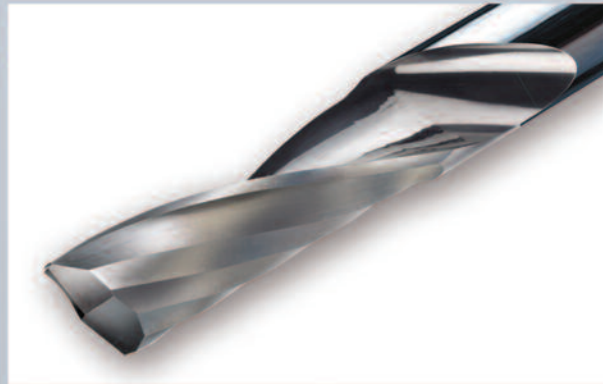
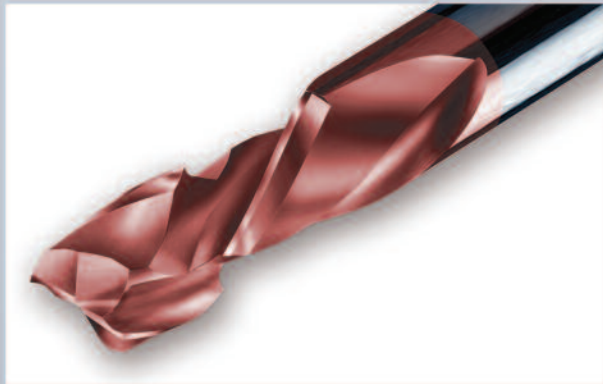


Production Cutting Tools - METRIC





comprehensive training

Increased productivity equals lower cost, improved profitability, and ultimately, survival of your business in today's competitive environment. **The LMT Onsrud Performance Team** will work with all levels of your operation to increase your productivity. All levels of training, general to production-specific on the shop floor, are only a call away!

factory technical support

LMT Onsrud provides your business with access to our staff of highly trained professional factory technicians. We can assist you with those difficult production machining problems while increasing your performance and productivity.

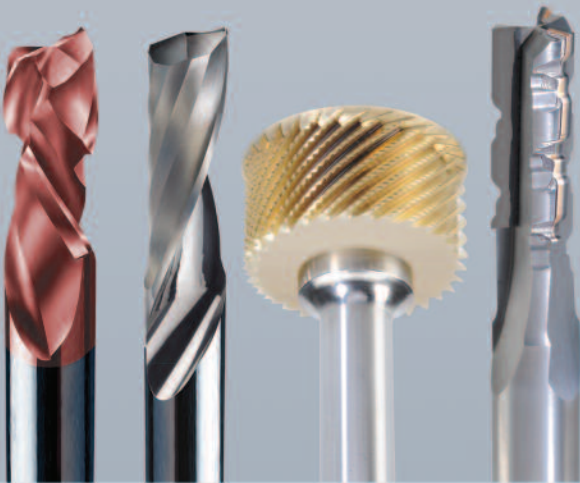
on-site trouble shooting

Correct tool selection, proper hold-down techniques, faster feed rates, fewer and quicker set ups are all pieces to the productivity puzzle. **The LMT Onsrud Performance Team** offers tailored solutions for problem solving and productivity gains.

t h e
ONSRUD
a d v a n t a g e

custom tool design

Not only does LMT Onsrud offer the largest selection of cutting tools for day to day operations, but we will also design a tool for your specific application or material. We will take your tool requirements from the drawing board, to sophisticated computer-aided design, to in-house testing on our CNC router and CNC Mill. Custom tooling made to meet your productivity goals.



Wood

Plastic

Honeycomb

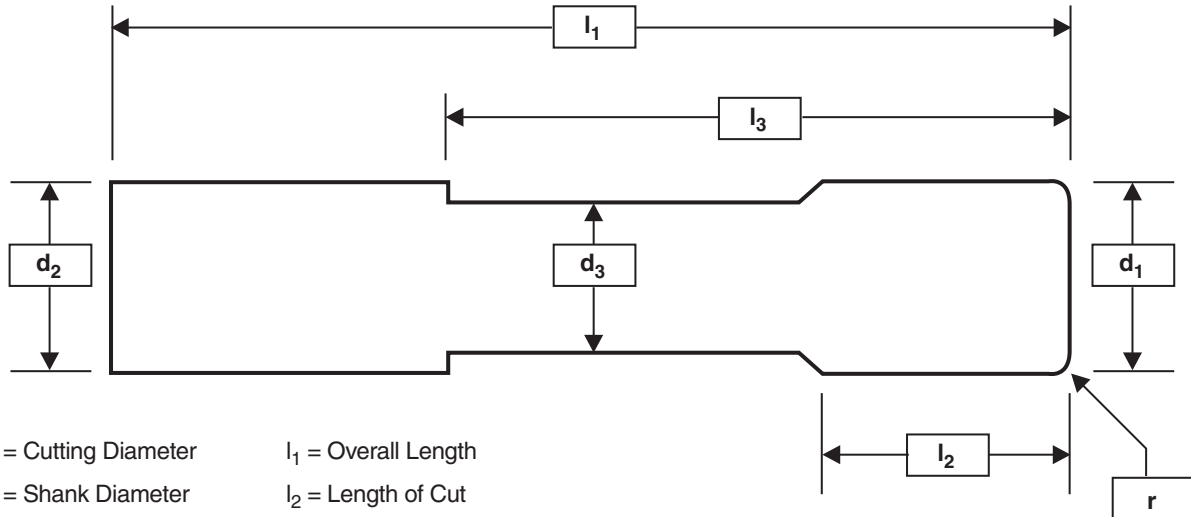
Composite

www.onsrud.com

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Description of Terms



d_1 = Cutting Diameter
 d_2 = Shank Diameter
 d_3 = Neck Diameter
 z = Number of Flutes
 l_1 = Overall Length
 l_2 = Length of Cut
 l_3 = Extended Length
 r = Corner Radius

37-00
37-20



Single Flute - Solid Carbide Engraving Tools

The engraving tools are offered with a wide range of tip sizes and angles to accommodate many engraving styles.

Usage Wood, plastic, aluminum and solid surface

Part #	d ₁	Included Angle	d ₂	l ₁
37-25M	0.5	30	6	50
37-27M	0.76	30	6	50
37-29M	1	30	6	50

Part #	d ₁	Included Angle	d ₂	l ₁
37-05M	0.5	60	6	50
37-07M	0.76	60	6	50
37-09M	1	60	6	50

29-000



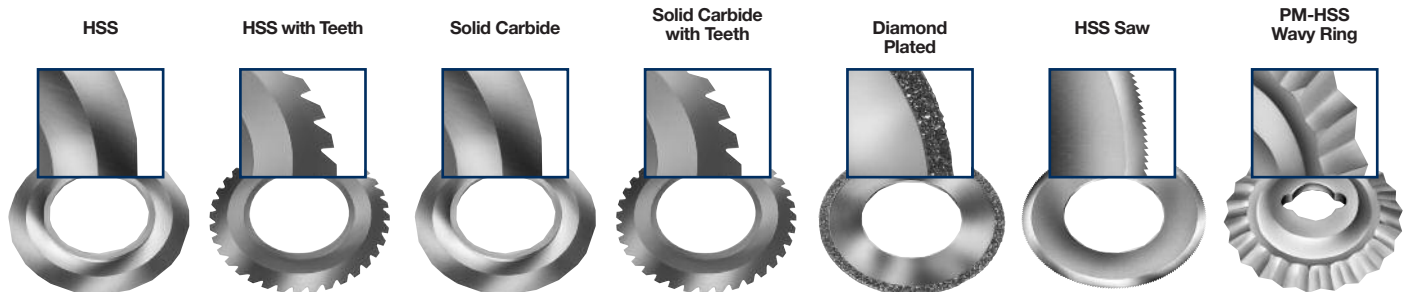
HSS Hollow Core Cutters

This specialized cutter is designed to vertically cut the honeycomb cells producing a clean, flag free edge. The core material will remain attached at the bottom and can be removed using one of our valve style honeycomb cutters. This product along with our 31-100 or 30-000 series tools is an effective combination to create pockets in honeycomb core and get a perfectly clean edge.

Usage Honeycomb

Part #	d ₁	l ₂	d ₂	l ₁
29-003	6.35	38.10	6.35	95.25
29-006	9.52	47.63	9.52	95.25
29-009	12.7	73.03	12.7	127
29-012	15.88	73.03	15.88	127
29-015	19.05	73.03	19.05	127

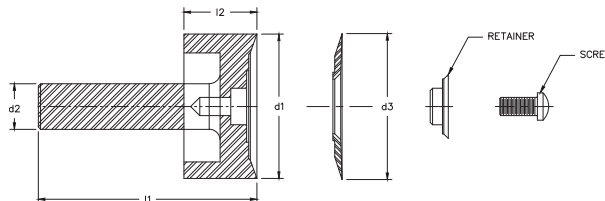
Cutting Blades for Cutters and Hoggers



Diamond Grit Hogger

Diamond grit hoggers are used on abrasive cores (graphite, phenolic, or fiberglass) in order to achieve long tool life. The hogger is capable of holding existing honeycomb blades. A 35% weight reduction has been designed into the larger diameter tools resulting in better performance on 3 or 5 axis machines.

