

Frese 2 tagli sferiche scaricate per acciai temprati con gambo corto ed elevata precisione rivestite **MUGEN PREMIUM Plus**

MUGEN COATING PREMIUM Plus 2-Flute Long Neck Ball End Mill with Short Shank
for Hardened Steel and High accuracy cutting

New **MRBSH230SF**

Acciaio temprato
Hardened Steel



New

Rivestimento
**MUGEN
PREMIUM Plus**



Elevata precisione e lunga durata utensile su acciaio temprato fino a 70 HRC

High precision and long tool life even for hardened steel up to 70 HRC

MRBSH230SF

R0.05 ~ R3

83 misure disponibili
Total 83 sizes



Rivestimento MUGEN PREMIUM Plus

New

MUGEN COATING PREMIUM Plus

Nuovo rivestimento con elevata resistenza all'ossidazione e all'abrasione sviluppato per il taglio di acciaio temprato fino a **70 HRC**

New developed coating realized cutting hardened steel up to 70HRC with high oxidation resistance and abrasion resistance

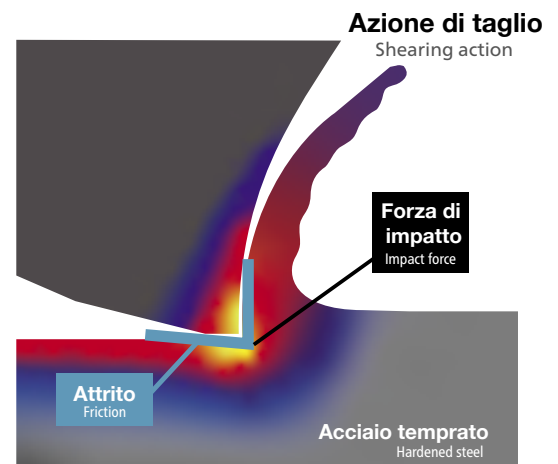
Caratteristiche dell'acciaio temprato

Features of hardened steel

Durante la lavorazione dell' acciaio temprato da 60 a 70 HRC si verifica un carico di taglio estremamente elevato poiché la durezza e la tenacità del materiale di lavoro sono elevate. Pertanto, l' "azione di taglio" sul bordo dell'utensile fa sì che ...

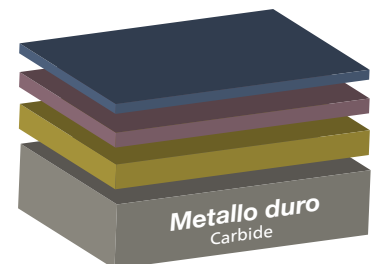
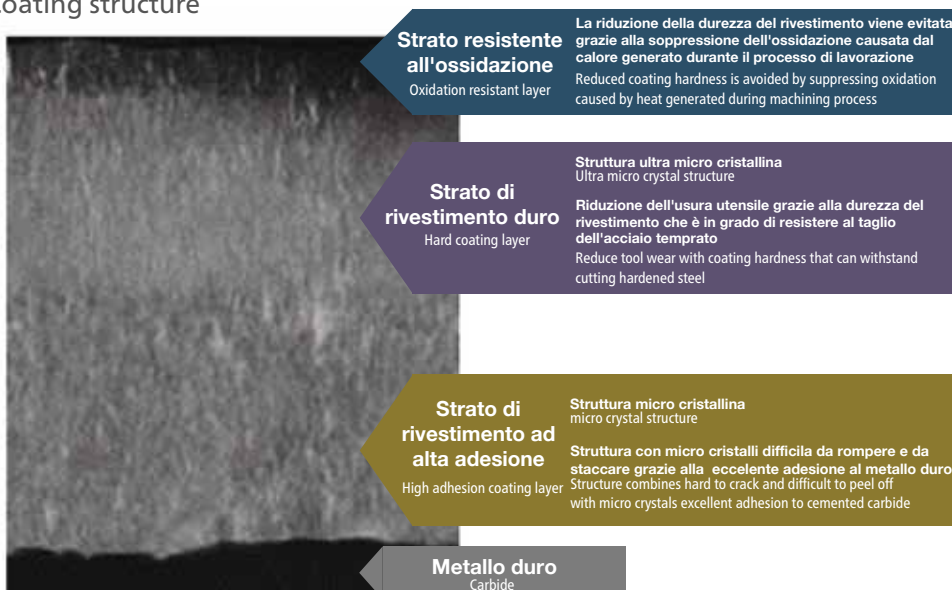
As a phenomenon when machining hardened steel of 60 to 70 HRC, the cutting load during processing is extremely high because hardness and toughness of work material are high. Therefore, the "shearing action" at tool edge cause that...

- Gli utensili si usurano facilmente a causa dell'attrito
Tools to wear easily causing frict
- Gli utensili tendono a usurarsi a causa della temperatura di taglio che ossida il rivestimento e ne riduce la durezza
Tools tends to wear to reduced hardness of material on coating oxidizes of cutting heat
- L'utensile si danneggia facilmente se la forza d'impatto è elevata
Tool is easily damaged if impact force is large



Struttura del rivestimento

Coating structure



Durezza del materiale da lavorare

Work material hardness

Rivestimento MUGEN	Rivestimento MUGEN PREMIUM	Rivestimento MUGEN PREMIUM Plus	
MUGEN COATING	MUGEN COATING PREMIUM	MUGEN COATING PREMIUM Plus	
		New	
Durezza del materiale da lavorare Work Material Hardness	50 HRC	60 HRC	70 HRC

Ottimizzato per il taglio di materiali da 60 a 70 HRC

Optimized for cutting 60 to 70 HRC material

Ruolo del rivestimento

Role of coating

Strato resistente all'ossidazione
Oxidation resistant layer

Previene l'ossidazione causata dalla generazione del calore durante il taglio
Prevents oxidation due to heat generated during cutting

Strato di rivestimento duro (struttura ultra micro cristallina)
Hard coating layer (Ultra micro crystal structure)

Immagine della sezione trasversale dell'avanzamento usura nel rivestimento
Image of wear progress cross section of coating

L'usura dell'utensile può essere ridotta durante la lavorazione di acciaio ad elevata durezza
Tool wear can be reduced when machining on high hardened steel

Strato di rivestimento ad alta adesione (struttura micro cristallina)
High adhesion coating layer (micro crystal structure)

Immagine schematica della crescita delle crepe e dell'adesione
Image diagram of crack growth and adhesion

Sezione trasversale rivestimento
Cross section of coating

Struttura dalla difficile formazione e propagazione di crepe per la forza di impatto
Structure that is difficult to crack and propagate when impact forced

Elevata adesione
High adhesion

Confronto della durata dell'utensile su HAP40 HRC64

Tool life comparison for HAP40 (64HRC)

Condizioni di taglio $n = 20'000 \text{ g/min}$ $V_a = 1600 \text{ mm/min}$ $a_p 0.15 \times a_e 0.3 \text{ mm}$, refrigerante: minimale
Cutting condition $n = 20,000 \text{ min}^{-1}$, $V_f = 1,600 \text{ mm/min}$ $a_p 0.15 \times a_e 0.3 \text{ mm}$, Coolant: Oil mist

	MRBSH230SF	Competitore A Other tool brand A	Competitore B Other tool brand B	Competitore C Other tool brand C
Foto usura Wear pictures	 Usura : 0.102mm Wear width : 0.102mm	 Usura : 0.137mm Wear width : 0.137mm	 Usura : 0.190mm Wear width : 0.190mm	 Usura : 0.157mm Wear width : 0.157mm
Tempo di taglio Cutting time	70 min 70 min			

Elevata precisione e lunga durata utensile su acciaio temprato fino a 70 HRC

High precision and long tool life even for hardened steel up to 70 HRC

MRBSH230SF

R0.05 ~ R3

83 misure disponibili
Total 83 sizes

Lunga durata utensile e un taglio di alta precisione anche su acciaio temprato a 70 HRC

Achieves long-tool life and high precision cutting even for 70 HRC hardened steel



La tolleranza del raggio R è riferita alla metà del valore reale del diametro
R accuracy is based on a half value of actual diameter

Caratteristiche

Features



Rivestimento Coating

1	<p>Nuovo rivestimento MUGEN PREMIUM Plus con elevata resistenza all'ossidazione e all'abrasione</p> <p>New coating MUGEN COATING PREMIUM Plus with high Oxidation resistance and abrasion resistance</p>
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Introdotta nella pagina precedente
Introduced in the previous page

