EHHB

High Hardness Four Flute Ball End Mills

FEATURES

Highly efficient cutting with four flutes.

Varibale flute geometry enables vibration suppresion.

Wide chip pocket improves chip removal for stable cutting.

ATH Coating provides long tool life even in hardened steels.

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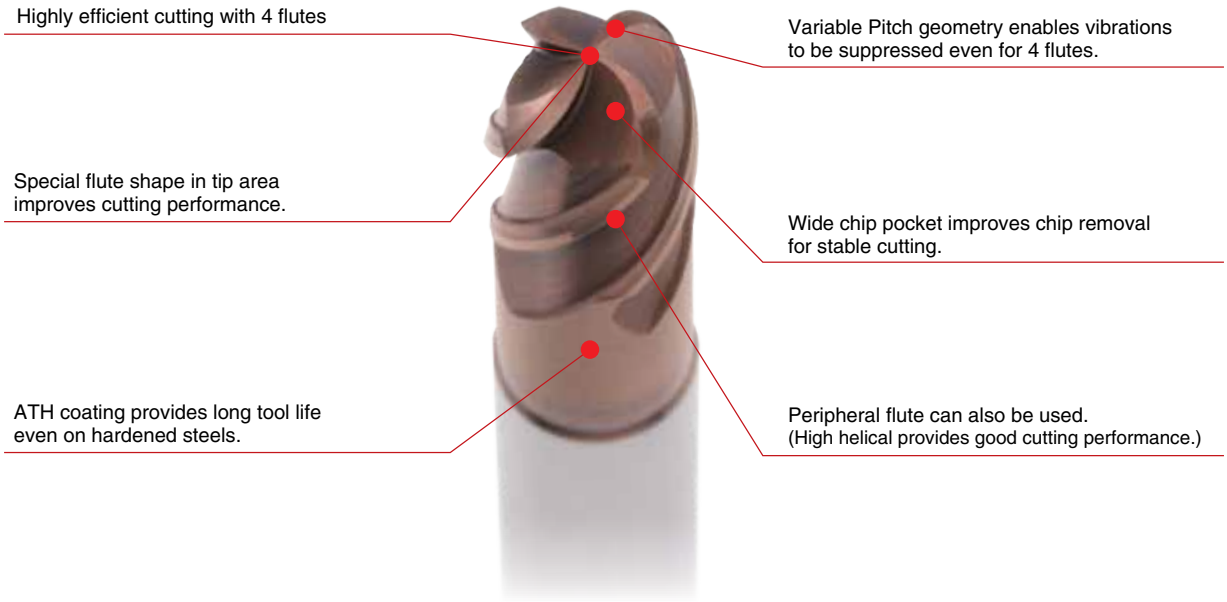
INTRODUCTION

EHHB High Hard Four Flute Ball End Mills are designed for the high-efficiency direct milling of hardened steels up to 72HRC. The variable pitch geometry suppresses vibration during machining, resulting in better surface finishes and longer tool life. The wide chip pocket provides superior chip evacuation, further improving stable cutting.