Usage Honeycomb



HONEYCOMB HOGGER					CUTTING BLADE OPTIONS							SPARE PARTS	
Part #	d_1	l_2	d_2	l_1	Blade Diameter d_3	HSS	HSS w/Teeth	Solid Carbide	Solid Carbide w/Teeth	Diamond Plated	HSS Saw	Adapter Ring	Screw
29-052	6.35	31.75	6.35	101.6	-	-	-	-	-	-	-	-	-
29-057	8.76	63.5	12.7	101.6	9.52	30-016	30-316	-	-	-	-	-	HRD51646
29-062	11.94	76.2	12.7	127	12.7	30-017	30-317	-	-	-	-	-	HRD51646
29-067	18.28	76.2	12.7	127	19.05	-	-	30-015	30-318	-	-	-	30-011-2
29-072	24.63	25.4	12.7	76.2	25.4	-	-	30-012	30-313	30-113	30-213	-	30-011-2
29-073	24.63	50.8	19.05	127	25.4	-	-	30-012	30-313	30-113	30-213	-	30-011-2
29-078	37.33	25.4	12.7	76.2	38.10	-	-	30-014	30-314	30-114	30-214	30-020-3	30-020-4
29-079	37.33	50.8	19.05	127	38.10	-	-	30-014	30-314	30-114	30-214	30-020-3	30-020-4
29-083	44.24	25.4	12.7	76.2	45	-	-	30-026	30-326	30-126 ²	30-226 ²	30-020-3	30-020-4
29-084	44.24	50.8	19.05	127	45	-	-	30-026	30-326	30-126 ²	30-226 ²	30-020-3	30-020-4
29-088	50.03	25.4	15.88	76.2	50.8	-	-	30-022	30-322	30-122	30-222	30-020-3	30-020-4
29-089	50.03	50.8	19.05	127	50.8	-	-	30-022	30-322	30-122	30-222	30-020-3	30-020-4
29-093	62.23	25.4	15.88	76.2	63	-	-	30-036	30-336	30-136	30-236	30-030-3	30-030-4
29-095	75.43	25.4	19.05	76.2	76.20	-	-	30-032	30-332	30-132	30-232	30-030-3	30-030-4
29-096	75.43	25.4	19.05	101.6	76.20	-	-	30-032	30-332	30-132	30-232	30-030-3	30-030-4
29-098	100.83	25.4	19.05	76.2	101.6	-	-	30-042	30-342	30-142	30-242	30-040-3	30-040-4
29-099	100.83	25.4	19.05	101.6	101.6	-	-	30-042	30-342	30-142	30-242	30-040-3	30-040-4

2 = 50mm diameter honecomb blade

See page 4, 6 or 8 for Images of Cutting Blades

Diamond Grit Hogger Ballnose

Diamond grit hoggers are used on abrasive cores (graphite, phenolic, or fiberglass) in order to achieve long tool life. The tools are available in a ball nose version.

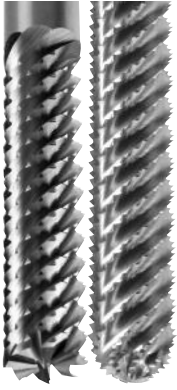
Usage Honeycomb

BALL NOSE

Part #	d_1	l_2	d_2	l_1
29-054	6	32	6	100
29-056	10	60	10	120
29-061	12	75	12	120
29-065	20	75	20	120



**29-100/
29-100B**



Solid Carbide Honeycomb Hogger (Coated)

Designed to be a versatile tool and cut most honeycomb core materials. The solid carbide body offers long tool life while the proven hogger geometry shreds the core and evacuates chips. The long flute length allows for deep pocket applications and can also be used to surface large areas. Hoggers are coated with ZRN.

Usage Honeycomb

Part #	d ₁	l ₂	d ₂	l ₁
29-120	12	60	12	150
29-135	16	80	16	150

BALLNOSE

Part #	d ₁	l ₂	d ₂	l ₁
29-130B	12.7	114.3	12.7	165.1
29-140B	19.05	76.2	19.05	152.4
29-145B	19.05	114.3	19.05	165.1

30-000



Replaceable Ring Type Honeycomb Cutter

These tools are for contouring, carving and chamfering cuts of 6.35mm or less. The unique patented holding system prevents the solid carbide blades from coming out of the holder if it is fractured.

The HSS saw blades and the diamond plated blades dish on the bottom so they clear the cut core finish like the hollow ground solid carbide style rings. The solid carbide rings may be reground several times at the factory making them very economical to use.

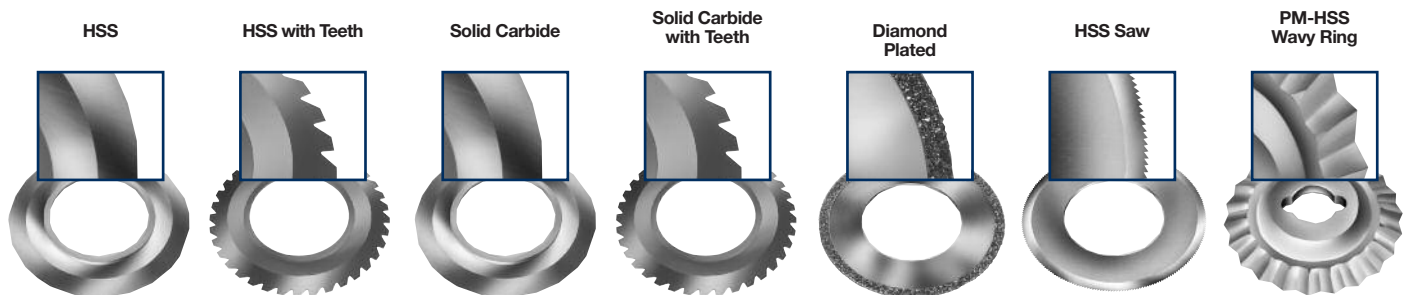
The HSS saw and diamond plated blades are disposable, offering the convenience of a constant diameter.

Usage For contouring, carving and chamfering cuts

SHANK ASSEMBLY			CUTTING BLADE OPTIONS				SPARE PARTS	
Part #	Blade Diameter d ₃	d ₂	Solid Carbide	Solid Carbide with Teeth	Diamond Plated	HSS Saw	Adapter Ring	Screw
30-010	25	12	30-052	-	30-115	30-215	-	30-011-2
30-011	25.4	12.7	30-012	30-313	30-112	30-213	-	30-011-2
30-013	45	12	30-026	30-326	30-126	30-226	30-020-3	30-020-4
30-021	50.8	12.7	30-022	30-322	30-122	30-222	30-020-3	30-020-4
30-023	63	12	30-036	30-336	30-136	30-236	30-030-3	30-030-4
30-031	76.2	12.7	30-032	30-332	30-132	30-232	30-030-3	30-030-4
30-041	101.6	12.7	30-042	30-342	30-142	30-242	30-040-3	30-040-4

See page 4, 6 or 8 for Images of Cutting Blades

Cutting Blades for Cutters and Hoggers



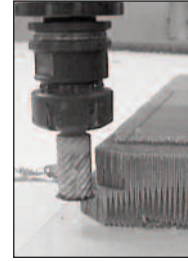
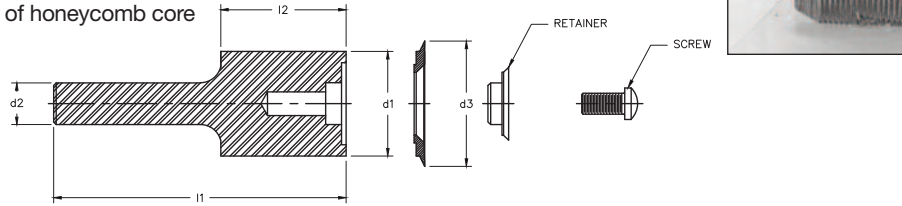
HSS Integral Shank Honeycomb Hogger Cutter

30-300

**High Speed Steel Hoggers • High Speed Replaceable Saw Blade
Solid Carbide Replaceable Blade • Diamond Plated Replaceable Blade**

The spiral hogger geometry ground integral to the shank allows for faster feed rates and deeper cuts than any previous cutter. The availability of several different blades makes this cutter suitable for most core types. The hogger design also imparts less force as it evacuates and shreds scrap.

Usage CNC machining of honeycomb core



HONEYCOMB HOGGER					CUTTING BLADE OPTIONS					SPARE PARTS	
Part #	d ₁	l ₂	d ₂	l ₁	Blade Diameter d ₃	Solid Carbide	Solid Carbide w/Teeth	Diamond Plated	HSS Saw	Adapter Ring	Screw
30-310	22.22	38.1	12.7	88.9	25.4	30-012	30-313	30-113	30-213	-	30-011-2
30-315	31.75	38.1	12.7	88.9	38.1	30-014	30-314	30-114	30-214	30-020-3	30-020-4
30-321	44.45	38.1	12.7	88.9	50.8	30-022	30-322	30-122	30-222	30-020-3	30-020-4
30-331	69.85	25.4	12.7	88.9	76.2	30-032	30-332	30-132	30-232	30-030-3	30-030-4
30-341	95.25	25.4	19.05	88.9	101.6	30-042	30-342	30-142	30-242	30-040-3	30-040-4

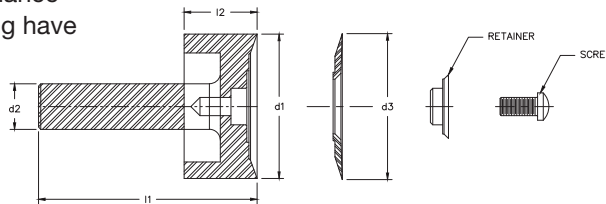
See page 4, 6 or 8 for Images of Cutting Blades

Reduced Weight Honeycomb Cutter

30-700

35% weight reduction has been designed into the larger diameter tools resulting in better performance on 3 or 5 axis machines. Part lifting and flagging have also been reduced due to the new tooth and flute design. Existing honeycomb blades will mount on these hoggers.