Geometria Shape

2-1	<p>Tagliante affilato per la riduzione delle forze di taglio</p> <p>Cutting edge shape with reduced cutting load</p>
2-2	<p>Elevata rigidità grazie alla sporgenza ottimale</p> <p>Achieves high rigidity with optimal tool overhung</p>
2-3	<p>Gambo a elevata precisione a supporto del calettamento a caldo</p> <p>High accuracy precision shank supported shrink fit chuck</p>
2-3	<p>Raggio estremamente preciso regolare e senza segni di giunzione</p> <p>Highly accurate R shape that is smooth and seamless</p>



Range di tolleranza
0.002 mm
Tolerance range



Materiale Material

3	<p>Metallo duro dalla super micro grana con miglior resistenza alla frattura</p> <p>Super micro grain carbide with improved fracture resistance</p>
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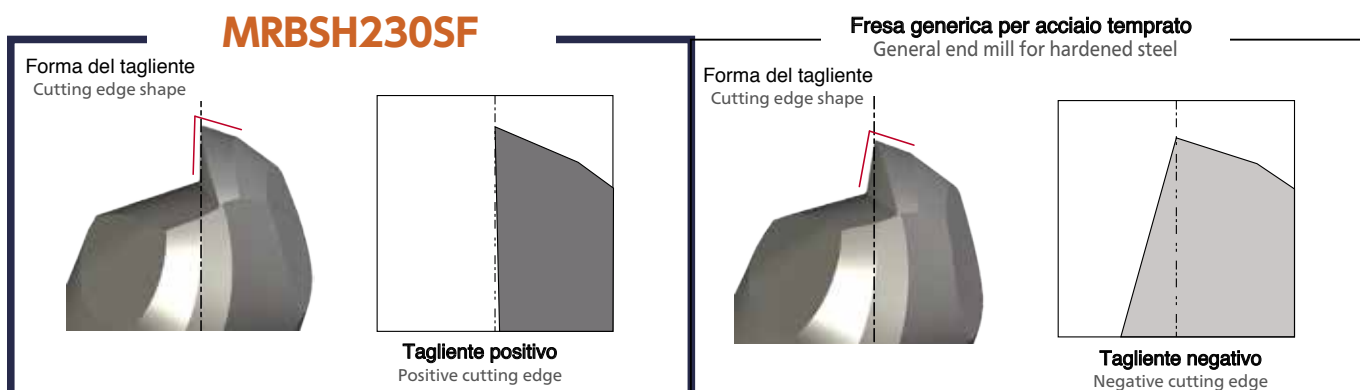
Caratteristiche
2-1

Lavorabilità migliorata
Improved machinability

Geometria Tagliente
Shape Cutting edge

Il tagliente affilato dalle forze di taglio ridotte e il nuovo materiale dall'elevata resistenza alla frattura garantiscono una lunga durata dell'utensile e un'elevata precisione nella lavorazione dell'acciaio temprato

Sharp cutting edge with reduced cutting load and new material with fracture resistance realizes long tool life and high precision for hardened steel



Forza di taglio ridotta grazie al tagliente positivo e resistenza alla scheggiatura nella lavorazione di acciaio temprato grazie alla nuova super micro grana di metallo duro

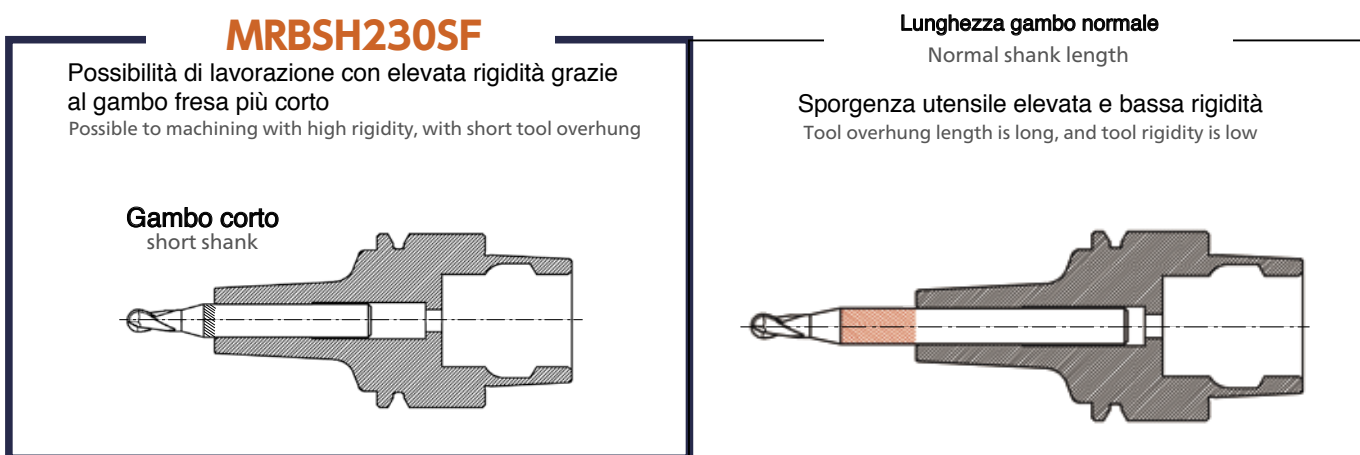
Cutting load is reduced by positive cutting edge and by adopting a new material Super micro grain carbide prevent chipping even with hardened steel

Forma del tagliente negativa con elevate forze di taglio
Negative cutting edge shape with high cutting load

Caratteristiche
2-2

Precisione migliorata
Improved cutting accuracy

Geometria Sporgenza ottimale
Shape Optimal overhung length



Caratteristiche
2-2

Per mandrini a calettamento precisi
Compatible with high accuracy shrink-fit chuck

Geometria Gambo preciso
Shape High accuracy shank



ϕd - 0.001
 ϕd - 0.003

Range di tolleranza
Tolerance range
0.002 mm



Elevata precisione e lunga durata utensile su acciaio temprato fino a 70 HRC

High precision and long tool life even for hardened steel up to 70 HRC

Caratteristiche
2-3

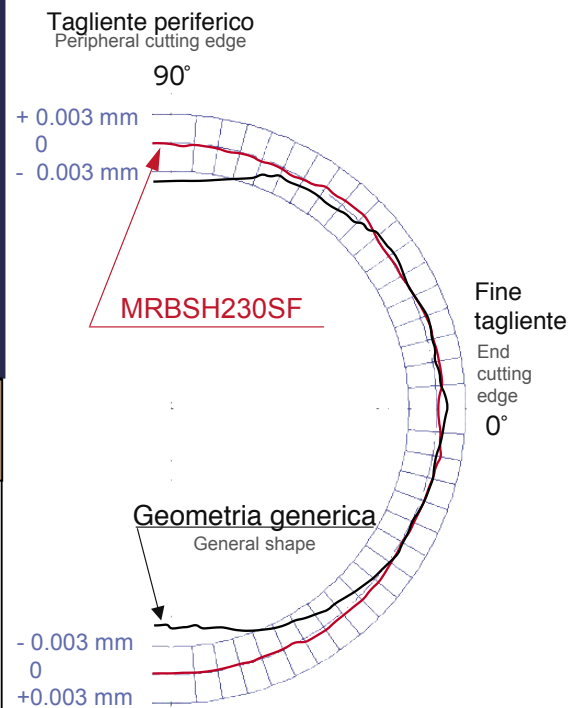
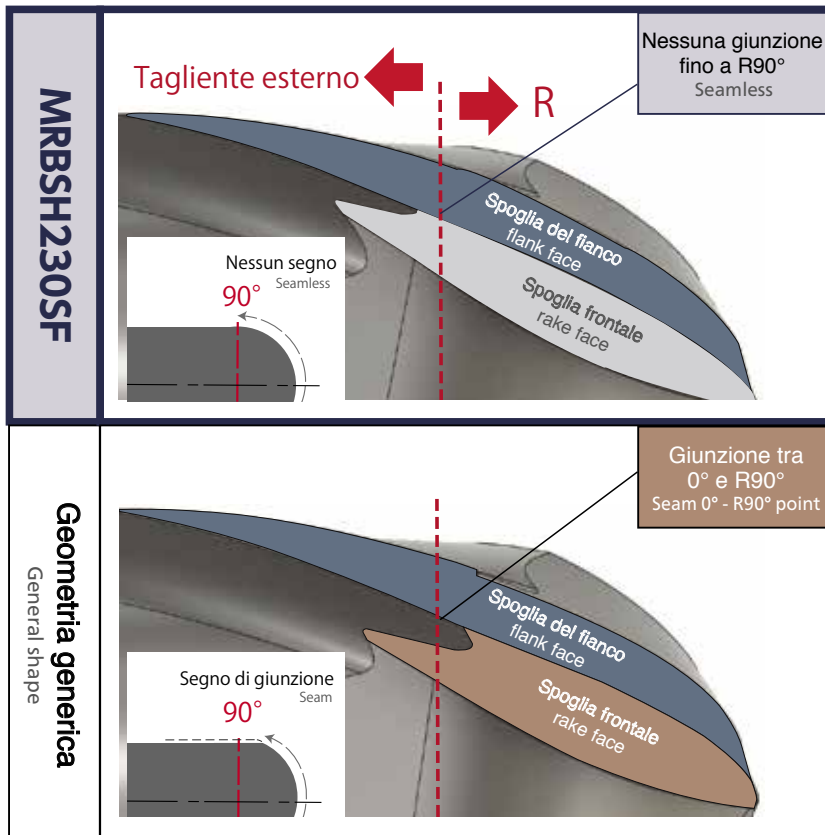
Elevata precisione del raggio
High accuracy R

