

CARBIDE, 2 FLUTE CORNER RADIUS for RIB PROCESSING

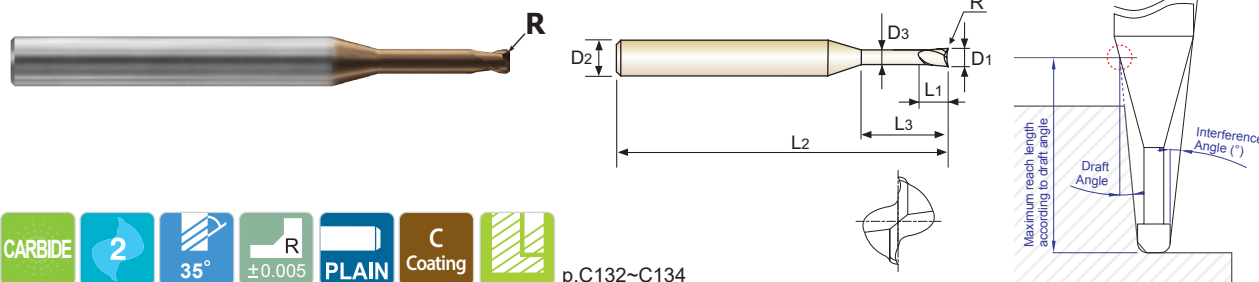
● **VOLLHARTMETALL, 2 SCHNEIDEN ECKENRADIUS für SCHMALE RIPPEN**

● **Fraise carbure, 2 dents, torique pour usinage de rainure**

● **2 TAGLIENTI, TORICA PER NERVATURE**

- ▶ Improvement of tool life by applying new coating.
- ▶ Application of tight tolerances for precision machining.

- ▶ Verbesserung der Werkzeugstandzeit durch Aufbringen einer neuen Beschichtung
- ▶ Enge Toleranzen für die Präzisionsbearbeitung



p.C132~C134

Unit : mm

EDP No.	Corner Radius	Mill Diameter	Shank Diameter	Length of Cut	Length Below Shank	Overall Length	Neck Diameter	Interference Angle(°)	Maximum reach lengths according to draft angle				
	R	D1	D2	L1	L3	L2	D3		0.5°	1°	1.5°	2°	3°
HPI89002	R0.02	0.2	4	0.15	0.5	45	0.17	13.99	0.61	0.65	0.68	0.72	0.82
HPI89901	R0.05	0.2	4	0.15	0.5	45	0.17	14.04	0.61	0.64	0.68	0.72	0.81
HPI89902	R0.02	0.2	4	0.15	1	45	0.17	13.16	1.14	1.20	1.27	1.35	1.54
HPI89903	R0.05	0.2	4	0.15	1	45	0.17	13.21	1.14	1.20	1.27	1.34	1.52
HPI89904	R0.02	0.2	4	0.15	1.5	45	0.17	12.42	1.67	1.76	1.86	1.97	2.25
HPI89905	R0.05	0.2	4	0.15	1.5	45	0.17	12.46	1.66	1.75	1.85	1.96	2.23
HPI89906	R0.02	0.2	4	0.15	2	45	0.17	11.76	2.19	2.31	2.45	2.60	2.96
HPI89907	R0.05	0.2	4	0.15	2	45	0.17	11.80	2.19	2.31	2.44	2.59	2.95
HPI89003	R0.02	0.3	4	0.25	1	45	0.27	13.12	1.14	1.20	1.27	1.35	1.54
HPI89908	R0.05	0.3	4	0.25	1	45	0.27	13.16	1.14	1.20	1.27	1.34	1.52
HPI89909	R0.02	0.3	4	0.25	1.5	45	0.27	12.36	1.67	1.76	1.86	1.97	2.25
HPI89910	R0.05	0.3	4	0.25	1.5	45	0.27	12.41	1.66	1.75	1.85	1.96	2.23
HPI89911	R0.02	0.3	4	0.25	2	45	0.27	11.69	2.19	2.31	2.45	2.60	2.96
HPI89912	R0.05	0.3	4	0.25	2	45	0.27	11.73	2.19	2.31	2.44	2.59	2.95
HPI89913	R0.02	0.3	4	0.25	2.5	45	0.27	11.09	2.72	2.87	3.03	3.22	3.67
HPI89914	R0.05	0.3	4	0.25	2.5	45	0.27	11.12	2.72	2.86	3.03	3.21	3.66
HPI89915	R0.02	0.3	4	0.25	3	45	0.27	10.54	3.24	3.42	3.62	3.84	4.38
HPI89916	R0.05	0.3	4	0.25	3	45	0.27	10.57	3.24	3.42	3.61	3.83	4.37
HPI89004	R0.02	0.4	4	0.3	1	45	0.37	13.07	1.14	1.20	1.27	1.35	1.54
HPI89917	R0.05	0.4	4	0.3	1	45	0.37	13.12	1.14	1.20	1.27	1.34	1.52
HPI89918	R0.1	0.4	4	0.3	1	45	0.37	13.20	1.14	1.19	1.26	1.33	1.50
HPI89919	R0.02	0.4	4	0.3	1.5	45	0.37	12.30	1.67	1.76	1.86	1.97	2.25
HPI89920	R0.05	0.4	4	0.3	1.5	45	0.37	12.35	1.66	1.75	1.85	1.96	2.23
HPI89921	R0.02	0.4	4	0.3	2	45	0.37	11.62	2.19	2.31	2.45	2.60	2.96
HPI89922	R0.05	0.4	4	0.3	2	45	0.37	11.66	2.19	2.31	2.44	2.59	2.95
HPI89923	R0.1	0.4	4	0.3	2	45	0.37	11.72	2.19	2.30	2.43	2.58	2.92

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Corner Radius Tolerance (mm)	Mill Dia. Tolerance (mm)	Shank Dia. Tolerance
±0.005	0~-0.010	h4

◎ : Excellent ○ : Good

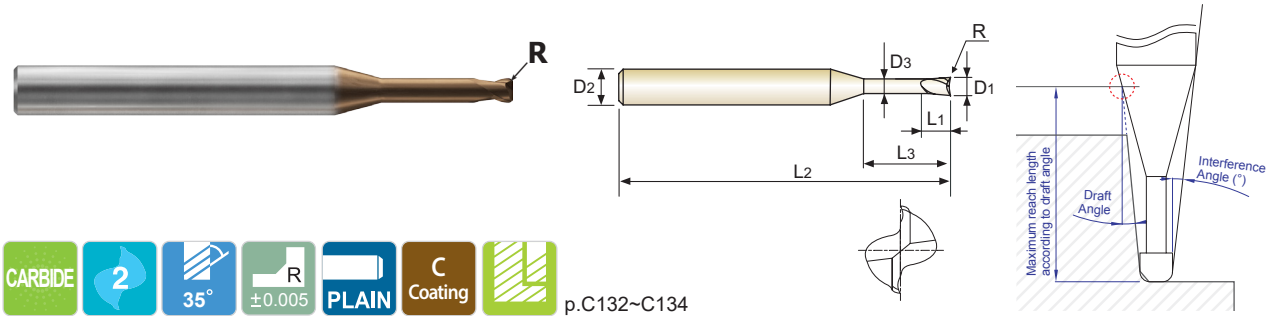
ISO	P												M			K								
Material Description	Non-alloy steel					Low alloy steel				High alloyed steel, and tool steel			Stainless steel			Grey cast iron		Nodular cast iron		Malleable cast iron				
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	11.2	12	13	14.1	15	16	17	18	19	20			
HRC	13	23	25	28	32	10	29	32	38	15	35	44	15	23	10	15	26	3	25					
HB	125	190	250	270	300	180	275	300	350	200	325	409	200	240	180	180	260	160	250	130	230			
Recommend					○			○	○		○	○												
ISO	N										S							H						
Material Description	Aluminum-wrought alloy		Aluminum-cast, alloyed			Copper and Copper Alloys (Bronze / Brass)			Non Metallic Materials		Heat Resistant Super Alloys				Titanium Alloys			Hardened steel				Chilled Cast Iron	Hardened Cast Iron	
VDI 3323	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38.1	38.2	39.1	39.2	39.3	40	41
HRC											15	30	25	38	34			45-49	50-55	56-60	61-65	66-70	42	55
HB	60	100	75	90	130	110	90	100			200	280	250	350	320	400 Rm	1050 Rm	421-469	481-560	577-654	670-739		400	550
Recommend																		◎	◎	◎	◎	◎	◎	◎

