels < 40 Rc Ad = 10% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 40 - 50 Rc Ad = 5% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 50 - 60 Rc Ad = 4% dia Axial Depth[1]	rpm[2]	Feed / Tooth
1	.10	60,640	.015	.05	72,285	.015	.04	49,485	.010
1.5	.15	40,400	.030	.08	48,155	.025	.06	32,965	.020
2	.20	30,335	.045	.10	36,160	.035	.08	24,755	.025
2.5	.25	24,265	.050	.13	28,920	.040	.10	19,800	.030
3	.30	20,215	.075	.15	24,100	.055	.12	16,495	.045
4	.40	15,160	.095	.20	18,070	.065	.16	12,370	.050
5	.50	12,125	.100	.25	14,455	.075	.20	9,895	.060
6	.60	10,110	.125	.30	12,050	.095	.24	8,250	.075
8	.80	7,580	.150	.40	9,035	.125	.32	6,185	.095
10	1.0	6,065	.205	.50	7,230	.150	.40	4,950	.115
12	1.2	5,055	.255	.60	6,025	.190	.48	4,125	.145
16	1.6	3,790	.280	.80	4,520	.200	.64	3,095	.150
20	2.0	3,030	.300	1.0	3,615	.215	.80	2,475	.160

P (pitch) = up to 40% of dia



FORMULAS – METRIC

m / min = (3.14 x cutting diameter x rpm) / 1000

rpm = (1000 x m / min) / (3.14 x cutting diameter)

feed (mm / minute) = feed per tooth x number of teeth x rpm

cusp height* = (tool diameter / 2) - $\sqrt{\text{tool diameter}^2 - \text{pitch}^2) / 4}$

pitch = $\sqrt{4 \times (\text{cusp height} \times \text{tool diameter}) - 4 \times (\text{cusp height}^2)}$

Finishing - Metric

Diameter	Steels < 40 Rc Ad = 3% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 40 - 50 Rc Ad = 2% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 50 - 60 Rc Ad = 1% dia Axial Depth[1]	rpm[2]	Feed / Tooth
1	.03	92,660	.020	.02	112,555	.020	.010	97,030	.010
1.5	.05	61,730	.045	.03	74,980	.030	.015	64,635	.025
2	.06	46,355	.050	.04	56,305	.040	.020	48,540	.030
2.5	.08	37,075	.055	.05	45,035	.045	.025	38,820	.040
3	.09	30,890	.085	.06	37,520	.065	.030	32,345	.050
4	.12	23,165	.100	.08	28,135	.075	.040	24,255	.060
5	.15	18,530	.110	.10	22,505	.085	.050	19,400	.065
6	.18	15,445	.140	.12	18,760	.105	.060	16,175	.080
8	.24	11,580	.170	.16	14,065	.140	.080	12,125	.105
10	.30	9,265	.225	.20	11,255	.170	.100	9,700	.130
12	.36	7,720	.280	.24	9,380	.210	.120	8,085	.160
16	.48	5,790	.305	.32	7,035	.230	.160	6,065	.170
20	.60	4,635	.320	.40	5,630	.255	.200	4,850	.180

P (pitch) = dependent on finish requirement (see formulas)

* on flat surface

[1] suggested maximum

[2] if recommendation exceeds your machine limit use the maximum available