

HANNIBAL

Carbide Tool, Inc.

ISO 9001 Certified



CARBIDE TIPPED

& SOLID CARBIDE

CUTTING TOOLS

2016 Tool Selector Guide & Pricing

WHY HANNIBAL IS ACKNOWLEDGED WORLD CLASS...

THE HANNIBAL WORLD CLASS DIFFERENCE:

END USER BENEFITS:

QUALITY — CONSISTENT QUALITY

- ISO 9001 certified since August 18, 1999
- Mature quality system – Ford Q101 certified in 1989 and many other major end users' certifications
- Continuous product & quality improvement
- Emphasis on defect prevention & variation reduction

- Tighter tolerances mean better products
- Longer tool life means less down time
- Lower tool cost per part machined

SERVICE — EXCEPTIONAL SERVICE

- Over 97% of line item orders filled – huge finished tool inventory
- Over 97% of orders shipped same date received – drop shipments
- Over 96% of special order tools shipped on promised date
- Special order tool quotes usually same day, always by next day

- Reduces end user's tool inventory cost
- Enables successful "Just in Time" programs
- Reduces tool procurement lead times
- Eliminates end user's production delays

VALUE — SUPERIOR VALUE

- Competitively priced
- Dramatically outperforms high speed steel tools
- Technically advanced tool geometries, carbide grades & titanium coatings outperform all competitors
- Material specific tools for more demanding applications
- Tool selection & application support available on the phone or in the field – just call us

- Dramatically reduces tool cost per operation
- Improves end user's competitive position
- Better performing tools

RESPONSIVENESS — MARKET DRIVEN RESPONSIVENESS

- End user demands generated our standard tool offering of over 20,000 stocked line items
- Solution focused technical & engineering staff
- Tool design creativity based on extensive field experience
- No minimum order size

- Multi-operation tools eliminate operations
- Comprehensive tooling solutions
- Ease of doing business
- Personalized service

LEADERSHIP — RESPONSIBLE LEADERSHIP

- Extensive & deep management commitment
- Long term planning emphasized
- Highest standards of integrity in all of our relationships – customers, suppliers, and employees
- 1999 Recipient of American Eagle Award – Employee Category

- Constantly improving tool supplier
- Availability of latest tool technology
- Understands end user's specific tooling requirements

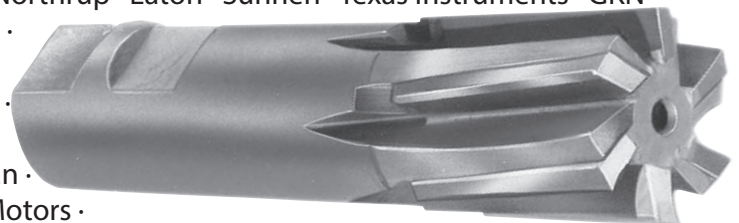
STABILITY — FOR TODAY & TOMORROW

- Strong, financially sound – no debt
- One family ownership with three generations of solid commitment to the cutting tool industry
- Stable, loyal employee team at all levels – tool makers, technical/engineering, customer service, and management
- Extremely small employee turnover

- Dependable long term supplier partner
- Continuity of individual relationships

HANNIBAL'S WORLD CLASS END USERS

John Deere · Boeing · Sikorsky · Caterpillar · Cummins Engine · General Electric · Vought Aircraft · Navistar · Cloyes · Bell Helicopter · Kennedy Valve · Grumman · Northrup · Eaton · Sunnen · Texas Instruments · GKN · Detroit Diesel · Pratt & Whitney · Lockheed · Homelite · Ford · Mack · Sundstrand · Delco · Briggs & Stratton · Cooper · Colt · Mercury Marine · Delta · Borg Warner · Harrison Radiator · Gardners · NACCO · Otis Elevator · Golden's Foundry · APEX · Remington · Parker · Spartan · Stratoflight · Bosch · Dexter · Allied · Alcoa · General Motors · Sturm Ruger · General · Rockwell · Copeland · Harley Davidson · Cleveland Pneumatic · Saginaw Steering · Smith & Wesson · Hamilton Standard · Vermeer · Jacobs · AAR · IngersollChrysler · Alcoa · Dana · ACME ·





WORLD CLASS CONTENTS

MARKET REQUESTS – HANNIBAL RESPONDS

Requests for quicker delivery on larger diameter reamers.

HANNIBAL adds Expanded size ranges:

- h6 Shank Reamers now up to 1" diameter pages 31-32
- Extended Length Reamers now up to 1" diameter pages 35-40
- Material Specific Reamers up to 2-1/2" page 78
- Coolant Reamers up to 2" pages 90-93
- Solid Carbide Head Reamers now up to 1" diameter pages 110-111

Requests for Spiral Flutes in the h6 Shank Reamers offering.

HANNIBAL adds Right and Left Spiral Flute design:

- Right Spiral Flutes page 33
- Left Spiral Flutes page 34

Requests for a Twist Drill for Steel applications.

HANNIBAL adds a Cobalt Jobber Drill offering:

- Cobalt Jobber Drills page 138

Requests for Stagger Tooth Cutters.

HANNIBAL adds Stagger Tooth Side Milling Cutters:

- Stagger Tooth Side Milling Cutters page 162

Requests for Modified Cutters for Steel applications.

HANNIBAL adds Cutters for Steel applications that can be ground to specified width sizes with radii and/or chamfers:

- Modified Cutters for Steel pages 166-169

a personal note . . .

Hannibal Carbide Tool's *continuous improvement* journey to meet customer needs has led us to create new standard tool types and expanded size offerings based on repetitive full special requests. This *value added approach* reduces the cost to our customers and delivery times are reduced from weeks to days. When we don't have a standard tool that meets our customer's need, we modify our standard tools. This results in *faster deliveries* and *competitive prices*. Our Material Specific tooling has specific carbide grades and/or cutting tool geometry for the material being machined that extends tool life and improves finish. Our mission is to find the right cutting tool for the job whether standard, modified or full special! Our customer service specialists and application engineers will work with you to make this happen. The entire *Hannibal Carbide Tool Team* looks forward to your call and working with you to get you the best cutting tool for the application.

Paul Enander
Paul Enander

HANNIBAL

TECHNICAL

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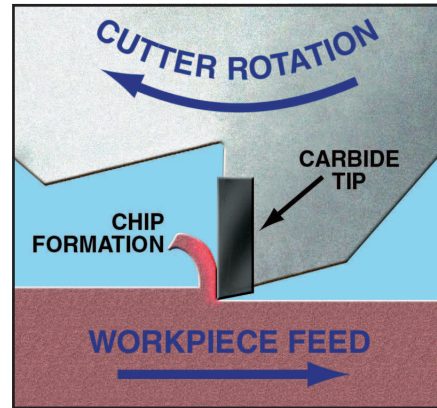
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ALL ABOUT CARBIDE TECHNICAL INFORMATION

THE CUTTING PROCESS

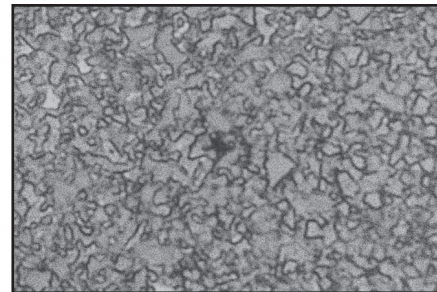
- Intense concentrated force at the cutting edge separates the metal's individual crystals
- Continuous flowing chip is separated from the workpiece
- Chip moves up cutting tool face until chip's internal stresses cause a chip fracture and chip breaks away as a segmented or discontinuous chip
- Large amount of heat is generated at cutting edge during chip separation and as chip flows along cutting tool face
- Individual carbide grains are so very hard that they do not flow or deform under the intense forces and very high temperatures



CHIP FORMATION

CARBIDE PRODUCTION

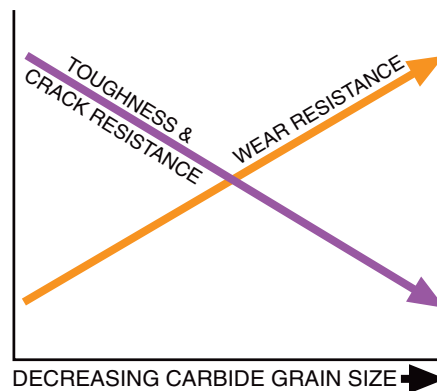
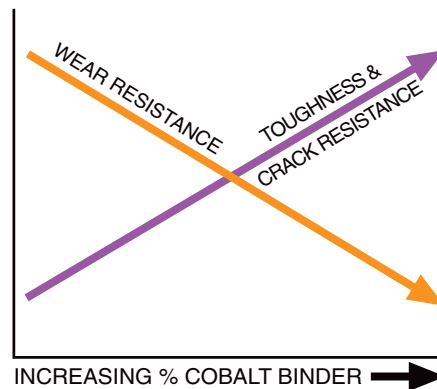
- Carbide powders are created by heating metal powders, usually tungsten, and carbon to a very high temperature – over 2800°F
- Resultant tungsten carbide powder grains are extremely hard and stable at elevated temperatures
- These carbide powders are sorted by grain size and recombined in appropriate ratios to achieve specified physical properties
- Cobalt metal powders are thoroughly mixed with the tungsten powders and forced under high pressure (30,000 psi) into multicavity molds of the desired shape and size
- Carbide rounds are made with an extrusion process
- Carbide blanks are low temperature pre-sintered to develop sufficient physical strength for handling
- Finally, the carbide blank is high temperature sintered at 2500°F to 2900°F; a dramatic shrinkage of almost 40% volume occurs as the carbide blank internally pulls together, resulting in an extremely dense & hard material



C-2 TUNGSTEN CARBIDE
HIGH MAGNIFICATION (1000X)

CARBIDE TECHNICAL

- Types of Carbide Powders
 - Tungsten Carbide (WC) — Primary carbide component
 - Titanium Carbide (TiC) — Added to increase resistance to abrasive wear or cratering of chip forming surface
 - Tantalum Carbide (TaC) — Added to increase resistance to cutting edge deformation at higher temperatures during heavy cuts
- Cobalt binder is a major factor in determining the carbide's hardness and toughness (see upper right graph)
- Toughness is the carbide's ability to withstand the mechanical shock or impact load experienced in the cutting process
- Carbide conducts heat away from cutting edge and chip formation surface two to three times faster than high speed steel
- Carbide surface is very hard and resists abrasive wear that results in early tool failure of high speed steel tools
- Micrograin carbides are used in positive-rake tool designs where a free cutting edge is needed but is relatively unsupported
- Tough shock resistant grades are softer and more prone to wear; harder wear resistant grades are less able to withstand shock loads in interrupted cuts (see lower right graph)



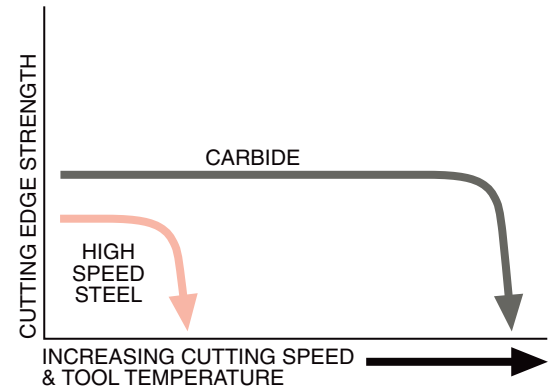
IMPORTANT NOTE: Some solid carbide tools now utilize a cobalt enriched cutting edge zone. HANNIBAL has utilized this same principle for many years — our hardened tough alloy steel bodies have always enabled us to select the carbide grade best suited for the cutting edge without the limitation of their lower structural strength.



THE HANNIBAL CARBIDE TIPPED END USER ADVANTAGE

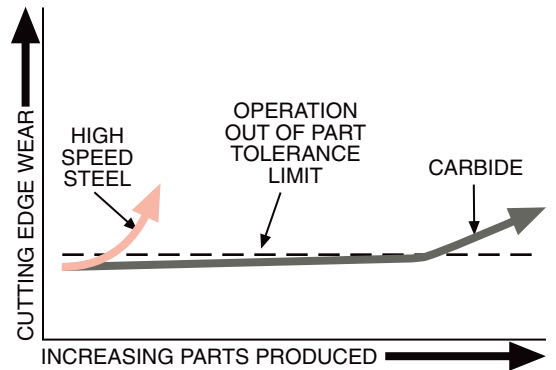
CARBIDE TIPPED VS. HIGH SPEED STEEL

- ADVANTAGE #1**
 - Higher feeds & speeds
 - Retains cutting edge at very high machining temperature (see upper right graph)
 - More aggressive machining reduces cycle time
- ADVANTAGE #2**
 - Exceptional wear resistance at cutting edge
 - Holds size far longer (see lower right graph)
- ADVANTAGE #3**
 - Far longer runs before sharpening
 - Reduces machine downtime for tool changes
 - Chip forming surface resists wear much better
 - Cratering minimized

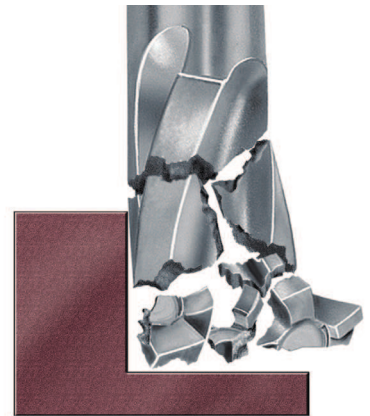


CARBIDE TIPPED VS. SOLID CARBIDE

- ADVANTAGE #1**
 - Carbide grade selected for cutting characteristics – not compromised for structural strength
 - More aggressive cutting edge geometries – shear, edge & rake angles
 - Hardened tough alloy steel body provides superior structure to absorb shock loads
- ADVANTAGE #2**
 - Carbide cracks stopped in steel body pocket rather than shattering the entire tool
 - Reduced scrap & machine downtime as even a cracked carbide tipped tool keeps cutting
 - A shattered solid carbide tool often damages the piece being machined
- ADVANTAGE #3**
 - Tipped tools usually cost less than solid carbide
 - Expensive carbide only used for cutting edge & chip forming surface
 - Often utilize specialty carbides not available in solid round forms

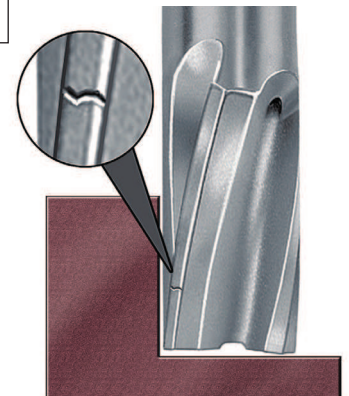


CRACKED SOLID CARBIDE TOOL SHATTERS



CRACKED CARBIDE TIPPED TOOL KEEPS CUTTING

TOUGH ALLOY STEEL BODY STOPS CRACK



CARBIDE TIPPED VS. CARBIDE INSERT

- ADVANTAGE #1**
 - Initial tooling costs far lower for carbide tipped tools
- ADVANTAGE #2**
 - Insert pocket interferes with chip flow
 - Vibration-free brazed carbide tip permits higher feeds & speeds since inserts simply cannot be securely clamped to avoid all vibration problems
 - Far better finish using carbide tipped tools
- ADVANTAGE #3**
 - Inserts are impractical for many operations such as reaming and most drilling



TOOL SELECTION USING CHIP CLASSIFICATIONS

TECHNICAL

1 FIND THE MATERIAL BEING MACHINED

2 CONFIRM CHIP FORM – BASED ON DRILL CHIP

ALUMINUM ALLOY - CAST	308.0, 356.0, 360.0, 380.0, 390.0, 514.0
ALUMINUM ALLOY - WROUGHT	3003, 4032, 5052, 6061, 7075
COPPER ALLOY - TOUGH	110, 170, 172, 175, 280, 425, 610, 655
LEAD ALLOY	ALLOYS 7, 8, 13, 15, 15b-95b
NON-METAL AND PLASTIC.....	Bakelite, Nylon, Polystyrene, PVC
ZINC - DIE CAST ALLOY	AC41A, AG40A, AMS4803, ZDC NO. 7

LONG STRINGY CHIPS
(WROUGHT ALUMINUM, COPPER, AND PLASTIC)

MEDIUM LENGTH CURLED CHIPS
(ALL OTHER MATERIALS)

- CHIP EVACUATION IS KEY WHEN DRILLING OR REAMING THESE MATERIALS

ALUMINUM BRONZE.....	614, 952-958
BRASS - LEADED AND FREE CUTTING.....	340, 342, 353, 360, 370, 485
BRASS - YELLOW, RED, NAVAL	268, 270, 464-467
COMMERCIAL BRONZE (LEADED)	314
MAGNESIUM ALLOY	AM60A, AZ21A, AZ91B-C, K1A
NICKEL SILVER	745-770, 973-978

SHORT CHIPS

- THESE MATERIALS CREATE NO MAJOR DRILLING OR REAMING PROBLEMS

DUCTILE CAST IRON - AUSTENITIC	D-2, D-2B, D-2C, D-2M, D-3, D-3A, D-4, D-5
FERRITIC	60-40-18, 65-45-12, D4018, D4512
FERRITIC-PEARLITIC	80-55-06, D5506
PEARLITIC-MARTENSITIC	100-70-03, D7003
MARTENSITIC.....	120-90-02, DQ&T
GRAY CAST IRON	20, 25, 30, 35, 40, 45, 50, 55
MALLEABLE CAST IRON - FERRITIC OR PEARLITIC.....	32510, 35018, 45008, M3210, M4504

DISCONTINUOUS CURLED CHIPS

- THESE MATERIALS ARE VERY ABRASIVE WHICH CAN CAUSE RAPID WEAR OF THE TOOL MARGINS AND CUTTING EDGES

LOW AND MEDIUM CARBON STEEL - WROUGHT.....	1005-1029, 1030-1050
LOW CARBON STEEL - CAST	1010, 1020
MEDIUM CARBON STEEL - CAST	1030, 1040, 1050

LONG CONTINUOUS CHIPS

- HEAT TREATMENT MAY IMPROVE THE MACHINABILITY OF SOME OF THESE MATERIALS
- CARBIDE TIPPED DRILLS ARE NOT GENERALLY RECOMMENDED FOR PLAIN CARBON STEEL

LOW AND MEDIUM CARBON ALLOY STEEL	4320, 4340, 4620, 5015, 8620, 9310
LOW AND MEDIUM CARBON ALLOY STEEL - FREE MACH.....	4140, 4142Se, 4145Te, 4150, 86L20
MEDIUM AND HIGH CARBON ALLOY STEEL - LEADED	41L30, 41L40, 41L50
STAINLESS STEEL - 300 SERIES (FREE MACH.)	303, 303MA, 303Pb, 303 PLUS X, 303Se
STAINLESS STEEL - 400 SERIES.....	409, 410, 420, 430, 436
STAINLESS STEEL - 400 SERIES (FREE MACH.).....	416, 416Se, 420F, 430F, 440F

THICK CURLED CHIPS

- HEAT TREATMENT MAY IMPROVE THE MACHINABILITY OF SOME OF THESE MATERIALS
- COOLANT FED DRILLS ARE GENERALLY RECOMMENDED FOR THESE MATERIALS

ARMOR PLATE.....	HY-80, HY-100, HY-180, MIL-5-12560
HIGH CARBON ALLOY STEEL	50100, 51100, 52100
HIGH STRENGTH STEEL - WROUGHT.....	300M, 4330V, 98BV40, HP 9-4-20
MARAGING STEEL.....	GRADES 200, 250, 300, 350, HY 230
NITRIDING STEEL	Nitralloy 125, 135, 135 Mod., 230
TOOL STEEL.....	SERIES A2, D2, H13, M50, P20, S7, W1

SHORT WIRY CURLED CHIPS

- CHIP DISCOLORATION IS COMMON WITH THESE MATERIALS
- THESE STEELS ARE DIFFICULT TO MACHINE DUE TO THE HIGH CARBON AND ALLOY CONTENT
- COOLANT FED DRILLS ARE GENERALLY RECOMMENDED FOR THESE MATERIALS

IRON BASE ALLOY.....	A-286, Discaloy, Incoloy 800-802
NICKEL BASE ALLOY.....	Hastelloy C, Inconel 600, 625, 718, 825
STAINLESS STEEL - 300 SERIES.....	302, 304, 309, 314, 316, 330, 347, 385
STAINLESS STEEL - PH SERIES.....	15-5PH, 16-6PH, 17-4PH, AM-350
TITANIUM ALLOY.....	Ti-6Al-4V, Ti-10v-2Fe-3Al, 98.9, 99.5

LONG WIRY CHIPS

- CHIP DISCOLORATION IS COMMON WITH THESE MATERIALS
- THIS GROUP MAY WORK HARDEN IF NOT MACHINED WITH CORRECT FEED RATES

3 LOCATE CHIP CLASS



NON-FERROUS LONG CHIPS
CHIP CLASS **20**



NON-FERROUS SHORT CHIPS
CHIP CLASS **40**



CAST IRONS
CHIP CLASS **60**



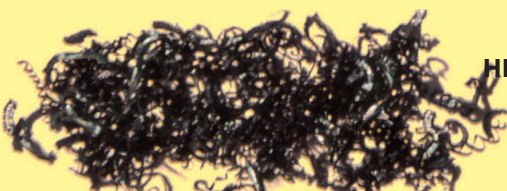
LOW STRENGTH STEELS
CHIP CLASS **80**



MEDIUM STRENGTH STEELS
CHIP CLASS **100**



HIGH STRENGTH STEELS
CHIP CLASS **120**



HIGH TEMPERATURE ALLOYS
CHIP CLASS **140**

4 SELECT FROM RECOMMENDATIONS IN TOOL SELECTOR BOX

CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
20	NON-FERROUS - LONG CHIPS	
40	NON-FERROUS - SHORT CHIPS	
60	CAST IRONS	
80	LOW STRENGTH STEELS	
100	MEDIUM STRENGTH STEELS	
120	HIGH STRENGTH STEELS	
140	HIGH TEMPERATURE ALLOYS	

HANNIBAL'S RECOMMENDED TOOL TYPE(S) APPEAR IN TOOL SELECTOR BOX FOR EACH CATALOG ITEM

"|" = PREFERRED TYPE NOTED FIRST (e.g., "459/458")
"or" = NO PREFERENCE (e.g., "620 or 622")



MILLING STAINLESS STEELS CHIP CLASSIFICATIONS

MATERIAL MACHINED	CHIP CLASS
FREE MACHINING 300 SERIES	60
FERRITIC 400 SERIES MARTENSITIC 400 SERIES	100
AUSTENITIC 200 OR 300 SERIES PH SERIES	140

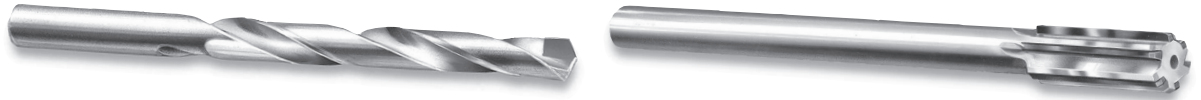
HANNIBAL'S CHIP CLASSIFICATIONS ARE BASED ON EACH MATERIAL'S MOST COMMON CONDITION. SPECIAL HEAT TREATMENTS OR PROCESSING MAY CHANGE THE MATERIAL'S MACHINING CHARACTERISTICS. THIS HANNIBAL GUIDE IS A SUGGESTED STARTING POINT FOR TOOL SELECTION.



FEEDS & SPEEDS — DRILLING OR REAMING GENERAL PURPOSE OR COOLANT FED

GENERAL PURPOSE

COOLANT FED



TECHNICAL

CHIP CLASS	MATERIAL BEING MACHINED	MATERIAL EXAMPLES	BRINELL HARDNESS	CHIP DESCRIPTION
20	ALUMINUM ALLOY CAST AND WROUGHT	308.0, 356.0, 360.0, 380.0, 383.0, 390.0, 2024, 3003, 4032, 5052, 6061, 7075	30-150 (500 kg)	DISCONTINUOUS FLAKY OR LONG STRINGY
	COPPER ALLOY TOUGH	101, 110, 115, 120, 130, 142, 155, 170, 172, 175, 195, 425, 610, 630, 655, 725, 805, 826, 910	40-200 (500 kg)	LONG CONTINUOUS
	LEAD ALLOY	Alloys 7, 8, 13, 15 1Sb, 4Sb, 6Sb, 8Sb, 9Sb	10-20 (500 kg)	DISCONTINUOUS TIGHTLY CURLED
	PLASTIC	ABS, Acrylic, Allyl, Bakelite, Epoxy, Furan, Nylon, Polyethylene, Polystyrene, PVC	—	CONTINUOUS
	ZINC ALLOY	AC41A, AG40A, AMS4803, ILZRO 12, ZDC NO. 7, GRADES 903, 925	80-100	LONG TIGHTLY CURLED
40	ALUMINUM BRONZE	614, 952-958	40-175	SHORT LOOSELY CURLED
	COPPER ALLOY/BRASS/BRONZE FREE MACHINING	268, 270, 314, 332, 335, 340, 342, 353, 356, 360, 370, 464-467, 485, 838, 945	10-100 Rb	FLAT SMALL
	MAGNESIUM ALLOY	AM60A, AZ21A, AZ91B-C, HM31A, K1A, ZE41A, ZK40A	50-90 (500 kg)	FLAT SMALL
	NICKEL SILVER	745, 752, 754, 757, 700, 973-978	10-100 Rb	LOOSELY CURLED
60	CAST IRON-DUCTILE AUSTENITIC (NI-RESIST)	TYPES D-2, D-2B, D-2C, D-2M, D-3, D-3A, D-4, D-5, D-5B	120-275	DISCONTINUOUS TIGHTLY CURLED
	CAST IRON-DUCTILE FERRITIC & FERRITIC-PEARLITIC	GRADES 60-40-18, 65-45-12, 80-55-06, D4018, D4512, D5506	140-270	DISCONTINUOUS TIGHTLY CURLED
	CAST IRON-DUCTILE MARTENSITIC & PEARLITIC-MARTENSITIC	GRADES 100-70-03, 120-90-02, D7003, DQ&T	270-400	DISCONTINUOUS TIGHTLY CURLED
	CAST IRON-GRAY FERRITIC & FERRITIC-PEARLITIC	CLASSES 20, 25, 30, 35, 40 GRADES G1800, G2500, G3000	120-220	DISCONTINUOUS
	CAST IRON-GRAY PEARLITIC	CLASSES 45, 50, 55, 60 GRADES G3500, G4000	220-320	DISCONTINUOUS
	CAST IRON-MALLEABLE FERRITIC & PEARLITIC	CLASSES 32510, 35018, 40010, 45008 GRADES M3210, M4504, M5003	110-240	DISCONTINUOUS
	CAST IRON-MALLEABLE TEMPERED MARTENSITE	GRADES 60004, 70003, 80002 GRADES M5003, M8501	200-320	DISCONTINUOUS
80	STEEL-LOW & MEDIUM STRENGTH FREE MACHINING	1108-1119, 1132-1151, 10L17, 10L18, 10L50, 11L44, 12L13, 12L14, 12L15	100-250	DISCONTINUOUS LOOSELY CURLED
	STEEL-LOW & MEDIUM STRENGTH WROUGHT	1005-1029, 1030-1050, 1513, 1518, 1524, 1552	100-375	CONTINUOUS STRINGY
100	ALLOY STEEL-LOW & MEDIUM STRENGTH FREE MACHINING	41L30, 41L40, 41L50, 86L20, 4142Se, 4145Te	100-275	DISCONTINUOUS TIGHTLY CURLED
	ALLOY STEEL-LOW & MEDIUM STRENGTH	1330, 1345, 1515, 4012, 4130, 4140, 4150, 4320, 4340, 4620, 5130, 8620, 8630, 8645, 9310	85-375	LOOSELY CURLED
	STAINLESS STEEL 400 SERIES	409, 410, 414, 420, 430, 436, 442, 446	135-325	DISCONTINUOUS TIGHTLY CURLED
	STAINLESS STEEL FREE MACHINING	203 EZ, 303, 303MA, 303Pb, 303 PLUS X, 303Se, 416, 416Se, 420F, 430F, 440F	135-275	SHORT TIGHTLY CURLED
120	ALLOY STEEL-HIGH STRENGTH, MARAGING STEEL, NITRIDING STEEL, TOOL STEEL	50100, 51100, 52100, GRADES 200-350, Nitralloy, SERIES A2, D2, H13, M50, P20, S7, WI	175-400	CONTINUOUS WIRY
140	HIGH TEMP ALLOY NICKEL & IRON	A-286; Hastelloy C; Inconel 600, 625, 718, 825; Monel 400; Nimonic 75, 80; Rene 41; Waspaloy	140-300	CONTINUOUS WIRY
	STAINLESS STEEL 300 SERIES	301, 302, 304, 309, 314, 316, 321, 330, 347, 385, Nitronic 32, 33, 40, 50, 60	135-375	WIRY LOOSELY CURLED
	STAINLESS STEEL PH SERIES	13-8 Mo, 15-5PH, 16-6PH, 17-4PH, 17-7PH, AM-350, AM-355	150-440	WIRY LOOSELY CURLED
	TITANIUM ALLOY	98.9, 99.0, 99.2, 99.5, Ti-6Al-4V, Ti-6Al-6V2Sn, Ti-8Mn, Ti-10v-2Fe-3Al	110-380	CONTINUOUS WIRY

TOOL APPLIC.		CUTTING SPEED (SFM) STARTING RANGE*		FEED RATE (INCHES PER REVOLUTION)																	
				HOLE DIAMETER IN INCHES																	
				1/8		1/4		3/8		1/2		5/8		3/4		1		1 1/4		1 1/2	
				GEN. PUR-POSE	COOL-ANT FED	GEN. PUR-POSE	COOL-ANT FED	GEN. PUR-POSE	COOL-ANT FED	GEN. PUR-POSE	COOL-ANT FED	GEN. PUR-POSE	COOL-ANT FED	GEN. PUR-POSE	COOL-ANT FED	GEN. PUR-POSE	COOL-ANT FED	GEN. PUR-POSE	COOL-ANT FED	GEN. PUR-POSE	COOL-ANT FED
DRILL REAM	250-350 150-250	375-550 200-300	.003 .004	- -	.005 .006	.004 .008	.007 .008	.005 .010	.008 .011	.006 .013	.010 .012	.006 .015	.011 .013	.007 .017	.014 .016	.009 .021	.017 .019	- .022	.019 .020	- .024	
DRILL REAM	125-190 50-90	225-300 70-105	.002 .005	- -	.005 .006	.004 .008	.007 .008	.005 .010	.008 .010	.006 .013	.009 .011	.007 .014	.010 .012	.008 .016	.012 .014	.010 .018	.014 .016	.010 .019	- -	.016 .017	- .020
DRILL REAM	350-450 150-250	400-500 200-300	.003 .002	- -	.005 .006	.004 .008	.006 .008	.006 .010	.007 .012	.007 .016	.008 .014	.008 .017	.009 .015	.009 .018	.013 .018	.013 .022	.015 .021	- .024	.017 .022	- .026	
DRILL REAM	175-450 90-250	- 125-300	.002 .004	- -	.004 .005	- .006	.005 .007	- .008	.005 .008	- .009	.006 .010	- .010	.008 .012	- .014	.009 .014	- .016	.010 .016	- .018	.012 .018	- .020	
DRILL REAM	300-400 140-210	400-500 170-240	.003 .005	- -	.005 .007	.004 .009	.007 .008	.005 .011	.009 .010	.006 .013	.011 .011	.008 .014	.012 .012	.009 .016	.014 .015	.010 .020	.016 .018	- .022	.018 .020	- .025	
DRILL REAM	125-190 50-90	200-300 70-105	.002 .004	- -	.005 .006	.004 .008	.007 .010	.005 .013	.008 .012	.006 .015	.009 .014	.007 .016	.010 .016	.008 .018	.012 .018	.010 .021	.014 .020	- .024	.016 .022	- .028	
DRILL REAM	225-400 100-250	300-450 125-300	.003 .005	- -	.005 .008	.004 .010	.007 .011	.005 .014	.008 .015	.006 .020	.009 .017	.007 .022	.010 .018	.008 .024	.012 .020	.010 .026	.014 .022	- .028	.016 .025	- .032	
DRILL REAM	300-400 130-190	450-550 150-250	.003 .005	- -	.005 .010	.005 .012	.006 .012	.006 .015	.007 .015	.007 .018	.008 .016	.008 .019	.009 .017	.009 .020	.013 .020	.013 .024	.015 .022	- .026	.016 .025	- .028	
DRILL REAM	125-190 50-90	225-300 70-190	.002 .004	- -	.005 .006	.004 .007	.007 .008	.005 .010	.008 .010	.006 .012	.009 .011	.007 .013	.010 .012	.008 .014	.012 .014	.010 .017	.014 .015	- .018	.016 .016	- .018	
DRILL REAM	- 45-70	- 65-100	- .004	- -	- .006	- .008	- .007	- .009	- .008	- .011	- .010	- .014	- .013	- .016	- .015	- .018	- .018	- .020	- .020	- .025	
DRILL REAM	150-225 50-90	200-250 70-105	.002 .004	- -	.004 .005	.004 .007	.006 .008	.005 .010	.008 .010	.006 .012	.010 .012	.007 .015	.012 .014	.008 .017	.014 .017	.010 .022	.016 .020	- .024	.018 .023	- .027	
DRILL REAM	- 35-60	200-250 50-85	- .004	- -	- .006	.004 .008	- .007	.005 .009	- .008	.006 .009	- .011	.007 .011	- .010	.008 .013	- .012	.010 .014	- .014	- .017	- .016	- .019	
DRILL REAM	175-300 65-135	250-400 95-190	.002 .005	- -	.005 .008	.004 .010	.007 .010	.006 .013	.009 .011	.008 .014	.011 .013	.010 .017	.014 .016	.012 .020	.017 .020	.015 .024	.018 .022	.019 .028	.019 .025	.030	
DRILL REAM	130-225 45-70	225-325 55-100	.002 .004	- -	.004 .006	.004 .008	.006 .008	.006 .010	.007 .009	.008 .012	.009 .010	.010 .014	.012 .015	.013 .018	.015 .018	.016 .020	- .018	.018 .020	.018 .020	.026	
DRILL REAM	125-190 60-120	200-250 70-105	.002 .004	- -	.005 .006	.004 .007	.008 .010	.006 .012	.009 .011	.008 .014	.010 .012	.008 .014	.011 .013	.008 .014	.012 .014	.010 .017	.014 .016	- .020	.016 .018	- .022	
DRILL REAM	100-150 45-70	200-250 65-100	.002 .004	- -	.004 .006	.004 .008	.006 .008	.005 .010	.007 .010	.006 .012	.008 .012	.007 .014	.010 .013	.008 .015	.012 .015	.010 .020	.014 .018	- .023	.016 .025	- .030	
DRILL REAM	125-175 70-100	150-250 100-150	.003 .005	- -	.004 .008	.005 .012	.008 .010	.006 .014	.010 .012	.008 .016	.012 .014	.009 .018	.014 .015	.010 .020	.017 .020	.012 .025	.018 .025	- .030	.019 .030	- .035	
DRILL REAM	- 30-85	- 40-110	- .004	- -	- .008	- .009	- .009	- .011	- .011	- .013	- .013	- .015	- .015	- .017	- .018	- .022	- .020	- .024	- .022	- .026	
DRILL REAM	- 65-100	100-220 90-135	- .005	- -	- .008	.005 .010	- .010	.006 .012	- .015	.007 .018	- .017	.008 .020	- .018	.010 .022	- .022	.012 .025	- .025	- .027	- .027	- .030	
DRILL REAM	- 40-85	100-150 65-100	- .005	- -	- .010	.005 .012	- .012	.006 .015	- .015	.007 .018	- .018	.008 .022	- .020	.010 .024	- .025	.012 .028	- .027	- .030	- .030	- .033	
DRILL REAM	- 40-90	110-150 50-100	- .003	- -	- .005	.004 .007	- .006	.005 .007	- .007	.006 .008	- .008	.007 .009	- .008	.008 .009	- .010	.010 .012	- .011	- .014	- .012	- .015	
DRILL REAM	100-150 65-100	125-190 90-135	.002 .004	- -	.004 .006	.004 .008	.005 .007	.005 .009	.006 .008	.006 .010	.007 .009	.007 .011	.008 .009	.007 .012	.010 .010	.008 .013	.012 .011	- .013	.014 .012	- .014	
DRILL REAM	- 35-70	100-150 50-100	- .004	- -	- .006	.004 .007	- .007	.006 .008	- .008	.007 .009	- .009	.008 .011	- .010	.010 .012	- .011	.012 .014	- .012	.015 .015	- .013	- .016	
DRILL REAM	15-85	20-115	.003	-	.005	.006	.005	.007	.005	.007	.006	.008	.007	.008	.008	.010	.010	.012	.012	.015	
DRILL REAM	40-75	60-90	.003	-	.004	.006	.005	.007	.006	.008	.006	.008	.007	.009	.008	.010	.009	.011	.010	.012	
DRILL REAM	35-70	50-90	.003	-	.004	.006	.004	.006	.005	.007	.006	.008	.007	.009	.008	.010	.009	.012	.010	.014	
DRILL REAM	30-45	40-60	.004	-	.006	.008	.008	.010	.010	.013	.011	.014	.011	.014	.012	.016	.013	.016	.014	.018	

*Use low end of speed range for high end of hardness range.



