2009 Product Catalog

MILLSTAR®

A Cole TOOLING SYSTEMS CO.

MILLSTAR® Index

Indexable Milling Holder Identification System

CB	SFCY	0500	-	6.0	-	0500
Denotes Shank Material "CB" = Carbide " "= Steel	Shank Type SFCY = Cylindrical CY = Cylindrical Spike SFTA = Taper TA = Taper Spike	Diameter Size		Tool Cutter Length		Tool Cutter Diameter

The Inserts

- Millstar inserts are fully ground precision inserts for better chip control, faster metal removal and higher surface accuracies. They are far more accurate than pressed and O.D. sharpened inserts. Millstar insert radius and seat are accurate to +/- 0.00025" (+/- 0.0065 mm) of nominal radius and cut exactly as programmed. This unparalleled accuracy also eliminates redundant Z-axis pick ups and assures accurate blending.
- Positive ground chipbreaker or strong negative cutting edge designs guarantee outstanding cutting performance in a wide variety of ferrous and non-ferrous materials.
- A choice of state-of-the-art insert grades, designs and tool coatings allow for optimum speed and feed rates in wet and dry machining. Reduced machining times by 25% to 60% are not uncommon.
- Economical one-piece inserts with two cutting edges are cost-effective for contour milling. True radius geometry is fully CNC-ground for higher machining accuracy and greatly reduced manual finishing and polishing time.
- Choose from side-cutting ball nose inserts with 180 degree nose radius, and popular ball nose inserts with a cutting edge covering 230 degrees for steep wall up-and-down ramping, profiling, contour milling and blending, and for a wider range of applications compared to conventional ball nose tools.
- Select from a variety of flat bottom, back draft and toroid inserts for steep or straight wall milling with long extensions on hard to reach cores, cavities or fillets. Milling with small radii prevents deflection and results in superior finishes and contour accuracies. Available with or without chipbreaker and coating in a variety of corner radii and sizes.

Rock Solid Insert Clamping

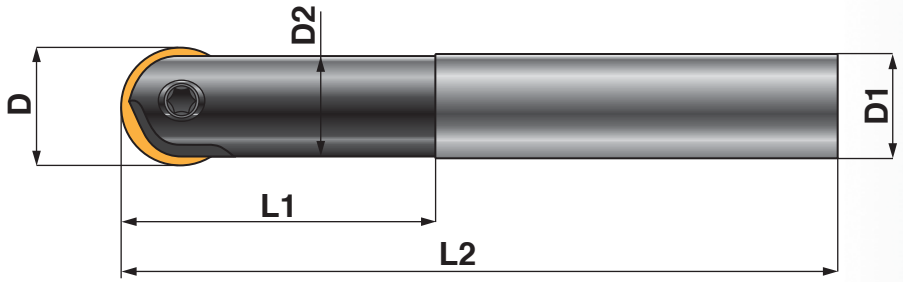
Cutting insert clamping is highly accurate and rigid. Unique V-pocket design gives a truly positive seat for the insert and will not allow insert movement when milling with a side thrust. "Sandwiched" insert clamping with single locking screw is unsurpassed for rigidity. The advanced design of Millstar inserts eliminates heat-seizing of locking screws or insert movement due to costly locating screws or pins of less advanced design. Positive V-pocket seating eliminates mismatch when changing to fresh inserts. It also eliminates the need to program new length or diameter offsets.

The Tool Holders

Millstar is proud to offer the largest selection of roughing and finishing ball nose, back draft, flat bottom and toroid milling cutters available from one source. Cylindrical and tapered toolholders include the longest reach profiling tools available as standard catalog items. Tool holders are inherently balanced for high spindle speeds. Machine with confidence at the increased speeds and velocities dictated by modern high velocity machining. Super intelligent machine controls with high speed data transfer, rapid advances in cutting edge materials and coating technologies enable ever faster machining speeds and increased productivity. Millstar tools are designed to keep pace.

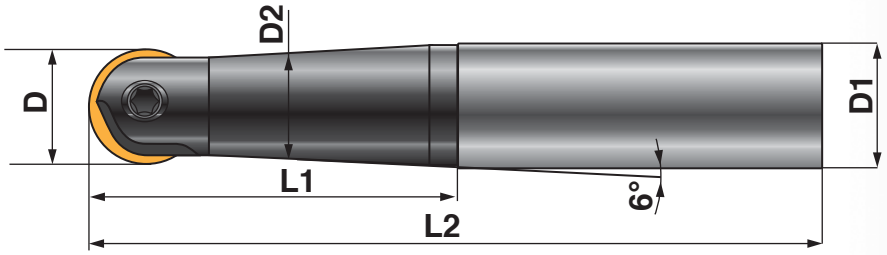
The Millstar product line is manufactured in the USA under ISO 9001 specifications, and all tools are fully traceable. Nearly six decades of cutting tool design and manufacturing for automotive, aerospace and many other industries, as well as special design capabilities using 3-D CAD allow us to respond quickly to requests for special designs.

SFCY - Cylindrical Steel Shank Holder, Ball



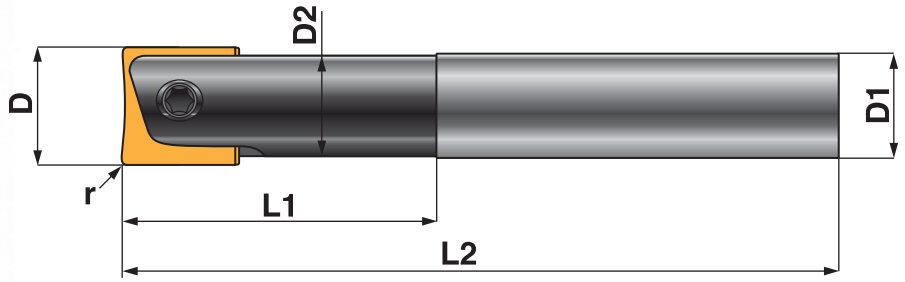
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
SFCY 0500-4.0-0500	0.500	0.500	0.440	1.250	4.000	MS 12	T20		MB, MBT, RB-N, BS-N
SFCY 0500-5.0-0500	0.500	0.500	0.440	1.500	5.000	MS 12	T20		
SFCY 0500-6.0-0500	0.500	0.500	0.440	1.750	6.000	MS 12	T20		
SFCY 0500-6.0-12**	0.500	12mm	0.440	1.750	6.000	MS 12	T20		
SFCY 0625-5.0-0625	0.625	0.625	0.550	1.375	5.000	MS 16	T20		
SFCY 0625-6.25-0625	0.625	0.625	0.550	2.000	6.250	MS 16	T20		
SFCY 0750-4.5-0750	0.750	0.750	0.675	1.750	4 .500	MS 20	T20		
SFCY 0750-6.0-0750	0.750	0.750	0.675	2.000	6.000	MS 20	T20		
SFCY 0750-7.5-0750	0.750	0.750	0.675	2.375	7.500	MS 20	T20		
SFCY 0750-9.0-0750	0.750	0.750	0.675	2.375	9.000	MS 20	T20		
SFCY 1000-6.0-1000	1.000	1.000	0.882	1.750	6.000	MS 25	T20		
SFCY 1000-6.0-25**	1.000	25mm	0.882	1.750	6.000	MS 25	T20		
SFCY 1000-8.0-1000	1.000	1.000	0.882	2.500	8.000	MS 25	T20		
SFCY 1000-10.0-1000	1.000	1.000	0.882	2.750	10.000	MS 25	T20		
SFCY 1000-10.0-25**	1.000	25mm	0.882	2.750	10.000	MS 25	T20		
SFCY 1250-7.5-1250	1.250	1.250	1.125	2.250	7.500	MS 32	T30		
SFCY 1250-10.0-1250	1.250	1.250	1.125	3.000	10.000	MS 32	T30		

SFTA - Taper Steel Shank Holder, Ball



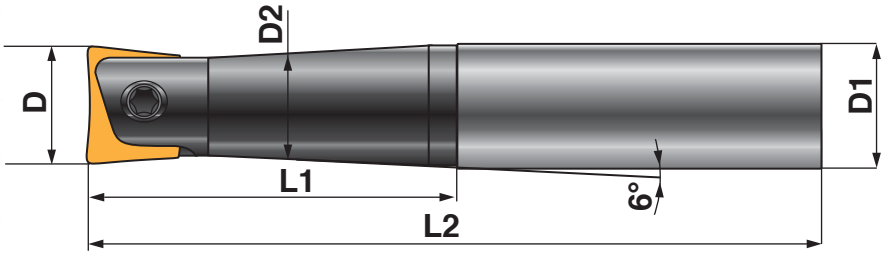
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
SFTA 0500-7.5-0625	0.500	0.625	0.440	2.000	7.500	MS 12	T20		MB, MBT, RB-N, BS-N
SFTA 0625-7.5-0750	0.625	0.750	0.550	2.250	7.500	MS 16	T20		
SFTA 0750-8.0-1000	0.750	1.000	0.675	3.500	8.000	MS 20	T20		
SFTA 0750-10.0-1000	0.750	1.000	0.675	3.500	10.000	MS 20	T20		
SFTA 1000-10.0-1250	1.000	1.250	0.882	4.000	10.000	MS 25	T20		
SFTA 1000-12.5-1250	1.000	1.250	0.882	4.000	12.500	MS 25	T20		
SFTA 1000-15.0-1250	1.000	1.250	0.882	4.000	15.000	MS 25	T20		
SFTA 1250-9.0-1500	1.250	1.500	1.125	4.000	9.000	MS 32	T30		
SFTA 1250-12.0-1500	1.250	1.500	1.125	4.000	12.000	MS 32	T30		

CYF - Cylindrical Steel Shank Holder, Flat



Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
CYF 0375-4.0-0375	0.375	0.375	0.337	0.750	4.000	MS 10	T15		BD-N, BD-R, BDS, FB-R, TO, TOBD-NF, HF
CYF 0500-4.0-0500	0.500	0.500	0.440	1.250	4.000	MS 12	T20		
CYF 0500-6.0-0500	0.500	0.500	0.440	1.750	6.000	MS 12	T20		
CYF 0500-6.0-12**	0.500	12mm	0.440	1.750	6.000	MS 12	T20		
CYF 0625-6.25-0625	0.625	0.625	0.550	2.000	6.250	MS 16	T20		
CYF 0750-6.0-0750	0.750	0.750	0.675	2.000	6.000	MS 20	T20		
CYF 0750-9.0-0750	0.750	0.750	0.675	2.375	9.000	MS 20	T20		
CYF-0750-9.0-18**	0.750	18mm	0.675	2.375	9.000	MS 20	T20		
CYF 1000-6.0-1000	1.000	1.000	0.882	1.750	6.000	MS 25	T20		
CYF 1000-6.0-25**	1.000	25mm	0.882	1.750	6.000	MS 25	T20		
CYF 1000-8.0-1000	1.000	1.000	0.882	2.500	8.000	MS 25	T20		
CYF 1000-10.0-1000	1.000	1.000	0.882	2.750	10.000	MS 25	T20		
CYF 1000-10.0-25**	1.000	25mm	0.882	2.750	10.000	MS 25	T20		
CYF 1250-7.5-1250	1.250	1.250	1.125	2.250	7.500	MS 32	T30		
CYF 1250-10.0-1250	1.250	1.250	1.125	3.000	10.000	MS 32	T30		

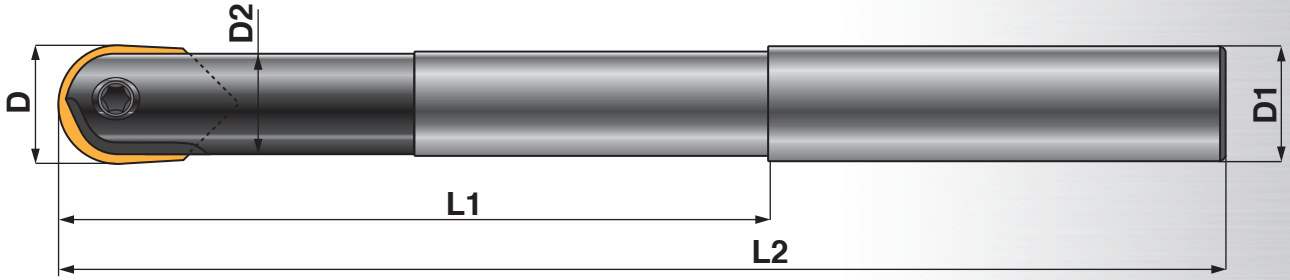
TAF - Taper Steel Shank Holder, Flat



Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
TAF 0375-6.0-0500	0.375	0.500	0.337	1.750	6.000	MS 10	T15		BD-N, BD-R, BDS, FB-R, TO, TOBD-NF, HF
TAF 0500-7.5-0625	0.500	0.625	0.440	2.000	7.500	MS 12	T20		
TAF 0625-7.5-0750	0.625	0.750	0.550	2.250	7.500	MS 16	T20		
TAF 0750-10.0-1000	0.750	1.000	0.675	3.500	10.000	MS 20	T20		
TAF 1000-10.0-1250	1.000	1.250	0.882	4.000	10.000	MS 25	T20		
TAF 1000-12.5-1250	1.000	1.250	0.882	4.000	12.500	MS 25	T20		
TAF 1000-15.0-1250	1.000	1.250	0.882	4.000	15.000	MS 25	T20		
TAF 1250-9.0-1500	1.250	1.500	1.125	4.000	9.000	MS 32	T30		
TAF 1250-12.0-1500	1.250	1.500	1.125	4.000	12.000	MS 32	T30		

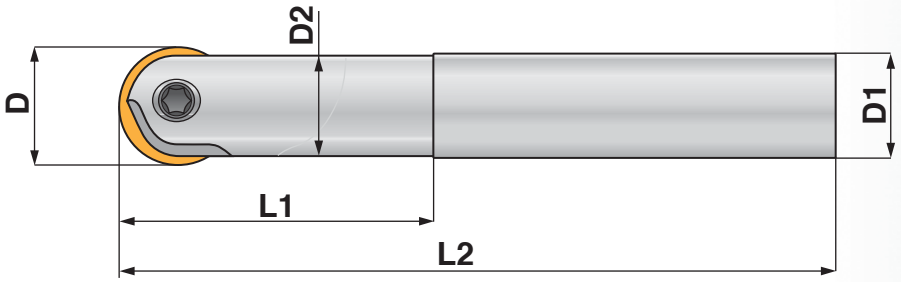
** Tools with smaller shank diameter than cutter diameter for full-length side clearance.

TAV, CY, TA - Spike-Line Cylindrical Steel Shank



Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
TAV 0250-3.75-0500	0.250	0.500	0.225	1.250	3.750	MS06N	T7		VRBS, VBD, MB, MBT, RB-N, BS-N, BD, BDS, FB, TO, HF
TAV 0312-3.75-0500	0.3125	0.500	0.281	1.250	3.750	MS08N	T7		
CY 0375-4.0-0375	0.375	0.375	0.337	0.750	4.000	MS10	T15		
CY 0375-4.0-0500	0.375	0.500	0.337	1.000	4.000	MS10	T15		
TA 0375-6.0-0500	0.375	0.500	0.337	1.750	6.000	MS10	T15		

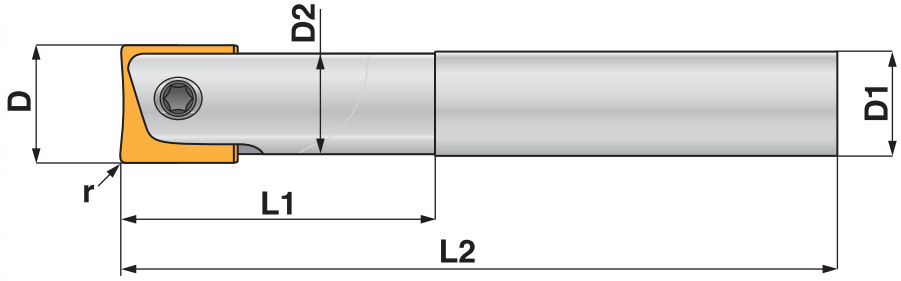
CB SFCY - Cylindrical Carbide Shank Holder, Ball



Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
CBCY-0375-4.0-0375	0.375	0.375	0.337	1.145	4.000	MS10	T15		MB, MBT, RB-N, BS-N
CBCY-0375-6.0-0375	0.375	0.375	0.337	1.145	6.000	MS10	T15		
CBSFCY 0500-6.0-0500	0.500	0.500	0.440	1.145	6.625	MS12	T20		
CBSFCY 0500-6.0-12**	0.500	12mm	0.440	1.145	6.625	MS12	T20		
CBSFCY 0625-6.0-0625	0.625	0.625	0.550	1.325	6.750	MS16	T20		
CBSFCY 0750-8.0-18**	0.750	18mm	0.675	1.500	8.875	MS20	T20		
CBSFCY 0750-8.0-0750	0.750	0.750	0.675	1.512	8.875	MS20	T20		
CBSFCY 1000-8.0-1000	1.000	1.000	0.882	1.866	9.125	MS25	T20		
CBSFCY 1000-8.0-25**	1.000	25mm	0.882	1.866	9.125	MS25	T20		

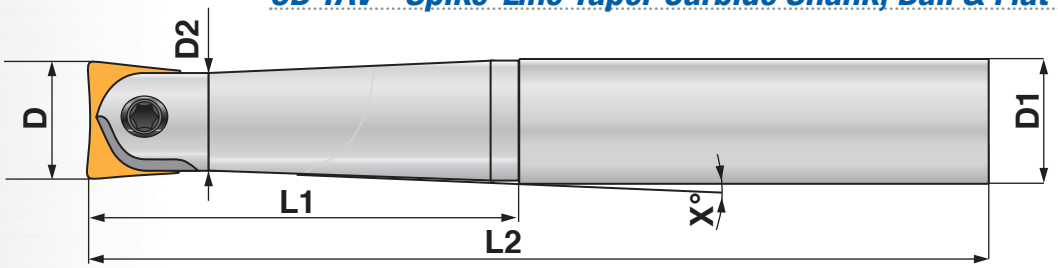
** Tools with smaller shank diameter than cutter diameter for full-length side clearance.

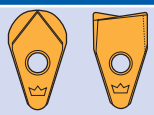
CB CYF - Cylindrical Carbide Shank Holder, Flat



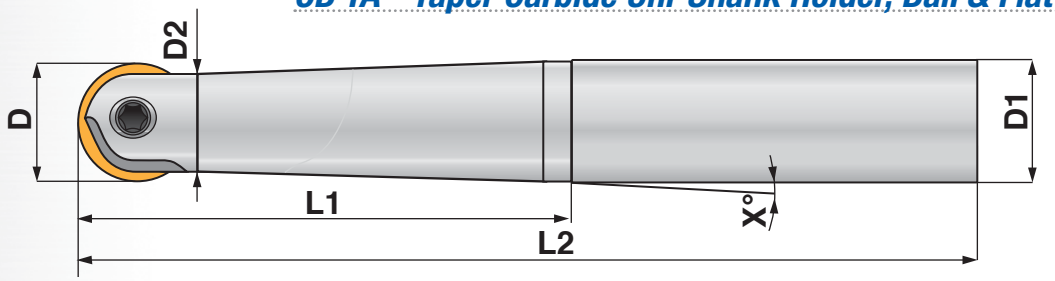
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
CBCYF 0500-6.0-0500	0.500	0.500	0.440	1.145	6.625	MS12	T20		BD-N, BD-R, BDS, FB-R, TO, TOBD-NF, HF
CBCYF 0500-6.0-12**	0.500	12mm	0.440	1.145	6.625	MS12	T20		
CBCYF 0625-6.0-0625	0.625	0.625	0.550	1.325	6.750	MS16	T20		
CBCYF 0750-8.0-18**	0.750	18mm	0.675	1.500	8.875	MS20	T20		
CBCYF 0750-8.0-0750	0.750	0.750	0.675	1.512	8.875	MS20	T20		
CBCYF 1000-8.0-1000	1.000	1.000	0.82	1.866	9.125	MS25	T20		
CBCYF 1000-8.0-25**	1.000	25mm	0.882	1.866	9.125	MS25	T20		

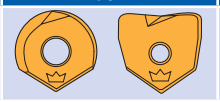
CB TAV - Spike-Line Taper Carbide Shank, Ball & Flat



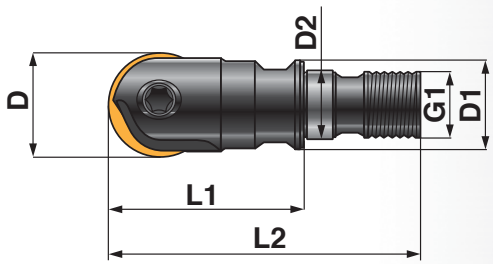
Tool Ordering Number	Dimensions					X°	Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2				Type	Code
CBTAV 0250-6.0-0500*	0.250	0.500	0.224	1.181 taper	6.125	6° (3°/side)	MS06N	T7		VRBS, VBD
CBTAV 0250-6.0-0500 LT*	0.250	0.500	0.224	2.750 taper	6.125	6° (3°/side)	MS06N	T7		
CBTAV 0312-6.0-0500*	0.312	0.500	0.285	1.181 taper	6.125	6° (3°/side)	MS08N	T7		

CB TA - Taper Carbide Uni-Shank Holder, Ball & Flat



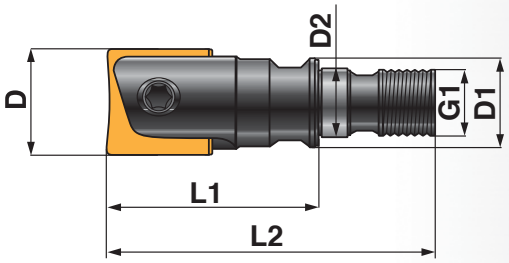
Tool Ordering Number	Dimensions					X°	Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck L1	Total L2				Type	Code
CBTA 0375-6.0-0500	0.375	0.500	0.337	1.181 taper	6.125	6° (3°/side)	MS10	T15		MB, MBT, RB-N, BS-N, BD, BDS, FB, TO, HF

SF CY - Screw-on Head, Ball



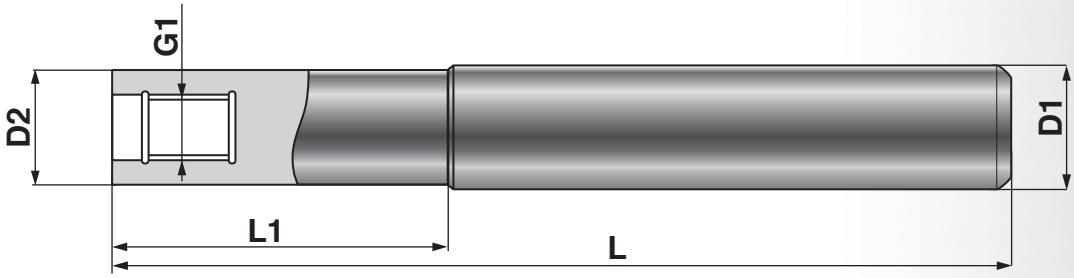
Tool Ordering Number	Size ØD	Diameter D1	Diameter D2	Thread G1	Length L1	Length L2	Fits Shank Ø	Use with Inserts	
								Type	Code
SFCY 0375-SC-M6	0.375	.340	.256	M6	0.95	1.50	0.500/10+12mm		MB, MBT, RB-N, BS-N
SFCY 0500-SC-M6	0.500	.444	.256	M6	1.00	1.70	0.500/12mm		
SFCY 0625-SC-M8	0.625	.566	.335	M8	1.25	1.95	0.625/16mm		
SFCY 0750-SC-M10	0.750	.678	.414	M10	1.40	2.22	0.750/20mm		
SFCY 1000-SC-M12	1.000	.886	.492	M12	1.71	2.58	1.000/25mm		

CYF - Screw-on Head, Flat



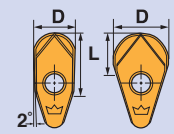
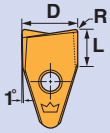
Tool Ordering Number	Size ØD	Diameter D1	Diameter D2	Thread G1	Length L1	Length L2	Fits Shank Ø	Use with Inserts	
								Type	Code
CYF 0375-SC-M6	10	.340	.256	M6	0.95	1.50	0.500/10+12mm		BD-N, BD-R, BDS, FB-R, TO, TOBD-NF, HF
CYF 0500-SC-M6	12	.444	.256	M6	1.00	1.70	0.500/12mm		
CYF 0625-SC-M8	16	.566	.335	M8	1.25	1.95	0.625/16mm		
CYF 0750-SC-M10	20	.678	.414	M10	1.40	2.22	0.750/20mm		
CYF 1000-SC-M12	25	.886	.492	M12	1.71	2.58	1.000/25mm		

Solid Carbide Adaptor

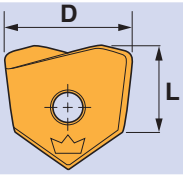


Tool Ordering Number	Dimensions				Thread G1	Screw	Key
	Size ØD1	Neck ØD2	Neck L1	Total L			
CY 0500-6.0-SC-M6	0.500	-	1.070	6.000	M6	MS12	T20
CY 0625-6.0-SC-M8	0.625	-	1.220	6.000	M8	MS16	T20
CY 0750-8.0-SC-M10	0.750	-	1.350	8.000	M10	MS20	T20
CY 1000-10.0-SC-M12	1.000	-	1.730	10.000	M12	MS25	T20

Small Ball Nose & Back Draft Inserts

VRBS	Tool Ordering Number	Dimensions			Grade			Description
		D	L	R	XRN	TLN	HSN	
	VRBS-0250	0.250	0.294		•	•	•	Used for rough to finish-milling small radius or detail work, and surface milling in soft and herd steel, cast iron, aerospace and non-ferrous alloys, graphite, etc. Suitable for high speed and hard milling.
	VRBS-0312	0.312	0.184		•	•	•	
VBD								
	VBD-0250	0.250	0.313	0.015	•	•	•	Used for rough to finish-milling small radius or detail work, and surface milling in soft and herd steel, cast iron, aerospace and non-ferrous alloys, graphite, etc. Suitable for high speed and hard milling
	VBD-0312	0.312	0.215	0.015	•	•	•	

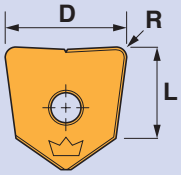
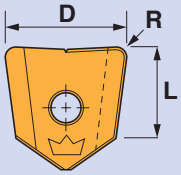
High Feed Inserts

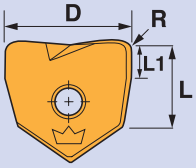
HF	Tool Ordering Number	Dimensions			Grade			Description
		D	L	PR	XRN	TLN	HSN	
	HF-0375...	0.375	0.0125	0.028	•	•	•	Millstar HF insert is designed for High feed and High speed machining. It runs at high cutting speed and feed rates with shallow depth of cut. It allows the chip to flow up and out of the cut quickly. It allows heavy chip loads.
	HF-0500...	0.500	0.0203	0.052	•	•	•	
	HF-0625...	0.625	0.0235	0.071	•	•	•	
	HF-0750...	0.750	0.0315	0.094	•	•	•	
	HF-1000...	1.000	0.0345	0.111	•	•	•	

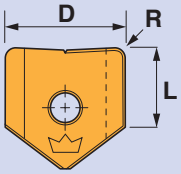
Cutting Recommendations for High Feed Inserts

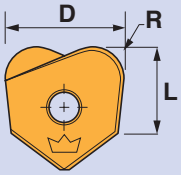
Work Material	Material Hardness	Cutting Depth at Diameter ap max					Cutting Width	Insert	Coating Type Recom.	Cut speed at D	Max feed per tooth fz at cutting insert diameter D				
USA/W.-Nr./ JIS	Hrc	0.375	0.500	0.625	0.750	1.000	Ae max			sfm/min	0.375	0.500	0.625	0.750	1.000
H13/1.2344/ SKD61	<41	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	800-1200	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
H13/1.2344/ SKD61	41-50	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	600-800	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
H13/1.2344/ SKD61	51+	0.012	0.016	0.019	0.025	0.031	75%	HF	HSN	300-600	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
A2/1,2363/ SKD12	<41	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	800-1200	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
A2/1,2363/ SKD12	41-50	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	600-800	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
A2/1,2363/ SKD12	51+	0.012	0.016	0.019	0.025	0.031	75%	HF	HSN	300-600	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
P20/1,2330	<41	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	800-1200	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
P20/1,2330	41-50	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	600-800	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
D2/1,2379/ SKD11	<41	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	600-800	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
D2/1,2379/ SKD11	41-50	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	300-500	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
D2/1,2379/ SKD11	51+	0.012	0.016	0.019	0.025	0.031	75%	HF	HSN	200-500	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
Grey Cast Iron/GG	<41	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	800-1500	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
Cast Iron/ GGG	41+	0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	600-1200	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04
Titanium (6AL 4V)		0.016	0.019	0.025	0.031	0.039	75%	HF	XRN/HSN	600-1200	0.01~0.02	0.12~0.22	0.016~0.028	0.02~0.035	0.02~.04