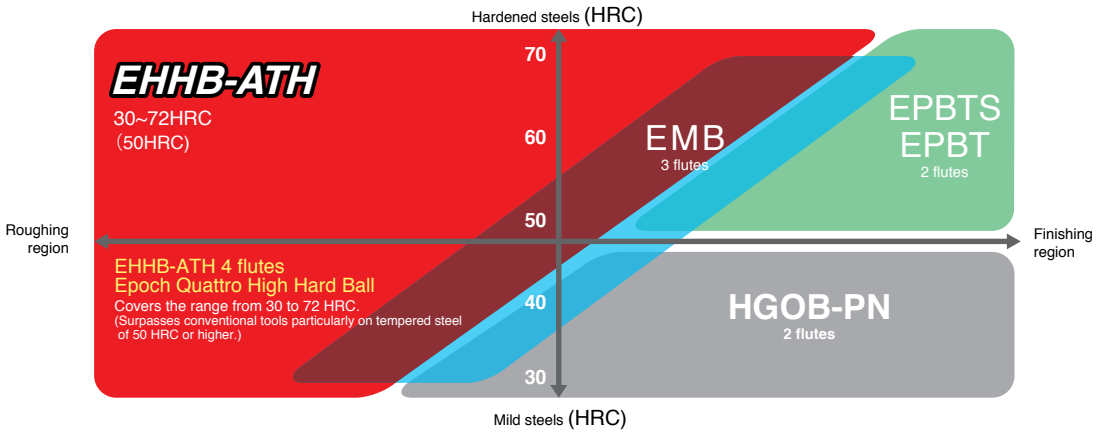
FEATURES

1. Features of Epoch High Hard Ball End Mill



Achieves high-efficiency direct milling of hardened steels!

2. Performance and Positioning

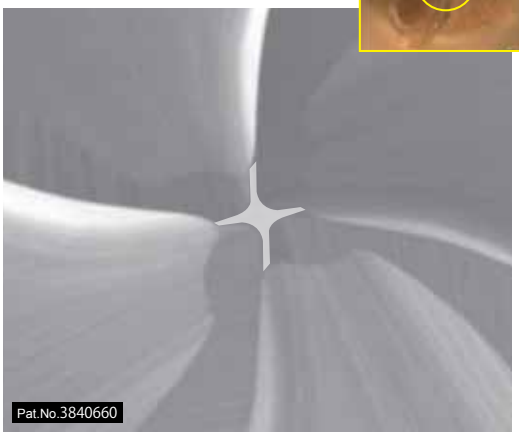


1 Feed rate can be increased to achieve high-efficiency cutting.
Example: Performing improved efficiency by adjusting override factor of the same cutting program.

2 Exhibits its effect particularly for semi-finishing of materials after heat-treatment.

3. Special Tip Shape

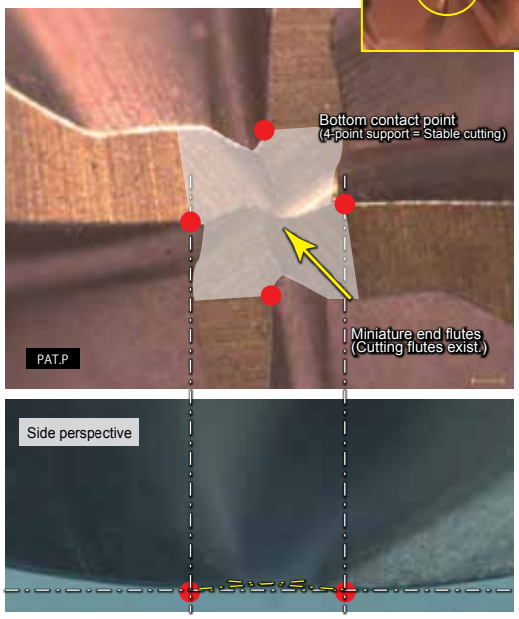
φ1～φ3



Features and effects

By creating a special flank face with a tiny relief angle at the very tip section, R accuracy is improved even with 4 flutes.
This realizes stable cutting due to improved tip rigidity.

φ4～φ12

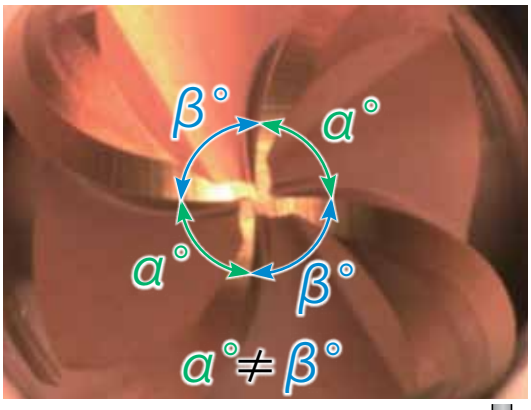


Features and effects

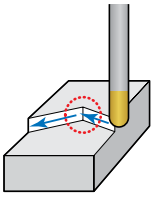
Features: Zero cutting point at the center is isolated from the cutting point.

Effects: Chipping due to jamming of cutting chips at center area is suppressed.