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Unit : mm

EDP No.	Corner Radius	Mill Diameter	Shank Diameter	Length of Cut	Length Below Shank	Overall Length	Neck Diameter	Interference Angle(°)	Maximum reach lengths according to draft angle				
	R	D1	D2	L1	L3	L2	D3		0.5°	1°	1.5°	2°	3°
HPI89924	R0.02	0.4	4	0.3	2.5	45	0.37	11.01	2.72	2.87	3.03	3.22	3.67
HPI89925	R0.05	0.4	4	0.3	2.5	45	0.37	11.04	2.72	2.86	3.03	3.21	3.66
HPI89926	R0.02	0.4	4	0.3	3	45	0.37	10.46	3.24	3.42	3.62	3.84	4.38
HPI89927	R0.05	0.4	4	0.3	3	45	0.37	10.49	3.24	3.42	3.61	3.83	4.37
HPI89928	R0.1	0.4	4	0.3	3	45	0.37	10.54	3.24	3.41	3.61	3.82	4.35
HPI89929	R0.02	0.4	4	0.3	4	45	0.37	9.50	4.30	4.53	4.79	5.09	5.80
HPI89930	R0.05	0.4	4	0.3	4	45	0.37	9.53	4.30	4.53	4.79	5.08	5.79
HPI89931	R0.1	0.4	4	0.3	4	45	0.37	9.57	4.29	4.52	4.78	5.07	5.77
HPI89005	R0.02	0.5	4	0.4	1	45	0.45	12.96	1.20	1.27	1.34	1.42	1.62
HPI89932	R0.05	0.5	4	0.4	1	45	0.45	13.01	1.20	1.26	1.33	1.41	1.60
HPI89933	R0.1	0.5	4	0.4	1	45	0.45	13.09	1.20	1.26	1.32	1.40	1.58
HPI89934	R0.02	0.5	4	0.4	2	45	0.45	11.50	2.25	2.37	2.51	2.67	3.04
HPI89935	R0.05	0.5	4	0.4	2	45	0.45	11.54	2.25	2.37	2.51	2.66	3.03
HPI89936	R0.1	0.5	4	0.4	2	45	0.45	11.60	2.25	2.37	2.50	2.65	3.01
HPI89937	R0.02	0.5	4	0.4	3	45	0.45	10.33	3.30	3.48	3.69	3.91	4.46
HPI89938	R0.05	0.5	4	0.4	3	45	0.45	10.36	3.30	3.48	3.68	3.91	4.45
HPI89939	R0.1	0.5	4	0.4	3	45	0.45	10.41	3.30	3.48	3.67	3.89	4.43
HPI89940	R0.02	0.5	4	0.4	4	45	0.45	9.37	4.36	4.59	4.86	5.16	5.88
HPI89941	R0.05	0.5	4	0.4	4	45	0.45	9.40	4.35	4.59	4.86	5.15	5.87
HPI89942	R0.1	0.5	4	0.4	4	45	0.45	9.44	4.35	4.59	4.85	5.14	5.85
HPI89943	R0.02	0.5	4	0.4	5	45	0.45	8.58	5.41	5.70	6.04	6.41	7.31
HPI89944	R0.05	0.5	4	0.4	5	45	0.45	8.60	5.41	5.70	6.03	6.40	7.30
HPI89945	R0.1	0.5	4	0.4	5	45	0.45	8.63	5.40	5.70	6.02	6.39	7.27
HPI89946	R0.02	0.5	4	0.4	6	45	0.45	7.90	6.46	6.81	7.21	7.65	8.73
HPI89947	R0.05	0.5	4	0.4	6	45	0.45	7.92	6.46	6.81	7.20	7.65	8.72
HPI89948	R0.1	0.5	4	0.4	6	45	0.45	7.95	6.46	6.81	7.20	7.63	8.70

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±0.005	0~-0.010	h4

◎ : Excellent ○ : Good

ISO	P												M			K						
Material Description	Non-alloy steel					Low alloy steel				High alloyed steel, and tool steel			Stainless steel			Grey cast iron		Nodular cast iron		Malleable cast iron		
VDI 3323	1	2	3	4	5	6	7	8	9	10	11.1	11.2	12	13	14.1	15	16	17	18	19	20	
HRc		13	25	28	32	10	29	32	38	15	35	44	15	23	10	10	26	3	25		21	
HB	125	190	250	270	300	180	275	300	350	200	325	409	200	240	180	180	260	160	250	130	230	
Recommend					○			○	○		○	○										
ISO	N										S							H				
Material Description	Aluminum-wrought alloy		Aluminum-cast, alloyed		Copper and Copper Alloys (Bronze / Brass)		Non Metallic Materials		Heat Resistant Super Alloys					Titanium Alloys		Hardened steel					Chilled Cast Iron	Hardened Cast Iron
VDI 3323	21	22	23	24	25	26	27	28	31	32	33	34	35	36	37	38.1	38.2	39.1	39.2	39.3	40	41
HRc									15	30	25	38	34			45-49	50-55	56-60	61-65	66-70	42	55
HB	60	100	75	90	130	110	90	100	200	280	250	350	320	400 Rm	1050 Rm	421-469	481-560	577-654	670-739	400	550	
Recommend																◎	◎	◎	◎	◎	○	◎