ENGINEERED COATINGS FOR CARBIDE TIPPED TOOLS



TECHNICAL

BENEFITS OF USING COATED TOOLS

- HIGHER FEEDS AND SPEEDS
- INCREASED TOOL LIFE
- TOLERANCES HELD LONGER
- IMPROVED WORKPIECE FINISHES

IMPORTANT STEPS IN TOOL COATING SELECTION

1. Use the HANNIBAL Tool Coating Selector Guide to select the *recommended coating* for the machining operation being performed on your specific material.
2. Review the selected coating's detailed description on page 11 to confirm that it meets your specific conditions & requirements.
3. Without a trial production run, you cannot be certain that a specific coating will be the very best for your particular application.
 - Do not order a large quantity of coated standard tools but rather order several with different coatings & review the trial production run results. Then order the full quantity with the most effective coating.
 - When ordering coated special tools, request several tools with different coatings & review the trial production run results before selecting the most effective coating for the balance of the special tool order.
4. The many variables involved in selecting the very best coating for your specific application can only be resolved by trial production run & analysis. Improved coated tool performance will offset your initial time & effort.

PRE-CONDITIONS FOR SUCCESSFUL USE OF COATED TOOLS

- Good operator/manufacturing engineering skills to maximize coating benefits.
- Adequate horsepower and rigidity for maximum feeds and speeds.
- Resharpener policy to only sharpen a tool's cutting edges, thereby preserving the flute face coating.

RESHARPENING METHODS FOR PRESERVING THE FLUTE FACE COATING

- Drills: Grind lips only
- Reamers: Grind relief on chamfers only
- Counterbores: Grind relief on cutting edges only
- End Mills: Grind relief on OD and/or end teeth only
- Milling Cutters: Grind relief on OD and/or side teeth only

SPECIFIC QUALIFIED COATING COMPANIES

PVD Coating Service companies have significant equipment & processing differences that can dramatically influence the coating's effectiveness for different types of tools. HANNIBAL has selected several technically focused coating companies that collectively can meet our customers' exacting needs for all coatings & tool types.

COATING SELECTOR GUIDE							
CHIP CLASS	MATERIAL MACHINED	DRILLING	REAMING	COUNTERBORING		MILLING	
		WET	WET	WET	DRY	WET	DRY
20	NON-FERROUS LONG CHIPS	ZrN	TiCN/ZrN	ZrN	ZrN	ZrN	ZrN
40	NON-FERROUS SHORT CHIPS	ZrN	TiCN/ZrN	ZrN	ZrN	ZrN	ZrN
60	CAST IRONS	AlTiN	TiCN/AlTiN	AlTiN	AlTiN	AlTiN	AlTiN
80	LOW STRENGTH STEELS	AlTiN	AlTiN	AlTiN	AlTiN	AlTiN	AlTiN
100	MEDIUM STRENGTH STEELS	AlTiN	AlTiN	AlTiN	AlTiN	AlTiN	AlTiN
120	HIGH STRENGTH STEELS	AlTiN	AlTiN	AlTiN	AlTiN	AlTiN	AlTiN
140	HIGH TEMPERATURE ALLOYS	AlTiN	AlTiN	AlTiN	*	AlTiN	*

* Chip class 140 materials should not be machined dry

WHY COATED TOOLS IMPROVE PRODUCTIVITY

1. Thermal Insulation – Heat at the cutting edge is a primary reason why tools break down. Coatings bond a thermally insulating barrier to the tool to reject heat from the tool surface back into the chip, thus protecting the tool substrate and making it last longer. Some coatings, such as TiAlN and AlTiN under certain conditions, actually produce a hard layer of aluminum oxide (an excellent insulator) during the cut.
2. Mechanical Strength – Abrasion from the chip flow combined with microscopic roughness of the tool surface tends to wear the substrate and dull the cutting edge during normal operations. The high hardness, lower friction coefficient, and reduced surface roughness of coatings allow the chip to flow off the surface of the tool. This reduces built up edge and wear so tool life is increased.
3. Chemical Resistance – Heat, pressure, coolant, and workpiece material all add to the chemically reactive forces present at the cutting edge. When reactive elements are brought together under these conditions, the uncoated tool will degrade. Coatings protect the tool substrate from exposure to these reactive forces thus stabilizing the cutting edge even under the harshest conditions.

COATING COMPARISONS				
	TiN	TiCN	ZrN	AlTiN
Hardness (Vickers)	2200	3000	2500	3600
Relative Toughness (1=Toughest)	3	2	2	4
Max Service Temperature	525°C (975°F)	400°C (750°F)	600°C (1110°F)	750°C (1380°F)
Friction Coefficient	.50	.40	.50	.60
Thickness	2-4 microns	2-4 microns	2-4 microns	2-4 microns
Surface Roughness (R _a µm)	.20	.17	.20	.30



PVD COATINGS TiN – TiCN – ZrN – AlTiN

FOR IMPROVED PERFORMANCE OF WET MACHINING

PHYSICAL VAPOR DEPOSITION (PVD)

HANNIBAL utilizes the Physical Vapor Deposition (PVD) process exclusively. PVD has a much lower process temperature than Chemical Vapor Deposition (CVD), thus preserving the strength and hardness of the alloy steel body and allowing for more aggressive machining without tool failure. The fine finish of PVD also results in a smoother, sharper cutting edge which stabilizes the cutting process, reduces edge build up, and improves surface finish on the workpiece.

TiN

Titanium Nitride coating with its familiar gold color remains a popular general purpose coating. The excellent wear resistance, thermal stability, and low coefficient of friction reduces built up edge, improving thermal transfer of heat away from the tool.

- Hardness (Vickers): 2200
- Max Service Temp: 525°C (975°F)
- Friction Coefficient: .50
- Thickness: 2-4 microns
- Surface Roughness (R_a um): .20

Applications: A good general purpose coating for drilling, reaming, counterboring and milling of Chip Class 20 thru 140 materials. Drilling and reaming should be restricted to shallow holes (<2.5x tool diameter) and to applications where coolant reaction must be minimized.

TiCN

Titanium Carbonitride, blue grey in color, has a hard, smooth finish which offers improved wear and built up edge resistance. Performs well on applications where low to moderate temperatures are generated at the cutting edge.

- Hardness (Vickers): 3000
- Max Service Temp: 400°C (750°F)
- Friction Coefficient: .40
- Thickness: 2-4 microns
- Surface Roughness (R_a um): .17

Applications: Excellent for machining materials which generate low cutting edge temperatures. Because of the relatively low service temperature of TiCN, coolant must be applied correctly to control the temperature at the cutting edge. Failure to do so can lead to premature wear of the coated surface.

ZrN

Zirconium Nitride, light gold in color, is excellent when machining non-ferrous and plastic materials. Offers a higher service temperature than TiCN.

- Hardness (Vickers): 2500
- Max Service Temp: 600°C (1110°F)
- Friction Coefficient: .50
- Thickness: 2-4 microns
- Surface Roughness (R_a um): .20

Applications: Very reliable coating when moderate temperatures are generated at the cutting edge. Generally most effective in Chip Class 20 thru 40 materials.

AlTiN

Aluminum Titanium Nitride, black in color, is excellent in abrasive and high temperature applications (>800°C). AlTiN creates a hard aluminum oxide layer during the cutting process. It is now the choice coating for Chip Classes 60 thru 140, in all applications.

- Hardness (Vickers): 3600
- Max Service Temp: 750°C (1380°F)
- Friction Coefficient: .60
- Thickness: 2-4 microns
- Surface Roughness (R_a um): .30

Applications: Preferred coating for tough and abrasive materials. Recommended for use when milling, drilling, reaming or counterboring titanium alloys, high temperature alloys, and other abrasive and difficult to machine materials.



MODIFICATIONS OF STANDARD TOOLS DRILLS - END MILLS - C'BORES - REAMERS - CUTTERS

LOW COST & PROMPT DELIVERY

Over 20% of standard tools ordered specify one or more modifications

WHY MODIFY A STANDARD TOOL?

- Modification of cutting form often eliminates subsequent machining operations
- Modifications often improve cutting geometries for machining extra tough or abrasive materials
- Shank modifications often improve tool holding or driving
- Very short lead times – usually within one week, sometimes same day
- Very economical for small quantities – often used to try new application ideas before committing to a large quantity, special tool order with longer delivery

DRILLS

- Modified tool diameter
- Non-stocked metric tool diameter
- Modified point and/or angle
- Shortened shank
- Reduced shank diameter
- Flat(s) on shank
- Extra long shank
- Tanged shank
- Shank whistle notch for set screw
- Coatings available:

TITANIUM NITRIDE – TiN

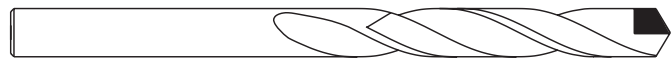
TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

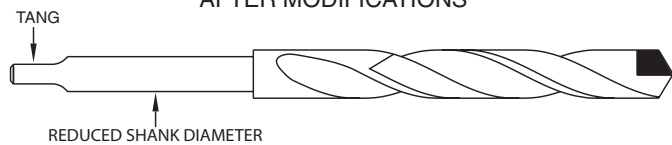
AL TITANIUM NITRIDE – AlTiN

- For core drills, see reamers' modification list

BEFORE MODIFICATIONS



AFTER MODIFICATIONS



END MILLS

- Modified tool diameter
- Metric tool diameter
- Cutting diameter reduced for step or pilot
- Corner chamfer or corner radius
- Shortened shank
- Reduced shank diameter
- Additional shank drive flat(s)
- Coolant outlets
- Coatings available:

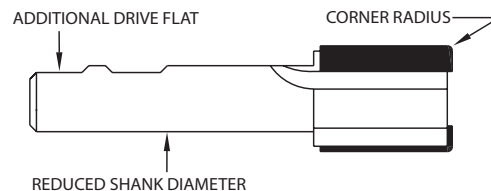
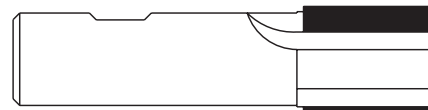
TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

BEFORE MODIFICATIONS



COUNTERBORES

- Modified tool diameter
- Non-stocked metric tool diameter
- Cutting diameter reduced for step
- Corner chamfer or corner radius
- Shortened shank
- Reduced shank diameter
- Flat(s) on shank
- Tanged shank
- Shank whistle notch for set screw
- Smaller taper shank
- Coatings available:

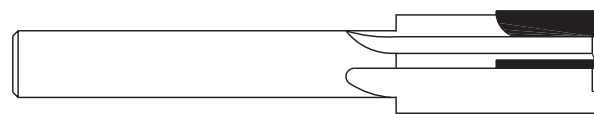
TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

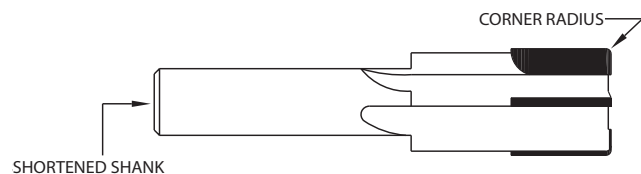
ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

BEFORE MODIFICATIONS



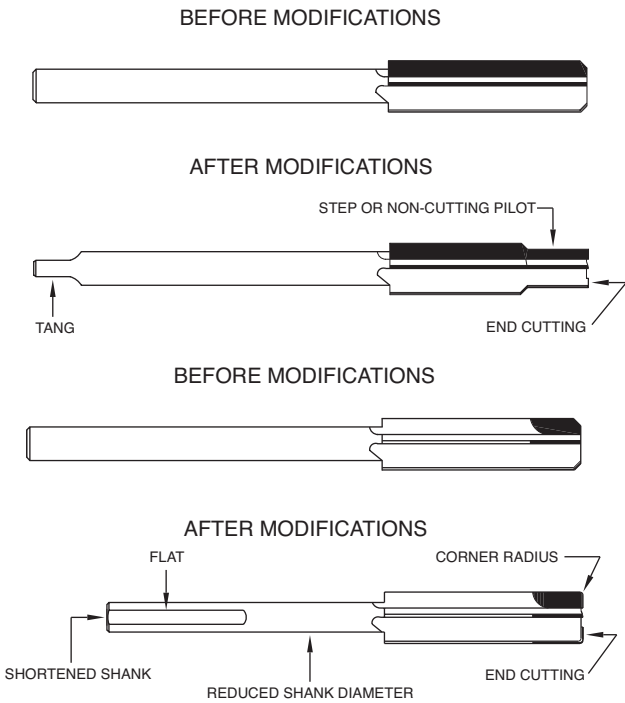
AFTER MODIFICATIONS



REAMERS

- Modified tool diameter
- Non-stocked metric tool diameter
- Closer tool diameter tolerance
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank
- Reduced shank diameter
- Flat(s) on shank
- Tanged shank
- Shank whistle notch for set screw
- Smaller taper shank
- Coatings available:

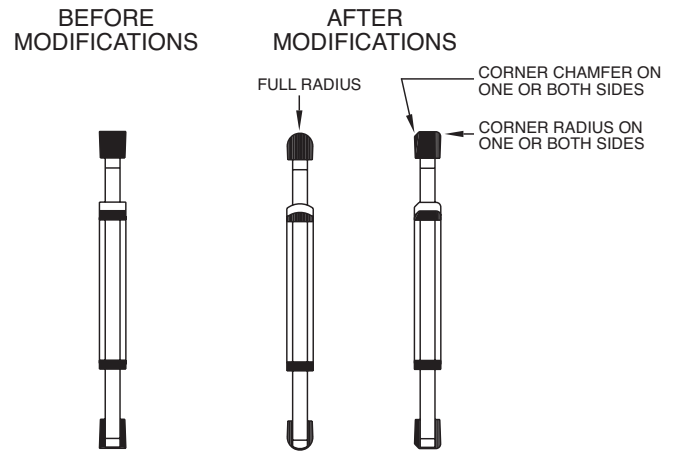
TITANIUM NITRIDE – TiN
TITANIUM CARBONITRIDE – TiCN
ZIRCONIUM NITRIDE – ZrN
AL TITANIUM NITRIDE – AlTiN



SLITTING SAWS & SIDE MILLING CUTTERS

- Alternate chamfer every other tooth
- Corner chamfer or corner radius on one side
- Corner chamfer or corner radius on both sides
- Full radius
- Reduced face width
- Closer tool diameter tolerance
- Chip breakers
- Matched tool diameter set(s)
- Reduced hub width
- Additional keyway
- Coatings available:

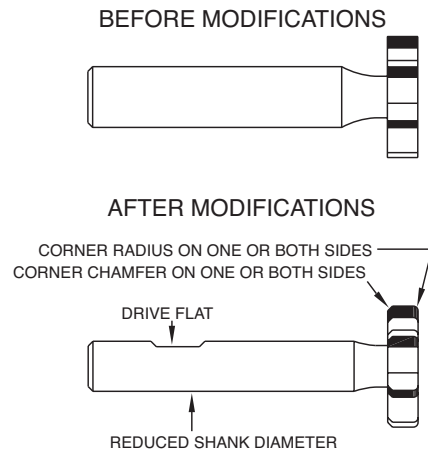
TITANIUM NITRIDE – TiN
TITANIUM CARBONITRIDE – TiCN
ZIRCONIUM NITRIDE – ZrN
AL TITANIUM NITRIDE – AlTiN



KEYSEAT CUTTERS & MISCELLANEOUS CUTTERS

- Modified tool diameter
- Metric tool diameter
- Modified face width
- Metric face width
- Corner chamfer or corner radius on one side
- Corner chamfer or corner radius on both sides
- Reduced neck diameter
- Shortened shank
- Reduced shank diameter
- Shank drive flat(s)
- Coatings available:

TITANIUM NITRIDE – TiN
TITANIUM CARBONITRIDE – TiCN
ZIRCONIUM NITRIDE – ZrN
AL TITANIUM NITRIDE – AlTiN

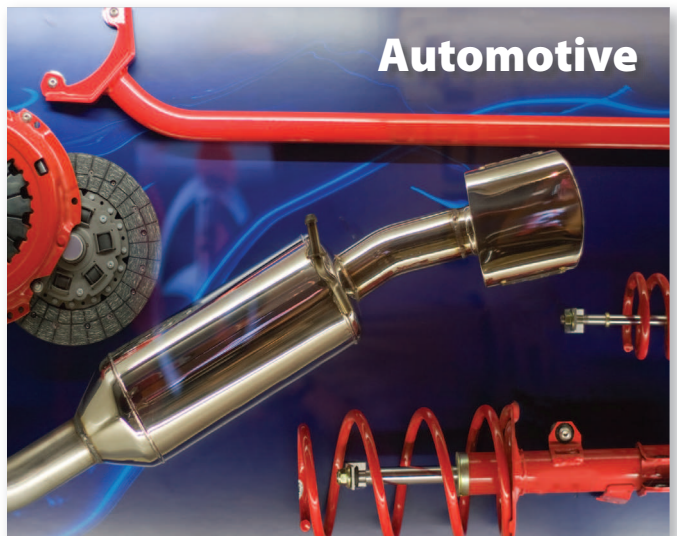




SPECIAL ENGINEERED TOOLS TO PRINT

QUALITY "MADE TO PRINT" TOOLS FOR ALL MANUFACTURING SECTORS

TECHNICAL





SPECIAL ENGINEERED TOOLS TO PRINT

ENGINEERED TOOLS TO YOUR SPECIFICATIONS

TECHNICAL

- Over 40 Years Experience in "Made to Print" Tooling
- Experienced Tech Support 7 am – 5 pm C.S.T.
- 24 Hour Quote Response
- 96% On Time Delivery
- Competitive Pricing
- ACAD Drawings
- Many "To Print" Tool Designs

*Reamers

Solid Carbide Head
Carbide Tipped
Solid Carbide

*Coolant Fed

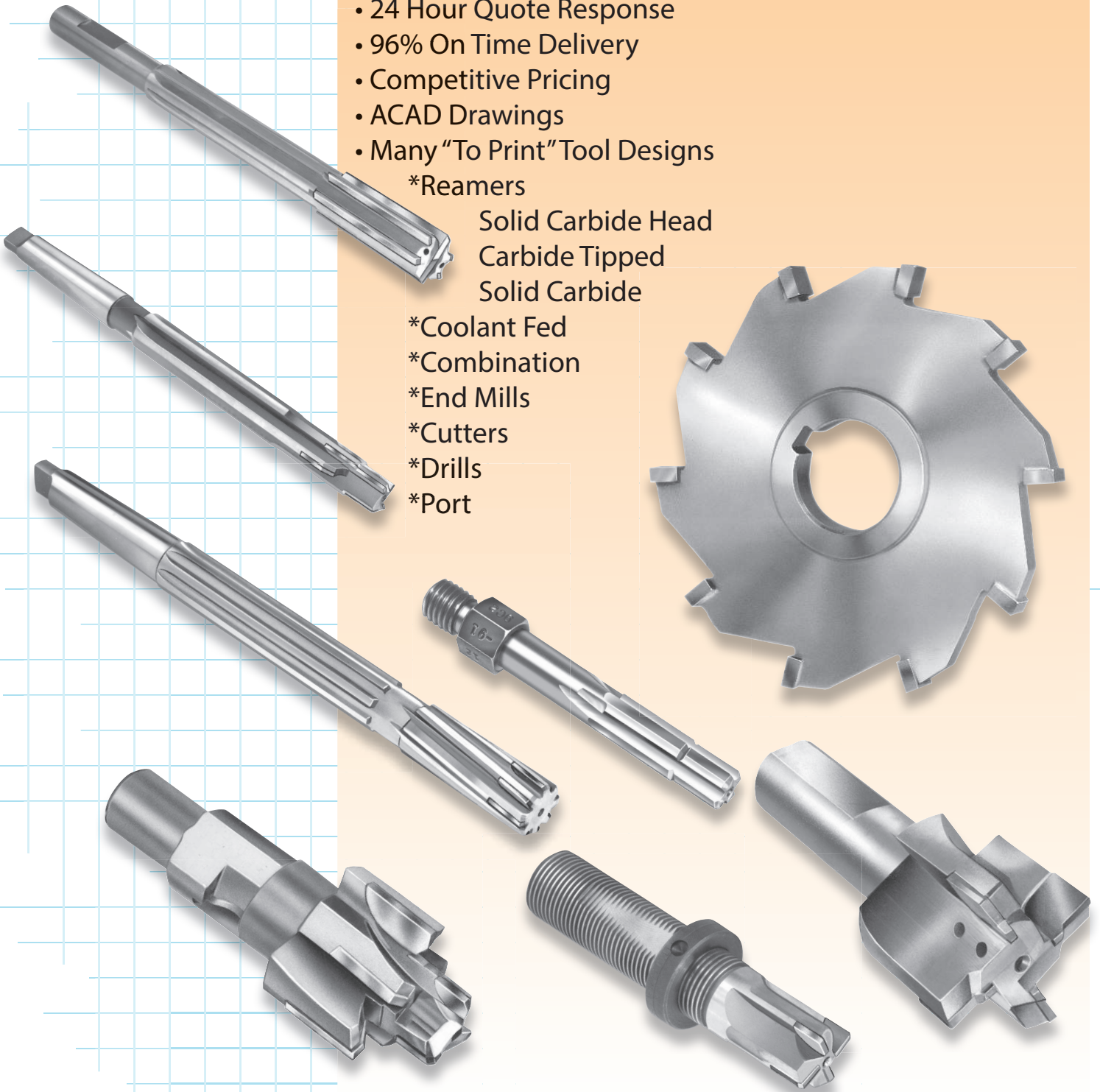
*Combination

*End Mills

*Cutters

*Drills

*Port





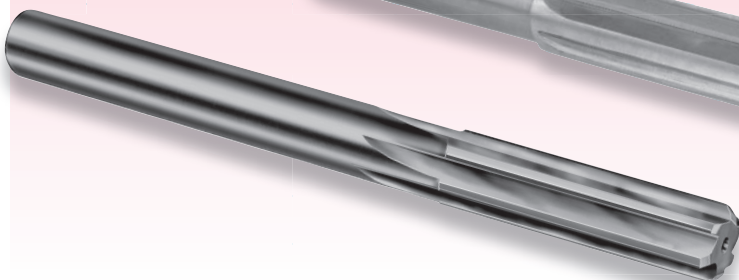
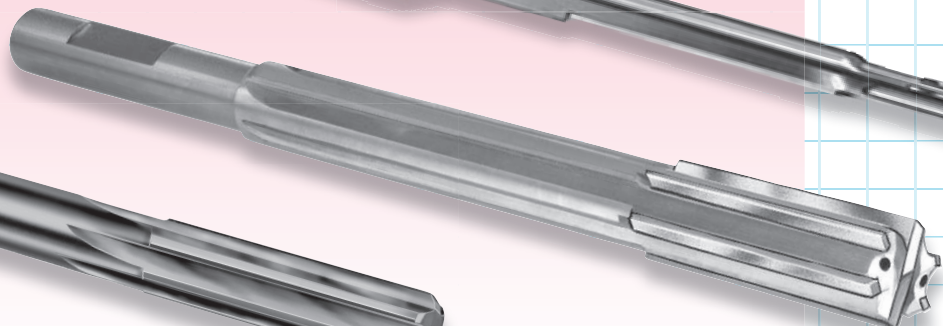
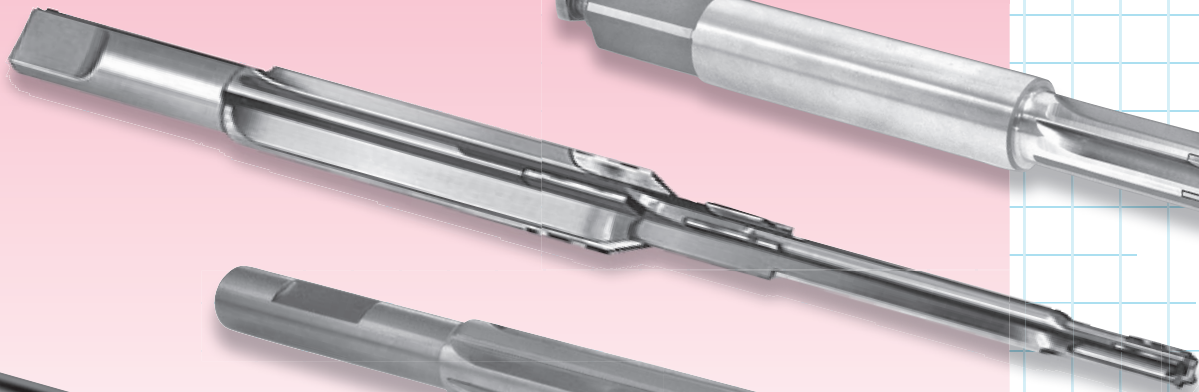
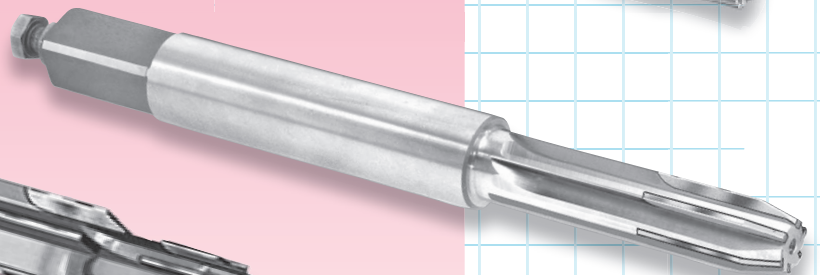
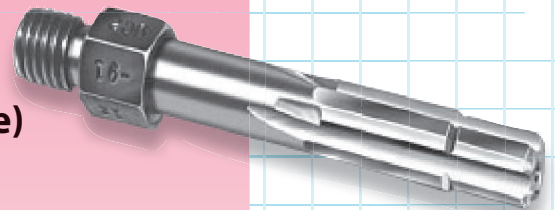
SPECIAL ENGINEERED TOOLS TO PRINT

QUALITY "MADE TO PRINT" TOOLS FOR ALL MANUFACTURING SECTORS

REAMERS

Carbide Tipped – Solid Carbide – Solid Carbide Head

- Center Cutting
- Coolant Fed (center and flute outlet)
- Deep Hole (should be coolant fed if possible)
- Hand
- Long Length (length/diameter ratio limitations)
- Line
- Odd number of flutes and irregular spaced flutes
- Piloted (Front or Rear)
- Pipe tap
- Shell (max diameter 3.250", max arbor size is #10)
- Shell reamer arbors (straight and taper shank)
- Step (all diameters are cutting)
- Stub screw machine
- Subland construction
(ex: 3 flutes ream 3 flutes chamfer)
- Tapered (24-degree maximum included angle)





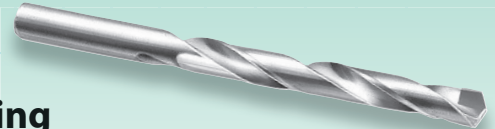
SPECIAL ENGINEERED TOOLS TO PRINT

ENGINEERED TOOLS TO YOUR SPECIFICATIONS



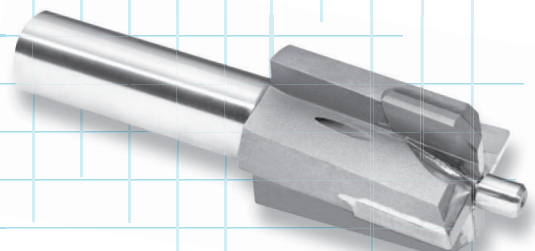
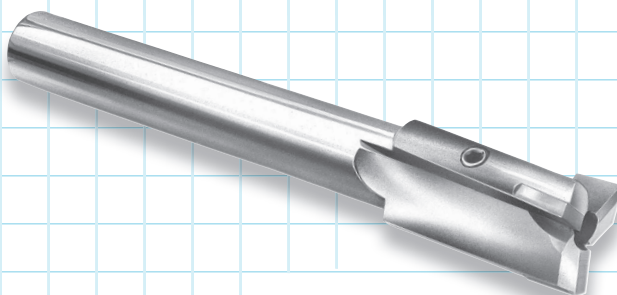
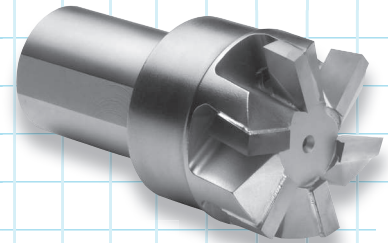
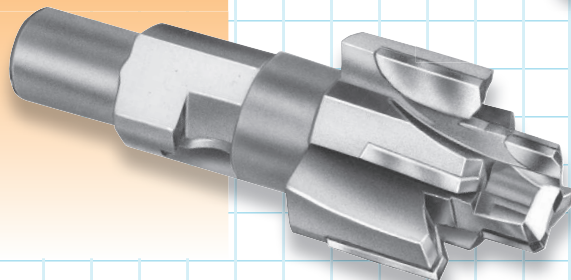
DRILLS

- Coolant fed — straight and spiral flutes
- Core
- Extension
- Hard steel
- Jobber
- Silver & Deming
- Spotting/Centering
- Stub
- Taper length



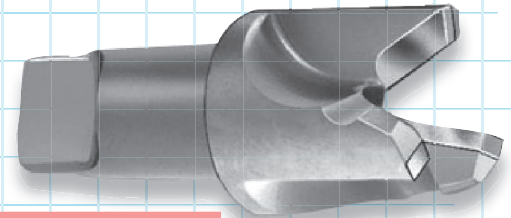
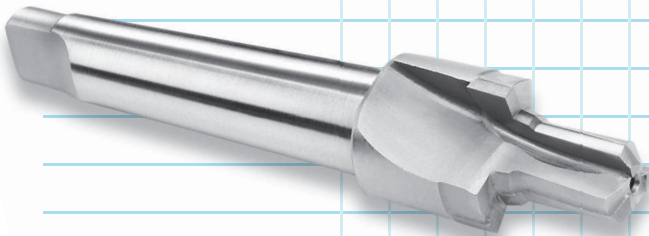
COUNTERBORES & SPOT FACE

- Aircraft
- Center cutting
- Piloted
- Radial/pin drive shank
- Stub taper shank
- Step
- Subland



END MILLS

- Center cutting (25° max spiral, 1½" max diameter)
- Coolant fed (center or flute feed)
- Corner rounding (¾" maximum radius)
- Longer length of cut (4 times diameter max)
- O.D. chipbreakers
- Tapered (24° max included angle)



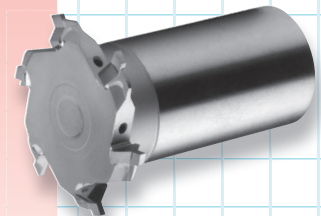
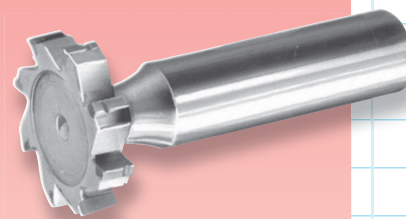
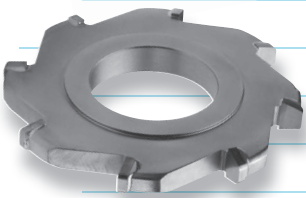
CUTTERS

SHANK TYPE

- Chamfer
- Double angle
- Dovetail
- Face Mills
- Keyseat
- Port
- Radius - convex
- T-Slot

ARBOR MOUNTED TYPE

- Double angle
- Full radius (convex only)
- Matched sets
- Side Milling
- Slitting Saw
- Shell Mill