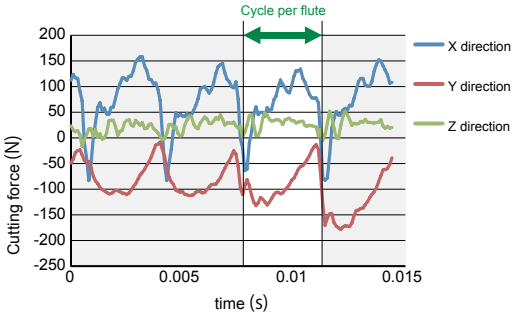
4. Suppresed Vibration With Variable Pitch Geometry



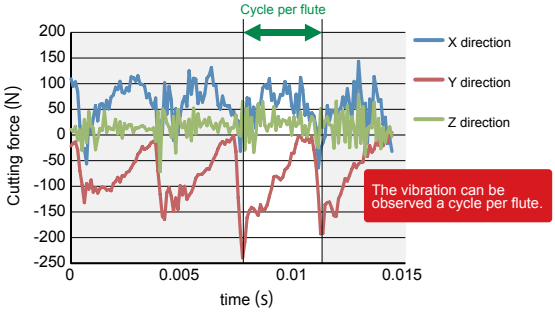
Work material: YXR3(58HRC)
Tool: φ8(R4) × 4 flutes
n =4,000min^{-1} (vc=100m/min)
vf =1,920mm/min (fz=0.12mm/t)
ap=0.3mm ae=0.1mm
Dry Air-blow
Machine: HSK-A6 Overhang: 332mm



EHHB-ATH
4 flutes
Variable Pitch



Conventional
4 flutes
Equal pitch



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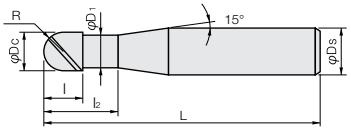
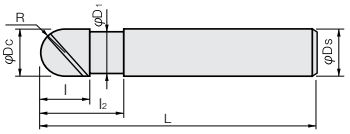
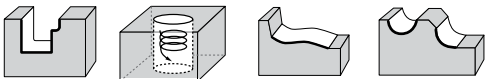
A type



B type





Helix Angle:	40°	Ds:	h5

Part No.	Stock	Size (mm) R	D_c	l	l_2	D_1	L	D_s	Type
EHHB4010-S4-ATH	□	0.50	1.0	1.5	3.0	0.95	50	4	A
EHHB4010-S6-ATH	●							6	A
EHHB4015-S4-ATH	□	0.75	1.5	2.5	4.5	1.43	50	4	A
EHHB4015-S6-ATH	●							6	A
EHHB4020-S4-ATH	□	1.00	2.0	3.0	6.0	1.90	50	4	A
EHHB4020-S6-ATH	●							6	A
EHHB4025-S4-ATH	□	1.25	2.5	4.0	7.5	2.38	50	4	A
EHHB4025-S6-ATH	□							6	A
EHHB4030-S4-ATH	□	1.50	3.0	4.5	9.0	2.90	70	4	A
EHHB4030-S6-ATH	●							6	A
EHHB4040-S4-ATH	□	2.00	4.0	6.0	12.0	3.90	70	4	B
EHHB4040-S6-ATH	●							6	A
EHHB4050-ATH	●	2.50	5.0	7.5	15.0	4.70	80	6	A
EHHB4060-ATH	●	3.00	6.0	9.0	18.0	5.70	90	6	B
EHHB4080-ATH	●	4.00	8.0	12.0	24.0	7.60	100	8	B
EHHB4100-ATH	●	5.00	10.0	15.0	30.0	9.50	100	10	B
EHHB4120-ATH	●	6.00	12.0	18.0	36.0	11.50	110	12	B

R	Tolerance on R	Tolerance on Dia.
R0.5-1.5	±0.005	0~-0.010
R2-3	±0.007	0~-0.014
R4-6	±0.010	0~-0.020

□ = Stocked items in Japan

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Table of standard cutting conditions (Roughing)