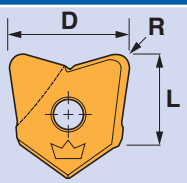
Flat Bottom, Back Draft, Toroid

BD-N	Tool Ordering Number	Dimensions D	L	R	Grade XRN	TLN	HSN	Description
	BD 0375 N	0.375	0.357	1/32,1/16	•	•	•	Precision ground with 7° back taper. Used for milling of cores, cavities, fillets with straight or very steep walls of harder materials.
	BD 0500 N	0.500	0.380	1/32,1/16,1/8	•	•	•	
	BD 0625 N	0.625	0.457	1/32,1/16,5/32	•	•	•	
	BD 0750 N	0.750	0.540	1/32,1/16,1/8	•	•	•	
	BD 1000 N	1.000	0.740	1/32,1/16,1/8	•	•	•	
	BD 1250 N	1.250	0.919	1/32,1/16,1/8	•	•	•	
BD-R	**Number**	**D**	**L**	**R**	**XRN**	**TLN**	**HSN**	**Description**
	BD 0375 R	0.375	0.340	1/32,1/16	•	•	•	Precision ground with positive ground chip-breaker and 7° back taper. Used for milling of cores, cavities, filets with straight or very steep walls of softer materials.
	BD 0625 R	0.625	0.457	1/32,1/16	•	•	•	
	BD 0750 R	0.750	0.540	1/32,1/16,1/8	•	•	•	
	BD 1000 R	1.000	0.740	1/32,1/16,1/8	•	•	•	
	BD 1250 R	1.250	0.919	1/32,1/16,1/8	•	•	•	

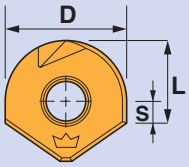
BDS	Number	D	L	R	L1	XRN	TLN	HSN	Description
	BDS 0375	0.375	0.340	1/32	0.125	•	•	•	Precision ground with unique cross-over design between flat bottom FB and back draft DB inserts. Allows straight walls with a larger step down than BD. Allows higher cutting speeds and feeds.
	BDS 0500	0.500	0.380	.015,1/32,1/16	0.125	•	•	•	
	BDS 0625	0.625	0.457	1/32,1/16	0.125	•	•	•	
	BDS 0750	0.750	0.540	1/32,1/16,1/8	0.125	•	•	•	
	BDS 1000	1.000	0.740	1/32,1/16,1/8	0.125	•	•	•	

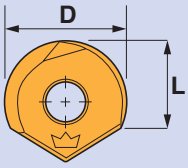
FB-R	Number	D	L	R	XRN	TLN	HSN	Description
	FB 0250 R	0.250	0.270	0.015	•	•	•	Precision ground with positive ground chip-breaker. Flat bottom inserts for shoulder milling, fillet finishing and long reach angular wall finishing of softer materials.
	FB 0312 R	0.312	0.270	0.015	•	•	•	
	FB 0375 R	0.375	0.341	1/32	•	•	•	
	FB 0500 R	0.500	0.350	1/32,1/16,1/8	•	•	•	
	FB 0625 R	0.625	0.421	1/32,1/16	•	•	•	
	FB 0750 R	0.750	0.496	1/32,1/16,1/8	•	•	•	
	FB 1000 R	1.000	0.679	1/32,1/16,1/8	•	•	•	
	FB 1250 R	1.250	0.843	1/32,1/16,1/8	•	•	•	

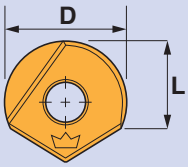
TO	Number	D	L	R	XRN	TLN	HSN	Description
	TO 0375	0.375	0.349	0.125	•	•	•	Precision ground large corner radius & back taper for spiral and packet milling. Milling of pre-hard and hardened flat surfaces at higher speeds than tools with smaller corner radii. Good choice for HS milling of Aluminum.
	TO 0500	0.500	0.377	0.125	•	•	•	
	TO 0625	0.625	0.433	0.156	•	•	•	
	TO 0750	0.750	0.518	0.187	•	•	•	
	TO 1000	1.000	0.716	0.250	•	•	•	
	TO 1250	1.250	0.865	0.312	•	•	•	

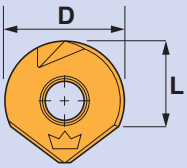
TOBD-NF	Number	D	L	R	XRN	TLN	HSN	Description
	TOBD 0500-NF	0.500	0.377	0.125				Millstar inserts designed for high seed high feed roughing of Aluminum, but also has the versatility to be used for fine finishing as well.
	TOBD 0625-NF	0.625	0.433	0.125				
	TOBD 0750-NF	0.750	0.518	0.125				
	TOBD 1000-NF	1.000	0.716	0.125				

Ball Nose Inserts

BS-N	Tool Ordering Number	Dimensions D	L	S	Grade XRN	TLN	HSN	Description
	BS 0375 N	0.375	0.390	0.154	•	•	•	Sidecutting, non-chipbreaker. Side cutting insert used in cavity and core profiling, for blending of fillets on medium and hard materials.
	BS 0500 N	0.500	0.350	0.100	•	•	•	
	BS 0625 N	0.625	0.421	0.109	•	•	•	
	BS 0750 N	0.750	0.496	0.121	•	•	•	
	BS 1000 N	1.000	0.679	0.179	•	•	•	
	BS 1250 N	1.250	0.828	0.203	•	•	•	

MB	Number	D	L	XRN	TLN	HSN	Description
	MB 0375	0.375	0.349	•	•	•	Unique cutting edge allows performance in all operations in material below 42 HRc; in semi, & finishing operations above. Significant benefits in heat-treated intricate geometries. Insert geometry allows smoother cutting motion-diminishing heat build up & tool deflection, reduces vibration caused by cutting action.
	MB 0500	0.500	0.377	•	•	•	
	MB 0625	0.625	0.443	•	•	•	
	MB 0750	0.750	0.518	•	•	•	
	MB 1000	1.000	0.716	•	•	•	
	MB 1250	1.250	0.865	•	•	•	

MBT	Number	D	L	XRN	TLN	HSN	Description
	MBT 0375	0.375	0.349	•	•	•	Precision ground, harder grade, for semi-finish and finish milling. Excellent choice for unattended finish milling at small depth and high speeds and feed rates.
	MBT 0500	0.500	0.377	•	•	•	
	MBT 0625	0.625	0.443	•	•	•	
	MBT 0750	0.750	0.518	•	•	•	
	MBT 1000	1.000	0.716	•	•	•	
	MBT 1250	1.250	0.865	•	•	•	

RB-N	Number	D	L	XRN	TLN	HSN	Description
	RB 0375 N	0.375	0.390	•	•	•	Precision ground, non-chipbreaker. Best choice for cavity, core and profile milling of pre-hard and fully hard die/mold steels, cast steels and cast iron. Strongest cutting edge design.
	RB 0500 N	0.500	0.377	•	•	•	
	RB 0625 N	0.625	0.443	•	•	•	
	RB 0750 N	0.750	0.518	•	•	•	
	RB 1000 N	1.000	0.716	•	•	•	
	RB 1250 N	1.250	0.865	•	•	•	

Insert Coatings

NA Non-coated grade. The lowest cost choice. May be used at normal speeds, or lower speeds on older machines, for all purpose milling. May be resharpened or altered.

XRN Multi-layer hybrid coating of AlTiCrN. This coating has very good heat resistance and also a low friction coefficient. The XRN coating is designed for use in HSM of un-heat treated softer materials such as Titanium, Inconel, Stainless Steels and other gummy materials that require the use of liquid coolant.

TCN Titanium Carbo-Nitride PVD multi layer coating. Higher hardness and toughness than TIN. Choose on heavy cuts or high feeds and speeds, preferably with coolant. Excellent crater and wear resistance. Useful on abrasive and gummy materials (cast iron, brass, aluminum alloys) and on stainless steels and highly alloyed materials, including nickel and chrome based alloys.

HSN Millstar's new coating is a multi-layer hybrid Nano coating. This new coating has very good heat resistance and high hardness. The HSN coating is designed for use in HSM of Heat Treated materials up to 72 HRc Customers using our new HSN coating are seeing average tool life increases of 3-4 times more than the competition. Tool life increases as much as 10 times have been documented.

ALTiN-EXALON (TLN) Titanium Aluminum Nitride advanced PVD coating. A special, improved ALTiN coating approaching surface hardness of CBN on a tough substrate. Recommended for tough and hard metal machining applications. When high cutting temperatures are encountered the coating acts as a heat barrier, protecting the cutting edge. This allows for aggressive, high speed and dry milling so often encountered in today's die and mold machining. Use on tool, die and higher alloy steels, especially at hardness over 40 HRc. Also appropriate for all stainless steels (300, 400 and PH series), nickel alloys, titanium, nodular and gray cast iron. Also useful in machining carbon graphite.

DMD Diamond coating. Custom coating for cutting non-ferrous, non-metallic and very abrasive materials at highly elevated speeds. Use on copper, bronze, brass, aluminum-silicon alloys, carbon graphite, solid and fiber-reinforced plastics, ceramics and composite materials.

Custom tool coatings for specific applications are available by request.

Cutting Conditions for Using Steel Shank Holders

WORKING MATERIAL	HARDNESS	GRADE	SFM	FEED fn (inch/Rev) INSERT DIAMETER (inch)								Ap Max mm	Ae Max mm
				0.250	0.312	0.375	0.500	0.625	0.750	1.000	1.250		
Low Alloy Steel (1.7225)	200-280HB	TLN	450-1200	0.008	0.012	0.016	0.016	0.020	0.020	0.020	0.020	D/10	D/40
Alloy & Die Steel (1.2311, P20, DME2/3/5)	32-42HRC	TLN	300-800	0.006	0.010	0.012	0.016	0.016	0.016	0.020	0.020	D/8	D/35
Tool Steel (1.2344, 1.2379)	42-52HRC	TLN	300-700	0.006	0.010	0.012	0.016	0.020	0.020	0.020	0.020	D/6	D/30
Stainless Steel (1.4301, 1.4401)	200-350HB	XRN,TCN,TLN	250-400	0.006	0.010	0.012	0.016	0.016	0.016	0.020	0.020	D/10	D/40
Gray Cast Iron (GG25-GG30)	160-260HB	TLN	600-1200	0.008	0.012	0.016	0.020	0.023	0.023	0.028	0.028	D/10	D/50
Nodular Cast Iron (GGG60-GGG70)	180-300HB	TLN	450-1200	0.008	0.012	0.016	0.020	0.023	0.023	0.028	0.028	D/15	D/50
Copper Alloy	80-150HB	XRN	450-1500	0.010	0.016	0.020	0.023	0.028	0.028	0.028	0.028	D/10	D/40
Aluminum Alloys	30-120HB	XRN	1000-3000	0.010	0.016	0.020	0.023	0.028	0.028	0.028	0.028	D/10	D/50
Graphite		TLN	600-2000	0.012	0.020	0.023	0.028	0.030	0.030	0.030	0.030	D/20	D/50
Ni & Co Based Alloy	250-320HB	XRN, HSN	100-300	0.006	0.008	0.012	0.016	0.016	0.020	0.020	0.020	D/8	D/30
Titanium Alloy (Annealed)	<350HB	XRN, HSN	150-400	0.006	0.008	0.010	0.012	0.012	0.016	0.020	0.020	D/8	D/33
Titanium Alloy (Sol. Treated/Aged)	<380HB	XRN, HSN	120-300	0.004	0.006	0.008	0.012	0.012	0.012	0.016	0.016	D/8	D/35

Cutting Conditions for Using Carbide Shank Holders

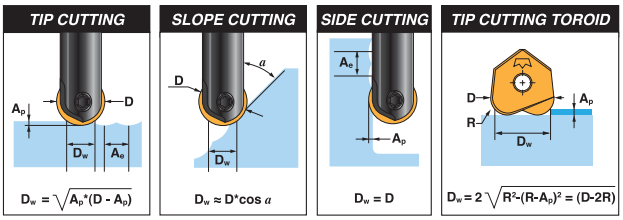
WORKING MATERIAL	HARDNESS	GRADE	SFM	FEED fn (inch/Rev) INSERT DIAMETER (inch)								Ap Max mm	Ae Max mm
				0.250	0.312	0.375	0.500	0.625	0.750	1.000	1.250		
Low Alloy Steel (1.7225)	200-280HB	TLN	450-1200	0.012	0.016	0.016	0.02	0.023	0.023	0.028	0.028	D/10	D/50
Alloy & Die Steel (1.2311, P20, DME2/3/5)	32-42HRC	TLN	300-1200	0.012	0.012	0.012	0.016	0.02	0.02	0.023	0.023	D/8	D/40
Tool Steel (1.2344, 1.2379)	42-52HRC	TLN	300-800	0.012	0.012	0.012	0.016	0.02	0.02	0.023	0.023	D/6	D/35
Stainless Steel (1.4301, 1.4401)	200-350HB	XRN,TCN,TLN	250-400	0.012	0.012	0.016	0.02	0.023	0.028	0.028	0.03	D/10	D/50
Gray Cast Iron (GG25-GG30)	160-260HB	TLN	600-1200	0.012	0.016	0.02	0.02	0.023	0.028	0,8	0.04	D/10	D/40
Nodular Cast Iron (GGG60-GGG70)	180-300HB	TLN	450-1200	0.012	0.016	0.016	0.02	0.023	0.023	0.028	0.03	D/10	D/40
Copper Alloy	80-150HB	XRN	450-1500	0.012	0.016	0.016	0.02	0.023	0.023	0.028	0.028	D/10	D/40
Aluminum Alloys	30-120HB	XRN	1000-3000	0.012	0.016	0.02	0.023	0.028	0.028	0.03	0.03	D/10	D/40
Graphite		TLN	600-2000	0.012	0.02	0.023	0.028	0.03	0.03	0.03	0.03	D/20	D/40
Ni & Co Based Alloy	250-320HB	XRN, HSN	100-300	0.012	0.012	0.016	0.016	0.02	0.023	0.023	0.028	D/8	D/50
Titanium Alloy (Annealed)	<350HB	XRN, HSN	150-400	0.006	0.008	0.012	0.012	0.012	0.016	0.02	0.02	D/8	D/50
Titanium Alloy (Sol. Treated/Aged)	<380HB	XRN, HSN	120-300	0.004	0.006	0.008	0.012	0.012	0.016	0.016	0.02	D/8	D/50
Harden Steel (1.2344, 1.2379)	45-55HRC	HSN, TLN	300-1200	0.008	0.01	0.012	0.016	0.02	0.02	0.023	0.023	D/8	D/35

1. Find the Cutting Speed V_c (m/min) & Feed f_n (mm/π^{-1})

Find Vc and fn range in Table 1 or Table 2 on opposite page. Choose the average value for Vc and the lower value for feed in the range.

2. Compute the Dw

In order to compute the RPM value of the spindle it is necessary to determine the Dw which is the effective engaged tool diameter. The Dw depends on the geometry of the inserts (ball nose or toroid) and the relative position of the tool against the working piece surface. Example calculation is of Dw is presented to the right.



3. Calculate Spindle Speed N(n/min)

Use the formula: $N = (V_c * 1{,}000)/\pi * D_w$

Table 3 - WORKING DIAMETER FOR BALL NOSE TOOLS

ØD	0.250	0.312	0.375	0.500	0.625	0.750	1.000	1.250
Depth of cut	Dw Working Diameter (inch) Actual effective cutting diameter							
0.020	0.135	0.153	0.169	0.196	0.220	0.242	0.280	0.314
0.050	0.200	0.229	0.255	0.300	0.339	0.374	0.436	0.490
0.075	0.229	0.267	0.300	0.357	0.406	0.450	0.527	0.594
0.100	0.245	0.292	0.332	0.400	0.458	0.510	0.600	0.678
0.125	0.250	0.306	0.345	0.433	0.500	0.559	0.661	0.750
0.156		0.312	0.370	0.464	0.541	0.609	0.726	0.827
0.188			0.375	0.484	0.573	0.650	0.781	0.893
0.250				0.500	0.612	0.707	0.866	1.000
0.312					0.625	0.739	0.927	1.082
0.375						0.750	0.968	1.146
0.500							1.000	1.225
0.625								1.250

Table 4 - WORKING DIAMETER FOR TOROID TOOLS

Insert Diameter "D"	0.375	0.500	0.625	0.750	1.000	1.250
Depth of cut	Dw Working Diameter (inch) Actual cutting diameter of toroid inserts					
0.020	0.260	0.385	0.465	0.544	0.696	0.845
0.050	0.325	0.450	0.541	0.630	0.800	0.964
0.075	0.354	0.479	0.579	0.675	0.867	1.031
0.100	0.370	0.495	0.604	0.707	0.900	1.083
0.125	0.375	0.500	0.618	0.720	0.933	1.125
0.156			0.625	0.745	0.964	1.166
0.188				0.750	0.984	1.198
0.250					1.000	1.237
0.312						1.250

4. Calculate the Table Feed V_f (m/min)

Use the formula: $V_f = N * f_n * K_f$. K_f is the feed rate multiplier coefficient taking inconsideration that chip load is less than theoretical value. Take the value of K_f from Table 5 or Table 6.

Table 5 - FEED RATE MULTIPLIER FOR BALL NOSE INSERTS

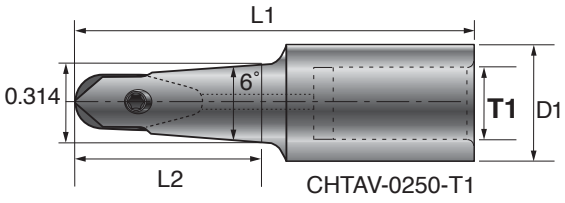
Insert Diameter "D"	0.250	0.312	0.375	0.500	0.625	0.750	1.000	1.250
Depth of cut	FEEDRATE MULTIPLIER FACTORS (for Working Diameters Dw)							
0.020	1.850	2.040	2.220	2.550	2.840	3.000	3.750	4.000
0.050	1.250	1.360	1.470	1.670	1.840	2.000	2.290	2.550
0.075	1.090	1.170	1.250	1.400	1.540	1.670	1.900	2.100
0.100	1.020	1.070	1.130	1.250	1.370	1.470	1.670	1.840
0.125	1.000	1.020	1.060	1.150	1.250	1.340	1.510	1.660
0.156		1.000	1.010	1.080	1.160	1.230	1.380	1.510
0.188			1.000	1.030	1.090	1.150	1.280	1.400
0.250				1.000	1.020	1.060	1.150	1.250
0.312					1.000	1.020	1.080	1.150
0.375						1.000	1.030	1.090
0.500							1.000	1.020
0.625								1.000

Table 6 - FEED RATE MULTIPLIER FOR TOROID TOOLS

Insert Diameter "D"	0.375	0.500	0.625	0.750	1.000	1.250
Depth of cut	FEEDRATE MULTIPLIER FACTORS (inch) (for Toroid Working Diameters Dw)					
0.020	1.850	1.850	2.040	2.220	2.550	2.840
0.050	1.250	1.250	1.360	1.470	1.670	1.840
0.075	1.090	1.090	1.170	1.250	1.400	1.540
0.100	1.020	1.020	1.070	1.130	1.250	1.370
0.125	1.000	1.000	1.020	1.060	1.150	1.250
0.156			1.000	1.010	1.080	1.160
0.188				1.000	1.030	1.090
0.250					1.000	1.020
0.312						1.000

Shrink Fit System

Millstar's Carbide Modular Shrink System offers versatility, strength and accuracy. The carbide shank offers strength and rigidity and the shrink tolerances offer better accuracy than screw on type systems. These tools are designed for high speed machining and hard metal machining and will allow for better tool life as well as better surface finishes.



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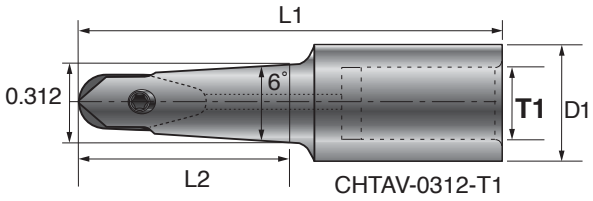

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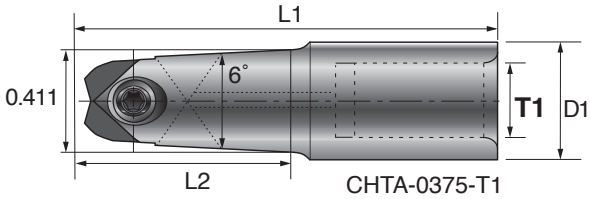

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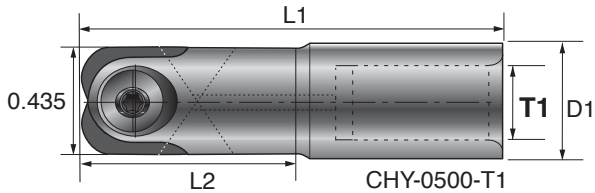
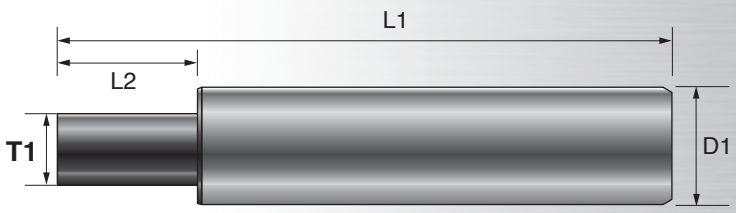
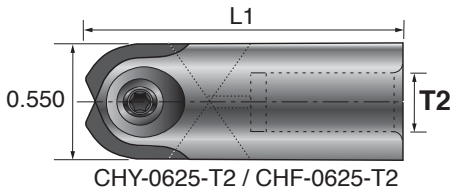
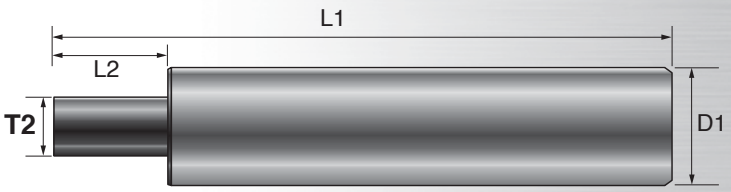


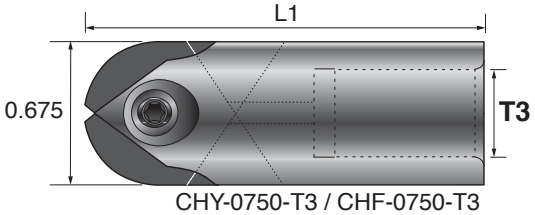
CHY-0500-T1
CHF-0500-T1



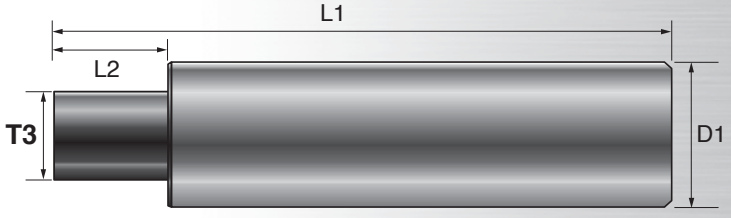


CHY-0625-T2 / CHF-0625-T2





CHY-0750-T3 / CHF-0750-T3



Insert		Shrink Fit head				Shrink Fit Shank			
			Dimensions				Dimensions		
Type	Code	Tool Number	ØD1	L1	L2	Tool Number	ØD1	L1	L2
	VBD, VRBS	CHTAV-0250-T1	0.460	1.700	0.879	CSS-0500-2.9-T1 CSS-0500-4.9-T1	0.500 0.500	2.900 4.900	0.600 0.600
		CHTAV-0312-T1	0.460	1.700	0.827				
	TO, HF, FB, BDS, MB,MBT, BD, TOBD-NF	CHTAV-0375-T1	0.460	1.700	0.845				
	RB, MB, MBT, BS	CHY-0500-T1	0.460	1.700	0.857				
	FB, BD, BDS, HF, TO, TOBD-NF	CHF-0500-T1	0.460	1.700	0.857				
	BS, RB, MB, MBT	CHY-0625-T2	0.550	1.500		CSS-0625-4.1-T2 CSS-0625-7.1-T2	0.625 0.625	4.100 7.100	0.650 0.650
	FB, BD, BDS, HF, TO, TOBD-NF	CHF-0625-T2	0.550	1.500					
	RB, BS, MB, MBT	CHY-0750-T3	0.675	1.900		CSS-0750-3.8-T3 CSS-0750-6.8-T3 CSS-18-150-T3	0.750 0.750 18mm	3.800 6.800 6.000	0.700 0.700 0.700
	FB, BD, BDS, HF, TO, TOBD-NF	CHF-0750-T3	0.675	1.900					

High Performance Milling from Heavy Roughing to Fine Finishing

Millstar face mills are equally useful on newer high velocity machines and older slower equipment and will optimize milling performance of all your machine tools. The hardened tool bodies can be run at aggressive spindle speed and feed rates, when used with Millstar's precision ground, strong and thick, round inserts with proven hard, high performance TLN tool coating.

The tools provide for precision finish results, minimal tool deflection and run-out. Excellent milling results can be achieved in roughing, semi finishing and fine finishing in Z-level, profiling or raster cuts, as well as in linear or circular interpolation milling or ramping.

The tools may be used with coolant, but we recommend dry, mist or MQL (minimum quantity lubrication) milling with strong air blast when high speed or hard machining steel, particularly in the higher hardness range (> 45HRc / 425 HBN). Please refer to FAQs (frequently asked questions) about milling on our web site www.millstar.com.