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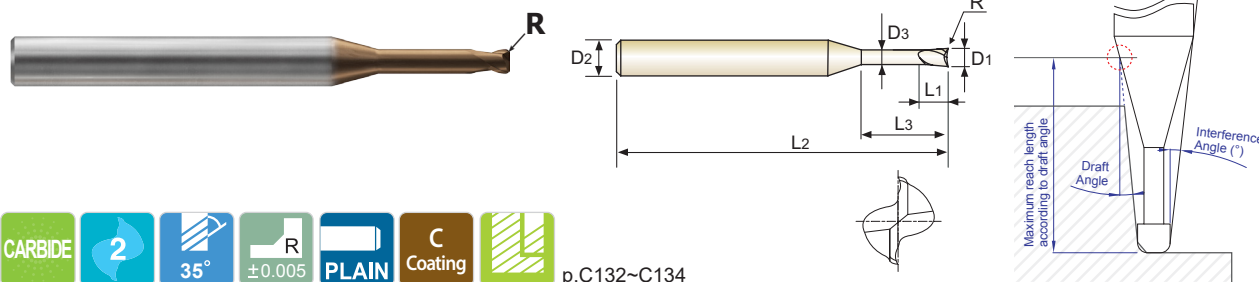
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	R	D1	D2	L1	L3	L2	D3		0.5°	1°	1.5°	2°	3°
HPI89006	R0.02	0.6	4	0.5	2	45	0.55	11.42	2.25	2.37	2.51	2.67	3.04
HPI89949	R0.05	0.6	4	0.5	2	45	0.55	11.46	2.25	2.37	2.51	2.66	3.03
HPI89950	R0.1	0.6	4	0.5	2	45	0.55	11.52	2.25	2.37	2.50	2.65	3.01
HPI89951	R0.02	0.6	4	0.5	4	45	0.55	9.27	4.36	4.59	4.86	5.16	5.88
HPI89952	R0.05	0.6	4	0.5	4	45	0.55	9.29	4.35	4.59	4.86	5.15	5.87
HPI89953	R0.1	0.6	4	0.5	4	45	0.55	9.34	4.35	4.59	4.85	5.14	5.85
HPI89954	R0.02	0.6	4	0.5	6	45	0.55	7.80	6.46	6.81	7.21	7.65	8.73
HPI89955	R0.05	0.6	4	0.5	6	45	0.55	7.81	6.46	6.81	7.20	7.65	8.72
HPI89956	R0.1	0.6	4	0.5	6	45	0.55	7.85	6.46	6.81	7.20	7.63	8.70
HPI89957	R0.02	0.6	4	0.5	8	50	0.55	6.72	8.56	9.03	9.56	10.15	11.41
HPI89958	R0.05	0.6	4	0.5	8	50	0.55	6.74	8.56	9.03	9.55	10.14	11.40
HPI89959	R0.1	0.6	4	0.5	8	50	0.55	6.76	8.56	9.03	9.54	10.13	11.39
HPI89960	R0.02	0.6	4	0.5	10	50	0.55	5.91	10.67	11.25	11.91	12.64	13.74
HPI89961	R0.05	0.6	4	0.5	10	50	0.55	5.92	10.67	11.25	11.90	12.63	13.74
HPI89962	R0.1	0.6	4	0.5	10	50	0.55	5.94	10.66	11.25	11.89	12.62	13.73
HPI89007	R0.02	0.7	4	0.55	2	45	0.65	11.34	2.25	2.37	2.51	2.67	3.04
HPI89963	R0.05	0.7	4	0.55	2	45	0.65	11.38	2.25	2.37	2.51	2.66	3.03
HPI89964	R0.1	0.7	4	0.55	2	45	0.65	11.44	2.25	2.37	2.50	2.65	3.01
HPI89965	R0.02	0.7	4	0.55	4	45	0.65	9.16	4.36	4.59	4.86	5.16	5.88
HPI89966	R0.05	0.7	4	0.55	4	45	0.65	9.19	4.35	4.59	4.86	5.15	5.87
HPI89967	R0.1	0.7	4	0.55	4	45	0.65	9.23	4.35	4.59	4.85	5.14	5.85
HPI89968	R0.02	0.7	4	0.55	6	45	0.65	7.68	6.46	6.81	7.21	7.65	8.73
HPI89969	R0.05	0.7	4	0.55	6	45	0.65	7.70	6.46	6.81	7.20	7.65	8.72
HPI89970	R0.1	0.7	4	0.55	6	45	0.65	7.73	6.46	6.81	7.20	7.63	8.70
HPI89008	R0.02	0.8	4	0.65	2	45	0.75	11.25	2.25	2.37	2.51	2.67	3.04
HPI89971	R0.05	0.8	4	0.65	2	45	0.75	11.29	2.25	2.37	2.51	2.66	3.03

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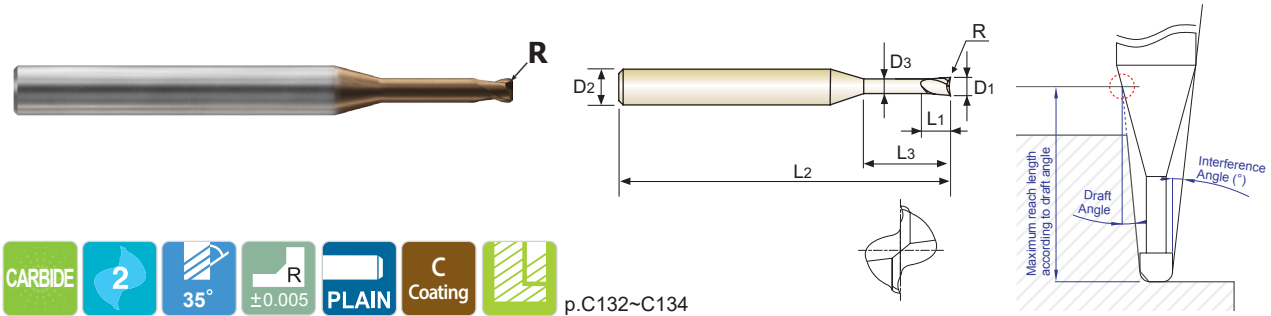
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VDI 3323	1	2	3	4	5	6	7	8	9	10	11	11.2	12	13	14.1	15	16	17	18	19	20			
HRC		13	25	28	32	10	29	32	38	15	35	44	15	23	10	10	26	3	25		21			
HB	125	190	250	270	300	180	275	300	350	200	325	409	200	240	180	180	260	160	250	130	230			
Recommend					○				○		○	○												
ISO	N										S							H						
Material Description	Aluminum-wrought alloy		Aluminum-cast, alloyed			Copper and Copper Alloys (Bronze / Brass)			Non Metallic Materials	Heat Resistant Super Alloys					Titanium Alloys		Hardened steel					Chilled Cast Iron	Hardened Cast Iron	
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HRC											15	30	25	38	34			45-49	50-55	56-60	61-65	66-70	42	55
HB	60	100	75	90	130	110	90	100			200	280	250	350	320	400 Rm	1050 Rm	421-469	481-560	577-654	670-739		400	550
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HPI89972	R0.1	0.8	4	0.65	2	45	0.75	11.36	2.25	2.37	2.50	2.65	3.01
HPI89973	R0.2	0.8	4	0.65	2	45	0.75	11.50	2.24	2.36	2.48	2.62	2.96
HPI89974	R0.02	0.8	4	0.65	4	45	0.75	9.05	4.36	4.59	4.86	5.16	5.88
HPI89975	R0.05	0.8	4	0.65	4	45	0.75	9.08	4.35	4.59	4.86	5.15	5.87
HPI89976	R0.1	0.8	4	0.65	4	45	0.75	9.12	4.35	4.59	4.85	5.14	5.85
HPI89977	R0.2	0.8	4	0.65	4	45	0.75	9.21	4.35	4.57	4.83	5.12	5.81
HPI89978	R0.02	0.8	4	0.65	6	45	0.75	7.57	6.46	6.81	7.21	7.65	8.73
HPI89979	R0.05	0.8	4	0.65	6	45	0.75	7.59	6.46	6.81	7.20	7.65	8.72
HPI89980	R0.1	0.8	4	0.65	6	45	0.75	7.62	6.46	6.81	7.20	7.63	8.70
HPI89981	R0.2	0.8	4	0.65	6	45	0.75	7.68	6.45	6.79	7.18	7.61	8.65
HPI89982	R0.02	0.8	4	0.65	8	50	0.75	6.50	8.56	9.03	9.56	10.15	11.29
HPI89983	R0.05	0.8	4	0.65	8	50	0.75	6.51	8.56	9.03	9.55	10.14	11.29
HPI89984	R0.1	0.8	4	0.65	8	50	0.75	6.54	8.56	9.03	9.54	10.13	11.28
HPI89985	R0.2	0.8	4	0.65	8	50	0.75	6.58	8.56	9.01	9.53	10.10	11.26
HPI89986	R0.05	0.8	4	0.65	12	50	0.75	5.08	12.77	13.47	14.25	15.11	15.96
HPI89987	R0.1	0.8	4	0.65	12	50	0.75	5.09	12.77	13.46	14.24	15.11	15.95
HPI89988	R0.2	0.8	4	0.65	12	50	0.75	5.12	12.76	13.45	14.22	15.09	15.93
HPI89009	R0.1	0.9	4	0.7	4	45	0.85	9.01	4.35	4.59	4.85	5.14	5.85
HPI89989	R0.1	0.9	4	0.7	8	50	0.85	6.42	8.56	9.03	9.54	10.13	11.22
HPI89010	R0.1	1.0	4	0.8	4	50	0.95	8.89	4.35	4.59	4.85	5.14	5.85
HPI89990	R0.2	1.0	4	0.8	4	50	0.95	8.98	4.35	4.57	4.83	5.12	5.81
HPI89991	R0.1	1.0	4	0.8	6	50	0.95	7.37	6.46	6.81	7.20	7.63	8.70
HPI89992	R0.2	1.0	4	0.8	6	50	0.95	7.44	6.45	6.79	7.18	7.61	8.65
HPI89993	R0.3	1.0	4	0.8	6	50	0.95	7.50	6.45	6.78	7.16	7.58	8.61
HPI89994	R0.1	1.0	4	0.8	8	50	0.95	6.30	8.56	9.03	9.54	10.13	11.16
HPI89995	R0.2	1.0	4	0.8	8	50	0.95	6.34	8.56	9.01	9.53	10.10	11.15