SPECIAL ENGINEERED TOOLS TO PRINT

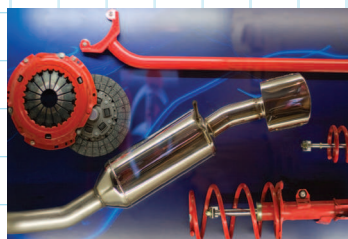
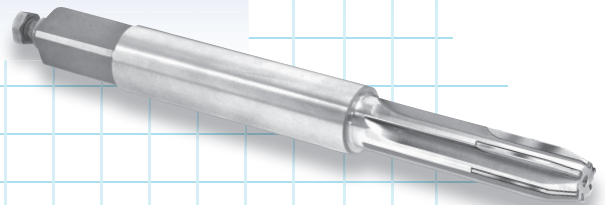
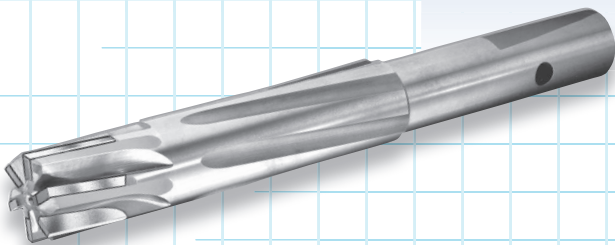
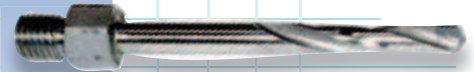
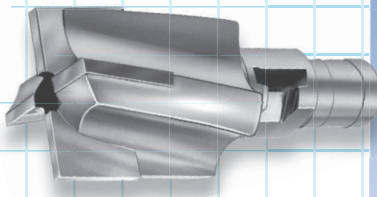
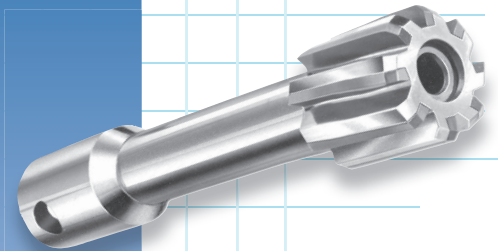
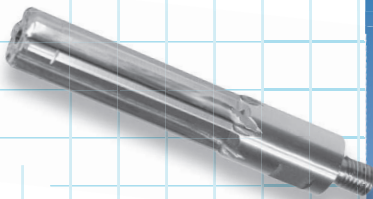
QUALITY "MADE TO PRINT" TOOLS FOR ALL MANUFACTURING SECTORS

TECHNICAL



SHANK CONFIGURATIONS

- Acme thread with nut
- End adjusting screw (for length pre-setting)
- Hex adapter
- Pin drive
- Quick-change adapters
- Radial drive
- Square drive
- Straight
- Tanged
- Taper
- Threaded
- Weldon flats
- Whistle notch

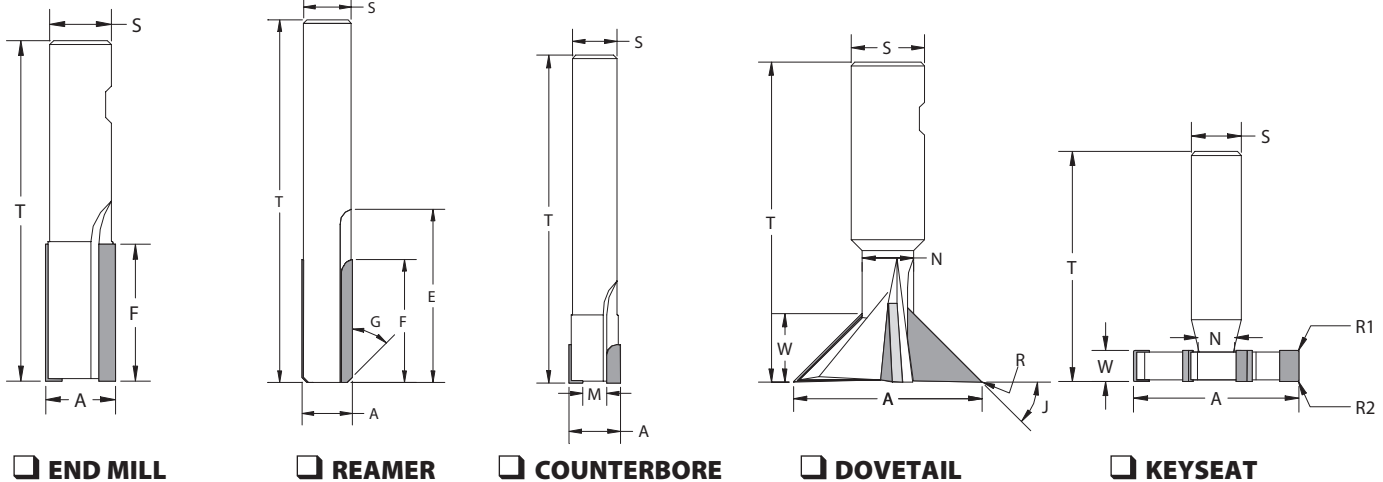




CARBIDE TIPPED SPECIALS QUOTE FORM

REQUIRED INFORMATION FOR QUOTING AND ORDERING
 FAX TO 800-633-7302 or E-MAIL TO sales@hannibalcarbide.com

CARBIDE TIPPED - SHANK TYPE TOOLS



- END MILL
 REAMER
 COUNTERBORE
 DOVETAIL
 KEYSEAT

QUOTE REQUEST FORM:

INDIVIDUAL: _____

COMPANY: _____

CITY/STATE: _____

FAX #: _____ PHONE #: _____

QUANTITY BREAKS: _____ pcs _____ pcs _____ pcs _____ pcs

Chip class of MATERIAL BEING MACHINED (from page 6-8)

- 20
 40
 60
 80
 100
 120
 140
 Other Material _____

BODY OF TOOL

T= _____ Overall Length S= _____ Shank Diameter A= _____ Major Diameter

FLUTES

E= _____ Flute Length F= _____ Carbide Length G= _____ ° Chamfer Angle

- Straight Flutes
 Right Hand Cutting
 Left Hand Cutting
 Number of Flutes _____
 Right Hand Spiral _____ °
 Left Hand Spiral _____ °

IF PILOTED
 Cutting Pilot
 Non-Cutting Pilot
 Head Diam. _____
 Head Length _____
 M= Min. Cutting Diam. _____

IF STEP REAMER
 Cutting Step
 Non-Cutting Step
 (Also see pages 98-100)
 Minor Diam. _____
 Step Length _____
 Step Angle _____ °

IF KEYSEAT
 W= _____ Width
 Straight Tooth
 R1= _____ Radius/Chamfer
 N= _____ Neck Diameter
 Staggered Tooth
 R2= _____ Radius/Chamfer

IF DOVETAIL
 N= _____ Neck Diam.
 J= _____ ° Angle
 R= _____ Radius
 W= _____ Width

ADDITIONAL APPLICATION NOTES: _____

Special order tool quotes usually same day; always next. Over 96% of Special tool orders shipped on promise date.

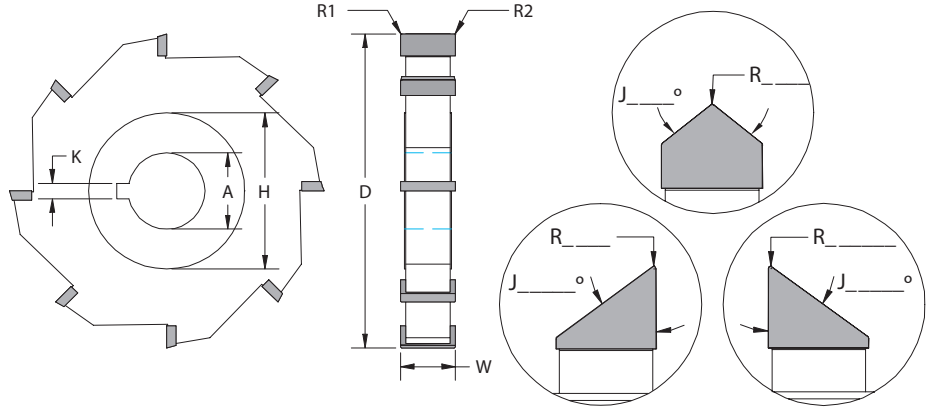


CARBIDE TIPPED SPECIALS QUOTE FORM

REQUIRED INFORMATION FOR QUOTING AND ORDERING
 FAX TO 800-633-7302 or E-MAIL TO sales@hannibalcarbide.com

CARBIDE TIPPED - ARBOR TYPE TOOLS

- D= _____ Cutter Diameter
- W= _____ Cutter Width
- A= _____ Arbor Hole Diam.
- N= _____ # of Teeth
- H= _____ Hub Diameter
- K= _____ Keyway Size
- R1= _____ Radius/Chamfer
- R2= _____ Radius/Chamfer



- Straight Tooth
- Straight Stagger
- Herringbone Stagger

- MILLING CUTTER
- SLITTING SAW

- ANGLE CUTTER
(Fill in "J" & "R")

QUOTE REQUEST FORM:

INDIVIDUAL: _____

COMPANY: _____

CITY/STATE: _____

FAX #: _____ PHONE #: _____

QUANTITY BREAKS: _____ pcs _____ pcs _____ pcs _____ pcs

Chip class of MATERIAL BEING MACHINED (from page 6-8)

- 20
- 40
- 60
- 80
- 100
- 120
- 140
- Other Material _____

Special order tool quotes usually same day; always next. Over 96% of Special tool orders shipped on promise date.

WARNING - Because cutting tools may shatter or break, government regulations require the use of safety glasses and other safety equipment at all times in the vicinity of cutting tool use. Grinding of solid carbide or carbide tipped tools will produce carbide and braze dust that may be hazardous to your health. Use adequate ventilation and read the applicable "Material Safety Data Sheets."

LIMITED WARRANTY

Hannibal Carbide Tool, Inc. does not give any warranty on its products except as follows: Hannibal Carbide Tool, Inc. warrants to original equipment manufacturers, distributors and industrial and commercial users of its products that each new product manufactured or supplied by Hannibal Carbide Tool, Inc. shall be free from defects in material and workmanship. Hannibal Carbide Tool, Inc.'s sole obligation under this warranty is limited to furnishing, without additional charge, a replacement for, or at its option, repairing or issuing credit for any such product which shall within one year from the date of sale by Hannibal Carbide Tool, Inc. be returned freight prepaid to Hannibal Carbide Tool, Inc. and which upon inspection is determined by Hannibal Carbide Tool, Inc. to be defective in materials or workmanship. The provisions of this warranty shall not apply to any product which has been subjected to misuse; improper operating conditions, machine setup or application of cutting fluid; or which has been repaired or altered if such repair or alteration in the judgment of Hannibal Carbide Tool, Inc. would adversely affect performance of the product. Complete written information with respect to all such matters, including operating condition, machine setup, cutting fluid, cutting speed and feed rate, must be furnished to Hannibal Carbide Tool, Inc. as a prerequisite to its consideration of any claim or complaint under this warranty.

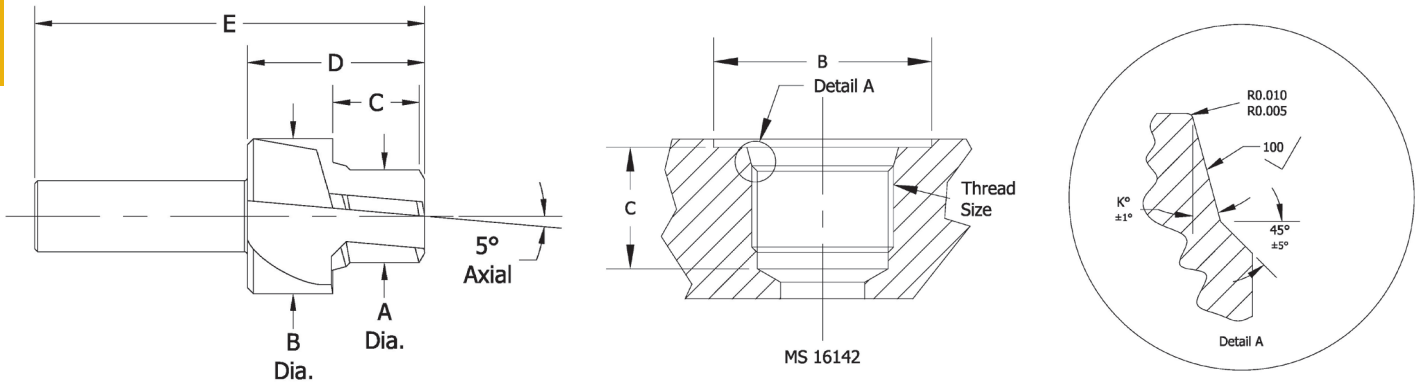
THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Hannibal Carbide Tool, Inc. shall have no liability or responsibility on any claim of any kind, whether in contract, tort or otherwise, for any loss or damage arising out of, connected with, or resulting from the manufacture, sale, delivery or use of any product sold hereunder, in excess of the cost of replacement or repair provided herein. IN NO EVENT SHALL HANNIBAL CARBIDE TOOL, INC. BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES. Hannibal Carbide Tool, Inc. makes no other warranty, expressed or implied, except the warranty against defects in material and workmanship set forth above; and Hannibal Carbide Tool, Inc. neither assumes nor authorizes any other person or entity to assume for it any other obligation or liability in connection with any of its products.



SPECIAL PORT CONTOUR TOOLS CARBIDE TIPPED

REQUIRED INFORMATION FOR QUOTING AND ORDERING
FAX TO 800-633-7302 or E-MAIL TO sales@hannibalcarbide.com

TECHNICAL



A=Reamer Dia. B=Spotface Dia. C=Reamer Length D=Head Length E=OAL K=Sealing Seat Angle

QUOTE REQUEST FORM:

INDIVIDUAL: _____

COMPANY: _____

CITY/STATE: _____

FAX #: _____ PHONE #: _____

QUANTITY BREAKS: _____ pcs _____ pcs _____ pcs _____ pcs

Chip class of MATERIAL BEING MACHINED (from page 6-8)

20 40 60 80 100 120 140 Other Material _____

TYPE OF TOOL:

- A.N.D. 10050 Integral Reamer Pilot Series
- ISO 6149-1 Metric Port without I.D. Groove
- Metric Port Reamer Pilot Series
- MS33649 Integral Reamer Pilot Series
- S.A.E. Ports - MS16142 - J514F - J1926

SHANK STYLE _____

SHANK LENGTH _____

THREAD SIZE _____

COOLANT FED YES or NO

A = _____ REAMER DIAMETER

D = _____ HEAD LENGTH

B = _____ SPOTFACE DIAMETER

E = _____ OVERALL LENGTH

C = _____ REAMER LENGTH

K = _____ SEALING SEAT ANGLE

ADDITIONAL APPLICATION NOTES: _____

Special order tool quotes usually same day; always next. Over 96% of Special tool orders shipped on promise date.



REAMER GUIDE

BASIC TECHNICAL INFORMATION FOR REAMERS



HANNIBAL CARBIDE would like to inform you of some basic technical knowledge regarding reamers. Following these guidelines will reduce overall set-up time, while increasing productivity. Selecting the right tool, proper stock removal and correct speeds and feeds are all important and covered here in the HANNIBAL Reamer Guide. Ream it right the first time with HANNIBAL.

.....from the Hannibal Technical Team

REAMERS

FLUTE STYLES

Straight:

Best suited for non-chip forming materials, i.e. cast iron, bronze and free cutting brass. Preferred hole condition would be a thru hole.

Right Hand Spiral:

Designed to pull the chip out of the hole in a blind hole application. Due to aggressive flute geometry, a right hand spiral may cut slightly oversized. Effective in bridging interruptions, such as keyways, cross-holes, etc. Excellent in highly ductile materials.

Left Hand Spiral:

Excellent in thru holes, as the flutes tend to push the chips out ahead of the reamer. Effective in bridging interruptions, such as keyways, cross-holes, etc. Good for reaming hard materials. Should provide the very best size and finish.

Expansion Reamers:

Designed for high production runs in abrasive materials, when size or finish can be rapidly lost. Expand the diameter by turning the screw clockwise. The tool is now ready to be reground back to its original diameter and resharpened. This process should produce like new tool performance.

COOLANT OPTIONS

Center Fed Coolant (axial):

Center fed coolant design is used for blind hole reaming. Combine center fed coolant with right hand spiral for maximum chip clearing ability in highly ductile material.

Flute Fed Coolant (radial):

Flute fed coolant design is used for thru hole reaming. Effective in a cavity large enough for chip clearance. Flute fed coolant will flush the chips ahead of the reamer, providing the best hole size and finish.



REAMER GUIDE

BASIC TECHNICAL INFORMATION FOR REAMERS



While developing optimum conditions will require some investment in time, it will be beneficial by reducing cycle times and getting the best possible tool life. There are several elements to evaluate in this section. These elements are key to maximizing tool efficiency.

OPTIMUM OPERATING CONDITIONS

Stock Removal:

2%-3% of the reamer diameter will normally be appropriate stock removal when reaming.

Example: a .500" diameter tool would remove .010"-.015" of stock.

Example: a 1.0" diameter tool would remove .020"-.030" of stock.

These examples cover finish reaming.

When your application calls for a rough ream, stock removal can be up to 5%

See "Pre-Ream Drill Size Chart" on page 26.

Runout (TIR) Concerns:

One of the most overlooked areas in reaming.

It is critical to the function of the tool to be running concentric with the machine spindle.

Some of the most important areas to consider include:

Tool Holders - precision collets and hydraulic chucks are widely used for straight shank tools. When using hydraulic chucks be sure shank diameter tolerance is acceptable. If using taper shank reamers make sure holders are free from dirt, grit and burrs that could cause the shank to not seat properly.

Tool Overhang - Use the shortest tool possible. Runout multiplies rapidly as the distance from the spindle increases.

Rigid Fixturing - Make sure the part piece is secure. Movement of the piece may cause tool breakage, oversized holes, poor finish and would shorten tool life.

Checking TIR - Check the reamer diameter with a dial indicator (at the circular margin). Ideally a reamer should run within .001" TIR.

Coolant feeding reamers:

Coolant induced thru the reamer should be utilized when possible.

Benefits include better finishes, superior tool life and the ability to increase speeds and feeds.

Speeds and Feeds:

Reaming is a finishing operation and the correct combination of speed and feed is critical to tool life. Proper speeds & feeds must be run to achieve size, straightness and finish. See pages 8 and 9 for starting speed and feed information and further guidelines.

Tool Geometry and Carbide Grade:

Geometry may be altered to obtain optimum performance and extend tool life.

Material specific carbide grades are beneficial in reaming material of a specific hardness & condition. Hannibal offers stocked material specific reamers in most all styles.



REAMER GUIDE

BASIC TECHNICAL INFORMATION FOR REAMERS



DEVELOPING OPTIMUM SPEED AND FEEDS

- Most reamer manufacturers will provide you with a starting point for speeds and feeds. It is very important to remember when optimizing your cycle that increasing feed will give you quicker cycles than running higher SFM at lower feed rates.
- With the surface feet per minute (SFM) at the manufacturers low range, begin trying to increase the feed rate. Increase in small increments, .001 - .0015 per revolution. Continue to increase the feed until an undesirable condition develops. This could be an unacceptable finish, a bell, tapered, or egg shaped hole, or poor size. At this point return to the previous feed rate. You are now at or close to the optimum feed rate.
- Increase the speed in increments of 10-20 SFM. Like the feed, increase until undesirable conditions appear, then return to the previous SFM. You should now be at or near the optimum speed and feed. It may also be necessary to fine-tune these numbers after a few runs to achieve the very best tool life.
- As you seek the optimum speed and feed for your application, look and listen for signs or sounds that could save you time. Listen for the reamer squealing upon entry—this means speed or feed is too high or alignment is poor. Examine the chip for size and color. Examine the finish for signs of chatter.

AVOIDING PROBLEMS – Common Problem Areas to Avoid.

- **Improper Tool** - make sure you are using the correct flute style and tool type.
- **Stock Removal** - HANNIBAL recommends 2-3% of the reamer diameter as a starting point for stock removal. 2% for steels and tough alloys, 3% for non-ferrous materials and cast irons. Solid carbide & carbide tipped reamers must have adequate stock to remove or they will rub in the hole and generate excessive heat, which leads to premature tool wear.
- **Improper Speeds & Feeds** - The right combination of speeds and feeds is critical to tool life and consistent size and finish. Getting the correct starting points is a key element. Reaming is a finishing operation and proper speeds and feeds must be run to achieve size, straightness and finish.
- **Poor Fixturing** - If the fixturing cannot hold the piece securely and in line with the spindle, then producing a good finish will be very difficult. A reamed hole is only going to be as good as the machine and fixturing used to machine and hold the part.
- **Excessing Runout (spindle or tool holder)** - Runout leads to poor finishes, oversized, tapered, and bellmouth holes, as well as poor tool life. Floating holders or bushings can sometimes be used to compensate for runout, but the best solution is to fix the problem.
- **Improper Coolant** - Make sure the coolant you are using is recommended for reaming your particular materials. Many coolants will prove effective for reaming if the concentration level is maintained with specifications. Take the time to check the levels on a regular basis.
- **Improper Sharpening or Geometry** - If a new tool works fine, but fails to perform after resharpening, the problem is obvious. However, depending on the hardness and condition of the material you are reaming, the tool geometry may need to be altered to get optimum performance and tool life. Geometries most often changed are the circular margins, radial rake, and the primary chamfer clearance.
- **Material Changes (hardness and/or condition)** - Castings lead the way in inconsistency. Hard spots, free carbides, and scale can all lead to inconsistent results when reaming. A heat treatment that varies just a few points from part to part can cause problems.



REAMER GUIDE

BASIC TECHNICAL INFORMATION FOR REAMERS

HANNIBAL PRE-REAM DRILL SIZE CHART

REAMERS

REAMER DIAMETER FRACTION - DECIMAL (NOMINAL)	HOLE SIZE TO LEAVE 2%	DRILL SIZE TO LEAVE 2%	HOLE SIZE TO LEAVE 3%	DRILL SIZE TO LEAVE 3%
1/8 - .1250	.1225	31	.1213	3.0mm
9/64 - .1406	.1378	29	.1364	3.4mm
5/32 - .1562	.1532	24	.1516	25
11/64 - .1719	.1685	19	.1667	4.2mm
3/16 - .1875	.1838	14	.1819	15
13/64 - .2031	.1990	5.0mm	.1970	9
7/32 - .2188	.2144	5.4mm	.2122	4
15/64 - .2344	.2297	1	.2274	5.7mm
1/4 - .2500	.2450	C	.2425	6.1mm
17/64 - .2656	.2600	6.5mm	.2576	F
9/32 - .2812	.2756	I	.2728	6.9mm
19/64 - .2969	.2910	7.3mm	.2880	7.25mm
5/16 - .3125	.3063	7.75mm	.3031	N
21/64 - .3281	.3215	8.1mm	.3183	O
11/32 - .3438	.3370	8.5mm	.3335	8.4mm
23/64 - .3594	.3522	S	.3486	8.8mm
3/8 - .3750	.3675	9.25mm	.3638	23/64
25/64 - .3906	.3828	9.6mm	.3789	V
13/32 - .4062	.3982	10.0mm	.3941	25/64
27/64 - .4219	.4135	10.4mm	.4092	13/32
7/16 - .4375	.4288	10.8mm	.4244	27/64
29/64 - .4531	.4440	11.2mm	.4395	7/16
15/32 - .4688	.4594	11.6mm	.4547	29/64
31/64 - .4844	.4747	12.0mm	.4699	15/32
1/2 - .5000	.4900	31/64	.4850	12.2mm
33/64 - .5156	.5053	1/2	.5000	12.6mm
17/32 - .5312	.5206	33/64	.5153	13.0mm
35/64 - .5469	.5360	17/32	.5305	13.4mm
9/16 - .5625	.5513	35/64	.5456	13.8mm
37/64 - .5781	.5665	9/16	.5608	14.2mm
19/32 - .5938	.5820	37/64	.5760	14.5mm
39/64 - .6094	.5972	19/32	.5911	14.9mm
5/8 - .6250	.6125	39/64	.6063	15.3mm
41/64 - .6406	.6278	5/8	.6214	15.7mm
21/32 - .6562	.6431	41/64	.6365	16.1mm
43/64 - .6719	.6585	21/32	.6517	16.5mm
11/16 - .6875	.6738	17.0mm	.6669	16.8mm
45/64 - .7031	.6890	11/16	.6820	17.2mm
23/32 - .7188	.7044	45/64	.6972	17.6mm
47/64 - .7344	.7197	18.2mm	.7124	18.0mm
3/4 - .7500	.7350	18.5mm	.7275	18.3mm
49/64 - .7656	.7502	18.9mm	.7426	18.8mm
25/32 - .7812	.7656	19.3mm	.7578	3/4
51/64 - .7969	.7810	19.7mm	.7730	49/64
13/16 - .8125	.7963	20.1mm	.7881	25/32
53/64 - .8281	.8115	20.5mm	.8034	51/64
27/32 - .8438	.8270	20.8mm	.8185	13/16
55/64 - .8594	.8422	21.25mm	.8336	53/64
7/8 - .8750	.8575	21.6mm	.8488	27/32
57/64 - .8906	.8728	22.0mm	.8639	55/64
29/32 - .9062	.8881	22.5mm	.8790	7/8
59/64 - .9219	.9035	22.8mm	.8942	57/64
15/16 - .9375	.9188	23.25mm	.9094	29/32
61/64 - .9531	.9340	23.5mm	.9245	59/64
31/32 - .9688	.9494	24.0mm	.9397	15/16
63/64 - .9844	.9647	24.4mm	.9549	61/64
1 - 1.0000	.9800	24.75mm	.9700	31/32

This chart allows for drill oversize based on study done by the United States Cutting Tool Institute



REAMER SELECTION GUIDE BASED ON HOLE CONDITION



CARBIDE LENGTH

- Use flute long carbide for hole depths exceeding maximum shallow depth (shown in table to right)

Hole Diameter	Max. Shallow Hole Depth
.1875" thru .3125"	.500"
.3126" thru .7188"	.625"
.7189" thru 1.0625"	.750"
1.0626" thru 1.5000"	.875"

FLUTE STYLES

- Straight Flutes - Good in a wide variety of applications
- Right Spiral Flutes - Tend to bridge interruptions such as keyways, slots or intersecting holes; Good chip clearing ability for ductile materials and blind holes
- Left Spiral Flutes - Also tend to bridge interruptions; Good for cast irons, heat treated steels and other hard materials
Do **not** use in blind holes
- Expansion Reamers - Economical for abrasive materials

MATERIAL CHIP CLASS	FLUTE STYLE	THRU HOLE				BLIND HOLE			
		SHALLOW		DEEP		SHALLOW		DEEP	
		STR. SHANK	TPR. SHANK	STR. SHANK	TPR. SHANK	STR. SHANK	TPR. SHANK	STR. SHANK	TPR. SHANK
20 ALUMINUM ALLOY COPPER ALLOY (TOUGH) LEAD ALLOY NON-METAL & PLASTIC ZINC ALLOY	GENERAL PURPOSE TYPES								
	SPIRAL	420 - pg. 68	422 - pg. 70	440 - pg. 42	-	410 - pg. 68	412 - pg. 70	-	-
	STRAIGHT	400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62	400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62
	EXPANSION	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66
	MATERIAL SPECIFIC TYPES								
	SPIRAL	433 - pg. 86	-	482 - pg. 87	-	432 - pg. 84	-	442 - pg. 85	-
	STRAIGHT	407 - pg. 76	472 - pg. 80	457 - pg. 78	453 - pg. 81	407 - pg. 76	472 - pg. 80	457 - pg. 78	453 - pg. 81
	EXPANSION	464 - pg. 82	461 - pg. 83	464 - pg. 82	461 - pg. 83	464 - pg. 82	461 - pg. 83	464 - pg. 82	461 - pg. 83
	COOLANT FED TYPES								
	SPIRAL	427 - pg. 96	-	427 - pg. 96	-	411 - pg. 94	-	411 - pg. 94	-
	STRAIGHT	416 - pg. 92	-	416 - pg. 92	-	414 - pg. 90	-	414 - pg. 90	-
	40 ALUMINUM BRONZE BRASS BRONZE MAGNESIUM ALLOY NICKEL SILVER	GENERAL PURPOSE TYPES							
SPIRAL		420 - pg. 68	422 - pg. 70	440 - pg. 42	-	410 - pg. 68	412 - pg. 70	-	-
STRAIGHT		400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62	400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62
EXPANSION		465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66
MATERIAL SPECIFIC TYPES									
SPIRAL		433 - pg. 86	-	482 - pg. 87	-	432 - pg. 84	-	442 - pg. 85	-
STRAIGHT		407 - pg. 76	472 - pg. 80	457 - pg. 78	453 - pg. 81	407 - pg. 76	472 - pg. 80	457 - pg. 78	453 - pg. 81
EXPANSION		464 - pg. 82	461 - pg. 83	464 - pg. 82	461 - pg. 83	464 - pg. 82	461 - pg. 83	464 - pg. 82	461 - pg. 83
COOLANT FED TYPES									
SPIRAL		427 - pg. 96	-	427 - pg. 96	-	411 - pg. 94	-	411 - pg. 94	-
STRAIGHT		416 - pg. 92	-	416 - pg. 92	-	414 - pg. 90	-	414 - pg. 90	-
60 DUCTILE CAST IRON GRAY CAST IRON MALLEABLE CAST IRON NODULAR CAST IRON		GENERAL PURPOSE TYPES							
	SPIRAL	420 - pg. 68	422 - pg. 70	440 - pg. 42	-	410 - pg. 68	412 - pg. 70	-	-
	STRAIGHT	400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62	400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62
	EXPANSION	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66
	MATERIAL SPECIFIC TYPES								
	SPIRAL	437 - pg. 86	-	483 - pg. 87	-	436 - pg. 84	-	443 - pg. 85	-
	STRAIGHT	408 - pg. 76	473 - pg. 80	458 - pg. 78	454 - pg. 81	408 - pg. 76	473 - pg. 80	458 - pg. 78	454 - pg. 81
	EXPANSION	468 - pg. 82	462 - pg. 83	466 - pg. 82	462 - pg. 83	466 - pg. 82	462 - pg. 83	466 - pg. 82	462 - pg. 83
	COOLANT FED TYPES								
	SPIRAL	428 - pg. 96	-	428 - pg. 96	-	413 - pg. 94	-	413 - pg. 94	-
	STRAIGHT	426 - pg. 92	-	426 - pg. 92	-	424 - pg. 90	-	424 - pg. 90	-
	80 - 100 - 120 LOW STRENGTH STEEL MEDIUM STRENGTH STEEL HIGH STRENGTH STEEL TOOL STEEL	GENERAL PURPOSE TYPES							
SPIRAL		420 - pg. 68	422 - pg. 70	440 - pg. 42	-	410 - pg. 68	412 - pg. 70	-	-
STRAIGHT		400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62	400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62
EXPANSION		465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66
MATERIAL SPECIFIC TYPES									
SPIRAL		439 - pg. 86	-	484 - pg. 87	-	438 - pg. 84	-	444 - pg. 85	-
STRAIGHT		409 - pg. 76	474 - pg. 80	459 - pg. 78	455 - pg. 81	409 - pg. 76	474 - pg. 80	459 - pg. 78	455 - pg. 81
EXPANSION		468 - pg. 82	463 - pg. 83	468 - pg. 82	463 - pg. 83	468 - pg. 82	463 - pg. 83	468 - pg. 82	463 - pg. 83
COOLANT FED TYPES									
SPIRAL		429 - pg. 96	-	429 - pg. 96	-	415 - pg. 94	-	415 - pg. 94	-
STRAIGHT		435 - pg. 92	-	435 - pg. 92	-	434 - pg. 90	-	434 - pg. 90	-
140 IRON BASE ALLOY NICKEL BASE ALLOY 300 SERIES STAINLESS 400 SERIES STAINLESS PH SERIES STAINLESS TITANIUM ALLOY		GENERAL PURPOSE TYPES							
	SPIRAL	420 - pg. 68	422 - pg. 70	440 - pg. 42	-	410 - pg. 68	412 - pg. 70	-	-
	STRAIGHT	400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62	400 - pg. 46	402 - pg. 54	450 - pg. 56	452 - pg. 62
	EXPANSION	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66	465 - pg. 64	467 - pg. 66
	MATERIAL SPECIFIC TYPES								
	SPIRAL	439 - pg. 86	-	484 - pg. 87	-	438 - pg. 84	-	444 - pg. 85	-
	STRAIGHT	409 - pg. 76	474 - pg. 80	459 - pg. 78	455 - pg. 81	409 - pg. 76	474 - pg. 80	459 - pg. 78	455 - pg. 81
	EXPANSION	468 - pg. 82	463 - pg. 83	468 - pg. 82	463 - pg. 83	468 - pg. 82	463 - pg. 83	468 - pg. 82	463 - pg. 83
	COOLANT FED TYPES								
	SPIRAL	429 - pg. 96	-	429 - pg. 96	-	415 - pg. 94	-	415 - pg. 94	-
	STRAIGHT	435 - pg. 92	-	435 - pg. 92	-	434 - pg. 90	-	434 - pg. 90	-



COST EFFECTIVE REAMER SELECTION CARBIDE TIPPED VS. HSS AND COBALT

REAMERS

REAMER SELECTOR	CHIP CLASS	1 FIND THE CLASS FOR MATERIAL BEING REAMED - SEE PAGES 6 & 7	2 DETERMINE MATERIAL CONDITION AND HARDNESS	3 DETERMINE TOTAL NUMBER OF HOLES TO BE REAMED, THEN LOCATE MOST COST EFFECTIVE REAMER ON MATERIAL CONDITION/HARDNESS LINE									
		MATERIAL CLASS	MATERIAL CONDITION/HARDNESS	TOTAL NUMBER OF HOLES TO BE REAMED									
				1	5	10	20	40	80	160	320	640	
20	NON-FERROUS LONG CHIPS		SOFT - UNDER 10% SILICON	HSS	HSS	HSS	HSS	CT	CT	CT	CT	CT	CT
			ABRASIVE - OVER 10% SILICON	HSS	Cobalt	CT	CT	CT	CT	CT	CT	CT	CT
40	NON-FERROUS SHORT CHIPS		SOFT - FREE MACHINING	HSS	HSS	HSS	HSS	CT	CT	CT	CT	CT	CT
			HARD - HIGH TENSILE	HSS	Cobalt	Cobalt	CT	CT	CT	CT	CT	CT	CT
60	CAST IRONS		SOFT - 120 TO 220 Bhn	HSS	HSS	HSS	CT	CT	CT	CT	CT	CT	CT
			MEDIUM - 220 TO 300 Bhn	HSS	Cobalt	Cobalt	CT	CT	CT	CT	CT	CT	CT
			HARD - OVER 300 Bhn	HSS	Cobalt	CT	CT	CT	CT	CT	CT	CT	CT
80	LOW STRENGTH STEELS		SOFT - 80 TO 175 Bhn	HSS	HSS	HSS	CT	CT	CT	CT	CT	CT	CT
			MEDIUM - 176 TO 275 Bhn	HSS	Cobalt	CT	CT	CT	CT	CT	CT	CT	CT
			HARD - OVER 275 Bhn	Cobalt	Cobalt	CT	CT	CT	CT	CT	CT	CT	CT
100	MEDIUM STRENGTH STEELS		SOFT - 150 TO 275 Bhn	HSS	HSS	HSS	CT	CT	CT	CT	CT	CT	CT
			MEDIUM - 276 TO 425 Bhn	HSS	Cobalt	CT	CT	CT	CT	CT	CT	CT	CT
			HARD - OVER 45 Rc	Cobalt	CT	CT	CT	CT	CT	CT	CT	CT	CT
120	HIGH STRENGTH STEELS		SOFT - 135 TO 275 Bhn	HSS	HSS	CT	CT	CT	CT	CT	CT	CT	CT
			MEDIUM - 276 TO 425 Bhn	Cobalt	Cobalt	CT	CT	CT	CT	CT	CT	CT	CT
			HARD - OVER 45 Rc	Cobalt	CT	CT	CT	CT	CT	CT	CT	CT	CT
140	HIGH TEMP ALLOYS		ALL CONDITIONS	CT	CT	CT	CT	CT	CT	CT	CT	CT	CT

CT=Carbide Tipped HSS=High Speed Steel

DECREASE YOUR MACHINING COST PER HOLE REAMED WITH CARBIDE TIPPED REAMERS

Why is **total cost** per hole reamed **far lower** with **carbide tipped** reamers despite its higher initial cost? Because of:

- Higher feeds & speeds due to heat resistant cutting edges — reduces machine cycle time per part
- Consistent quality — maintains hole size and surface finish far longer
- Longer tool life — reduces down time for tool changes



REAMER PROBLEM SOLVING GUIDE CARBIDE TIPPED

REAMING PROBLEMS	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. POOR FINISH	Unequal chamfers Incorrect margins Excessive spindle runout Chatter Insufficient cutting action	Regrind reamer with equal chamfer height Regrind reamer with narrower margins for reaming higher tensile materials Use bushing — .0002"/.0003" over reamer diameter Increase feed and reduce speed rate Use power feed unless material is hard Use spiral fluted reamer Grind secondary lead angle immediately behind 45° chamfer Specify reamer with positive radial rake to reduce cutting pressure — may produce slightly larger diameter holes
2. OVERSIZED HOLES TAPERED HOLES BELL MOUTH HOLES	Misalignment Incorrect feed and/or speed	Check fixturing & setup for possible causes; use floating holder if necessary Consider using precision bushings or piloted reamers Verify feeds & speeds (see pages 8 & 9)
3. EXCESSIVE TOOL WEAR	Improper stock removal Excessive reaming pressure Misalignment	Change pre-ream hole size to leave 2 to 3% of tool diameter Decrease feed rate (see "Feeds & Speeds" Chart on pages 8 & 9) See solution for "improper stock removal" in #3 See solution for "misalignment" in #2
4. CROOKED HOLES	Drill walking or incorrect sharpening	Correct drilling operation — reamer will follow drilled hole Increase 90° included chamfer angle to 120° – 180°
5. TOOL BREAKAGE	Excessive reaming pressure Misalignment	See solution for "excessive reaming pressure" in #3 See solution for "misalignment" in #2



CARBIDE TIPPED REAMERS TECHNICAL INFORMATION

REAMER BASICS

- The reamer is used to finish machine a previously formed hole to an exact diameter with a smooth finish. It should **not** be used to significantly enlarge a hole (max. 5% – depending on material and hardness).
- Carbide tipped reamers are especially appropriate for close tolerance reaming. Because carbide is very highly resistant to wear, the reamer will produce accurate hole size and a smooth finish far longer than high speed steel or cobalt.
- The reamer is an end cutting tool, cutting only on the chamfer's edge at the outside diameter of the preformed hole.