Milling Cutters Identification System

Modular

FMA 2000 / 5

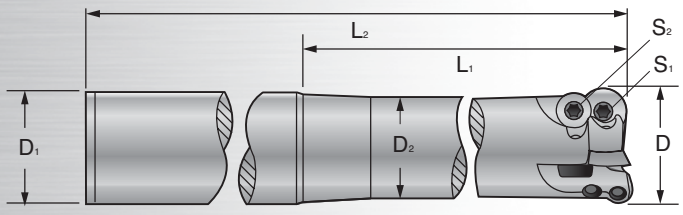
FMA	2000	5
Denotes Copy Milling Cutter Arbor Style	Denotes Diameter Size	Denotes Number of Flutes

Shank

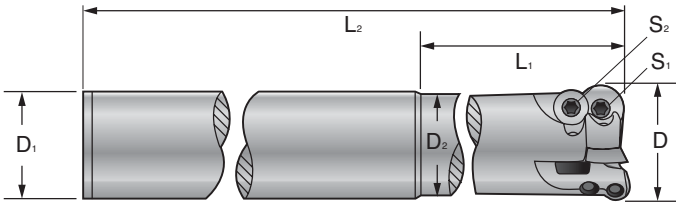
FM 1000 / 2 - 6.0 - 1000

FM	1000	2	6.0	1000
Denotes Copy Milling Cutter	Denotes Diameter Size	Denotes Number of Flutes	Denotes Tool Cutter Length	Denotes Tool Diameter Shank

Toroid Taper End Milling Cutters

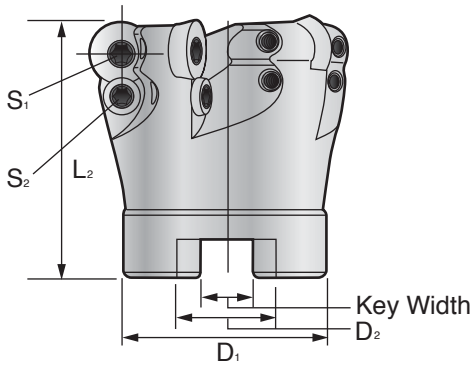


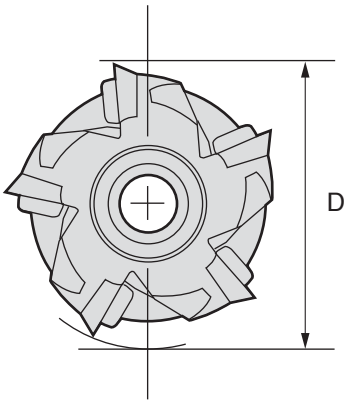
Toroid Cylindrical End Milling Cutters



Tool Ordering Number	Dimensions						Screw	Key	Face Clamp	Insert Code
	ØD	ØD1	ØD2	L1	L2	Z				
FM 1000/2-6.0-1000	1.000	1.000	0.882	3.000	6.000	2	FMIS-1	T15	FMIS2	FMI-12T3
FM 1250/3-6.0-1000	1.250	1.000	0.882	1.500	6.000	3	FMIS-1	T15	FMIS2	FMI-12T3
FM 1500/4-6.0-1250	1.500	1.250	1.125	1.500	6.000	4	FMIS-1	T15	FMIS2	FMI-12T3

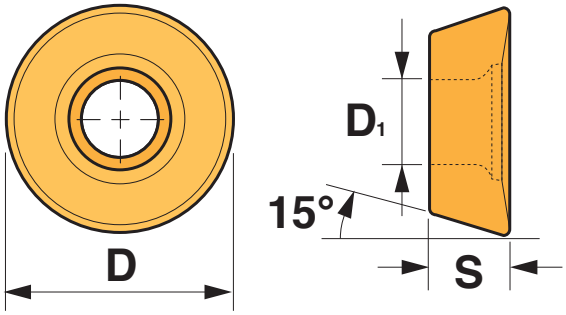
Arbor Style Milling Cutters





Tool Ordering Number	Dimensions						Insert Screw	Face Clamp Screw	Key	Insert Code
	ØD	ØD1	L2	Z	Key Width	D2				
FMA 2000/5	2.000	1.570	2.000	5	0.312	0.750	FMIS-1	FMIS-2	T15	FMI-12T3
FMA 2500/5	2.500	1.570	2.000	5	0.375	1.000	FMIS-1	FMIS-2	T15	FMI-12T3
FMA 3000/5	3.000	1.570	2.000	5	0.375	1.000	FMIS-1	FMIS-2	T15	FMI-12T3

Insert Data



Tool Ordering Number	Dimensions			HSN	TLN
	D	S	D1		
FMI-1003	0.393/10mm	0.125	0.153	•	•
FMI-12T3	0.472/12mm	0.156	0.154	•	•
FMI-1604	0.629/16mm	0.205	0.1875	•	•

Cutting Conditions Data

RECOMMENDED CUTTING SPEED AND Ap

WORKING MATERIAL	HARDNESS	GRADE	SFM	Ap Max Roughing	Ap Max Medium	Ap Max Light
Low Alloy Steel(1.7225)	200-280HB	HSN, TLN	300-800	.08-.16	.04-.08	.004-.04
Alloy & Die Steel(1.2311, P20, DME2/3/5)	32-42HRC	HSN, TLN	300-600	.08-.16	.04-.08	.004-.04
Tool Steel (1.2344, 1.2379)	42-52HRC	HSN, TLN	200-450	.08-.12	.04-.08	.004-.04
Stainless Steel (1.4301, 1.4401)	200-350HB	HSN, TLN	300-600	.08-.16	.04-.08	.004-.04
Gray Cast Iron (GG25-GG30)	160-260HB	HSN, TLN	300-600	.08-.16	.04-.08	.004-.04
Nodular Cast Iron (GGG60-GGG70)	180-300HB	HSN, TLN	300-1200	.08-.16	.04-.08	.004-.04
Copper Alloy	80-150HB	TLN	1200	.08-.16	.04-.08	.004-.04
Aluminum Alloys	30-120HB	TLN	3000	.08-.16	.04-.08	.004-.04
Ni & Co Based Alloy	250-320HB	HSN, TLN	100-450	.08-.12	.04-.08	.004-.04
Titanium Alloy (Annealed)	<350HB	HSN, TLN	100-450	.08-.12	.04-.08	.004-.04

RECOMMENDED FEED fz (mm/tooth)

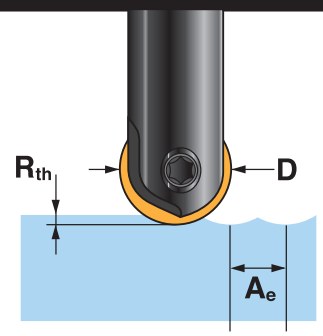
OPERATION	Ap										
	IC	0.012	0.02	0.028	0.031	0.04	0.05	0.08	0.12	0.16	0.2
LIGHT	10	0.012	0.008	0.008	0.007	0.006	0	0	0	0	0
	12	0.015	0.012	0.010	0.012	0.008	0.006	0	0	0	0
	16	0.016	0.015	0.012	0.012	0.009	0.008	0.007	0	0	0
ROUGH	10	0	0	0	0	0.012	0.009	0.008	0.007	0.006	0.005
	12	0	0	0	0	0.016	0.014	0.012	0.011	0.009	0.008
	16	0	0	0	0	0.02o	0.017	0.015	0.012	0.011	0.010

The "fz" indicated above is for an overhang of 3xD. The values are calculated based on the recommended thickness of the chip "hm".
LIGHT: Ae up to 25% of the Diameter of the Tool "D".
ROUGH: Ae up to 75% of the Diameter of the Tool "D".

Verify the Surface Roughness (R_{th})

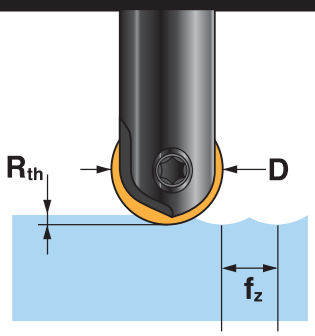
1. Decreasing the A_e and feed by half will improve surface roughness by 4 times.
2. Using $f_z = A_e$ in most cases is the best option.

SURFACE ROUGHNESS STEP-OVER

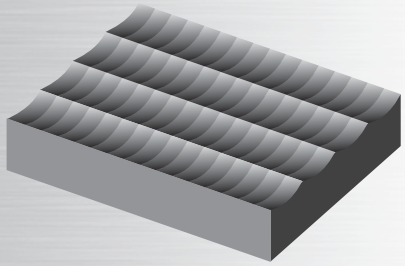


$$R_{th}, A_e = \frac{D}{2} - \sqrt{\frac{D^2 - A_e^2}{4}}$$

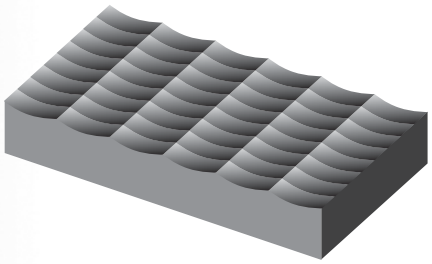
SURFACE ROUGHNESS FEED DIR



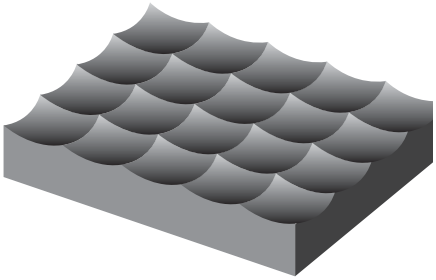
$$R_{th}, A_e = \frac{D}{2} - \sqrt{\frac{D^2 - f_z^2}{4}}$$



$f_z > A_e$



$f_z < A_e$

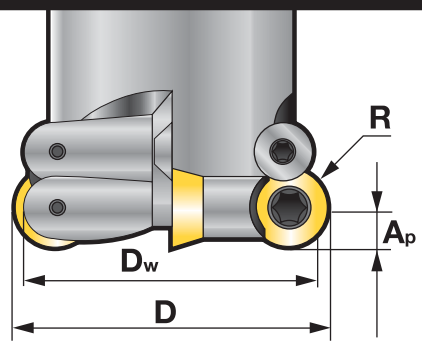


$f_z = A_e$

Working Diameter (D_w)

In order to compute the RPM value of the spindle it is necessary to determine the Dw which is the effective engaged tool diameter. The Dw depends on the geometry of the inserts (ball nose or toroid) and of the relative position of the tool against the working piece surface. A formula is presented.

WORKING DIAMETER D_w



$$D_w = D - 2R + 2 * \sqrt{R^2 - (R - A_p)^2}$$

Milling Cutters Identification System

Modular

HF SC 1000 / 3

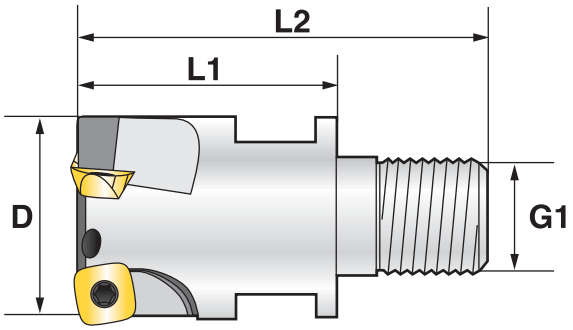
HF	SC	1000	3
Denotes High Feed Cutter	SC = Screw-On Cutter A = Shell Cutter	Denotes Diameter Size	Denotes Number of Flutes

Shank

HF SS 1000-5.5-1000

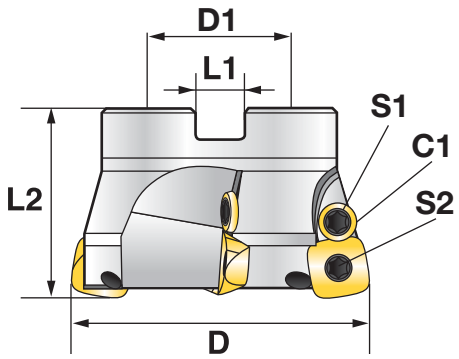
HF	SS	1000	5.5	1000
Denotes High Feed Cutter	Denotes Shank Cutter	Denotes Diameter Size	Denotes Tool Cutter Length	Denotes Tool Diameter Shank

HFSC - Modular Screw-On Heads



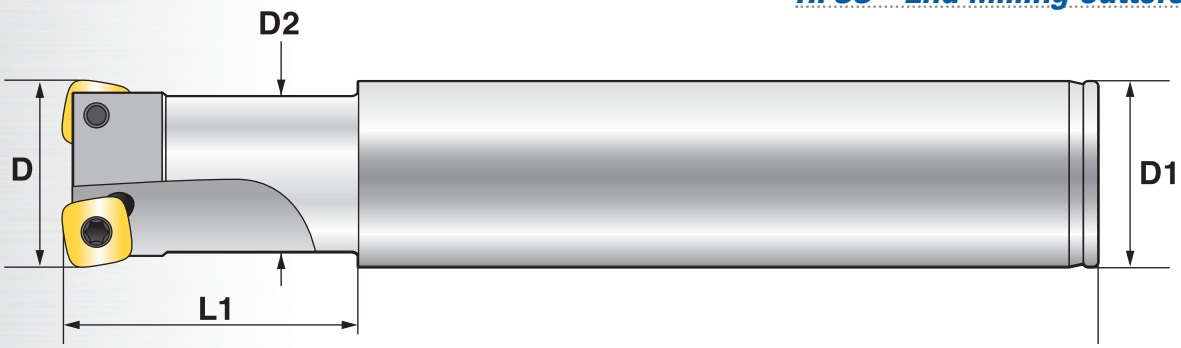
Tool Ordering Number	Dimensions				Thread G1	Screw	Clamp	Key	Use with Inserts	CAM R
	ØD	L1	L2	Z						
HFSC-1000/3	1.000	1.250	2.000	3	M10	HFIS-1	-	T8	HFCI 09T3	0.089
HFSC-1250/4	1.250	1.570	2.500	4	M12	HFIS-1	-	T8	HFCI 09T3	0.089
HFSC-1500/4	1.500	1.570	2.500	4	M16	HFIS-2	HFIC-1	T15	HFCI 1204	0.138

HFA - Shell Milling Cutters



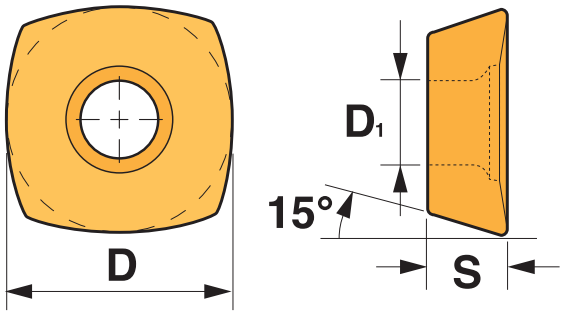
Tool Ordering Number	Dimensions					Screw S1	Screw S2	Clamp C1	Key	Use with Inserts	CAM R
	ØD	ØD1	L1	L2	Z						
HFA-1500/4	1.500	0.500	0.252	1.575	4	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	0.138
HFA-2000/5	2.000	0.750	0.312	1.575	5	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	0.138
HFA-2500/6	2.500	1.000	0.375	1.575	5	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	0.138
HFA-3000/7	3.000	1.000	0.375	1.968	6	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	0.138
HFA-4000/8	4.000	1.250	0.500	1.968	6	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	0.138

HFSS - End Milling Cutters



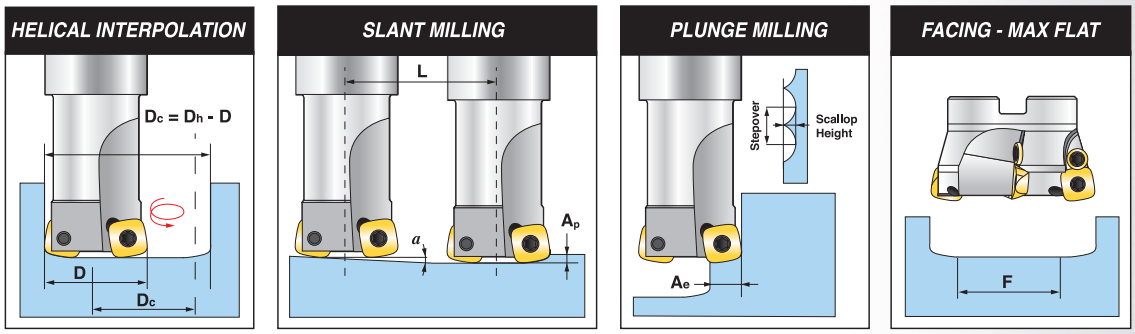
Tool Ordering Number	Dimensions					Screw	Clamp C1	Key	Use with Inserts	CAM R
	ØD	ØD1	L1	L2	Z					
HFSS-1000-5.5-1000	1.000	1.000	1.580	5.500	2	HFIS-1	-	T8	HFCI 09T3	0.089
HFSS-1000-7.0-1000	1.000	1.000	1.580	7.000	3	HFIS-1	-	T8	HFCI 09T3	0.089
HFSS-1250-6.0-1250	1.250	1.250	1.580	6.000	3	HFIS-1	-	T8	HFCI 09T3	0.089
HFSS-1250-8.0-1250	1.250	1.250	1.580	8.000	3	HFIS-1	-	T8	HFCI 09T3	0.089
HFSS-1500-6.0-1500	1.500	1.500	1.580	6.000	4	HFIS-2	HFIC-1	T15	HFCI 1204	0.138
HFSS-1500-9.0-1500	1.500	1.500	1.580	9.000	4	HFIS-2	HFIC-1	T15	HFCI 1204	0.138

Insert Data



Tool Ordering Number	Dimensions			Grade		CAM	
	D	S	D1	XRN	HSN	R	T
HFCI 09T3	9,525	3,97	4,4	•	•	0.089	0.020
HFCI 1204	12,700	4,76	3,4	•	•	0.138	0.025

Machining Application Data



Tool Ordering Number	Dimensions				Helical Interpolation	
	ØD	ØDh	Ap	F	ØDh min	ØDh max
HFSC-1000/3	1.000	9mm	0.040	0.500	1.400	1.900
HFSC-1250/4	1.250	9mm	0.040	0.750	1.800	2.250
HFSC-1500/4	1.500	12mm	0.040	0.800	2.000	2.500
HFSS-1000-5.5-1000	1.000	9mm	0.040	0.500	1.500	1.900
HFSS-1000-7.0-1000	1.000	9mm	0.040	0.500	1.500	1.900
HFSS-1250-6.0-1250	1.250	9mm	0.040	0.800	1.000	2.500
HFSS-1250-8.0-1250	1.250	9mm	0.040	0.800	1.000	2.500
HFSS-1500-6.0-1500	1.500	12mm	0.040	1.125	1.250	3.000
HFSS-1500-9.0-1500	1.500	12mm	0.066	0.800	1.250	3.000
HFA-1500/4	1.500	12mm	0.066	1.000	2.500	3.250
HFA-2000/5	2.000	12mm	0.066	1.250	3.125	3.750
HFA-2500/6	2.500	12mm	0.066	1.900	4.000	4.750
HFA-3000/7	3.000	12mm	0.066	2.500	5.500	6.000
HFA-4000/8	4.000	12mm	0.066	3.250	7.000	7.750

- For Slant Milling or Helical Interpolation decrease the recommended feed by 30%.
- In case of Helical Interpolation do not exceed the max Ap/revolution.
- For Plunging use 50% of recommended feed only.
- For insert HFCI 09T3 the max Ae is: 0.200
- For insert HFCI 1204 the max Ae is: 0.250

The Values of "n" and "Vf" in the tables on the following pages are computed. In the application, use the closest (up side) speed from the range of the machine tool.

The cutting parameters have to be adjusted accordingly to the rigidity of the machine-tool and working piece.

In case of hard steel alloy of 50-55 HRC decrease by 30% the Ap, Vc and feed.

Cutter	Insert	Grade	Work Piece Material	Overhang	n	Vc	Vf	fz	Ap	Ae
					RPM	sfm	Max RPM	inch/tooth	inch	inch
HFSC 1000/3	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	2420	623	11618	0.040	0.025	<.75
				3D-5D	1783	459	5350	0.040	0.025	<.75
				5D-7D	1656	426	4968	0.040	0.025	<.75
				>7D	1146	295	3439	0.040	0.025	<.75
			Alloy Steel 32-42HRC	<3D	2038	524	9783	0.040	0.025	<.75
				3D-5D	1656	426	4968	0.040	0.025	<.75
				5D-7D	1529	393	4586	0.040	0.025	<.75
				>7D	1146	295	3439	0.040	0.025	<.75
			Tool Steel 42-52HRC	<3D	1783	459	7490	0.040	0.025	<.75
				3D-5D	1274	328	3057	0.040	0.025	<.75
				5D-7D	1274	328	3057	0.040	0.025	<.75
				>7D	1146	295	2064	0.040	0.025	<.75
			Cast Iron	<3D	2293	590	11006	0.040	0.025	<.75
				3D-5D	1783	459	6420	0.040	0.025	<.75
				5D-7D	1656	426	5962	0.040	0.025	<.75
				>7D	1146	295	4127	0.040	0.025	<.75
HFSC 1250/4	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	2017	623	12102	0.040	0.025	<.75
				3D-5D	1486	459	5350	0.040	0.025	<.75
				5D-7D	1380	426	4968	0.040	0.025	<.75
				>7D	955	295	3439	0.040	0.025	<.75
			Alloy Steel 32-42HRC	<3D	1699	525	10191	0.040	0.025	<.75
				3D-5D	1380	427	4968	0.040	0.025	<.75
				5D-7D	1274	394	4586	0.040	0.025	<.75
				>7D	955	295	3439	0.040	0.025	<.75
			Tool Steel 42-52HRC	<3D	1486	459	7134	0.040	0.025	<.75
				3D-5D	1062	328	3397	0.040	0.025	<.75
				5D-7D	1062	328	2548	0.040	0.025	<.75
				>7D	955	295	2293	0.040	0.025	<.75
			Cast Iron	<3D	1911	591	12229	0.040	0.025	<.75
				3D-5D	1486	459	7134	0.040	0.025	<.75
				5D-7D	1380	427	6624	0.040	0.025	<.75
				>7D	955	295	4586	0.040	0.025	<.75
HFSC 1500/4	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1441	623	8644	0.040	0.025	<1
				3D-5D	1062	459	3822	0.040	0.025	<1
				5D-7D	986	427	3549	0.040	0.025	<1
				>7D	682	295	2457	0.040	0.025	<1
			Alloy Steel 32-42HRC	<3D	1213	525	7279	0.040	0.025	<1
				3D-5D	986	427	3549	0.040	0.025	<1
				5D-7D	910	394	3276	0.040	0.025	<1
				>7D	682	295	2457	0.040	0.025	<1
			Tool Steel 42-52HRC	<3D	1062	459	5945	0.040	0.025	<1
				3D-5D	758	328	2426	0.040	0.025	<1
				5D-7D	758	328	2426	0.040	0.025	<1
				>7D	682	295	1638	0.040	0.025	<1
			Cast Iron	<3D	1365	591	9827	0.040	0.025	<1
				3D-5D	1062	459	5945	0.040	0.025	<1
				5D-7D	986	427	5520	0.040	0.025	<1
				>7D	682	295	3822	0.040	0.025	<1

Cutter	Insert	Grade	Work Piece Material	Overhang	n	Vc	Vf	fz	Ap	Ae
					RPM	sfm	Max RPM	inch/tooth	inch	inch
HFSS-1000-5.5-1000 HFSS-1000-7.0-1000	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	2420	623	11618	0.040	0.025	<.75
				3D-5D	1783	459	5350	0.040	0.025	<.75
				5D-7D	1656	427	4968	0.040	0.025	<.75
				>7D	1146	295	3439	0.040	0.025	<.75
			Tool Steel 32-42HRC	<3D	2038	525	9783	0.040	0.025	<.75
				3D-5D	1656	427	4968	0.040	0.025	<.75
				5D-7D	1529	394	4586	0.040	0.025	<.75
				>7D	1146	295	3439	0.040	0.025	<.75
			Tool Steel 42-52HRC	<3D	1783	459	7490	0.040	0.025	<.75
				3D-5D	1274	328	3057	0.040	0.025	<.75
				5D-7D	1274	328	3057	0.040	0.025	<.75
				>7D	1146	295	2064	0.040	0.025	<.75
			Cast Iron	<3D	2293	591	11006	0.040	0.025	<.75
				3D-5D	1783	459	6420	0.040	0.025	<.75
				5D-7D	1656	427	5962	0.040	0.025	<.75
				>7D	1146	295	4127	0.040	0.025	<.75
HFSS 1250-6.0-1250 HFSS-1250-8.0-1250	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	2017	623	12102	0.040	0.025	<.75
				3D-5D	1486	459	5350	0.040	0.025	<.75
				5D-7D	1380	427	4968	0.040	0.025	<.75
				>7D	896	295	3225	0.040	0.025	<.75
			Tool Steel 32-42HRC	<3D	1699	525	10191	0.040	0.025	<.75
				3D-5D	1380	427	4968	0.040	0.025	<.75
				5D-7D	1274	394	4586	0.040	0.025	<.75
				>7D	896	295	3225	0.040	0.025	<.75
			Tool Steel 42-52HRC	<3D	1486	459	7134	0.040	0.025	<.75
				3D-5D	1062	328	3397	0.040	0.025	<.75
				5D-7D	1062	328	2548	0.040	0.025	<.75
				>7D	896	295	2150	0.040	0.025	<.75
			Cast Iron	<3D	1911	591	12229	0.040	0.025	<.75
				3D-5D	1486	459	7134	0.040	0.025	<.75
				5D-7D	1380	427	6624	0.040	0.025	<.75
				>7D	896	295	4299	0.040	0.025	<.75
HFSS-1500-6.0-1500 HFSS-1500-9.0-1500	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1441	623	8644	0.040	0.040	<1
				3D-5D	1062	459	3822	0.040	0.040	<1
				5D-7D	986	427	3549	0.040	0.040	<1
				>7D	717	295	2580	0.040	0.040	<1
			Tool Steel 32-42HRC	<3D	1213	525	7279	0.040	0.040	<1
				3D-5D	986	427	3549	0.040	0.040	<1
				5D-7D	910	394	3276	0.040	0.040	<1
				>7D	717	295	2580	0.040	0.040	<1
			Tool Steel 42-52HRC	<3D	1062	459	5945	0.040	0.040	<1
				3D-5D	758	328	2426	0.040	0.040	<1
				5D-7D	758	328	2426	0.040	0.040	<1
				>7D	717	295	1720	0.040	0.040	<1
			Cast Iron	<3D	1365	591	9827	0.040	0.040	<1
				3D-5D	1062	459	5945	0.040	0.040	<1
				5D-7D	986	427	5520	0.040	0.040	<1
				>7D	717	295	4013	0.040	0.040	<1

Cutter	Insert	Grade	Work Piece Material	Overhang	n	Vc	Vf	fz	Ap	Ae
					RPM	sfm	Max RPM	inch/tooth	inch	inch
HFA 1500/4	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1441	623	8644	0.040	0.040	<1
				3D-5D	1062	459	3822	0.040	0.040	<1
				5D-7D	986	427	3549	0.040	0.040	<1
				>7D	682	295	2457	0.040	0.040	<1
			Tool Steel 32-42HRC	<3D	1213	525	7279	0.040	0.040	<1
				3D-5D	986	427	3549	0.040	0.040	<1
				5D-7D	910	394	3276	0.040	0.040	<1
				>7D	682	295	2457	0.040	0.040	<1
			Tool Steel 42-52HRC	<3D	1062	459	5945	0.040	0.040	<1
				3D-5D	758	328	2426	0.040	0.040	<1
				5D-7D	758	328	2426	0.040	0.040	<1
				>7D	682	295	1638	0.040	0.040	<1
			Cast Iron	<3D	1365	591	9827	0.040	0.040	<1
				3D-5D	1062	459	5945	0.040	0.040	<1
				5D-7D	986	427	5520	0.040	0.040	<1
				>7D	682	295	3822	0.040	0.040	<1
HFA 2000/5	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1210	623	8471	0.040	0.040	<1.375
				3D-5D	892	459	4459	0.040	0.040	<1.375
				5D-7D	828	427	4140	0.040	0.040	<1.375
				>7D	573	295	2293	0.040	0.040	<1.375
			Tool Steel 32-42HRC	<3D	1019	525	6115	0.040	0.040	<1.375
				3D-5D	828	427	4140	0.040	0.040	<1.375
				5D-7D	764	394	3822	0.040	0.040	<1.375
				>7D	573	295	2293	0.040	0.040	<1.375
			Tool Steel 42-52HRC	<3D	892	459	5350	0.040	0.040	<1.375
				3D-5D	637	328	2548	0.040	0.040	<1.375
				5D-7D	637	328	2548	0.040	0.040	<1.375
				>7D	573	295	2293	0.040	0.040	<1.375
			Cast Iron	<3D	1146	591	9172	0.040	0.040	<1.375
				3D-5D	892	459	5350	0.040	0.040	<1.375
				5D-7D	828	427	4968	0.040	0.040	<1.375
				>7D	573	295	3439	0.040	0.040	<1.375
HFA 2500/6	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	917	623	7701	0.040	0.040	<1.8
				3D-5D	676	459	4053	0.040	0.040	<1.8
				5D-7D	627	427	3764	0.040	0.040	<1.8
				>7D	434	295	2085	0.040	0.040	<1.8
			Tool Steel 32-42HRC	<3D	772	525	5559	0.040	0.040	<1.8
				3D-5D	627	427	3764	0.040	0.040	<1.8
				5D-7D	579	394	3474	0.040	0.040	<1.8
				>7D	434	295	2085	0.040	0.040	<1.8
			Tool Steel 42-52HRC	<3D	676	459	4864	0.040	0.040	<1.8
				3D-5D	483	328	2316	0.040	0.040	<1.8
				5D-7D	483	328	2316	0.040	0.040	<1.8
				>7D	434	295	2085	0.040	0.040	<1.8
			Cast Iron	<3D	869	591	8338	0.040	0.040	<1.8
				3D-5D	676	459	4864	0.040	0.040	<1.8
				5D-7D	627	427	4517	0.040	0.040	<1.8
				>7D	434	295	3127	0.040	0.040	<1.8

Hi-Tech Tool for Hi-Tech Applications in Your Industry

Millstar's new High Performance and ultra-precise solid carbide end mills were specifically designed for High Speed, High Velocity and Hard Steel milling. Designed with specially selected premium sub-micron carbide substrate, special tool geometry and proprietary heat-defying EXALON tool coating, these tools are beating the best products the competition has to offer. They are made in the United States, and are competitively priced. Please note just some of the benefits to users:

- Square nose tools Series EMS / EIS with sharp corner or square nose tools Series EIB / EMB with corner radius, all with medium-high helix and strong cutting edges and tool body, work extremely well in materials up to 65HRc as well as in softer materials.

