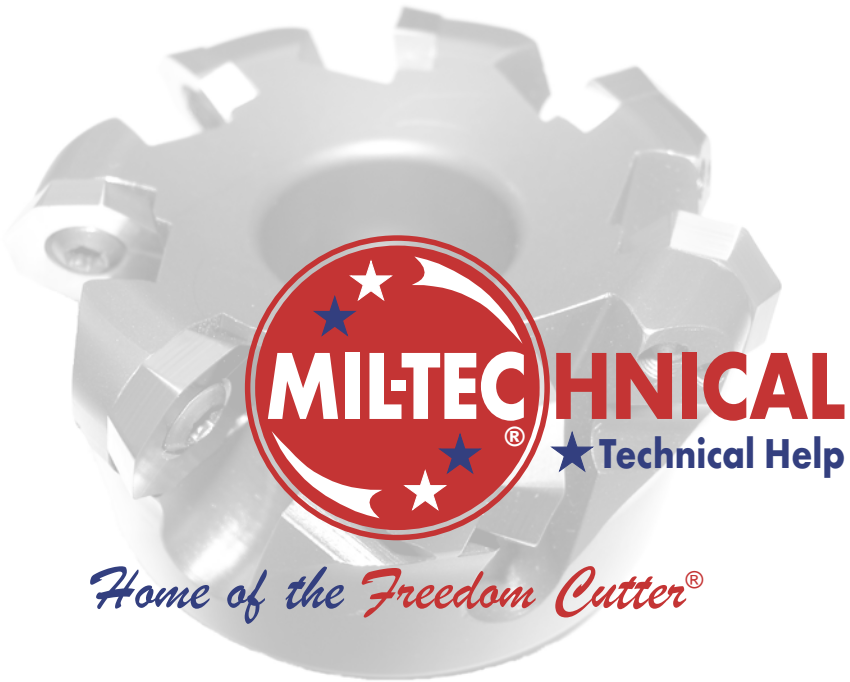
SHEARDISBELIEF

OURS Shears material with positive ground geometry Carries heat off with the chip Leaves the workpiece cool to the touch

THEIRS Pushes material with pressed geometry Punishes the workpiece Punishes the entire machine tool assembly

"REPROGRAM YOUR MILLING EXPECTATIONS"



MIL-TEC HNICAL

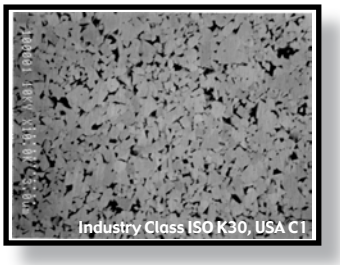
★ Technical Help

Home of the Freedom Cutter®

Phone (800) 564-5832 Fax (866) 244-0298 miltecusa.com toolalliance.com e-mail: sales@miltecusa.com

Components of Guaranteed Quality

COMPONENT #1: Carbide Substrate From being the first Company to introduce MicroGrain carbide to the mass-market round tool industry through the present day, **Tool Alliance®** has consistently innovated new powder and grade combinations for demanding applications. We recognize that our material is the very first Significant Characteristic. By creating partnerships with a limited number of tungsten powder and cemented-carbide material suppliers, we are able to guarantee that our customers receive precision-tolerance tools ground from only the purest, finest grades available worldwide. The following photograph of **Ultra-Carb® 2** demonstrates the complexity of the compound we commonly refer to as Cemented Carbide. Taken at magnification of 10,000 X through an SEM (Scanning Electron Microscope), the visible grains are tungsten while the cobalt binder appears as dark shadows. The largest tungsten grains appearing in the Ultra-Carb photo are less than one micron in size.