Geometria
shape

Maggiore precisione raggio
Highly accurate R

Design senza segni di giunzione sull'angolo di spoglia frontale e del fianco nel punto di raccordo tra il raggio fresa e il tagliente periferico. Questo consente di ottenere un'elevata precisione del raggio.
Seamless design on rake face and flank face from R-curve to peripheral cutting edge. Realized high precision R accuracy

In attesa di brevetto
PATENT PENDING



* La tolleranza del raggio R è riferita alla metà del valore reale del diametro R accuracy is based on a half value of actual diameter

Caratteristiche
3

Resistenza all'usura migliorata
Upgrade abrasion ability

Materiale
Material

Metallo duro
Carbide material



Utilizzato nuovo metallo duro con «super micrograna» dalla speciale resistenza all'abrasione e alla frattura.

New material adopted «Super micro grain carbide» to specialize abrasion resistance and fracture resistance.

Esempio di lavorazione ad elevata precisione 1

High precision cutting sample 1

HAP72 (70HRC) : confronto dimensionale dopo sgrossatura

HAP72 (70HRC) : Comparison of dimensional accuracy after rough cutting

Utensile Tool : MRBSH230SF R1 × 6

Processo : Sgrossatura z-cost in 4 passate

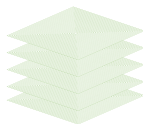
Cutting content : Roughing contour lines for 4 pockets

Sovrametallo Stock : 0.02mm

Target Target : 7.960mm

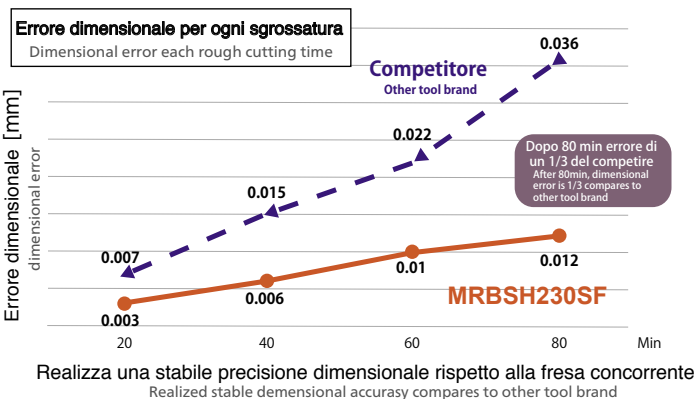
Tempo Cutting time : 20 min/ tasca pocket

Percorso Tool path : Sgrossatura z-cost Roughing contour line



Sgrossatura Roughing

$n = 16,000 \text{ min}^{-1}$ $V_f = 1,200 \text{ mm/min}$ $a_p 0.1 \times a_e 0.3 \text{ mm}$ minimale Oil Mist



Esempio di lavorazione ad elevata precisione 2

High precision cutting sample 2

HAP72 (70HRC) : confronto dimensionale dopo finitura

HAP72 (70HRC) : Comparison of dimensional accuracy after finish cutting

Utensile Tool : MRBSH230SF R1 × 6

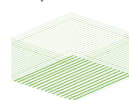
Processo : Finitura di una tasca

Cutting content : Finishing cutting for 1 pocket

Tempo Cutting time : 32 min/tasca per pocket

Percorso Tool path : Finitura in contonatura

Contour line finishing

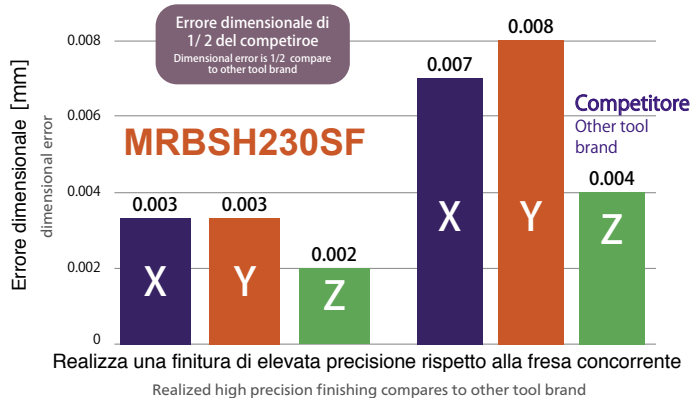
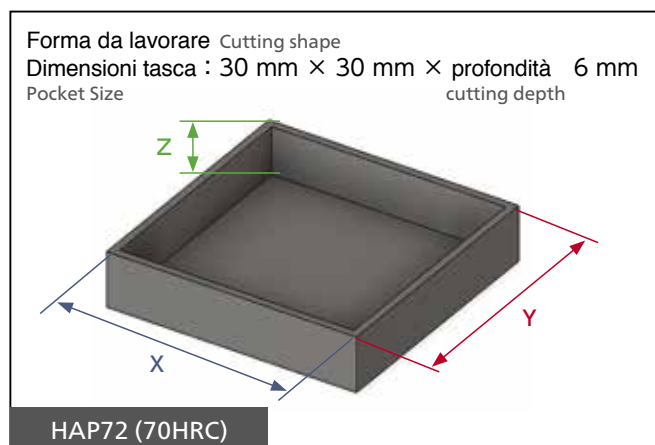


Finitura in scansione

Scanning line finishing

Finitura Finishing

$n = 16,000 \text{ min}^{-1}$ $V_f = 1,000 \text{ mm/min}$ $a_p 0.03 \times a_e 0.03 \text{ mm}$ minimale Oil Mist



MRBSH230SF

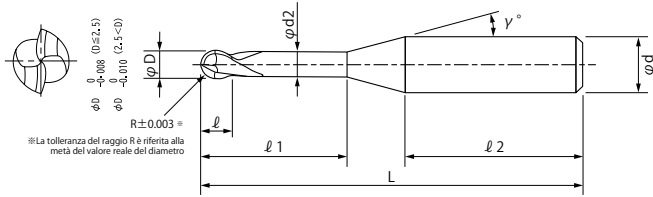
R0.05 ~ R3 83 misure disponibili



MUGEN PREMIUM Plus

Frese 2 tagli sferiche scaricate per acciai temprati con gambo corto ed elevata precisione
MUGEN COATING PREMIUM Plus 2-Flute Long Neck Ball End Mill with Short Shank for Hardened Steel

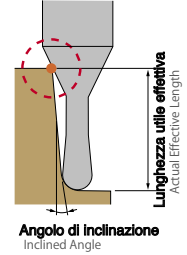
New



- Consente prestazioni di taglio stabili anche su acciai temprati a 70 HRC.
- Nuovo rivestimento MUGEN PREMIUM Plus sviluppato per incrementare la resistenza all'ossidazione e all'abrasione.
- Materiale e design dell'utensile ottimizzati per ridurre il carico di taglio.
- Precisione del raggio $\pm 0.003\text{mm}$ (riferita a metà del valore reale del diametro)
- La tolleranza del diametro del gambo, ad alta precisione, è - 0,001 ~ - 0,003.
- Realize stable cutting performance even for 70 HRC hardened steels.
- Developed new MUGEN COATING PREMIUM Plus to upgrade oxidation resistance and abrasion resistance.
- Adopt optimized new tool material and tool design to reduce cutting load.
- R accuracy is $\pm 0.003\text{mm}$ (R accuracy is based on a half value of actual diameter).
- Shank diameter tolerance, high accuracy type, is - 0.001 ~ - 0.003.