- Ball nose tools Series BI / BM are designed with two flutes and special nose geometry for true High Speed and Hard Material milling up to 68 HRc. Ball nose tools are the most aggressive tools for these applications. We will be glad to share our proven approach to improving your machining results.

- The Toroid Series TOM with large corner radius and slight back taper is a Millstar innovative addition. It is very useful in I.D. and O.D. Z-level and spiral milling at constant tool pressure, pocket milling, and milling of pre-hard and hardened flat surfaces at higher speeds than tools with smaller or sharp corner radii.

- Extended Reach ball nose tools Series BMNL and extended reach square nose tools Series EMR are useful tools specifically designed for long reach milling of extrusion dies, deep cavities and cores, deep rib milling and similar applications. The reduced flute length and neck diameter assure constant cutting pressure and minimal tool deflection.

Millstar's Hi-Tech Cutting Tools are ideal choices for accurately and aggressively machining products in many industries. Here are some examples

- Mold and die making: injection molds, glass molds, forging dies, extrusion dies.
- Aerospace: engine, landing gear and tail hook components, structural components, blisks, airfoil machining and forging dies, helicopter rotor components.
- Power generating: turbine blades and other components.
- Medical: hip and knee replacement joints, surgical instruments, medical device molds.
- Automotive: stamping dies, wheel and tire molds, ball joints, cam shaft machining, racing engine details, bumper and other injection molds, die cast dies, forging dies for crank and cam shafts, connecting rods, steering knuckles and yokes, and many other forged components.
- Consumer products: molds for cake forms and baking dishes, cell phones, lawn chairs, trash cans, toys, bottles, recyclable cutlery and dishes, jewelry, golf clubs, safety helmets, computer and accessory housings and much more.

Call on Millstar application specialists or visit our web site www.millstar.com for more product information and expert application assistance.

EIS - Square End Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-0.01	Corner Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
EIS-.020-EX	0.020	-	0.250 / (1/4)	3	0.020	0.060	7.500˚ / side	2.500
EIS-.031-EX	0.031 / (1/32)	-	0.250 / (1/4)	3	0.031	0.100	7.500˚ / side	2.500
EIS-.062-EX	0.062 / (1/16)	-	0.250 / (1/4)	4	0.062	0.200	7.500˚ / side	2.500
EIS-.093-EX	0.093 / (3/32)	-	0.250 / (1/4)	4	0.093	0.300	7.500˚ / side	2.500
EIS-.125-EX	0.125 / (1/8)	-	0.250 / (1/4)	5	0.125	0.375	7.500˚ / side	3.000
EIS-.187-EX	0.187 / (3/16)	-	0.250 / (1/4)	6	0.187	0.600	7.500˚ / side	3.000
EIS-.250-EX	0.250 / (1/4)	-	0.250 / (1/4)	6	0.250	0.750	-	3.000
EIS-.312-EX	0.312 / (5/16)	-	0.312 / (5/16)	6	0.312	1.000	-	3.500
EIS-.375-EX	0.375 / (3/8)	-	0.375 / (3/8)	6	0.375	1.125	-	3.500
EIS-.437-EX	0.437 / (7/16)	-	0.437 / (7/16)	6	0.437	1.315	-	4.000
EIS-.500-EX	0.500 / (1/2)	-	0.500 / (1/2)	6	0.500	1.500	-	4.000

EIB - Square End Bull Nose w/Corner Radius Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-0.01	Corner Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
EIB-.062-015-EX	0.062 / (1/16)	0.015	0.250 / (1/4)	4	0.062	0.200	7.500˚ / side	2.500
EIB-.093-015-EX	0.093 / (3/32)	0.015	0.250 / (1/4)	4	0.093	0.300	7.500˚ / side	2.500
EIB-.125-015-EX	0.125 / (1/8)	0.015	0.250 / (1/4)	5	0.125	0.375	7.500˚ / side	3.000
EIB-.125-030-EX	0.125 / (1/8)	0.030	0.250 / (1/4)	5	0.125	0.375	7.500˚ / side	3.000
EIB-.187-030-EX	0.187 / (3/16)	0.030	0.250 / (1/4)	6	0.187	0.600	7.500˚ / side	3.000
EIB-.250-015-EX	0.250 / (1/4)	0.015	0.250 / (1/4)	6	0.250	0.750	-	3.000
EIB-.250-030-EX	0.250 / (1/4)	0.030	0.250 / (1/4)	6	0.250	0.750	-	3.000
EIB-.312-030-EX	0.312 / (5/16)	0.030	0.312 / (5/16)	6	0.312	1.000	-	3.500
EIB-.375-030-EX	0.375 / (3/8)	0.030	0.375 / (3/8)	6	0.375	1.125	-	3.500
EIB-.437-030-EX	0.437 / (7/16)	0.030	0.437 / (7/16)	6	0.437	1.315	-	4.000
EIB-.500-030-EX	0.500 / (1/2)	0.030	0.500 / (1/2)	6	0.500	1.500	-	4.000

BI - Ball Nose Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-0.01	Ball Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
BI.020 EX	0.020	0.010	0.250 / (1/4)	2	-	0.020	7.500˚ / side	2.500
BI.031 EX	0.031 / (1/32)	0.015	0.250 / (1/4)	2	-	0.031	7.500˚ / side	2.500
BI.062 EX	0.062 / (1/16)	0.031	0.250 / (1/4)	2	-	0.062	7.500˚ / side	2.500
BI.090 EX	0.090	0.045	0.250 / (1/4)	2	-	0.090	7.500˚ / side	2.500
BI.093 EX	0.093 / (3/32)	0.046	0.250 / (1/4)	2	-	0.093	7.500˚ / side	2.500
BI.125 EX	0.125 / (1/8)	0.062	0.250 / (1/4)	2	-	0.125	7.500˚ / side	3.000
BI.187 EX	0.187 / (3/16)	0.093	0.250 / (1/4)	2	-	0.187	7.500˚ / side	3.000
BI.250 EX	0.250 / (1/4)	0.125	0.250 / (1/4)	2	-	0.250	-	3.000
BI.312 EX	0.312 / (5/16)	0.156	0.312 / (5/16)	2	-	0.312	-	3.500
BI.375 EX	0.375 / (3/8)	0.187	0.375 / (3/8)	2	-	0.375	-	3.500
BI.375 EXLL	0.375 / (3/8)	0.187	0.375 / (3/8)	2	-	0.375	-	4.000
BI.437 EX	0.437 / (7/16)	0.218	0.437 / (7/16)	2	-	0.437	-	4.000
BI.500 EX	0.500 / (1/2)	0.250	0.500 / (1/2)	2	-	0.500	-	4.000

TOI - Toroid Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-0.01	Corner Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
TOI.125 EX	0.125 / (1/8)	0.030	0.250 / (1/4)	2	0.115	0.125	0.375 / 7.500˚	2.500
TOI.250 EX	0.250 / (1/4)	0.062	0.250 / (1/4)	2	0.230	0.250	0.750 / -	2.500
TOI.375 EX	0.375 / (3/8)	0.093	0.375 / (3/8)	2	0.345	0.375	1.125 / -	3.000
TOI.500 EX	0.500 / 1/2)	0.125	0.500 / (1/2)	2	0.460	0.500	1.500 / -	3.500
All tools backdraft 3˚								

HFI4 - High Feed Four Flute Solid Carbide

Tool Ordering No.	Diameter D	Programmable Radius	Shank Diameter	Neck Diameter	Length of Cut	Neck Length	Overall Length	Step Over Ae	Depth of Cut Ap	Feed per Tooth Fz
HFI4-0125...	0.125	0.015	0.250	0.115	0.0938	0.650	3	0.094	0.005	0.003 - 0.006
HFI4-0250...	0.250	0.031	0.250	0.235	0.1500	1.000	3	0.187	0.009	0.006 - 0.011
HFI4-0375...	0.375	0.046	0.375	0.360	0.1700	1.250	4	0.280	0.014	0.009 - 0.016
HFI4-0500...	0.500	0.061	0.500	0.485	0.1800	1.500	4	0.375	0.019	0.012 - 0.022
...After the part number, please indicate XRN or HSN when ordering.										

HFI Cutting Conditions

Work Material	Material Hardness	Cutting Depth at Diameter ap max				Cutting Width	Coating type Recom.	Cut speed at D	Max Feed per Tooth Fz at cutting insert diameter D			
USA/W.-Nr./JIS	Hrc	0.125	0.250	0.375	0.500	Ae max	Coating	SFM	0.125	0.250	0.375	0.500
H13/1.2344/SKD61	<41	0.006	0.010	0.016	0.020	75%	XRN/HSN	800-1200	.003-.006	.006-.011	.009-.016	.012-.022
H13/1.2344/SKD61	41-50	0.006	0.010	0.016	0.020	75%	XRN/HSN	800-1200	.003-.006	.006-.011	.009-.016	.012-.022
H13/1.2344/SKD61	51+	0.005	0.008	0.012	0.016	75%	HSN	300-600	.003-.006	.006-.011	.009-.016	.012-.022
A2/1,2363/SKD12	<41	0.006	0.010	0.016	0.020	75%	XRN/HSN	800-1200	.003-.006	.006-.011	.009-.016	.012-.022
A2/1,2363/SKD12	41-50	0.006	0.010	0.016	0.020	75%	XRN/HSN	800-1200	.003-.006	.006-.011	.009-.016	.012-.022
A2/1,2363/SKD12	51+	0.005	0.008	0.012	0.016	75%	HSN	300-600	.003-.006	.006-.011	.009-.016	.012-.022
P20/1,2330	<41	0.006	0.010	0.016	0.020	75%	XRN/HSN	800-1200	.003-.006	.006-.011	.009-.016	.012-.022
P20/1,2330	41-50	0.006	0.010	0.016	0.020	75%	XRN/HSN	800-1200	.003-.006	.006-.011	.009-.016	.012-.022
D2/1,2379/SKD11	<41	0.006	0.010	0.016	0.020	75%	XRN/HSN	800-1200	.003-.006	.006-.011	.009-.016	.012-.022
D2/1,2379/SKD11	41-50	0.006	0.010	0.016	0.020	75%	XRN/HSN	300-600	.003-.006	.006-.011	.009-.016	.012-.022
D2/1,2379/SKD11	51+	0.005	0.010	0.012	0.016	75%	HSN	250-500	.003-.006	.006-.011	.009-.016	.012-.022
Grey Cast Iron/GG	<41	0.006	0.010	0.016	0.020	75%	XRN/HSN	1000-3000	.003-.006	.006-.011	.009-.016	.012-.022
Cast Iron/GGG	41+	0.006	0.010	0.016	0.020	75%	XRN/HSN	800-1200	.003-.006	.006-.011	.009-.016	.012-.022
Titanium (6AL 4V)		0.006	0.010	0.016	0.020	75%	XRN/HSN	800-1200	.003-.006	.006-.011	.009-.016	.012-.022

EIS2...LL - 2 Flute Long Series Endmill, Square End

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EIS2-0125-LL-	1/8”	XX	0.125	0.625	2.000
EIS2-0187-LL-	3/16”	XX	0.187	1.000	3.000
EIS2-0250-LL-	1/4”	XX	0.250	1.000	3.000
EIS2-0312-LL-	5/16”	XX	0.312	1.000	3.000
EIS2-0375-LL-	3/8”	XX	0.375	1.000	4.000
EIS2-0437-LL-	7/16”	XX	0.437	1.000	4.000
EIS2-0500-LL-	1/2”	XX	0.500	1.000	4.000
EIS2-0625-LL-	5/8”	XX	0.625	2.000	6.000
EIS2-0750-LL-	3/4”	XX	0.750	2.000	6.000
EIS2-1000-LL-	1”	XX	1.000	2.000	6.000

EIS4...LL - 4 Flute Long Series Endmill, Square End

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EIS4-0125-LL-	1/8”	XX	0.125	0.625	2.000
EIS4-0187-LL-	3/16”	XX	0.187	1.000	3.000
EIS4-0250-LL-	1/4”	XX	0.250	1.000	3.000
EIS4-0312-LL-	5/16”	XX	0.312	1.000	3.000
EIS4-0375-LL-	3/8”	XX	0.375	1.000	4.000
EIS4-0437-LL-	7/16”	XX	0.437	1.000	4.000
EIS4-0500-LL-	1/2”	XX	0.500	1.000	4.000
EIS4-0625-LL-	5/8”	XX	0.625	2.000	6.000
EIS4-0750-LL-	3/4”	XX	0.750	2.000	6.000
EIS4-1000-LL-	1”	XX	1.000	2.000	6.000

AlumiSTAR EISA - 3 Flute Endmill, 45° - Aluminum

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EISA-0125-	1/8”	XX	0.125	0.500	1.500
EISA-0187-	3/16”	XX	0.187	0.625	2.000
EISA-0250-	1/4”	XX	0.250	0.750	2.500
EISA-0312-	5/16”	XX	0.312	0.750	2.500
EISA-0375-	3/8”	XX	0.375	0.875	2.500
EISA-0437-	7/16”	XX	0.437	0.875	2.500
EISA-0500-	1/2”	XX	0.500	1.250	3.000
EISA-0625-	5/8”	XX	0.625	1.250	3.500
EISA-0750-	3/4”	XX	0.750	1.500	4.000
EISA-1000-	1”	XX	1.000	1.500	4.000

AlumiSTAR BIA - 3 Flute Endmill, Ballnose 45° - Aluminum

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
BIA-0125-	1/8”	0.063”	0.125	0.500	1.500
BIA-0187-	3/16”	0.094”	0.187	0.625	2.000
BIA-0250-	1/4”	0.125”	0.250	0.750	2.500
BIA-0312-	5/16”	0.156”	0.312	0.750	2.500
BIA-0375-	3/8”	0.188”	0.375	0.875	2.500
BIA-0437-	7/16”	0.219”	0.437	0.875	2.500
BIA-0500-	1/2”	0.250”	0.500	1.250	3.000
BIA-0625-	5/8”	0.313”	0.625	1.250	3.500
BIA-0750-	3/4”	0.375”	0.750	1.500	4.000
BIA-1000-	1”	0.500”	1.000	1.500	4.000

BI2 - 2 Flute Long Series Endmill, Ballnose

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
BI2-0125-LL-	1/8”	0.063”	0.125	0.625	2.000
BI2-0187-LL-	3/16”	0.094”	0.187	1.000	3.000
BI2-0250-LL-	1/4”	0.125”	0.250	1.000	3.000
BI2-0312-LL-	5/16”	0.156”	0.312	1.000	3.000
BI2-0375-LL-	3/8”	0.188”	0.375	1.000	4.000
BI2-0437-LL-	7/16”	0.219”	0.437	1.000	4.000
BI2-0500-LL-	1/2”	0.250”	0.500	1.000	4.000
BI2-0625-LL-	5/8”	0.313”	0.625	2.000	6.000
BI2-0750-LL-	3/4”	0.375”	0.750	2.000	6.000
BI2-1000-LL-	1”	0.500”	1.000	2.000	6.000

BI4 - 4 Flute Endmill Long Series, Ballnose

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
BI4-0125-LL-	1/8”	0.063”	0.125	0.625	2.000
BI4-0187-LL-	3/16”	0.094”	0.187	1.000	3.000
BI4-0250-LL-	1/4”	0.125”	0.250	1.000	3.000
BI4-0312-LL-	5/16”	0.156”	0.312	1.000	3.000
BI4-0375-LL-	3/8”	0.188”	0.375	1.000	4.000
BI4-0437-LL-	7/16”	0.219”	0.437	1.000	4.000
BI4-0500-LL-	1/2”	0.250”	0.500	1.000	4.000
BI4-0625-LL-	5/8”	0.313”	0.625	2.000	6.000
BI4-0750-LL-	3/4”	0.375”	0.750	2.000	6.000
BI4-1000-LL-	1”	0.500”	1.000	2.000	6.000

EIV4 - 4 Flute Variable Fluted Endmill, Square End w/45° Chamfer

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EIV4-0125-	1/8”	XX	0.125	0.500	1.500
EIV4-0187-	3/16”	XX	0.187	0.625	2.00
EIV4-0250-	1/4”	XX	0.250	0.750	2.500
EIV4-0312-	5/16”	XX	0.312	0.750	2.500
EIV4-0375-	3/8”	XX	0.375	0.875	2.500
EIV4-0437-	7/16”	XX	0.437	0.875	2.500
EIV4-0500-	1/2”	XX	0.500	1.250	3.000
EIV4-0625-	5/8”	XX	0.625	1.250	3.500
EIV4-0750-	3/4”	XX	0.750	1.500	4.000
EIV4-1000-	1”	XX	1.000	1.500	4.000

BI220 - 220° 2 Flute Endmill, Ballnose

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
BI220-0125-	1/8”	0.125”	0.125	0.0938	1.500
BI220-0187-	3/16”	0.093”	0.187	0.141	2.000
BI220-0250-	1/4”	0.125”	0.250	0.188	2.500
BI220-0312-	5/16”	0.156”	0.312	0.234	2.500
BI220-0375-	3/8”	0.187”	0.375	0.281	2.500
BI220-0437-	7/16”	0.218”	0.437	0.328	2.500
BI220-0500-	1/2”	0.250”	0.500	0.375	3.000

EIS2 - 2 Flute Endmill, Square End

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)	Nose Taper Per Side
EIS2-031-	1/32”	XX	0.125	0.094	1.500	7.5 Deg
EIS2-062-	1/16”	XX	0.125	0.250	1.500	7.5 Deg
EIS2-093-	3/32”	XX	0.125	0.375	1.500	7.5 Deg
EIS2-0125-	1/8”	XX	0.125	0.500	1.500	-
EIS2-0187-	3/16”	XX	0.187	0.625	2.000	-
EIS2-0250-	1/4”	XX	0.250	0.750	2.500	-
EIS2-0312-	5/16”	XX	0.312	0.750	2.500	-
EIS2-0375-	3/8”	XX	0.375	0.875	2.500	-
EIS2-0437-	7/16”	XX	0.437	0.875	2.500	-
EIS2-0500-	1/2”	XX	0.500	1.250	3.000	-
EIS2-0625-	5/8”	XX	0.625	1.250	3.500	-
EIS2-0750-	3/4”	XX	0.750	1.500	4.000	-
EIS2-0875-	7/8”	XX	0.875	1.500	4.000	-
EIS2-1000-	1”	XX	1.000	1.500	4.000	

EIS4 - 4 Flute Endmill, Square End

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)	Nose Taper Per Side
EIS4-031-	1/32”	XX	0.125	0.094	1.500	7.5 Deg
EIS4-062-	1/16”	XX	0.125	0.250	1.500	7.5 Deg
EIS4-093-	3/32”	XX	0.125	0.375	1.500	7.5 Deg
EIS4-0125-	1/8”	XX	0.125	0.500	1.500	-
EIS4-0187-	3/16”	XX	0.187	0.625	2.000	-
EIS4-0250-	1/4”	XX	0.250	0.750	2.500	-
EIS4-0312-	5/16”	XX	0.312	0.750	2.500	-
EIS4-0375-	3/8”	XX	0.375	0.875	2.500	-
EIS4-0437-	7/16”	XX	0.437	0.875	2.500	-
EIS4-0500-	1/2”	XX	0.500	1.250	3.000	-
EIS4-0625-	5/8”	XX	0.625	1.250	3.500	-
EIS4-0750-	3/4”	XX	0.750	1.500	4.000	-
EIS4-0875-	7/8”	XX	0.875	1.500	4.000	-

Indexable Milling Holder Identification System

CB	SFCY	12	-	150	-	12
Denotes Shank Material "CB" = Carbide " "= Steel	Shank Type SFCY = Cylindrical CY = Cylindrical Spike SFTA = Taper TA = Taper Spike	Diameter Size		Tool Cutter Length		Tool Cutter Diameter

The Inserts

- Millstar inserts are fully ground precision inserts for better chip control, faster metal removal and higher surface accuracies. They are far more accurate than pressed and O.D. sharpened inserts. Millstar insert radius and seat are accurate to +/- 0.00025" (+/- 0.0065 mm) of nominal radius and cut exactly as programmed. This unparalleled accuracy also eliminates redundant Z-axis pick ups and assures accurate blending.
- Positive ground chipbreaker or strong negative cutting edge designs guarantee outstanding cutting performance in a wide variety of ferrous and non-ferrous materials.
- A choice of state-of-the-art insert grades, designs and tool coatings allow for optimum speed and feed rates in wet and dry machining. Reduced machining times by 25% to 60% are not uncommon.
- Economical one-piece inserts with two cutting edges are cost-effective for contour milling. True radius geometry is fully CNC-ground for higher machining accuracy and greatly reduced manual finishing and polishing time.
- Choose from side-cutting ball nose inserts with 180 degree nose radius, and popular ball nose inserts with a cutting edge covering 230 degrees for steep wall up-and-down ramping, profiling, contour milling and blending, and for a wider range of applications compared to conventional ball nose tools.
- Select from a variety of flat bottom, back draft and toroid inserts for steep or straight wall milling with long extensions on hard to reach cores, cavities or fillets. Milling with small radii prevents deflection and results in superior finishes and contour accuracies. Available with or without chipbreaker and coating in a variety of corner radii and sizes.

Rock Solid Insert Clamping

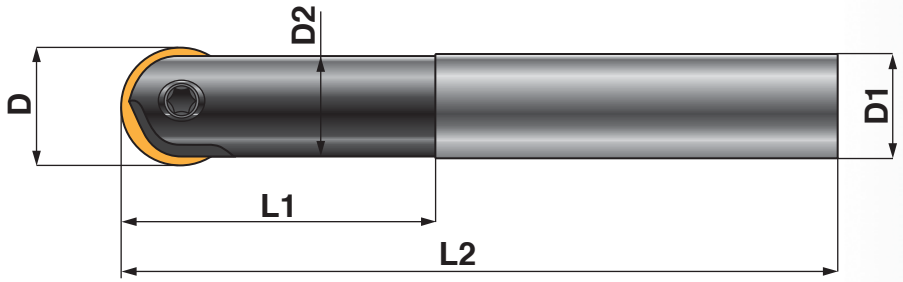
Cutting insert clamping is highly accurate and rigid. Unique V-pocket design gives a truly positive seat for the insert and will not allow insert movement when milling with a side thrust. "Sandwiched" insert clamping with single locking screw is unsurpassed for rigidity. The advanced design of Millstar inserts eliminates heat-seizing of locking screws or insert movement due to costly locating screws or pins of less advanced design. Positive V-pocket seating eliminates mismatch when changing to fresh inserts. It also eliminates the need to program new length or diameter offsets.

The Tool Holders

Millstar is proud to offer the largest selection of roughing and finishing ball nose, back draft, flat bottom and toroid milling cutters available from one source. Cylindrical and tapered toolholders include the longest reach profiling tools available as standard catalog items. Tool holders are inherently balanced for high spindle speeds. Machine with confidence at the increased speeds and velocities dictated by modern high velocity machining. Super intelligent machine controls with high speed data transfer, rapid advances in cutting edge materials and coating technologies enable ever faster machining speeds and increased productivity. Millstar tools are designed to keep pace.

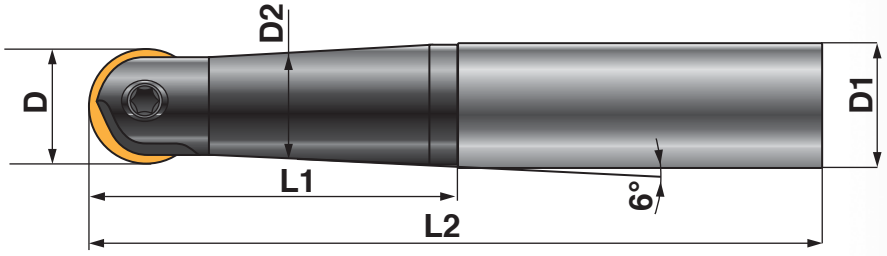
The Millstar product line is manufactured in the USA under ISO 9001 specifications, and all tools are fully traceable. Nearly six decades of cutting tool design and manufacturing for automotive, aerospace and many other industries, as well as special design capabilities using 3-D CAD allow us to respond quickly to requests for special designs.

SFCY - Cylindrical Steel Shank Holder, Ball



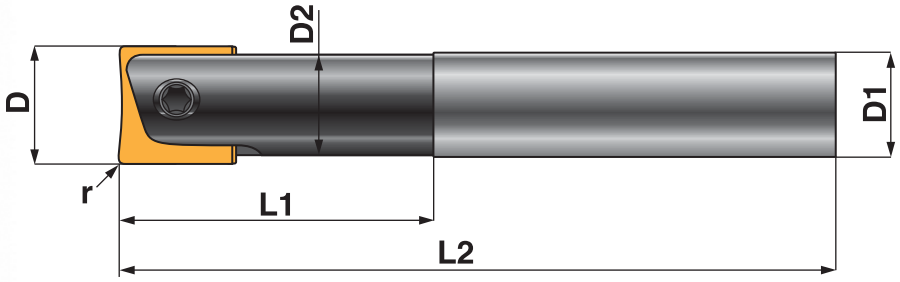
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
SFCY 12-125-12	12	12	10,8	36	125	MS12	T20		MB, MBT, RB-N, BS-N
SFCY 12-150-12	12	12	10,8	46	150	MS12	T20		
SFCY 14-125-16	14	16	12,6	36	125	MS16	T20		
SFCY 16-160-16	16	16	14,4	50	160	MS16	T20		
SFCY 20-150-20	20	20	18,0	50	150	MS20	T20		
SFCY 20-190-20	20	20	18,0	61	190	MS20	T20		
SFCY 22-200-25	22	25	19,8	50	200	MS25	T20		
SFCY 25-150-25	22	25	22,5	50	150	MS25	T20		
SFCY 25-200-25	25	25	22,5	64	200	MS25	T20		
SFCY 25-250-25	25	25	22,5	64	250	MS25	T20		
SFCY 30/32-190-32	30/32	32	27,2	57	190	MS32	T30		
SFCY 30/32-250-32	30/32	32	27,2	76	250	MS32	T30		
SFCY 30/32-300-32	30/32	32	27,2	57	300	MS32	T30		

SFTA - Taper Steel Shank Holder, Ball



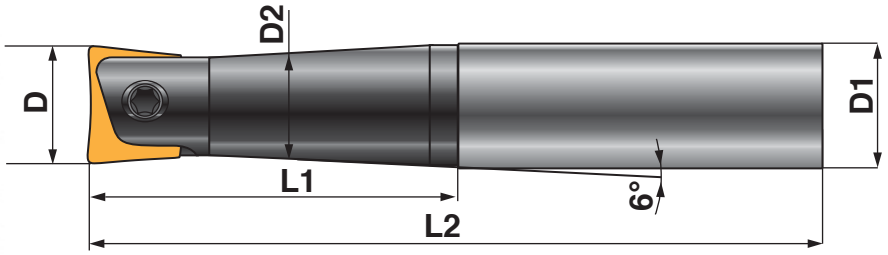
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
SFTA 12-190-16	12	16	10,8	60	190	MS12	T20		MB, MBT, RB-N, BS-N
SFTA 16-190-20	16	20	14,4	57	190	MS16	T20		
SFTA 20-200-25	20	25	18,0	80	200	MS20	T20		
SFTA 25-250-32	25	32	22,5	100	250	MS25	T20		
SFTA 25-315-32	25	32	22,5	100	315	MS25	T20		
SFTA 30/32-250-40	30/32	40	27,2	120	250	MS32	T30		
SFTA 30/32-250-42	30/32	42	27,2	120	250	MS32	T30		