		Alloy Steels (25~35HRC)				Pre-hardened Steels (35~45HRC)				Hardened Steels (45~55HRC)			
		v_c=200m/min				v_c=170m/min				v_c=140m/min			
R	D_c	n min^{-1}	Vf (mm/min)`	a_p (mm)	a_e (mm)	n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)	n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)
0.50	**1.0**	60,000	5,610	0.11	0.33	54,100	4,610	0.10	0.30	44,600	3,430	0.09	0.27
0.75	**1.5**	42,500	5,420	0.17	0.50	36,100	4,200	0.15	0.45	29,700	3,120	0.14	0.41
1.00	**2.0**	31,800	5,410	0.22	0.66	27,100	4,200	0.20	0.60	22,300	3,120	0.18	0.54
1.25	**2.5**	25,500	5,090	0.28	0.83	21,700	3,950	0.25	0.75	17,800	2,930	0.23	0.68
1.50	**3.0**	21,200	5,080	0.33	0.99	18,000	3,930	0.30	0.90	14,900	2,940	0.27	0.81
2.00	**4.0**	15,900	5,140	0.44	1.32	13,500	3,980	0.40	1.20	11,100	2,950	0.36	1.08
2.50	**5.0**	12,700	5,240	0.55	1.65	10,800	4,060	0.50	1.50	8,900	3,020	0.45	1.35
3.00	**6.0**	10,600	5,240	0.66	1.98	9,000	4,060	0.60	1.80	7,400	3,010	0.54	1.62
4.00	**8.0**	8,000	5,440	0.88	2.64	6,800	4,220	0.80	2.40	5,600	3,140	0.72	2.16
5.00	**10.0**	6,400	5,440	1.10	3.30	5,400	4,190	1.00	3.00	4,500	3,150	0.90	2.70
6.00	**12.0**	5,300	5,140	1.32	3.96	4,500	3,980	1.20	3.60	3,700	2,950	1.08	3.24

		Hardened Steels (55~62HRC)				Hardened Steels (62~66HRC)				Hardened Steels (66~72HRC)			
		v_c=110m/min				v_c=90m/min				v_c=70m/min			
R	D_c	n min^{-1}	Vf (mm/min)`	a_p (mm)	a_e (mm)	n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)	n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)
0.50	**1.0**	35,000	1,930	0.08	0.23	28,700	1,340	0.06	0.18	22,300	860	0.05	0.14
0.75	**1.5**	23,400	1,760	0.11	0.34	19,100	1,220	0.09	0.27	14,900	780	0.07	0.20
1.00	**2.0**	17,500	1,750	0.15	0.45	14,300	1,220	0.12	0.36	11,100	780	0.09	0.27
1.25	**2.5**	14,000	1,650	0.19	0.56	11,500	1,150	0.15	0.45	8,900	730	0.11	0.34
1.50	**3.0**	11,700	1,650	0.23	0.68	9,600	1,150	0.18	0.54	7,400	730	0.14	0.41
2.00	**4.0**	8,800	1,670	0.30	0.90	7,200	1,160	0.24	0.72	5,600	740	0.18	0.54
2.50	**5.0**	7,000	1,700	0.38	1.13	5,700	1,170	0.30	0.90	4,500	760	0.23	0.68
3.00	**6.0**	5,800	1,690	0.45	1.35	4,800	1,190	0.36	1.08	3,700	750	0.27	0.81
4.00	**8.0**	4,400	1,760	0.60	1.80	3,600	1,220	0.48	1.44	2,800	780	0.36	1.08
5.00	**10.0**	3,500	1,750	0.75	2.25	2,900	1,230	0.60	1.80	2,200	770	0.45	1.35
6.00	**12.0**	2,900	1,650	0.90	2.70	2,400	1,160	0.72	2.16	1,900	760	0.54	1.62

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 vadjust 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.