La tolleranza del raggio R è riferita alla metà del valore reale del diametro
R accuracy is based on a half value of actual diameter



Materiale Work Material	
Acciaio temprato Hardened Steels	
45 ~ 60 HRC	60 ~ 70 HRC
○	◎

Unità di misura: mm Unit [Size : mm]

Codice Code No.	(R) Raggio Radius	(l1) Lungh. scarico Under Neck Length	(l) Lungh. tagli Length of Cut	(D) Diametro Dia.	(d2) Dia. scarico Neck Dia.	(gamma) Angolo Neck Taper Angle	(d) Dia. gambo Shank Dia.	(l2) Lungh. gambo Shank Length	(L) Lungh. totale Overall Length	La lungh. utile effettiva dipende dall'angolo d'inclinazione del pezzo Actual effective length depending on inclined angle of workpiece.				
										30°	1°	1° 30'	2°	3°
										08-00537-00052	R0.05	0.2	0.07	0.1
08-00537-00053	0.3	0.07	0.1	0.085	15°	4	27.3	35	0.33	0.34		0.35	0.36	0.39
08-00537-00055	0.5	0.07	0.1	0.085	15°	4	27.1	35	0.54	0.56		0.57	0.59	0.64
08-00537-00072	R0.075	0.3	0.1	0.15	0.13	15°	4	27.4	35	0.34	0.35	0.36	0.37	0.40
08-00537-00073		0.5	0.1	0.15	0.13	15°	4	27.2	35	0.55	0.56	0.58	0.60	0.65
08-00537-00101	R0.1	0.3	0.15	0.2	0.18	15°	4	27.5	35	0.34	0.35	0.36	0.37	0.39
08-00537-00102		0.5	0.15	0.2	0.18	15°	4	27.3	35	0.55	0.56	0.58	0.60	0.64
08-00537-00103		0.75	0.15	0.2	0.18	15°	4	27.1	35	0.81	0.83	0.86	0.89	0.95
08-00537-00105	R0.15	1	0.15	0.2	0.18	15°	4	26.8	35	1.06	1.10	1.13	1.17	1.26
08-00537-00150		0.5	0.2	0.3	0.28	15°	4	27.5	35	0.55	0.56	0.57	0.59	0.63
08-00537-00151		0.6	0.2	0.3	0.28	15°	4	27.4	35	0.65	0.67	0.69	0.71	0.75
08-00537-00152	R0.2	0.75	0.2	0.3	0.28	15°	4	27.3	35	0.80	0.83	0.85	0.88	0.94
08-00537-00153		1	0.2	0.3	0.28	15°	4	27.0	35	1.06	1.09	1.13	1.17	1.25
08-00537-00155		1.5	0.2	0.3	0.28	15°	4	26.5	35	1.58	1.63	1.68	1.74	1.87
08-00537-00201	R0.25	0.5	0.3	0.4	0.37	15°	4	27.7	35	0.56	0.58	0.59	0.60	0.64
08-00537-00202		0.8	0.3	0.4	0.37	15°	4	27.4	35	0.87	0.90	0.92	0.95	1.01
08-00537-00203		1	0.3	0.4	0.37	15°	4	27.2	35	1.08	1.11	1.14	1.18	1.26
08-00537-00204		1.5	0.3	0.4	0.37	15°	4	26.7	35	1.60	1.65	1.70	1.75	1.88
08-00537-00205		2	0.3	0.4	0.37	15°	4	26.2	35	2.11	2.18	2.25	2.33	2.50
08-00537-00206		2.5	0.3	0.4	0.37	15°	4	25.7	35	2.63	2.72	2.81	2.90	3.13
08-00537-00252	R0.3	1	0.35	0.5	0.46	15°	4	27.3	35	1.10	1.13	1.16	1.19	1.27
08-00537-00253		1.5	0.35	0.5	0.46	15°	4	26.8	35	1.61	1.66	1.71	1.77	1.89
08-00537-00254		2	0.35	0.5	0.46	15°	4	26.3	35	2.13	2.20	2.27	2.34	2.51
08-00537-00255		2.5	0.35	0.5	0.46	15°	4	25.8	35	2.65	2.73	2.82	2.92	3.14
08-00537-00256		3	0.35	0.5	0.46	15°	4	25.3	35	3.16	3.27	3.38	3.49	3.76
08-00537-00300	R0.4	1	0.45	0.6	0.56	15°	4	27.5	35	1.10	1.12	1.15	1.19	1.26
08-00537-00301		1.5	0.45	0.6	0.56	15°	4	27.0	35	1.61	1.66	1.71	1.76	1.88
08-00537-00302		2	0.45	0.6	0.56	15°	4	26.5	35	2.13	2.19	2.26	2.34	2.50
08-00537-00303		2.5	0.45	0.6	0.56	15°	4	26.0	35	2.65	2.73	2.82	2.91	3.12
08-00537-00304		3	0.45	0.6	0.56	15°	4	25.5	35	3.16	3.26	3.37	3.49	3.75
08-00537-00305		3.5	0.45	0.6	0.56	15°	4	25.0	35	3.68	3.80	3.92	4.06	4.37
08-00537-00306	R0.5	4	0.45	0.6	0.56	15°	4	29.5	40	4.20	4.33	4.48	4.64	4.99
08-00537-00402		2	0.6	0.8	0.76	15°	4	26.9	35	2.13	2.19	2.25	2.32	2.48
08-00537-00403		3	0.6	0.8	0.76	15°	4	25.9	35	3.16	3.26	3.36	3.47	3.72
08-00537-00405	R0.5	4	0.6	0.8	0.76	15°	4	24.9	35	4.19	4.33	4.47	4.62	4.97
08-00537-00406		5	0.6	0.8	0.76	15°	4	28.9	40	5.23	5.40	5.58	5.77	6.21
08-00537-00501		2	0.75	1	0.95	15°	4	27.3	35	2.14	2.20	2.26	2.33	2.48
08-00537-00502		2.5	0.75	1	0.95	15°	4	26.8	35	2.66	2.73	2.82	2.90	3.10
08-00537-00503		3	0.75	1	0.95	15°	4	26.3	35	3.18	3.27	3.37	3.48	3.72
08-00537-00504		4	0.75	1	0.95	15°	4	25.3	35	4.21	4.34	4.48	4.63	4.97
08-00537-00505	R0.5	5	0.75	1	0.95	15°	4	29.3	40	5.24	5.41	5.59	5.78	6.21
08-00537-00506		6	0.75	1	0.95	15°	4	28.3	40	6.28	6.48	6.69	6.93	7.45

Attenzione

Quando ordinate, indicate MRBSH230SF (R) x (l1)
When you order, indicate MRBSH230SF (R) x (l1).

*(gamma) è un valore di riferimento
*(gamma) is reference value.