CYF - Cylindrical Steel Shank Holder, Flat



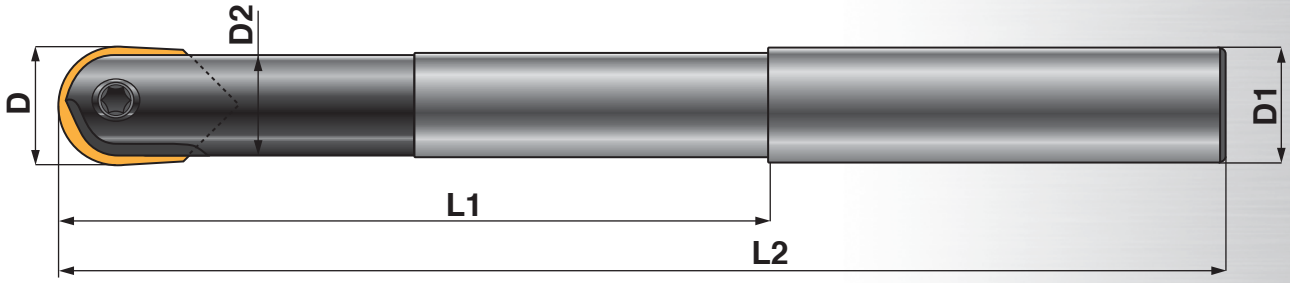
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
CYF 10-100-10	10	10	9,0	19	100	MS10	T15		BD-N, BD-R, BDS, FB-R, TO, TOBD-NF, HF
CYF 12-125-12	12	12	10,8	36	125	MS12	T20		
CYF 12-150-12	12	12	10,8	46	150	MS12	T20		
CYF 16-160-16	16	16	14,4	50	160	MS16	T20		
CYF 20-150-20	20	20	18,0	50	150	MS20	T20		
CYF 20-200-20	20	20	18,0	61	200	MS20	T20		
CYF 25-150-25	25	25	22,5	50	150	MS25	T20		
CYF 25-200-25	25	25	22,5	64	200	MS25	T20		
CYF 30/32-190-32	30/32	32	28,6	57	190	MS32	T30		
CYF 30/32-250-32	30/32	32	28,6	76	250	MS32	T30		

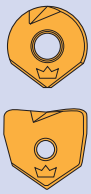
TAF - Taper Steel Shank Holder, Flat



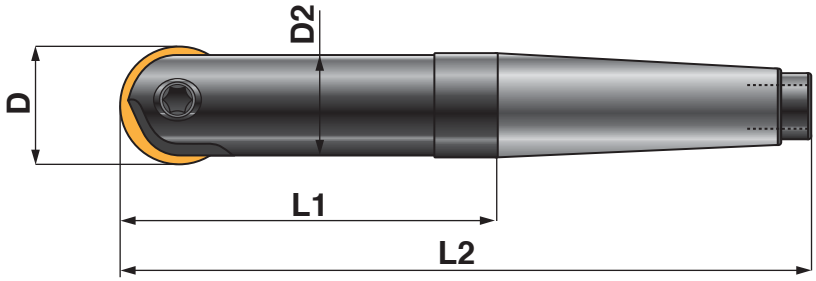
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
TAF 10-150-12	10	12	9,0	35	150	MS10	T15		BD-N, BD-R, BDS, FB-R, TO, TOBD-NF, HF
TAF 12-190-16	12	16	10,8	60	190	MS12	T20		
TAF 16-190-20	16	20	14,4	57	190	MS16	T20		
TAF 20-200-25	20	25	18,0	80	200	MS20	T20		
TAF 25-250-32	25	32	22,5	100	250	MS25	T20		
TAF 25-315-32	25	32	22,5	100	315	MS25	T20		
TAF 30/32-250-40	30/32	40	28,6	120	250	MS32	T30		

TAV, CY, TA - Spike-Line Cylindrical Steel Shank



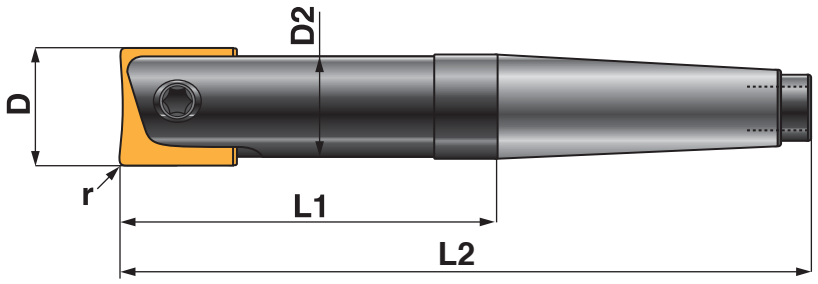
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
TAV 06-095-12	6	12	5,7	30	95	MS06N	T7		VRBS, VBD, MB, MBT, RB-N, BS-N, BD, BDS, FB, TO, HF
TAV 08-095-12	8	12	7,5	32	95	MS08N	T7		
CY 10-100-10	10	10	9,0	19	100	MS10	T15		
CY 10-100-12	10	12	9,0	25	100	MS10	T15		
TA 10-125-12	10	12	9,0	35	125	MS10	T15		
TA 10-150-12	10	12	9,0	35	150	MS10	T15		

CYMK - Morse Steel Shank Holder, Ball



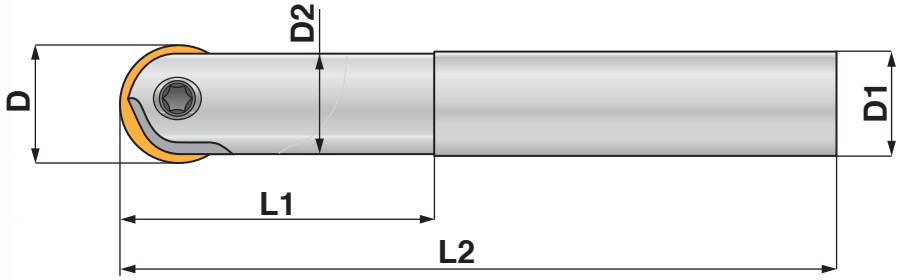
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck L1	Total L2	MORSE			Type	Code
CYMK 2-130-12	12	10,8	40	130	MK2	MS12	T20		MB, MBT, RB-N, BS-N
CYMK 2 140-16	16	14,4	45	140	MK2	MS16	T20		
CYMK 2-150-20	20	18,0	55	150	MK2	MS20	T20		
CYMK 3-180-25	25	22,5	70	180	MK3	MS25	T20		
CYMK 4-210-32	32	27,2	75	210	MK4	MS25	T20		

CYFMK - Morse Steel Shank Holder, Flat



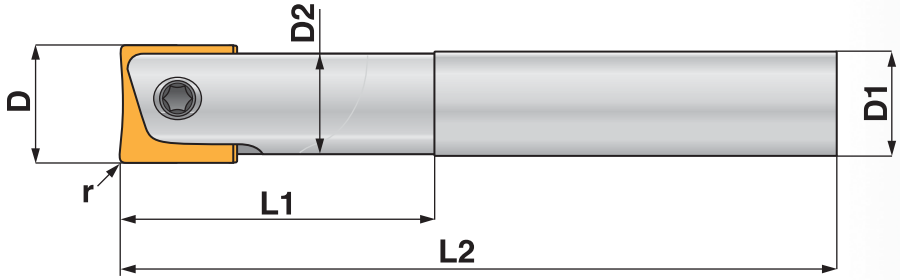
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck L1	Total L2	MORSE			Type	Code
CYFMK 2-130-12	12	10,8	40	130	MK2	MS12	T20		BD-N, BD-R, BDS, FB-R, TO, TOBD-NF, HF
CYFMK 2 140-16	16	14,4	45	140	MK2	MS16	T20		
CYFMK 2-150-20	20	18,0	55	150	MK2	MS20	T20		
CYFMK 3-180-25	25	22,5	70	180	MK3	MS25	T20		
CYFMK 4-210-32	32	27,2	75	210	MK4	MS25	T20		

CB SFCY - Cylindrical Carbide Shank Holder, Ball



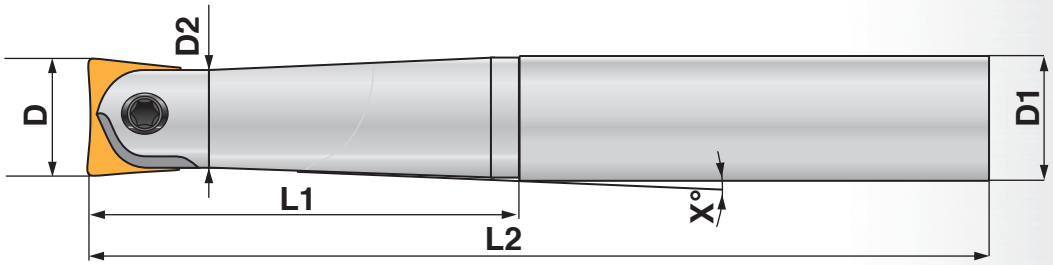
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
CBSFCY 12-150-12	12	12	10,8	52	165	MS12	T20		MB, MBT, RB-N, BS-N
CBSFCY 16-150-16	16	16	14,4	52	170	MS16	T20		
CBSFCY 20-200-20	20	20	18,0	77	225	MS20	T20		
CBSFCY 25-200-25	25	25	22,5	93	230	MS25	T20		
CBSFCY 30/32-190-32	30/32	32	27,2	57	230	MS32	T30		

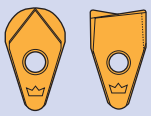
CB CYF - Cylindrical Carbide Shank Holder, Flat



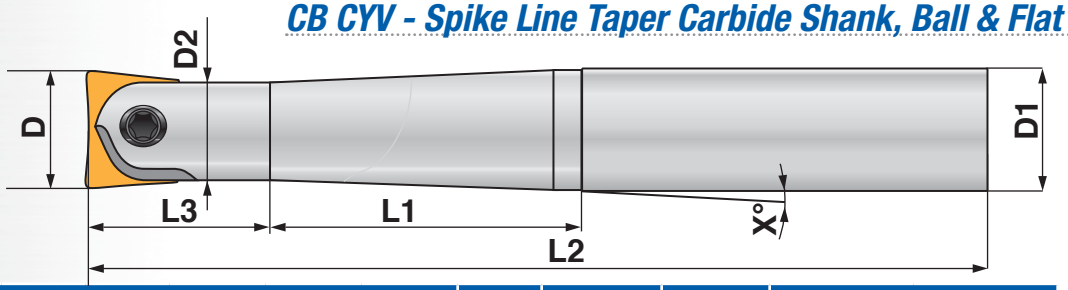
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2			Type	Code
CBCYF 12-150-12	12	12	10,8	52	165	MS12	T20		BD-N, BD-R, BDS, FB-R, TO, TOBD-NF, HF
CBCYF 16-150-16	16	16	14,4	52	170	MS16	T20		
CBCYF 20-200-20	20	20	18,0	77	225	MS20	T20		
CBCYF 25-200-25	25	25	22,5	93	230	MS25	T20		

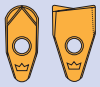
CB TAV - Spike-Line Taper Carbide Shank, Ball & Flat



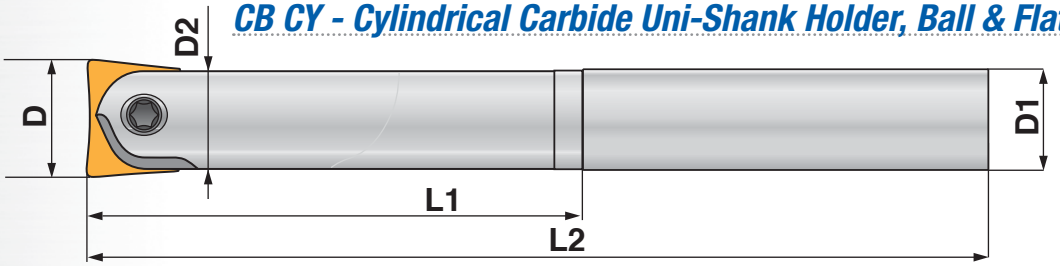
Tool Ordering Number	Dimensions					X°	Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck Length L1	Total Length L2				Type	Code
CBTAV 06-075-12	6	12	5,7	35	75	1,5°	MS06N	T7		VRBS, VBD
CBTAV 06-150-12	6	12	5,7	30	155	3°	MS06N	T7		
CBTAV 06-150-12 LT	6	12	5,7	70	155	3°	MS06N	T7		
CBTAV 08-080-12	8	12	7,5	40	80	1,5°	MS08N	T7		
CBTAV -08150-12	8	12	7,5	30	155	3°	MS08N	T7		

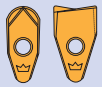
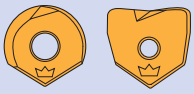
CB CYV - Spike Line Taper Carbide Shank, Ball & Flat



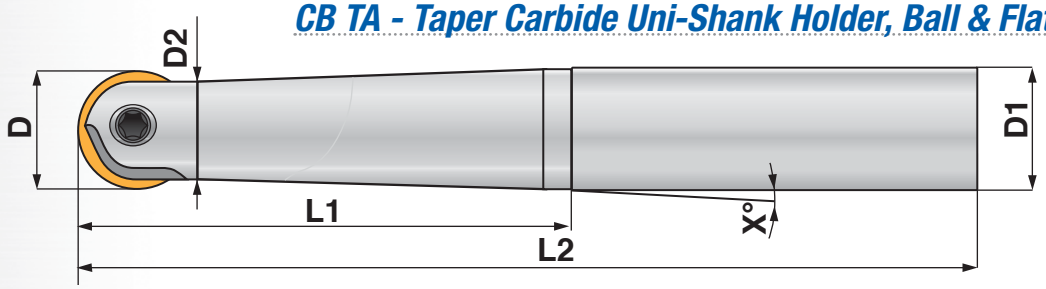
Tool Ordering Number	Dimensions						X°	Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck L3	Shaft L1	Total L2				Type	Code
CBCYV 06-115-12	6	12	5,7	30	45	115	1°	MS06N	T7		VRBS, VBD
CBCYV 08-100-12	8	12	7,5	30	30	100	1°	MS08N	T7		

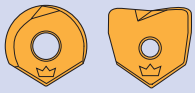
CB CY - Cylindrical Carbide Uni-Shank Holder, Ball & Flat



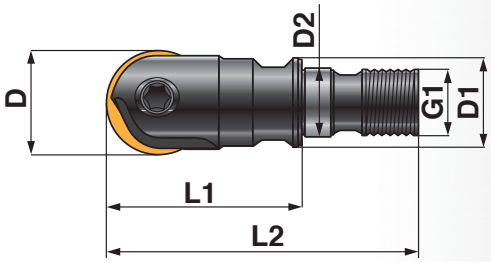
Tool Ordering Number	Dimensions					Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck L1	Total L2			Type	Code
CBCYV 06-115-06	6	6	5,7	30	115	MS06N	T7		VRBS, VBD
CBCYV 08-130-08	8	8	7,5	30	130	MS08N	T7		
CBCY 10-150-10	10	10	9,0	32	150	MS10	T15		MB, MBT, RB-N, BS-N, BD, BDS, FB, TO, HF

CB TA - Taper Carbide Uni-Shank Holder, Ball & Flat



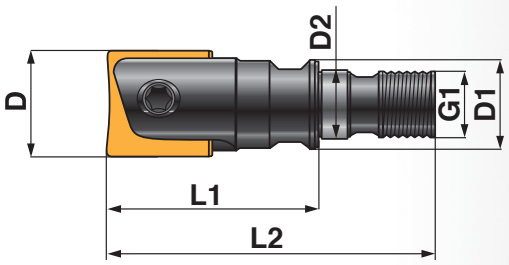
Tool Ordering Number	Dimensions					X°	Screw	Key	Use with Inserts	
	Size ØD	Shank ØD1	Neck ØD2	Neck L1	Total L2				Type	Code
CBTA 10-150-12	10	12	9,0	30	165	3°	MS10	T15		MB, MBT, RB-N, BS-N, BD, BDS, FB, TO, HF

SF CY - Screw-on Head, Ball



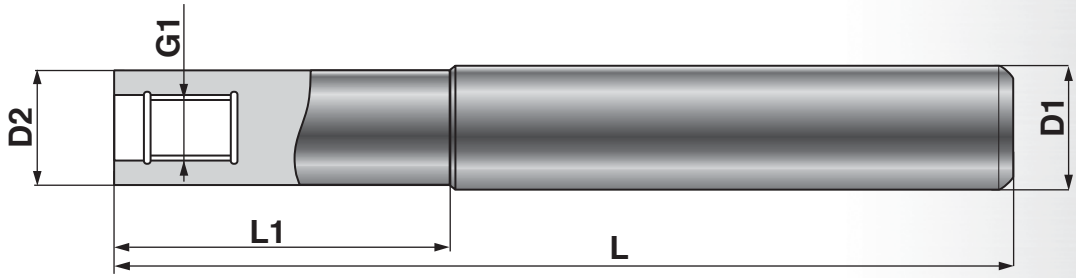
Tool Ordering Number	Size ØD	Diameter D1	Diameter D2	Thread G1	Length L1	Length L2	Screw	Key	Use with Inserts	
									Type	Code
SFCY 10-SC-M6	10	10	6,5	M6	24	40	MS10	T15		MB, MBT, RB-N, BS-N
SFCY 12-SC-M6	12	12	6,5	M6	26	42	MS12	T20		
SFCY 16-SC-M8	16	16	8,5	M8	30	48	MS16	T20		
SFCY 20-SC-M10	20	20	10,5	M10	36	56	MS20	T20		
SFCY 25-SC-M12	25	25	12,5	M12	44	65	MS25	T20		
SFCY 32-SC-M16	32	32	16,5	M16	50	74	MS32	T30		

CYF - Screw-on Head, Flat



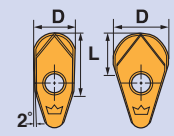
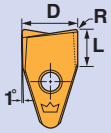
Tool Ordering Number	Size ØD	Diameter D1	Diameter D2	Thread G1	Length L1	Length L2	Screw	Key	Use with Inserts	
									Type	Code
CYF 10-SC-M6	10	10	6,5	M6	24	40	MS10	T15		BD-N, BD-R, BDS, FB-R, TO, TOBD-NF, HF
CYF 12-SC-M6	12	12	6,5	M6	26	42	MS12	T20		
CYF 16-SC-M8	16	16	8,5	M8	30	48	MS16	T20		
CYF 20-SC-M10	20	20	10,5	M10	36	56	MS20	T20		
CYF 25-SC-M12	25	25	12,5	M12	44	65	MS25	T20		
CYF 32-SC-M16	32	32	16,5	M16	50	74	MS32	T30		

Solid Carbide Adaptor

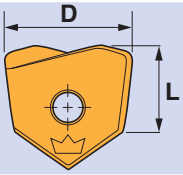


Tool Ordering Number	Dimensions				Thread G1	Screw	Key
	Size ØD1	Neck ØD2	Neck L1	Total L			
CY-10-150-SC-M6	10	6,5	30	150	M6	MS10	T15
CY 12-150-SC-M6	12	6,5	27	150	M6	MS12	T20
CY-16-200-SC-M8	16	8,5	31	200	M8	MS16	T20
CY-20-200-SC-M10	20	10,5	36	200	M10	MS20	T20
CY-25-250-SC-M12	25	12,5	44	250	M12	MS25	T20
CY-32-300-SC-M16	32	16,5	52	300	M16	MS32	T30

Small Ball Nose & Back Draft Inserts

VRBS	Tool Ordering Number	Dimensions			Grade			Description
		D	L	R	XRN	TLN	HSN	
	VRBS 6	6	8,10	3	•	•	•	Used for rough to finish-milling small radius or detail work, and surface milling in soft and herd steel, cast iron, aerospace and non-ferrous alloys, graphite, etc. Suitable for high speed and hard milling.
	VRBS 8	8	4,50	4	•	•	•	
VBD								
	VBD -06	6	8,6	0,4	•	•	•	Used for rough to finish-milling small radius or detail work, and surface milling in soft and herd steel, cast iron, aerospace and non-ferrous alloys, graphite, etc. Suitable for high speed and hard milling
	VBD -08	8	5	0,4	•	•	•	

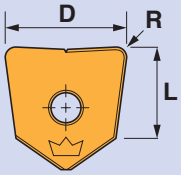
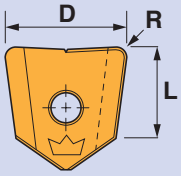
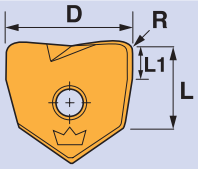
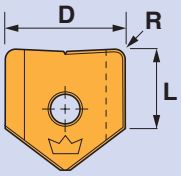
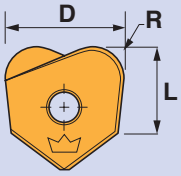
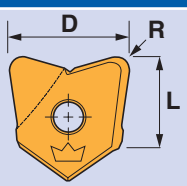
High Feed Inserts

HF	Tool Ordering Number	Dimensions			Grade			Description
		D	L	PR	XRN	TLN	HSN	
	HF 10	10	3	1,00	•	•	•	Millstar HF insert is designed for High feed and High speed machining. It runs at high cutting speed and feed rates with shallow depth of cut. It allows the chip to flow up and out of the cut quickly. It allows heavy chip loads.
	HF 12	12	4	1,43	•	•	•	
	HF 16	16	5	1,94	•	•	•	
	HF 20	20	6	2,26	•	•	•	
	HF 25	25	7	2,82	•	•	•	

Cutting Recommendations for High Feed Inserts

Work Material	Material Hardness	Cutting Depth at Diameter ap max					Cutting Width	Insert	Coating Type Recom.	Cut speed at D	Max feed per tooth fz at cutting insert diameter D				
USA/W.-Nr./ JIS	Hrc	10	12	16	20	25	Ae max			sfm/min	10	12	16	20	25
H13/1.2344/ SKD61	<41	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	244-365	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
H13/1.2344/ SKD61	41-50	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	183-244	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
H13/1.2344/ SKD61	51+	0.3	0.4	0.48	0.64	0.8	75%	HF	HSN	90-150	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
A2/1,2363/ SKD12	<41	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	244-365	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
A2/1,2363/ SKD12	41-50	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	183-244	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
A2/1,2363/ SKD12	51+	0.3	0.4	0.48	0.64	0.8	75%	HF	HSN	90-150	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
P20/1,2330	<41	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	244-365	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
P20/1,2330	41-50	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	183-244	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
D2/1,2379/ SKD11	<41	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	183-244	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
D2/1,2379/ SKD11	41-50	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	105-140	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
D2/1,2379/ SKD11	51+	0.3	0.4	0.48	0.64	0.8	75%	HF	HSN	80-140	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
Grey Cast Iron/GG	<41	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	350-900	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
Cast Iron/ GGG	41+	0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	250-400	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0
Titanium (6AL 4V)		0.4	0.48	0.64	0.8	1	75%	HF	XRN/HSN	183-365	0,25~0,5	0,3~0,55	0,4~0,71	0,5~0,89	0,56~1,0

Flat Bottom, Back Draft, Toroid

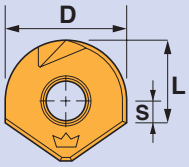
BD-N	Tool Ordering Number	Dimensions D	L	R	Grade XRN	TLN	HSN	Description
	BD 10 N	10	8,5	0,5/0,8/1	•	•	•	Precision ground with 7° back taper. Used for milling of cores, cavities, fillets with straight or very steep walls of harder materials.
	BD 12 N	12	9,95	0,5/1/2	•	•	•	
	BD 16 N	16	11,55	0,5/1/1,3/2/3	•	•	•	
	BD 20 N	20	13,35	0,5/1/1,6/2/3	•	•	•	
	BD 25 N	25	19,95	1/2	•	•	•	
	BD 30 N	30	23,35	1/2,6	•	•	•	
	BD 32 N	32	8,5	1,0/2,6	•	•	•	
BD-R	**Number**	**D**	**L**	**R**	**XRN**	**TLN**	**HSN**	**Description**
	BD 10 R	10	8,5	0,5/0,8/1	•	•	•	Precision ground with positive ground chip-breaker and 7° back taper. Used for milling of cores, cavities, filets with straight or very steep walls of softer materials.
	BD 12 R	12	9,95	0,5/1	•	•	•	
	BD 16 R	16	11,55	0,5/1/1,3	•	•	•	
	BD 20 R	20	13,35	0,5/1/1,6	•	•	•	
	BD 25 R	25	19,95	1/2	•	•	•	
	BD 32 R	32	23,35	2,6	•	•	•	
BDS	**Number**	**D**	**L**	**R**	**L1**	**XRN**	**TLN**	**HSN**	**Description**
	BDS 10 N	10	8,5	0,8/1,0	3	•	•	•	Precision ground with unique cross-over design between flat bottom FB and back draft DB inserts. Allows straight walls with a larger step down than BD. Allows higher cutting speeds and feeds.
	BDS 12 N	12	9,95	1	3	•	•	•	
	BDS 16 N	16	11,55	1/1,3	3	•	•	•	
	BDS 20 N	20	13,35	1/1,6	3	•	•	•	
	BDS 25 N	25	19,95	1/2	3	•	•	•	
FB-R	**Number**	**D**	**L**	**R**	**XRN**	**TLN**	**HSN**	**Description**
	FB 10 R	10	8,5	0,8	•	•	•	Precision ground with positive ground chip-breaker. Flat bottom inserts for shoulder milling, fillet finishing and long reach angular wall finishing of softer materials.
	FB 12 R	12	9,15	1	•	•	•	
	FB 16 R	16	10,65	0,5/1,3	•	•	•	
	FB 20 R	20	12,25	1,6	•	•	•	
	FB 25 R	25	16,35	2	•	•	•	
	FB 32 R	32	21,3	2,6	•	•	•	
TO	**Number**	**D**	**L**	**R**	**XRN**	**TLN**	**HSN**	**Description**
	TO 10	10	8,65	3	•	•	•	Precision ground large corner radius & back taper for spiral and packet milling. Milling of pre-hard and hardened flat surfaces at higher speeds than tools with smaller corner radii. Good choice for HS milling of Aluminum.
	TO 12	12	9,20	3	•	•	•	
	TO 16	16	11,25	4	•	•	•	
	TO 20	20	13,15	5	•	•	•	
	TO 25	25	18,25	6	•	•	•	
	TO 30	30	22,15	7,5	•	•	•	
	TO 32	32	21,95	8	•	•	•	
TOBD-NF	**Number**	**D**	**L**	**R**	**XRN**	**TLN**	**HSN**	**Description**
	TOBD 12-NF	12	9,2	3	•	•	•	Millstar inserts designed for high seed high feed roughing of Aluminum, but also has the versatility to be used for fine finishing as well.
	TOBD 16-NF	16	11,25	3	•	•	•	
	TOBD 20-NF	20	13,15	3	•	•	•	
	TOBD 25-NF	25	18,25	3	•	•	•	

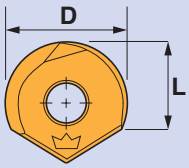
Insert Coatings

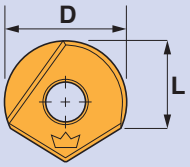
NA Non-coated grade. The lowest cost choice. May be used at normal speeds, or lower speeds on older machines, for all purpose milling. May be resharpened or altered.

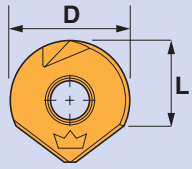
XRN Multi-layer hybrid coating of AlTiCrN. This coating has very good heat resistance and also a low friction coefficient. The XRN coating is designed for use in HSM of un-heat treated softer materials such as Titanium, Inconel, Stainless Steels and other gummy materials that require the use of liquid coolant.

Ball Nose Inserts

BS-N	Tool Ordering Number	Dimensions D	L	S	Grade XRN	TLN	HSN	Description
	BS 10 N	10	9,50	3,65	•	•	•	Sidecutting, non-chipbreaker. Side cutting insert used in cavity and core profiling, for blending of fillets on medium and hard materials.
	BS 12 N	12	8,80	2,90	•	•	•	
	BS 16 N	16	10,70	2,85	•	•	•	
	BS 20 N	20	12,75	2,85	•	•	•	
	BS 25 N	25	17,20	4,85	•	•	•	
	BS 30 N	30	20,00	5,10	•	•	•	
	BS 32 N	32	21,00	5,30	•	•	•	

MB	Number	D	L	XRN	TLN	HSN	Description
	MB 10	10	8,65	•	•	•	Unique cutting edge allows performance in all operations in material below 42 HRc; in semi, & finishing operations above. Significant benefits in heat-treated intricate geometries. Insert geometry allows smoother cutting motion-diminishing heat build up & tool deflection, reduces vibration caused by cutting action.
	MB 12	12	9,20	•	•	•	
	MB 16	16	11,25	•	•	•	
	MB 20	20	13,15	•	•	•	
	MB 25	25	18,25	•	•	•	
	MB 30	30	22,15	•	•	•	
	MB 32	32	21,95	•	•	•	

MBT	Number	D	L	XRN	TLN	HSN	Description
	MBT 10	10	8,65	•	•	•	Precision ground, harder grade, for semi-finish and finish milling. Excellent choice for unattended finish milling at small depth and high speeds and feed rates.
	MBT 12	12	9,20	•	•	•	
	MBT 16	16	11,25	•	•	•	
	MBT 20	20	13,15	•	•	•	
	MBT 25	25	18,25	•	•	•	
	MBT 30	30	22,15	•	•	•	
	MBT 32	32	21,95	•	•	•	

RB-N	Number	D	L	XRN	TLN	HSN	Description
	RB 10 N	10	9,50	•	•	•	Precision ground, non-chipbreaker. Best choice for cavity, core and profile milling of pre-hard and fully hard die/mold steels, cast steels and cast iron. Strongest cutting edge design.
	RB 12 N	12	9,20	•	•	•	
	RB 14 N	14	9,45	•	•	•	
	RB 16 N	16	11,25	•	•	•	
	RB 20 N	20	13,15	•	•	•	
	RB 22 N	22	17,45	•	•	•	
	RB 25 N	25	18,25	•	•	•	
	RB 30 N	30	22,15	•	•	•	
	RB 32 N	32	21,95	•	•	•	

TCN Titanium Carbo-Nitride PVD multi layer coating. Higher hardness and toughness than TIN. Choose on heavy cuts or high feeds and speeds, preferably with coolant. Excellent crater and wear resistance. Useful on abrasive and gummy materials (cast iron, brass, aluminum alloys) and on stainless steels and highly alloyed materials, including nickel and chrome based alloys.