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Table of standard cutting conditions (Finishing)

R	D_C	Alloy Steels (25~35HRC) v_c=280m/min n min^{-1}	Vf (mm/min)`	a_p (mm)	a_e (mm)	Pre-hardened Steels (35~45HRC) v_c=250m/min n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)	Hardened Steels (45~55HRC) v_c=210m/min n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)
0.50	1.0	60,000	3,240	0.02~0.05	0.02	60,000	2,970	0.02~0.05	0.02	60,000	2,700	0.02~0.05	0.02
0.75	1.5	60,000	4,860	0.02~0.07	0.03	53,100	3,940	0.02~0.07	0.03	44,600	3,010	0.02~0.07	0.03
1.00	2.0	44,600	4,820	0.02~0.10	0.04	39,800	3,940	0.02~0.10	0.04	33,400	3,010	0.02~0.10	0.04
1.25	2.5	35,700	5,030	0.05~0.12	0.05	31,800	4,110	0.05~0.12	0.05	26,800	3,150	0.05~0.12	0.05
1.50	3.0	29,700	5,030	0.05~0.15	0.06	26,500	4,110	0.05~0.15	0.06	22,300	3,140	0.05~0.15	0.06
2.00	4.0	22,300	5,080	0.05~0.20	0.08	19,900	4,160	0.05~0.20	0.08	16,700	3,170	0.05~0.20	0.08
2.50	5.0	17,800	5,180	0.05~0.25	0.10	15,900	4,240	0.05~0.25	0.10	13,400	3,250	0.05~0.25	0.10
3.00	6.0	14,900	5,200	0.05~0.30	0.12	13,300	4,260	0.05~0.30	0.12	11,100	3,230	0.05~0.30	0.12
4.00	8.0	11,100	5,330	0.05~0.40	0.16	10,000	4,400	0.05~0.40	0.16	8,400	3,360	0.05~0.40	0.16
5.00	10.0	8,900	5,340	0.05~0.50	0.20	8,000	4,400	0.05~0.50	0.20	6,700	3,350	0.05~0.50	0.20
6.00	12.0	7,400	5,060	0.05~0.60	0.24	6,600	4,140	0.05~0.60	0.24	5,600	3,190	0.05~0.60	0.24

R	D_C	Hardened Steels (55~62HRC) v_c=160m/min n min^{-1}	Vf (mm/min)`	a_p (mm)	a_e (mm)	Hardened Steels (62~66HRC) v_c=140m/min n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)	Hardened Steels (66~72HRC) v_c=120m/min n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)
0.50	1.0	51,000	1,840	0.02~0.05	0.02	44,600	1,300	0.02~0.05	0.02	38,200	950	0.02~0.05	0.02
0.75	1.5	34,000	1,840	0.02~0.07	0.03	29,700	1,300	0.02~0.07	0.03	25,500	950	0.02~0.07	0.03
1.00	2.0	25,500	1,840	0.02~0.10	0.04	22,300	1,300	0.02~0.10	0.04	19,100	950	0.02~0.10	0.04
1.25	2.5	20,400	1,920	0.05~0.12	0.05	17,800	1,360	0.05~0.12	0.05	15,300	990	0.05~0.12	0.05
1.50	3.0	17,000	1,920	0.05~0.15	0.06	14,900	1,370	0.05~0.15	0.06	12,700	980	0.05~0.15	0.06
2.00	4.0	12,700	1,930	0.05~0.20	0.08	11,100	1,370	0.05~0.20	0.08	9,600	1000	0.05~0.20	0.08
2.50	5.0	10,200	1,980	0.05~0.25	0.10	8,900	1,400	0.05~0.25	0.10	7,600	1010	0.05~0.25	0.10
3.00	6.0	8,500	1,980	0.05~0.30	0.12	7,400	1,400	0.05~0.30	0.12	6,400	1020	0.05~0.30	0.12
4.00	8.0	6,400	2,050	0.05~0.40	0.16	5,600	1,460	0.05~0.40	0.16	4,800	1060	0.05~0.40	0.16
5.00	10.0	5,100	2,040	0.05~0.50	0.20	4,500	1,460	0.05~0.50	0.20	3,800	1050	0.05~0.50	0.20
6.00	12.0	4,200	1,920	0.05~0.60	0.24	3,700	1,370	0.05~0.60	0.24	3,200	1000	0.05~0.60	0.24

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 vadjust 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.