ULTRA-Carb® 1

Cobalt Percentage: 12%
Grain Size (µm): ≤ 1.9
Hardness: 90.2 HRa
TRS (PSI): 540,000
Density (gm/cc): 14.1
Code C1 / K40

ULTRA-Carb® 2

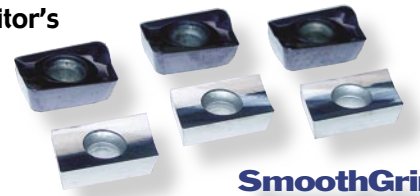
Cobalt Percentage: 10%
Grain Size (µm): ≤ 1.0
Hardness: 91.6 HRa
TRS (PSI): 480,000
Density (gm/cc): 14.5
Code C1 / K30

ULTRA-Carb® 5

Cobalt Percentage: 11.5%
Grain Size (µm): ≤ 1.9
Hardness: 91.0 HRa
TRS (PSI): 350,000
Density (gm/cc): 12.9
Code C5 / P40 / M30

COMPONENT #2: The Grinding Process After selecting the best material available, **Mil-Tec** has perfected the manufacturing technology to optimize 100% of its physical properties. We call this process **SmoothGrind®**. Years in development, SmoothGrind is the result of a proprietary combination of material, abrasive, coolant, machine-tool, software, and grinding method technologies that produce cutting tools with superior qualitative characteristics. Sharper and longer lasting cutting edges, enhanced workpiece finishes, and improved lubricity are just some of the benefits brought to you by the latest indexable carbide rotary tooling advances from Mil-Tec. The following photograph displays a Mil-Tec insert featuring SmoothGrind (bottom) versus a major competitor's product (top). Our 100% precision-ground shearing, positive geometries create cutting forces much more similar to solid carbide milling than traditional pressed and sintered insert milling. Love your machine tool? Love your spindle? Treat them right and lower your maintenance costs at the same time you increase your throughput and improve your part finish.

Competitor's



SmoothGrind® MIL-TEC®

SmoothEdge® SE 1 SE 2

COMPONENT #3: The Edge Preparation Process
Our cutting edges are literally too sharp for certain materials. For our carbide inserts and now increasingly for our solid carbide round tools, proper edge preparation can yield huge productivity improvements to "out of the box" tool application. Using a treatment we call **SmoothEdge®** and performed on machine tools developed in our own R&D lab, we've taken the mystery out of tool "break-in" and provided a consistency that can be counted on time and again. The process for inserts selects from either **SmoothEdge 1**, a light brush hone, to **SmoothEdge 2**, which doubles the cycle. Both will sound and run smooth from the first cut and protect your tooling investment from unnecessary potential for chipping during your initial tooling paths. Big productivity gains can be achieved in certain applications as well due to improved chip formation and evacuation. In addition, a microblasting treatment using extremely fine aluminum oxide powder is provided with all coated inserts, further prepping the cutting edge. For aluminum grades and certain other non-ferrous materials, we eliminate the process to achieve maximum edge sharpness.

COMPONENT #4: The Tooling Process All the best physical ingredients are wasted unless they are all pulled together in a comprehensive system that maximizes their respective attributes. Mil-Tec calls this process **SmoothContricity®**. Our indexable products are designed to run more like solid carbide end mills versus the traditional pressed & sintered insert. SmoothContricity ensures that optimum results can be obtained by minimizing run-out (TIR), and providing industry-leading tolerances on diameter & radius. Combined, these attributes allow our consumers to reach full machining potential and position the cutting tool as a systematic contributor to process consistency and repeatability. Furthermore, you'll see benefits through the production stream like reduced maintenance costs, more uptime, better part finishes, and more.

SmoothContricity®

COMPONENT #5: The Coating Process Please see Page #3 for complete information regarding SmoothCoat. **SmoothCoat®**

Components of Guaranteed Quality continued from Page #1

Our coating @ 2,000X (top).
Everybody else's (bottom).