Usage CNC Machining of Honeycomb Core



HONEYCOMB HOGGER					CUTTING BLADE OPTIONS							SPARE PARTS	
Part #	d ₁	l ₂	D ₂	l ₁	Blade Diameter d ₃	HSS	HSS w/Teeth	Solid Carbide	Solid Carbide w/Teeth	Diamond Plated	HSS Saw	Adapter Ring	Screw
30-703	8.76	25.4	12.7	76.2	9.52	30-016	30-316	-	-	-	-	-	HRD51646
30-705	11.93	25.4	12.7	76.2	12.7	30-017	30-317	-	-	-	-	-	HRD51646
30-707	18.28	25.4	12.7	76.2	19.05	-	-	30-015	30-318	-	-	-	30-011-2
30-710	24.63	25.4	12.7	76.2	25.4	-	-	30-012	30-313	30-113	30-213	-	30-011-2
30-715	37.33	25.4	12.7	76.2	38.10	-	-	30-014	30-314	30-114	30-214	30-020-3	30-020-4
30-720	44.24	25.4	12.7	76.2	45	-	-	30-026	30-326	30-126 ¹	30-226 ¹	30-020-3	30-020-4
30-725	50.03	25.4	15.88	76.2	50.8	-	-	30-022	30-322	30-122	30-222	30-020-3	30-020-4
30-730	62.23	25.4	15.88	76.2	63	-	-	30-036	30-336	30-136	30-236	30-030-3	30-030-4
30-735	75.43	25.4	19.05	76.2	76.20	-	-	30-032	30-332	30-132	30-232	30-030-3	30-030-4
30-740	100.83	25.4	19.05	76.2	101.6	-	-	30-042	30-342	30-142	30-242	30-040-3	30-040-4

¹ = 50mm diameter honecomb blade

See page 4, 6 or 8 for Images of Cutting Blades

31-000

High Speed Steel Cutter



Designed primarily for use on aluminum core, offering the versatility of smaller sizes for use on hand-held machines in field or maintenance type repairs. This cutter offers the strength of an integral shank and blade that has an edge sharpness unattainable with any other material. This sharpness and the relieved bottom yield part surfaces that require a minimum of preparation before bonding operation.

Usage Aluminum Core

Part #	d ₁	d ₂	l ₁
31-010	12.7	6.35	52.39
31-015	19.05	6.35	53.18
31-020	25.4	6.35	53.98
31-025	38.1	12.7	57.15
31-030	50.8	12.7	69.85
31-040	76.2	12.7	74.61

Core Type	Rating
Aluminum, Lo Density (Less than 5#/cuft)	1
Aluminum, Hi Density (More than 5#/cuft)	2
Paper	2
Paper, Reinforced	N
Fiberglass	N
Phenolic	N
Polycarbonate	N
Aramid	N

1 - Excellent, 2 - Good, N - Not Recommended

31-100

High Speed Steel Honeycomb Cutter With Teeth

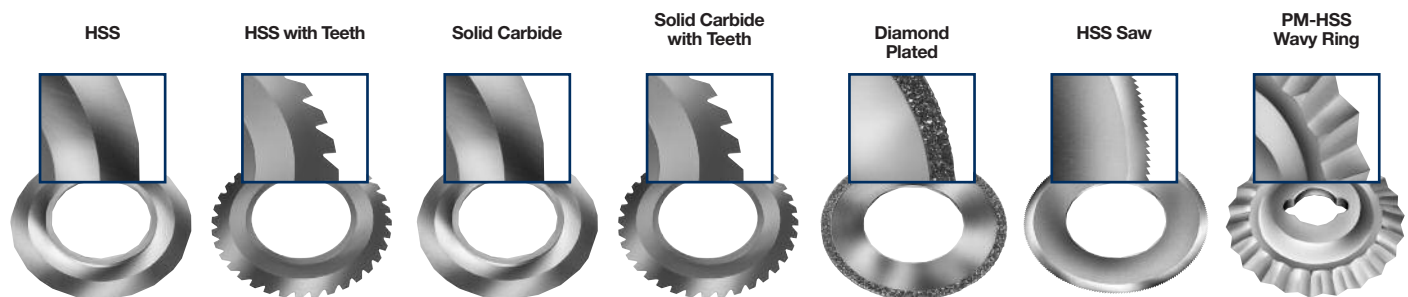


Small diameter honeycomb cutters were designed to offer the flexibility of cutting small slots or pockets in honeycomb core. The tools are versatile and can be used on CNC machines or hand held machines for field or maintenance type repairs.

Usage For contouring, carving, pocketing, and chamfer cuts

Part #	d ₁	d ₂	l ₁
31-102TCN	9.53	12.7	76.2
31-104TCN	12.7	12.7	76.2
31-106TCN	15.88	12.7	76.2
31-108TCN	19.05	12.7	76.2

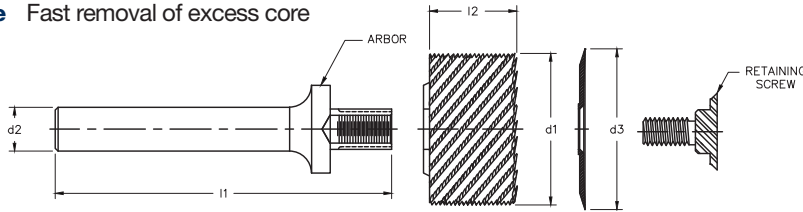
Cutting Blades for Cutters and Hoggers



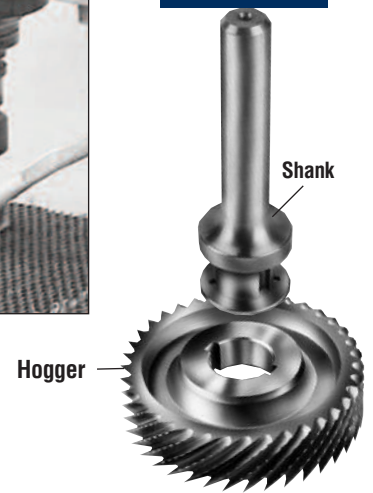
High Speed Steel Hogger

These cutters are specifically designed for fast (low force) removal of excess core followed by a final finish pass to obtain excellent finishes with one tool. These cutters enable cuts of up to 15mm depths in a single pass. The availability of several different blades makes this cutter suitable for most core types. All assemblies require a shank, hogger and blade.

Usage Fast removal of excess core



32-000



HONEYCOMB HOGGER			SHANK		CUTTING BLADE OPTIONS					SPARE PARTS	
Part #	d ₁	l ₂	Part #	d ₂	Blade Diameter d ₃	Solid Carbide	Diamond Plated	HSS Wavy Ring	HSS Saw	Adapter Ring	Screw
32-022	44	16	32-021	12.7	45	32-026	-	32-023	-	-	-
					50	-	32-029*	-	32-027*	32-028	-
32-032	61.5	16	32-031	12.7	63	32-036	-	32-033	-	-	-
					75	-	32-039*	-	32-037*	32-038	-

32-100 - Wrench for 32-000 Tools

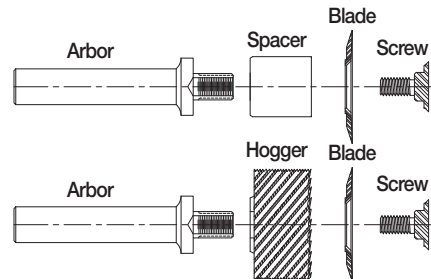
See page 4, 6 or 8 for Images of Cutting Blades

* Requires Adapter Ring

HSS Three Piece Honeycomb Hogger (Coated)

Designed with more aggressive hogger geometry than the 32-000 series. Both the hogger and blade with teeth have a fine tooth grind pattern resulting in increased feed rates and improved part finish. All hogs and blades are coated with a ZRN coating for increase in tool life. All hogger assemblies require a shank, a hogger and a blade. This design also allows the tool to be use without the hogger by replacing the hogger with a spacer.

Usage Fast removal of excess core



32-200



HONEYCOMB HOGGER			SHANK			CUTTING BLADE OPTIONS			SPARE PARTS	
Part #	d ₁	l ₂	Part #	d ₂	l ₁	Blade Diameter d ₃	Solid Carbide	Solid Carbide w/Teeth	Spacer	Retaining Screw
32-210	23.88	25.4	32-221	9.52	101.6	25.4	32-412	32-512	32-221-3	32-221-4
32-225	49.28	25.4	32-231	12.7	101.6	50.8	32-422	32-522	32-231-3	32-231-4
			32-241	15.88	101.6					
32-235	74.68	25.4	32-231	12.7	101.6	76.2	32-432	32-532	32-231-3	32-231-4
			32-241	15.88	101.6					
32-220	43.69	25.4	32-231	12.7	101.6	45	32-426	32-526	32-231-3	32-231-4
			32-241	15.88	101.6					
32-230	61.47	25.4	32-231	12.7	101.6	63	32-436	32-536	32-231-3	32-231-4
			32-241	15.88	101.6					

32-201 - Wrench for 32-200 Tools (for Shank Diameters 12.7 & 15.88)

32-202 - Wrench for 32-200 Tools (for Shank Diameters 9.52)

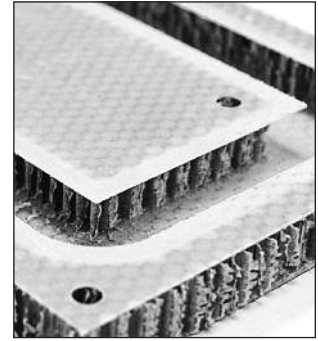
See page 4, 6 or 8 for Images of Cutting Blades

34-000



Aircraft Panel Tools

This modular tool is designed to produce slots in composite panels so potting compound can be applied to strengthen the edge. This tool consists of a PCD arbor which accepts a diamond grit or HSS under cutting tool to be screwed into it.