Unità di misura: mm Unit [Size : mm]

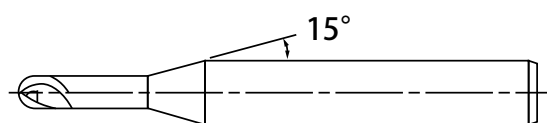
Codice Code No.	(R) Raggio Radius	(Ø 1) Lungh. scarico Under Neck Length	(Ø) Lungh. tagli. Length of Cut	(D) Diametro Dia.	(d2) Dia. scarico Neck Dia.	(γ) Angolo Neck Taper Angle	(d) Dia. gambo Shank Dia.	(Ø 2) Lungh. gambo Shank Length	(L) Lungh. totale Overall Length	La lungh. utile effettiva dipende dall'angolo d'inclinazione del pezzo Actual effective length depending on inclined angle of workpiece.				
										30°	1°	1° 30'	2°	3°
08-00537-00602	R0.6	2.4	0.9	1.2	1.15	15°	4	27.2	35	2.55	2.62	2.69	2.77	2.95
08-00537-00603		4	0.9	1.2	1.15	15°	4	25.6	35	4.21	4.33	4.47	4.61	4.94
08-00537-00605		6	0.9	1.2	1.15	15°	4	28.6	40	6.27	6.47	6.68	6.91	7.43
08-00537-00606		8	0.9	1.2	1.15	15°	4	26.6	40	8.34	8.61	8.90	9.21	9.91
08-00537-00752	R0.75	3	1.1	1.5	1.45	15°	4	27.2	35	3.17	3.25	3.34	3.44	3.66
08-00537-00753		4	1.1	1.5	1.45	15°	4	26.2	35	4.20	4.32	4.45	4.59	4.91
08-00537-00754		6	1.1	1.5	1.45	15°	4	29.2	40	6.27	6.46	6.67	6.89	7.39
08-00537-00755		8	1.1	1.5	1.45	15°	4	27.2	40	8.34	8.60	8.88	9.19	9.88
08-00537-00756	R0.8	10	1.1	1.5	1.45	15°	4	25.2	40	10.40	10.74	11.10	11.49	12.36
08-00537-00805		8	1.2	1.6	1.55	15°	4	27.4	40	8.33	8.60	8.88	9.18	9.87
08-00537-01000		3	1.5	2	1.94	15°	4	28.1	35	3.18	3.25	3.34	3.43	3.63
08-00537-01001		4	1.5	2	1.94	15°	4	27.1	35	4.21	4.32	4.45	4.58	4.87
08-00537-01002	R1	6	1.5	2	1.94	15°	4	25.1	35	6.28	6.46	6.66	6.88	7.36
08-00537-01003		8	1.5	2	1.94	15°	4	28.1	40	8.35	8.60	8.88	9.18	9.84
08-00537-01004		10	1.5	2	1.94	15°	4	26.1	40	10.41	10.74	11.10	11.48	12.33
08-00537-01005		12	1.5	2	1.94	15°	4	29.1	45	12.48	12.88	13.31	13.77	14.82
08-00537-01252	R1.25	6	2.3	2.5	2.4	15°	4	26.0	35	6.35	6.53	6.72	6.92	7.39
08-00537-01253		8	2.3	2.5	2.4	15°	4	29.0	40	8.42	8.67	8.93	9.22	9.88
08-00537-01254		10	2.3	2.5	2.4	15°	4	27.0	40	10.48	10.81	11.15	11.52	12.36
08-00537-01256		15	2.3	2.5	2.4	15°	4	27.0	45	15.65	16.15	16.69	17.27	Free
08-00537-01500	R1.5	6	2.5	3	2.85	15°	6	33.1	45	6.44	6.61	6.79	7.00	7.45
08-00537-01501		8	2.5	3	2.85	15°	6	31.1	45	8.5	8.75	9.01	9.29	9.93
08-00537-01502		10	2.5	3	2.85	15°	6	29.1	45	10.57	10.89	11.23	11.59	12.42
08-00537-01503		12	2.5	3	2.85	15°	6	27.1	45	12.64	13.03	13.44	13.89	14.91
08-00537-01504		14	2.5	3	2.85	15°	6	30.1	50	14.71	15.17	15.66	16.19	17.39
08-00537-01505		16	2.5	3	2.85	15°	6	28.1	50	16.77	17.31	17.88	18.49	19.88
08-00537-01506		20	2.5	3	2.85	15°	6	29.1	55	20.91	21.58	22.31	23.09	24.85
08-00537-02000		R2	8	3	4	3.8	15°	6	32.8	45	8.58	8.81	9.06	9.33
08-00537-02001	10		3	4	3.8	15°	6	30.8	45	10.65	10.95	11.28	11.63	12.42
08-00537-02002	12		3	4	3.8	15°	6	28.8	45	12.72	13.09	13.49	13.93	14.90
08-00537-02004	15		3	4	3.8	15°	6	30.8	50	15.82	16.30	16.82	17.38	18.63
08-00537-02005	20		3	4	3.8	15°	6	30.8	55	20.99	21.65	22.36	23.13	Free
08-00537-02006	25		3	4	3.8	15°	6	30.8	60	26.16	27.00	27.90	28.88	Free
08-00537-02502	R2.5	10	3.5	5	4.8	15°	6	32.7	45	10.63	10.92	11.22	11.55	Free
08-00537-02503		15	3.5	5	4.8	15°	6	27.7	45	15.8	16.27	16.77	Free	Free
08-00537-02504		20	3.5	5	4.8	15°	6	27.7	50	20.97	21.62	Free	Free	Free
08-00537-03000	R3	10	6	6	5.7	—	6	34.4	45	Free	Free	Free	Free	Free
08-00537-03001		15	6	6	5.7	—	6	29.4	45	Free	Free	Free	Free	Free
08-00537-03002		20	6	6	5.7	—	6	29.4	50	Free	Free	Free	Free	Free
08-00537-03003		25	6	6	5.7	—	6	29.4	55	Free	Free	Free	Free	Free
08-00537-03004		30	6	6	5.7	—	6	29.4	60	Free	Free	Free	Free	Free

Attenzione

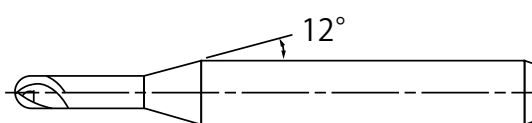
Quando ordinate, indicate MRBSH230SF (R) × (Ø 1)
When you order, indicate MRBSH230SF (R) × (Ø 1).

*(γ) è un valore di riferimento
*(γ) is reference value.

- L'angolo di sforno (γ) della fresa MRBSH230SF è di 15°. Gli altri nostri prodotti hanno un angolo (γ) di 12°.
- Neck taper angle (γ) of MRBSH230SF is 15°. Our other products have a neck taper angle (γ) of 12°.



MRBSH230SF



Gli altri nostri prodotti hanno un angolo di sforno (γ) di 12°
Our other products have a neck taper angle (γ) of 12°