▶ NEXT PAGE

Corner Radius Tolerance (mm)	Mill Dia. Tolerance (mm)	Shank Dia. Tolerance
±0.005	0~-0.010	h4

◎ : Excellent ○ : Good

ISO	P												M			K						
Material Description	Non-alloy steel					Low alloy steel				High alloyed steel, and tool steel			Stainless steel			Grey cast iron		Nodular cast iron		Malleable cast iron		
VDI 3323	1	2	3	4	5	6	7	8	9	10	11.1	11.2	12	13	14.1	15	16	17	18	19	20	
HRc		13	25	28	32	10	29	32	38	15	35	44	15	23	10	10	26	3	25		21	
HB	125	190	250	270	300	180	275	300	350	200	325	409	200	240	180	180	260	160	250	130	230	
Recommend					○			○	○		○	○										
ISO	N										S							H				
Material Description	Aluminum-wrought alloy		Aluminum-cast, alloyed		Copper and Copper Alloys (Bronze / Brass)		Non Metallic Materials		Heat Resistant Super Alloys					Titanium Alloys		Hardened steel					Chilled Cast Iron	Hardened Cast Iron
VDI 3323	21	22	23	24	25	26	27	28	31	32	33	34	35	36	37	38.1	38.2	39.1	39.2	39.3	40	41
HRc									15	30	25	38	34			45-49	50-55	56-60	61-65	66-70	42	55
HB	60	100	75	90	130	110	90	100	200	280	250	350	320	400 Rm	1050 Rm	421-469	481-560	577-654	670-739	400	550	
Recommend																◎	◎	◎	◎	◎	○	◎

CARBIDE, 2 FLUTE CORNER RADIUS for RIB PROCESSING

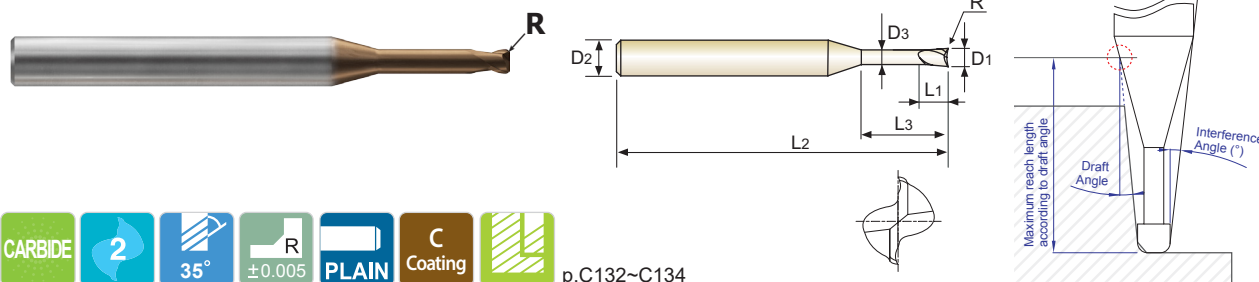
● **VOLLHARTMETALL, 2 SCHNEIDEN ECKENRADIUS für SCHMALE RIPPEN**

● **Fraise carbure, 2 dents, torique pour usinage de rainure**

● **2 TAGLIENTI, TORICA PER NERVATURE**

- ▶ Improvement of tool life by applying new coating.
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- ▶ Verbesserung der Werkzeugstandzeit durch Aufbringen einer neuen Beschichtung
- ▶ Enge Toleranzen für die Präzisionsbearbeitung



p.C132~C134

Unit : mm

EDP No.	Corner Radius	Mill Diameter	Shank Diameter	Length of Cut	Length Below Shank	Overall Length	Neck Diameter	Interference Angle(°)	Maximum reach lengths according to draft angle				
	R	D1	D2	L1	L3	L2	D3		0.5°	1°	1.5°	2°	3°
HPI89996	R0.1	1.0	4	0.8	10	50	0.95	5.50	10.66	11.25	11.89	12.62	13.50
HPI89997	R0.2	1.0	4	0.8	10	50	0.95	5.53	10.66	11.23	11.88	12.60	13.48
HPI89998	R0.3	1.0	4	0.8	10	50	0.95	5.57	10.65	11.22	11.86	12.57	13.47
HPI89999	R0.1	1.0	4	0.8	12	55	0.95	4.87	12.77	13.46	14.24	15.00	15.84
HPI89801	R0.2	1.0	4	0.8	12	55	0.95	4.90	12.76	13.45	14.22	14.99	15.82
HPI89802	R0.1	1.0	4	0.8	16	60	0.95	3.97	16.98	17.90	18.92	19.42	20.51
HPI89803	R0.2	1.0	4	0.8	16	60	0.95	3.99	16.97	17.89	18.92	19.41	20.49
HPI89804	R0.3	1.0	4	0.8	16	60	0.95	4.01	16.97	17.88	18.90	19.40	20.47
HPI89805	R0.1	1.0	4	0.8	20	60	0.95	3.35	21.19	22.34	23.23	23.85	25.18
HPI89806	R0.2	1.0	4	0.8	20	60	0.95	3.37	21.18	22.33	23.23	23.84	25.16
HPI89807	R0.3	1.0	4	0.8	20	60	0.95	3.38	21.17	22.32	23.22	23.83	25.15
HPI89015	R0.1	1.5	4	1.35	4	50	1.45	8.21	4.23	4.37	4.53	4.69	5.06
HPI89808	R0.2	1.5	4	1.35	4	50	1.45	8.31	4.22	4.36	4.51	4.68	5.04
HPI89809	R0.1	1.5	4	1.35	8	50	1.45	5.64	8.36	8.65	8.96	9.29	10.04
HPI89810	R0.2	1.5	4	1.35	8	50	1.45	5.68	8.36	8.64	8.95	9.28	10.01
HPI89811	R0.3	1.5	4	1.35	8	50	1.45	5.73	8.36	8.64	8.94	9.26	9.99
HPI89812	R0.2	1.5	4	1.35	12	55	1.45	4.32	12.49	12.92	13.38	13.88	14.99
HPI89813	R0.1	1.5	4	1.35	15	55	1.45	3.64	15.60	16.14	16.72	17.34	18.74
HPI89814	R0.2	1.5	4	1.35	15	55	1.45	3.66	15.59	16.13	16.71	17.33	18.71
HPI89815	R0.3	1.5	4	1.35	15	55	1.45	3.68	15.59	16.12	16.70	17.31	18.69
HPI89816	R0.1	1.5	4	1.35	20	60	1.45	2.90	20.77	21.49	22.26	23.09	-
HPI89817	R0.2	1.5	4	1.35	20	60	1.45	2.91	20.76	21.48	22.25	23.07	-
HPI89818	R0.3	1.5	4	1.35	20	60	1.45	2.93	20.76	21.47	22.24	23.06	-
HPI89020	R0.2	2.0	4	1.7	6	50	1.95	5.93	6.29	6.50	6.73	6.98	7.53
HPI89819	R0.5	2.0	4	1.7	6	50	1.95	6.12	6.28	6.48	6.70	6.93	7.45
HPI89820	R0.2	2.0	4	1.7	8	50	1.95	4.92	8.36	8.64	8.95	9.28	10.01