Usage HCC Panels

Part #	d ₁	l ₂	d ₂	
34-008	12.7	-	12.7	Arbor (non-cutting)
30-009	12.7	6.35	12	PCD Arbor
34-010	12.7	6.35	12.7	PCD Arbor
34-022	22.23	3.3	n/a	Diamond Grit Cutter
34-024	22.23	6.35	n/a	Diamond Grit Cutter
34-026	22.23	9.652	n/a	Diamond Grit Cutter
34-028	22.23	12.7	n/a	Diamond Grit Cutter
34-030	22.23	16	n/a	Diamond Grit Cutter
34-042	22.23	3.3	n/a	HSS Cutter
34-044	22.23	6.35	n/a	HSS Cutter
34-046	22.23	9.652	n/a	HSS Cutter
34-048	22.23	12.7	n/a	HSS Cutter
34-050	22.23	16	n/a	HSS Cutter

34-100

Potted Fastener Tools (Coated)

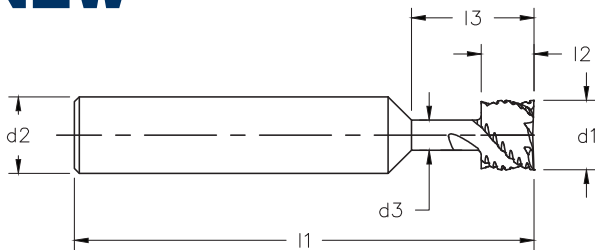


The tool was designed to eliminate the inconsistencies in producing the holes in aircraft interior panels to mount potted, glued in, fasteners. This tool for composite panels will plunge and shred the HCC. In aluminum panels an entry hole is required but the HCC shred is clean and effective. Coated for increased tool life.

Usage Honeycomb Panel

Part #	d ₁	l ₂	d ₂	d ₃	l ₃	l ₁
34-106	11.51	3.30	12	4.57	20.32	76
34-108	11.51	6.35	12	4.57	20.32	76
34-110	11.51	9.65	12	4.57	20.32	76
34-112	11.51	12.70	12	4.57	20.32	76
34-114	12.70	3.30	12	4.83	20.32	76
34-116	12.70	6.35	12	4.83	20.32	76
34-118	12.70	9.65	12	4.83	20.32	76
34-120	12.70	12.70	12	4.83	20.32	76
34-122	14.29	3.30	12	5.59	20.32	76
34-124	14.29	6.35	12	5.59	20.32	76
34-126	14.29	9.65	12	5.59	20.32	76
34-128	14.29	12.70	12	5.59	20.32	76
34-130	16.00	3.30	16	6.35	20.32	76
34-132	16.00	6.35	16	6.35	20.32	76
34-134	16.00	9.65	16	6.35	20.32	76
34-136	16.00	12.70	16	6.35	20.32	76

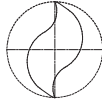
NEW



52-200B**Double Flute - Solid Carbide Upcut Spiral Ball Nose**

Designed for carving and modeling operations. Their improved tip geometry gives a superior cut compared to most ballnose endmills.

Usage Plastic, solid surface, block & plate aluminum natural wood and wood composite

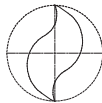


Part #	d ₁	l ₂	d ₂	l ₁
52-240BM	3	12	6	50
52-280BM	6	22	6	64
52-320BM	10	29	10	76
52-360BM	12	29	12	76

**52-400****Double Flute - Solid Carbide Upcut Spiral Wood Rout**

Designed for routing where upward chip removal, tool rigidity, long life and high quality finish is desired.

Usage Natural wood, wood composites, plastic and solid surface



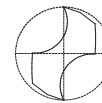
Part #	d ₁	l ₂	d ₂	l ₁
52-410	4	16	6	64
52-411	5	20	6	64
52-412	6	25	6	64
52-414	8	25	8	64
52-416	10	35	10	76
52-418	12	35	12	76

HELIX ANGLE ≈ 30°

**52-700****Double Flute - Solid Carbide Upcut Spiral O Flute**

High helix geometry designed to cut soft plastic with a smooth finish and upward chip flow. Special point geometry for improved bottom finish.

Usage Soft plastic, extruded acrylic, nylon, ABS, PE, acetal, PET, HDPE, UHMW, polycarbonate, solid surface and foam.



Part #	d ₁	l ₂	d ₂	l ₁
52-742	12	35	12	100
52-744	12	45	12	100
52-746	12	55	12	100
52-752	16	45	16	120
52-754	16	55	16	120
52-764	20	65	20	125

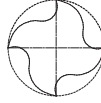


54-200

Four Flute - Solid Carbide Spiral for Glass-Reinforced Plastic (Coated)

Updated line of three and four flute tools for machining glass-reinforced plastic. Geometry has been optimized to shear the glass fibers while creating a chip which removes heat from the cut to avoid melting of the material. Tools are coated to withstand the abrasive characteristics inherent to glass-reinforced plastic (GRP).

Usage Fiberglass and Composites



UPCUT

Part #	d ₁	l ₂	d ₂	l ₁
54-260	6	19	6	76
54-266	8	22	8	76
54-270	10	25	10	76
54-276	12	25	12	76

DOWNCUT

Part #	d ₁	l ₂	d ₂	l ₁
54-261	6	19	6	76
54-267	8	22	8	76
54-271	10	25	10	76
54-277	12	25	12	76

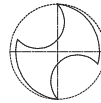
NEW

56-430

Double Flute - Solid Carbide Straight O Flute

Designed with free cutting O flute geometry along with a double flute design for smooth finish.

Usage Polycarbonate, ABS, HIPS, HDPE, PET, acrylic, polystyrene, polypropylene, PE, PVC, acetal, UHMW



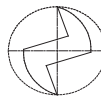
Part #	d ₁	l ₂	d ₂	l ₁
56-612M	3	12	6	50
56-430	4	16	6	64
56-431	5	20	6	64
56-432	6	25	6	64
56-434	8	25	8	76
56-436	10	35	10	88
56-650M	12	25	12	76
56-438	12	35	12	88

56-450

Double Flute - Solid Carbide Straight

Designed specifically to rout harder, more rigid plastics

Usage Phenolic, acrylic, nylon, PVC, ABS, acetal and solid surface

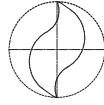


Part #	d ₁	l ₂	d ₂	l ₁
56-450	4	16	6	64
56-451	5	20	6	64
56-452	6	25	6	64
56-454	8	25	8	76
56-456	10	35	10	88
56-458	12	35	12	88

Double Flute - Solid Carbide Downcut Spiral Wood Rout

Designed for routing where downward chip removal, tool rigidity, long life, and high quality finish is desired.

Usage Natural wood and wood composites



Part #	d ₁	l ₂	d ₂	l ₁
57-410	4	16	6	64
57-411	5	20	6	64
57-412	6	25	6	64
57-414	8	25	8	64
57-416	10	35	10	76

HELIX ANGLE ≈ 30°

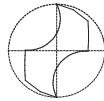
57-400



Double Flute - Solid Carbide Downcut Spiral O Flute

Designed to cut plastic with a smooth finish and downward chip flow.

Usage Acrylic, nylon, ABS, PE, acetal, PET, HDPE, UHMW, polycarbonate and solid surface



Part #	d ₁	l ₂	d ₂	l ₁
57-627	6	25	6	64
57-639	8	25	8	76

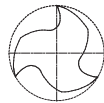
57-600



Three Flute - Solid Carbide Upcut Lock Mortise

The scalloped upcut cutting edge design and extra spinback provide fast material removal in deep cuts for horizontal and vertical lock mortise routing.

Usage Natural wood and wood composites



Part #	d ₁	l ₂	l ₃	d ₂	l ₁
60-091	16	50	114	16	170

HELIX ANGLE ≈ 30°

60-090



60-100MC



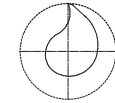
NEW

Single & Double Flute - Marathon Compression Spiral (Coated)

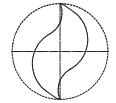
The LMT Onsrud Marathon is the longest running compression tool due to advancements in cutting geometry and the addition of a unique Onsrud coating. The coating is formulated to protect the cutting edge from the high temperatures generated when routing laminated and composite wood products.

Usage Double-sided laminated and Veneered Wood Composites

Part #	d ₁	l ₂	Upcut l ₂	d ₂	l ₁	Z
60-152MC	6	22	4	6	64	1
60-153MC	8	22	4	8	64	2
60-155MC	10	22	4	10	76	2
60-156MC	12	28	6	12	76	2



Single Flute



Double Flute

60-100MW

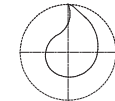


Single & Double Flute - Solid Carbide *Max Life* Compression Spiral

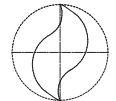
Designed for maximum life when cutting in high-wear applications. Unique geometries and carbides improve the wear characteristics of the tool under abrasive applications with superior part finish. Mortise compressions are designed with short upcut to allow mortise cut with downcut action.

Usage Double sided laminated and veneered materials

Part #	d ₁	l ₂	Upcut l ₂	d ₂	l ₁	Z
60-152MW	6	22	4	6	64	1
60-153MW	8	22	4	8	64	2
60-155MW	10	22	4	10	76	2
60-156MW	12	28	6	12	76	2



Single Flute



Double Flute

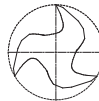
60-470



Three Flute - Solid Carbide Low Helix Finisher

Designed for perfect balance and ultra smooth finish over a wide speed range.

Usage Natural wood, plastic, composite plastic and solid surface



UPCUT

Part #	d ₁	l ₂	d ₂	l ₁
60-471	8	25	8	76
60-473	10	35	10	76
60-475	12	35	12	88

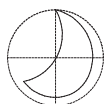
HELIX ANGLE ≈ 10°

61-400

Single Flute - Solid Carbide Straight

Designed to combine the fast free cutting of O flute geometry with the tool life available from solid carbide particularly in small diameters.

Usage Polycarbonate, polyethylene, polypropylene, polystyrene, PVC, extruded acrylic, HDPE, UHMW and hard plastic



Part #	d ₁	l ₂	d ₂	l ₁
61-410	4	16	6	64
61-411	5	20	6	64
61-412	6	25	6	64
61-414	8	25	8	64
61-418	12	35	12	88

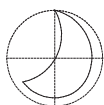


Single Flute - Solid Carbide Downcut Spiral O Flute

(HP) Designed to provide a smooth finish in hard plastics with downward chip removal.