MRBSH230SF

Parametri di taglio raccomandati Recommended Milling Conditions

Materiale Work Material			Acciaio HSS / Acciaio temprato High Speed Steels / Hardened Steels SKH51·SKD11 (~62HRC)				Acciaio HSS High Speed Steels SKH55·HAP40 (~66HRC)				Acciaio HSS High Speed Steels SKH57·HAP72 (~70HRC)			
Raggio Radius	Lungh. scarico Under Neck Length	Rapporto diametro lunghezza L/D	Profondità di taglio Depth of Cut		Avanz. Feed mm/min	Giri Spindle Speed min ⁻¹	Profondità di taglio Depth of Cut		Avanz. Feed mm/min	Giri Spindle Speed min ⁻¹	Profondità di taglio Depth of Cut		Avanz. Feed mm/min	Giri Spindle Speed min ⁻¹
			ap mm	ae mm			ap mm	ae mm			ap mm	ae mm		
R0.05	0.2	2	0.002	0.005	100	40,000	0.002	0.003	70	40,000	0.002	0.003	50	40,000
	0.3	3	0.002	0.005	70	40,000	0.002	0.003	50	40,000	0.002	0.003	40	40,000
	0.5	5	0.001	0.003	50	40,000	0.001	0.002	30	40,000	0.001	0.002	20	40,000
R0.075	0.3	2	0.002	0.005	150	40,000	0.002	0.003	100	40,000	0.002	0.003	80	40,000
	0.5	3.3	0.002	0.005	120	40,000	0.002	0.003	70	40,000	0.002	0.003	50	40,000
R0.1	0.3	1.5	0.005	0.005	300	40,000	0.003	0.003	200	40,000	0.003	0.003	150	40,000
	0.5	2.5	0.005	0.005	280	40,000	0.003	0.003	180	40,000	0.003	0.003	130	40,000
	0.75	3.75	0.003	0.005	200	40,000	0.002	0.003	150	40,000	0.002	0.003	110	40,000
	1	5	0.002	0.003	160	40,000	0.001	0.002	120	40,000	0.001	0.002	90	40,000
R0.15	0.5	1.7	0.007	0.01	300	40,000	0.003	0.005	280	40,000	0.003	0.005	210	40,000
	0.6	2	0.005	0.007	300	40,000	0.003	0.005	250	40,000	0.003	0.005	180	40,000
	0.75	2.5	0.005	0.007	280	40,000	0.003	0.005	230	40,000	0.003	0.005	170	40,000
	1	3.3	0.005	0.007	250	40,000	0.003	0.005	200	40,000	0.003	0.005	150	40,000
R0.2	1.5	5	0.003	0.005	180	40,000	0.002	0.003	120	40,000	0.002	0.003	90	40,000
	0.5	1.25	0.03	0.03	720	40,000	0.009	0.02	580	40,000	0.009	0.02	420	35,000
	0.8	2	0.02	0.03	720	40,000	0.008	0.02	580	40,000	0.008	0.02	420	35,000
	1	2.5	0.02	0.03	720	40,000	0.008	0.02	580	40,000	0.008	0.02	400	35,000
	1.5	3.75	0.01	0.02	500	40,000	0.005	0.01	400	40,000	0.005	0.01	280	35,000
	2	5	0.007	0.01	380	40,000	0.005	0.007	300	40,000	0.005	0.007	220	35,000
	2.5	6.25	0.005	0.007	300	40,000	0.003	0.005	260	40,000	0.003	0.005	190	35,000
R0.25	1	2	0.02	0.03	860	40,000	0.01	0.02	650	35,000	0.01	0.02	450	30,000
	1.5	3	0.01	0.03	720	40,000	0.007	0.02	520	35,000	0.007	0.02	350	30,000
	2	4	0.01	0.02	650	40,000	0.007	0.01	400	35,000	0.007	0.01	270	30,000
	2.5	5	0.007	0.01	530	40,000	0.005	0.007	360	35,000	0.005	0.007	240	30,000
	3	6	0.007	0.01	420	35,000	0.005	0.007	320	35,000	0.005	0.007	220	30,000
R0.3	1	1.7	0.03	0.06	1,000	40,000	0.02	0.05	720	30,000	0.02	0.05	540	25,000
	1.5	2.5	0.03	0.06	1,000	40,000	0.02	0.05	720	30,000	0.02	0.05	540	25,000
	2	3.3	0.03	0.06	1,000	40,000	0.02	0.05	720	30,000	0.02	0.05	540	25,000
	2.5	4.1	0.02	0.04	840	40,000	0.02	0.03	640	30,000	0.02	0.03	480	25,000
	3	5	0.02	0.04	840	40,000	0.02	0.03	600	30,000	0.02	0.03	450	25,000
	3.5	5.9	0.01	0.03	600	30,000	0.01	0.02	420	30,000	0.01	0.02	310	25,000
R0.4	4	6.7	0.01	0.03	600	30,000	0.01	0.02	420	30,000	0.01	0.02	310	25,000
	2	2.5	0.07	0.1	1,600	35,000	0.05	0.1	1,200	30,000	0.03	0.1	900	25,000
	3	3.75	0.05	0.1	1,600	35,000	0.05	0.05	1,200	30,000	0.03	0.05	900	25,000
	4	5	0.04	0.06	1,200	30,000	0.03	0.05	860	25,000	0.02	0.05	640	20,000
R0.5	5	6.25	0.03	0.05	1,000	25,000	0.02	0.03	620	25,000	0.015	0.03	460	20,000
	2	2	0.1	0.2	2,000	30,000	0.08	0.1	1,400	25,000	0.05	0.1	1,000	20,000
	2.5	2.5	0.1	0.2	2,000	30,000	0.08	0.1	1,400	25,000	0.05	0.1	1,000	20,000
	3	3	0.1	0.2	2,000	30,000	0.08	0.1	1,400	25,000	0.05	0.1	1,000	20,000
	4	4	0.05	0.15	1,600	28,000	0.05	0.1	1,200	25,000	0.03	0.1	900	20,000
	5	5	0.04	0.1	1,400	25,000	0.03	0.05	920	20,000	0.02	0.05	700	16,000
	6	6	0.04	0.05	1,200	22,000	0.02	0.05	740	20,000	0.015	0.05	550	16,000

MRBSH230SF

Parametri di taglio raccomandati Recommended Milling Conditions

Materiale Work Material			Acciaio HSS / Acciaio temprato High Speed Steels / Hardened Steels SKH51·SKD11 (~62HRC)				Acciaio HSS High Speed Steels SKH55·HAP40 (~66HRC)				Acciaio HSS High Speed Steels SKH57·HAP72 (~70HRC)			
Raggio Radius	Lungh. scarico Under Neck Length	Rapporto diametro lunghezza L/D	Profondità di taglio Depth of Cut		Avanz Feed	Giri Spindle Speed	Profondità di taglio Depth of Cut		Avanz Feed	Giri Spindle Speed	Profondità di taglio Depth of Cut		Avanz Feed	Giri Spindle Speed
			ap mm	ae mm	mm/min	min ⁻¹	ap mm	ae mm	mm/min	min ⁻¹	ap mm	ae mm	mm/min	min ⁻¹
R0.6	2.4	2	0.1	0.2	2,000	30,000	0.08	0.1	1,600	25,000	0.05	0.1	1,200	20,000
	4	3.3	0.1	0.2	2,000	30,000	0.06	0.1	1,600	25,000	0.05	0.1	1,200	20,000
	6	5	0.05	0.1	1,400	25,000	0.03	0.07	1,000	20,000	0.02	0.07	750	16,000
	8	6.7	0.03	0.07	1,200	22,000	0.02	0.05	850	20,000	0.015	0.05	650	16,000
R0.75	3	2	0.1	0.3	2,500	30,000	0.1	0.2	2,000	25,000	0.06	0.2	1,500	20,000
	4	2.7	0.1	0.3	2,000	25,000	0.1	0.2	1,600	22,000	0.06	0.2	1,200	18,000
	6	4	0.1	0.2	1,600	22,000	0.1	0.1	1,200	20,000	0.06	0.1	950	16,000
	8	5.3	0.05	0.2	1,400	20,000	0.05	0.1	1,000	18,000	0.03	0.1	700	13,000
	10	6.7	0.05	0.1	1,200	18,000	0.05	0.05	850	16,000	0.03	0.05	650	13,000
R0.8	8	5	0.07	0.2	1,400	20,000	0.05	0.1	1,000	16,000	0.03	0.1	750	13,000
R1	3	1.5	0.2	0.5	2,500	25,000	0.15	0.3	2,000	20,000	0.1	0.3	1,500	16,000
	4	2	0.2	0.5	2,500	25,000	0.15	0.3	2,000	20,000	0.1	0.3	1,500	16,000
	6	3	0.2	0.3	2,000	22,000	0.15	0.3	1,600	20,000	0.1	0.3	1,200	16,000
	8	4	0.1	0.2	1,600	18,000	0.1	0.15	1,200	16,000	0.06	0.15	950	13,000
	10	5	0.1	0.2	1,400	16,000	0.1	0.1	1,000	14,000	0.06	0.1	750	11,000
	12	6	0.07	0.1	1,200	14,000	0.05	0.1	850	12,000	0.03	0.1	650	9,500
R1.25	6	2.4	0.2	0.5	2,500	20,000	0.15	0.4	2,000	18,000	0.1	0.4	1,500	14,000
	8	3.2	0.2	0.3	2,100	20,000	0.15	0.3	1,800	18,000	0.1	0.3	1,300	14,000
	10	4	0.15	0.2	1,800	18,000	0.1	0.15	1,500	16,000	0.06	0.15	1,100	13,000
	15	6	0.07	0.15	1,200	14,000	0.05	0.1	900	12,000	0.03	0.1	700	9,500
R1.5	6	2	0.2	0.6	2,500	18,000	0.2	0.5	2,000	15,000	0.12	0.5	1,500	12,000
	8	2.7	0.2	0.6	2,500	18,000	0.2	0.5	2,000	15,000	0.12	0.5	1,500	12,000
	10	3.3	0.2	0.4	2,100	18,000	0.15	0.3	1,800	15,000	0.1	0.3	1,300	12,000
	12	4	0.2	0.4	2,000	18,000	0.1	0.3	1,500	15,000	0.06	0.3	1,100	12,000
	14	4.7	0.1	0.3	1,600	16,000	0.1	0.2	1,200	12,000	0.06	0.2	900	10,000
	16	5.3	0.1	0.3	1,600	16,000	0.1	0.2	1,200	12,000	0.06	0.2	900	10,000
	20	6.7	0.08	0.2	1,200	14,000	0.08	0.1	850	12,000	0.06	0.1	650	9,500
R2	8	2	0.2	0.8	2,500	15,000	0.2	0.6	2,000	12,000	0.15	0.6	1,500	9,500
	10	2.5	0.2	0.8	2,500	15,000	0.2	0.6	2,000	12,000	0.15	0.6	1,500	9,500
	12	3	0.2	0.8	2,500	15,000	0.2	0.6	2,000	12,000	0.15	0.6	1,500	9,500
	15	3.75	0.2	0.8	2,000	15,000	0.15	0.6	1,600	12,000	0.12	0.6	1,200	9,500
	20	5	0.1	0.6	1,700	14,000	0.1	0.4	1,200	10,000	0.08	0.4	900	8,000
	25	6.25	0.1	0.4	1,200	14,000	0.1	0.2	850	10,000	0.08	0.2	650	8,000
R2.5	10	2	0.2	1.2	2,500	12,000	0.2	0.7	2,000	10,000	0.15	0.7	1,500	8,000
	15	3	0.2	1.2	2,500	12,000	0.2	0.7	2,000	10,000	0.15	0.7	1,500	8,000
	20	4	0.2	1	2,000	10,000	0.15	0.6	1,600	8,500	0.12	0.6	1,200	6,500
R3	10	1.7	0.3	1.2	2,500	8,000	0.2	1	2,000	7,000	0.15	1	1,500	5,500
	15	2.5	0.3	1.2	2,500	8,000	0.2	1	2,000	7,000	0.15	1	1,500	5,500
	20	3.3	0.3	1.2	2,500	8,000	0.2	1	2,000	7,000	0.15	1	1,500	5,500
	25	4.1	0.2	1	2,200	8,000	0.15	0.7	1,600	7,000	0.12	0.7	1,200	5,500
	30	5	0.2	1	1,800	7,000	0.15	0.7	1,300	6,500	0.12	0.7	950	5,000
Note Notes			※ 1 ap indica la profondità di taglio assiale, ae indica l'impegno radiale. ※ 2 In caso di vibrazioni, ecc., regolare le condizioni di taglio se necessario. ※ 3 Nelle zone in cui il carico di taglio è elevato (es. gli angoli) prestare attenzione alle condizioni di taglio e dei percorsi utensile. ※ 4 Aggiustare il numero di giri e l'avanzamento della stessa proporzione. ※ 5 Si consiglia l'utilizzo di mandrini a calettamento a caldo. Se si utilizza la pinza o altro, attenersi alla lunghezza di presa minima. ※ 6 Si raccomanda l'utilizzo del minimale. ※ 1 Depth of cut ap indicates Axial Depth of Cut, ae indicates Radial Depth of Cut. ※ 2 In case of chattering etc., please adjust cutting conditions if necessary. ※ 3 At point where cutting load is high such as at corners, pay attention to setting cutting conditions and tool paths particularly. ※ 4 Adjust both spindle speed and feed at the same rate. ※ 5 A shrink fit type is recommended for holding tool. When using collet type or others, strictly adhere to minimum gripping length. ※ 6 We recommend using oil mist coolant.											