SmoothCoat®

COMPONENT #5: The Coating Process The challenge of finding a coating method to leverage 100% of the inherent assets of our carbide grade and grinding technologies was difficult. What we finally discovered was such a perfect fit and so logical for our product lines that we invested heavily into the process we now call SmoothCoat®. Much more than simply the standard arc-deposited PVD coating, SmoothCoat involves sputter multi-layering and a multi-step prep & post operation called Micro-Blasting. The advantages of this procedure include relieving of tensile stresses underneath the cutting edge, increased stability of the coating surface, and perhaps most importantly, elevating SmoothGrind even another notch by leveling and activating the cemented carbide substrate. The result is a smooth, shiny, tough, and durable surface that can withstand tomorrow's machining requirements and outlast competitive coatings. Additionally, we've made it a standard feature on thousands of our standard catalog items. Our coating services are performed within our own factories for quality & extremely quick turnaround times.

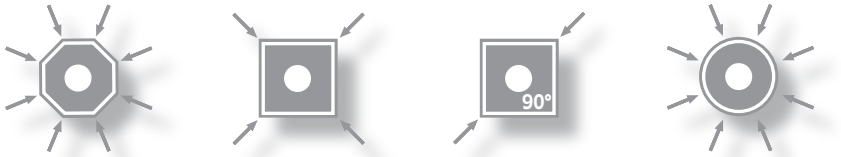
Coating Availability Order by adding the suffix TA, TN, AT, TC, A1, D1, or D2 to the EDP #.

UC	TA	TN	AT	TC	A1	D1	D2
Uncoated	TiAlN	TiN	AlTiN HSN2	TiCN	TiB2	PVD Diamond	CVD Diamond
	Standard Coatings available at "Coated" List Price					Premium Coatings available	

Mil-Tec Freedom Cutter® Inserts Nomenclature Guide & Technical Information

All selections not available • Stocked catalog standards are referenced by EDP# • Specials available upon quotation
Mil-Tec Freedom Cutter inserts can be ordered in hundreds of variations. The ability to match a specific application with geometry, coating, edge prep and carbide substrate make the Freedom Cutter the perfect application-specific milling system.

1 Insert Shape Availability order as O, S, Z, or R



Octagon (O) | Square (S) | Square 90 (Z) | Round (R)

Each arrow represents a cutting edge index.

Octagon (O) = 8
Square (S) = 4
Square 90 (Z) = 2
Round (R) = 8

2 Geometry Availability order as SS, PS, NP, MS, GP, or SA

SS Super Shear High Dish SmoothGrind®
High positive grind available in all shapes. Ideal for aluminum, non-ferrous, plastic, & non-metals.

PS Power Shear Medium Dish SmoothGrind®
Medium positive grind for steel, stainless, and exotics. The perfect "all-application" geometry.

NP Negative / Positive Frustroconical Land SmoothGrind®
Strongest insert and designed for heavy feed rates. Ideal for steel, stainless, & heat-treated alloys.

MS Mag-Na-Shear Pre-Formed + SmoothGrind®
Molded and ground chip control; ideal for stainless & exotics including titanium and inconel.

GP General Purpose Flat Top SmoothGrind®
Flat top grind for all materials.

SA90 Super Aluminum Extreme Dish SmoothGrind®
Maximum high positive grind for milling 90° corner in Aluminum. Available in Square 90 (Z) shape.

SS90 Super Shear 90° High Dish SmoothGrind®
Super Shear grind for milling 90° corner available in Square 90 (Z).

PS90 Power Shear 90° Medium Dish SmoothGrind®
Power Shear grind for milling 90° corner available in Square 90 (Z).

3 Radius Availability order as 000, 005, 016, 032, 047, 062, 093, 125, 187, 250, or 312

Octagon shape available in 062 only; Round is 312 by default.