(SP) Designed to provide provide a smooth finish in soft plastic with downward chip removal.

Usage **(HP):** Acrylic, nylon, PVC, polycarbonate and solid surface
(SP): HDPE, HIPS, UHMW, ABS, polycarbonate, PE, polystyrene, polypropylene, acetal, acrylic, PET and solid surface



HARD PLASTIC		SOFT PLASTIC			
Part #	Part #	d ₁	l ₂	d ₂	l ₁
62-816*	62-866*	3	12	6	64
62-824*	62-874*	4	20	6	64
62-830	62-880	5	16	6	64
62-840		6	30	6	76
62-842*		6	38	6	76
62-844		8	25	8	64
62-846	62-896	8	38	8	76

HELIX ANGLE ~ 21°

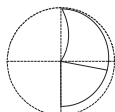
***Tool balanced by design to run at spindle speeds up to 60,000 RPM**

**62-800
62-850**

Single Flute - Solid Carbide Upcut for Soft Aluminum (Coated)

These tools are specially designed to cut soft grades of aluminum and create a good edge finish. The improved cutting geometry properly forms and evacuates the chips preventing chip rewelding.

Usage Soft aluminum sheet



Part #	d ₁	l ₂	d ₂	l ₁	Coating
63-450	5	6	6	64	ZRN
63-460	6	6	6	64	ZRN

CUTTING PARAMETERS

Part #	RPM	Feed Rate
63-450	10,000	2 meter per minute
63-460	13,250	2.5 meter per minute

63-400**NEW**

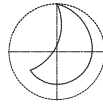


Single Flute - Solid Carbide Upcut Spiral O Flute

(HP) Designed to provide a smooth finish in hard plastics with upward chip removal.

(SP) Designed to provide a smooth finish in soft plastic with upward chip removal.

Usage (HP): Acrylic, nylon, PVC, polycarbonate and solid surface
(SP): HDPE, HIPS, UHMW, ABS, polycarbonate, PE, polystyrene, polypropylene, acetal, acrylic, PET and solid surface



HARD PLASTIC		SOFT PLASTIC			
Part #	Part #	d ₁	l ₂	d ₂	l ₁
63-802		2	8	2	50
63-804*	63-854	2	8	6	64
63-806		2.5	8	2.5	50
63-808*		2.5	8	6	64
63-810*	63-860*	3	8	3	50
63-812*	63-862*	3	8	6	64
63-814*	63-864*	3	12	3	64
63-816*	63-866*	3	12	6	64
63-818*		4	8	4	64
63-820*	63-870*	4	12	4	64
63-822*		4	20	4	64
63-824*	63-874*	4	20	6	64
63-826*		4	30	4	64
63-828	63-878*	5	16	5	64
63-830	63-880	5	16	6	64
63-832		5	30	5	64
63-834		6	8	6	64
63-836	63-886	6	12	6	64
63-838	63-888	6	20	6	64
63-840		6	30	6	76
63-842*	63-892*	6	38	6	76
63-844	63-894*	8	25	8	64
63-846	63-896	8	38	8	76
63-848	63-898	10	30	10	76
63-849		10	35	10	76
63-847	63-897	12	38	12	76

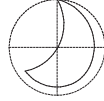
HELIX ANGLE ≈ 21°

*** Tool balanced by design to run at spindle speeds up to 60,000 RPM**

Single Flute - Solid Carbide Upcut Spiral O Flute

High speed cutters for machining aluminum sheet and block material. These tools are optimized for use on high-speed CNC mills, high speed machining centers and CNC routers.

Usage Aluminum plate and single/multi sheet aluminum



Part #	d ₁	l ₂	d ₂	l ₁
63-904	2	6	6	64
63-908	2.5	6	6	64
63-912	3	8	6	64
63-916	3	12	6	64
63-918	4	8	4	64
63-924	4	20	6	64
63-930	5	16	6	64
63-934	6	8	6	64
63-938	6	20	6	64
63-944	8	25	8	64
63-946	8	38	8	76
63-948	10	30	10	76

HELIX ANGLE ≈ 22°

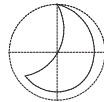
63-900



Single Flute - Solid Carbide Downcut Spiral O Flute

The polished flute allows for razor sharp cutting edge and easy chip evacuation. The tool is available in a down cut spiral for improved part holding.

Usage Plastic, wood, aluminum and solid surface



Part #	d ₁	l ₂	d ₂	l ₁
64-012M	3	12	6	50
64-026M	6	32	6	76

HELIX ANGLE ≈ 21°

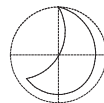
64-000



Single Flute - Solid Carbide Upcut Spiral O Flute

The polished flute allows for razor sharp cutting edge and easy chip evacuation. The tool is available in a upcut spiral for improved chip evacuation.

Usage Plastic, wood, aluminum and solid surface



Part #	d ₁	l ₂	d ₂	l ₁
65-000M	2	6	3	50
65-018M	5	16	6	64
65-023M	6	16	6	64
65-033M	10	29	10	76

HELIX ANGLE ≈ 22°

65-000



65-200B**Two Flute - High Finish Ballnose for Plastics**

The tool's unique geometry, specially designed point, and highly polished primary clearance and flute give the tool the ability to attain a surface finish of 28 Ra in mechanical plastic.

Usage Plastic

Part #	d ₁	l ₂	d ₂	l ₁
65-280B	3	12	3	64
65-285B	6	20	6	76
65-290B	8	25	8	76
65-295B	10	30	10	76

NEW**66-700****DFC Multi-Flute Low Helix (Coated)**

The diamond film coated (CVD) solid carbide multi-flute low helix tools are designed to produce superior edge quality and finish in composite materials at higher feed rates than a PCD tool.

Usage Composite

Part #	d ₁	l ₂	d ₂	l ₁	Z
66-725	8mm	25mm	8mm	100mm	8
66-730	10mm	30mm	10mm	100mm	8
66-735	12mm	40mm	12mm	100mm	10

NEW**66-800****DFC Compression for Composites (Coated)**

The diamond film coated (CVD) solid carbide compression routers unique geometry prevents delamination on top and the bottom edges of the composites. The open flute geometry dissipates heat to prevent resin flow.

Usage Composite

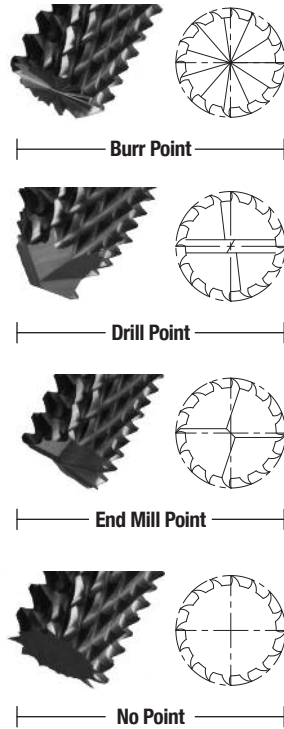
Part #	d ₁	l ₂	Upcut l ₂	d ₂	l ₁	Z
66-852DFC	6	20	7.75	6	90	4
66-858DFC	8	25	8	8	100	4
66-864DFC	10	25	8.5	10	100	6
66-870DFC	12	25	9	12	100	6

NEW

High Performance Composite Router (Coated)

The new High Performance Composite Router is designed for more efficient routing of composite materials, in both hand-fed and in CNC applications. Coated for increased tool life.

Usage Composites and fiberglass



Part #	Point Style	d ₁	l ₂	d ₂	l ₁
66-971ALTIN	No	4	16	6	50
66-972ALTIN	BURR	4	16	6	50
66-973ALTIN	Endmill	4	16	6	50
66-974ALTIN	Drill	4	16	6	50
66-975ALTIN	No	6	19	6	75
66-976ALTIN	BURR	6	19	6	75
66-977ALTIN	Endmill	6	19	6	75
66-978ALTIN	Drill	6	19	6	75
66-979ALTIN	No	6	25	6	75
66-980ALTIN	BURR	6	25	6	75
66-981ALTIN	Endmill	6	25	6	75
66-982ALTIN	Drill	6	25	6	75
66-983ALTIN	No	8	25	8	63
66-984ALTIN	BURR	8	25	8	63
66-985ALTIN	Endmill	8	25	8	63
66-986ALTIN	Drill	8	25	8	63
66-987ALTIN	No	10	25	10	75
66-988ALTIN	BURR	10	25	10	75
66-989ALTIN	Endmill	10	25	10	75
66-990ALTIN	Drill	10	25	10	75
66-991ALTIN	No	12	25	12	75
66-992ALTIN	BURR	12	25	12	75
66-993ALTIN	Endmill	12	25	12	75
66-994ALTIN	Drill	12	25	12	75



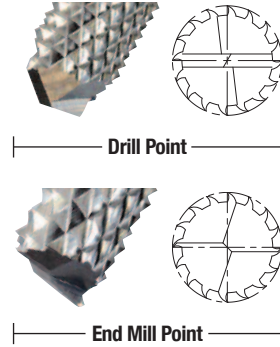
NEW

67-000

Solid Carbide Fiberglass Router

Designed as fiberglass routers. Their upcut/ downcut diamond design effectively shears fibrous materials.

Usage Fiberglass and composites



DRILL POINT

Part #	d ₁	l ₂	d ₂	l ₁
67-090	4	16	6	50
67-091	6	19	6	76
67-092	6	25	6	76
67-093	8	25	8	76
67-094	10	25	10	76
67-095	12	25	12	76

END MILL POINT

Part #	d ₁	l ₂	d ₂	l ₁
67-096	3	12	3	52
67-097	4	16	4	64
67-098	6	19	6	76
67-099	6	25	6	76
67-101	8	25	8	76
67-102	10	25	10	76
67-103	12	25	12	76

67-200

Three Flute - Solid Carbide Phenolic Cutter

Equally adaptable to low or high spindle speed applications in any CNC machining environment. The free cutting action of the tools provides for better finishes and significantly lower noise levels.