▶ NEXT PAGE

Corner Radius Tolerance (mm)	Mill Dia. Tolerance (mm)	Shank Dia. Tolerance
±0.005	0~-0.010	h4

◎ : Excellent ○ : Good

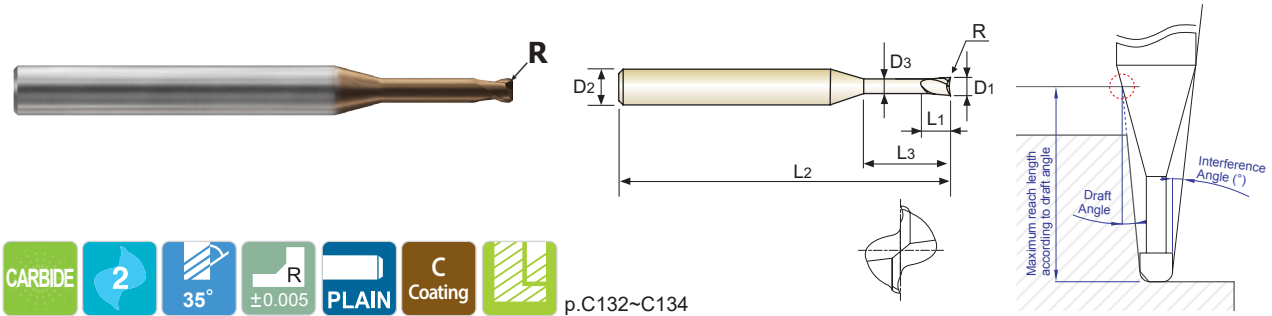
ISO	P												M			K								
Material Description	Non-alloy steel					Low alloy steel					High alloy steel, and tool steel			Stainless steel			Grey cast iron		Nodular cast iron		Malleable cast iron			
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	11.2	12	13	14.1	15	16	17	18	19	20			
HRC	13	23	25	28	32	10	29	32	38	15	35	44	15	23	10	10	26	3	25					
HB	125	190	250	270	300	180	275	300	350	200	325	409	200	240	180	180	260	160	250	130	230			
Recommend					○			○	○		○	○												
ISO	N										S							H						
Material Description	Aluminum-wrought alloy		Aluminum-cast, alloyed			Copper and Copper Alloys (Bronze / Brass)			Non Metallic Materials		Heat Resistant Super Alloys					Titanium Alloys		Hardened steel					Chilled Cast Iron	Hardened Cast Iron
VDI 3323	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38.1	38.2	39.1	39.2	39.3	40	41
HRC											15	30	25	38	34			45-49	50-55	56-60	61-65	66-70	42	55
HB	60	100	75	90	130	110	90	100			200	280	250	350	320	400 Rm	1050 Rm	421-469	481-560	577-654	670-739		400	550
Recommend																		◎	◎	◎	◎	◎	◎	◎

CARBIDE, 2 FLUTE CORNER RADIUS for RIB PROCESSING

-  **VOLLHARTMETALL, 2 SCHNEIDEN ECKENRADIUS für SCHMALE RIPPEN**
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Unit : mm

EDP No.	Corner Radius	Mill Diameter	Shank Diameter	Length of Cut	Length Below Shank	Overall Length	Neck Diameter	Interference Angle(°)	Maximum reach lengths according to draft angle				
	R	D1	D2	L1	L3	L2	D3		0.5°	1°	1.5°	2°	3°
HPI89821	R0.3	2.0	4	1.7	8	50	1.95	4.96	8.36	8.64	8.94	9.26	9.99
HPI89822	R0.5	2.0	4	1.7	8	50	1.95	5.05	8.35	8.62	8.92	9.23	9.94
HPI89823	R0.8	2.0	4	1.7	8	50	1.95	5.18	8.34	8.60	8.88	9.19	9.87
HPI89824	R0.2	2.0	4	1.7	12	55	1.95	3.66	12.49	12.92	13.38	13.88	14.99
HPI89825	R0.5	2.0	4	1.7	12	55	1.95	3.73	12.48	12.90	13.35	13.83	14.91
HPI89826	R0.2	2.0	4	1.7	16	55	1.95	2.92	16.63	17.20	17.81	18.48	-
HPI89827	R0.3	2.0	4	1.7	16	55	1.95	2.93	16.62	17.19	17.80	18.46	-
HPI89828	R0.5	2.0	4	1.7	16	55	1.95	2.96	16.62	17.18	17.78	18.43	-
HPI89829	R0.8	2.0	4	1.7	16	55	1.95	3.01	16.61	17.16	17.75	18.39	19.81
HPI89830	R0.2	2.0	4	1.7	20	60	1.95	2.42	20.76	21.48	22.25	23.07	-
HPI89831	R0.3	2.0	4	1.7	20	60	1.95	2.43	20.76	21.47	22.24	23.06	-
HPI89832	R0.5	2.0	4	1.7	20	60	1.95	2.45	20.75	21.46	22.22	23.03	-
HPI89833	R0.8	2.0	4	1.7	20	60	1.95	2.49	20.74	21.44	22.18	22.98	-
HPI89834	R0.2	2.0	4	1.7	25	65	1.95	2.00	25.93	26.83	27.79	28.82	-
HPI89835	R0.5	2.0	4	1.7	25	65	1.95	2.02	25.92	26.81	27.76	28.78	-
HPI89836	R0.2	2.0	4	1.7	30	70	1.95	1.70	31.10	32.18	33.33	-	-
HPI89837	R0.5	2.0	4	1.7	30	70	1.95	1.72	31.09	32.16	33.30	-	-
HPI89030	R0.2	3.0	6	2.5	8	55	2.85	6.26	8.55	8.84	9.16	9.49	10.24
HPI89838	R0.3	3.0	6	2.5	8	55	2.85	6.30	8.55	8.84	9.14	9.48	10.22
HPI89839	R0.5	3.0	6	2.5	8	55	2.85	6.40	8.54	8.82	9.12	9.45	10.17
HPI89840	R0.2	3.0	6	2.5	12	60	2.85	4.85	12.69	13.12	13.59	14.09	15.22
HPI89841	R0.5	3.0	6	2.5	12	60	2.85	4.93	12.68	13.10	13.56	14.05	15.14
HPI89842	R0.2	3.0	6	2.5	16	60	2.85	3.96	16.82	17.40	18.02	18.69	20.19
HPI89843	R0.3	3.0	6	2.5	16	60	2.85	3.98	16.82	17.39	18.01	18.67	20.17
HPI89844	R0.5	3.0	6	2.5	16	60	2.85	4.01	16.81	17.38	17.99	18.64	20.12
HPI89845	R0.2	3.0	6	2.5	20	65	2.85	3.34	20.96	21.68	22.45	23.29	25.16