The standard 45° chamfer angle provides effective cutting action for most materials.

Reamer Types:

- General Purpose** – Superior performance over high speed steel and cobalt; good in a wide variety of materials
- Material Specific** – Excellent in large production runs due to material specific carbide & tool geometry
- Coolant Fed** – Exceptional performance and tool life using material specific reamer technology and coolant fed capabilities; maximizes feeds & speeds

TECHNICAL REAMING GUIDE INFORMATION PAGES 23-29

Contact us for a PDF copy of "HANNIBAL'S Guide to Cost Effective Reaming." It includes:

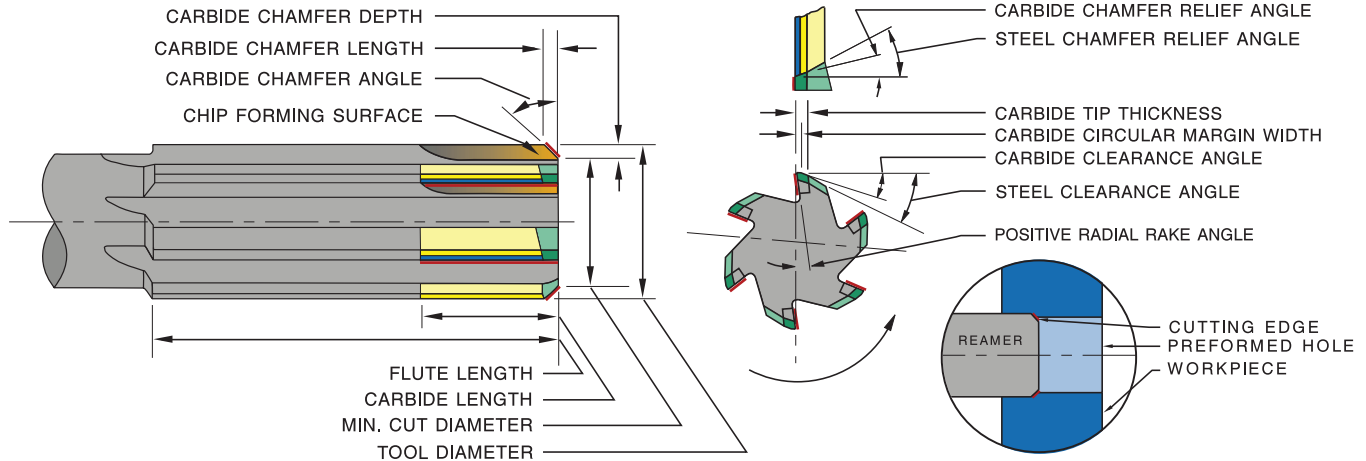
Reamer Expedite Fees: Order must be received by 2:00 PM CST

Does not apply to types 401, 403, 431, 441, 490, and EL Reamers

18 pieces max per diameter

Does NOT require air shipment of the product

Reamer Diameter	Service	Fee
Up to 1.0000"	24 Hour	75.00
Up to 1.0000"	48 Hour	50.00
Over 1.0000"	48 Hour	75.00
Over 1.0000"	72 Hour	50.00



REAMER SPECIFICATIONS

- Geometry and carbide grade appropriate for material being machined
- Carbide tips brazed to tough hardened alloy steel body, except expansion reamers which are not hardened
- Polished flutes for easy chip flow
- ASME/ANSI B94.2; NAS 897; USCTI
- Precision ground cutting edges
- "Taper Shank No." refers to American Standard taper series (formerly Morse taper series) per ASME/ANSI B5.10
- Material specific reamer shanks are ground to next smallest shank diameter listed in NAS 897 if tool diameter is within .005" of shank diameter
- Expansion reamers can be expanded for regrinding as follows:

Tool Diameter	Guaranteed Minimum Expansion
5/16" - 15/32"	.006"
1/2" - 31/32"	.010"
1" - 1 1/2"	.013"
1 1/4" - 2 1/2"	.015"

REAMER TOLERANCES

Tool diameter tolerance:

General purpose & Coolant fed

Thru 1 1/2" tool diameter: plus .0003", minus .0000"

Over 1 1/2" tool diameter: plus .0004", minus .0000"

Material specific (excluding coolant fed)

Thru 1/2" tool diameter: plus .0002", minus .0000"

Over 1/2" tool diameter thru 3/4": plus .0003", minus .0000"

Over 3/4" tool diameter: plus .0004", minus .0000"

Closer tool diameter tolerance pricing per tool:

Standard Tolerance	Modified to Closer Tolerance		
	.0003"	.0002"	.0001"
.0004"	\$1	\$3	\$5
.0003"	–	\$1	\$3
.0002"	–	–	\$3

Shank diameter tolerance:

General purpose

minus .0005", minus .0015"

Material specific (NAS) & Coolant fed

Thru 23/32" tool diameter: plus .0000", minus .0010"

Over 23/32" tool diameter: plus .0000", minus .0015"

REAMERS INDEX AND COMPARISON CHART

REAMERS

DESCRIPTION	HANNIBAL			CJT	CLEVELAND	FULLERTON	IMCO	MORSE	MAFORD
	FRAC. PAGE	METRIC PAGE	TOOL TYPE						
EXTENDED LENGTH REAMERS									
Straight Flutes – Flute Long Carbide	35	–	457EL/458EL/459EL	–	–	–	–	–	–
Right Spiral Flutes – Flute Long Carbide	37	–	442EL/443EL/444EL	–	–	–	–	–	–
Left Spiral Flutes – Flute Long Carbide	39	–	482EL/483EL/484EL	–	–	–	–	–	–
EXTENDED LENGTH REAMERS - COOLANT FED									
Straight Flutes – Flute Long Carbide	36	–	416EL/426EL/435EL	–	–	–	–	–	–
Right Spiral Flutes – Flute Long Carbide	37	–	411EL/413EL/415EL	–	–	–	–	–	–
Left Spiral Flutes – Flute Long Carbide	40	–	427EL/428EL/429EL	–	–	–	–	–	–
COOLANT FED REAMERS									
Straight Flutes – Center Fed	90	91	414/424/434	452	–	–	–	–	–
Straight Flutes – Flute Fed	92	93	416/426/435	452A	–	–	–	–	–
Right Spiral Flutes – Center Fed	94	–	411/413/415	453	–	–	–	–	–
Right Spiral Flutes – Flute Fed	95	–	417/418/419	453A	–	–	–	–	–
Left Spiral Flutes – Flute Fed	96	–	427/428/429	–	–	–	–	–	–
Metcut Type – Right Spiral Flutes	97	–	490	–	–	–	–	–	–
GENERAL PURPOSE CHUCKING REAMERS									
Stub Length – Straight Flutes	42	43	430	–	–	50SM	8200	5670	–
Stub Length – Left Spiral Flutes	42	43	440	–	4701	50SML	8250	5669	–
Jobbers Drill Length – Straight Flutes	44	–	401	–	–	–	–	–	–
Dowell Pin Sizes/Over & Under Sizes	45	–	477/479	–	–	–	–	–	–
Straight Flutes – Straight Shank	46	52	400	450	4703	50SS	8000	5655	–
Dowell Pin Sizes/Over & Under Sizes	47	–	476/478	450	–	–	8003/2	–	–
Wire & Letter Sizes	45	–	400	–	–	–	–	–	–
Stocked .0005" Increments	48	–	400	–	–	–	–	–	–
Straight Flutes – Taper Shank	54	55	402	–	–	50TS	8010	5656	–
Straight Flute Long Carbide – Straight Shank	56	57	450	480	–	50SF	8100	5659	–
Stocked .0005" Increments	58	–	450	–	–	–	–	–	–
Straight Flute Long Carbide – Taper Shank	62	63	452	–	–	–	8110	5660	–
Expansion Type – Straight Shank	64	65	465	490	–	50ES	8500	5733	–
Expansion Type – Taper Shank	66	67	467	495	–	50ET	8510	5734	–
Right Spiral Flutes – Straight Shank	68	69	410	470	–	50SR	8020	5653	–
Right Spiral Flutes – Taper Shank	70	–	412	–	–	–	8040	–	–
Left Spiral Flutes – Straight Shank	68	69	420	–	–	50SL	8030	5651	–
Left Spiral Flutes – Taper Shank	70	–	422	–	–	–	8050	–	–
Jobbers – Taper Shank	41	–	403	–	–	–	–	–	–
h6 SHANK REAMERS									
Straight Flutes - Center Fed	31	31	–	–	–	–	–	–	–
Straight Flutes - Flute Fed	32	32	–	–	–	–	–	–	–
Right Spiral Flutes - Center Fed	33	33	–	–	–	–	–	–	–
Left Spiral Flutes - Flute Fed	34	34	–	–	–	–	–	–	–
MATERIAL SPECIFIC CHUCKING REAMERS									
Stub Length – Straight Flutes	88	–	470/471/475	–	–	–	–	–	–
Straight Flutes & Shank – For Steels	74	73	480	–	–	–	–	–	–
Dowell Pin Sizes/Over & Under Sizes	75	–	486/488	–	–	–	–	–	–
Straight Flutes – Straight Shank	76	77	407/408/409	–	4703	–	–	–	–
Straight Flutes – Taper Shank	80	–	472/473/474	–	4715	–	–	–	–
Straight Flute Long Carbide – Straight Shank	78	79	457/458/459	–	–	–	–	–	–
Straight Flute Long Carbide – Taper Shank	81	–	453/454/455	–	–	–	–	–	–
Expansion Type – Straight Shank	82	–	464/466/468	–	704	–	–	–	–
Expansion Type – Taper Shank	83	–	461/462/463	–	716	–	–	–	–
Right Spiral Flutes – Straight Shank	84	–	432/436/438	–	4711	–	–	–	–
Right Spiral Flt Long Carbide – Straight Shank	85	–	442/443/444	–	–	–	–	–	–
Left Spiral Flutes – Straight Shank	86	–	433/437/439	–	4709	–	–	–	–
Left Spiral Flute Long Carbide – Straight Shank	87	–	482/483/484	–	–	–	–	–	–
PIPE TAP REAMERS									
Straight Shank	41	–	446	–	–	–	–	–	–
Taper Shank	41	–	447	–	–	–	–	–	–
SEMI-FINISHED REAMERS	53	–	7 Types	–	–	–	Many	Many	–
SHELL REAMERS									
Straight Flutes	71	–	431	–	–	–	–	5625	–
Left Spiral Flutes	72	–	441	–	–	–	–	–	–
Arbors – Straight Shank	72	–	481	–	–	–	–	505	–
Arbors – Taper Shank	72	–	481	–	–	–	–	506	–
SOLID CARBIDE REAMERS									
Straight Flutes (General Purpose)	105	105	804	–	1730	1400	9000	5661	272
Wire & Letter Sizes	105	–	804	–	–	1400	9000	–	272
Stocked .0005" Increments	106	–	804	–	–	–	–	–	272
Straight Flutes (Material Specific)	104	–	802/803	–	1730	1410	–	–	272
Right Spiral Flutes (Material Specific)	104	–	812/813	–	1711	1410R	–	–	–
Left Spiral Flutes (Material Specific)	104	–	822/823	–	–	1410L	–	–	272L
SOLID CARBIDE COOLANT FED REAMERS									
Straight Flutes (Material Specific)	102	–	806/807	–	–	–	–	–	–
Right Spiral Flutes (Material Specific)	103	–	816/817	–	–	–	–	–	–
Left Spiral Flutes (Material Specific)	103	–	828/829	–	–	–	–	–	–
SOLID CARBIDE HEAD REAMERS									
Straight Flutes – Steel Shank	110	–	800/801	–	–	1450	9500	–	–
Right Spiral Flutes – Steel Shank	111	–	810/811	–	–	1450R	–	–	–
Left Spiral Flutes – Steel Shank	111	–	820/821	–	–	1450L	–	–	–
STEP REAMERS									
Straight Flute Long Carbide	98	–	457/458/459 Step	–	–	–	–	–	–
Right Spiral Flute Long Carbide	99	–	442/443/444 Step	–	–	–	–	–	–
Left Spiral Flute Long Carbide	100	–	482/483/484 Step	–	–	–	–	–	–



PRECISION h6 SHANK REAMERS CARBIDE TIPPED TYPES 414h6, 424h6, 434h6 FRACTIONAL & METRIC



CENTER FED FOR BLIND HOLES STRAIGHT FLUTES & SHANK



USE:

- Center coolant outlet for reaming blind holes as chips are flushed **back** towards the shank
- Improves hole finish and permits higher feeds & speeds with longer tool life
- Use Tool Selector on page 90 to determine appropriate type

- TYPE 414h6 - FOR NON-FERROUS MATERIALS**
- TYPE 424h6 - FOR CAST IRONS & MULTI-PURPOSE**
- TYPE 434h6 - FOR STEELS & HIGH TEMP ALLOYS**

• Center coolant outlet • Polished flutes • Flute long carbide

TOOL DIAMETER RANGE	TYPE 414h6 NON FERROUS EDP NO.	TYPE 424h6 CAST IRON EDP NO.	TYPE 434h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		1	2	3	4	5-7	8-14*
						FLT	OVER-ALL						
0.3471 - 0.3780	41412h6	42412h6	43412h6	.3125	4	1 3/4	5	\$189.95	\$169.45	\$162.65	\$159.35	\$155.80	\$153.10
0.3781 - 0.4090	41413h6	42413h6	43413h6	.3125	4	1 3/4	5	190.35	170.00	163.15	159.85	156.40	153.55
0.4091 - 0.4410	41414h6	42414h6	43414h6	.3750	6	1 3/4	5	191.95	171.45	164.60	161.40	157.80	155.15
0.4411 - 0.4720	41415h6	42415h6	43415h6	.3750	6	1 3/4	5	193.25	172.80	165.95	162.70	159.15	156.45
0.4721 - 0.5030	41416h6	42416h6	43416h6	.4375	6	2	6	195.00	174.55	167.75	164.50	160.95	158.20
0.5031 - 0.5340	41417h6	42417h6	43417h6	.4375	6	2	6	198.40	177.90	171.15	167.90	164.40	161.60
0.5341 - 0.5660	41418h6	42418h6	43418h6	.4375	6	2	6	200.70	180.25	173.40	170.15	166.65	163.85
0.5661 - 0.5970	41419h6	42419h6	43419h6	.4375	6	2	6	204.00	183.55	176.65	173.50	170.00	167.20
0.5971 - 0.6280	41420h6	42420h6	43420h6	.5625	6	2 1/4	6	207.10	186.65	179.80	176.55	173.05	170.30
0.6281 - 0.6590	41421h6	42421h6	43421h6	.5625	6	2 1/4	6	224.90	204.45	197.55	194.40	190.85	188.10
0.6591 - 0.6910	41422h6	42422h6	43422h6	.5625	6	2 1/4	6	228.65	208.20	201.35	198.15	194.55	191.85
0.6911 - 0.7220	41423h6	42423h6	43423h6	.5625	6	2 1/4	6	236.70	216.30	209.50	206.20	202.70	199.90
0.7221 - 0.7530	41424h6	42424h6	43424h6	.6250	6	2 1/2	6	236.70	216.30	209.50	206.20	202.70	199.90
0.7531 - 0.7840	41425h6	42425h6	43425h6	.6250	6	2 1/2	6	242.55	222.10	215.25	212.00	208.50	205.70
0.7841 - 0.8160	41426h6	42426h6	43426h6	.6250	6	2 1/2	6	242.55	222.10	215.25	212.00	208.50	205.70
0.8161 - 0.8470	41427h6	42427h6	43427h6	.6250	6	2 1/2	6	249.45	228.95	222.15	218.85	215.35	212.55
0.8471 - 0.8780	41428h6	42428h6	43428h6	.7500	6	2 3/8	6	257.50	237.05	230.20	226.95	223.45	220.65
0.8781 - 0.9090	41429h6	42429h6	43429h6	.7500	6	2 3/8	6	281.45	261.00	254.15	250.90	247.40	244.60
0.9091 - 0.9410	41430h6	42430h6	43430h6	.7500	8	2 3/8	6	281.45	261.00	254.15	250.90	247.40	244.60
0.9411 - 0.9720	41431h6	42431h6	43431h6	.7500	8	2 3/8	6	282.35	261.85	255.05	251.80	248.25	245.50
0.9721 - 1.0030	41432h6	42432h6	43432h6	.8750	8	2 3/4	6	282.35	261.85	255.05	251.80	248.25	245.50

REAMERS



CENTER FED FOR BLIND HOLES STRAIGHT FLUTES & SHANK

MODIFICATIONS

- Cut off
- End chamfer other than 45°
- End cutting or corner radius
- Increased/Decreased back taper
- Closer tool diameter tolerance (.0001")
- Cutting diameter reduced for step or pilot (Some modifications may affect the TIR)



- TYPE 414h6 - FOR NON-FERROUS MATERIALS - METRIC**
- TYPE 424h6 - FOR CAST IRONS & MULTI-PURPOSE - METRIC**
- TYPE 434h6 - FOR STEELS & HIGH TEMP ALLOYS - METRIC**

• Center coolant outlet • Polished flutes • Flute long carbide

TOOL DIAMETER RANGE	TYPE 414h6 NON FERROUS EDP NO.	TYPE 424h6 CAST IRON EDP NO.	TYPE 434h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM. (mm)	NO. OF FLTS	LENGTH		1	2	3	4	5-7	8-14*
						FLT (mm)	OVER-ALL (mm)						
8.815 - 9.601	414095h6	424095h6	434095h6	8	4	45	127	\$193.35	\$172.95	\$166.10	\$162.75	\$159.35	\$156.50
9.602 - 10.389	414100h6	424100h6	434100h6	8	4	45	127	193.80	173.50	166.65	163.30	159.85	157.00
10.390 - 11.201	414110h6	424110h6	434110h6	10	6	45	127	195.30	175.00	168.15	164.80	161.40	158.55
11.202 - 12.000	414120h6	424120h6	434120h6	10	6	45	127	196.65	176.30	169.45	166.10	162.70	159.85
12.001 - 12.875	414125h6	424125h6	434125h6	10	6	51	153	198.40	178.15	171.20	167.90	164.50	161.60
12.876 - 13.565	414135h6	424135h6	434135h6	12	6	51	153	201.85	181.55	174.60	171.30	167.90	165.00
13.566 - 14.376	414140h6	424140h6	434140h6	12	6	51	153	204.10	183.70	176.90	173.55	170.15	167.25
14.377 - 15.164	414150h6	424150h6	434150h6	12	6	51	153	207.45	187.05	180.25	176.90	173.50	170.60
15.165 - 16.100	414160h6	424160h6	434160h6	14	6	57	153	210.50	190.20	183.30	179.95	176.55	173.70
16.101 - 16.740	414165h6	424165h6	434165h6	14	6	57	153	228.30	207.90	201.10	197.80	194.40	191.50
16.741 - 17.551	414175h6	424175h6	434175h6	14	6	57	153	232.05	211.75	204.90	201.55	198.15	195.25
17.552 - 18.340	414180h6	424180h6	434180h6	14	6	57	153	240.15	219.85	212.95	209.65	206.20	203.35
18.341 - 19.250	414190h6	424190h6	434190h6	16	6	64	153	240.15	219.85	212.95	209.65	206.20	203.35
19.251 - 20.126	414200h6	424200h6	434200h6	16	6	64	153	242.10	221.60	214.80	211.50	208.00	205.20
20.127 - 21.127	414210h6	424210h6	434210h6	16	6	64	153	248.95	228.50	221.65	218.40	214.90	212.10
21.128 - 22.127	414220h6	424220h6	434220h6	20	6	64	153	248.95	228.50	221.65	218.40	214.90	212.10
22.128 - 23.127	414230h6	424230h6	434230h6	20	6	67	153	280.90	260.40	253.60	250.30	246.80	244.00
23.128 - 24.127	414240h6	424240h6	434240h6	20	8	67	153	281.80	261.35	254.50	251.25	247.75	244.95
24.128 - 25.127	414250h6	424250h6	434250h6	20	8	70	153	281.80	261.35	254.50	251.25	247.75	244.95

*Quantities of 15 or more - Contact Hannibal Specials Dept.



PRECISION h6 SHANK REAMERS CARBIDE TIPPED



TYPES 416h6, 426h6, 435h6 FRACTIONAL & METRIC

FLUTE FED FOR THRU HOLES STRAIGHT FLUTES & SHANK



USE:

- Flute coolant outlets for reaming thru holes as chips are flushed **forward** through the hole being reamed
- Improves hole finish and permits higher feeds & speeds with longer tool life
- Use Tool Selector on page 92 to determine appropriate type

- TYPE 416h6 - FOR NON-FERROUS MATERIALS**
- TYPE 426h6 - FOR CAST IRONS & MULTI-PURPOSE**
- TYPE 435h6 - FOR STEELS & HIGH TEMP ALLOYS**
- Coolant outlets in each flute • Polished flutes • Flute long carbide

TOOL DIAMETER RANGE	TYPE 416h6 NON FERROUS EDP NO.	TYPE 426h6 CAST IRON EDP NO.	TYPE 435h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		PRICE EACH - BASED ON QUANTITY ORDERED					
						FLT	OVER-ALL	1	2	3	4	5-7	8-14*
0.3471-0.3780	41612h6	42612h6	43512h6	.3125	4	1 3/4	5	\$191.25	\$170.80	\$163.95	\$160.70	\$157.25	\$154.40
0.3781-0.4090	41613h6	42613h6	43513h6	.3125	4	1 3/4	5	195.00	174.55	167.75	164.50	160.95	158.20
0.4091-0.4410	41614h6	42614h6	43514h6	.3750	6	1 3/4	5	198.70	178.30	171.45	168.20	164.75	161.95
0.4411-0.4720	41615h6	42615h6	43515h6	.3750	6	1 3/4	5	198.70	178.30	171.45	168.20	164.75	161.95
0.4721-0.5030	41616h6	42616h6	43516h6	.4375	6	2	6	198.70	178.30	171.45	168.20	164.75	161.95
0.5031-0.5340	41617h6	42617h6	43517h6	.4375	6	2	6	207.85	187.40	180.60	177.35	173.80	171.10
0.5341-0.5660	41618h6	42618h6	43518h6	.4375	6	2	6	210.20	189.80	182.90	179.60	176.15	173.40
0.5661-0.5970	41619h6	42619h6	43519h6	.4375	6	2	6	211.80	191.30	184.50	181.20	177.70	175.00
0.5971-0.6280	41620h6	42620h6	43520h6	.5625	6	2 1/4	6	211.80	191.30	184.50	181.20	177.70	175.00
0.6281-0.6590	41621h6	42621h6	43521h6	.5625	6	2 1/4	6	230.35	209.90	202.95	199.75	196.25	193.50
0.6591-0.6910	41622h6	42622h6	43522h6	.5625	6	2 1/4	6	230.35	209.90	202.95	199.75	196.25	193.50
0.6911-0.7220	41623h6	42623h6	43523h6	.5625	6	2 1/4	6	243.35	222.85	216.05	212.85	209.20	206.55
0.7221-0.7530	41624h6	42624h6	43524h6	.6250	6	2 1/2	6	243.35	222.85	216.05	212.85	209.20	206.55
0.7531-0.7840	41625h6	42625h6	43525h6	.6250	6	2 1/2	6	244.20	223.70	216.90	213.60	210.10	207.30
0.7841-0.8160	41626h6	42626h6	43526h6	.6250	6	2 1/2	6	244.20	223.70	216.90	213.60	210.10	207.30
0.8161-0.8470	41627h6	42627h6	43527h6	.6250	6	2 1/2	6	250.25	229.80	222.95	219.70	216.20	213.40
0.8471-0.8780	41628h6	42628h6	43528h6	.7500	6	2 5/8	6	258.35	237.90	231.05	227.80	224.30	221.50
0.8781-0.9090	41629h6	42629h6	43529h6	.7500	6	2 5/8	6	285.15	264.65	257.85	254.55	251.05	248.25
0.9091-0.9410	41630h6	42630h6	43530h6	.7500	8	2 5/8	6	290.75	270.25	263.45	260.20	256.65	253.90
0.9411-0.9720	41631h6	42631h6	43531h6	.7500	8	2 5/8	6	290.75	270.25	263.45	260.20	256.65	253.90
0.9721-1.0030	41632h6	42632h6	43532h6	.8750	8	2 3/4	6	290.75	270.25	263.45	260.20	256.65	253.90

FLUTE FED FOR THRU HOLES STRAIGHT FLUTES & SHANK

- TYPE 416h6 - FOR NON-FERROUS MATERIALS - METRIC**
- TYPE 426h6 - FOR CAST IRONS & MULTI-PURPOSE - METRIC**
- TYPE 435h6 - FOR STEELS & HIGH TEMP ALLOYS - METRIC**
- Coolant outlets in each flute • Polished flutes • Flute long carbide

MODIFICATIONS

- Cut off
- End chamfer other than 45°
- End cutting or corner radius
- Increased/Decreased back taper
- Closer tool diameter tolerance (.0001")
- Cutting diameter reduced for step or pilot (Some modifications may affect the TIR)

TOOL DIAMETER RANGE	TYPE 416h6 NON FERROUS EDP NO.	TYPE 426h6 CAST IRON EDP NO.	TYPE 435h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER					
				MAX. SHANK DIAM. (mm)	NO. OF FLTS	LENGTH		PRICE EACH - BASED ON QUANTITY ORDERED					
						FLT (mm)	OVER-ALL (mm)	1	2	3	4	5-7	8-14*
8.815-9.601	416095h6	426095h6	435095h6	8	4	45	127	\$194.65	\$174.30	\$167.40	\$164.10	\$160.70	\$157.80
9.602-10.389	416100h6	426100h6	435100h6	8	4	45	127	198.40	178.15	171.20	167.90	164.50	161.60
10.390-11.201	416110h6	426110h6	435110h6	10	6	45	127	202.10	181.85	175.00	171.60	168.20	165.40
11.202-12.000	416120h6	426120h6	435120h6	10	6	45	127	202.10	181.85	175.00	171.60	168.20	165.40
12.001-12.875	416125h6	426125h6	435125h6	10	6	51	153	202.10	181.85	175.00	171.60	168.20	165.40
12.876-13.565	416135h6	426135h6	435135h6	12	6	51	153	211.25	190.90	184.05	180.75	177.35	174.45
13.566-14.376	416140h6	426140h6	435140h6	12	6	51	153	213.60	193.25	186.45	183.10	179.60	176.85
14.377-15.164	416150h6	426150h6	435150h6	12	6	51	153	215.25	194.85	187.95	184.60	181.20	178.40
15.165-16.100	416160h6	426160h6	435160h6	14	6	57	153	215.25	194.85	187.95	184.60	181.20	178.40
16.101-16.740	416165h6	426165h6	435165h6	14	6	57	153	233.80	213.35	206.55	203.20	199.75	196.95
16.741-17.551	416175h6	426175h6	435175h6	14	6	57	153	233.80	213.35	206.55	203.20	199.75	196.95
17.552-18.340	416180h6	426180h6	435180h6	14	6	57	153	246.75	226.35	219.50	216.20	212.85	209.95
18.341-19.250	416190h6	426190h6	435190h6	16	6	64	153	246.75	226.35	219.50	216.20	212.85	209.95
19.251-20.126	416200h6	426200h6	435200h6	16	6	64	153	243.75	223.30	216.45	213.20	209.70	206.90
20.127-21.127	416210h6	426210h6	435210h6	16	6	64	153	249.80	229.30	222.50	219.25	215.70	212.95
21.128-22.127	416220h6	426220h6	435220h6	20	6	64	153	249.80	229.30	222.50	219.25	215.70	212.95
22.128-23.127	416230h6	426230h6	435230h6	20	6	67	153	284.60	264.15	257.30	254.05	250.55	247.75
23.128-24.127	416240h6	426240h6	435240h6	20	8	67	153	290.25	269.80	262.95	259.70	256.20	253.40
24.128-25.127	416250h6	426250h6	435250h6	20	8	70	153	290.25	269.80	262.95	259.70	256.20	253.40

*Quantities of 15 or more - Contact Hannibal Specials Dept.