Usage Phenolic



UPCUT

Part #	d ₁	l ₂	d ₂	l ₁
67-207	10	22	10	75
67-209	12	28	12	75

DOWNCUT

Part #	d ₁	l ₂	d ₂	l ₁
67-208	10	22	10	75
67-210	12	28	12	75

HELIX ANGLE ~ 10°

67-220

Three Flute - PCD Progressive Chipbreaker for Composites

Provides superior chip control and increased tool life when cutting dense and abrasive materials. The new chipbreaker incorporates a unique geometry with a PCD cutting edge to support a wide range of feed rates and depth of cut combinations while extending the life of the tool. This is accomplished by utilizing a distinct Hi-Low asymmetrical chipbreaker profile which reduces vibration and chatter, caused by harmonic imbalance, resulting in improved surface finishes, while reducing noise levels and wear on the tool.

Usage Composites and phenolic



Part #	d ₁	l ₂	d ₂	l ₁
67-230	10	12	10	76
67-233	12	20	12	100

NEW

Solid Carbide Un-Ruffer™^{PATENTED}

The unique design allows for the cutting performance of a burr while achieving a good surface finish.

Usage Composite panels

Part #	d ₁	l ₂	d ₂	l ₁
67-426M	6	25	6	64
67-435M	10	25	10	76
67-445M	12	25	12	76

67-400



Solid Carbide CG Tool (Carbon Graphite)

The geometry of these tools increases the amount of effective cutting flutes resulting in superior performance over a standard burr.

Usage Carbon graphite and carbon fiber panels

Part #	d ₁	l ₂	d ₂	l ₁
67-511M	6	20	6	76
67-520M	10	29	10	76
67-523M	12	29	12	88

67-500



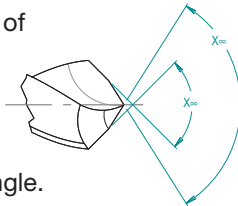
Solid Carbide 8 Facet Drill

Designed to reduce cutting forces and eliminating delamination when exiting the material.

Usage Composites, Carbon fiber, mechanical plastics, and fiber reinforced plastics

What is an 8 Facet Drill?

An 8 facet drill consists of 4 cutting edges with 2 facets per cutting edge. These facets consist of the lip relief and the lip clearance angle.



Part #	d ₁	l ₂	d ₂	l ₁
67-961	3.00	32	3.00	57
67-962	3.50	35	3.50	64
67-963	4.00	35	4.00	64
67-964	4.50	41	4.50	70
67-965	5.00	44	5.00	76
67-966	5.50	44	5.50	76
67-967	6.00	51	6.00	83
67-968	6.50	51	6.50	83
67-969	7.00	57	7.00	89
67-970	7.50	60	7.50	95
67-971	8.00	60	8.00	95
67-972	8.50	64	8.50	102
67-973	9.00	64	9.00	102
67-974	9.50	70	9.50	108
67-975	10.00	73	10.00	114
67-976	10.50	73	10.50	114
67-977	11.00	73	11.00	114
67-978	11.50	76	11.50	121
67-979	12.00	76	12.00	121

67-800



68-200**Double Flute - PCD SERF™ Cutter**

The PCD Serf Tool is used primarily in roughing applications. The unique geometry reduces the cutting forces resulting in longer tool life, higher feed rates and reduced noise.

Usage Composites

Part #	d ₁	l ₂	d ₂	l ₁
68-213M	6	20	6	76
68-226M	10	25	10	88
68-236M	12	32	12	100

68-300**Three Flute - PCD SERFIN™ Cutter**

Three-Flute tool with two roughing edges that have geometry to reduce cutting forces and shear fibers in high-strength composite and other fiber reinforced plastic materials. The finishing edge cleans up after roughing cuts to create a smooth edge on material.

Usage Composites

Part #	d ₁	l ₂	d ₂	l ₁
68-310	8	10	8	76
68-325	10	14	10	100
68-330	12	14	12	100
68-335	12	26	12	100
68-355	16	26	16	100

68-400**Double Flute - PCD Ballnose**

Designed for use in abrasive materials where cut quality and tool life are important.

Usage Composites

Part #	d ₁	l ₂	d ₂	l ₁
68-440	6	10	6	76
68-445	8	10	8	76
68-450	10	12	10	76
68-455	12	20	12	100

NEW

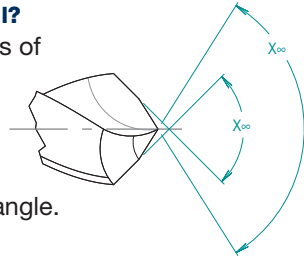
PCD 8 Facet Drills

The PCD 8 facet drill works well in composite material where long tool life and a delamination free hole is required. The drill diameters are oversized allowing for aircraft fasteners to extend through the holes.

Usage Composites

What is an 8 Facet Drill?

An 8 facet drill consists of 4 cutting edges with 2 facets per cutting edge. These facets consist of the lip relief and the lip clearance angle.



Part #	d ₁	l ₂	d ₂	l ₁
68-902	2.54	25.4	6.35	76.2
68-903	3	20	3	60
68-904	3.28	25.4	6.35	76.2
68-908	3.73	25.4	6.35	76.2
68-909	4	20	4	60
68-910	4.88	25.4	6.35	76.2
68-911	5	20	5	60
68-912	6	25	6	74
68-914	6.375	25.4	6.35	76.2
68-918	7.95	25.4	7.94	76.2
68-919	8	25	8	74
68-922	9.55	25.4	9.53	76.2
68-923	10	25	10	74
68-924	12	25	12	74
68-926	12.75	25.4	12.7	76.2



HSS Plastic Drill

Designed to produce holes in hard and soft plastic while eliminating edge chipping and chip wrapping.

Usage Hard and soft plastic



- NO Wrapping
- NO Cleaning
- NO Melting
- NO Surface Marring
- NO Interrupted Operation



Part #	d ₁	l ₂	d ₂	l ₁
70-714	3.00	41	3.00	70
70-715	3.50	44	3.50	73
70-716	4.00	54	4.00	83
70-717	4.5	56	4.50	86
70-718	5.00	62	5.00	92
70-719	5.50	64	5.50	95
70-720	6.00	70	6.00	102
70-721	6.50	73	6.50	105
70-722	7.00	73	7.00	105
70-723	7.50	78	7.50	111
70-724	8.00	81	8.00	114
70-725	8.50	87	8.50	121
70-726	9.00	89	9.00	124
70-727	9.50	92	9.50	127
70-728	10.00	95	10.00	130
70-729	10.50	98	10.50	133
70-730	11.00	103	11.00	140
70-731	11.50	106	11.50	143
70-732	12.00	111	12.00	149
70-733	12.50	114	12.50	152
70-734	13.00	114	13.00	152

Solid Carbide Boring Bits

Two styles of tools are available in this series. The brad point drill is designed to cut blind holes and produce a clean edge on the top surface. The 60° through drill is designed to produce through holes while providing clean edges on both sides.

Usage Wood

BRAD POINT - designed to produce a blind hole while preventing fraying on the top edge.

THROUGH HOLE (60° POINT) - produces a through hole and reduces fraying on the entry and exit edges.

RIGHT HAND ROTATION

Part #	d ₁	d ₂	l ₁
72-001	3	10	57
72-005	5	10	57
72-009	6	10	57
72-013	8	10	57

RIGHT HAND ROTATION

Part #	d ₁	d ₂	l ₁	Part #	d ₁	d ₂	l ₁
72-021	3	10	70	72-053	3	10	57
72-025	5	10	70	72-057	5	10	57
72-029	6	10	70	72-061	6	10	57
72-033	8	10	70	72-065	8	10	57

LEFT HAND ROTATION

Part #	d ₁	d ₂	l ₁
72-002	3	10	57
72-006	5	10	57
72-010	6	10	57
72-014	8	10	57

LEFT HAND ROTATION

Part #	d ₁	d ₂	l ₁	Part #	d ₁	d ₂	l ₁
72-022	3	10	70	72-054	3	10	57
72-026	5	10	70	72-058	5	10	57
72-030	6	10	70	72-062	6	10	57
72-034	8	10	70	72-066	8	10	57

HINGE BIT - This 35mm carbide tipped bit is designed to produce a flat bottom hole with clean edges for hinge mounting.

Part #	d ₁	d ₂	l ₁
72-097	35	10	70

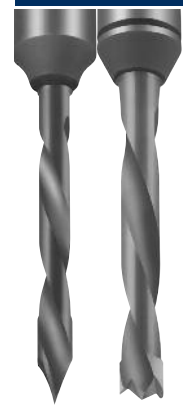
Double or Three Flute Solid Carbide Taper Tools

The taper tools are available with a variety of taper angles and come standard with a ball nose point. The tools are designed to produce a good edge finish in a wide variety of materials.

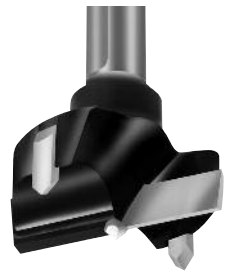
Usage Wood, plastic and aluminum

Part #	d ₁	l ₂	d ₂	l ₁	Angle Per Side	Radius	Z
77-102M	3	39	6	76	1°	1.5	3
77-104M	3	25	6	76	3°	1.5	3
77-106M	3	19	6	76	5°	1.5	3
77-108M	3	12	6	76	7°	1.5	3
77-112M	6	50	12	100	3°	3	2
77-114M	6	35	12	100	5°	3	2
77-116M	6	25	12	100	7°	3	2

72-000



Through Hole Brad Point



Hinge

77-100



85-800**Solid Carbide CFRP Drill (Coated)**

The CFRP drill is designed to ensure hole quality and diameter. The “W” point of the drill centers the drill to let the peripheral cutting edges shear the material producing a clean, tight tolerance hole without fraying or delamination. The drills are coated with a Diamond Like Carbon (DLC) coating.