► NEXT PAGE

Corner Radius Tolerance (mm)	Mill Dia. Tolerance (mm)	Shank Dia. Tolerance
±0.005	0~-0.010	h4

◎ : Excellent ○ : Good

ISO	P												M			K								
Material Description	Non-alloy steel					Low alloy steel				High alloyed steel, and tool steel			Stainless steel			Grey cast iron		Nodular cast iron		Malleable cast iron				
VDI 3323	1	2	3	4	5	6	7	8	9	10	11.1	11.2	12	13	14.1	15	16	17	18	19	20			
HRc		13	25	28	32	10	29	32	38	15	35	44	15	23	10	10	26	3	25					
HB	125	190	250	270	300	180	275	300	350	200	325	409	200	240	180	180	260	160	250	130	230			
Recommend					○			○	○		○	○												
ISO	N										S							H						
Material Description	Aluminum-wrought alloy		Aluminum-cast, alloyed		Copper and Copper Alloys (Bronze / Brass)		Non Metallic Materials		Heat Resistant Super Alloys					Titanium Alloys		Hardened steel					Chilled Cast Iron	Hardened Cast Iron		
VDI 3323	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38.1	38.2	39.1	39.2	39.3	40	41
HRc											15	30	25	38	34			45-49	50-55	56-60	61-65	66-70	42	55
HB	60	100	75	90	130	110	90	100			200	280	250	350	320	400 Rm	1050 Rm	421-469	481-560	577-654	670-739	400	550	
Recommend																		◎	◎	◎	◎	◎	○	◎

CARBIDE, 2 FLUTE CORNER RADIUS for RIB PROCESSING

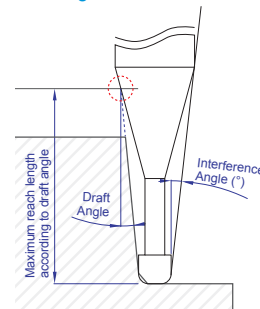
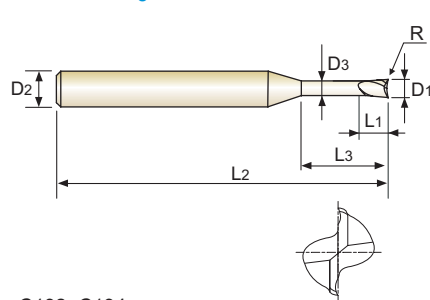
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p.C132~C134

Unit : mm

EDP No.	Corner Radius	Mill Diameter	Shank Diameter	Length of Cut		Overall Length	Neck Diameter	Interference Angle(°)	Maximum reach lengths according to draft angle				
	R	D1	D2	L1	L3	L2	D3		0.5°	1°	1.5°	2°	3°
HPI89846	R0.3	3.0	6	2.5	20	65	2.85	3.36	20.95	21.67	22.44	23.27	25.14
HPI89847	R0.5	3.0	6	2.5	20	65	2.85	3.38	20.95	21.66	22.42	23.24	25.09
HPI89848	R0.2	3.0	6	2.5	30	75	2.85	2.41	31.29	32.38	33.54	34.79	-
HPI89849	R0.3	3.0	6	2.5	30	75	2.85	2.41	31.29	32.37	33.53	34.77	-
HPI89850	R0.5	3.0	6	2.5	30	75	2.85	2.43	31.28	32.36	33.51	34.74	-
HPI89851	R0.2	3.0	6	2.5	35	80	2.85	2.11	36.46	37.72	39.08	40.54	-
HPI89852	R0.5	3.0	6	2.5	35	80	2.85	2.13	36.45	37.70	39.05	40.49	-

Corner Radius Tolerance (mm)	Mill Dia. Tolerance (mm)	Shank Dia. Tolerance
±0.005	0~-0.010	h4

ISO	P												M			K								
Material Description	Non-alloy steel					Low alloy steel					High alloyed steel, and tool steel		Stainless steel			Grey cast iron		Nodular cast iron		Malleable cast iron				
VDI 3323	1	2	3	4	5	6	7	8	9	10	11	11.2	12	13	14.1	15	16	17	18	19	20			
HRc	13	23	25	28	32	10	29	32	38	15	35	44	15	23	10	10	26	3	25		21			
HB	125	190	250	270	300	180	275	300	350	200	325	409	200	240	180	180	260	160	250	130	230			
Recommend					○			○	○		○	○												
ISO	N										S							H						
Material Description	Aluminum-wrought alloy		Aluminum-cast, alloyed			Copper and Copper Alloys (Bronze / Brass)			Non Metallic Materials		Heat Resistant Super Alloys					Titanium Alloys		Hardened steel					Chilled Cast Iron	Hardened Cast Iron
VDI 3323	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38.1	38.2	39.1	39.2	39.3	40	41
HRc											15	30	25	38	34			45-49	50-55	56-60	61-65	66-70	42	55
HB	60	100	75	90	130	110	90	100			200	280	250	350	320	400 Rm	1050 Rm	421-469	481-560	577-654	670-739		400	550
Recommend																		◎	◎	◎	◎	◎	◎	◎

SELECTION GUIDE



SERIES	HPI90	HPI91	HPI92	HPI89	HPI88
FLUTE	2	2	2	2	2
HELIX ANGLE	30°	30°	30°	35°	35°
CUTTING EDGE SHAPE	BALL NOSE	BALL NOSE	BALL NOSE	CORNER RADIUS	SQUARE
SIZE MIN	R0.05	R0.05	R0.05	D0.2	D0.1
SIZE MAX	R10.0	R3.0	R6.0	D3.0	D6.0
PAGE	C87	C88	C98	C107	C114

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Recommended cutting conditions : p. C120