HSN Millstar's new coating is a multi-layer hybrid Nano coating. This new coating has very good heat resistance and high hardness. The HSN coating is designed for use in HSM of Heat Treated materials up to 72 HRc Customers using our new HSN coating are seeing average tool life increases of 3-4 times more than the competition. Tool life increases as much as 10 times have been documented.

ALTiN-EXALON (TLN) Titanium Aluminum Nitride advanced PVD coating. A special, improved ALTiN coating approaching surface hardness of CBN on a tough substrate. Recommended for tough and hard metal machining applications. When high cutting temperatures are encountered the coating acts as a heat barrier, protecting the cutting edge. This allows for aggressive, high speed and dry milling so often encountered in today's die and mold machining. Use on tool, die and higher alloy steels, especially at hardness over 40 HRc. Also appropriate for all stainless steels (300, 400 and PH series), nickel alloys, titanium, nodular and gray cast iron. Also useful in machining carbon graphite.

DMD Diamond coating. Custom coating for cutting non-ferrous, non-metallic and very abrasive materials at highly elevated speeds. Use on copper, bronze, brass, aluminum-silicon alloys, carbon graphite, solid and fiber-reinforced plastics, ceramics and composite materials.

Cutting Conditions for Using Steel Shank Holders

WORKING MATERIAL	HARDNESS	GRADE	Vc m/min	FEED fn (mm/Rev) INSERT DIAMETER (mm)									Ap Max mm	Ae Max mm
				6	8	10	12	16	20	25	30	32		
Low Alloy Steel (1.7225)	200-280HB	TLN	150-200	0,2	0,3	0,4	0,4	0,5	0,5	0,6	0,6	0,6	D/15	D/15
Alloy & Die Steel (1.2311, P20, DME2/3/5)	32-42HRC	TLN	100-150	0,15	0,25	0,3	0,4	0,4	0,4	0,5	0,5	0,5	D/20	D/20
Tool Steel (1.2344, 1.2379)	42-52HRC	TLN	120-160	0,15	0,25	0,3	0,4	0,5	0,5	0,6	0,6	0,6	D/20	D/20
Stainless Steel (1.4301, 1.4401)	200-350HB	XRN,TCN, TLN	90-120	0,15	0,25	0,3	0,4	0,4	0,4	0,5	0,5	0,5	D/20	D/20
Gray Cast Iron (GG25-GG30)	160-260HB	TLN	200-360	0,2	0,3	0,4	0,5	0,6	0,6	0,7	0,7	0,7	D/10	D/10
Nodular Cast Iron (GGG60-GGG70)	180-300HB	TLN	150-300	0,2	0,3	0,4	0,5	0,6	0,6	0,7	0,7	0,7	D/15	D/15
Copper Alloy	80-150HB	XRN	150-200	0,25	0,4	0,5	0,6	0,7	0,7	0,8	0,8	0,8	D/10	D/10
Aluminum Alloys	30-120HB	XRN	200-300	0,25	0,4	0,5	0,6	0,7	0,7	0,8	0,8	0,8	D/6	D/6
Graphite		TLN	200-400	0,3	0,5	0,6	0,7	0,8	0,8	0,9	0,9	0,9	D/5	D/5
Ni & Co Based Alloy	250-320HB	XRN, HSN	30-70	0,15	0,2	0,3	0,4	0,4	0,5	0,5	0,6	0,6	D/30	D/30
Titanium Alloy (Annealed)	<350HB	XRN, HSN	50-120	0,15	0,2	0,25	0,35	0,35	0,4	0,45	0,5	0,5	D/33	D/33
Titanium Alloy (Sol. Treated/Aged)	<380HB	XRN, HSN	40-90	0,1	0,15	0,2	0,3	0,3	0,35	0,4	0,45	0,45	D/35	D/35
Harden Steel (1.2344, 1.2379)	45-55HRC	HSN, TLN	70-90	0,15	0,25	0,3	0,4	0,5	0,5	0,6	0,6	0,6	D/30	D/30

Cutting Conditions for Using Carbide Shank Holders

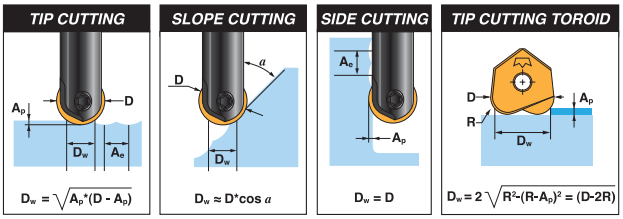
WORKING MATERIAL	HARDNESS	GRADE	Vc m/min	FEED fn (mm/Rev) INSERT DIAMETER (mm)									Ap Max mm	Ae Max mm
				6	8	10	12	16	20	25	30	32		
Low Alloy Steel (1.7225)	200-280HB	TLN	260-380	0,3	0,4	0,4	0,5	0,6	0,6	0,7	0,7	0,7	0,1-0,3	D/50
Alloy & Die Steel (1.2311, P20, DME2/3/5)	32-42HRC	TLN	250-330	0,25	0,3	0,3	0,4	0,5	0,5	0,6	0,6	0,6	0,1-0,2	D/50
Tool Steel (1.2344, 1.2379)	42-52HRC	TLN	240-320	0,25	0,3	0,3	0,4	0,5	0,5	0,6	0,6	0,6	0,1-0,2	D/50
Stainless Steel (1.4301, 1.4401)	200-350HB	XRN,TCN, TLN	200-260	0,25	0,3	0,4	0,5	0,6	0,65	0,7	0,8	0,8	0,1-0,2	D/50
Gray Cast Iron (GG25-GG30)	160-260HB	TLN	360-450	0,35	0,45	0,5	0,5	0,6	0,7	0,8	1,0	1,0	0,1-0,3	D/40
Nodular Cast Iron (GGG60-GGG70)	180-300HB	TLN	300-400	0,3	0,4	0,4	0,5	0,6	0,6	0,7	0,8	0,8	0,1-0,3	D/15
Copper Alloy	80-150HB	XRN	300-400	0,3	0,4	0,4	0,5	0,6	0,6	0,7	0,7	0,7	0,1-0,5	D/40
Aluminum Alloys	30-120HB	XRN	400-500	0,3	0,4	0,5	0,6	0,7	0,7	0,8	0,8	0,8	0,1-0,5	D/40
Graphite		TLN	600-800	0,3	0,5	0,6	0,7	0,8	0,8	0,9	0,9	0,9	0,1-0,5	D/40
Ni & Co Based Alloy	250-320HB	XRN, HSN	80-110	0,25	0,3	0,4	0,4	0,5	0,6	0,6	0,7	0,7	D/30	D/50
Titanium Alloy (Annealed)	<350HB	XRN, HSN	150-230	0,15	0,2	0,25	0,35	0,35	0,4	0,45	0,5	0,5	D/33	D/50
Titanium Alloy (Sol. Treated/Aged)	<380HB	XRN, HSN	110-220	0,1	0,15	0,2	0,3	0,3	0,35	0,4	0,45	0,45	D/35	D/50
Harden Steel (1.2344, 1.2379)	45-55HRC	HSN, TLN	120-220	0,2	0,25	0,3	0,4	0,5	0,5	0,6	0,6	0,6	0,1-0,2	D/30

1. Find the Cutting Speed V_c (m/min) & Feed f_n (mm/π^{-1})

Find Vc and fn range in Table 1 or Table 2 on opposite page. Choose the average value for Vc and the lower value for feed in the range.

2. Compute the Dw

In order to compute the RPM value of the spindle it is necessary to determine the Dw which is the effective engaged tool diameter. The Dw depends on the geometry of the inserts (ball nose or toroid) and the relative position of the tool against the working piece surface. Example calculation is of Dw is presented to the right.



3. Calculate Spindle Speed N(n/min)

Use the formula: $N = (V_c * 1{,}000)/\pi * D_w$

Table 3 - WORKING DIAMETER FOR BALL NOSE TOOLS (TIP CUTTING)

ØD	Ap																		
	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1	1,5	2	2,5	3	3,5	4	5	6	7
6	1,5	2,2	2,6	3	3,3	3,6	3,9	4,1	4,3	4,5	5,2	5,7	5,9	6,0					
8	1,8	2,5	3	3,5	3,9	4,2	4,5	4,8	5,1	5,3	6,2	6,9	7,4	7,7					
10	2	2,8	3,4	3,9	4,4	4,7	5,1	5,4	5,7	6,0	7,1	8,0	8,7	9,2	9,5				
12	2,2	3,1	3,7	4,3	4,8	5,2	5,6	6,0	6,3	6,6	7,9	8,9	9,7	10,4	10,9	11,3	11,8		
14	2,4	3,3	4,1	4,7	5,2	5,7	6,1	6,5	6,9	7,2	8,7	9,8	10,7	11,5	12,1	12,6	13,4	13,9	
16	2,5	3,6	4,3	5	5,6	6,1	6,5	7,0	7,4	7,7	9,3	10,6	11,6	12,5	13,2	13,9	14,8	15,5	15,9
20	2,8	4	4,9	5,6	6,2	6,8	7,4	7,8	8,3	8,7	10,5	12,0	13,2	14,3	15,2	16,0	17,3	18,3	19,1
25		4,5	5,4	6,3	7,0	7,7	8,2	8,8	9,3	9,8	11,9	13,6	15,0	16,2	17,3	18,3	20,0	21,4	22,4
30			6	6,9	7,7	8,4	9,1	9,7	10,2	10,8	13,1	15,0	16,6	18,0	19,3	20,4	22,4	24,0	25,4
32				7,1	7,9	8,7	9,4	10,0	10,6	11,1	13,5	15,5	17,2	18,7	20	21,2	23,2	25,0	26,5

Table 4 - WORKING DIAMETER FOR TOROID TOOLS (tip cutting)

Insert Diameter "D"	0,1	0,2	0,3	0,4	0,5	0,6	0,7
Depth of Cut	Dw Working Diameter (metric) Actual cutting diameter of toroid inserts						
0.5	7.3	9.3	11.9	14.3	17.8	20.4	21.6
1.0	8.5	10.5	13.3	16.0	19.6	22.5	23.8
2.0	9.7	11.7	14.9	18.0	22.0	25.2	26.6
3.0	10.0	12.0	15.8	19.2	23.4	27.0	28.5
4.0			16.0	19.8	24.3	28.3	29.9
5.0				20.0	24.9	29.2	30.8
6.0					25.0	29.7	31.5
8.0						30.0	32.0

4. Calculate the Table Feed V_f (m/min)

Use the formula: $V_f = N * f_n * K_f$. K_f is the feed rate multiplier coefficient taking inconsideration that chip load is less than theoretical value. Take the value of K_f from Table 5 or Table 6.

Table 5 - FEED RATE MULTIPLIER FOR BALL NOSE INSERTS

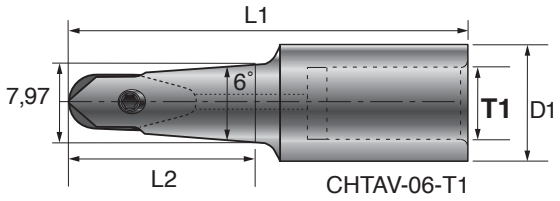
Insert Diameter "D"	6	8	10	12	16	20	25	30	32
Depth of Cut	FEEDRATE MULTIPLIER FACTORS (for working diameters Dw)								
0.5	1.8	2.0	2.2	2.5	2.8	3.2	3.5	3.8	4.0
1.0	1.2	1.5	1.6	1.8	2.0	2.2	2.5	2.6	2.8
2.0	1.0	1.1	1.2	1.3	1.5	1.6	1.8	1.9	2.0
3.0	0.0	1.0	1.1	1.1	1.2	1.4	1.5	1.6	1.7
4.0		1.0	1.0	1.1	1.2	1.2	1.3	1.4	1.5
5.0			1.0	1.0	1.1	1.1	1.2	1.3	1.4
6.0				1.0	1.0	1.1	1.2	1.2	1.3
8.0					1.0	1.0	1.1	1.1	1.2
10.0						1.0	1.0	1.1	1.1
12.5							1.0	1.0	1.0
16.0								1.0	1.0

Table 6 - FEED RATE MULTIPLIER FOR TOROID TOOLS

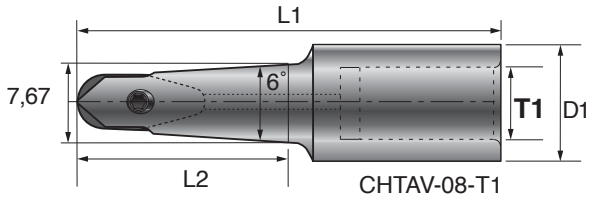
Insert Diameter "D"	10	12	16	20	25	30	32
Depth of Cut	FEEDRATE MULTIPLIER FACTORS (for Toroid working diameters Dw)						
0.5	1.8	1.8	2.0	2.2	2.5	2.6	2.8
1.0	1.2	1.2	1.5	1.6	1.8	1.9	2.0
2.0	1.0	1.0	1.1	1.2	1.3	1.4	1.5
3.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2
4.0			1.0	1.0	1.1	1.2	1.2
5.0				1.0	1.0	1.1	1.1
6.0					1.0	1.0	1.0
8.0						1.0	1.0

Shrink Fit System

Millstar's Carbide Modular Shrink System offers versatility, strength and accuracy. The carbide shank offers strength and rigidity and the shrink tolerances offer better accuracy than screw on type systems. These tools are designed for high speed machining and hard metal machining and will allow for better tool life as well as better surface finishes.



CHTAV-06-T1



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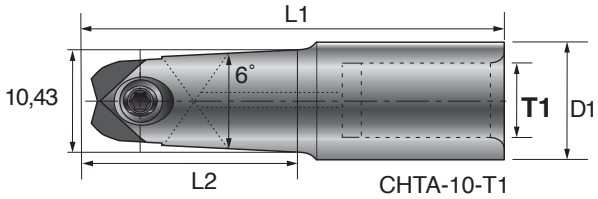
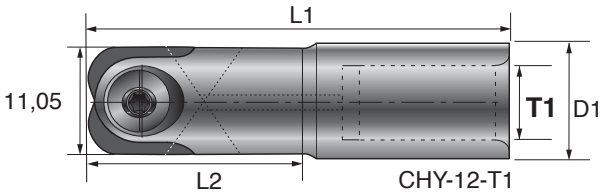
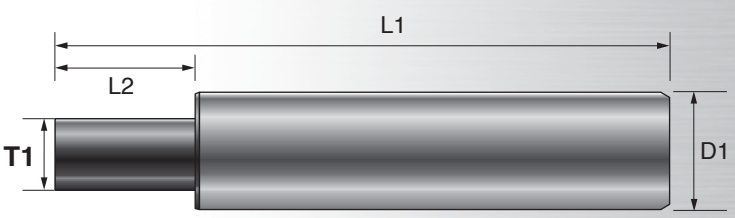
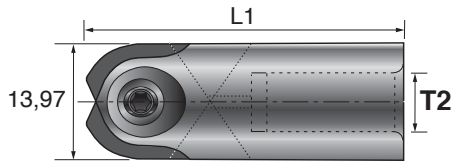


CHTA-10-T1

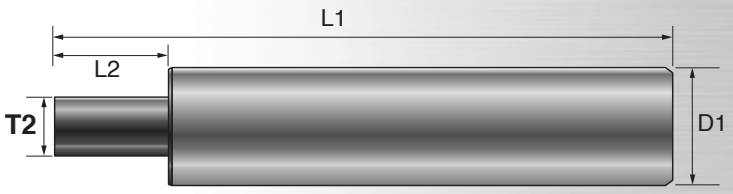


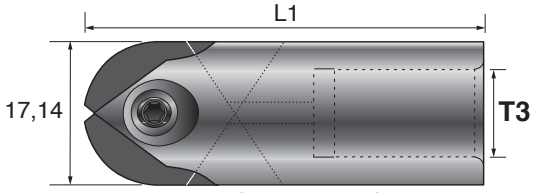
CHY-12-T1
CHF-12-T1



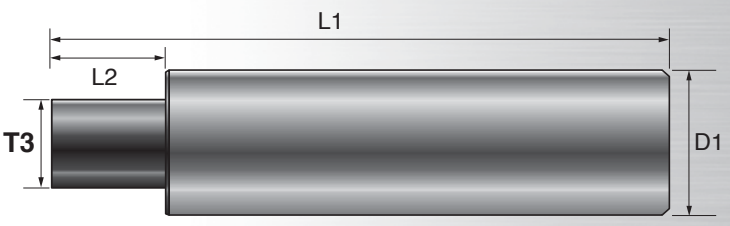


CHY-16-T2 / CHF-16-T2





CHY-20-T3 / CHF-20-T3



Insert		Shrink Fit head				Shrink Fit Shank			
			Dimensions				Dimensions		
Type	Code	Tool Number	ØD1	L1	L2	Tool Number	ØD1	L1	L2
	VBD, VRBS	CHTAV-06-T1	11,7	43,2	22,3	CSS-12-75-T1 CSS-12-125-T1	12 12	73,60 124,40	15,24 15,24
		CHTAV-08-T1	11,7	43,2	20,9				
	TO, HF, FB, BDS, MB,MBT, BD, TOBD-NF	CHTAV-10-T1	11,7	43,2	21,5				
	RB, MB, MBT, BS	CHY-12-T1	11,7	43,2	21,5				
	FB, BD, BDS, HF, TO, TOBD-NF	CHF-12-T1	11,7	43,2	21,5				
	BS, RB, MB, MBT	CHY-16-T2	14,0	38,2		CSS-16-105-T2 CSS-16-180-T2	16 16	104,80 180,80	16,51 16,51
	FB, BD, BDS, HF, TO, TOBD-NF	CHF-16-T2	14,0	38,2					
	RB, BS, MB, MBT	CHY-20-T3	17,1	48,3		CSS-20-95-T3 CSS-20-175-T3 CSS-18-150-T3	20 20 18	96,50 172,70 150	17,78 17,78 17,78
	FB, BD, BDS, HF, TO, TOBD-NF	CHF-20-T3	17,1	48,3					

High Performance Milling from Heavy Roughing to Fine Finishing

Millstar face mills are equally useful on newer high velocity machines and older slower equipment and will optimize milling performance of all your machine tools. The hardened tool bodies can be run at aggressive spindle speed and feed rates, when used with Millstar's precision ground, strong and thick, round inserts with proven hard, high performance TLN tool coating.

The tools provide for precision finish results, minimal tool deflection and run-out. Excellent milling results can be achieved in roughing, semi finishing and fine finishing in Z-level, profiling or raster cuts, as well as in linear or circular interpolation milling or ramping.

The tools may be used with coolant, but we recommend dry, mist or MQL (minimum quantity lubrication) milling with strong air blast when high speed or hard machining steel, particularly in the higher hardness range (> 45HRc / 425 HBN). Please refer to FAQs (frequently asked questions) about milling on our web site www.millstar.com.

Milling Cutters Identification System

Modular

FMA 25 / 5

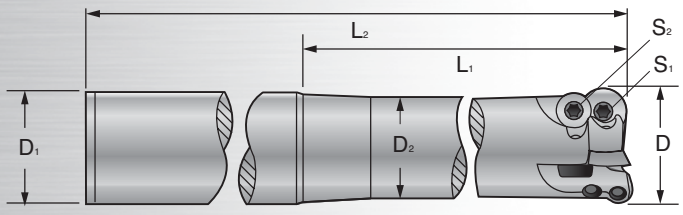
FMA	25	5
Denotes Copy Milling Cutter Arbor Style	Denotes Diameter Size	Denotes Number of Flutes

Shank

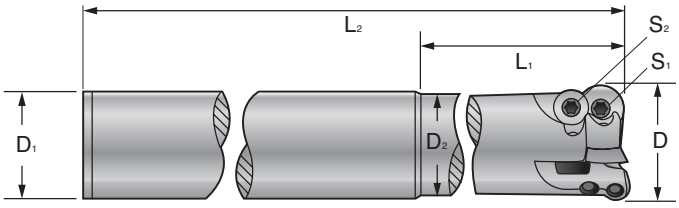
FM 25 / 2 - 180 - 25

FM	25	2	180	25
Denotes Copy Milling Cutter	Denotes Diameter Size	Denotes Number of Flutes	Denotes Tool Cutter Length	Denotes Tool Diameter Shank

Toroid Taper End Milling Cutters



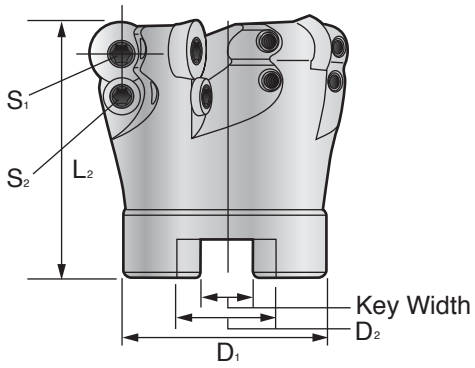
Toroid Cylindrical End Milling Cutters

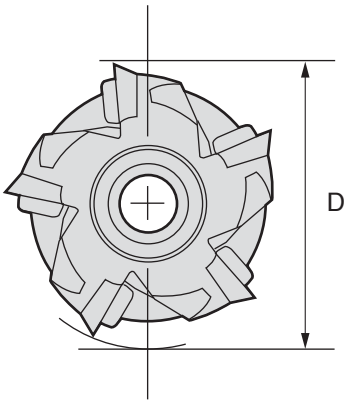


Tool Ordering Number	Dimensions						Screw	Key	Face Clamp	Insert Code
	ØD	ØD1	ØD2	L1	L2	Z				
FM 32/3-180-25	32	25	24	42	180	3	FMIS-1	T15	FMIS2	FMI-12T3
FM 40/4-180-32	40	32	31	42	180	4	FMIS-1	T15	FMIS2	FMI-12T3
FM 42/4-180-32	42	32	31	42	180	4	FMIS-1	T15	FMIS2	FMI-12T3
FM 32/2-180-32	32	32	31	42	180	2	FMIS-1	T15	FMIS2	FMI-12T3
FM 40/3-180-32	40	32	31	42	180	3	FMIS-1	T15	FMIS2	FMI-12T3

Tool Ordering Number	Dimensions						Screw	Key	Face Clamp	Insert Code
	ØD	ØD1	ØD2	L1	L2	Z				
FM 25/2-180-25	25	25	23	100	180	2	FMIS-1	T15	FMIS2	FMI-12T3
FM 32/3-180-32	32	32	29	100	180	3	FMIS-1	T15	FMIS2	FMI-12T3

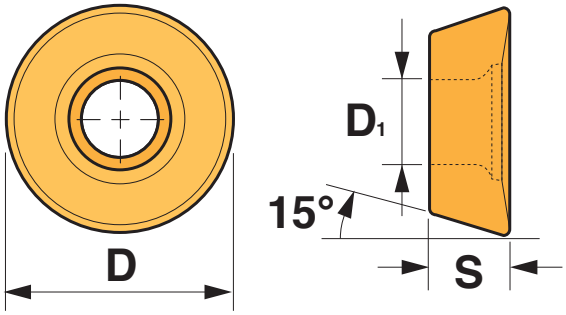
Arbor Style Milling Cutters





Tool Ordering Number	Dimensions						Insert Screw	Face Clamp Screw	Key	Insert Code
	ØD	ØD1	L2	Z	Key Width	D2				
FMA 50/5	50	40	50	5	10.4	22	FMIS-1	FMIS-2	T15	FMI-12T3
FMA 52/5	52	40	50	5	10.4	22	FMIS-1	FMIS-2	T15	FMI-12T3
FMA 63/5	63	40	50	5	12.4	27	FMIS-1	FMIS-2	T15	FMI-12T3
FMA 52/4	52	40	50	4	10.4	22	FMIS-1	FMIS-2	T15	FMI-12T3
FMA 63/5	63	40	50	5	12.4	27	FMIS-1	FMIS-2	T15	FMI-12T3
FMA 52/4-16	52	40	50	4	10.4	22	FMIS-1	FMIS-2	T15	FMI-1604
FMA 63/5-16	63	40	50	5	12.4	27	FMIS-1	FMIS-2	T15	FMI-1604

Insert Data



Tool Ordering Number	Dimensions			HSN	TLN
	D	S	D1		
FMI-1003	10	3,18	3,88	•	•
FMI-12T3	12	3,97	3,9	•	•
FMI-1604	16	4,77	5,2	•	•

Cutting Conditions Data

RECOMMENDED CUTTING SPEED AND Ap

WORKING MATERIAL	HARDNESS	GRADE	Vc m/min	Ap Max Roughing	Ap Max Medium	Ap Max Light
Low Alloy Steel (1.7225)	200-280HB	5110, TLN	130-200	2,5-4,5	1,0-2,5	0,1-1,0
Alloy & Die Steel (1.2311, P20, DME2/3/5)	32-42HRC	5110, TLN	100-150	2,5-4,0	1,0-2,5	0,1-1,0
Tool Steel (1.2344, 1.2379)	42-52HRC	5110, TLN	80-100	2,0-3,5	1,0-2,5	0,1-1,0
Stainless Steel (1.4301, 1.4401)	200-350HB	5110, TLN	120-170	2,5-4,0	1,0-2,5	0,1-1,0
Gray Cast Iron (GG25-GG30)	160-260HB	5110, TLN	140-190	2,5-4,0	1,0-2,5	0,1-1,0
Nodular Cast Iron (GGG60-GGG70)	180-300HB	5110, TLN	120-170	2,5-4,0	1,0-2,5	0,1-1,0
Copper Alloy	80-150HB	TLN	350	2,5-4,5	1,0-2,5	0,1-1,0
Aluminum Alloys	30-120HB	TLN	400	2,5-5,0	1,0-2,5	0,1-1,0
Ni & Co Based Alloy	250-320HB	5110, TLN	30-60	2,0-3,0	1,0-2,5	0,1-1,0
Titanium Alloy (Annealed)	<350HB	5110, TLN	50-70	2,0-3,0	1,0-2,5	0,1-1,0

RECOMMENDED FEED fz (mm/tooth)

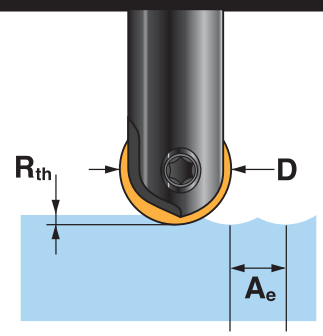
OPERATION	Ap												
	IC	0,3	0,5	0,7	0,8	1	1,2	2	3	4	5	6	8
LIGHT	10	0,3	0,23	0,2	0,18	0,15	0	0	0	0	0	0	0
	12	0,38	0,3	0,25	0,23	0,21	0,18	0	0	0	0	0	0
	16	0,45	0,35	0,3	0,27	0,23	0,21	0,18	0	0	0	0	0
ROUGH	10	0	0	0	0	0,32	0,29	0,22	0,18	0,16	0,14	0	0
	12	0	0	0	0	0,42	0,38	0,3	0,28	0,24	0,20	0,18	0,16
	16	0	0	0	0	0,50	0,47	0,36	0,3	0,27	0,25	0,34	0,23

The "fz" indicated above is for an overhang of 3xD. The values are calculated based on the recommended thickness of the chip "hm".
LIGHT: Ae up to 25% of the Diameter of the Tool "D".
ROUGH: Ae up to 75% of the Diameter of the Tool "D".