Usage Carbon Fiber Reinforced Plastics, Kevlar® and Composites

Part #	d ₁	l ₂	d ₂	l ₁
85-961	3	12	3	76
85-963	4	12	4	76
85-965	5	12	5	76
85-967	6	12	6	76
85-971	8	12	8	76
85-975	10	12	10	76
85-979	12	12	12	76

NEW**86-100****Diamond Film Coated Solid Carbide Parabolic Drill**

Designed to produce a clean, delamination free hole in composite materials. The diamond film coated (CVD) parabolic drill is an economical solution to PCD composite drills.

Usage Carbon fiber and other composite materials

Part #	d ₁	l ₂	d ₂	l ₁
86-103	3	20	3	60
86-104	4	20	4	60
86-107	5	20	5	60
86-109	6	25	6	74
86-111	8	25	8	74
86-119	10	25	10	74
86-128	12	25	12	74

CHIP LOAD PER TOOTH

(f_z in mm)

Hard Plastic Chipload Chart - Cutting Edge Diameter (d_1)

Series	Cut	2	3	4	5	6	8	10	12		
37-00/37-20	1 x d_1					0.10 - 0.15					
52-200B/BL	1 x d_1		0.05 - 0.10			0.10 - 0.15		0.10 - 0.15	0.15 - 0.20		
56-430	1 x d_1		0.13 - 0.18	0.13 - 0.18	0.13 - 0.18	0.15 - 0.20	0.15 - 0.20	0.18 - 0.23	0.20 - 0.25		
56-450	1 x d_1			0.13 - 0.18	0.13 - 0.18	0.15 - 0.20	0.15 - 0.20	0.18 - 0.23	0.20 - 0.25		
57-600	1 x d_1					0.15 - 0.20	0.15 - 0.20				
60-470	1 x d_1						0.10 - 0.15	0.10 - 0.15	0.15 - 0.25		
61-400	1 x d_1			0.36 - 0.41	0.36 - 0.41	0.38 - 0.43	0.38 - 0.43		0.43 - 0.48		
62-800	1 x d_1		0.15 - 0.20	0.15 - 0.20	0.20 - 0.25	0.20 - 0.30	0.20 - 0.30				
62-850	1 x d_1		0.10 - 0.15	0.10 - 0.15	0.15 - 0.20	0.20 - 0.30	0.20 - 0.30				
63-800	1 x d_1	0.05 - 0.10	0.15 - 0.20		0.20 - 0.25	0.20 - 0.30	0.20 - 0.30	0.20 - 0.30	0.30 - 0.41		
63-850	1 x d_1	0.05 - 0.10	0.10 - 0.15		0.15 - 0.20	0.20 - 0.30		0.20 - 0.30	0.25 - 0.36		
64-000/ 65-000	1 x d_1	0.05 - 0.10	0.15 - 0.20		0.20 - 0.25	0.20 - 0.30		0.20 - 0.30			
77-100	1 x d_1		0.13 - 0.18			0.20 - 0.25					

Soft Plastic Chipload Chart - Cutting Edge Diameter (d_1)

Series	Cut	2	3	4	5	6	8	10	12	16	20
37-00/37-20	1 x d_1					0.10 - 0.15					
52-200B/BL	1 x d_1		0.05 - 0.10			0.10 - 0.15		0.10 - 0.15	0.15 - 0.20		
52-400	1 x d_1		0.05 - 0.10	0.05 - 0.10	0.08 - 0.13	0.10 - 0.20	0.10 - 0.20	0.13 - 0.18	0.15 - 0.20		0.41 - 0.46
52-700	1 x d_1								0.30 - 0.36	0.36 - 0.41	
56-430	1 x d_1		0.15 - 0.20	0.15 - 0.20	0.15 - 0.20	0.18 - 0.23	0.18 - 0.23	0.20 - 0.25	0.23 - 0.28		
57-600	1 x d_1					0.20 - 0.25	0.20 - 0.25				
60-470	1 x d_1						0.10 - 0.15	0.10 - 0.15	0.15 - 0.25		
61-400	1 x d_1			0.43 - 0.48	0.43 - 0.48	0.46 - 0.51	0.46 - 0.51		0.51 - 0.53		
62-850	1 x d_1		0.10 - 0.15	0.10 - 0.15	0.15 - 0.20	0.20 - 0.30	0.20 - 0.30				
63-850	1 x d_1	0.05 - 0.10	0.10 - 0.15	0.10 - 0.15	0.15 - 0.20	0.20 - 0.30	0.20 - 0.30	0.20 - 0.30	0.25 - 0.36		
64-000/ 65-000	1 x d_1	0.05 - 0.10	0.10 - 0.15		0.15 - 0.20	0.20 - 0.30		0.20 - 0.30			
65-200B	1 x d_1		0.05 - 0.08			0.08 - 0.13	0.08 - 0.13	0.10 - 0.15			
77-100	1 x d_1		0.13 - 0.18			0.20 - 0.25					

Composite Chipload Chart - Cutting Edge Diameter (d_1)

Series	Cut	4	5	6	8	10	12	16	20		
54-200	1 x d_1			0.05 - 0.10	0.08 - 0.15	0.08 - 0.15	0.13 - 0.25				
56-450	1 x d_1	0.05 - 0.13	0.05 - 0.13	0.08 - 0.13	0.08 - 0.15	0.10 - 0.15	0.13 - 0.18				
66-700	1 x d_1				0.015 - 0.025	0.015 - 0.025	0.02 - 0.038				
66-800	1 x d_1			0.03 - 0.05	0.05 - 0.08	0.05 - 0.08	0.08 - 0.10				
66-900	1 x d_1	0.05 - 0.10		0.10 - 0.15	0.10 - 0.15	0.10 - 0.15	0.15 - 0.20				
67-000	1 x d_1	0.05 - 0.10		0.10 - 0.15	0.10 - 0.15	0.10 - 0.15	0.10 - 0.15				
67-200	1 x d_1					0.05 - 0.25	0.05 - 0.25				
67-220	1 x d_1					0.03 - 0.05	0.03 - 0.05				
67-400	1 x d_1			0.10 - 0.15		0.10 - 0.15	0.10 - 0.15				
67-500	1 x d_1			0.05 - 0.10			0.10 - 0.15				
68-200	1 x d_1			0.01 - 0.03		0.03 - 0.05	0.03 - 0.05				
68-300	1 x d_1				0.03 - 0.05	0.03 - 0.05	0.03 - 0.05	0.05 - 0.10	0.10 - 0.15		
68-400				0.10 - 0.15	0.10 - 0.15	0.10 - 0.15	0.10 - 0.15				

Formulas

Cutting Speed V_C [m/min] $V_C = n \cdot 0.00314 \cdot d_1$

Speed n [RPM] $n = \frac{V_C \cdot 1000}{\pi \cdot d_1}$

Feed Rate V_f [mm/min] $V_f = f_z \cdot z \cdot n$

Feed per Tooth f_z [mm/tooth] $f_z = \frac{V_f}{n \cdot z}$

a_e	= Width of Cut in mm
a_p	= Depth of Cut in mm
d_1	= Cutter Diameter in mm
f_z	= Feed per Tooth in mm
n	= RPM
V_C	= Cutting Speed in mm
V_f	= Feed Rate in mm
Z	= Number of Flutes

CHIP LOAD PER TOOTH

(f_z in mm)

Aluminum Chipload Chart - Cutting Edge Diameter (d_1)

Series	Cut	2	3	5	6	8	10	12		
37-00/37-20	1 x d_1				0.10 - 0.15					
52-200B/BL	1 x d_1		0.08 - 0.13		0.10 - 0.15		0.15 - 0.20	0.25 - 0.30		
63-900	1 x d_1	0.05 - 0.10	0.05 - 0.10	0.08 - 0.15	0.08 - 0.15	0.08 - 0.15	0.10 - 0.20			
64-000/65-000	1 x d_1	0.05 - 0.10	0.05 - 0.10	0.08 - 0.15	0.08 - 0.15		0.10 - 0.20			
77-100			0.05 - 0.10		0.08 - 0.13					

Engineered Panel Chipload Chart - Cutting Edge Diameter (d_1)

Series	Cut	2	3	4	5	6	8	10	12	16
37-00/37-20	1 x d_1					0.10 - 0.15				
52-200B	1 x d_1		0.13 - 0.18			0.15 - 0.20		0.18 - 0.23	0.20 - 0.25	
52-400/57-400	1 x d_1			0.10 - 0.15	0.10 - 0.15	0.13 - 0.18	0.15 - 0.20	0.15 - 0.20	0.20 - 0.25	
60-090										0.08 - 0.13
60-100MC						0.38 - 0.43	0.43 - 0.48	0.48 - 0.53	0.53 - 0.58	
60-100MW						0.38 - 0.43	0.43 - 0.48	0.48 - 0.53	0.53 - 0.58	
60-470							0.10 - 0.15	0.13 - 0.18	0.13 - 0.18	
64-000/65-000		0.05 - 0.10	0.05 - 0.10		0.10 - 0.15	0.10 - 0.15		0.13 - 0.18		
77-100			0.08 - 0.13			0.13 - 0.18				

Drilling Chipload Chart - Cutting Edge Diameter (d_1)

Series			3	5	6	8	10	12		
67-800	Composites	70 m/min	0.03 - 0.08	0.03 - 0.08	0.05 - 0.10	0.05 - 0.10	0.08 - 0.13	0.08 - 0.13		
68-900	Composites	70 m/min	0.03		0.04		0.04	0.04		
70-500	Plastic	60 m/min	0.48 - 0.53		0.53 - 0.58		0.58 - 0.64	0.64 - 0.69		
72-000*	Wood		0.23 - 0.28	0.28 - 0.33	0.33 - 0.38	0.38 - 0.43				
85-800	Composites	70 m/min	0.01	0.01	0.03	0.03	0.03	0.03		
86-100	Composites	50 m/min	0.03		0.4	0.4	0.4	0.4		