ISO	VDI 3323	Material Description	Composition / Structure / Heat Treatment		HB	HRc					
P	1	Non-alloy steel	About 0.15% C	Annealed	125						
	2		About 0.45% C	Annealed	190	13					
	3		About 0.45% C	Quenched & tempered	250	25					
	4		About 0.75% C	Annealed	270	28					
	5		About 0.75% C	Quenched & tempered	300	32	○	○	○	○	○
	6	Low alloy steel		Annealed	180	10					
	7			Quenched & tempered	275	29					
	8			Quenched & tempered	300	32	○	○	○	○	○
	9			Quenched & tempered	350	38	○	○	○	○	○
	10			Annealed	200	15					
	11.1	High alloyed steel, and tool steel		Quenched & Tempered	325	35	○	○	○	○	○
	11.2			Quenched & Tempered	409	44	○	○	○	○	○
M	12	Stainless steel	Ferritic / Martensitic	Annealed	200	15					
	13		Martensitic	Quenched & Tempered	240	23					
	14.1			Austenitic	180	10					
K	15	Grey cast iron	Pearlitic / ferritic		180	10					
	16		Pearlitic (Martensitic)		260	26					
	17	Nodular cast iron	Ferritic		160	3					
	18		Pearlitic		250	25					
	19	Malleable cast iron	Ferritic		130						
	20		Pearlitic		230	21					
N	21	Aluminum-wrought alloy	Not Curable		60						
	22		Curable Hardened		100						
	23	Aluminum-cast, alloyed	≤ 12% Si, Not Curable		75						
	24		≤ 12% Si, Curable Hardened		90						
	25		> 12% Si, Not Curable		130						
	26	Copper and Copper Alloys (Bronze / Brass)	Cutting Alloys, PB>1%		110						
	27		CuZn, CuSnZn (Brass)		90						
	28		CuSn, lead-free copper and electrolytic copper		100						
	29	Non Metallic Materials	Duroplastic, Fiber Reinforced Plastic								
	30		Rubber, Wood, etc.								
S	31	Heat Resistant Super Alloys	Fe Based	Annealed	200	15					
	32			Cured	280	30					
	33		Ni or Co Based	Annealed	250	25					
	34			Cured	350	38					
	35			Cast	320	34					
	36	Titanium Alloys	Pure Titanium		400 Rm						
	37		Alpha + Beta Alloys Hardened		1050 Rm						
H	38	Hardened steel		Hardened	421-469	45-49	◎	◎	◎	◎	◎
	39			Hardened		66-70	◎	◎	◎	◎	◎
	40	Chilled Cast Iron		Cast	400	42	○	○	○	○	○
	41	Hardened Cast Iron		Hardened	550	55	◎	◎	◎	◎	◎



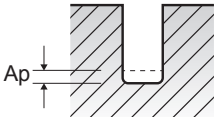
RECOMMENDED CUTTING CONDITIONS
EMPFOHLENE SCHNEIDPARAMETER

Vc = m/min.
fz = mm/tooth
RPM = rev/min.
FEED = mm/min.
Ap = mm
LBS = Length Below Shank

HPI89 SERIES 2 FLUTE CORNER RADIUS for RIB PROCESSING

ISO	VDI 3323	Material Description	Slotting	Parameter	Diameter (Ø)																	
					0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5
			Ae	LBS	0.5	1	1.5	2	1	1.5	2	2.5	3	1	1.5	2	2.5	3	4	1	2	3
P	5	Non-alloy steel	1.0D	Vc	31	31	28	28	46	46	42	42	42	67	67	67	60	60	60	82	82	74
				fz	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.004	0.004
				RPM	49178	49178	44260	44260	49178	49178	44260	44260	44260	53277	53277	53277	47949	47949	47949	52458	52458	47212
				FEED	98	98	89	89	197	197	177	177	177	213	213	213	192	192	192	420	420	378
	8~9	Low alloy steel	1.0D	Ap	0.010	0.009	0.008	0.007	0.014	0.014	0.012	0.011	0.011	0.020	0.018	0.018	0.016	0.016	0.014	0.025	0.023	0.020
				Vc	31	31	28	28	46	46	42	42	42	67	67	67	60	60	60	82	82	74
				fz	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.004	0.004
				RPM	49178	49178	44260	44260	49178	49178	44260	44260	44260	53277	53277	53277	47949	47949	47949	52458	52458	47212
	11.1	High alloyed steel, and tool steel	1.0D	FEED	98	98	89	89	197	197	177	177	177	213	213	213	192	192	192	420	420	378
				Ap	0.010	0.009	0.008	0.007	0.014	0.014	0.012	0.011	0.011	0.020	0.018	0.018	0.016	0.016	0.014	0.025	0.023	0.020
				Vc	31	31	28	28	46	46	42	42	42	67	67	67	60	60	60	82	82	74
				fz	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.004	0.004	0.004
	11.2	High alloyed steel, and tool steel	1.0D	RPM	49178	49178	44260	44260	43714	43714	39343	39343	39343	45081	45081	45081	40573	40573	40573	45900	45900	41310
				FEED	98	98	89	89	175	175	157	157	157	180	180	180	162	162	162	275	275	248
				Ap	0.009	0.008	0.007	0.006	0.011	0.011	0.010	0.009	0.009	0.017	0.015	0.015	0.014	0.014	0.012	0.021	0.019	0.017
				Vc	31	31	28	28	41	41	37	37	37	57	57	57	51	51	51	72	72	65
H	38.1	Hardened steel	1.0D	fz	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	
				RPM	49178	49178	44260	44260	43714	43714	39343	39343	39343	45081	45081	45081	40573	40573	40573	45900	45900	41310
				FEED	98	98	89	89	175	175	157	157	157	180	180	180	162	162	162	275	275	248
				Ap	0.009	0.008	0.007	0.006	0.011	0.011	0.010	0.009	0.009	0.017	0.015	0.015	0.014	0.014	0.012	0.021	0.019	0.017
	38.2		1.0D	Vc	26	26	23	23	41	41	37	37	37	52	52	52	46	46	46	67	67	60
				fz	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003
				RPM	40983	40983	36885	36885	43714	43714	39343	39343	39343	40983	40983	40983	36885	36885	36885	42621	42621	38359
				FEED	82	82	74	74	87	87	79	79	79	164	164	164	148	148	148	256	256	230
	39.1		1.0D	Ap	0.009	0.008	0.007	0.006	0.011	0.011	0.010	0.009	0.009	0.017	0.015	0.015	0.014	0.014	0.012	0.021	0.019	0.017
				Vc	21	21	19	19	31	31	28	28	28	41	41	41	37	37	37	52	52	46
				fz	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
				RPM	32786	32786	29507	29507	32786	32786	29507	29507	29507	32786	32786	32786	29507	29507	29507	32786	32786	29507
	39.2		1.0D	FEED	66	66	59	59	66	66	59	59	59	66	66	66	59	59	59	131	131	118
				Ap	0.008	0.007	0.006	0.006	0.011	0.011	0.010	0.008	0.008	0.016	0.014	0.014	0.013	0.013	0.011	0.020	0.018	0.016
				Vc	21	21	19	19	26	26	23	23	23	31	31	31	28	28	28	41	41	37
				fz	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
	39.3		1.0D	RPM	32786	32786	29507	29507	27322	27322	24590	24590										

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HPI89 SERIES
2 FLUTE CORNER RADIUS for RIB PROCESSING

Vc = m/min.
fz = mm/tooth
RPM = rev/min.
FEED = mm/min.
Ap = mm
LBS = Length Below Shank