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Table of standard cutting conditions (Side Milling)

		Alloy Steels (25~35HRC)				Pre-hardened Steels (35~45HRC)				Hardened Steels (45~55HRC)			
		v_c=240m/min				v_c=210m/min				v_c=180m/min			
R	D_C	n min^{-1}	Vf (mm/min)`	a_p (mm)	a_e (mm)	n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)	n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)
0.50	**1.0**	60,000	5,280	1.0	0.06	60,000	4,620	1.0	0.04	57,300	3,780	1.0	0.03
0.75	**1.5**	51,000	6,120	1.5	0.09	44,600	4,680	1.5	0.06	38,200	3,440	1.5	0.05
1.00	**2.0**	38,200	6,110	2.0	0.12	33,400	4,680	2.0	0.08	28,700	3,440	2.0	0.06
1.25	**2.5**	30,600	5,750	2.5	0.15	26,800	4,410	2.5	0.10	22,900	3,230	2.5	0.08
1.50	**3.0**	25,500	5,750	3.0	0.18	22,300	4,400	3.0	0.12	19,100	3,230	3.0	0.09
2.00	**4.0**	19,100	5,810	4.0	0.24	16,700	4,440	4.0	0.16	14,300	3,260	4.0	0.12
2.50	**5.0**	15,300	5,940	5.0	0.30	13,400	4,550	5.0	0.20	11,500	3,350	5.0	0.15
3.00	**6.0**	12,700	5,910	6.0	0.36	11,100	4,520	6.0	0.24	9,600	3,350	6.0	0.18
4.00	**8.0**	9,600	6,140	8.0	0.48	8,400	4,700	8.0	0.32	7,200	3,460	8.0	0.24
5.00	**10.0**	7,600	6,080	10.0	0.60	6,700	4,690	10.0	0.40	5,700	3,420	10.0	0.30
6.00	**12.0**	6,400	5,840	12.0	0.72	5,600	4,470	12.0	0.48	4,800	3,280	12.0	0.36

		Hardened Steels (55~62HRC)				Hardened Steels (62~66HRC)				Hardened Steels (66~72HRC)			
		v_c=150m/min				v_c=125m/min				v_c=100m/min			
R	D_C	n min^{-1}	Vf (mm/min)`	a_p (mm)	a_e (mm)	n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)	n min^{-1}	Vf (mm/min)	a_p (mm)	a_e (mm)
0.50	**1.0**	47,800	2,630	1.0	0.02	39,800	1,750	1.0	0.02	31,800	1050	1.0	0.01
0.75	**1.5**	31,800	2,390	1.5	0.03	26,500	1,590	1.5	0.02	21,200	950	1.5	0.02
1.00	**2.0**	23,900	2,390	2.0	0.04	19,900	1,590	2.0	0.03	15,900	950	2.0	0.02
1.25	**2.5**	19,100	2,240	2.5	0.05	15,900	1,490	2.5	0.04	12,700	900	2.5	0.03
1.50	**3.0**	15,900	2,240	3.0	0.06	13,300	1,500	3.0	0.05	10,600	900	3.0	0.03
2.00	**4.0**	11,900	2,260	4.0	0.08	10,000	1,520	4.0	0.06	8,000	910	4.0	0.04
2.50	**5.0**	9,600	2,330	5.0	0.10	8,000	1,550	5.0	0.08	6,400	930	5.0	0.05
3.00	**6.0**	8,000	2,330	6.0	0.12	6,600	1,540	6.0	0.09	5,300	930	6.0	0.06
4.00	**8.0**	6,000	2,400	8.0	0.16	5,000	1,600	8.0	0.12	4,000	960	8.0	0.08
5.00	**10.0**	4,800	2,400	10.0	0.20	4,000	1,600	10.0	0.15	3,200	960	10.0	0.10
6.00	**12.0**	4,000	2,280	12.0	0.24	3,300	1,500	12.0	0.18	2,700	920	12.0	0.12

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