PRECISION h6 SHANK REAMERS CARBIDE TIPPED TYPES 411h6, 413h6, 415h6 FRACTIONAL & METRIC



CENTER FED FOR BLIND HOLES RIGHT SPIRAL FLUTES

USE:

- Center coolant outlet for reaming blind holes as chips are flushed **back** towards the shank
- Improves hole finish and permits higher feeds & speeds with longer tool life
- Use Tool Selector on page 94 to determine appropriate type

- TYPE 411h6 - FOR NON-FERROUS MATERIALS**
- TYPE 413h6 - FOR CAST IRONS & MULTI-PURPOSE**
- TYPE 415h6 - FOR STEELS & HIGH TEMP ALLOYS**

• Center coolant outlet • Polished flutes • Flute long carbide

TOOL DIAMETER RANGE	TYPE 411h6 NON FERROUS EDP NO.	TYPE 413h6 CAST IRON EDP NO.	TYPE 415h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		PRICE EACH - BASED ON QUANTITY ORDERED					
						FLT	OVER-ALL	1	2	3	4	5-7	8-14*
0.3471 - 0.3780	41112h6	41312h6	41512h6	.3125	4	1 3/4	5	\$193.70	\$173.25	\$166.40	\$163.15	\$159.65	\$156.85
0.3781 - 0.4090	41113h6	41313h6	41513h6	.3125	4	1 3/4	5	194.15	173.65	166.85	163.60	160.05	157.30
0.4091 - 0.4410	41114h6	41314h6	41514h6	.3750	6	1 3/4	5	195.70	175.25	168.40	165.15	161.65	158.85
0.4411 - 0.4720	41115h6	41315h6	41515h6	.3750	6	1 3/4	5	197.15	176.65	169.85	166.60	163.05	160.30
0.4721 - 0.5030	41116h6	41316h6	41516h6	.4375	6	2	6	203.30	182.80	176.00	172.70	169.20	166.40
0.5031 - 0.5340	41117h6	41317h6	41517h6	.4375	6	2	6	209.20	188.75	181.90	178.65	175.15	172.35
0.5341 - 0.5660	41118h6	41318h6	41518h6	.4375	6	2	6	209.20	188.75	181.90	178.65	175.15	172.35
0.5661 - 0.5970	41119h6	41319h6	41519h6	.4375	6	2	6	215.90	195.40	188.60	185.30	181.80	179.00
0.5971 - 0.6280	41120h6	41320h6	41520h6	.5625	6	2 1/4	6	215.90	195.40	188.60	185.30	181.80	179.00
0.6281 - 0.6590	41121h6	41321h6	41521h6	.5625	6	2 1/4	6	238.60	218.15	211.30	208.05	204.55	201.75
0.6591 - 0.6910	41122h6	41322h6	41522h6	.5625	6	2 1/4	6	238.60	218.15	211.30	208.05	204.55	201.75
0.6911 - 0.7220	41123h6	41323h6	41523h6	.5625	6	2 1/4	6	247.15	226.70	219.85	216.60	213.10	210.30
0.7221 - 0.7530	41124h6	41324h6	41524h6	.6250	6	2 1/2	6	234.40	213.95	207.10	203.85	200.35	197.55
0.7531 - 0.7840	41125h6	41325h6	41525h6	.6250	6	2 1/2	6	263.20	242.70	235.90	232.65	229.10	226.35
0.7841 - 0.8160	41126h6	41326h6	41526h6	.6250	6	2 1/2	6	266.00	245.55	238.70	235.45	231.95	229.15
0.8161 - 0.8470	41127h6	41327h6	41527h6	.6250	6	2 1/2	6	270.20	249.75	242.90	239.65	236.15	233.35
0.8471 - 0.8780	41128h6	41328h6	41528h6	.7500	6	2 5/8	6	282.75	262.30	255.45	252.20	248.70	245.90
0.8781 - 0.9090	41129h6	41329h6	41529h6	.7500	6	2 5/8	6	297.15	276.70	269.85	266.60	263.10	260.30
0.9091 - 0.9410	41130h6	41330h6	41530h6	.7500	8	2 5/8	6	309.35	288.85	282.05	278.80	275.25	272.50
0.9411 - 0.9720	41131h6	41331h6	41531h6	.7500	8	2 5/8	6	310.15	289.70	282.85	279.60	276.10	273.30
0.9721 - 1.0030	41132h6	41332h6	41532h6	.8750	8	2 3/4	6	310.60	290.10	283.30	280.05	276.50	273.75

REAMERS



CENTER FED FOR BLIND HOLES RIGHT SPIRAL FLUTES STRAIGHT SHANK

MODIFICATIONS

- Cut off
- End chamfer other than 45°
- End cutting or corner radius
- Increased/Decreased back taper
- Closer tool diameter tolerance (.0001")
- Cutting diameter reduced for step or pilot (Some modifications may affect the TIR)



- TYPE 411h6 - FOR NON-FERROUS MATERIALS - METRIC**
- TYPE 413h6 - FOR CAST IRONS & MULTI-PURPOSE - METRIC**
- TYPE 415h6 - FOR STEELS & HIGH TEMP ALLOYS - METRIC**

• Center coolant outlet • Polished flutes • Flute long carbide

TOOL DIAMETER RANGE	TYPE 411h6 NON FERROUS EDP NO.	TYPE 413h6 CAST IRON EDP NO.	TYPE 415h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER					
				MAX. SHANK DIAM. (mm)	NO. OF FLTS	LENGTH		PRICE EACH - BASED ON QUANTITY ORDERED					
						FLT (mm)	OVER-ALL (mm)	1	2	3	4	5-7	8-14*
8.815 - 9.601	411095h6	413095h6	415095h6	8	4	45	127	\$193.70	\$173.25	\$166.40	\$163.15	\$159.65	\$156.85
9.602 - 10.389	411100h6	413100h6	415100h6	8	4	45	127	194.15	173.65	166.85	163.60	160.05	157.30
10.390 - 11.201	411110h6	413110h6	415110h6	10	6	45	127	195.70	175.25	168.40	165.15	161.65	158.85
11.202 - 12.000	411120h6	413120h6	415120h6	10	6	45	127	203.30	182.80	176.00	172.70	169.20	166.40
12.001 - 12.875	411125h6	413125h6	415125h6	10	6	51	153	209.20	188.75	181.90	178.65	175.15	172.35
12.876 - 13.565	411135h6	413135h6	415135h6	12	6	51	153	209.20	188.75	181.90	178.65	175.15	172.35
13.566 - 14.376	411140h6	413140h6	415140h6	12	6	51	153	209.20	188.75	181.90	178.65	175.15	172.35
14.377 - 15.164	411150h6	413150h6	415150h6	12	6	51	153	215.90	195.40	188.60	185.30	181.80	179.00
15.165 - 16.100	411160h6	413160h6	415160h6	14	6	57	153	238.60	218.15	211.30	208.05	204.55	201.75
16.101 - 16.740	411165h6	413165h6	415165h6	14	6	57	153	238.60	218.15	211.30	208.05	204.55	201.75
16.741 - 17.551	411175h6	413175h6	415175h6	14	6	57	153	238.60	218.15	211.30	208.05	204.55	201.75
17.552 - 18.340	411180h6	413180h6	415180h6	14	6	57	153	247.15	226.70	219.85	216.60	213.10	210.30
18.341 - 19.250	411190h6	413190h6	415190h6	16	6	64	153	263.20	242.70	235.90	232.65	229.10	226.35
19.251 - 20.126	411200h6	413200h6	415200h6	16	6	64	153	266.00	245.55	238.70	235.45	231.95	229.15
20.127 - 21.127	411210h6	413210h6	415210h6	16	6	64	153	270.20	249.75	242.90	239.65	236.15	233.35
21.128 - 22.127	411220h6	413220h6	415220h6	20	6	64	153	282.75	262.30	255.45	252.20	248.70	245.90
22.128 - 23.127	411230h6	413230h6	415230h6	20	6	67	153	309.35	288.85	282.05	278.80	275.25	272.50
23.128 - 24.127	411240h6	413240h6	415240h6	20	8	67	153	310.15	289.70	282.85	279.60	276.10	273.30
24.128 - 25.127	411250h6	413250h6	415250h6	20	8	70	153	310.60	290.10	283.30	280.05	276.50	273.75

*Quantities of 15 or more - Contact Hannibal Specials Dept.



PRECISION h6 SHANK REAMERS CARBIDE TIPPED



TYPES 427h6, 428h6, 429h6 FRACTIONAL & METRIC

FLUTE FED FOR THRU HOLES LEFT SPIRAL FLUTES

USE:

- Flute coolant outlets for reaming thru holes as chips are flushed **forward** through the hole being reamed
- Improves hole finish and permits higher feeds & speeds with longer tool life
- Use Tool Selector on page 96 to determine appropriate type

- TYPE 427h6 - FOR NON-FERROUS MATERIALS**
- TYPE 428h6 - FOR CAST IRONS & MULTI-PURPOSE**
- TYPE 429h6 - FOR STEELS & HIGH TEMP ALLOYS**
- Coolant outlets in each flute • Polished flutes • Flute long carbide

TOOL DIAMETER RANGE	TYPE 427h6 NON FERROUS EDP NO.	TYPE 428h6 CAST IRON EDP NO.	TYPE 429h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		PRICE EACH - BASED ON QUANTITY ORDERED					
						FLT	OVER-ALL	1	2	3	4	5-7	8-14*
0.3471-0.3780	42712h6	42812h6	42912h6	.3125	4	1 3/4	5	\$230.50	\$210.00	\$203.20	\$199.90	\$196.40	\$193.60
0.3781-0.4090	42713h6	42813h6	42913h6	.3125	4	1 3/4	5	231.25	210.80	203.95	200.70	197.20	194.40
0.4091-0.4410	42714h6	42814h6	42914h6	.3750	6	1 3/4	5	233.00	212.50	205.70	202.45	198.90	196.15
0.4411-0.4720	42715h6	42815h6	42915h6	.3750	6	1 3/4	5	234.75	214.25	207.45	204.15	200.65	197.85
0.4721-0.5030	42716h6	42816h6	42916h6	.4375	6	2	6	237.20	216.70	209.90	206.65	203.10	200.35
0.5031-0.5340	42717h6	42817h6	42917h6	.4375	6	2	6	241.30	220.80	214.00	210.75	207.20	204.45
0.5341-0.5660	42718h6	42818h6	42918h6	.4375	6	2	6	244.25	223.75	216.95	213.70	210.15	207.40
0.5661-0.5970	42719h6	42819h6	42919h6	.4375	6	2	6	248.50	228.00	221.20	217.95	214.40	211.65
0.5971-0.6280	42720h6	42820h6	42920h6	.5625	6	2 1/4	6	252.30	231.85	225.00	221.75	218.25	215.45
0.6281-0.6590	42721h6	42821h6	42921h6	.5625	6	2 1/4	6	275.00	254.50	247.70	244.45	240.90	238.15
0.6591-0.6910	42722h6	42822h6	42922h6	.5625	6	2 1/4	6	279.80	259.35	252.50	249.25	245.75	242.95
0.6911-0.7220	42723h6	42823h6	42923h6	.5625	6	2 1/4	6	284.85	264.40	257.55	254.30	250.80	248.00
0.7221-0.7530	42724h6	42824h6	42924h6	.6250	6	2 1/2	6	290.05	269.60	262.75	259.50	256.00	253.20
0.7531-0.7840	42725h6	42825h6	42925h6	.6250	6	2 1/2	6	294.30	273.85	267.00	263.75	260.25	257.45
0.7841-0.8160	42726h6	42826h6	42926h6	.6250	6	2 1/2	6	297.40	276.95	270.10	266.85	263.35	260.55
0.8161-0.8470	42727h6	42827h6	42927h6	.6250	6	2 1/2	6	302.05	281.55	274.75	271.50	267.95	265.20
0.8471-0.8780	42728h6	42828h6	42928h6	.7500	6	2 5/8	6	316.35	295.90	289.05	285.80	282.30	279.50
0.8781-0.9090	42729h6	42829h6	42929h6	.7500	6	2 5/8	6	332.65	312.15	305.35	302.10	298.55	295.80
0.9091-0.9410	42730h6	42830h6	42930h6	.7500	8	2 5/8	6	346.80	326.35	319.50	316.25	312.75	309.95
0.9411-0.9720	42731h6	42831h6	42931h6	.7500	8	2 5/8	6	347.55	327.10	320.25	317.00	313.50	310.70
0.9721-1.0030	42732h6	42832h6	42932h6	.8750	8	2 3/4	6	347.95	327.50	320.65	317.40	313.90	311.10

REAMERS



FLUTE FED FOR THRU HOLES LEFT SPIRAL FLUTES STRAIGHT SHANK

MODIFICATIONS

- Cut off
- End chamfer other than 45°
- End cutting or corner radius
- Increased/Decreased back taper
- Closer tool diameter tolerance (.0001")
- Cutting diameter reduced for step or pilot (Some modifications may affect the TIR)



- TYPE 427h6 - FOR NON-FERROUS MATERIALS - METRIC**
- TYPE 428h6 - FOR CAST IRONS & MULTI-PURPOSE - METRIC**
- TYPE 429h6 - FOR STEELS & HIGH TEMP ALLOYS - METRIC**
- Coolant outlets in each flute • Polished flutes • Flute long carbide

TOOL DIAMETER RANGE	TYPE 427h6 NON FERROUS EDP NO.	TYPE 428h6 CAST IRON EDP NO.	TYPE 429h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER					
				MAX. SHANK DIAM. (mm)	NO. OF FLTS	LENGTH		PRICE EACH - BASED ON QUANTITY ORDERED					
						FLT (mm)	OVER-ALL (mm)	1	2	3	4	5-7	8-14*
8.815-9.601	427095h6	428095h6	429095h6	8	4	45	127	\$230.50	\$210.00	\$203.20	\$199.90	\$196.40	\$193.60
9.602-10.389	427100h6	428100h6	429100h6	8	4	45	127	231.25	210.80	203.95	200.70	197.20	194.40
10.390-11.201	427110h6	428110h6	429110h6	10	6	45	127	233.00	212.50	205.70	202.45	198.90	196.15
11.202-12.000	427120h6	428120h6	429120h6	10	6	45	127	237.20	216.70	209.90	206.65	203.10	200.35
12.001-12.875	427125h6	428125h6	429125h6	10	6	51	153	241.30	220.80	214.00	210.75	207.20	204.45
12.876-13.565	427135h6	428135h6	429135h6	12	6	51	153	244.25	223.75	216.95	213.70	210.15	207.40
13.566-14.376	427140h6	428140h6	429140h6	12	6	51	153	244.25	223.75	216.95	213.70	210.15	207.40
14.377-15.164	427150h6	428150h6	429150h6	12	6	51	153	248.50	228.00	221.20	217.95	214.40	211.65
15.165-16.100	427160h6	428160h6	429160h6	14	6	57	153	275.00	254.50	247.70	244.45	240.90	238.15
16.101-16.740	427165h6	428165h6	429165h6	14	6	57	153	279.80	259.35	252.50	249.25	245.75	242.95
16.741-17.551	427175h6	428175h6	429175h6	14	6	57	153	279.80	259.35	252.50	249.25	245.75	242.95
17.552-18.340	427180h6	428180h6	429180h6	14	6	57	153	284.85	264.40	257.55	254.30	250.80	248.00
18.341-19.250	427190h6	428190h6	429190h6	16	6	64	153	294.30	273.85	267.00	263.75	260.25	257.45
19.251-20.126	427200h6	428200h6	429200h6	16	6	64	153	297.40	276.95	270.10	266.85	263.35	260.55
20.127-21.127	427210h6	428210h6	429210h6	16	6	64	153	302.05	281.55	274.75	271.50	267.95	265.20
21.128-22.127	427220h6	428220h6	429220h6	20	6	64	153	316.35	295.90	289.05	285.80	282.30	279.50
22.128-23.127	427230h6	428230h6	429230h6	20	6	67	153	346.80	326.35	319.50	316.25	312.75	309.95
23.128-24.127	427240h6	428240h6	429240h6	20	8	67	153	347.55	327.10	320.25	317.00	313.50	310.70
24.128-25.127	427250h6	428250h6	429250h6	20	8	70	153	347.95	327.50	320.65	317.40	313.90	311.10

*Quantities of 15 or more - Contact Hannibal Specials Dept.



EXTENDED LENGTH REAMERS CARBIDE TIPPED TYPES 457EL, 458EL, 459EL

MATERIAL SPECIFIC

STRAIGHT FLUTE LONG CARBIDE

- TYPE 457EL - FOR NON-FERROUS MATERIALS**
- TYPE 458EL - FOR CAST IRONS & NAS MULTI-PURPOSE**
- TYPE 459EL - FOR STEELS & HIGH TEMP ALLOYS**

- Extended length versions of types 457, 458, and 459 found on page 78
- All extended length reamers provided with controlled shank
- Must specify overall length when ordering (centers supplied only at maximum overall length)



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	457EL
	40	NON-FERROUS - SHORT CHIPS	457EL
	60	CAST IRONS	458EL
	80	LOW STRENGTH STEELS	459EL
	100	MEDIUM STRENGTH STEELS	459EL
	120	HIGH STRENGTH STEELS	459EL
	140	HIGH TEMPERATURE ALLOYS	459EL

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Closer tool diameter tolerance - pg. 29
- Cutting diam. reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

REAMERS

TOOL DIAMETER RANGE	TYPE 457EL NON FERROUS EDP NO.	TYPE 458EL CAST IRON EDP NO.	TYPE 459EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		PRICE EACH - BASED ON QUANTITY ORDERED					
						FLT	OVERALL RANGE	1	2	3	4	5-7	8-14**
* 0.1121-0.1280	45704EL	45804EL	45904EL	.1099	4	1 1/2	2 3/32 - 6	\$219.45	\$192.15	\$183.00	\$178.70	\$174.05	\$170.35
* 0.1281-0.1435	457045EL	458045EL	459045EL	.1255	4	1 1/2	2 17/32 - 6 1/2	220.20	192.95	183.80	179.45	174.75	171.15
* 0.1436-0.1590	45705EL	45805EL	45905EL	.1411	4	1 1/2	2 17/32 - 7	223.80	196.55	187.40	183.05	178.40	174.70
* 0.1591-0.1750	457055EL	458055EL	459055EL	.1567	4	1 1/2	2 25/32 - 8	228.05	200.75	191.70	187.30	182.65	178.95
* 0.1751-0.1910	45706EL	45806EL	45906EL	.1724	4	1 1/2	4 17/32 - 9	234.10	206.85	197.70	193.40	188.70	185.00
* 0.1911-0.2210	45707EL	45807EL	45907EL	.1880	4	1 1/2	5 1/32 - 10	242.00	214.80	205.65	201.30	196.60	192.95
* 0.2211-0.2530	45708EL	45808EL	45908EL	.2193	4	1 1/2	6 1/32 - 12	257.65	230.35	221.30	216.95	212.25	208.60
* 0.2531-0.2840	45709EL	45809EL	45909EL	.2505	4	1 1/2	6 1/32 - 12	271.05	243.80	234.70	230.30	225.65	221.95
0.2841-0.3150	45710EL	45810EL	45910EL	.2792	4	1 1/2	6 1/32 - 12	192.35	165.10	156.00	151.60	146.95	143.30
0.3151-0.3470	45711EL	45811EL	45911EL	.2792	4	1 1/2	6 1/32 - 12	192.35	165.10	156.00	151.60	146.95	143.30
0.3471-0.3780	45712EL	45812EL	45912EL	.3105	4	1 3/4	7 1/32 - 14	198.65	171.40	162.30	157.90	153.25	149.55
0.3781-0.4090	45713EL	45813EL	45913EL	.3105	4	1 3/4	7 1/32 - 14	198.65	171.40	162.30	157.90	153.25	149.55
0.4091-0.4410	45714EL	45814EL	45914EL	.3730	6	1 3/4	7 1/32 - 14	204.95	177.70	168.60	164.20	159.55	155.85
0.4411-0.4720	45715EL	45815EL	45915EL	.3730	6	1 3/4	7 1/32 - 14	204.95	177.70	168.60	164.20	159.55	155.85
0.4721-0.5030	45716EL	45816EL	45916EL	.4355	6	2	8 1/32 - 16	209.20	181.90	172.80	168.45	163.80	160.10
0.5031-0.5340	45717EL	45817EL	45917EL	.4355	6	2	8 1/32 - 16	209.20	181.90	172.80	168.45	163.80	160.10
0.5341-0.5660	45718EL	45818EL	45918EL	.4355	6	2	8 1/32 - 16	213.10	181.90	176.70	172.35	167.70	164.00
0.5661-0.5970	45719EL	45819EL	45919EL	.4355	6	2	8 1/32 - 16	213.10	185.80	176.70	172.35	167.70	164.00
0.5971-0.6280	45720EL	45820EL	45920EL	.5615	6	2 1/4	9 1/32 - 18	217.60	190.30	181.20	176.85	172.20	168.50
0.6281-0.6590	45721EL	45821EL	45921EL	.5615	6	2 1/4	9 1/32 - 18	217.60	190.30	181.20	176.85	172.20	168.50
0.6591-0.6910	45722EL	45822EL	45922EL	.5615	6	2 1/4	9 1/32 - 18	218.20	190.95	181.80	177.45	172.80	169.10
0.6911-0.7220	45723EL	45823EL	45923EL	.5615	6	2 1/4	9 1/32 - 18	218.20	190.95	181.80	177.45	172.80	169.10
0.7221-0.7530	45724EL	45824EL	45924EL	.6245	6	2 1/2	9 17/32 - 18	234.25	206.95	197.80	193.50	188.85	185.15
0.7531-0.7840	45725EL	45825EL	45925EL	.6245	6	2 1/2	9 17/32 - 18	284.25	258.25	249.55	245.45	241.00	237.50
0.7841-0.8160	45726EL	45826EL	45926EL	.6245	6	2 1/2	9 17/32 - 18	293.30	267.30	258.60	254.50	250.05	246.55
0.8161-0.8470	45727EL	45827EL	45927EL	.6245	6	2 1/2	9 17/32 - 18	296.70	270.70	262.00	257.90	253.45	249.95
0.8471-0.8780	45728EL	45828EL	45928EL	.7495	6	2 5/8	10 1/32 - 18	302.95	276.95	268.25	264.15	259.70	256.20
0.8781-0.9090	45729EL	45829EL	45929EL	.7495	6	2 5/8	10 1/32 - 18	315.70	289.70	281.00	276.90	272.45	268.95
0.9091-0.9410	45730EL	45830EL	45930EL	.7495	8	2 5/8	10 1/32 - 18	318.85	292.85	284.15	280.05	275.60	272.10
0.9411-0.9720	45731EL	45831EL	45931EL	.7495	8	2 5/8	10 1/32 - 18	321.90	295.90	287.20	283.10	278.65	275.15
0.9721-1.0030	45732EL	45832EL	45932EL	.8745	8	2 3/4	10 17/32 - 18	329.40	303.40	294.70	290.60	286.15	282.65

*Solid Carbide

**Quantities of 15 or more — Contact Hannibal Specials Dept.



EXTENDED LENGTH REAMERS CARBIDE TIPPED TYPES 416EL, 426EL, 435EL



FLUTE FED FOR THRU HOLES STRAIGHT FLUTES

- TYPE 416EL - FOR NON-FERROUS MATERIALS**
- TYPE 426EL - FOR CAST IRONS**
- TYPE 435EL - FOR STEELS & HIGH TEMP ALLOYS**

- Coolant outlets in each flute
- Extended length versions of types 416, 426, and 435 found on page 92
- All extended length reamers provided with controlled shank
- Must specify overall length when ordering (centers supplied only at maximum overall length)

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	416EL
40	NON-FERROUS - SHORT CHIPS	416EL	
60	CAST IRONS	426EL	
80	LOW STRENGTH STEELS	435EL	
100	MEDIUM STRENGTH STEELS	435EL	
120	HIGH STRENGTH STEELS	435EL	
140	HIGH TEMPERATURE ALLOYS	435EL	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diam. reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN



TOOL DIAMETER RANGE	TYPE 416EL NON FERROUS EDP NO.	TYPE 426EL CAST IRON EDP NO.	TYPE 435EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		1	2	3	4	5-7	8-14**
						FLT	OVERALL RANGE						
* 0.1751-0.1910	41606EL	42606EL	43506EL	.1724	4	1 1/2	4 17/32 - 9	\$280.10	\$252.85	\$243.70	\$239.35	\$234.70	\$231.00
* 0.1911-0.2210	41607EL	42607EL	43507EL	.1880	4	1 1/2	5 1/2 - 10	290.90	263.60	254.45	250.15	245.50	241.80
* 0.2211-0.2530	41608EL	42608EL	43508EL	.2193	4	1 1/2	6 1/2 - 12	323.15	295.90	286.75	282.45	277.70	274.05
* 0.2531-0.2840	41609EL	42609EL	43509EL	.2505	4	1 1/2	6 1/2 - 12	338.80	311.55	302.40	298.05	293.35	289.70
0.2841-0.3150	41610EL	42610EL	43510EL	.2792	4	1 1/2	6 1/2 - 12	250.55	223.30	214.15	209.80	205.10	201.45
0.3151-0.3470	41611EL	42611EL	43511EL	.2792	4	1 1/2	6 1/2 - 12	250.55	223.30	214.15	209.80	205.10	201.45
0.3471-0.3780	41612EL	42612EL	43512EL	.3105	4	1 3/4	7 1/2 - 14	255.45	228.20	219.10	214.80	210.10	206.45
0.3781-0.4090	41613EL	42613EL	43513EL	.3105	4	1 3/4	7 1/2 - 14	255.45	228.20	219.10	214.80	210.10	206.45
0.4091-0.4410	41614EL	42614EL	43514EL	.3730	6	1 3/4	7 1/2 - 14	256.55	229.25	220.15	215.85	211.15	207.50
0.4411-0.4720	41615EL	42615EL	43515EL	.3730	6	1 3/4	7 1/2 - 14	256.55	229.25	220.15	215.85	211.15	207.50
0.4721-0.5030	41616EL	42616EL	43516EL	.4355	6	2	8 1/2 - 16	279.10	251.80	242.70	238.35	233.70	230.00
0.5031-0.5340	41617EL	42617EL	43517EL	.4355	6	2	8 1/2 - 16	279.10	251.80	242.70	238.35	233.70	230.00
0.5341-0.5660	41618EL	42618EL	43518EL	.4355	6	2	8 1/2 - 16	281.05	253.80	244.65	240.30	235.60	231.95
0.5661-0.5970	41619EL	42619EL	43519EL	.4355	6	2	8 1/2 - 16	281.05	253.80	244.65	240.30	235.60	231.95
0.5971-0.6280	41620EL	42620EL	43520EL	.5615	6	2 1/4	9 1/2 - 18	286.60	259.35	250.20	245.85	241.20	237.50
0.6281-0.6590	41621EL	42621EL	43521EL	.5615	6	2 1/4	9 1/2 - 18	286.60	259.35	250.20	245.85	241.20	237.50
0.6591-0.6910	41622EL	42622EL	43522EL	.5615	6	2 1/4	9 1/2 - 18	289.70	262.45	253.30	248.95	244.30	240.60
0.6911-0.7220	41623EL	42623EL	43523EL	.5615	6	2 1/4	9 1/2 - 18	289.70	262.45	253.30	248.95	244.30	240.60
0.7221-0.7530	41624EL	42624EL	43524EL	.6245	6	2 1/2	9 17/32 - 18	301.60	274.35	265.25	260.85	256.20	252.50
0.7531-0.7840	41625EL	42625EL	43525EL	.6245	6	2 1/2	9 17/32 - 18	343.75	317.80	309.10	304.95	300.50	297.00
0.7841-0.8160	41626EL	42626EL	43526EL	.6245	6	2 1/2	9 17/32 - 18	356.10	330.15	321.45	317.30	312.85	309.35
0.8161-0.8470	41627EL	42627EL	43527EL	.6245	6	2 1/2	9 17/32 - 18	359.40	333.45	324.75	320.60	316.15	312.65
0.8471-0.8780	41628EL	42628EL	43528EL	.7495	6	2 5/8	10 1/2 - 18	361.65	335.70	327.00	322.85	318.40	314.90
0.8781-0.9090	41629EL	42629EL	43529EL	.7495	6	2 5/8	10 1/2 - 18	375.70	349.75	341.05	336.90	332.45	328.95
0.9091-0.9410	41630EL	42630EL	43530EL	.7495	8	2 5/8	10 1/2 - 18	382.15	356.20	347.50	343.35	338.90	335.40
0.9411-0.9720	41631EL	42631EL	43531EL	.7495	8	2 5/8	10 1/2 - 18	384.25	358.30	349.60	345.45	341.00	337.50
0.9721-1.0030	41632EL	42632EL	43532EL	.8745	8	2 3/4	10 17/32 - 18	395.30	369.35	360.65	356.50	352.05	348.55

*Solid Carbide

**Quantities of 15 or more — Contact Hannibal Specials Dept.



EXTENDED LENGTH REAMERS CARBIDE TIPPED TYPES 442EL, 443EL, 444EL

MATERIAL SPECIFIC

**RIGHT SPIRAL FLUTES
FLUTE LONG CARBIDE**

- TYPE 442EL - FOR NON-FERROUS MATERIALS**
- TYPE 443EL - FOR CAST IRONS & NAS MULTI-PURPOSE**
- TYPE 444EL - FOR STEELS & HIGH TEMP ALLOYS**

- Extended length versions of types 442, 443, and 444 found on page 85
- All extended length reamers provided with controlled shank
- Must specify overall length when ordering (centers supplied only at maximum overall length)

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	442EL
	40	NON-FERROUS - SHORT CHIPS	442EL
	60	CAST IRONS	443EL
	80	LOW STRENGTH STEELS	444EL
	100	MEDIUM STRENGTH STEELS	444EL
	120	HIGH STRENGTH STEELS	444EL
140	HIGH TEMPERATURE ALLOYS	444EL	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diam. reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN



REAMERS

TOOL DIAMETER RANGE	TYPE 442EL NON FERROUS EDP NO.	TYPE 443EL CAST IRON EDP NO.	TYPE 444EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		1	2	3	4	5-7	8-14**
						FLT	OVERALL RANGE						
* 0.2211 - 0.2530	44208EL	44308EL	44408EL	.2193	4	1 1/2	6 1/32 - 12	\$309.15	\$276.45	\$265.50	\$260.35	\$254.75	\$250.30
* 0.2531 - 0.2840	44209EL	44309EL	44409EL	.2505	4	1 1/2	6 1/32 - 12	325.30	292.55	281.60	276.40	270.80	266.40
0.2841 - 0.3150	44210EL	44310EL	44410EL	.2792	4	1 1/2	6 1/32 - 12	230.85	198.15	187.20	181.95	176.35	171.95
0.3151 - 0.3470	44211EL	44311EL	44411EL	.2792	4	1 1/2	6 1/32 - 12	230.85	198.15	187.20	181.95	176.35	171.95
0.3471 - 0.3780	44212EL	44312EL	44412EL	.3105	4	1 3/4	7 1/32 - 14	238.40	205.70	194.70	189.50	183.90	179.55
0.3781 - 0.4090	44213EL	44313EL	44413EL	.3105	4	1 3/4	7 1/32 - 14	238.40	205.70	194.70	189.50	183.90	179.55
0.4091 - 0.4410	44214EL	44314EL	44414EL	.3730	6	1 3/4	7 1/32 - 14	245.95	213.25	202.30	197.05	191.40	187.05
0.4411 - 0.4720	44215EL	44315EL	44415EL	.3730	6	1 3/4	7 1/32 - 14	245.95	213.25	202.30	197.05	191.40	187.05
0.4721 - 0.5030	44216EL	44316EL	44416EL	.4355	6	2	8 1/32 - 16	251.05	218.30	207.40	202.10	196.55	192.10
0.5031 - 0.5340	44217EL	44317EL	44417EL	.4355	6	2	8 1/32 - 16	251.05	218.30	207.40	202.10	196.55	192.10
0.5341 - 0.5660	44218EL	44318EL	44418EL	.4355	6	2	8 1/32 - 16	255.75	222.95	212.05	206.80	201.25	196.75
0.5661 - 0.5970	44219EL	44319EL	44419EL	.4355	6	2	8 1/32 - 16	255.75	222.95	212.05	206.80	201.25	196.75
0.5971 - 0.6280	44220EL	44320EL	44420EL	.5615	6	2 1/4	9 1/32 - 18	261.15	228.40	217.40	212.25	206.65	202.25
0.6281 - 0.6590	44221EL	44321EL	44421EL	.5615	6	2 1/4	9 1/32 - 18	261.15	228.40	217.40	212.25	206.65	202.25
0.6591 - 0.6910	44222EL	44322EL	44422EL	.5615	6	2 1/4	9 1/32 - 18	261.80	229.10	218.15	213.00	207.40	202.95
0.6911 - 0.7220	44223EL	44323EL	44423EL	.5615	6	2 1/4	9 1/32 - 18	261.80	229.10	218.15	213.00	207.40	202.95
0.7221 - 0.7530	44224EL	44324EL	44424EL	.6245	6	2 1/2	9 17/32 - 18	281.10	248.40	237.40	232.15	226.60	222.20
0.7531 - 0.7840	44225EL	44325EL	44425EL	.6245	6	2 1/2	9 17/32 - 18	324.00	292.85	282.40	277.50	272.15	267.95
0.7841 - 0.8160	44226EL	44326EL	44426EL	.6245	6	2 1/2	9 17/32 - 18	333.35	302.20	291.75	286.85	281.50	277.30
0.8161 - 0.8470	44227EL	44327EL	44427EL	.6245	6	2 1/2	9 17/32 - 18	336.70	305.55	295.10	290.20	284.85	280.65
0.8471 - 0.8780	44228EL	44328EL	44428EL	.7495	6	2 5/8	10 1/32 - 18	338.00	306.85	296.40	291.50	286.15	281.95
0.8781 - 0.9090	44229EL	44329EL	44429EL	.7495	6	2 5/8	10 1/32 - 18	349.30	318.15	307.70	302.80	297.45	293.25
0.9091 - 0.9410	44230EL	44330EL	44430EL	.7495	8	2 5/8	10 1/32 - 18	361.05	329.90	319.45	314.55	309.20	305.00
0.9411 - 0.9720	44231EL	44331EL	44431EL	.7495	8	2 5/8	10 1/32 - 18	363.20	332.05	321.60	316.70	311.35	307.15
0.9721 - 1.0030	44232EL	44332EL	44432EL	.8745	8	2 3/4	10 17/32 - 18	376.45	345.30	334.85	329.95	324.60	320.40

*Solid Carbide

**Quantities of 15 or more — Contact Hannibal Specials Dept.



EXTENDED LENGTH REAMERS CARBIDE TIPPED TYPES 411EL, 413EL, & 415EL

MATERIAL SPECIFIC

COOLANT FED

CENTER FED FOR BLIND HOLES RIGHT SPIRAL FLUTES

TYPE 411EL - FOR NON-FERROUS MATERIALS

TYPE 413EL - FOR CAST IRONS

TYPE 415EL - FOR STEELS & HIGH TEMP ALLOYS

- Coolant hole through the center
- Extended length versions of types 411, 413, and 415 found on page 94
- All extended length reamers provided with controlled shank
- Must specify overall length when ordering (centers supplied only at maximum overall length)

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	411EL
40	NON-FERROUS - SHORT CHIPS	411EL	
60	CAST IRONS	413EL	
80	LOW STRENGTH STEELS	415EL	
100	MEDIUM STRENGTH STEELS	415EL	
120	HIGH STRENGTH STEELS	415EL	
140	HIGH TEMPERATURE ALLOYS	415EL	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Closer tool diameter tolerance - pg. 29
- Cutting diam. reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN



TOOL DIAMETER RANGE	TYPE 411EL NON FERROUS EDP NO.	TYPE 413EL CAST IRON EDP NO.	TYPE 415EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		1	2	3	4	5-7	8-14**
						FLT	OVERALL RANGE						
* 0.2211-0.2530	41108EL	41308EL	41508EL	.2193	4	1 1/2	6 1/2 - 12	\$387.75	\$355.05	\$344.15	\$338.90	\$333.25	\$328.90
* 0.2531-0.2840	41109EL	41309EL	41509EL	.2505	4	1 1/2	6 1/2 - 12	406.55	373.85	362.90	357.70	352.05	347.65
0.2841-0.3150	41110EL	41310EL	41510EL	.2792	4	1 1/2	6 1/2 - 12	300.60	267.90	257.00	251.75	246.10	241.75
0.3151-0.3470	41111EL	41311EL	41511EL	.2792	4	1 1/2	6 1/2 - 12	300.60	267.90	257.00	251.75	246.10	241.75
0.3471-0.3780	41112EL	41312EL	41512EL	.3105	4	1 3/4	7 1/2 - 14	306.60	273.85	262.85	257.70	252.10	247.70
0.3781-0.4090	41113EL	41313EL	41513EL	.3105	4	1 3/4	7 1/2 - 14	306.60	273.85	262.85	257.70	252.10	247.70
0.4091-0.4410	41114EL	41314EL	41514EL	.3730	6	1 3/4	7 1/2 - 14	307.85	275.15	264.20	259.00	253.35	248.95
0.4411-0.4720	41115EL	41315EL	41515EL	.3730	6	1 3/4	7 1/2 - 14	307.85	275.15	264.20	259.00	253.35	248.95
0.4721-0.5030	41116EL	41316EL	41516EL	.4355	6	2	8 1/2 - 16	334.90	302.20	291.20	286.00	280.40	276.05
0.5031-0.5340	41117EL	41317EL	41517EL	.4355	6	2	8 1/2 - 16	334.90	302.20	291.20	286.00	280.40	276.05
0.5341-0.5660	41118EL	41318EL	41518EL	.4355	6	2	8 1/2 - 16	337.25	304.50	293.60	288.40	282.75	278.35
0.5661-0.5970	41119EL	41319EL	41519EL	.4355	6	2	8 1/2 - 16	337.25	304.50	293.60	288.40	282.75	278.35
0.5971-0.6280	41120EL	41320EL	41520EL	.5615	6	2 1/4	9 1/2 - 18	343.95	311.20	300.25	295.05	289.45	285.00
0.6281-0.6590	41121EL	41321EL	41521EL	.5615	6	2 1/4	9 1/2 - 18	343.95	311.20	300.25	295.05	289.45	285.00
0.6591-0.6910	41122EL	41322EL	41522EL	.5615	6	2 1/4	9 1/2 - 18	347.65	314.95	304.00	298.80	293.15	288.75
0.6911-0.7220	41123EL	41323EL	41523EL	.5615	6	2 1/4	9 1/2 - 18	347.65	314.95	304.00	298.80	293.15	288.75
0.7221-0.7530	41124EL	41324EL	41524EL	.6245	6	2 1/2	9 17/32 - 18	361.95	329.25	318.25	313.10	307.45	303.10
0.7531-0.7840	41125EL	41325EL	41525EL	.6245	6	2 1/2	9 17/32 - 18	365.40	334.25	323.85	318.85	313.50	309.35
0.7841-0.8160	41126EL	41326EL	41526EL	.6245	6	2 1/2	9 17/32 - 18	377.35	346.20	335.80	330.80	325.45	321.30
0.8161-0.8470	41127EL	41327EL	41527EL	.6245	6	2 1/2	9 17/32 - 18	380.75	349.60	339.20	334.20	328.85	324.70
0.8471-0.8780	41128EL	41328EL	41528EL	.7495	6	2 5/8	10 1/2 - 18	382.00	350.85	340.45	335.45	330.10	325.95
0.8781-0.9090	41129EL	41329EL	41529EL	.7495	6	2 5/8	10 1/2 - 18	395.65	364.50	354.10	349.10	343.75	339.60
0.9091-0.9410	41130EL	41330EL	41530EL	.7495	8	2 5/8	10 1/2 - 18	407.75	376.60	366.20	361.20	355.85	351.70
0.9411-0.9720	41131EL	41331EL	41531EL	.7495	8	2 5/8	10 1/2 - 18	409.90	378.75	368.35	363.35	358.00	353.85
0.9721-1.0030	41132EL	41332EL	41532EL	.8745	8	2 3/4	10 17/32 - 18	426.05	394.90	384.50	379.50	374.15	370.00

*Solid Carbide

**Quantities of 15 or more — Contact Hannibal Specials Dept.



EXTENDED LENGTH REAMERS CARBIDE TIPPED TYPES 482EL, 483EL, 484EL



LEFT SPIRAL FLUTES FLUTE LONG CARBIDE

TYPE 482EL - FOR NON-FERROUS MATERIALS

TYPE 483EL - FOR CAST IRONS & NAS MULTI-PURPOSE

TYPE 484EL - FOR STEELS & HIGH TEMP ALLOYS

- Extended length versions of types 482, 483, and 484 found on page 87
- All extended length reamers provided with controlled shank
- Must specify overall length when ordering (centers supplied only at maximum overall length)

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	482EL
	40	NON-FERROUS - SHORT CHIPS	482EL
	60	CAST IRONS	483EL
	80	LOW STRENGTH STEELS	484EL
	100	MEDIUM STRENGTH STEELS	484EL
	120	HIGH STRENGTH STEELS	484EL
	140	HIGH TEMPERATURE ALLOYS	484EL

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diam. reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN



TOOL DIAMETER RANGE	TYPE 482EL NON FERROUS EDP NO.	TYPE 483EL CAST IRON EDP NO.	TYPE 484EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		1	2	3	4	5-7	8-14**
						FLT	OVERALL RANGE						
* 0.2211 - 0.2530	48208EL	48308EL	48408EL	.2193	4	1 1/2	6 1/32 - 12	\$309.15	\$276.45	\$265.50	\$260.35	\$254.75	\$250.30
* 0.2531 - 0.2840	48209EL	48309EL	48409EL	.2505	4	1 1/2	6 1/32 - 12	325.30	292.55	281.60	276.40	270.80	266.40
0.2841 - 0.3150	48210EL	48310EL	48410EL	.2792	4	1 1/2	6 1/32 - 12	230.85	198.15	187.20	181.95	176.35	171.95
0.3151 - 0.3470	48211EL	48311EL	48411EL	.2792	4	1 1/2	6 1/32 - 12	230.85	198.15	187.20	181.95	176.35	171.95
0.3471 - 0.3780	48212EL	48312EL	48412EL	.3105	4	1 3/4	7 1/32 - 14	238.40	205.70	194.70	189.50	183.90	179.55
0.3781 - 0.4090	48213EL	48313EL	48413EL	.3105	4	1 3/4	7 1/32 - 14	238.40	205.70	194.70	189.50	183.90	179.55
0.4091 - 0.4410	48214EL	48314EL	48414EL	.3730	6	1 3/4	7 1/32 - 14	245.95	213.25	202.30	197.05	191.40	187.05
0.4411 - 0.4720	48215EL	48315EL	48415EL	.3730	6	1 3/4	7 1/32 - 14	245.95	213.25	202.30	197.05	191.40	187.05
0.4721 - 0.5030	48216EL	48316EL	48416EL	.4355	6	2	8 1/32 - 16	251.05	218.30	207.40	202.10	196.55	192.10
0.5031 - 0.5340	48217EL	48317EL	48417EL	.4355	6	2	8 1/32 - 16	251.05	218.30	207.40	202.10	196.55	192.10
0.5341 - 0.5660	48218EL	48318EL	48418EL	.4355	6	2	8 1/32 - 16	255.75	222.95	212.05	206.80	201.25	196.75
0.5661 - 0.5970	48219EL	48319EL	48419EL	.4355	6	2	8 1/32 - 16	255.75	222.95	212.05	206.80	201.25	196.75
0.5971 - 0.6280	48220EL	48320EL	48420EL	.5615	6	2 1/4	9 1/32 - 18	261.15	228.40	217.40	212.25	206.65	202.25
0.6281 - 0.6590	48221EL	48321EL	48421EL	.5615	6	2 1/4	9 1/32 - 18	261.15	228.40	217.40	212.25	206.65	202.25
0.6591 - 0.6910	48222EL	48322EL	48422EL	.5615	6	2 1/4	9 1/32 - 18	261.80	229.10	218.15	213.00	207.40	202.95
0.6911 - 0.7220	48223EL	48323EL	48423EL	.5615	6	2 1/4	9 1/32 - 18	261.80	229.10	218.15	213.00	207.40	202.95
0.7221 - 0.7530	48224EL	48324EL	48424EL	.6245	6	2 1/2	9 17/32 - 18	281.10	248.40	237.40	232.15	226.60	222.20
0.7531 - 0.7840	48225EL	48325EL	48425EL	.6245	6	2 1/2	9 17/32 - 18	324.00	292.85	282.40	277.50	272.15	267.95
0.7841 - 0.8160	48226EL	48326EL	48426EL	.6245	6	2 1/2	9 17/32 - 18	333.35	302.20	291.75	286.85	281.50	277.30
0.8161 - 0.8470	48227EL	48327EL	48427EL	.6245	6	2 1/2	9 17/32 - 18	336.70	305.55	295.10	290.20	284.85	280.65
0.8471 - 0.8780	48228EL	48328EL	48428EL	.7495	6	2 5/8	10 1/32 - 18	338.00	306.85	296.40	291.50	286.15	281.95
0.8781 - 0.9090	48229EL	48329EL	48429EL	.7495	6	2 5/8	10 1/32 - 18	349.30	318.15	307.70	302.80	297.45	293.25
0.9091 - 0.9410	48230EL	48330EL	48430EL	.7495	8	2 5/8	10 1/32 - 18	361.05	329.90	319.45	314.55	309.20	305.00
0.9411 - 0.9720	48231EL	48331EL	48431EL	.7495	8	2 5/8	10 1/32 - 18	363.20	332.05	321.60	316.70	311.35	307.15
0.9721 - 1.0030	48232EL	48332EL	48432EL	.8745	8	2 3/4	10 17/32 - 18	376.45	345.30	334.85	329.95	324.60	320.40

*Solid Carbide

**Quantities of 15 or more — Contact Hannibal Specials Dept.



EXTENDED LENGTH REAMERS CARBIDE TIPPED TYPES 427EL, 428EL, 429EL



FLUTE FED FOR THRU HOLES LEFT SPIRAL FLUTES

TYPE 427EL - FOR NON-FERROUS MATERIALS

TYPE 428EL - FOR CAST IRONS

TYPE 429EL - FOR STEELS & HIGH TEMP ALLOYS

- Extended length versions of types 427, 428, and 429 found on page 96
- Coolant outlets in each flute
- All extended length reamers provided with controlled shank
- Must specify overall length when ordering (centers supplied only at maximum overall length)

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	427EL
	40	NON-FERROUS - SHORT CHIPS	427EL
	60	CAST IRONS	428EL
	80	LOW STRENGTH STEELS	429EL
	100	MEDIUM STRENGTH STEELS	429EL
	120	HIGH STRENGTH STEELS	429EL
	140	HIGH TEMPERATURE ALLOYS	429EL

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diam. reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN



TOOL DIAMETER RANGE	TYPE 427EL NON FERROUS EDP NO.	TYPE 428EL CAST IRON EDP NO.	TYPE 429EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		1	2	3	4	5-7	8-14**
						FLT	OVERALL RANGE						
* 0.2211-0.2530	42708EL	42808EL	42908EL	.2193	4	1 1/2	6 1/2 -12	\$387.75	\$355.05	\$344.15	\$338.90	\$333.25	\$328.90
* 0.2531-0.2840	42709EL	42809EL	42909EL	.2505	4	1 1/2	6 1/2 -12	406.55	373.85	362.90	357.70	352.05	347.65
0.2841-0.3150	42710EL	42810EL	42910EL	.2792	4	1 1/2	6 1/2 -12	300.60	267.90	257.00	251.75	246.10	241.75
0.3151-0.3470	42711EL	42811EL	42911EL	.2792	4	1 1/2	6 1/2 -12	300.60	267.90	257.00	251.75	246.10	241.75
0.3471-0.3780	42712EL	42812EL	42912EL	.3105	4	1 3/4	7 1/2 -14	306.60	273.85	262.85	257.70	252.10	247.70
0.3781-0.4090	42713EL	42813EL	42913EL	.3105	4	1 3/4	7 1/2 -14	306.60	273.85	262.85	257.70	252.10	247.70
0.4091-0.4410	42714EL	42814EL	42914EL	.3730	6	1 3/4	7 1/2 -14	307.85	275.15	264.20	259.00	253.35	248.95
0.4411-0.4720	42715EL	42815EL	42915EL	.3730	6	1 3/4	7 1/2 -14	307.85	275.15	264.20	259.00	253.35	248.95
0.4721-0.5030	42716EL	42816EL	42916EL	.4355	6	2	8 1/2 -16	334.90	302.20	291.20	286.00	280.40	276.05
0.5031-0.5340	42717EL	42817EL	42917EL	.4355	6	2	8 1/2 -16	334.90	302.20	291.20	286.00	280.40	276.05
0.5341-0.5660	42718EL	42818EL	42918EL	.4355	6	2	8 1/2 -16	337.25	304.50	293.60	288.40	282.75	278.35
0.5661-0.5970	42719EL	42819EL	42919EL	.4355	6	2	8 1/2 -16	337.25	304.50	293.60	288.40	282.75	278.35
0.5971-0.6280	42720EL	42820EL	42920EL	.5615	6	2 1/4	9 1/2 -18	343.95	311.20	300.25	295.05	289.45	285.00
0.6281-0.6590	42721EL	42821EL	42921EL	.5615	6	2 1/4	9 1/2 -18	343.95	311.20	300.25	295.05	289.45	285.00
0.6591-0.6910	42722EL	42822EL	42922EL	.5615	6	2 1/4	9 1/2 -18	347.65	314.95	304.00	298.80	293.15	288.75
0.6911-0.7220	42723EL	42823EL	42923EL	.5615	6	2 1/4	9 1/2 -18	347.65	314.95	304.00	298.80	293.15	288.75
0.7221-0.7530	42724EL	42824EL	42924EL	.6245	6	2 1/2	9 17/32 -18	361.95	329.25	318.25	313.10	307.45	303.10
0.7531-0.7840	42725EL	42825EL	42925EL	.6245	6	2 1/2	9 17/32 -18	382.15	351.00	340.60	335.60	330.25	326.10
0.7841-0.8160	42726EL	42826EL	42926EL	.6245	6	2 1/2	9 17/32 -18	395.00	363.85	353.45	348.45	343.10	338.95
0.8161-0.8470	42727EL	42827EL	42927EL	.6245	6	2 1/2	9 17/32 -18	398.35	367.20	356.80	351.80	346.45	342.30
0.8471-0.8780	42728EL	42828EL	42928EL	.7495	6	2 5/8	10 1/2 -18	399.55	368.40	358.00	353.00	347.65	343.50
0.8781-0.9090	42729EL	42829EL	42929EL	.7495	6	2 5/8	10 1/2 -18	414.35	383.20	372.80	367.80	362.45	358.30
0.9091-0.9410	42730EL	42830EL	42930EL	.7495	8	2 5/8	10 1/2 -18	426.50	395.35	384.95	379.95	374.60	370.45
0.9411-0.9720	42731EL	42831EL	42931EL	.7495	8	2 5/8	10 1/2 -18	428.60	397.45	387.05	382.05	376.70	372.55
0.9721-1.0030	42732EL	42832EL	42932EL	.8745	8	2 3/4	10 17/32 -18	445.75	414.60	404.20	399.20	393.85	389.70

*Solid Carbide

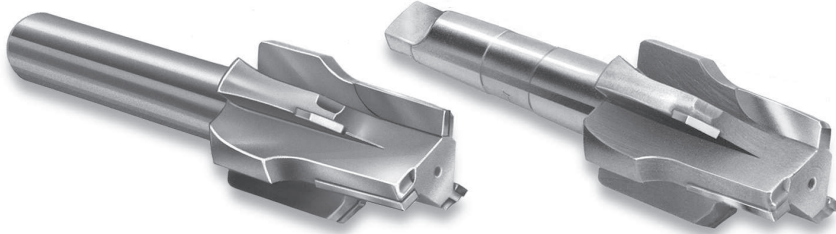
**Quantities of 15 or more — Contact Hannibal Specials Dept.



PIPE TAP REAMERS CARBIDE TIPPED TYPES 446 & 447 FRACTIONAL



STRAIGHT OR TAPER SHANK



TYPE 446 - STRAIGHT SHANK

TYPE 447 - TAPER SHANK

BOTH TYPES:

- Three flutes on pipe tap sizes through 1/2-14
- Six alternate cutting flutes on pipe tap sizes 3/4-14 and larger (three with pipe taper and three with chamfer angle)

USE:

- Cuts on taper and chamfer diameters - far better than high speed steel tools

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	446 or 447
	40	NON-FERROUS - SHORT CHIPS	446 or 447
	60	CAST IRONS	446 or 447
	80	LOW STRENGTH STEELS	446 or 447
	100	MEDIUM STRENGTH STEELS	446 or 447
	120	HIGH STRENGTH STEELS	446 or 447
	140	HIGH TEMPERATURE ALLOYS	446 or 447

MODIFICATIONS (Prompt delivery)

- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

PIPE TAP SIZE	TOOL DIAM.	DIMENSIONS			STRAIGHT SHANK - TYPE 446					TAPER SHANK - TYPE 447			
		LARGE DIAM. TAPER	SMALL DIAM. TAPER	REAMER TAPER LENGTH	SHANK DIAM.	SHANK LENGTH	OVERALL LENGTH	TYPE 446 EDP NO.	PRICE	TAPER SHANK NO.	OVERALL LENGTH	TYPE 447 EDP NO.	PRICE
1/8 - 27	5/8	.347	.318	1 1/2	1/2	1 1/2	2 19/32	44601	\$120.55	2	4 1 1/2	44701	\$134.65
1/4 - 18	3/4	.450	.409	2 1/2	1/2	1 1/2	2 29/32	44602	124.40	2	4 2 1/2	44702	139.20
3/8 - 18	7/8	.586	.543	1 1/4	1/2	2	3 7/16	44603	142.65	2	4 1 1/4	44703	159.40
1/2 - 14	1	.725	.670	7/8	1/2	2	3 7/8	44604	151.50	2	5 1/8	44704	169.75
3/4 - 14	1 1/4	.937	.882	7/8	1	2 1/2	4 5/8	44606	204.65	3	6 1/8	44706	228.85
1 - 11 1/2	1 1/2	1.173	1.107	1 1/16	1	2 1/2	5 1/16	44608	237.95	3	6 1/16	44708	266.45
1 1/2 - 11 1/2	1 1/2	1.173	1.107	1 1/16	-	-	-	-	-	4	7 9/16	44709	273.40
1 3/4 - 11 1/2	1 7/8	1.518	1.448	1 1/8	1 1/2	3	5 5/8	44610	284.15	3	6 5/8	44710	317.40
1 1/4 - 11 1/2	1 7/8	1.518	1.448	1 1/8	-	-	-	-	-	4	7 5/8	44711	340.70
1 1/2 - 11 1/2	2 1/8	1.757	1.687	1 1/8	1 1/2	3	5 7/8	44612	391.10	3	6 7/8	44712	438.45
1 1/2 - 11 1/2	2 1/8	1.757	1.687	1 1/8	-	-	-	-	-	4	7 7/8	44713	450.40
2 - 11 1/2	2 5/8	2.230	2.154	1 7/32	1 1/2	3	6 7/32	44616	443.10	3	7 3/32	44716	496.20
2 - 11 1/2	2 5/8	2.230	2.154	1 7/32	-	-	-	-	-	4	8 7/32	44717	509.55
2 1/2 - 8	3 1/8	2.670	2.561	1 3/4	1 1/2	3	6 3/4	44620	595.95	3	7 3/4	44720	667.30
2 1/2 - 8	3 1/8	2.670	2.561	1 3/4	-	-	-	-	-	4	8 3/4	44721	685.30
3 - 8	3 3/4	3.296	3.180	1 7/8	1 1/2	3	6 7/8	44624	614.60	3	7 7/8	44724	688.40



JOBBER'S REAMERS - CARBIDE TIPPED TYPE 403 FRACTIONAL



TYPE 403

- Straight polished flutes and taper shank
- Detailed specifications on page 29



TOOL DIAMETER		TYPE 403 EDP NO.	PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
FRAC.	DECIMAL			TAPER SHANK NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED						
						FLUTE	CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*	
3/8	.3750	40312	\$120.55	1	4	2 1/2	5/8	5 13/16	0.3471 - 0.3780	\$151.05	\$135.70	\$130.65	\$128.20	\$125.60	\$123.55	
7/16	.4375	40314	126.20	1	4	2 3/4	5/8	6 1/8	0.4091 - 0.4410	156.70	141.40	136.30	133.90	131.30	129.20	
1/2	.5000	40316	131.95	1	6	3	5/8	6 7/16	0.4721 - 0.5030	162.45	147.15	142.00	139.65	137.00	134.90	
5/8	.6250	40320	144.50	2	6	3 1/2	5/8	7 9/16	0.5971 - 0.6280	175.00	159.65	154.60	152.15	149.50	147.45	
11/16	.6875	40322	150.95	2	6	3 7/8	5/8	8	0.6591 - 0.6910	181.40	166.10	161.00	158.55	155.90	153.90	
3/4	.7500	40324	157.05	2	6	4 3/16	3/4	8 3/8	0.7221 - 0.7530	187.55	172.30	167.15	164.75	162.10	160.05	
13/16	.8125	40326	163.00	2	6	4 9/16	3/4	8 13/16	0.7841 - 0.8160	193.45	178.20	173.10	170.70	168.05	166.00	
7/8	.8750	40328	175.55	2	6	4 7/8	3/4	9 3/16	0.8471 - 0.8780	207.15	191.30	186.00	183.50	180.75	178.60	
15/16	.9375	40330	184.70	3	8	5 1/8	3/4	10	0.9091 - 0.9410	210.40	200.45	195.15	192.55	189.90	187.75	
1	1.0000	40332	188.50	3	8	5 7/16	3/4	10 3/8	0.9721 - 1.0030	220.10	204.30	199.00	196.40	193.65	191.55	

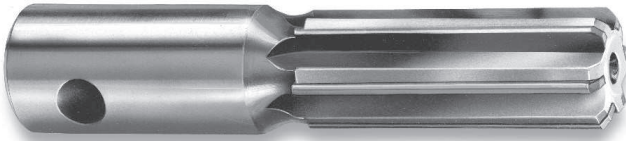
*Quantities of 15 or more - price of fractional size in same size range.



CNC STUB REAMERS CARBIDE TIPPED TYPES 430 & 440 FRACTIONAL



STRAIGHT OR LEFT SPIRAL FLUTES FLUTE LONG CARBIDE STRAIGHT SHANK



TYPE 430 - STRAIGHT FLUTES



**TYPE 440 - LEFT SPIRAL FLUTES
BOTH TYPES:**

- Polished flutes; flute long carbide on .2841" tool diameter and larger
- Straight shank fits into standard holders
- Pin cross hole permits use in pin drive floating holders
- Left spiral flutes should not be used on blind holes
- Detailed specifications on page 29

NOTE: For semi-finished reamers, see page 53.

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	430/440
40	NON-FERROUS - SHORT CHIPS	430/440	
60	CAST IRONS	430/440	
80	LOW STRENGTH STEELS	440/430	
100	MEDIUM STRENGTH STEELS	440/430	
120	HIGH STRENGTH STEELS	440/430	
140	HIGH TEMPERATURE ALLOYS	440/430	

For material specific CNC stub with straight flutes, see page 88

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Modified metric tool diameter - priced on pg. 43
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Reduced shank diameter
- Flat(s) on shank
- Coatings available:
See page 44

TOOL DIAMETER		TYPE 430 STRAIGHT EDP NO.	TYPE 440 LEFT EDP NO.	BOTH TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
FRACTIONAL	DECIMAL				SHANK DIAM.	NO. OF FLUTES	LENGTH			PIN HOLE DIAM.	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLUTE	CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*	
3/16	.1875	43006	44006	\$41.50	1/4	4	1	1/2	2 1/4	3/32	0.1770-0.2040	\$71.90	\$56.65	\$51.55	\$49.15	\$46.50	\$44.45
7/32	.2188	43007	44007	41.50	1/4	4	1	1/2	2 1/4	3/32	0.2041-0.2210	71.90	56.65	51.55	49.15	46.50	44.45
15/64	.2344	4302344	4402344	41.50	1/4	4	1	1/2	2 1/4	3/32	0.2211-0.2380	71.90	56.65	51.55	49.15	46.50	44.45
1/4	.2500	43008	44008	41.50	1/4	4	1	1/2	2 1/4	3/32	0.2381-0.2530	71.90	56.65	51.55	49.15	46.50	44.45
9/32	.2812	43009	44009	41.50	3/8	4	1	1/2	2 1/4	1/8	0.2531-0.2840	71.90	56.65	51.55	49.15	46.50	44.45
5/16	.3125	43010	44010	48.20	3/8	4	1	1	2 1/4	1/8	0.2841-0.3150	78.65	63.35	58.30	55.85	53.20	51.20
11/32	.3438	43011	44011	48.60	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3151-0.3470	79.05	63.85	58.70	56.30	53.65	51.60
3/8	.3750	43012	44012	52.75	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3471-0.3780	83.20	67.95	62.85	60.40	57.75	55.70
13/32	.4062	43013	44013	53.50	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.3781-0.4090	84.00	68.65	63.60	61.15	58.55	56.50
7/16	.4375	43014	44014	63.30	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4091-0.4410	93.80	78.55	73.40	71.05	68.40	66.35
15/32	.4688	43015	44015	63.30	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4411-0.4720	93.80	78.55	73.40	71.05	68.40	66.35
1/2	.5000	43016	44016	69.30	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4721-0.5030	100.60	84.95	79.70	77.20	74.50	72.40
17/32	.5312	43017	44017	69.30	5/8	6	1 1/2	1 1/2	3	1/4	0.5031-0.5340	100.60	84.95	79.70	77.20	74.50	72.40
9/16	.5625	43018	44018	73.05	5/8	6	1 1/2	1 1/2	3	1/4	0.5341-0.5660	104.25	88.65	83.35	80.90	78.15	76.05
19/32	.5938	43019	44019	73.05	5/8	6	1 1/2	1 1/2	3	1/4	0.5661-0.5970	104.25	88.65	83.35	80.90	78.15	76.05
5/8	.6250	43020	44020	75.00	5/8	6	1 1/2	1 1/2	3	1/4	0.5971-0.6280	106.30	90.60	85.35	82.85	80.15	78.05
21/32	.6562	43021	44021	75.00	5/8	6	1 1/2	1 1/2	3	1/4	0.6281-0.6590	106.30	90.60	85.35	82.85	80.15	78.05
11/16	.6875	43022	44022	78.50	5/8	6	1 1/2	1 1/2	3	1/4	0.6591-0.6910	109.70	94.05	88.85	86.30	83.65	81.55
23/32	.7188	43023	44023	78.50	3/4	6	1 1/2	1 1/2	3	5/16	0.6911-0.7220	109.70	94.05	88.85	86.30	83.65	81.55
3/4	.7500	43024	44024	80.50	3/4	6	1 1/2	1 1/2	3	5/16	0.7221-0.7530	111.70	96.10	90.80	88.30	85.65	83.55
25/32	.7812	43025	44025	80.50	3/4	6	1 1/2	1 1/2	3	5/16	0.7531-0.7840	111.70	96.10	90.80	88.30	85.65	83.55
13/16	.8125	43026	44026	87.40	3/4	6	1 1/2	1 1/2	3	5/16	0.7841-0.8160	118.70	103.05	97.75	95.30	92.60	90.50
27/32	.8438	43027	44027	87.40	3/4	6	1 1/2	1 1/2	3	5/16	0.8161-0.8470	118.70	103.05	97.75	95.30	92.60	90.50
7/8	.8750	43028	44028	95.50	3/4	6	1 1/2	1 1/2	3	5/16	0.8471-0.8780	128.00	111.65	106.25	103.65	100.90	98.70
29/32	.9062	43029	44029	95.50	3/4	6	1 1/2	1 1/2	3	5/16	0.8781-0.9090	128.00	111.65	106.25	103.65	100.90	98.70
15/16	.9375	43030	44030	105.20	3/4	6	1 1/2	1 1/2	3	5/16	0.9091-0.9410	137.65	121.40	115.95	113.35	110.55	108.40
31/32	.9688	43031	44031	105.20	3/4	8	1 1/2	1 1/2	3	5/16	0.9411-0.9720	137.65	121.40	115.95	113.35	110.55	108.40
1	1.0000	43032	44032	110.35	3/4	8	1 1/2	1 1/2	3	5/16	0.9721-1.0030	142.85	126.60	121.15	118.55	115.70	113.55
1 1/16	1.0625	43034	44034	110.35	3/4	8	1 1/2	1 1/2	3	5/16	1.0031-1.0660	142.85	126.60	121.15	118.55	115.70	113.55
1 1/8	1.1250	43036	44036	129.20	3/4	8	1 1/2	1 1/2	3	5/16	1.0661-1.1280	161.65	145.35	139.90	137.35	134.55	132.35
1 3/16	1.1875	43038	44038	134.65	3/4	8	1 1/2	1 1/2	3	5/16	1.1281-1.1905	167.15	150.90	145.40	142.85	140.05	137.85
1 1/4	1.2500	43040	44040	157.75	3/4	8	1 1/2	1 1/2	3	5/16	1.1906-1.2530	190.25	174.00	168.60	165.95	163.20	161.00
1 5/16	1.3125	43042	44042	157.75	3/4	8	1 1/2	1 1/2	3	5/16	1.2531-1.3155	190.25	174.00	168.60	165.95	163.20	161.00
1 3/8	1.3750	43044	44044	160.05	3/4	8	1 1/2	1 1/2	3	5/16	1.3156-1.3780	192.50	176.25	170.85	168.20	165.50	163.30
1 7/16	1.4375	43046	44046	186.55	3/4	8	1 1/2	1 1/2	3	5/16	1.3781-1.4405	219.05	202.75	197.35	194.70	191.95	189.80
1 1/2	1.5000	43048	44048	224.05	3/4	8	1 1/2	1 1/2	3	5/16	1.4406-1.5030	256.50	240.30	234.85	232.25	229.40	227.20

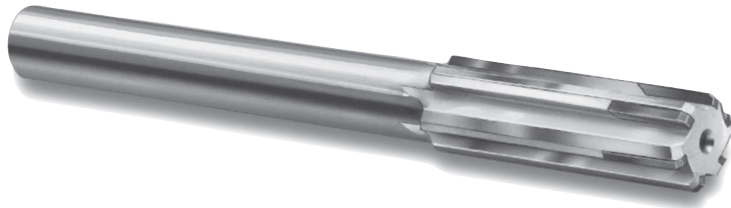
*Quantities of 15 or more - price of fractional size in same size range.



JOBBERS DRILL LENGTH REAMERS CARBIDE TIPPED TYPE 401 FRACTIONAL



**STRAIGHT FLUTES
STRAIGHT SHANK**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	401
	40	NON-FERROUS - SHORT CHIPS	401
	60	CAST IRONS	401
	80	LOW STRENGTH STEELS	401
	100	MEDIUM STRENGTH STEELS	401
	120	HIGH STRENGTH STEELS	401
	140	HIGH TEMPERATURE ALLOYS	401

TYPE 401

- Straight polished flutes and straight shank
- Short length for extra rigidity
- Detailed specifications on pg. 29

USE:

- Production length reamers are similar in length to jobbers length drills. This reduces costly setup time, while increasing the rigidity of the reamer compared to the standard length chucking reamer. For shallow holes only (see page 27).