ISO	VDI 3323	Parameter LBS	Diameter (Ø)																							
			0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	1	1	1	1	
			4	5	6	2	4	6	8	10	2	4	6	2	4	6	8	12	4	8	4	6	8	10		
P	5	Vc	74	74	66	98	88	88	78	59	113	102	102	129	129	116	116	103	144	130	154	139	139	139		
		fz	0.004	0.004	0.003	0.005	0.005	0.005	0.004	0.004	0.006	0.005	0.005	0.006	0.006	0.005	0.005	0.005	0.007	0.006	0.010	0.009	0.009	0.009		
		RPM	47212	47212	41966	51911	46720	46720	41529	31147	51569	46412	46412	51228	51228	46105	46105	40982	51000	45900	49178	44260	44260	44260		
		FEED	378	378	252	519	467	467	332	249	619	464	464	615	615	461	461	410	714	551	984	797	797	797		
		Ap	0.020	0.018	0.018	0.027	0.024	0.021	0.018	0.015	0.035	0.028	0.025	0.040	0.036	0.032	0.028	0.024	0.041	0.032	0.045	0.040	0.040	0.035		
	8~9	Vc	74	74	66	98	88	88	78	59	113	102	102	129	129	116	116	103	144	130	154	139	139	139		
		fz	0.004	0.004	0.003	0.005	0.005	0.005	0.004	0.004	0.006	0.005	0.005	0.006	0.006	0.005	0.005	0.005	0.007	0.006	0.010	0.009	0.009	0.009		
		RPM	47212	47212	41966	51911	46720	46720	41529	31147	51569	46412	46412	51228	51228	46105	46105	40982	51000	45900	49178	44260	44260	44260		
		FEED	378	378	252	519	467	467	332	249	619	464	464	615	615	461	461	410	714	551	984	797	797	797		
		Ap	0.020	0.018	0.018	0.027	0.024	0.021	0.018	0.015	0.035	0.028	0.025	0.040	0.036	0.032	0.028	0.024	0.041	0.032	0.045	0.040	0.040	0.035		
	11.1	Vc	74	74	66	98	88	88	78	59	113	102	102	129	129	116	116	103	144	130	154	139	139	139		
		fz	0.004	0.004	0.003	0.005	0.005	0.005	0.004	0.004	0.006	0.005	0.005	0.006	0.006	0.005	0.005	0.005	0.007	0.006	0.010	0.009	0.009	0.009		
		RPM	47212	47212	41966	51911	46720	46720	41529	31147	51569	46412	46412	51228	51228	46105	46105	40982	51000	45900	49178	44260	44260	44260		
		FEED	378	378	252	519	467	467	332	249	619	464	464	615	615	461	461	410	714	551	984	797	797	797		
		Ap	0.020	0.018	0.018	0.027	0.024	0.021	0.018	0.015	0.035	0.028	0.025	0.040	0.036	0.032	0.028	0.024	0.041	0.032	0.045	0.040	0.040	0.035		
	11.2	Vc	65	65	58	88	79	79	70	53	93	84	84	103	103	93	93	82	113	102	124	111	111	111		
		fz	0.003	0.003	0.002	0.004	0.004	0.004	0.003	0.003	0.005	0.005	0.005	0.006	0.006	0.005	0.005	0.005	0.007	0.006	0.008	0.007	0.007	0.007		
		RPM	41310	41310	36720	46447	41802	41802	37158	27868	42230	38007	38007	40983	40983	36885	36885	32786	40072	36065	39343	35409	35409	35409		
		FEED	248	248	147	372	334	334	223	167	422	380	380	492	492	369	369	328	561	433	629	496	496	496		
		Ap	0.017	0.015	0.015	0.023	0.020	0.018	0.015	0.013	0.030	0.024	0.021	0.034	0.031	0.027	0.024	0.020	0.034	0.027	0.038	0.034	0.034	0.030		
H	38.1	Vc	65	65	58	88	79	79	70	53	93	84	84	103	103	93	93	82	113	102	124	111	111	111		
		fz	0.003	0.003	0.002	0.004	0.004	0.004	0.003	0.003	0.005	0.005	0.005	0.006	0.006	0.005	0.005	0.005	0.007	0.006	0.008	0.007	0.007	0.007		
		RPM	4																							



RECOMMENDED CUTTING CONDITIONS
EMPFOHLENE SCHNEIDPARAMETER

Vc = m/min.
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FEED = mm/min.
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LBS = Length Below Shank

HPI89 SERIES 2 FLUTE CORNER RADIUS for RIB PROCESSING

ISO	VDI 3323	Parameter	Diameter (Ø)																				
			1	1	1	1.5	1.5	1.5	1.5	1.5	2	2	2	2	2	2	2	3	3	3	3	3	
		LBS	12	16	20	4	8	12	15	20	6	8	12	16	20	25	30	8	12	16	20	30	35
P	5	Vc	124	93	93	196	176	176	176	157	216	216	195	195	195	173	173	211	211	190	190	190	169
		fz	0.008	0.007	0.007	0.011	0.010	0.010	0.010	0.009	0.013	0.013	0.012	0.012	0.012	0.010	0.010	0.019	0.019	0.017	0.017	0.017	0.015
		RPM	39342	29507	29507	41581	37423	37423	37423	33265	34426	34426	30983	30983	30983	27541	27541	22404	22404	20164	20164	20164	17923
		FEED	629	413	413	915	748	748	748	599	895	895	744	744	744	551	551	851	851	686	686	686	538
		Ap	0.035	0.030	0.025	0.075	0.060	0.060	0.053	0.045	0.100	0.090	0.080	0.080	0.070	0.070	0.060	0.150	0.135	0.120	0.120	0.105	0.105
	8~9	Vc	124	93	93	196	176	176	176	157	216	216	195	195	195	173	173	211	211	190	190	190	169
		fz	0.008	0.007	0.007	0.011	0.010	0.010	0.010	0.009	0.013	0.013	0.012	0.012	0.012	0.010	0.010	0.019	0.019	0.017	0.017	0.017	0.015
		RPM	39342	29507	29507	41581	37423	37423	37423	33265	34426	34426	30983	30983	30983	27541	27541	22404	22404	20164	20164	20164	17923
		FEED	629	413	413	915	748	748	748	599	895	895	744	744	744	551	551	851	851	686	686	686	538
		Ap	0.035	0.030	0.025	0.075	0.060	0.060	0.053	0.045	0.100	0.090	0.080	0.080	0.070	0.070	0.060	0.150	0.135	0.120	0.120	0.105	0.105
	11.1	Vc	124	93	93	196	176	176	176	157	216	216	195	195	195	173	173	211	211	190	190	190	169
		fz	0.008	0.007	0.007	0.011	0.010	0.010	0.010	0.009	0.013	0.013	0.012	0.012	0.012	0.010	0.010	0.019	0.019	0.017	0.017	0.017	0.015
		RPM	39342	29507	29507	41581	37423	37423	37423	33265	34426	34426	30983	30983	30983	27541	27541	22404	22404	20164	20164	20164	17923
		FEED	629	413	413	915	748	748	748	599	895	895	744	744	744	551	551	851	851	686	686	686	538
		Ap	0.035	0.030	0.025	0.075	0.060	0.060	0.053	0.045	0.100	0.090	0.080	0.080	0.070	0.070	0.060	0.150	0.135	0.120	0.120	0.105	0.105
	11.2	Vc	99	74	74	154	139	139	139	123	170	170	153	153	153	136	136	170	170	153	153	153	136
		fz	0.006	0.006	0.006	0.010	0.009	0.009	0.009	0.008	0.013	0.013	0.012	0.012	0.012	0.010	0.010	0.020	0.020	0.018	0.018	0.018	0.016
		RPM	31474	23606	23606	32754	29479	29479	29479	26203	27049	27049	24344	24344	24344	21639	21639	18032	18032	16229	16229	16229	14426
		FEED	378	283	283	655	531	531	531	419	703	703	584	584	584	433	433	721	721	584	584	584	462
		Ap	0.030	0.026	0.021	0.064	0.051	0.051	0.045	0.038	0.085	0.077	0.068	0.068	0.060	0.060	0.051	0.128	0.115	0.102	0.102	0.089	0.089
H	38.1	Vc	99	74	74	154	139	139	139	123	170	170	153	153	153	136	136	170	170	153	153	153	136
		fz	0.006	0.006	0.006	0.010	0.009	0.009	0.009	0.008	0.013	0.013	0.012	0.012	0.012	0.010	0.010	0.020	0.020	0.018	0.018	0.018	0.016
		RPM	31474	23606	23606	32754	29479	29479	29479	26203	27049	27049	24344	24344	24344	21639	21639	18032	18032	16229	16229	16229	14426
		FEED	378																				