* Gang drills run at 4,500 RPM and 3.8 m/min

29-000 Technical Data

Part #	Aluminum		Nomex		Paper	
	RPM	Feed Rate	RPM	Feed Rate	RPM	Feed Rate
29-003	500-10,000	2.54 m/min	500-10,000	3.05 m/min	500-10,000	3.05 m/min
29-006	500-10,000	2.54 m/min	500-10,000	3.05 m/min	500-10,000	3.05 m/min
29-009	500-10,000	2.54 m/min	500-10,000	3.05 m/min	500-10,000	3.05 m/min
29-012	500-10,000	2.54 m/min	500-10,000	3.05 m/min	500-10,000	3.05 m/min
29-015	500-10,000	2.54 m/min	500-10,000	3.05 m/min	500-10,000	3.05 m/min

Formulas

Cutting Speed V_c [m/min] $V_c = n * 0.00314 * d_1$

Speed n [RPM] $n = \frac{V_c * 1000}{\pi * d_1}$

Feed Rate V_f [mm/min] $V_f = f_z * z * n$

Feed per Tooth f_z [mm/tooth] $f_z = \frac{V_f}{n * z}$

a_e	= Width of Cut in mm
a_p	= Depth of Cut in mm
d_1	= Cutter Diameter in mm
f_z	= Feed per Tooth in mm
n	= RPM
V_c	= Cutting Speed in mm
V_f	= Feed Rate in mm
Z	= Number of Flutes

29-050, 29-100 Technical Data

29-050	DIA (mm)	Max RPM	Feed Rate (m/min)	Core Type	29-100	Feed Rate (m/min)	Max RPM	DIA (mm)
	6.35	25,000	NR	Aluminum, less than 5#/cuft		2.54	25000	6.35
	9.52	25,000	NR	Aluminum, More than 5#/cuft		2.54	25000	9.52
	12.7	25,000	20.3	Paper based		10.2	25000	12.7
	19.05	25,000	20.3	Paper, based w/Fiber Reinforcement		20.3	25000	19.05
	25.4	25,000	20.3	Fiberglass		15.25		
	38.1	18,000	20.3	Phenolic		15.25		
	45	18,000	NR	Carbon Fiber		20.3		
	50.8	16,500	2.5	Aramid, less than 5#/cuft		20.3		
	63	15,000	2.5	Aramid, More than 5#/cuft		20.3		
	76.2	14,000						
	101.6	12,000						

30-000, 30-300, 30-700, 32-200 Technical Data

Core Type	Solid Carbide (m/min)	Solid Carbide w/Teeth (m/min)	Diamond Saw (m/min)	HSS (m/min)	DIA (mm)	MAX RPM
Aluminum, Less than 5#/cuft	2.5	2.5	NR	3.8	6.35	25,000
Aluminum, More than 5#/cuft	2.5	2.5	NR	2.54	9.52	25,000
Paper based	10.2	10.2	NR	6.4	12.7	25,000
Paper, based with Fiber Reinforcement	20.3	20.3	10.2	3.8	19.05	25,000
Fiberglass	15.2	15.2	15.2	NR	25.4	25,000
Phenolic	5.1	5.1	10.2	NR	38.1	18,000
Carbon Fiber	NR	NR	20.3	NR	45	18,000
Aramid, Less than 5#/cuft	20.3	20.3	10.2	3.8	50.8	16,500
Aramid, More than 5#/cuft	20.3	20.3	10.2	NR	63	15,000
					76.2	14,000
					101.6	12,000

31-000 Technical Data

Core Type	Solid Carbide (m/min)	Diamond Plated (m/min)	HSS Saw (m/min)	HSS Wavy (m/min)	HSS (31-000) (m/min)	HSS (31-100) (m/min)	DIA (mm)	MAX RPM
Aluminum, Less than 5#/cuft	2.5	NR	3.8	2.5	2.5-3.6	2.3-3.6	9.52	25,000
Aluminum, More than 5#/cuft	2.5	NR	2.5	2.5	1.8	1.8	12.7	25,000
Paper based	7.6	NR	5.1	7.6	50	1.3	19.05	25,000
Paper, based w/Fiber Reinforcement	10.2	7.6	15.2	7.6	2.5 - 3.8	2.5 - 3.8	25.4	25,000
Fiberglass	NR	15.2	NR	NR	NR	NR	38.1	25,000
Phenolic	NR	15.2	NR	NR	NR	NR	45	25,000
Carbon Fiber	NR	20.3	NR	NR	NR	NR	50.8	18,000
Aramid, Less than 5#/cuft	5.1	NR	3.8	5.1	2.5 - 3.8	2.5 - 3.8	63	18,000
Aramid, More than 5#/cuft	5.1	10.2	NR	NR	NR	NR	76.2	18,000

34-000 Technical Data

Core Type	Cutter	RPM	Feed Rate (m/min)	Cut Direction
Fiberglass panels with paper core (Nomex)	Diamond Grit	18,000	5.6	Conventional
Aluminum panels with aluminum core	HSS Saw	16,000	3.1	Conventional

Formulas

Cutting Speed V_c [m/min] $V_c = n * 0.00314 * d_1$

Speed n [RPM] $n = \frac{V_c * 1000}{\pi * d_1}$

Feed Rate V_f [mm/min] $V_f = f_z * z * n$

Feed per Tooth f_z [mm/tooth] $f_z = \frac{V_f}{n * z}$

a_e	=	Width of Cut in mm
a_p	=	Depth of Cut in mm
d_1	=	Cutter Diameter in mm
f_z	=	Feed per Tooth in mm
n	=	RPM
V_c	=	Cutting Speed in mm
V_f	=	Feed Rate in mm
Z	=	Number of Flutes

CUTTING TOOL QUOTE REQUEST FORM

1081 S. Northpoint Blvd. • Waukegan, Illinois 60085 • Phone (847) 362-1560 • Fax (800) 557-6720 • www.onsrud.com

*Starred Items = Required information

*Distributor Name _____ *Distributor's Reference Number _____

*Distributor Address _____

*Contact _____ *Email Address _____

*Telephone _____ *Fax _____

End User Name _____ Customer Reference Number _____

End User Address _____

Contact _____ Email Address _____

Telephone _____ Fax _____

*Material being machined _____ Hardness _____

Machine type (Check all that apply): CNC Router CNC Mill Inverted Air Router Hand Other

If other, describe _____

H.P.= _____

Max. Spindle Speed _____ Coolant Type _____

*Tool Material: HSS Solid Carbide Carbide Tip Powder Metal PCD Full Face PCD Tip Other

If other, describe _____

*Flute Style: Spiral Up Spiral "O" Up Straight "V" Flute Compression
 Spiral Down Spiral "O" Down Straight "O" Flute Morise Compression

*Flute Form: Rougher Chipbrk/Finisher Finisher Other

*Point Geometry: Square Ball Nose Drill Point Other
 Center Cutting Non-Center Cutting

*If other, describe _____

*Tool Similar To: _____

Number of Flutes (z) _____

Cutting Diameter (d1) _____

Cutting Length (l2) _____

Shank Diameter (d2) _____

Overall Length (l1) _____

Neck Diameter (d3) _____

Neck Radius (l3) _____

Corner Radius (r) _____

Coolant Through Yes No

Transition Grind Needed _____

Flat Y / N What Type? _____

Coating Types: TiN TiCN AlTiN Diamond Grit ZrN TiAlN DFC Diamond "Like" Other

If other, describe _____

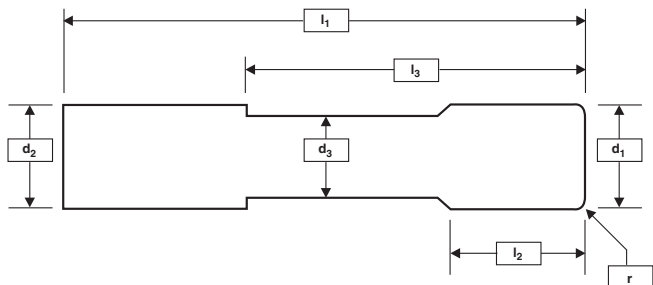
*Quantities Needed: _____

Minimum is 6 pieces

Any Target Pricing? _____

Distributor / End User? _____

Additional Notes: _____



LMT Onsrud Terms & Conditions

Shipping - F.O.B. Waukegan, IL USA. All shipments ground unless otherwise specified.

Claims – Any claims for shortage, damage or loss must be made within 30 days of invoice date. United Parcel Service is a preferred method of shipment because of reliability and ease of tracing problem shipments.

Guarantee - Our products are guaranteed against defects in material and quality of manufacture when used in the proper manner. If tools are returned and found to be defective, we will repair or replace the tools. Continued tool breakage caused by improper tool usage without the knowledge of LMT Onsrud's technical staff is not a condition for return and replacement of such tools.

Errors - LMT Onsrud, LP cannot be held responsible for incorrect parts made with our products due to mislabeling or defect.

Return Goods Policy – No merchandise can be returned without prior authorization. Credit will not be issued for merchandise returned without a return authorization number. Product must be a current revision catalog item in new and saleable condition. All returns subject to a 15% restocking fee or offsetting order of equal value.

Specials - LMT Onsrud, LP has the right to over or under ship by 10% all specials. Special orders less than 10 pieces are subject to +/- 1 piece. Specials and modified tools are not returnable for credit. Specials cancelled will be assessed an in-process charge based on the status of the order and expenses incurred at the time of cancellation. If a special tool has been completed, the tool will be shipped and the price quoted will be billed.

Safety Precautions – Cutting tools should only be used to perform operations that are compatible with the original tool design. Safety glasses and other appropriate safety equipment should be worn by all people in the vicinity of tool use.

Prices & Terms - All prices and terms are subject to change without notice. All orders are subject to acceptance at LMT Onsrud.



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