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shortened shank or reduced shank diameter

- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

TOOL DIAMETER		TYPE 401 EDP NO.	PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL			SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
		FLT	CARBIDE			OVER-ALL	1	2		3	4	5-7	8-14*		
5/32	.1562	40105	\$51.10	.151	4	1	1/2	3 1/8	0.1560-0.1769	\$81.60	\$66.35	\$61.20	\$58.75	\$56.20	\$54.10
11/64	.1719	4011719	51.10	.151	4	1	1/2	3 1/4	-	-	-	-	-	-	-
3/16	.1875	40106	49.40	11/64	4	1 1/8	1/2	3 1/2	0.1770-0.2040	79.05	64.20	59.25	56.85	54.40	52.35
13/64	.2031	4012031	49.75	11/64	4	1 1/8	1/2	3 5/8	-	-	-	-	-	-	-
7/32	.2188	40107	49.40	13/64	4	1 1/4	1/2	3 3/4	0.2041-0.2210	79.05	64.20	59.25	56.85	54.40	52.35
15/64	.2344	4012344	49.75	7/32	4	1 1/2	1/2	3 7/8	0.2211-0.2380	79.45	64.60	59.55	57.20	54.65	52.65
1/4	.2500	40108	49.40	15/64	4	1 1/2	1/2	4	0.2381-0.2530	79.05	64.20	59.25	56.85	54.40	52.35
17/64	.2656	4012656	50.40	15/64	4	1 1/2	1/2	4 1/8	-	-	-	-	-	-	-
9/32	.2812	40109	50.10	15/64	4	1 1/2	1/2	4 1/4	0.2531-0.2840	79.75	64.90	59.95	57.55	55.00	53.00
19/64	.2969	4012969	50.40	7/32	4	1 1/2	1/2	4 3/8	-	-	-	-	-	-	-
5/16	.3125	40110	50.10	9/32	4	1 1/2	1/2	4 1/2	0.2841-0.3150	79.75	64.90	59.95	57.55	55.00	53.00
21/64	.3281	4013281	51.90	9/32	4	1 1/2	5/8	4 5/8	-	-	-	-	-	-	-
11/32	.3438	40111	51.30	9/32	4	1 1/2	5/8	4 3/4	0.3151-0.3470	80.95	66.10	61.15	58.75	56.25	54.20
23/64	.3594	4013594	51.90	5/16	4	1 3/4	5/8	4 7/8	-	-	-	-	-	-	-
3/8	.3750	40112	47.10	5/16	4	1 3/4	5/8	5	0.3471-0.3780	74.30	60.65	56.05	53.90	51.60	49.75
25/64	.3906	4013906	53.85	5/16	4	1 3/4	5/8	5 1/8	-	-	-	-	-	-	53.85
13/32	.4062	40113	52.95	5/16	4	1 3/4	5/8	5 1/4	0.3781-0.4090	82.65	67.80	62.80	60.45	57.85	55.85
27/64	.4219	4014219	53.85	3/8	4	1 3/4	5/8	5 3/8	-	-	-	-	-	-	-
7/16	.4375	40114	55.30	3/8	4	1 3/4	5/8	5 1/2	0.4091-0.4410	84.95	70.10	65.10	62.75	60.15	58.15
29/64	.4531	4014531	57.45	3/8	4	1 3/4	5/8	5 5/8	-	-	-	-	-	-	-
15/32	.4688	40115	57.75	3/8	4	1 3/4	5/8	5 3/4	0.4411-0.4720	87.40	72.55	67.55	65.20	62.70	60.65
31/64	.4844	4014844	61.20	7/16	6	2	5/8	5 7/8	-	-	-	-	-	-	-
1/2	.5000	40116	64.85	7/16	6	2	5/8	6	0.4721-0.5030	97.50	81.10	75.70	73.10	70.25	68.05
33/64	.5156	4015156	68.90	7/16	6	2	5/8	6 5/8	-	-	-	-	-	-	-
17/32	.5312	40117	68.90	7/16	6	2	5/8	6 5/8	0.5031-0.5340	101.55	85.20	79.75	77.10	74.35	72.15
35/64	.5469	4015469	68.90	7/16	6	2	5/8	6 5/8	-	-	-	-	-	-	-
9/16	.5625	40118	68.90	7/16	6	2	5/8	6 5/8	0.5341-0.5660	101.55	85.20	79.75	77.10	74.35	72.15
37/64	.5781	4015781	70.80	7/16	6	2	5/8	6 5/8	-	-	-	-	-	-	-
19/32	.5938	40119	70.80	7/16	6	2	5/8	7 1/8	0.5661-0.5970	103.55	87.15	81.70	79.05	76.25	74.10
39/64	.6094	4016094	70.80	9/16	6	2 1/4	5/8	7 1/8	-	-	-	-	-	-	-
5/8	.6250	40120	70.80	9/16	6	2 1/4	5/8	7 1/8	0.5971-0.6280	103.55	87.15	81.70	79.05	76.25	74.10
41/64	.6406	4016406	71.70	9/16	6	2 1/4	5/8	7 1/8	-	-	-	-	-	-	-
21/32	.6562	40121	71.70	9/16	6	2 1/4	5/8	7 1/8	0.6281-0.6590	104.40	88.05	82.55	79.90	77.10	74.90
43/64	.6719	4016719	71.70	9/16	6	2 1/4	5/8	7 5/8	-	-	-	-	-	-	-
11/16	.6875	40122	71.70	9/16	6	2 1/4	5/8	7 5/8	0.6591-0.6910	104.40	88.05	82.55	79.90	77.10	74.90
45/64	.7031	4017031	74.20	9/16	6	2 1/4	5/8	7 5/8	-	-	-	-	-	-	-
23/32	.7188	40123	74.20	9/16	6	2 1/4	5/8	7 5/8	0.6911-0.7220	106.85	90.50	85.05	82.40	79.60	77.40
47/64	.7344	4017344	74.20	5/8	6	2 1/2	3/4	7 5/8	-	-	-	-	-	-	-
3/4	.7500	40124	74.20	5/8	6	2 1/2	3/4	8	0.7221-0.7530	106.85	90.50	85.05	82.40	79.60	77.40

*Quantities of 15 or more - price of fractional size in same size range.



JOBBER'S DRILL LENGTH REAMERS CARBIDE TIPPED TYPES 477 & 479 FRACTIONAL



OVER & UNDER SIZE REAMERS CARBIDE TIPPED

TYPE 479 - STRAIGHT FLUTES & SHANK

- Tool diameter tolerance: plus .0002", minus .0000"
- Same specifications and available modifications as Type 401 (pg. 44)

USE:

- These precision ground carbide tipped reamers are very effective for finishing accurate holes in most materials. For shallow holes only (see page 27)

DECIMAL TOOL DIAMETER	TYPE 479 EDP NO.	PRICE	DIMENSIONS				
			SHANK DIAM.	NO. OF FLUTES	LENGTH		
					FLUTE	CAR-BIDE	OVER-ALL
.1865	47918	\$49.75	1 ¹ / ₆₄	4	1 1/8	1/2	3 1/2
.1885	47919	49.75	1 ¹ / ₆₄	4	1 1/8	1/2	3 1/2
.2490	47924	49.75	1 ⁵ / ₆₄	4	1 1/2	1/2	4
.2510	47925	49.75	1 ⁵ / ₆₄	4	1 1/2	1/2	4
.3115	47931	50.40	3/32	4	1 1/2	1/2	4 1/2
.3135	47932	50.40	3/32	4	1 1/2	1/2	4 1/2
.3740	47937	51.90	5/16	4	1 3/4	5/8	5
.3760	47938	51.90	5/16	4	1 3/4	5/8	5
.4365	47943	57.45	3/8	4	1 3/4	5/8	5 1/2
.4385	47944	57.45	3/8	4	1 3/4	5/8	5 1/2
.4990	47949	61.20	7/16	6	2	5/8	6
.5010	47950	61.20	7/16	6	2	5/8	6

DOWEL PIN SIZE REAMERS CARBIDE TIPPED

TYPE 477 - STRAIGHT FLUTES & SHANK

- Special plus .0000", minus .0002" tool diameter tolerance
- Same specifications & available modifications as Type 401 (pg. 44)

USE:

- These precision ground reamers should be used in pairs, .0005" and .0020" under the dowel pin diameter. The .0020" smaller holes assure a tighter dowel pin fit, so all the pins will remain on the same side upon disassembly. Especially useful in plastic or die cast molds and machines when assembled sections are subject to shearing stress, yet require occasional disassembly.

DECIMAL TOOL DIAMETER	TYPE 477 EDP NO.	PRICE	DIMENSIONS				
			SHANK DIAM.	NO. OF FLUTES	LENGTH		
					FLUTE	CAR-BIDE	OVER-ALL
.1855	47717	\$49.75	1 ¹ / ₆₄	4	1 1/8	1/2	3 1/2
.1870	47718	49.75	1 ¹ / ₆₄	4	1 1/8	1/2	3 1/2
.2480	47723	49.75	1 ⁵ / ₆₄	4	1 1/2	1/2	4
.2495	47724	49.75	1 ⁵ / ₆₄	4	1 1/2	1/2	4
.3105	47730	50.40	3/32	4	1 1/2	1/2	4 1/2
.3120	47731	50.40	3/32	4	1 1/2	1/2	4 1/2
.3730	47736	51.90	5/16	4	1 3/4	5/8	5
.3745	47737	51.90	5/16	4	1 3/4	5/8	5
.4355	47742	57.45	3/8	4	1 3/4	5/8	5 1/2
.4370	47743	57.45	3/8	4	1 3/4	5/8	5 1/2
.4980	47748	61.20	7/16	6	2	5/8	6
.4995	47749	61.20	7/16	6	2	5/8	6

REAMERS



REGULAR LENGTH CHUCKING REAMERS CARBIDE TIPPED TYPE 400 WIRE & LETTER SIZES



STRAIGHT FLUTES & SHANK

For shallow holes only (see page 27)

(See specifications & available modifications on page 44)

TOOL DIAMETER		TYPE 400 EDP NO.	PRICE	DIMENSIONS				
WIRE/ LETTER	DECIMAL EQUIV.			SHANK DIAM.	NO. OF FLTS	LENGTH		
				FLT	CAR-BIDE	OVER-ALL		
22	.1570	4001570	\$44.75	.151	4	1	1/2	4
21	.1590	4001590	44.75	.151	4	1	1/2	4
20	.1610	4001610	44.75	.151	4	1	1/2	4
19	.1660	4001660	44.75	.151	4	1	1/2	4
18	.1695	4001695	44.75	.151	4	1	1/2	4
17	.1730	4001730	44.75	.151	4	1	1/2	4
16	.1770	4001770	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
15	.1800	4001800	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
14	.1820	4001820	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
13	.1850	400047	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
12	.1890	400048	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
11	.1910	4001910	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
10	.1935	4001935	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
9	.1960	4001960	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
8	.1990	4001990	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
7	.2010	4002010	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
6	.2040	4002040	41.65	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
5	.2055	4002055	41.65	1 ³ / ₆₄	4	1 1/4	1/2	5
4	.2090	4002090	41.65	1 ³ / ₆₄	4	1 1/4	1/2	5
3	.2130	4002130	41.65	1 ³ / ₆₄	4	1 1/4	1/2	5
2	.2210	4002210	41.65	1 ³ / ₆₄	4	1 1/4	1/2	5
1	.2280	4002280	43.60	7/32	4	1 1/2	1/2	6
A	.2340	4002340	43.60	7/32	4	1 1/2	1/2	6
B	.2380	4002380	43.60	7/32	4	1 1/2	1/2	6

TOOL DIAMETER		TYPE 400 EDP NO.	PRICE	DIMENSIONS				
LETTER	DECIMAL EQUIV.			SHANK DIAM.	NO. OF FLTS	LENGTH		
				FLT	CAR-BIDE	OVER-ALL		
C	.2420	4002420	\$41.65	1 ⁵ / ₆₄	4	1 1/2	1/2	6
D	.2460	4002460	41.65	1 ⁵ / ₆₄	4	1 1/2	1/2	6
E	.2500	40008	31.75	1 ⁵ / ₆₄	4	1 1/2	1/2	6
F	.2570	4002570	42.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
G	.2610	4002610	42.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
H	.2660	4002660	42.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
I	.2720	4002720	42.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
J	.2770	4002770	42.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
K	.2810	4002810	42.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
L	.2900	4002900	42.30	3/32	4	1 1/2	1/2	6
M	.2950	4002950	42.30	3/32	4	1 1/2	1/2	6
N	.3020	4003020	42.30	3/32	4	1 1/2	1/2	6
O	.3160	4003160	43.40	3/32	4	1 1/2	1/2	6
P	.3230	4003230	43.40	3/32	4	1 1/2	1/2	6
Q	.3320	4003320	43.40	3/32	4	1 1/2	1/2	6
R	.3390	4003390	43.40	3/32	4	1 1/2	1/2	6
S	.3480	4003480	39.85	5/16	4	1 3/4	5/8	7
T	.3580	4003580	39.85	5/16	4	1 3/4	5/8	7
U	.3680	4003680	39.85	5/16	4	1 3/4	5/8	7
V	.3770	4003770	39.85	5/16	4	1 3/4	5/8	7
W	.3860	4003860	45.10	5/16	4	1 3/4	5/8	7
X	.3970	4003970	45.10	5/16	4	1 3/4	5/8	7
Y	.4040	4004040	45.10	5/16	4	1 3/4	5/8	7
Z	.4130	4004130	47.40	3/8	4	1 3/4	5/8	7



CHUCKING REAMERS CARBIDE TIPPED TYPE 400 FRACTIONAL



**STRAIGHT FLUTES
STRAIGHT SHANK**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	400/407 ^{MS}
	40	NON-FERROUS - SHORT CHIPS	400/407 ^{MS}
	60	CAST IRONS	400/408 ^{MS}
	80	LOW STRENGTH STEELS	400/409 ^{MS}
	100	MEDIUM STRENGTH STEELS	400/409 ^{MS}
	120	HIGH STRENGTH STEELS	400/409 ^{MS}
140	HIGH TEMPERATURE ALLOYS	409 ^{MS}	

^{MS}See pages 76 & 77 for material specific reamers

TYPE 400

- Straight polished flutes and straight shank
- Detailed specifications on page 29

USE:

- For all general reaming of steels, cast irons, non-ferrous materials, plastics, and non-metals

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Modified metric tool diameter - priced on pg. 52
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius

- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:
See page 41

NOTE: For stocked tool diameters in .0005 increments, see pgs. 48-51. For semi-finished reamers, see pg. 53. For smaller tool diameters, see solid carbide reamers on pgs. 58, 105-107. For shallow holes only (see page 27).

TOOL DIAMETER		TYPE 400 EDP NO.	PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL			SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
		FLT	CARBIDE			OVER-ALL	1	2		3	4	5-7	8-14*		
5/32	.1562	40005	\$34.60	.151	4	1	1/2	4	0.1560-0.1769	\$65.45	\$49.80	\$44.75	\$42.25	\$39.65	\$37.60
11/64	.1719	4001719	34.60	.151	4	1	1/2	4	-	-	-	-	-	-	-
3/16	.1875	40006	31.75	11/64	4	1 1/8	1/2	4 1/2	0.1770-0.2040	61.40	46.55	41.65	39.20	36.70	34.65
3/16	.1875	40086	33.65	11/64	4	1 1/4	1/2	5	0.1770-0.2040	63.30	48.45	43.60	41.10	38.60	36.55
13/64	.2031	4002031	33.65	11/64	4	1 1/8	1/2	4 1/2	-	-	-	-	-	-	-
7/32	.2188	40007	31.75	13/64	4	1 1/4	1/2	5	0.2041-0.2210	61.40	46.55	41.65	39.20	36.70	34.65
15/64	.2344	4002344	33.65	7/32	4	1 1/2	1/2	6	0.2211-0.2380	63.30	48.45	43.60	41.10	38.60	36.55
1/4	.2500	40008	31.75	15/64	4	1 1/2	1/2	6	0.2381-0.2530	61.40	46.55	41.65	39.20	36.70	34.65
17/64	.2656	4002656	34.40	15/64	4	1 1/2	1/2	6	-	-	-	-	-	-	-
9/32	.2812	40009	32.45	15/64	4	1 1/2	1/2	6	0.2531-0.2840	62.10	47.25	42.30	39.90	37.35	35.35
19/64	.2969	4002969	34.40	9/32	4	1 1/2	1/2	6	-	-	-	-	-	-	-
5/16	.3125	40010	32.45	9/32	4	1 1/2	1/2	6	0.2841-0.3150	62.10	47.25	42.30	39.90	37.35	35.35
21/64	.3281	4003281	35.65	9/32	4	1 1/2	5/8	6	-	-	-	-	-	-	-
11/32	.3438	40011	33.60	9/32	4	1 1/2	5/8	6	0.3151-0.3470	63.25	48.40	43.40	41.05	38.55	36.50
23/64	.3594	4003594	35.65	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-
3/8	.3750	40012	33.60	5/16	4	1 3/4	5/8	7	0.3471-0.3780	63.25	48.40	43.40	41.05	38.55	36.50
25/64	.3906	4003906	37.45	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-
13/32	.4062	40013	35.25	5/16	4	1 3/4	5/8	7	0.3781-0.4090	64.90	50.05	45.10	42.70	40.15	38.15
27/64	.4219	4004219	39.85	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-
7/16	.4375	40014	37.65	3/8	4	1 3/4	5/8	7	0.4091-0.4410	67.30	52.45	47.40	45.10	42.50	40.55
29/64	.4531	4004531	40.50	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-
15/32	.4688	40015	38.15	3/8	4	1 3/4	5/8	7	0.4411-0.4720	67.85	52.95	48.00	45.60	43.05	41.05
31/64	.4844	4004844	43.75	7/16	6	2	5/8	8	-	-	-	-	-	-	-
1/2	.5000	40016	45.40	7/16	6	2	5/8	8	0.4721-0.5030	78.05	61.75	56.25	53.65	50.80	48.60
33/64	.5156	4005156	49.40	7/16	6	2	5/8	8	-	-	-	-	-	-	-
17/32	.5312	40017	49.40	7/16	6	2	5/8	8	0.5031-0.5340	82.10	65.75	60.30	57.65	54.80	52.65
35/64	.5469	4005469	49.40	7/16	6	2	5/8	8	-	-	-	-	-	-	-
9/16	.5625	40018	49.40	7/16	6	2	5/8	8	0.5341-0.5660	82.10	65.75	60.30	57.65	54.80	52.65
37/64	.5781	4005781	51.40	7/16	6	2	5/8	8	-	-	-	-	-	-	-
19/32	.5938	40019	51.40	7/16	6	2	5/8	8	0.5661-0.5970	84.10	67.70	62.20	59.65	56.80	54.65
39/64	.6094	4006094	51.40	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
5/8	.6250	40020	51.40	9/16	6	2 1/4	5/8	9	0.5971-0.6280	84.10	67.70	62.20	59.65	56.80	54.65
41/64	.6406	4006406	52.30	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
21/32	.6562	40021	52.30	9/16	6	2 1/4	5/8	9	0.6281-0.6590	84.95	68.55	63.10	60.50	57.70	55.50
43/64	.6719	4006719	52.30	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
11/16	.6875	40022	52.30	9/16	6	2 1/4	5/8	9	0.6591-0.6910	84.95	68.55	63.10	60.50	57.70	55.50
45/64	.7031	4007031	54.75	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
23/32	.7188	40023	54.75	9/16	6	2 1/4	5/8	9	0.6911-0.7220	87.40	71.10	65.55	63.00	60.15	58.00
47/64	.7344	4007344	54.75	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
3/4	.7500	40024	54.75	5/8	6	2 1/2	3/4	9 1/2	0.7221-0.7530	87.40	71.10	65.55	63.00	60.15	58.00

CONTINUED ON NEXT PAGE

*Quantities of 15 or more - price of fractional size in same size range.

TOOL DIAMETER		TYPE 400 EDP NO.	PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL			SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
		FLT	CAR-BIDE			OVER-ALL	1	2		3	4	5-7	8-14*		
.49/64	.7656	4007656	\$56.55	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
.25/32	.7812	40025	56.55	5/8	6	2 1/2	3/4	9 1/2	0.7531-0.7840	\$89.20	\$72.85	\$67.40	\$64.80	\$62.00	\$59.75
.51/64	.7969	4007969	56.55	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
.13/16	.8125	40026	56.55	5/8	6	2 1/2	3/4	9 1/2	0.7841-0.8160	89.20	72.85	67.40	64.80	62.00	59.75
.53/64	.8281	4008281	58.80	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
.27/32	.8438	40027	58.80	5/8	6	2 1/2	3/4	9 1/2	0.8161-0.8470	91.50	75.15	69.65	67.05	64.20	62.05
.55/64	.8594	4008594	58.80	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-
.7/8	.8750	40028	61.05	3/4	6	2 5/8	3/4	10	0.8471-0.8780	94.90	77.95	72.30	69.60	66.60	64.35
.57/64	.8906	4008906	71.10	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-
.29/32	.9062	40029	71.10	3/4	6	2 5/8	3/4	10	0.8781-0.9090	105.00	88.00	82.35	79.65	76.70	74.45
.59/64	.9219	4009219	71.10	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-
.15/16	.9375	40030	71.10	3/4	8	2 5/8	3/4	10	0.9091-0.9410	105.00	88.00	82.35	79.65	76.70	74.45
.61/64	.9531	4009531	74.55	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-
.31/32	.9688	40031	74.55	3/4	8	2 5/8	3/4	10	0.9411-0.9720	108.45	91.45	85.85	83.10	80.15	77.90
.63/64	.9844	4009844	74.55	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-
1	1.0000	40032	74.55	7/8	8	2 3/4	3/4	10 1/2	0.9721-1.0030	108.45	91.45	85.85	83.10	80.15	77.90
1 1/16	1.0625	40034	77.05	7/8	8	2 3/4	3/4	10 1/2	1.0031-1.0660	109.60	93.35	87.85	85.30	82.50	80.25
1 1/8	1.1250	40036	83.30	7/8	8	2 7/8	7/8	11	1.0661-1.1280	115.85	99.55	94.15	91.55	88.70	86.50
1 3/16	1.1875	40038	87.60	1	8	2 7/8	7/8	11	1.1281-1.1905	120.05	103.80	98.35	95.75	93.00	90.75
1 1/4	1.2500	40040	92.60	1	8	3	7/8	11 1/2	1.1906-1.2530	125.15	108.90	103.40	100.85	98.00	95.80
1 5/16	1.3125	40042	97.45	1	8	3	7/8	11 1/2	1.2531-1.3155	129.90	113.65	108.15	105.60	102.80	100.60
1 3/8	1.3750	40044	103.40	1	8	3 1/4	7/8	12	1.3156-1.3780	135.85	119.60	114.20	111.55	108.80	106.65
1 7/16	1.4375	40046	115.20	1 1/4	8	3 1/4	7/8	12	1.3781-1.4405	147.75	131.45	126.00	123.45	120.60	118.40
1 1/2	1.5000	40048	121.80	1 1/4	8	3 1/2	7/8	12 1/2	1.4406-1.5030	154.25	138.00	132.50	130.00	127.15	124.95
1 9/16	1.5625	40050	180.90	1 1/4	8	3 1/2	7/8	12 1/2	1.5031-1.5660	213.35	197.10	191.70	189.05	186.30	184.10
1 5/8	1.6250	40052	187.10	1 1/4	8	3 3/4	7/8	13	1.5661-1.6280	219.55	203.30	197.85	195.25	192.45	190.25
1 11/16	1.6875	40054	210.40	1 1/4	8	3 3/4	7/8	13	1.6281-1.6910	242.95	226.70	221.25	218.65	215.90	213.70
1 3/4	1.7500	40056	210.40	1 1/4	10	4	7/8	13 1/2	1.6911-1.7530	242.95	226.70	221.25	218.65	215.90	213.70
1 13/16	1.8125	40058	210.40	1 1/2	10	4	7/8	13 1/2	1.7531-1.8160	242.95	226.70	221.25	218.65	215.90	213.70
1 7/8	1.8750	40060	220.50	1 1/2	10	4 1/4	7/8	14	1.8161-1.8780	252.95	236.70	231.20	228.65	225.85	223.65
1 15/16	1.9375	40062	220.50	1 1/2	10	4 1/4	7/8	14	1.8781-1.9410	252.95	236.70	231.20	228.65	225.85	223.65
2	2.0000	40064	220.50	1 1/2	12	4 1/4	7/8	14	1.9411-2.0030	252.95	236.70	231.20	228.65	225.85	223.65

*Quantities of 15 or more - price of fractional size in same size range.

OVER & UNDER SIZE REAMERS CARBIDE TIPPED



TYPE 478 - STRAIGHT FLUTES & SHANK

- Tool diameter tolerance: plus .0002", minus .0000"
- Same specifications and available modifications as Type 400 (pg. 46)

USE:

- These precision ground carbide tipped reamers are very effective for finishing accurate holes in most materials

DECIMAL TOOL DIAMETER	TYPE 478 EDP NO.	PRICE	DIMENSIONS				
			SHANK DIAM.	NO. OF FLUTES	LENGTH		
FLUTE	CAR-BIDE	OVER-ALL					
.1865	47818	\$39.95	1/64	4	1 1/8	1/2	4 1/2
.1885	47819	39.95	1/64	4	1 1/8	1/2	4 1/2
.2490	47824	39.95	1/64	4	1 1/2	1/2	6
.2510	47825	39.95	1/64	4	1 1/2	1/2	6
.3115	47831	40.85	3/32	4	1 1/2	1/2	6
.3135	47832	40.85	3/32	4	1 1/2	1/2	6
.3740	47837	42.35	5/16	4	1 3/4	5/8	7
.3760	47838	42.35	5/16	4	1 3/4	5/8	7
.4365	47843	47.35	3/8	4	1 3/4	5/8	7
.4385	47844	47.35	3/8	4	1 3/4	5/8	7
.4990	47849	51.90	7/16	6	2	5/8	8
.5010	47850	51.90	7/16	6	2	5/8	8
.6240	47862	62.20	9/16	6	2 1/4	5/8	9
.6260	47863	62.20	9/16	6	2 1/4	5/8	9
.7490	47874	65.55	5/8	6	2 1/2	3/4	9 1/2
.7510	47875	65.55	5/8	6	2 1/2	3/4	9 1/2
.8740	47886	69.65	3/4	6	2 5/8	3/4	10
.8760	47887	72.30	3/4	6	2 5/8	3/4	10
.9990	47898	85.90	7/8	8	2 3/4	3/4	10 1/2
1.0010	47899	82.30	7/8	8	2 3/4	3/4	10 1/2

DOWEL PIN SIZE REAMERS CARBIDE TIPPED



TYPE 476 - STRAIGHT FLUTES & SHANK

- Special plus .0000", minus .0002" tool diameter tolerance
- Same specifications and available modifications as Type 400 (pg. 46)

USE:

- These precision ground reamers should be used in pairs, .0005" and .0020" under the dowel pin diameter. The .0020" smaller holes assure a tighter dowel pin fit, so all the pins will remain on the same side upon disassembly. Especially useful in plastic or die cast molds and machines when assembled sections are subject to shearing stress, yet require occasional disassembly.

DECIMAL TOOL DIAMETER	TYPE 476 EDP NO.	PRICE	DIMENSIONS				
			SHANK DIAM.	NO. OF FLUTES	LENGTH		
FLUTE	CAR-BIDE	OVER-ALL					
.1855	47617	\$39.95	1/64	4	1 1/8	1/2	4 1/2
.1870	47618	39.95	1/64	4	1 1/8	1/2	4 1/2
.2480	47623	39.95	15/64	4	1 1/2	1/2	6
.2495	47624	39.95	15/64	4	1 1/2	1/2	6
.3105	47630	40.85	3/32	4	1 1/2	1/2	6
.3120	47631	40.85	3/32	4	1 1/2	1/2	6
.3730	47636	42.35	5/16	4	1 3/4	5/8	7
.3745	47637	42.35	5/16	4	1 3/4	5/8	7
.4355	47642	47.35	3/8	4	1 3/4	5/8	7
.4370	47643	47.35	3/8	4	1 3/4	5/8	7
.4980	47648	51.90	7/16	6	2	5/8	8
.4995	47649	51.90	7/16	6	2	5/8	8
	47600	\$498.60	- CASED SET OF ABOVE 12 REAMERS				



CHUCKING REAMERS CARBIDE TIPPED TYPE 400 .0005 INCREMENTS



STOCKED DECIMAL TOOL DIAMETERS (.1560 TO .3055) STRAIGHT FLUTES & SHANK

For shallow holes only (see page 27)

NOTE: Dimension details and available modifications listed on page 46.

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.1560	4001560	\$44.75	.1860	4001860	\$41.65	.2160	4002160	\$41.65	.2460	4002460	\$41.65	.2760	4002760	\$42.30
.1565	4001565	44.75	.1865	47818	39.95	.2165	400055	41.65	.2465	4002465	41.65	.2765	4002765	42.30
.1570	4001570	44.75	.1870	4001870	41.65	.2170	4002170	41.65	.2470	4002470	41.65	.2770	4002770	42.30
.1575	400040	44.75	.1875	40006	31.75	.2175	4002175	41.65	.2475	4002475	41.65	.2775	4002775	42.30
.1580	4001580	44.75	.1880	4001880	41.65	.2180	4002180	41.65	.2480	400063	41.65	.2780	4002780	42.30
.1585	4001585	44.75	.1885	47819	39.95	.2185	4002185	41.65	.2485	4002485	41.65	.2785	4002785	42.30
.1590	4001590	44.75	.1890	400048	41.65	.2190	4002190	41.65	.2490	47824	39.95	.2790	4002790	42.30
.1595	4001595	44.75	.1895	4001895	41.65	.2195	4002195	41.65	.2495	4002495	41.65	.2795	400071	42.30
.1600	4001600	44.75	.1900	4001900	41.65	.2200	4002200	41.65	.2500	40008	31.75	.2800	4002800	42.30
.1605	4001605	44.75	.1905	4001905	41.65	.2205	400056	41.65	.2505	4002505	41.65	.2805	4002805	42.30
.1610	4001610	44.75	.1910	4001910	41.65	.2210	4002210	41.65	.2510	47825	39.95	.2810	4002810	42.30
.1615	4001615	44.75	.1915	4001915	41.65	.2215	4002215	43.60	.2515	4002515	41.65	.2815	4002815	42.30
.1620	4001620	44.75	.1920	4001920	41.65	.2220	4002220	43.60	.2520	400064	41.65	.2820	4002820	42.30
.1625	4001625	44.75	.1925	4001925	41.65	.2225	4002225	43.60	.2525	4002525	41.65	.2825	4002825	42.30
.1630	4001630	44.75	.1930	4001930	41.65	.2230	4002230	43.60	.2530	4002530	41.65	.2830	4002830	42.30
.1635	4001635	44.75	.1935	4001935	41.65	.2235	4002235	43.60	.2535	4002535	42.30	.2835	400072	42.30
.1640	4001640	44.75	.1940	4001940	41.65	.2240	4002240	43.60	.2540	4002540	42.30	.2840	4002840	42.30
.1645	4001645	44.75	.1945	4001945	41.65	.2245	4002245	43.60	.2545	4002545	42.30	.2845	4002845	42.30
.1650	4001650	44.75	.1950	4001950	41.65	.2250	4002250	43.60	.2550	4002550	42.30	.2850	4002850	42.30
.1655	4001655	44.75	.1955	4001955	41.65	.2255	4002255	43.60	.2555	4002555	42.30	.2855	4002855	42.30
.1660	4001660	44.75	.1960	4001960	41.65	.2260	4002260	43.60	.2560	4002560	42.30	.2860	4002860	42.30
.1665	4001665	44.75	.1965	4001965	41.65	.2265	4002265	43.60	.2565	4002565	42.30	.2865	4002865	42.30
.1670	4001670	44.75	.1970	4001970	41.65	.2270	4002270	43.60	.2570	4002570	42.30	.2870	4002870	42.30
.1675	4001675	44.75	.1975	4001975	41.65	.2275	4002275	43.60	.2575	4002575	42.30	.2875	4002875	42.30
.1680	4001680	44.75	.1980	4001980	41.65	.2280	4002280	43.60	.2580	4002580	42.30	.2880	4002880	42.30
.1685	4001685	44.75	.1985	4001985	41.65	.2285	4002285	43.60	.2585	4002585	42.30	.2885	4002885	42.30
.1690	4001690	44.75	.1990	4001990	41.65	.2290	4002290	43.60	.2590	4002590	42.30	.2890	4002890	42.30
.1695	4001695	44.75	.1995	4001995	41.65	.2295	4002295	43.60	.2595	4002595	42.30	.2895	4002895	42.30
.1700	4001700	44.75	.2000	4002000	41.65	.2300	4002300	43.60	.2600	4002600	42.30	.2900	4002900	42.30
.1705	4001705	44.75	.2005	4002005	41.65	.2305	4002305	43.60	.2605	4002605	42.30	.2905	4002905	42.30
.1710	4001710	44.75	.2010	4002010	41.65	.2310	4002310	43.60	.2610	4002610	42.30	.2910	4002910	42.30
.1715	4001715	44.75	.2015	4002015	41.65	.2315	4002315	43.60	.2615	4002615	42.30	.2915	4002915	42.30
.1720	4001720	44.75	.2020	4002020	41.65	.2320	4002320	43.60	.2620	4002620	42.30	.2920	4002920	42.30
.1725	4001725	44.75	.2025	4002025	41.65	.2325	4002325	43.60	.2625	4002625	42.30	.2925	4002925	42.30
.1730	4001730	44.75	.2030	4002030	41.65	.2330	4002330	43.60	.2630	4002630	42.30	.2930	4002930	42.30
.1735	4001735	44.75	.2035	4002035	41.65	.2335	4002335	43.60	.2635	4002635	42.30	.2935	4002935	42.30
.1740	4001740	44.75	.2040	4002040	41.65	.2340	4002340	43.60	.2640	4002640	42.30	.2940	4002940	42.30
.1745	4001745	44.75	.2045	4002045	41.65	.2345	4002345	43.60	.2645	4002645	42.30	.2945	4002945	42.30
.1750	4001750	44.75	.2050	4002050	41.65	.2350	4002350	43.60	.2650	4002650	42.30	.2950	4002950	42.30
.1755	4001755	44.75	.2055	4002055	41.65	.2355	4002355	43.60	.2655	4002655	42.30	.2955	4002955	42.30
.1760	4001760	44.75	.2060	4002060	41.65	.2360	4002360	43.60	.2660	4002660	42.30	.2960	4002960	42.30
.1765	4001765	44.75	.2065	4002065	41.65	.2365	4002365	43.60	.2665	4002665	42.30	.2965	4002965	42.30
.1770	4001770	41.65	.2070	4002070	41.65	.2370	4002370	43.60	.2670	4002670	42.30	.2970	4002970	42.30
.1775	4001775	41.65	.2075	4002075	41.65	.2375	4002375	43.60	.2675	4002675	42.30	.2975	4002975	42.30
.1780	4001780	41.65	.2080	4002080	41.65	.2380	4002380	43.60	.2680	4002680	42.30	.2980	4002980	42.30
.1785	4001785	41.65	.2085	4002085	41.65	.2385	4002385	41.65	.2685	4002685	42.30	.2985	4002985	42.30
.1790	4001790	41.65	.2090	4002090	41.65	.2390	4002390	41.65	.2690	4002690	42.30	.2990	4002990	42.30
.1795	4001795	41.65	.2095	4002095	41.65	.2395	4002395	41.65	.2695	4002695	42.30	.2995	4002995	42.30
.1800	4001800	41.65	.2100	4002100	41.65	.2400	4002400	41.65	.2700	4002700	42.30	.3000	4003000	42.30
.1805	4001805	41.65	.2105	4002105	41.65	.2405	4002405	41.65	.2705	4002705	42.30	.3005	4003005	42.30
.1810	4001810	41.65	.2110	4002110	41.65	.2410	4002410	41.65	.2710	4002710	42.30	.3010	4003010	42.30
.1815	4001815	41.65	.2115	4002115	41.65	.2415	4002415	41.65	.2715	4002715	42.30	.3015	4003015	42.30
.1820	4001820	41.65	.2120	4002120	41.65	.2420	4002420	41.65	.2720	4002720	42.30	.3020	4003020	42.30
.1825	4001825	41.65	.2125	4002125	41.65	.2425	4002425	41.65	.2725	4002725	42.30	.3025	4003025	42.30
.1830	4001830	41.65	.2130	4002130	41.65	.2430	4002430	41.65	.2730	4002730	42.30	.3030	4003030	42.30
.1835	4001835	41.65	.2135	4002135	41.65	.2435	4002435	41.65	.2735	4002735	42.30	.3035	4003035	42.30
.1840	4001840	41.65	.2140	4002140	41.65	.2440	4002440	41.65	.2740	4002740	42.30	.3040	4003040	42.30
.1845	4001845	41.65	.2145	4002145	41.65	.2445	4002445	41.65	.2745	4002745	42.30	.3045	4003045	42.30
.1850	400047	41.65	.2150	4002150	41.65	.2450	4002450	41.65	.2750	4002750	42.30	.3050	4003050	42.30
.1855	4001855	41.65	.2155	4002155	41.65	.2455	4002455	41.65	.2755	4002755	42.30	.3055	4003055	42.30

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 400 .0005 INCREMENTS



STOCKED DECIMAL TOOL DIAMETERS (.3060 TO .4555) STRAIGHT FLUTES & SHANK

For shallow holes only (see page 27)

NOTE: Dimension details and available modifications listed on page 46.