Verify the Surface Roughness (R_{th})

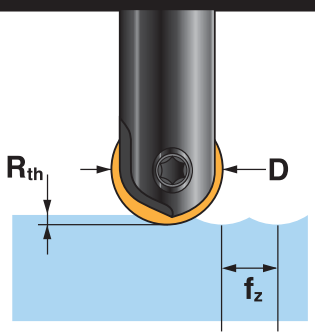
1. Decreasing the A_e and feed by half will improve surface roughness by 4 times.
2. Using $f_z = A_e$ in most cases is the best option.

SURFACE ROUGHNESS STEP-OVER

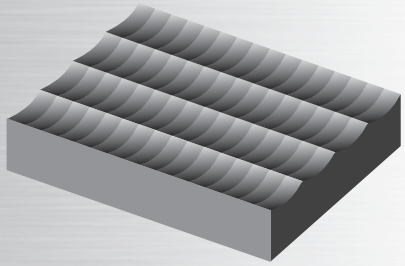


$$R_{th}, A_e = \frac{D}{2} - \sqrt{\frac{D^2 - A_e^2}{4}}$$

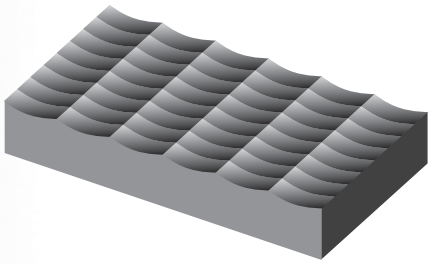
SURFACE ROUGHNESS FEED DIR



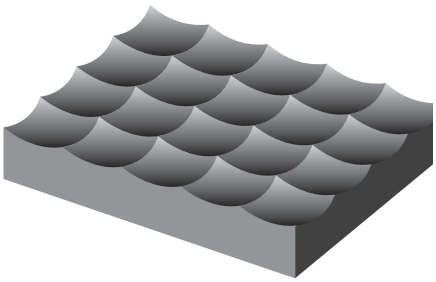
$$R_{th}, A_e = \frac{D}{2} - \sqrt{\frac{D^2 - f_z^2}{4}}$$



$f_z > A_e$



$f_z < A_e$



$f_z = A_e$

Milling Cutters Identification System

Modular

HF SC 25 / 3

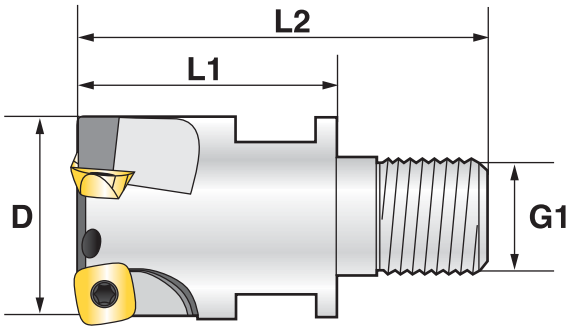
HF	SC	25	3
Denotes High Feed Cutter	SC = Screw-On Cutter A = Shell Cutter	Denotes Diameter Size	Denotes Number of Flutes

Shank

HF SS 25 - 140 - 25

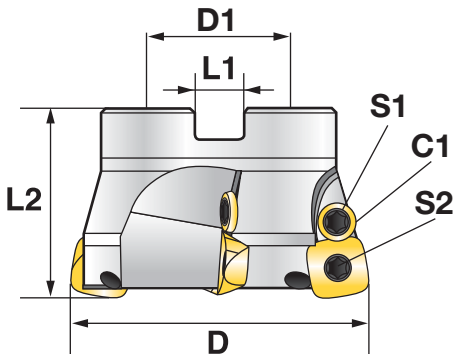
HF	SS	25	140	25
Denotes High Feed Cutter	Denotes Shank Cutter	Denotes Diameter Size	Denotes Tool Cutter Length	Denotes Tool Diameter Shank

HFSC - Modular Screw-On Heads



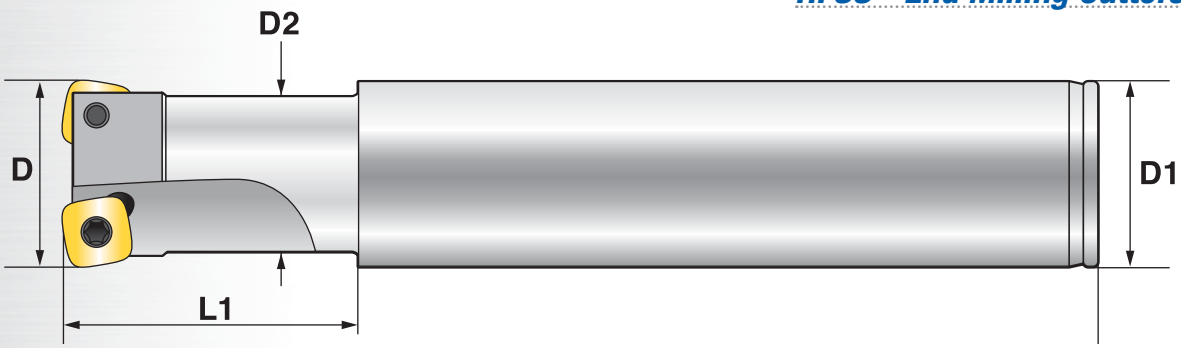
Tool Ordering Number	Dimensions				Thread G1	Screw	Clamp	Key	Use with Inserts	CAM R
	ØD	L1	L2	Z						
HFSC-20/2	20	31	49	2	M10	HFIS 1	-	T8	HFCI 09T3	2,27
HFSC-25/3	25	32	54	3	M12	HFIS 1	-	T8	HFCI 09T3	2,27
HFSC-30/4	30	40	63	4	M16	HFIS 1	-	T8	HFCI 09T3	2,27
HFSC-32/4	32	40	63	4	M16	HFIS 1	-	T8	HFCI 09T3	2,27
HFSC-32/3	32	40	63	3	M16	HFIS 2	HFIC-1	T15	HFCI 1204	3,52
HFSC-42/4	42	40	63	4	M16	HFIS 2	HFIC-1	T15	HFCI 1204	3,52

HFA - Shell Milling Cutters



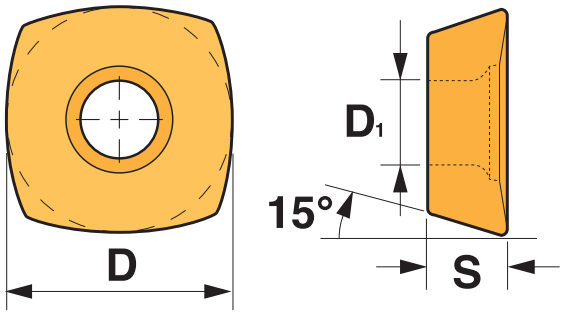
Tool Ordering Number	Dimensions					Screw S1	Screw S2	Clamp C1	Key	Use with Inserts	CAM R
	ØD	ØD1	L1	L2	Z						
HFA-42/4	42	16	8,4	40	4	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	3,52
HFA-50/5	50	22	10,4	40	5	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	3,52
HFA-52/5	52	22	10,4	50	5	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	3,52
HFA-63/6	63	22	10,4	50	6	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	3,52
HFA-66/6	66	22	10,4	50	6	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	3,52
HFA-80/7	80	27	12,4	50	7	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	3,52
HFA-100/8	100	32	14,4	50	8	HFIS-2	HFIS-2	HFIC-1	T15	HFCI 1204	3,52

HFSS - End Milling Cutters



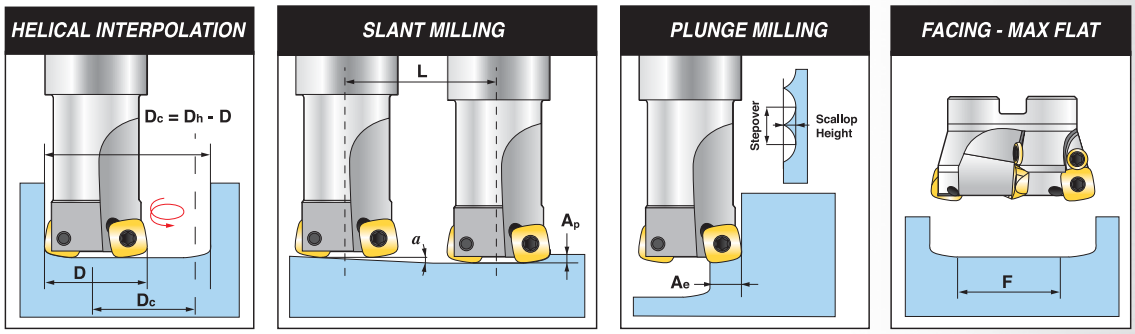
Tool Ordering Number	Dimensions					Screw	Clamp C1	Key	Use with Inserts	CAM R
	ØD	ØD1	L1	L2	Z					
HFSS-20-110-20	20	20	30	110	2	HFIS-1	-	T8	HFCI 09T3	2,27
HFSS-25-100-25	25	25	30	100	3	HFIS-1	-	T8	HFCI 09T3	2,27
HFSS-25-140-25	25	25	40	140	3	HFIS-1	-	T8	HFCI 09T3	2,27
HFSS-25-240-25	25	25	40	240	3	HFIS-1	-	T8	HFCI 09T3	2,27
HFSS-32-140-32	32	32	40	140	4	HFIS-1	-	T8	HFCI 09T3	2,27
HFSS-32-240-32	32	32	40	240	4	HFIS-1	-	T8	HFCI 09T3	2,27
HFSS-40-140-32	40	32	-	140	4	HFIS-2	HFIC-1	T15	HFCI 1204	3,52
HFSS-40-240-32	40	32	-	240	4	HFIS-2	HFIC-1	T15	HFCI 1204	3,52

Insert Data



Tool Ordering Number	Dimensions			Grade		CAM	
	D	S	D1	XRN	HSN	R	T
HFCI 09T3	9,525	3,97	4,4	•	•	2,27	0,52
HFCI 1204	12,700	4,76	3,4	•	•	3,52	0,64

Machining Application Data



Tool Ordering Number	Dimensions				Helical Interpolation	
	ØD	ØDh	Ap	F	ØDh min	ØDh max
HFSC-20/2	20	9	1	8.8	26.3	38.1
HFSC-25/3	25	9	1	13.8	36.3	48.1
HFSC-30/4	30	9	1	18.8	46.3	58.1
HFSC-32/4	32	9	1	20.8	50.3	62.1
HFSC-32/3	32	12	1.7	15.4	44.6	61.8
HFSC-42/4	42	12	1.7	25.4	64.6	81.8
HFSS-20-110-20	20	9	1	8.8	26.3	38.1
HFSS-25-100-25	25	9	1	13.8	36.3	48.1
HFSS-25-140-25	25	9	1	13.8	36.3	48.1
HFSS-25-240-25	25	9	1	13.8	36.3	48.1
HFSS-32-140-32	32	9	1	20.8	50.3	62.1
HFSS-32-240-32	32	9	1	20.8	50.3	62.1
HFSS-40-140-32	40	9	1	28.8	66.3	78.1
HFSS-40-240-32	40	12	1.7	23.4	60.6	77.8
HFSS-20-110-20	20	12	1.7	8.8	26.3	38.1
HFA-42/4	42	12	1.7	25.4	64.6	81.8
HFA-50/5	50	12	1.7	33.4	80.5	97.8
HFA-52/5	52	12	1.7	35.4	84.5	101.8
HFA-63/6	63	12	1.7	46.4	106.5	123.8
HFA-66/6	66	12	1.7	49.4	112.5	129.8
HFA-80/7	80	12	1.7	63.4	140.5	157.8
HFA-100/8	100	12	1.7	83.4	180.5	197.8

- For Slant Milling or Helical Interpolation decrease the recommended feed by 30%.
- In case of Helical Interpolation do not exceed the max Ap/revolution.
- For Plunging use 50% of recommended feed only.
- For insert HFCI 09T3 the max Ae is: 5,0
- For insert HFCI 1204 the max Ae is: 6,0

The Values of "n" and "Vf" in the tables on the following pages are computed. In the application, use the closest (up side) speed from the range of the machine tool.

The cutting parameters have to be adjusted accordingly to the rigidity of the machine-tool and working piece.

In case of hard steel alloy of 50-55 HRC decrease by 30% the Ap, Vc and feed.

Cutter	Insert	Grade	Work Piece Material	Overhang	n	Vc	Vf	fz	Ap	Ae
					RPM	mm/min	mm/min	mm/tooth	mm	mm
HFSC 20/2	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	3025	190	8471	1.4	0.6	<15
				3D-5D	2229	140	3567	0.8	0.6	<15
				5D-7D	2070	130	3312	0.8	0.5	<15
				>7D	1433	90	2293	0.8	0.4	<15
			Tool Steel 32-42HRC	<3D	2548	160	7134	1.4	0.4	<15
				3D-5D	2070	130	3312	0.8	0.5	<15
				5D-7D	1911	120	3057	0.8	0.4	<15
				>7D	1433	90	2293	0.8	0.3	<15
			Tool Steel 42-52HRC	<3D	2229	140	5350	1.2	0.4	<15
				3D-5D	1592	100	2548	0.8	0.4	<15
				5D-7D	1592	100	2548	0.8	0.3	<15
				>7D	1433	90	1720	0.6	0.2	<15
			Cast Iron	<3D	2866	180	9172	1.6	0.8	<15
				3D-5D	2229	140	5350	1.2	0.8	<15
				5D-7D	2070	130	4968	1.2	0.6	<15
				>7D	1433	90	3439	1.2	0.5	<15
HFSC 25/3	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	2420	190	11618	1.6	0.6	<20
				3D-5D	1783	140	5350	1	0.6	<20
				5D-7D	1656	130	4968	1	0.5	<20
				>7D	1146	90	3439	1	0.4	<20
			Alloy Steel 32-42HRC	<3D	2038	160	9783	1.6	0.4	<20
				3D-5D	1656	130	4968	1	0.5	<20
				5D-7D	1529	120	4586	1	0.4	<20
				>7D	1146	90	3439	1	0.3	<20
			Tool Steel 42-52HRC	<3D	1783	140	7490	1.4	0.4	<20
				3D-5D	1274	100	3057	0.8	0.4	<20
				5D-7D	1274	100	3057	0.8	0.3	<20
				>7D	1146	90	2064	0.6	0.2	<20
			Cast Iron	<3D	2293	180	11006	1.6	0.8	<20
				3D-5D	1783	140	6420	1.2	0.8	<20
				5D-7D	1656	130	5962	1.2	0.6	<20
				>7D	1146	90	4127	1.2	0.5	<20
HFSC 30/4	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	2017	190	12102	1.5	0.6	<21
				3D-5D	1486	140	5350	0.9	0.6	<21
				5D-7D	1380	130	4968	0.9	0.5	<21
				>7D	955	90	3439	0.9	0.4	<21
			Alloy Steel 32-42HRC	<3D	1699	160	10191	1.5	0.4	<21
				3D-5D	1380	130	4968	0.9	0.5	<21
				5D-7D	1274	120	4586	0.9	0.4	<21
				>7D	955	90	3439	0.9	0.3	<21
			Tool Steel 42-52HRC	<3D	1486	140	7134	1.2	0.4	<21
				3D-5D	1062	100	3397	0.8	0.4	<21
				5D-7D	1062	100	2548	0.6	0.3	<21
				>7D	955	90	2293	0.6	0.2	<21
			Cast Iron	<3D	1911	180	12229	1.6	0.8	<21
				3D-5D	1486	140	7134	1.2	0.8	<21
				5D-7D	1380	130	6624	1.2	0.6	<21
				>7D	955	90	4586	1.2	0.4	<21

Cutter	Insert	Grade	Work Piece Material	Overhang	n	Vc	Vf	fz	Ap	Ae
					RPM	mm/min	mm/min	mm/tooth	mm	mm
HFSC 32/4	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	1891	190	11346	1.5	0.6	<22
				3D-5D	1393	140	5016	0.9	0.6	<22
				5D-7D	1294	130	4658	0.9	0.5	<22
				>7D	896	90	3225	0.9	0.4	<22
			Alloy Steel 32-42HRC	<3D	1592	160	9554	1.5	0.4	<22
				3D-5D	1294	130	4658	0.9	0.5	<22
				5D-7D	1194	120	4299	0.9	0.4	<22
				>7D	896	90	3225	0.9	0.3	<22
			Tool Steel 42-52HRC	<3D	1393	140	6688	1.2	0.4	<22
				3D-5D	995	100	3185	0.8	0.4	<22
				5D-7D	995	100	2389	0.6	0.3	<22
				>7D	896	90	2150	0.6	0.2	<22
			Cast Iron	<3D	1791	180	11465	1.6	0.8	<22
				3D-5D	1393	140	6688	1.2	0.8	<22
				5D-7D	1294	130	6210	1.2	0.6	<22
				>7D	896	90	4299	1.2	0.4	<22
HFSC 32/3	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1891	190	8509	1.5	1	<22
				3D-5D	1393	140	3762	0.9	1.2	<22
				5D-7D	1294	130	3493	0.9	1	<22
				>7D	896	90	2418	0.9	0.8	<22
			Alloy Steel 32-42HRC	<3D	1592	160	7166	1.5	0.8	<22
				3D-5D	1294	130	3493	0.9	1	<22
				5D-7D	1194	120	3225	0.9	0.8	<22
				>7D	896	90	2418	0.9	0.6	<22
			Tool Steel 42-52HRC	<3D	1393	140	5852	1.4	0.8	<22
				3D-5D	995	100	2389	0.8	0.6	<22
				5D-7D	995	100	2389	0.8	0.5	<22
				>7D	896	90	1612	0.6	0.4	<22
			Cast Iron	<3D	1791	180	9674	1.8	1.2	<22
				3D-5D	1393	140	5852	1.4	1	<22
				5D-7D	1294	130	5434	1.4	0.8	<22
				>7D	896	90	3762	1.4	0.6	<22
HFSC 42/4	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1441	190	8644	1.5	1	<28
				3D-5D	1062	140	3822	0.9	1.2	<28
				5D-7D	986	130	3549	0.9	1	<28
				>7D	682	90	2457	0.9	0.8	<28
			Alloy Steel 32-42HRC	<3D	1213	160	7279	1.5	0.8	<28
				3D-5D	986	130	3549	0.9	1	<28
				5D-7D	910	120	3276	0.9	0.8	<28
				>7D	682	90	2457	0.9	0.6	<28
			Tool Steel 42-52HRC	<3D	1062	140	5945	1.4	0.8	<28
				3D-5D	758	100	2426	0.8	0.6	<28
				5D-7D	758	100	2426	0.8	0.5	<28
				>7D	682	90	1638	0.6	0.4	<28
			Cast Iron	<3D	1365	180	9827	1.8	1.2	<28
				3D-5D	1062	140	5945	1.4	1	<28
				5D-7D	986	130	5520	1.4	0.8	<28
				>7D	682	90	3822	1.4	0.6	<28

Cutter	Insert	Grade	Work Piece Material	Overhang	n	Vc	Vf	fz	Ap	Ae
					RPM	mm/min	mm/min	mm/tooth	mm	mm
HFSS-20-110-20	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	3025	190	8471	1.4	0.6	<15
				3D-5D	2229	140	3567	0.8	0.6	<15
				5D-7D	2070	130	3312	0.8	0.5	<15
				>7D	1433	90	2293	0.8	0.4	<15
			Tool Steel 32-42HRC	<3D	2548	160	7134	1.4	0.4	<15
				3D-5D	2070	130	3312	0.8	0.5	<15
				5D-7D	1911	120	3057	0.8	0.4	<15
				>7D	1433	90	2293	0.8	0.3	<15
			Tool Steel 42-52HRC	<3D	2229	140	5350	1.2	0.4	<15
				3D-5D	1592	100	2548	0.8	0.4	<15
				5D-7D	1592	100	2548	0.8	0.3	<15
				>7D	1433	90	1720	0.6	0.2	<15
			Cast Iron	<3D	2866	180	9172	1.6	0.8	<15
				3D-5D	2229	140	5350	1.2	0.8	<15
				5D-7D	2070	130	4968	1.2	0.6	<15
				>7D	1433	90	3439	1.2	0.5	<15
HFSS-25-110-25 HFSS-25-140-25 HFSS-25-240-25	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	2420	190	11618	1.6	0.6	<20
				3D-5D	1783	140	5350	1	0.6	<20
				5D-7D	1656	130	4968	1	0.5	<20
				>7D	1146	90	3439	1	0.4	<20
			Tool Steel 32-42HRC	<3D	2038	160	9783	1.6	0.4	<20
				3D-5D	1656	130	4968	1	0.5	<20
				5D-7D	1529	120	4586	1	0.4	<20
				>7D	1146	90	3439	1	0.3	<20
			Tool Steel 42-52HRC	<3D	1783	140	7490	1.4	0.4	<20
				3D-5D	1274	100	3057	0.8	0.4	<20
				5D-7D	1274	100	3057	0.8	0.3	<20
				>7D	1146	90	2064	0.6	0.2	<20
			Cast Iron	<3D	2293	180	11006	1.6	0.8	<20
				3D-5D	1783	140	6420	1.2	0.8	<20
				5D-7D	1656	130	5962	1.2	0.6	<20
				>7D	1146	90	4127	1.2	0.5	<20
HFSS 32-140-32 HFSS-32-240-32	HFCI 09T3	HSN XRN	Alloy Steel <32HRC	<3D	2017	190	12102	1.5	0.6	<21
				3D-5D	1486	140	5350	0.9	0.6	<21
				5D-7D	1380	130	4968	0.9	0.5	<21
				>7D	896	90	3225	0.9	0.4	<21
			Tool Steel 32-42HRC	<3D	1699	160	10191	1.5	0.4	<21
				3D-5D	1380	130	4968	0.9	0.5	<21
				5D-7D	1274	120	4586	0.9	0.4	<21
				>7D	896	90	3225	0.9	0.3	<21
			Tool Steel 42-52HRC	<3D	1486	140	7134	1.2	0.4	<21
				3D-5D	1062	100	3397	0.8	0.4	<21
				5D-7D	1062	100	2548	0.6	0.3	<21
				>7D	896	90	2150	0.6	0.2	<21
			Cast Iron	<3D	1911	180	12229	1.6	0.8	<21
				3D-5D	1486	140	7134	1.2	0.8	<21
				5D-7D	1380	130	6624	1.2	0.6	<21
				>7D	896	90	4299	1.2	0.4	<21

Cutter	Insert	Grade	Work Piece Material	Overhang	n	Vc	Vf	fz	Ap	Ae
					RPM	mm/min	mm/min	mm/tooth	mm	mm
HFSS-40-140-32 HFSS-40-240-32	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1441	190	8644	1.5	1	<28
				3D-5D	1062	140	3822	0.9	1.2	<28
				5D-7D	986	130	3549	0.9	1	<28
				>7D	717	90	2580	0.9	0.8	<28
			Tool Steel 32-42HRC	<3D	1213	160	7279	1.5	0.8	<28
				3D-5D	986	130	3549	0.9	1	<28
				5D-7D	910	120	3276	0.9	0.8	<28
				>7D	717	90	2580	0.9	0.6	<28
			Tool Steel 42-52HRC	<3D	1062	140	5945	1.4	0.8	<28
				3D-5D	758	100	2426	0.8	0.6	<28
				5D-7D	758	100	2426	0.8	0.5	<28
				>7D	717	90	1720	0.6	0.4	<28
			Cast Iron	<3D	1365	180	9827	1.8	1.2	<28
				3D-5D	1062	140	5945	1.4	1	<28
				5D-7D	986	130	5520	1.4	0.8	<28
				>7D	717	90	4013	1.4	0.6	<28
HFA 42/4	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1441	190	8644	1.5	1	<28
				3D-5D	1062	140	3822	0.9	1.2	<28
				5D-7D	986	130	3549	0.9	1	<28
				>7D	682	90	2457	0.9	0.8	<28
			Tool Steel 32-42HRC	<3D	1213	160	7279	1.5	0.8	<28
				3D-5D	986	130	3549	0.9	1	<28
				5D-7D	910	120	3276	0.9	0.8	<28
				>7D	682	90	2457	0.9	0.6	<28
			Tool Steel 42-52HRC	<3D	1062	140	5945	1.4	0.8	<28
				3D-5D	758	100	2426	0.8	0.6	<28
				5D-7D	758	100	2426	0.8	0.5	<28
				>7D	682	90	1638	0.6	0.4	<28
			Cast Iron	<3D	1365	180	9827	1.8	1.2	<28
				3D-5D	1062	140	5945	1.4	1	<28
				5D-7D	986	130	5520	1.4	0.8	<28
				>7D	682	90	3822	1.4	0.6	<28
HFA 50/5	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1210	190	8471	1.4	0.7	<35
				3D-5D	892	140	4459	1	1	<35
				5D-7D	828	130	4140	1	0.8	<35
				>7D	573	90	2293	0.8	0.6	<35
			Tool Steel 32-42HRC	<3D	1019	160	6115	1.2	0.6	<35
				3D-5D	828	130	4140	1	0.6	<35
				5D-7D	764	120	3822	1	0.6	<35
				>7D	573	90	2293	0.8	0.4	<35
			Tool Steel 42-52HRC	<3D	892	140	5350	1.2	0.6	<35
				3D-5D	637	100	2548	0.8	0.5	<35
				5D-7D	637	100	2548	0.8	0.4	<35
				>7D	573	90	2293	0.8	0.3	<35
			Cast Iron	<3D	1146	180	9172	1.6	1	<35
				3D-5D	892	140	5350	1.2	0.8	<35
				5D-7D	828	130	4968	1.2	0.6	<35
				>7D	573	90	3439	1.2	0.4	<35

Cutter	Insert	Grade	Work Piece Material	Overhang	n	Vc	Vf	fz	Ap	Ae
					RPM	mm/min	mm/min	mm/tooth	mm	mm
HFA 52/5	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	1164	190	8146	1.4	0.7	<36
				3D-5D	857	140	4287	1	1	<36
				5D-7D	796	130	3981	1	0.8	<36
				>7D	551	90	2205	0.8	0.6	<36
			Tool Steel 32-42HRC	<3D	980	160	5879	1.2	0.6	<36
				3D-5D	796	130	3981	1	0.6	<36
				5D-7D	735	120	3675	1	0.6	<36
				>7D	551	90	2205	0.8	0.4	<36
			Tool Steel 42-52HRC	<3D	857	140	5145	1.2	0.6	<36
				3D-5D	612	100	2450	0.8	0.5	<36
				5D-7D	612	100	2450	0.8	0.4	<36
				>7D	551	90	2205	0.8	0.3	<36
			Cast Iron	<3D	1102	180	8819	1.6	1	<36
				3D-5D	857	140	5145	1.2	0.8	<36
				5D-7D	796	130	4777	1.2	0.6	<36
				>7D	551	90	3307	1.2	0.4	<36
HFA 63/6	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	960	190	8068	1.4	0.7	<45
				3D-5D	708	140	4246	1	1	<45
				5D-7D	657	130	3943	1	0.8	<45
				>7D	455	90	2184	0.8	0.6	<45
			Tool Steel 32-42HRC	<3D	809	160	5823	1.2	0.6	<45
				3D-5D	657	130	3943	1	0.6	<45
				5D-7D	607	120	3640	1	0.6	<45
				>7D	455	90	2184	0.8	0.4	<45
			Tool Steel 42-52HRC	<3D	708	140	5096	1.2	0.6	<45
				3D-5D	506	100	2426	0.8	0.5	<45
				5D-7D	506	100	2426	0.8	0.4	<45
				>7D	455	90	2184	0.8	0.3	<45
			Cast Iron	<3D	910	180	8735	1.6	1	<45
				3D-5D	708	140	5096	1.2	0.8	<45
				5D-7D	657	130	4732	1.2	0.6	<45
				>7D	455	90	3276	1.2	0.4	<45
HFA 66/6	HFCI 1204	HSN XRN	Alloy Steel <32HRC	<3D	917	190	7701	1.4	0.7	<47
				3D-5D	676	140	4053	1	1	<47
				5D-7D	627	130	3764	1	0.8	<47
				>7D	434	90	2085	0.8	0.6	<47
			Tool Steel 32-42HRC	<3D	772	160	5559	1.2	0.6	<47
				3D-5D	627	130	3764	1	0.6	<47
				5D-7D	579	120	3474	1	0.6	<47
				>7D	434	90	2085	0.8	0.4	<47
			Tool Steel 42-52HRC	<3D	676	140	4864	1.2	0.6	<47
				3D-5D	483	100	2316	0.8	0.5	<47
				5D-7D	483	100	2316	0.8	0.4	<47
				>7D	434	90	2085	0.8	0.3	<47
			Cast Iron	<3D	869	180	8338	1.6	1	<47
				3D-5D	676	140	4864	1.2	0.8	<47
				5D-7D	627	130	4517	1.2	0.6	<47
				>7D	434	90	3127	1.2	0.4	<47

Hi-Tech Tool for Hi-Tech Applications in Your Industry

Millstar's new High Performance and ultra-precise solid carbide end mills were specifically designed for High Speed, High Velocity and Hard Steel milling. Designed with specially selected premium sub-micron carbide substrate, special tool geometry and proprietary heat-defying EXALON tool coating, these tools are beating the best products the competition has to offer. They are made in the United States, and are competitively priced. Please note just some of the benefits to users:

- Square nose tools Series EMS / EIS with sharp corner or square nose tools Series EIB / EMB with corner radius, all with medium-high helix and strong cutting edges and tool body, work extremely well in materials up to 65HRc as well as in softer materials.