Radius =	000	005	016	032	047	062	093	125	187	250	312
metric	0.00 mm	0.13 mm	0.40 mm	0.81 mm	1.20 mm	1.57 mm	2.36 mm	3.18 mm	4.75 mm	6.35 mm	7.92 mm
decimal	.000	.005	.016	.032	.047	.062	.093	.125	.187	.250	.312

4 Carbide Classification Availability order as 1, 2, or 5

ULTRA-Carb® 1
Toughest Grade
All applications + Exotics

ULTRA-Carb® 2
Hardest Grade
Cast Iron, Stainless
Low Carbon Steels

ULTRA-Carb® 5
Tough + Hard
Steels, Stainless
Hard materials

5 Edge Prep Availability order as 0, 1, or 2

SmoothEdge® 0
No Hone, Upsharp = 0
Razor sharp for max shearing
Plastics, Aluminum, Non-Ferrous

SmoothEdge® 1
Light Hone = 1
Added edge strength w/high shear
General Purpose for most materials

SmoothEdge® 2
Heavy Hone = 2
Strongest cutting edge
Exotics, PH Stainless, Heat treated alloys

6 Coating Availability order as UC, TA, TN, A1, AT, D1, D2, or TC

UC Uncoated | TA TiAlN | TN TiN | A1 TiB2 | AT HSN2 | D1 PVD Diamond | D2 CVD Diamond | TC TiCN

Example: 1 = Octagon, 2 = Super Shear, 3 = 1.57 mm, 4 = Ultra-Carb 5, 5 = SmoothEdge 1, 6 = TiAlN
Insert Part Number = O-SS-062-5-1-TA, or OSS06251TA (every FC Insert has 10 characters total)
Available catalog standards are referenced by EDP#.

Mil-Tec Freedom Cutter® Speeds and Feeds

Speeds and Feeds for the most common material groups plus typical insert selection.
Recommendations based on cut using 2/3rds body width and .150 or less axial depth.
Speed in Surface Feet Per Minute. Feed in inches per tooth.
*Grade references the last 4 characters of the complete 10 symbol insert name.

Class / Prep Coating: WET / DRY

Material	Alloy Grade	Mil-Tec Geometry	Speed SFPM	Octagon Feed	Square Feed	Round Feed	Mil-Tec Grade* (last 4 characters)	Coolant
Non-Ferrous	6061	Super Shear SS	1000 - 5000	.003 - .018	.003 - .018	.003 - .018	20UC or 20A1	Wet
	Copper, Brass	Super Shear SS	800 - 2000	.003 - .010	.003 - .006	.003 - .010	20UC or 20A1	Wet
	Plastics	Super Shear SS	500 - 3000+	.003 - .018	.003 - .018	.003 - .018	20UC or 20A1	Dry
Steels	1018, 1020	Power Shear PS	800 - 1500	.004- .008	.003 - .006	.004 - .010	51TA	Dry
	4140, 4340, P20	Power Shear PS	600 - 1200	.004 - .006	.002 - .006	.004 - .008	51TA or 52TA	Dry
	A2, D2, H13	Power Shear PS	400 - 1200	.003 - .006	.002 - .004	.003 - .006	52TA	Dry
Steels	1018, 1020	Neg / Positive NP	800 - 1500	.008 - .018	.006 - .008	.008 - .018	51TA	Dry
	4140, 4340, P20	Neg / Positive NP	600 - 1200	.008 - .012	.006 - .008	.008 - .012	51TA or 52TA	Dry
	A2, D2, H13	Neg / Positive NP	400 - 1200	.008 - .012	.006 - .008	.008 - .012	52TA	Dry
Stainless Steel	13-8, 15-5, 17-4	Power Shear PS	500 - 1200	.004 - .010	.002 - .008	.004 - .010	52TA or 22TA	Dry
	303, 304, 316	Power Shear PS	800 - 1700	.008 - .015	.002 - .012	.008 - .015	51TA or 21TA	Dry
	420, 440C	Power Shear PS	800 - 1500	.004 - .012	.002 - .006	.004 - .012	51TA or 52TA	Dry
Stainless Steel	13-8, 15-5, 17-4	Neg / Positive NP	500 - 1200	.008 - .012	.006 - .010	.008 - .012	52TA or 22TA	Dry
	303, 304, 316	Neg / Positive NP	800 - 1700	.010 - .020	.006 - .008	.010 - .020	51TA or 21TA	Dry
	420, 440C	Neg / Positive NP	800 - 1500	.010 - .014	.006 - .008	.010 - .014	51TA or 52TA	Dry
High Temp	Inconel	Power Shear PS	50 - 180	.002 - .006	.002 - .004	.002 - .006	12TA or 52TA	Wet
	Titanium	Power Shear PS	70 - 300	.004 - .006	.002 - .006	.004 - .006	12TA or 52TA	Wet
High Temp	Inconel	Mag Na Shear MS	50 - 250	.002 - .004	.002 - .003	.002 - .004	12TA or 52TA	Wet
	Titanium	Mag Na Shear MS	70 - 300	.002 - .004	.002 - .003	.002 - .004	12TA or 52TA	Wet
Cast Iron	Gray Iron	Power Shear PS	500 - 1200	.004 - .010	.004 - .006	.004 - .010	22TA or 52TA	Dry
	Ductile Iron	Power Shear PS	600 - 1200	.004 - .010	.004 - .006	.004 - .010	22TA or 52TA	Dry
Cast Iron	Gray Iron	Neg / Positive NP	500 - 1200	.010 - .014	.006 - .008	.010 - .014	22TA or 52TA	Dry
	Ductile Iron	Neg / Positive NP	600 - 1200	.010 - .014	.006 - .008	.010 - .014	22TA or 52TA	Dry