Esempio di lavorazione 1

Machining case 1



Materiale: HAP72 (70HRC)

Material : HAP72 (70HRC)

Refrigerante: Minimale

Coolant : Oil mist

Tempo di lavorazione Tot: 11 ore 33 min

Total machining time : 11hr 33min

Dimensione pezzo : ϕ 40 (base 50 \times 45 mm)

Work size : dia 40 (Base 50 \times 45 mm)

Profondità di taglio : 6mm

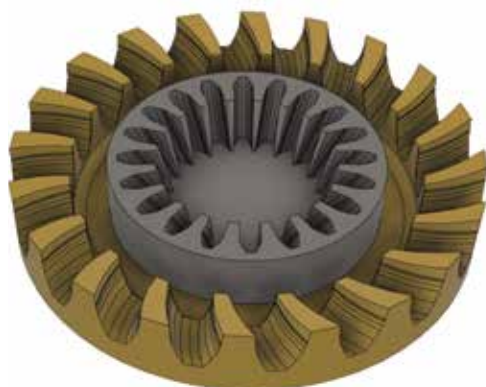
Cutting depth : 6mm

Ingranaggio esterno

Peripheral gear

Lavorazione ingranaggio esterno: 6 ore 57 min

Peripheral gear machining time : 6hr 57min



Zona fresata Milling part

Processo Process	Sgrossatura Roughing	Semifinitura Semi-finishing	Finitura Finishing
Utensile Tool	MRBSH230SF R1 \times 6	MRBSH230SF R1 \times 6	MRBSH230SF R1 \times 6
Giri [g/min] Spindle speed	12,000		
Avanzamento [mm/min] Feed	1,800		1,200
Profondità di taglio [mm] Depth of cut	ap 0.06 \times ae 0.3	Step laterale 0.1 Pick feed	Step laterale 0.03 Pick feed
Sovrametallo [mm] Stock	0.03	0.01	—
Tempo di lavorazione Machining times	2 ore 36 min 2 hr 36 min	51 min 51 min	3 ore 30 min 3 hr 30 min

Ingranaggio interno

Inside gear

Lavorazione ingranaggio interno: 4 ore 36 min

Inside gear machining time : 4hr 36min



Zona fresata Milling part

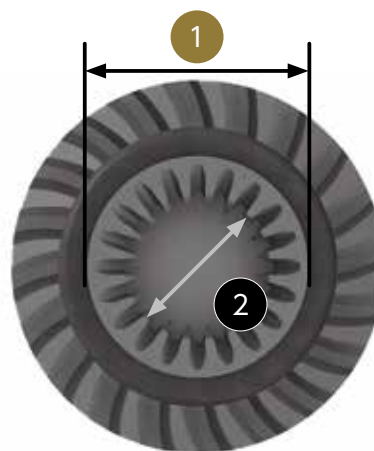
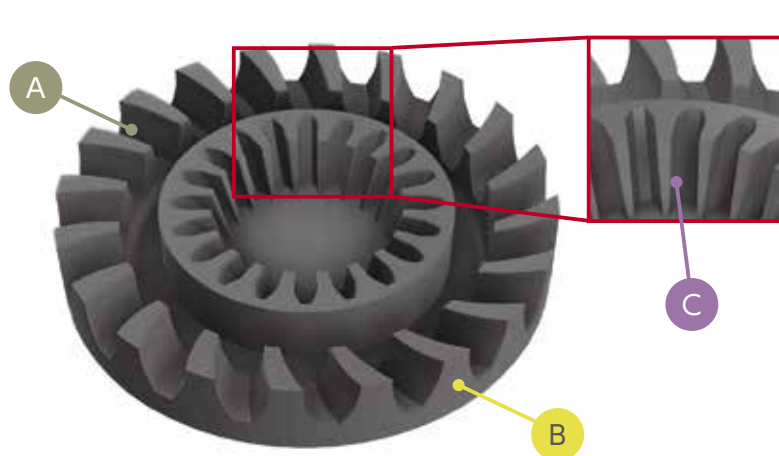
Processo Process	Sgrossatura Roughing	Semifinitura Semi-finishing	Finitura Finishing
Utensile Tool	MRBSH230SF R0.5 \times 6	MRBSH230SF R0.5 \times 6	MRBSH230SF R0.5 \times 6
Giri [g/min] Spindle speed	14,000		
Avanzamento [mm/min] Feed	1,000		700
Profondità di taglio [mm] Depth of cut	ap 0.03 \times ae 0.15	Step laterale 0.05 Pick feed	Step laterale 0.02 Pick feed
Sovrametallo [mm] Stock	0.03	0.01	—
Tempo di lavorazione Machining times	3 ore 6 min 3 hr 6 min	22 min 22 min	1 ore 8 min 1 hr 8 min

Usura utensile

Tool wear

Condizioni di taglio $n : 12,000 \text{ min}^{-1}$, Sgrossatura / semifinitura $V_a : 1,800 \text{ mm/min}$, finitura $V_a : 1,200 \text{ mm/min}$
 Cutting condition $n = 12,000 \text{ min}^{-1}$, Roughing / Semi-finishing $V_f = 1,800 \text{ mm/min}$, Finishing $V_f = 1,200 \text{ mm/min}$