- Ball nose tools Series BI / BM are designed with two flutes and special nose geometry for true High Speed and Hard Material milling up to 68 HRc. Ball nose tools are the most aggressive tools for these applications. We will be glad to share our proven approach to improving your machining results.

- The Toroid Series TOM with large corner radius and slight back taper is a Millstar innovative addition. It is very useful in I.D. and O.D. Z-level and spiral milling at constant tool pressure, pocket milling, and milling of pre-hard and hardened flat surfaces at higher speeds than tools with smaller or sharp corner radii.

- Extended Reach ball nose tools Series BMNL and extended reach square nose tools Series EMR are useful tools specifically designed for long reach milling of extrusion dies, deep cavities and cores, deep rib milling and similar applications. The reduced flute length and neck diameter assure constant cutting pressure and minimal tool deflection.

Millstar's Hi-Tech Cutting Tools are ideal choices for accurately and aggressively machining products in many industries. Here are some examples

- Mold and die making: injection molds, glass molds, forging dies, extrusion dies.
- Aerospace: engine, landing gear and tail hook components, structural components, blisks, airfoil machining and forging dies, helicopter rotor components.
- Power generating: turbine blades and other components.
- Medical: hip and knee replacement joints, surgical instruments, medical device molds.
- Automotive: stamping dies, wheel and tire molds, ball joints, cam shaft machining, racing engine details, bumper and other injection molds, die cast dies, forging dies for crank and cam shafts, connecting rods, steering knuckles and yokes, and many other forged components.
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EMS - Square End Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-0.01	Corner Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
EMS-0.5-EX	0.5	-	6	3	0,5	1,5	7.5° / side	63
EMS-1.0-EX	1	-	6	4	1	3	7.5° / side	63
EMS-1.5-EX	1.5	-	6	4	1,5	4,5	7.5° / side	63
EMS-2.0-EX	2	-	6	4	2,0	6	7.5° / side	63
EMS-3.0-EX	3	-	6	5	3,0	9	7.5° / side	75
EMS-4.0-EX	4	-	6	6	4,0	12	7.5° / side	75
EMS-5.0-EX	5	-	6	6	5	15	-	75
EMS-6.0-EX	6	-	6	6	6	18	-	75
EMS-8.0-EX	8	-	8	6	8	24	-	90
EMS-10.0-EX	10	-	10	6	10	30	-	100
EMS-12.0-EX	12	-	12	6	12	36	-	100

EMB - Square End Bull Nose w/Corner Radius Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-0.01	Corner Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
EMB-1.0-0.2-EX	1	0,2	6	4	1	3	7.5° / side	63
EMB-1.5-0.2-EX	1.5	0,2	6	4	1,5	4,5	7.5° / side	63
EMB-2.0-0.2-EX	2	0,2	6	4	2	6	7.5° / side	63
EMB-3.0-0.3-EX	3	0,3	6	5	3	9	7.5° / side	75
EMB-4.0-0.5-EX	4	0,5	6	6	4	12	7.5° / side	75
EMB-5.0-0.5-EX	5	0,5	6	6	5	15	7.5° / side	75
EMB-6.0-0.5-EX	6	0,5	6	6	6	18	-	75
EMB-6.0-1.0-EX	6	1	6	6	6	18	-	75
EMB-8.0-0.5-EX	8	0,5	8	6	8	24	-	90
EMB-10.0-1.0-EX	10	1	10	6	10	30	-	100
EMB-12.0-1.0-EX	12	1	12	6	12	36	-	100

BM - Ball Nose Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-0.01	Ball Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
BM 0.5 EX	0,5	0,25	6	2	-	0,5	7.5° / side	63
BM-0.6-EX	0,6	0,3	6	2	-	0,6	7.5° / side	63
BM-0.8-EX	0,8	0,4	6	2	-	0,8	7.5° / side	63
BM 1.0 EX	1	0,50	6	2	-	1,0	7.5° / side	63
BM 1.5 EX	1,5	0,75	6	2	-	1,5	7.5° / side	63
BM 2.0 EX	2	1,00	6	2	-	2,0	7.5° / side	63
BM 3.0 EX	3	1,50	6	2	-	3,0	7.5° / side	75
BM 4.0 EX	4	2,00	6	2	-	4,0	7.5° / side	75
BM 5.0 EX	5	2,50	6	2	-	5,0	7.5° / side	75
BM 6.0 EX	6	3,00	6	2	-	6,0	-	75
BM 6.0 EX-LL	6	3,00	6	2	-	6,0	-	100
BM 8.0 EX	8	4,00	8	2	-	8,0	-	90
BM 10.0 EX	10	5,00	10	2	-	10,0	-	100
BM 10.0 EX-LL	10	5,00	10	2	-	10,0	-	120
BM 12.0 EX	12	6,00	12	2	-	12,0	-	100
BM 12.0 EX-LL	12	6,00	12	2	-	12,0	-	120
BM 16.0 EX	16	8,00	16	2	-	16,0	-	100
BM 16.0 EX-LL	16	8,00	16	2	-	16,0	-	150

TOM - Toroid Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-0.01	Corner Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
TOM 2.0 EX	2	0.5	6.0	2	1.84	2.0	6 / 7.5°	63
TOM 3.0 EX	3	0.75	6.0	2	2.76	3.0	9 / 7.5°	63
TOM 4.0 EX	4	1.0	6	2	3.68	4.0	12 / 7.5°	63
TOM 6.0 EX	6	1.5	6	2	5.52	6.0	18 / -	63
TOM 8.0 EX	8	2.0	8	2	7.37	8.0	24 / -	75
TOM 10.0 EX	10	2.5	10	2	9.21	10.0	30 / -	75
TOM 12.0 EX	12	3.O	12	2	11.05	12.0	36 / -	90

All tools backdraft 3°

BMNL - Ball, Extended Reach Tapered Nose* Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-0.01	Corner Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
BM-2.0-EX-1.25NL	2	1	6	2	1,9 / 1,3	2	31,75 / (1,25")	75
BM-2.0-EX-1.80NL	2	1	6	2	1,9 / 1,3	2	45,70 / (1,8")	75
BM-2.5-EX-1.25NL	2,5	1,25	6	2	2,4 / 1,3	2,5	31,75 / (1,25")	75
BM-2.5-EX-1.80NL	2,5	1,25	6	2	2,4 / 1,3	2,5	45,70 / (1,8")	75
BM-3.0-EX-1.25NL	3	1,5	6	2	2,9 / 1,3	3	31,75 / (1,25")	75
BM-3.0-EX-1.50NL	3	1,5	6	2	2,9 / 1,3	3	38,1 / (1,5")	75
BM-3.0-EX-1.80NL	3	1,5	6	2	2,9 / 1,3	3	45,70 / (1,8")	75
BM-3.0-EX-50NL	3	1,5	6	2	2,9 / 1,3	3	50 / (1,95")	75
BM-4.0-EX-1.25NL	4	2	6	2	3,9 / 1,3	4	31,75 / (1,25")	75
BM-4.0-EX-1.80NL	4	2	6	2	3,9 / 1,3	4	45,70 / (1,8")	75
BM-4.0-EX-50NL	4	2	6	2	3,9 / 1,3	4	50 / (1,95")	75
BM-5.0-EX-1.25NL	5	2,5	6	2	4,9 / 1,3	5	31,75 / (1,25")	75
BM-5.0-EX-1.80NL	5	2,5	6	2	4,9 / 1,3	5	45,70 / (1,8")	75
BM-6.0-EX-1.25NL	6	3	6	2	5,9 / -	6	31,75 / (1,25")	75
BM-6.0-EX-1.50NL	6	3	6	2	5,9 / -	6	38,1 / (1,5")	75
BM-6.0-EX-1.80NL	6	3	6	2	5,9 / -	6	45,70 / (1,8")	75
BM-8.0-EX-1.25NL	8	4	8	2	7,9 / -	8	31,75 / (1,25")	75

* 1.3° Neck Taper Per Side

EMR - Square End Bull Nose w/Corner Radius, Extended Reach Tapered Nose*

Exalon (AlTiN) Coated

Tool Ordering No.	Cutter Diameter tol. +0 /-.0004	Corner Radius	Shank Diameter (h6)	No. of Flutes	Neck Diameter	Cutting Length	Nose Taper	Overall Length
EMR-2.0-0.2-EX-1.25NL	2	0,2	6	4	1,9 / 1,3	2	31,75 / (1,25")	75
EMR-2.0-0.2-EX-1.80NL	2	0,2	6	4	1,9 / 1,3	2	45,70 / (1,8")	75
EMR-2.0-0.2-EX-50NL	2	0,2	6	4	1,9 / 1,3	2	50 / (1,95")	75
EMR-2.5-0.2-EX-1.25NL	2,5	0,2	6	4	2,4 / 1,3	2,5	31,75 / (1,25")	75
EMR-2.5-0.2-EX-1.80NL	2,5	0,2	6	4	2,4 / 1,3	2,5	45,70 / (1,8")	75
EMR-3.0-0.2-EX-1.25NL	3	0,2	6	5	2,9 / 1,3	3	31,75 / (1,25")	75
EMR-3.0-0.2-EX-1.80NL	3	0,2	6	5	2,9 / 1,3	3	45,70 / (1,8")	75
EMR-3.0-0.2-EX-50NL	3	0,2	6	5	2,9 / 1,3	3	50 / (1,95")	75
EMR-4.0-0.2-EX-1.25NL	4	0,2	6	6	3,9 / 1,3	4	31,75 / (1,25")	75
EMR-4.0-0.2-EX-1.80NL	4	0,2	6	6	3,9 / 1,3	4	45,70 / (1,8")	75
EMR-4.0-0.2-EX-50NL	4	0,2	6	6	3,9 / 1,3	4	50 / (1,95")	75
EMR-5.0-0.2-EX-1.25NL	5	0,2	6	6	4,9 / 1,3	5	31,75 / (1,25")	75
EMR-5.0-0.2-EX-1.80NL	5	0,2	6	6	4,9 / 1,3	5	45,70 / (1,8")	75
EMR-6.0-0.2-EX-1.25NL	6	0,2	6	6	5,9 / -	6	31,75 / (1,25")	75
EMR-6.0-0.2-EX-1.80NL	6	0,2	6	6	5,9 / -	6	45,70 / (1,8")	75
EMR-12.0-0.2-EX-1.25NL	12	0,2	12	6	11,9 / -	12	31,75 / (1,25")	75
EMR-12.0-0.2-EX-1.80NL	12	0,2	12	6	11,9 / -	12	45,70 / (1,8")	75

* 1.3° Neck Taper Per Side

HFM4 - High Feed Four Flute Solid Carbide

Tool Ordering No.	Diameter D	Programmable Radius	Shank Diameter	Neck Diameter	Length of Cut	Neck Length	Overall Length	Step Over Ae	Depth of Cut Ap	Feed per Tooth Fz
HFM4-02...	2	0.234	6	1.85	2.2	12.0	76.0	1.5	0.09	0.03 - 0.05
HFM4-03...	3	0.365	6	2.74	2.8	16.0	76.0	2.25	0.12	0.07 - 0.14
HFM4-04...	4	0.465	6	3.60	3.5	20.0	76.0	3.0	0.15	0.10 - 0.20
HFM4-05...	5	0.597	6	4.75	3.5	20.0	76.0	3.75	0.20	0.12 - 0.24
HFM4-06...	6	0.731	6	5.61	3.8	25.0	76.0	4.5	0.24	0.14 - 0.28
HFM4-08...	8	0.977	8	7.62	4.0	30.0	76.0	6.0	0.32	0.18 - 0.36
HFM4-10...	10	1.226	10	9.60	4.3	33.0	100.0	7.5	0.40	0.22 - 0.44
HFM4-12...	12	1.651	12	11.61	4.6	38.0	101.0	9.0	0.48	0.27 - 0.54

...After the part number, please indicate XRN or HSN when ordering.

HFM Cutting Conditions

Work Material	Material Hardness	Cutting Depth at Diameter ap max								Cutting Width
USA/W.-Nr./JIS	Hrc	2	3	4	5	6	8	10	12	Ae max
H13/1.2344/SKD61	<41	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
H13/1.2344/SKD61	41-50	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
H13/1.2344/SKD61	51+	0.08	0.1	0.12	0.18	0.2	0.3	0.3	0.4	75%
A2/1,2363/SKD12	<41	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
A2/1,2363/SKD12	41-50	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
A2/1,2363/SKD12	51+	0.08	0.1	0.12	0.18	0.2	0.3	0.3	0.4	75%
P20/1,2330	<41	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
P20/1,2330	41-50	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
D2/1,2379/SKD11	<41	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
D2/1,2379/SKD11	41-50	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
D2/1,2379/SKD11	51+	0.08	0.1	0.12	0.2	0.24	0.32	0.3	0.4	75%
Grey Cast Iron/GG	<41	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
Cast Iron/GGG	41+	0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%
Titanium (6AL 4V)		0.09	0.12	0.15	0.2	0.24	0.32	0.4	0.48	75%

EMS2...LL - 2 Flute Long Series Endmill, Square End

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EMS2-03-LL-	3	XX	3	16	50
EMS2-04-LL-	4	XX	4	20	76
EMS2-06-LL-	6	XX	6	25	76
EMS2-08-LL-	8	XX	8	25	76
EMS2-10-LL-	10	XX	10	25	101
EMS2-12-LL-	12	XX	12	25	101
EMS2-16-LL-	16	XX	16	50	152
EMS2-20-LL-	20	XX	20	50	152

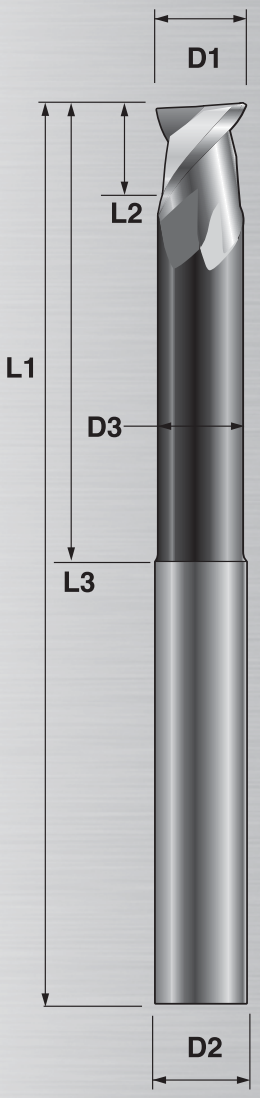
EMS4...LL - 4 Flute Long Series Endmill, Square End

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EMS4-03-LL-	3	XX	3	16	50
EMS4-04-LL-	4	XX	4	20	76
EMS4-06-LL-	6	XX	6	25	76
EMS4-08-LL-	8	XX	8	25	76
EMS4-10-LL-	10	XX	10	25	101
EMS4-12-LL-	12	XX	12	25	101
EMS4-16-LL-	16	XX	16	50	152
EMS4-20-LL-	20	XX	20	50	152

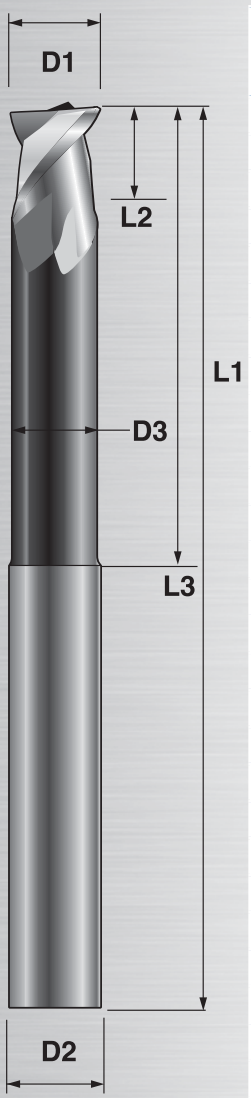
Coating type Recommended	Cut speed at D	Max feed per tooth fz at cutting insert dia D							
Coating	m/minute	2	3	4	5	6	8	10	12
XRN/HSN	244-365	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	183-244	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
HSN	90-150	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	244-365	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	183-244	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
HSN	90-150	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	244-365	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	183-244	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	183-244	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	105-140	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
HSN	80-140	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	350-900	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	250-400	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54
XRN/HSN	183-365	0.03-0.05	0.07-0.14	0.10-0.2	0.12-0.24	0.14-0.28	0.18-0.36	0.22-0.44	0.27-0.54

AlumiSTAR ALP - 2 Flute Endmill - Aluminum

Tool Ordering Number	Cutter Diameter (D1)	Cutting Length (L2)	Neck Length (L3)	Neck Diameter (D3)	Radius	Flutes	Total Length (L1)	Diameter (D2)
ALP2-8-2.3-75-NA	8	10	40	7.5	2.3	2	75	8
ALP2-8-3.2-75-NA	8	10	40	7.5	3.2	2	75	8
ALP2-10-0.3-100-NA	10	12	50	9.4	0.3	2	100	10
ALP2-10-3.2-72-NA	10	10	40	9.5	3.2	2	72	10
ALP2-12-0.0-110-NA	12	15	75	11.5	0	2	110	12
ALP2-12-110-NA	12	20	70	11.5	0	2	110	12
ALP2-12-2.5-75-NA	12	15	45	11.5	2.5	2	75	12
ALP2-12-3.0-115-NA	12	20	75	11.5	3	2	115	12
ALP2-12-3.0-120-NA	12	15	50	11.5	3	2	120	12
ALP2-12-3.2-83-NA	12	15	50	11.5	3.2	2	83	12
ALP2-12-3.6-73-NA	12	15	40	11.5	3.6	2	73	12
ALP2-12-4.8-73-NA	12	15	40	11.5	4.8	2	73	12
ALP2-12-5.0-83-NA	12	15	50	11.5	5	2	83	12
ALP2-12-5.1-73-NA	12	15	40	11.5	5.1	2	73	12
ALP2-14-0.0-85-NA	14	20	55	13.5	0	2	85	14
ALP2-14-0.0-150-NA	14	20	115	13.5	0	2	150	14
ALP2-14-3.2-120-NA	14	15	95	13.5	3.2	2	120	14
ALP2-14-6.3-75-NA	14	15	45	13.5	6.3	2	75	14
ALP2-16-0.0-92-NA	16	32	none	none	0	2	92	16
ALP2-16-0.0-110-NA	16	20	85	15	0	2	110	16
ALP2-16-2.5-92-NA	16	32	none	none	2.5	2	92	16
ALP2-16-3.0-92-NA	16	32	none	none	3	2	92	16
ALP2-16-3.0-110-NA	16	20	85	15	3	2	110	16
ALP2-16-3.0-160-NA	16	20	130	15	3	2	160	16
ALP2-16-3.2-82-NA	16	20	50	15	3.2	2	82	16
ALP2-16-3.2-130-NA	16	20	95	15	3.2	2	130	16
ALP2-16-3.6-92-NA	16	20	55	15	3.6	2	92	16
ALP2-16-4.0-92-NA	16	32	none	none	4	2	92	16
ALP2-16-5.0-82-NA	16	20	50	15	5	2	82	16
ALP2-16-6.3-82-NA	16	20	50	15	6.3	2	82	16
ALP2-20-0.0-104-NA	20	38	none	none	0	2	104	20
ALP2-20-0.0-150-NA	20	20	100	19	0	2	150	20
ALP2-20-1.5-120-NA	20	20	90	19	1.5	2	120	20
ALP2-20-2.5-104-NA	20	38	none	none	2.5	2	104	20
ALP2-20-3.0-120-NA	20	20	85	19	3	2	120	20
ALP2-20-3.0-150-NA	20	20	110	19	3	2	150	20
ALP2-20-3.0-165-NA	20	20	130	19	3	2	165	20
ALP2-20-3.2-92-NA	20	20	60	19	3.2	2	92	20
ALP2-20-3.2-130-NA	20	20	95	19	3.2	2	130	20
ALP2-20-3.2-150-NA	20	20	115	19	3.2	2	150	20
ALP2-20-6.3-92-NA	20	20	60	19	6.3	2	92	20
ALP2-20-6.3-130-NA	20	20	100	19	6.3	2	130	20
ALP2-20-5.0-150-NA	20	20	110	19	5	2	150	20
ALP2-20-5.0-165-NA	20	20	140	19	5	2	165	20



AlumiSTAR ALP - 3 Flute Endmill - Aluminum



Tool Ordering Number	Cutter Diameter (D1)	Cutting Length (L2)	Neck Length (L3)	Neck Diameter (D3)	Radius	Flutes	Total Length (L1)	Diameter (D2)
ALP3-6-.25-76-NA	6	6	36	5.6	0.25	3	76	6
ALP3-6-3-93-NA	6	6	56	5.6	3	3	93	6
ALP3-8-3-63-NA	8	10	26	7.2	3	3	63	8
ALP3-10-72-NA	10	10	35	9.4	3	0	72	10
ALP3-10-.25-72-NA	10	22	none	none	0.25	3	72	10
ALP3-10-.25-100-NA	10	12	56	9.4	0.25	3	100	10
ALP3-10-3-100-NA	10	12	56	9.4	3	3	100	10
ALP3-10-5-100-NA	10	14	56	9.4	5	3	100	10
ALP3-10-5-102-NA	10	14	56	9.4	5	3	102	10
ALP3-12-.25-83-NA	12	14	36	11.4	0.25	3	83	12
ALP3-12-.25-100-NA	12	14	50	11.4	0.25	3	100	12
ALP3-12-1.5-83-NA	12	14	37	11.4	1.5	3	83	12
ALP3-12-3-83-NA	12	14	36	11.4	3	3	83	12
ALP3-12-3-100-NA	12	14	56	11.4	3	3	100	12
ALP3-12-3.0-110-NA	12	14	56	11.4	3	3	110	12
ALP3-12-3.3-100-NA	12	14	56	11.4	3.3	3	100	12
ALP3-12-3.0-70-110-NA	12	14	70	10.8	3	3	125	12
ALP3-12-4.0-110-NA	12	14	70	10.8	4	3	125	12
ALP3-12-4.0-100-NA	12	14	50	10.8	4	3	100	12
ALP3-12-4.8-94-NA	12	14	48	11.4	4.8	3	94	12
ALP3-12-5-83-NA	12	14	37	11.4	5	3	83	12
ALP3-16-3.0-140-NA	16	18	70	14.4	3	3	125	16
ALP3-16-4.0-140-NA	16	18	70	14.4	4	3	125	16
ALP3-16-4.0-100-NA	16	18	50	14.4	4	3	100	16
ALP3-20-.25-100-NA	20	24	45	19	0.25	3	100	20
ALP3-20-.25-110-NA	20	24	56	19	0.25	3	110	20
ALP3-20-.25-122-NA	20	24	65	19	0.25	3	122	20
ALP3-20-1.0-100-NA	20	24	50	18	1	3	100	20
ALP3-20-1.0-130-NA	20	24	70	18	1	3	125	20
ALP3-20-1.5-100-NA	20	24	56	19	1.5	3	100	20
ALP3-20-1.5-110-NA	20	24	56	19	1.5	3	110	20
ALP3-20-1.5-129-NA	20	24	75	19	1.5	3	129	20
ALP3-20-3-110-NA	20	24	56	19	3	3	110	20
ALP3-20-3.3-110-NA	20	24	56	19	3.3	3	110	20
ALP3-20-4.0-50-100-NA	20	24	50	18	4	3	100	20
ALP3-20-4.0-60-100-NA	20	24	60	18	4	3	100	20
ALP3-20-4.0-130-NA	20	24	70	18	4	3	125	20
ALP3-20-4.0-150-NA	20	24	90	18	4	3	150	20
ALP3-20-4.8-100-NA	20	24	45	19	4.8	3	100	20
ALP3-20-52-4.8-110-NA	20	24	52	19	4.8	3	110	20
ALP3-20-5-122-NA	20	24	62	19	5	3	122	20

AlumiSTAR EMSA - 3 Flute Endmill, 45° - Aluminum

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EMSA-04-	4	XX	4,000	14	50
EMSA-06-	6	XX	6,000	19	63
EMSA-08-	8	XX	8,000	22	63
EMSA-10-	10	XX	10,000	25	63
EMSA-12-	12	XX	12,000	25	76
EMSA-16-	16	XX	16,000	38	88
EMSA-20-	20	XX	20,000	38	101

AlumiSTAR BMA - 3 Flute Endmill, Ballnose 45° - Aluminum

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
BMA-03-	3	1,5	3,000	12	38
BMA-04-	4	2	4,000	14	50
BMA-06-	6	3	6,000	19	63
BMA-08-	8	4	8,000	22	63
BMA-10-	10	5	10,000	25	63
BMA-12-	12	6	12,000	25	76
BMA-16-	16	8	16,000	38	88
BMA-20-	20	10	20,000	38	101

BM2 - 2 Flute Long Series Endmill, Ballnose

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
BM2-03-LL-	3	1,5	3	16	50
BM2-04-LL-	4	2	4	20	76
BM2-06-LL-	6	3	6	25	76
BM2-08-LL-	8	4	8	25	76
BM2-10-LL-	10	5	10	25	101
BM2-12-LL-	12	6	12	25	101
BM2-16-LL-	16	8	16	50	152
BM2-20-LL-	20	10	20	50	152

BM4 - 4 Flute Endmill Long Series, Ballnose

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
BM4-03-LL-	3	1,5	3	16	50
BM4-04-LL-	4	2	4	20	76
BM4-06-LL-	6	3	6	25	76
BM4-08-LL-	8	4	8	25	76
BM4-10-LL-	10	5	10	25	101
BM4-12-LL-	12	6	12	25	101
BM4-16-LL-	16	8	16	50	152
BM4-20-LL	20	10	20	50	152

EMV4 - 4 Flute Variable Fluted Endmill, Square End w/45° Chamfer

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EMV4-03-	3	XX	3	16	38
EMV4-04-	4	XX	4	20	50
EMV4-06-	6	XX	6	25	63
EMV4-08-	8	XX	8	25	63
EMV4-10-	10	XX	10	25	63
EMV4-12-	12	XX	12	25	76
EMV4-16-	16	XX	16	50	88
EMV4-20-	20	XX	20	50	101

BM220 - 220° 2 Flute Endmill, Ballnose

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
BM220-03-	3	1,5	3	2,25	38
BM220-04-	4	2	4	3,00	50
BM220-06-	6	3	6	4,50	63
BM220-08-	8	4	8	6,00	63
BM220-10-	10	5	10	7,50	63
BM220-12-	12	6	12	9,00	76

EMS2 - 2 Flute Endmill, Square End

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EMS2-01-	1*	XX	3,000	4	38
EMS2-02-	2*	XX	3,000	8	38
EMS2-03-	3	XX	3,000	12	38
EMS2-04-	4	XX	4,000	14	50
EMS2-06-	6	XX	6,000	19	63
EMS2-08-	8	XX	8,000	22	63
EMS2-10-	10	XX	10,000	25	63
EMS2-12-	12	XX	12,000	25	76
EMS2-16-	16	XX	16,000	38	88
EMS2-20-	20	XX	20,000	38	101

EMS4 - 4 Flute Endmill, Square End

Tool Ordering No.	Cutter Diameter tol. +0 /-0.015	Corner Radius (R1)	Shank Diameter (D1)	Cutting Length (L1)	Total Length (L2)
EMS4-03-	3	XX	3,000	12	38
EMS4-04-	4	XX	4,000	14	50
EMS4-06-	6	XX	6,000	19	63
EMS4-08-	8	XX	8,000	22	63
EMS4-10-	10	XX	10,000	25	63
EMS4-12-	12	XX	12,000	25	76
EMS4-16-	16	XX	16,000	38	88
EMS4-20-	20	XX	20,000	38	101

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