FC Series Specifications: Body Diameter ±.005, TIR with installed insert ±.001

Material	Operating Tips
Non-Ferrous	Our 20UC grade is ideal in aluminum and plastics. The polished surface provides a smooth cutting face with a low coefficient of friction. This grade also features an extremely sharp cutting edge for free cutting in soft or gummy materials. The 20A1 grade includes A1 coating. A1 adds additional lubricity and dramatically reduces chip welding. 20A1 is ideal in low coolant or dry machining applications.
Steels	We feature 2 primary grades for steel alloys, 51TA and 52TA. Both use a wear resistant carbide substrate that has been designed for performance in high heat applications. SmoothCoat TA provides further wear resistance, thermal protection, and lubricity. Our TA (a hybrid version of TiAlN) is well suited for dry machining of steel alloys. The difference between the 51TA and 52TA is the edge preparation; 52TA's heavier hone adds strength in the toughest alloys and heat treated steels, and is effective in reducing edge chipping in applications where vibration is a concern.
Stainless Steel	Variations of stainless steel are immense. 15-5 PH and 440C can be heat treated and have increased hardness. Others such as 304 and 316 will work harden and are gummy to machine. The challenge is to find the optimal combination of hardness and wear resistance that is balanced with toughness to prevent excessive chipping. We offer several grades that feature our SmoothEdge hone and TA coating to obtain the perfect balance.
High Temp	Titanium, Inconel, and other chromium / nickel alloys can be a challenge to machine. They were developed specifically for airframe applications where strength and toughness are primary goals. Insert toughness and wear characteristics are critical due to the slower speeds these materials are machined at. Our 12TA provides an excellent balance of both. For finishing applications, our 52TA can be highly effective due to outstanding wear abilities.
Cast Iron	Materials featuring short chips like cast iron require high cutting edge toughness. Casted materials can feature voids and inclusions that are destructive to cutting tools. Our 22TA and 52TA grades are designed to withstand these attributes. 22TA, the first choice, exhibits great toughness while 52TA has better wear resistance.

Mil-Tec Freedom Cutter® Facts, Tips & Hints

EFFECTIVE CUTTER DIAMETERS: The cutting diameter of your Freedom Cutter will change relative to the cutter body depending upon the shape of the insert selected. When using Square inserts, the cutting diameter will equal the body diameter. When using Octagon inserts, the cutting diameter is reduced approximately 3/8" from the body diameter. When using Round inserts, cutting diameter is reduced approximately 5/8" below the body diameter.