Usura utensile dopo lavorazione su HAP72 (70HRC) Tool wear after cutting on HAP72 (70HRC)	MRBSH230SF R1 × 6		
	Sgrossatura Roughing 2 ore 36 min 2hr36min	Semifinitura Semi-finishing 51 min 51min	Finitura Finishing 3 ore 30 min 3hr 30min
Spoglia frontale Rake face			
Tagliente periferico Peripheral cutting edge			
Tagliente al centro R R end cutting edge			



Rugosità

Roughness

Unità [μm] Unit [μm]

	A	B	C
Utensile Tool	MRBSH230SF R1 × 6		MRBSH230SF R0.5 × 6
Ra	0.133	0.137	0.282
Rz	0.815	1.336	1.676

Strumento di misura: Keyence VK-X250
 Measuring Instrument: Keyence VK-X250

Precisione

Accuracy

Unità [mm] Unit [mm]

	1	2
Utensile Tool	MRBSH230SF R1 × 6	MRBSH230SF R0.5 × 6
Target Target	24.500	15.480
Attuale Actual	24.505	15.472
Errore Error	0.005	0.008

Strumento di misura: microscopio Nikon MM-60
 Measuring instrument: Nikon microscope MM-60

Esempio di lavorazione 2

Machining Case 2

Esempio di lavorazione stampo per tranciatura fine

Fine blanking machining sample



Materiale : YXR3 (61HRC)

Material

Refrigerante : Minimale

Coolant Oil mist

Tempo di lavorazione Tot : 5 ore 41 min

Total machining time 5hr 41min

Dimensione pezzo: 60 × 60mm

Work size

Profondità di taglio : 4mm

Cutting depth

※Il tempo di lavorazione totale include il processo di elettroerosione (zona bianca) e la lavorazione della matrice e del premi lamiera

※Total machining time includes WEDM process (white part) both blank holder part and die part

Zona fresata
Milling part



Premi lamiera

Blank holder

Tempo lavorazione: 3 ore 16 min

Machining time : 3hr 16min



Matrice

Die

Tempo lavorazione: 1 ore 46 min

Machining time : 1hr 46min



Zona fresata Milling part

Processo Process	Premi lamiera Blank holder				Matrice Die	
	Sgrossatura Roughing	Semifinitura Semi-Finishing	Ripresa Stock removal	Finitura Finishing	Ripresa Stock removal	Ripresa Stock removal
Utensile Tool	MRBSH230SF R1×4		MRBSH230SF R0.5×2	MRBSH230SF R0.25×1.5	MRBSH230SF R0.2×1	MRBSH230SF R0.2×1
Giri [g/min] Spindle speed	25,000		30,000			
Avanzamento [mm/min] Feed	2,500		1,000	540	540	540
Prof. di taglio [mm] Depth of cut	ap 0.2 ae 0.5	Step laterale 0.05 pick feed		Step lat. 0.03	Step lat. 0.02	Step lat. 0.01
Sovrametallo [mm] Stock	0.03	0.01		(solo spigoli 0.005) Only corner part		—
Tempo di lavorazione Machining times	39 min 39 min	40 min 40 min	1 ore 3 min 1 hr 3 min	47 min 47 min	1 ora 26 min 1 hr 26min	1 ore 11 min 1 hr 11 min

Rugosità

Roughness

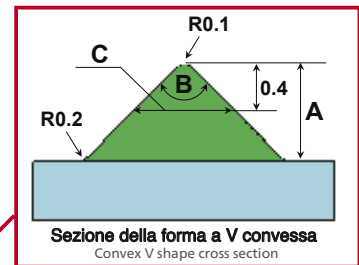
Unità [µm] Unit [µm]

	1	2
Utensile Tool	MRBSH230SF R0.5×2	MRBSH230SF R0.2×1
Ra	0.145	0.080
Rz	1.192	0.521

Strumento di misura: Keyence VK-X250
Measuring Instrument : Keyence VK-X250

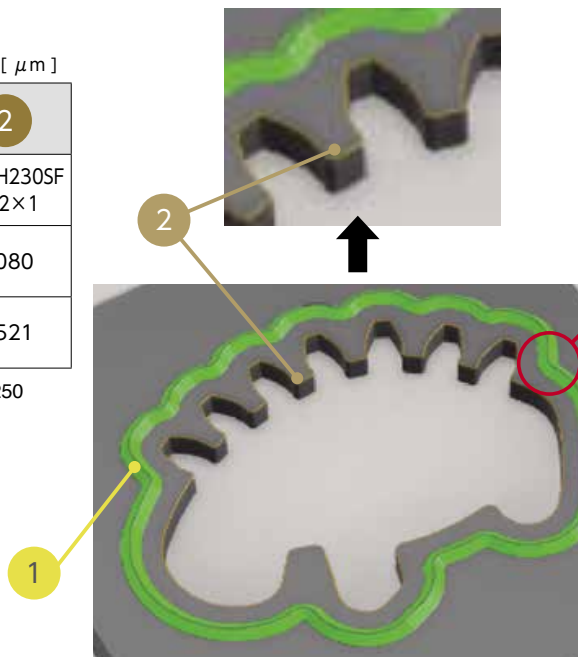
Precisione

Accuracy



	A	B	C
Target Target	0.958mm	90°0'00"	0.883mm
Attuale Actual	0.958mm	90°15'10"	0.888mm
Errore Error	0.000mm	0°15'10"	0.005mm

Strumento di misura: Keyence VK-X250
Measuring Instrument : Keyence VK-X250



Esempio di lavorazione 3

Machining Case 3



Materiale : HAP40 (65HRC)

Material

Refrigerante : Minimale

Coolant Oil mist

Tempo di lavorazione Tot: 8 ore 46 min

Total machining time 5hr 41min

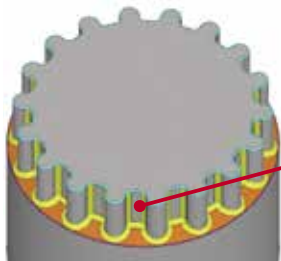
Dimensione pezzo: Φ 25 × 50mm Profondità di taglio : 6mm

Work size

Cutting depth

Processo Process	Sgrossatura Roughing	Ripresa Stock removal	Semifinitura Semi-finishing	Finitura Finishing
Utensile Tool	MRBSH230SF R1 × 6	MRBSH230SF R0.5 × 5	MRBSH230SF R0.5 × 5	MRBSH230SF R0.5 × 5
Giri [g/min] Spindle speed	20,000			12,000
Avanzamento [mm/min] Feed	1,600	920	920	460
Prof. di taglio [mm] ap × ae Depth of cut	0.15 × 0.3	0.03 × 0.1	Fianco Side face 0.03 × 0.02 Superficie Surface 0.02 × 0.05	Step laterale 0.015
Sovrametallo [mm] Stock	0.03		0.01	—
Tempo di lavorazione Machining time	24 min 24 min	3 ore 8 min 3 hr 8 min	1 ore 8 min 1 hr 8 min	4 ore 6 min 4 hr 6 min

Rugosità Roughness



Unità [μm] Unit [μm]

	Fianco Side face
Ra	0.031
Rz	0.225

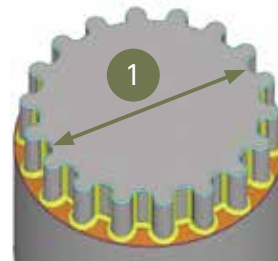
Riduzione del fianco 0,003 mm
(dopo 2 ore di contornatura)
R edge retreat amount 0,003mm
after side finishing for 2 hours



0.003mm

Strumento di misura: Keyence VK-X250
Measuring Instrument: Keyence VK-X250

Precisione Accuracy



Unità [μm] Unit [mm]

	1
Target Target	20.644
Attuale Actual	20.647
Errore Error	0.003

Strumento di misura: microscopio Nikon MM-60
Measuring instrument: Nikon microscope MM-60

Usura del fianco Tool wear

Processo Process	Sgrossatura Roughing	Ripresa Stock removal	Semifinitura Semi-finishing	Finitura Finishing
Utensile Tool	MRBSH230SF R1 × 6	MRBSH230SF R0.5 × 5	MRBSH230SF R0.5 × 5	MRBSH230SF R0.5 × 5
Spoglia frontale Rake side				
Tagliente periferico Peripheral cutting edge				
Tagliente al centro R R end cutting edge				