THINGS TO REMEMBER:
- Always run Stainless dry (coolant may be used only on very light finishing cuts of .005 – .015)
- SFPM & chip load recommendations are based on 2/3's width of cutter and climb milling
- Recommended depth of cut (DOC) ranges from .025 to .150
- For finishing cuts leave feed rate unchanged but increase RPM by 10% to 30%, with DOC at .015 to .030
- Recommended Speeds & Feeds are starting parameters and may require adjustment dependent upon material & machine condition

LOADING OF 90° INSERTS: When using any 90° insert, ensure that each insert is placed into the pocket with the straight, 90° edge on the periphery of the cutter body (concave edge is down).

USING THE PATENTED MIL-LOC FEATURE FOR ROUND INSERTS: The Mil-Loc keeps Round inserts from spinning under load and ensures 8 indexes. Using the 1/16" hex key included with every cutter, turn the screw from the back side so that the half-dog on the special Mil-Loc screw protrudes about .030". Be sure that the thread of the screw is not above the bottom of the pocket. Place the insert into the pocket so that the matching indents in the back of the insert align with the Mil-Loc screw in the cutter pocket. Tighten the insert normally with the center screw. Be sure to retract the Mil-Loc screw completely when using Octagon or Square inserts.

Commonly Used Formulas:

Surface Feet Minute (SFM)=RPM x Diam. x .262
Revolutions Per Minute (RPM)=3.82 x (SFM / Diam.)
Feed Rate (IPM)=IPT x #teeth x RPM
Feed Per Tooth (IPT)=IPM / (#teeth x RPM)
Convert Inches to millimeters: Multiply by 25.4
Convert millimeters to Inches: Multiply by .03937

Mil-Tec publishes a separate catalog with complete Metric sizing. Request it from our Sales Department or at miltecusa.com.

Mil-Tec HV3HD, HV5HD, & HV10 Speeds and Feeds

Speeds and Feeds for the most common material groups plus typical insert selection.
Recommendations based on normal slotting & peripheral milling with DOC .100 or less.
Speed in Surface Feet Per Minute. Feed in inches per tooth.

WET DRY

Material	Alloy Grade	Speed SFPM	HV3HD feed per tooth	HV5HD feed per tooth	HV10 feed per tooth	Mil-Tec Grade (Class/Prep/ Coating)	Coolant
Non-Ferrous	6061 Aluminum	1000 – 3000+	.003 – .010	.003 – .012	.003 – .024	20UC or 20A1	Wet
	Copper, Brass	800 – 1500	.003 – .008	.003 – .010	.003 – .018	20UC or 20A1	Wet
	Plastics	500 – 3000+	.003 – .015	.003 – .015	.003 – .015	20UC or 20A1	Dry
Steels	1018, 1020	800 – 1500	.002 – .006	.002 – .008	call factory	51TA	Dry
	4140, 4340, P20	600 – 1200	.002 – .005	.002 – .007	call factory	51TA	Dry
	A2, D2, H13	400 – 1000	.002 – .004	.002 – .006	call factory	51TA	Dry
Stainless Steel	13-8, 15-5, 17-4	500 – 1200	.001 – .004	.001 – .006	call factory	51TA or 11AT	Dry
	303, 304, 316	800 – 1500	.002 – .006	.002 – .006	call factory	51TA or 11AT	Dry
	420, 440C	800 – 1500	.002 – .005	.002 – .005	call factory	51TA or 11AT	Dry
High Temp	Inconel	100 – 300	.001 – .004	.001 – .004	call factory	11AT	Wet
	Titanium	70 – 250	.001 – .004	.001 – .004	call factory	11AT	Wet
Cast Iron	Gray Iron	500 – 1200	.002 – .004	.002 – .006	call factory	11TA	Dry
	Ductile Iron	600 – 1200	.002 – .004	.002 – .006	call factory	11TA	Dry

HV Series Specifications: Body Diameter +.000 / –.005, TIR with installed insert ±.001