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.3060	4003060	\$42.30	.3360	4003360	\$43.40	.3660	4003660	\$39.85	.3960	4003960	\$45.10	.4260	4004260	\$47.40
.3065	4003065	42.30	.3365	4003365	43.40	.3665	4003665	39.85	.3965	4003965	45.10	.4265	4004265	47.40
.3070	4003070	42.30	.3370	4003370	43.40	.3670	4003670	39.85	.3970	4003970	45.10	.4270	4004270	47.40
.3075	4003075	42.30	.3375	4003375	43.40	.3675	4003675	39.85	.3975	4003975	45.10	.4275	4004275	47.40
.3080	4003080	42.30	.3380	4003380	43.40	.3680	4003680	39.85	.3980	4003980	45.10	.4280	4004280	47.40
.3085	4003085	42.30	.3385	4003385	43.40	.3685	4003685	39.85	.3985	4003985	45.10	.4285	4004285	47.40
.3090	4003090	42.30	.3390	4003390	43.40	.3690	4003690	39.85	.3990	4003990	45.10	.4290	4004290	47.40
.3095	4003095	42.30	.3395	4003395	43.40	.3695	4003695	39.85	.3995	4003995	45.10	.4295	4004295	47.40
.3100	4003100	42.30	.3400	4003400	43.40	.3700	4003700	39.85	.4000	4004000	45.10	.4300	4004300	47.40
.3105	4003105	42.30	.3405	4003405	43.40	.3705	4003705	39.85	.4005	4004005	45.10	.4305	4004305	47.40
.3110	400079	42.30	.3410	4003410	43.40	.3710	4003710	39.85	.4010	4004010	45.10	.4310	4004310	47.40
.3115	47831	40.85	.3415	4003415	43.40	.3715	4003715	39.85	.4015	4004015	45.10	.4315	4004315	47.40
.3120	4003120	42.30	.3420	4003420	43.40	.3720	4003720	39.85	.4020	4004020	45.10	.4320	4004320	47.40
.3125	40010	32.45	.3425	400087	43.40	.3725	4003725	39.85	.4025	4004025	45.10	.4325	4004325	47.40
.3130	4003130	42.30	.3430	4003430	43.40	.3730	4003730	39.85	.4030	4004030	45.10	.4330	4004330	47.40
.3135	47832	40.85	.3435	4003435	43.40	.3735	4003735	39.85	.4035	4004035	45.10	.4335	4004335	47.40
.3140	4003140	42.30	.3440	4003440	43.40	.3740	47837	42.35	.4040	4004040	45.10	.4340	4004340	47.40
.3145	4003145	42.30	.3445	4003445	43.40	.3745	4003745	39.85	.4045	4004045	45.10	.4345	4004345	47.40
.3150	400080	42.30	.3450	4003450	43.40	.3750	40012	33.60	.4050	4004050	45.10	.4350	4004350	47.40
.3155	4003155	43.40	.3455	4003455	43.40	.3755	4003755	39.85	.4055	400103	45.10	.4355	4004355	47.40
.3160	4003160	43.40	.3460	4003460	43.40	.3760	47838	42.35	.4060	4004060	45.10	.4360	4004360	47.40
.3165	4003165	43.40	.3465	400088	43.40	.3765	4003765	39.85	.4065	4004065	45.10	.4365	47843	47.35
.3170	4003170	43.40	.3470	4003470	43.40	.3770	4003770	39.85	.4070	4004070	45.10	.4370	400111	47.40
.3175	4003175	43.40	.3475	4003475	39.85	.3775	4003775	39.85	.4075	4004075	45.10	.4375	40014	37.65
.3180	4003180	43.40	.3480	4003480	39.85	.3780	400096	39.85	.4080	4004080	45.10	.4380	4004380	47.40
.3185	4003185	43.40	.3485	4003485	39.85	.3785	4003785	45.10	.4085	4004085	45.10	.4385	47844	47.35
.3190	4003190	43.40	.3490	4003490	39.85	.3790	4003790	45.10	.4090	4004090	45.10	.4390	4004390	47.40
.3195	4003195	43.40	.3495	4003495	39.85	.3795	4003795	45.10	.4095	4004095	47.40	.4395	4004395	47.40
.3200	4003200	43.40	.3500	4003500	39.85	.3800	4003800	45.10	.4100	4004100	47.40	.4400	4004400	47.40
.3205	4003205	43.40	.3505	4003505	39.85	.3805	4003805	45.10	.4105	4004105	47.40	.4405	4004405	47.40
.3210	4003210	43.40	.3510	4003510	39.85	.3810	4003810	45.10	.4110	4004110	47.40	.4410	4004410	47.40
.3215	4003215	43.40	.3515	4003515	39.85	.3815	4003815	45.10	.4115	4004115	47.40	.4415	4004415	48.00
.3220	4003220	43.40	.3520	4003520	39.85	.3820	4003820	45.10	.4120	4004120	47.40	.4420	4004420	48.00
.3225	4003225	43.40	.3525	4003525	39.85	.3825	4003825	45.10	.4125	4004125	47.40	.4425	4004425	48.00
.3230	4003230	43.40	.3530	4003530	39.85	.3830	4003830	45.10	.4130	4004130	47.40	.4430	4004430	48.00
.3235	4003235	43.40	.3535	4003535	39.85	.3835	4003835	45.10	.4135	4004135	47.40	.4435	4004435	48.00
.3240	4003240	43.40	.3540	4003540	39.85	.3840	4003840	45.10	.4140	4004140	47.40	.4440	4004440	48.00
.3245	4003245	43.40	.3545	4003545	39.85	.3845	4003845	45.10	.4145	4004145	47.40	.4445	4004445	48.00
.3250	4003250	43.40	.3550	4003550	39.85	.3850	4003850	45.10	.4150	4004150	47.40	.4450	4004450	48.00
.3255	4003255	43.40	.3555	4003555	39.85	.3855	4003855	45.10	.4155	4004155	47.40	.4455	4004455	48.00
.3260	4003260	43.40	.3560	4003560	39.85	.3860	4003860	45.10	.4160	4004160	47.40	.4460	4004460	48.00
.3265	4003265	43.40	.3565	4003565	39.85	.3865	4003865	45.10	.4165	4004165	47.40	.4465	4004465	48.00
.3270	4003270	43.40	.3570	4003570	39.85	.3870	4003870	45.10	.4170	4004170	47.40	.4470	4004470	48.00
.3275	4003275	43.40	.3575	4003575	39.85	.3875	4003875	45.10	.4175	4004175	47.40	.4475	4004475	48.00
.3280	4003280	43.40	.3580	4003580	39.85	.3880	4003880	45.10	.4180	4004180	47.40	.4480	4004480	48.00
.3285	4003285	43.40	.3585	4003585	39.85	.3885	4003885	45.10	.4185	4004185	47.40	.4485	4004485	48.00
.3290	4003290	43.40	.3590	4003590	39.85	.3890	4003890	45.10	.4190	4004190	47.40	.4490	4004490	48.00
.3295	4003295	43.40	.3595	4003595	39.85	.3895	4003895	45.10	.4195	4004195	47.40	.4495	4004495	48.00
.3300	4003300	43.40	.3600	4003600	39.85	.3900	4003900	45.10	.4200	4004200	47.40	.4500	4004500	48.00
.3305	4003305	43.40	.3605	4003605	39.85	.3905	4003905	45.10	.4205	4004205	47.40	.4505	4004505	48.00
.3310	4003310	43.40	.3610	4003610	39.85	.3910	4003910	45.10	.4210	4004210	47.40	.4510	4004510	48.00
.3315	4003315	43.40	.3615	4003615	39.85	.3915	4003915	45.10	.4215	4004215	47.40	.4515	4004515	48.00
.3320	4003320	43.40	.3620	4003620	39.85	.3920	4003920	45.10	.4220	4004220	47.40	.4520	4004520	48.00
.3325	4003325	43.40	.3625	4003625	39.85	.3925	4003925	45.10	.4225	4004225	47.40	.4525	4004525	48.00
.3330	4003330	43.40	.3630	4003630	39.85	.3930	4003930	45.10	.4230	4004230	47.40	.4530	4004530	48.00
.3335	4003335	43.40	.3635	4003635	39.85	.3935	4003935	45.10	.4235	4004235	47.40	.4535	4004535	48.00
.3340	4003340	43.40	.3640	4003640	39.85	.3940	4003940	45.10	.4240	4004240	47.40	.4540	4004540	48.00
.3345	4003345	43.40	.3645	4003645	39.85	.3945	4003945	45.10	.4245	4004245	47.40	.4545	4004545	48.00
.3350	4003350	43.40	.3650	4003650	39.85	.3950	4003950	45.10	.4250	4004250	47.40	.4550	4004550	48.00
.3355	4003355	43.40	.3655	4003655	39.85	.3955	4003955	45.10	.4255	4004255	47.40	.4555	4004555	48.00

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 400 .0005 INCREMENTS



STOCKED DECIMAL TOOL DIAMETERS (.4560 TO .6055) STRAIGHT FLUTES & SHANK

For shallow holes only (see page 27)

NOTE: Dimension details and available modifications listed on page 46.

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.4560	4004560	\$48.00	.4860	4004860	\$56.25	.5160	4005160	\$60.30	.5460	4005460	\$60.30	.5760	4005760	\$62.20
.4565	4004565	48.00	.4865	4004865	56.25	.5165	4005165	60.30	.5465	4005465	60.30	.5765	4005765	62.20
.4570	4004570	48.00	.4870	4004870	56.25	.5170	4005170	60.30	.5470	4005470	60.30	.5770	4005770	62.20
.4575	4004575	48.00	.4875	4004875	56.25	.5175	4005175	60.30	.5475	4005475	60.30	.5775	4005775	62.20
.4580	4004580	48.00	.4880	4004880	56.25	.5180	4005180	60.30	.5480	4005480	60.30	.5780	4005780	62.20
.4585	4004585	48.00	.4885	4004885	56.25	.5185	4005185	60.30	.5485	4005485	60.30	.5785	4005785	62.20
.4590	4004590	48.00	.4890	4004890	56.25	.5190	4005190	60.30	.5490	4005490	60.30	.5790	4005790	62.20
.4595	4004595	48.00	.4895	4004895	56.25	.5195	4005195	60.30	.5495	4005495	60.30	.5795	4005795	62.20
.4600	4004600	48.00	.4900	4004900	56.25	.5200	4005200	60.30	.5500	4005500	60.30	.5800	4005800	62.20
.4605	4004605	48.00	.4905	4004905	56.25	.5205	4005205	60.30	.5505	4005505	60.30	.5805	4005805	62.20
.4610	4004610	48.00	.4910	4004910	56.25	.5210	4005210	60.30	.5510	4005510	60.30	.5810	4005810	62.20
.4615	4004615	48.00	.4915	4004915	56.25	.5215	4005215	60.30	.5515	4005515	60.30	.5815	4005815	62.20
.4620	4004620	48.00	.4920	4004920	56.25	.5220	4005220	60.30	.5520	4005520	60.30	.5820	4005820	62.20
.4625	4004625	48.00	.4925	4004925	56.25	.5225	4005225	60.30	.5525	4005525	60.30	.5825	4005825	62.20
.4630	4004630	48.00	.4930	4004930	56.25	.5230	4005230	60.30	.5530	4005530	60.30	.5830	4005830	62.20
.4635	4004635	48.00	.4935	4004935	56.25	.5235	4005235	60.30	.5535	4005535	60.30	.5835	4005835	62.20
.4640	4004640	48.00	.4940	4004940	56.25	.5240	4005240	60.30	.5540	4005540	60.30	.5840	4005840	62.20
.4645	4004645	48.00	.4945	4004945	56.25	.5245	4005245	60.30	.5545	4005545	60.30	.5845	4005845	62.20
.4650	4004650	48.00	.4950	4004950	56.25	.5250	4005250	60.30	.5550	4005550	60.30	.5850	4005850	62.20
.4655	4004655	48.00	.4955	4004955	56.25	.5255	4005255	60.30	.5555	4005555	60.30	.5855	4005855	62.20
.4660	4004660	48.00	.4960	4004960	56.25	.5260	4005260	60.30	.5560	4005560	60.30	.5860	4005860	62.20
.4665	4004665	48.00	.4965	4004965	56.25	.5265	4005265	60.30	.5565	4005565	60.30	.5865	4005865	62.20
.4670	4004670	48.00	.4970	4004970	56.25	.5270	4005270	60.30	.5570	4005570	60.30	.5870	4005870	62.20
.4675	4004675	48.00	.4975	4004975	56.25	.5275	4005275	60.30	.5575	4005575	60.30	.5875	4005875	62.20
.4680	4004680	48.00	.4980	4004980	56.25	.5280	4005280	60.30	.5580	4005580	60.30	.5880	4005880	62.20
.4685	400119	48.00	.4985	4004985	56.25	.5285	4005285	60.30	.5585	4005585	60.30	.5885	4005885	62.20
.4690	4004690	48.00	.4990	47849	51.90	.5290	4005290	60.30	.5590	4005590	60.30	.5890	4005890	62.20
.4695	4004695	48.00	.4995	4004995	56.25	.5295	4005295	60.30	.5595	4005595	60.30	.5895	4005895	62.20
.4700	4004700	48.00	.5000	40016	45.40	.5300	4005300	60.30	.5600	4005600	60.30	.5900	4005900	62.20
.4705	4004705	48.00	.5005	4005005	56.25	.5305	4005305	60.30	.5605	4005605	60.30	.5905	4005905	62.20
.4710	4004710	48.00	.5010	47850	51.90	.5310	4005310	60.30	.5610	4005610	60.30	.5910	4005910	62.20
.4715	4004715	48.00	.5015	4005015	56.25	.5315	400135	60.30	.5615	4005615	60.30	.5915	4005915	62.20
.4720	4004720	48.00	.5020	4005020	56.25	.5320	4005320	60.30	.5620	4005620	60.30	.5920	4005920	62.20
.4725	4004725	56.25	.5025	4005025	56.25	.5325	4005325	60.30	.5625	40018	49.40	.5925	4005925	62.20
.4730	4004730	56.25	.5030	4005030	56.25	.5330	4005330	60.30	.5630	400143	60.30	.5930	4005930	62.20
.4735	4004735	56.25	.5035	4005035	60.30	.5335	4005335	60.30	.5635	4005635	60.30	.5935	4005935	62.20
.4740	4004740	56.25	.5040	4005040	60.30	.5340	4005340	60.30	.5640	4005640	60.30	.5940	4005940	62.20
.4745	4004745	56.25	.5045	4005045	60.30	.5345	4005345	60.30	.5645	4005645	60.30	.5945	400151	62.20
.4750	4004750	56.25	.5050	4005050	60.30	.5350	4005350	60.30	.5650	4005650	60.30	.5950	4005950	62.20
.4755	4004755	56.25	.5055	4005055	60.30	.5355	4005355	60.30	.5655	4005655	60.30	.5955	4005955	62.20
.4760	4004760	56.25	.5060	4005060	60.30	.5360	4005360	60.30	.5660	4005660	60.30	.5960	4005960	62.20
.4765	4004765	56.25	.5065	4005065	60.30	.5365	4005365	60.30	.5665	4005665	62.20	.5965	4005965	62.20
.4770	4004770	56.25	.5070	4005070	60.30	.5370	4005370	60.30	.5670	4005670	62.20	.5970	4005970	62.20
.4775	4004775	56.25	.5075	4005075	60.30	.5375	4005375	60.30	.5675	4005675	62.20	.5975	4005975	62.20
.4780	4004780	56.25	.5080	4005080	60.30	.5380	4005380	60.30	.5680	4005680	62.20	.5980	4005980	62.20
.4785	4004785	56.25	.5085	4005085	60.30	.5385	4005385	60.30	.5685	4005685	62.20	.5985	4005985	62.20
.4790	4004790	56.25	.5090	4005090	60.30	.5390	4005390	60.30	.5690	4005690	62.20	.5990	4005990	62.20
.4795	4004795	56.25	.5095	4005095	60.30	.5395	4005395	60.30	.5695	4005695	62.20	.5995	4005995	62.20
.4800	4004800	56.25	.5100	4005100	60.30	.5400	4005400	60.30	.5700	4005700	62.20	.6000	4006000	62.20
.4805	4004805	56.25	.5105	4005105	60.30	.5405	4005405	60.30	.5705	4005705	62.20	.6005	4006005	62.20
.4810	4004810	56.25	.5110	4005110	60.30	.5410	4005410	60.30	.5710	4005710	62.20	.6010	4006010	62.20
.4815	4004815	56.25	.5115	4005115	60.30	.5415	4005415	60.30	.5715	4005715	62.20	.6015	4006015	62.20
.4820	4004820	56.25	.5120	4005120	60.30	.5420	4005420	60.30	.5720	4005720	62.20	.6020	4006020	62.20
.4825	4004825	56.25	.5125	4005125	60.30	.5425	4005425	60.30	.5725	4005725	62.20	.6025	4006025	62.20
.4830	4004830	56.25	.5130	4005130	60.30	.5430	4005430	60.30	.5730	4005730	62.20	.6030	4006030	62.20
.4835	4004835	56.25	.5135	4005135	60.30	.5435	4005435	60.30	.5735	4005735	62.20	.6035	4006035	62.20
.4840	4004840	56.25	.5140	4005140	60.30	.5440	4005440	60.30	.5740	4005740	62.20	.6040	4006040	62.20
.4845	4004845	56.25	.5145	4005145	60.30	.5445	4005445	60.30	.5745	4005745	62.20	.6045	4006045	62.20
.4850	4004850	56.25	.5150	4005150	60.30	.5450	4005450	60.30	.5750	4005750	62.20	.6050	4006050	62.20
.4855	4004855	56.25	.5155	4005155	60.30	.5455	4005455	60.30	.5755	4005755	62.20	.6055	4006055	62.20

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 400 .0005 INCREMENTS



STOCKED DECIMAL TOOL DIAMETERS (.6060 TO .7555) STRAIGHT FLUTES & SHANK

For shallow holes only (see page 27)

NOTE: Dimension details and available modifications listed on page 46.

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.6060	4006060	\$62.20	.6360	4006360	\$63.10	.6660	4006660	\$63.10	.6960	4006960	\$65.55	.7260	4007260	\$65.55
.6065	4006065	62.20	.6365	4006365	63.10	.6665	4006665	63.10	.6965	4006965	65.55	.7265	4007265	65.55
.6070	4006070	62.20	.6370	4006370	63.10	.6670	4006670	63.10	.6970	4006970	65.55	.7270	4007270	65.55
.6075	4006075	62.20	.6375	4006375	63.10	.6675	4006675	63.10	.6975	4006975	65.55	.7275	4007275	65.55
.6080	4006080	62.20	.6380	4006380	63.10	.6680	4006680	63.10	.6980	4006980	65.55	.7280	4007280	65.55
.6085	4006085	62.20	.6385	4006385	63.10	.6685	4006685	63.10	.6985	4006985	65.55	.7285	4007285	65.55
.6090	4006090	62.20	.6390	4006390	63.10	.6690	4006690	63.10	.6990	4006990	65.55	.7290	4007290	65.55
.6095	4006095	62.20	.6395	4006395	63.10	.6695	4006695	63.10	.6995	4006995	65.55	.7295	4007295	65.55
.6100	4006100	62.20	.6400	4006400	63.10	.6700	4006700	63.10	.7000	4007000	65.55	.7300	4007300	65.55
.6105	4006105	62.20	.6405	4006405	63.10	.6705	4006705	63.10	.7005	4007005	65.55	.7305	4007305	65.55
.6110	4006110	62.20	.6410	4006410	63.10	.6710	4006710	63.10	.7010	4007010	65.55	.7310	4007310	65.55
.6115	4006115	62.20	.6415	4006415	63.10	.6715	4006715	63.10	.7015	4007015	65.55	.7315	4007315	65.55
.6120	4006120	62.20	.6420	4006420	63.10	.6720	4006720	63.10	.7020	4007020	65.55	.7320	4007320	65.55
.6125	4006125	62.20	.6425	4006425	63.10	.6725	4006725	63.10	.7025	4007025	65.55	.7325	4007325	65.55
.6130	4006130	62.20	.6430	4006430	63.10	.6730	4006730	63.10	.7030	4007030	65.55	.7330	4007330	65.55
.6135	4006135	62.20	.6435	4006435	63.10	.6735	4006735	63.10	.7035	4007035	65.55	.7335	4007335	65.55
.6140	4006140	62.20	.6440	4006440	63.10	.6740	4006740	63.10	.7040	4007040	65.55	.7340	4007340	65.55
.6145	4006145	62.20	.6445	4006445	63.10	.6745	4006745	63.10	.7045	4007045	65.55	.7345	4007345	65.55
.6150	4006150	62.20	.6450	4006450	63.10	.6750	4006750	63.10	.7050	4007050	65.55	.7350	4007350	65.55
.6155	4006155	62.20	.6455	4006455	63.10	.6755	4006755	63.10	.7055	4007055	65.55	.7355	4007355	65.55
.6160	4006160	62.20	.6460	4006460	63.10	.6760	4006760	63.10	.7060	4007060	65.55	.7360	4007360	65.55
.6165	4006165	62.20	.6465	4006465	63.10	.6765	4006765	63.10	.7065	4007065	65.55	.7365	4007365	65.55
.6170	4006170	62.20	.6470	4006470	63.10	.6770	4006770	63.10	.7070	4007070	65.55	.7370	4007370	65.55
.6175	4006175	62.20	.6475	4006475	63.10	.6775	4006775	63.10	.7075	4007075	65.55	.7375	4007375	65.55
.6180	4006180	62.20	.6480	4006480	63.10	.6780	4006780	63.10	.7080	4007080	65.55	.7380	4007380	65.55
.6185	4006185	62.20	.6485	4006485	63.10	.6785	4006785	63.10	.7085	4007085	65.55	.7385	4007385	65.55
.6190	4006190	62.20	.6490	4006490	63.10	.6790	4006790	63.10	.7090	4007090	65.55	.7390	4007390	65.55
.6195	4006195	62.20	.6495	4006495	63.10	.6795	4006795	63.10	.7095	4007095	65.55	.7395	4007395	65.55
.6200	4006200	62.20	.6500	4006500	63.10	.6800	4006800	63.10	.7100	4007100	65.55	.7400	4007400	65.55
.6205	4006205	62.20	.6505	4006505	63.10	.6805	4006805	63.10	.7105	4007105	65.55	.7405	4007405	65.55
.6210	4006210	62.20	.6510	4006510	63.10	.6810	4006810	63.10	.7110	4007110	65.55	.7410	4007410	65.55
.6215	4006215	62.20	.6515	4006515	63.10	.6815	4006815	63.10	.7115	4007115	65.55	.7415	4007415	65.55
.6220	400158	62.20	.6520	4006520	63.10	.6820	4006820	63.10	.7120	4007120	65.55	.7420	4007420	65.55
.6225	4006225	62.20	.6525	4006525	63.10	.6825	4006825	63.10	.7125	4007125	65.55	.7425	4007425	65.55
.6230	4006230	62.20	.6530	4006530	63.10	.6830	4006830	63.10	.7130	4007130	65.55	.7430	4007430	65.55
.6235	4006235	62.20	.6535	400166	63.10	.6835	4006835	63.10	.7135	4007135	65.55	.7435	4007435	65.55
.6240	47862	62.20	.6540	4006540	63.10	.6840	4006840	63.10	.7140	4007140	65.55	.7440	4007440	65.55
.6245	4006245	62.20	.6545	4006545	63.10	.6845	4006845	63.10	.7145	4007145	65.55	.7445	4007445	65.55
.6250	40020	51.40	.6550	4006550	63.10	.6850	400174	63.10	.7150	4007150	65.55	.7450	4007450	65.55
.6255	4006255	62.20	.6555	4006555	63.10	.6855	4006855	63.10	.7155	4007155	65.55	.7455	4007455	65.55
.6260	47863	62.20	.6560	4006560	63.10	.6860	4006860	63.10	.7160	4007160	65.55	.7460	4007460	65.55
.6265	4006265	62.20	.6565	4006565	63.10	.6865	4006865	63.10	.7165	400182	65.55	.7465	4007465	65.55
.6270	4006270	62.20	.6570	4006570	63.10	.6870	4006870	63.10	.7170	4007170	65.55	.7470	4007470	65.55
.6275	4006275	62.20	.6575	400167	63.10	.6875	40022	52.30	.7175	4007175	65.55	.7475	4007475	65.55
.6280	4006280	62.20	.6580	4006580	63.10	.6880	4006880	63.10	.7180	4007180	65.55	.7480	400190	65.55
.6285	4006285	63.10	.6585	4006585	63.10	.6885	4006885	63.10	.7185	4007185	65.55	.7485	4007485	65.55
.6290	4006290	63.10	.6590	4006590	63.10	.6890	400175	63.10	.7190	4007190	65.55	.7490	47874	65.55
.6295	4006295	63.10	.6595	4006595	63.10	.6895	4006895	63.10	.7195	4007195	65.55	.7495	4007495	65.55
.6300	4006300	63.10	.6600	4006600	63.10	.6900	4006900	63.10	.7200	4007200	65.55	.7500	40024	54.75
.6305	4006305	63.10	.6605	4006605	63.10	.6905	4006905	63.10	.7205	400183	65.55	.7505	4007505	65.55
.6310	4006310	63.10	.6610	4006610	63.10	.6910	4006910	63.10	.7210	4007210	65.55	.7510	47875	65.55
.6315	4006315	63.10	.6615	4006615	63.10	.6915	4006915	65.55	.7215	4007215	65.55	.7515	4007515	65.55
.6320	4006320	63.10	.6620	4006620	63.10	.6920	4006920	65.55	.7220	4007220	65.55	.7520	400191	65.55
.6325	4006325	63.10	.6625	4006625	63.10	.6925	4006925	65.55	.7225	4007225	65.55	.7525	4007525	65.55
.6330	4006330	63.10	.6630	4006630	63.10	.6930	4006930	65.55	.7230	4007230	65.55	.7530	4007530	65.55
.6335	4006335	63.10	.6635	4006635	63.10	.6935	4006935	65.55	.7235	4007235	65.55	.7535	4007535	67.40
.6340	4006340	63.10	.6640	4006640	63.10	.6940	4006940	65.55	.7240	4007240	65.55	.7540	4007540	67.40
.6345	4006345	63.10	.6645	4006645	63.10	.6945	4006945	65.55	.7245	4007245	65.55	.7545	4007545	67.40
.6350	4006350	63.10	.6650	4006650	63.10	.6950	4006950	65.55	.7250	4007250	65.55	.7550	4007550	67.40
.6355	4006355	63.10	.6655	4006655	63.10	.6955	4006955	65.55	.7255	4007255	65.55	.7555	4007555	67.40

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 400 METRIC



STRAIGHT FLUTES & SHANK



For shallow holes only (see page 27)

NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 46).

TOOL DIAMETER		TYPE 400 METRIC EDP NO.	METRIC PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH			SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
						FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.0	.1575	400040	\$44.75	.151	4	1	½	4	3.962-4.493	\$67.60	\$52.45	\$47.30	\$44.80	\$42.25	\$40.10	\$37.20
4.5	.1772	400045	41.65	1¼/16	4	1 ½	½	4 ½	4.494-5.182	63.95	49.15	44.20	41.75	39.20	37.15	34.35
5.0	.1969	400050	41.65	1¼/16	4	1 ½	½	4 ½	-	-	-	-	-	-	-	-
5.5	.2165	400055	41.65	1¾/16	4	1 ¼	½	5	5.183-5.613	63.95	49.15	44.20	41.75	39.20	37.15	34.35
6.0	.2362	400060	43.60	7/32	4	1 ½	½	6	5.614-6.045	65.85	51.05	46.05	43.65	41.10	39.05	36.20
6.3	.2480	400063	41.65	15/64	4	1 ½	½	6	6.046-6.426	63.95	49.15	44.20	41.75	39.20	37.15	34.35
6.5	.2559	400065	42.30	15/64	4	1 ½	½	6	6.427-7.214	64.65	49.80	44.85	42.40	39.90	37.85	35.00
7.0	.2756	400070	42.30	15/64	4	1 ½	½	6	-	-	-	-	-	-	-	-
7.5	.2953	400075	42.30	9/32	4	1 ½	½	6	7.215-8.001	64.65	49.80	44.85	42.40	39.90	37.85	35.00
8.0	.3150	400080	42.30	9/32	4	1 ½	½	6	-	-	-	-	-	-	-	-
8.5	.3346	400085	43.40	9/32	4	1 ½	5/8	6	8.002-8.814	65.80	51.00	46.00	43.60	41.05	39.00	36.15
9.0	.3543	400090	43.40	5/16	4	1 ¾	5/8	7	8.815-9.601	65.80	51.00	46.00	43.60	41.05	39.00	36.15
9.5	.3740	400095	43.40	5/16	4	1 ¾	5/8	7	-	-	-	-	-	-	-	-
10.0	.3937	400100	45.10	5/16	4	1 ¾	5/8	7	9.602-10.389	67.40	52.60	47.60	45.20	42.70	40.65	37.80
10.5	.4134	400105	47.40	3/8	4	1 ¾	5/8	7	10.390-11.201	69.75	54.95	50.00	47.55	45.10	43.00	40.15
11.0	.4331	400110	47.40	3/8	4	1 ¾	5/8	7	-	-	-	-	-	-	-	-
11.5	.4528	400115	48.00	3/8	4	1 ¾	5/8	7	11.202-11.989	70.30	55.50	50.50	48.10	45.60	43.60	40.70
12.0	.4724	400120	56.25	7/16	6	2	5/8	8	11.990-12.776	80.80	64.50	59.05	56.40	53.65	51.35	48.20
12.5	.4921	400125	56.25	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
13.0	.5118	400130	60.30	7/16	6	2	5/8	8	12.777-13.564	84.80	68.50	63.05	60.40	57.65	55.40	52.20
13.5	.5315	400135	60.30	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
14.0	.5512	400140	60.30	7/16	6	2	5/8	8	13.565-14.376	84.80	68.50	63.05	60.40	57.65	55.40	52.20
14.5	.5709	400145	62.20	7/16	6	2	5/8	8	14.377-15.164	86.85	70.50	65.05	62.35	59.65	57.40	54.20
15.0	.5906	400150	62.20	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
15.5	.6102	400155	62.20	9/16	6	2 ¼	5/8	9	15.165-15.951	86.85	70.50	65.05	62.35	59.65	57.40	54.20
16.0	.6299	400160	63.10	9/16	6	2 ¼	5/8	9	15.952-16.739	87.75	71.40	65.90	63.20	60.50	58.20	55.05
16.5	.6496	400165	63.10	9/16	6	2 ¼	5/8	9	-	-	-	-	-	-	-	-
17.0	.6693	400170	63.10	9/16	6	2 ¼	5/8	9	16.740-17.551	87.75	71.40	65.90	63.20	60.50	58.20	55.05
17.5	.6890	400175	63.10	9/16	6	2 ¼	5/8	9	-	-	-	-	-	-	-	-
18.0	.7087	400180	65.55	9/16	6	2 ¼	5/8	9	17.552-18.339	90.15	73.85	68.40	65.75	63.00	60.70	57.55
18.5	.7283	400185	65.55	5/8	6	2 ½	¾	9 ½	18.340-19.126	90.15	73.85	68.40	65.75	63.00	60.70	57.55
19.0	.7480	400190	65.55	5/8	6	2 ½	¾	9 ½	-	-	-	-	-	-	-	-
19.5	.7677	400195	67.40	5/8	6	2 ½	¾	9 ½	19.127-19.914	91.95	75.70	70.20	67.50	64.80	62.50	59.40
20.0	.7874	400200	67.40	5/8	6	2 ½	¾	9 ½	19.915-20.726	91.95	75.70	70.20	67.50	64.80	62.50	59.40
20.5	.8071	400205	67.40	5/8	6	2 ½	¾	9 ½	-	-	-	-	-	-	-	-
21.0	.8268	400210	69.65	5/8	6	2 ½	¾	9 ½	20.727-21.514	94.25	77.90	72.45	69.75	67.05	64.80	61.65
21.5	.8465	400215	69.65	5/8	6	2 ½	¾	9 ½	-	-	-	-	-	-	-	-
22.0	.8661	400220	69.65	3/4	6	2 5/8	¾	10	21.515-22.301	94.25	77.90	72.45	69.75	67.05	64.80	61.65
22.5	.8858	400225	82.35	3/4	6	2 5/8	¾	10	22.302-23.089	107.85	90.90	85.25	82.50	79.65	77.30	74.00
23.0	.9055	400230	82.35	3/4	6	2 5/8	¾	10	-	-	-	-	-	-	-	-
23.5	.9252	400235	82.35	3/4	8	2 5/8	¾	10	23.090-23.901	107.85	90.90	85.25	82.50	79.65	77.30	74.00
24.0	.9449	400240	85.85	3/4	8	2 5/8	¾	10	23.902-24.689	111.30	94.35	88.70	85.95	83.10	80.75	77.50
24.5	.9646	400245	85.85	3/4	8	2 5/8	¾	10	-	-	-	-	-	-	-	-
25.0	.9843	400250	85.85	7/8	8	2 ¾	¾	10 ½	24.690-25.476	111.30	94.35	88.70	85.95	83.10	80.75	77.50
25.5	1.0039	400255	87.85	7/8	8	2 ¾	¾	10 ½	25.477-27.076	112.35	96.10	90.65	88.00	85.30	83.05	79.85
26.0	1.0236	400260	87.85	7/8	8	2 ¾	¾	10 ½	-	-	-	-	-	-	-	-
27.0	1.0630	400270	87.85	7/8	8	2 ¾	¾	10 ½	-	-	-	-	-	-	-	-
28.0	1.1024	400280	94.15	7/8	8	2 7/8	7/8	11	27.077-28.651	118.55	102.30	96.90	94.25	91.55	89.30	86.15
29.0	1.1417	400290	98.35	1	8	2 7/8	7/8	11	28.652-30.239	122.80	106.65	101.10	98.50	95.75	93.50	90.40
30.0	1.1811	400300	98.35	1	8	2 7/8	7/8	11	-	-	-	-	-	-	-	-
31.0	1.2205	400310	103.40	1	8	3	7/8	11 ½	30.240-31.826	127.85	111.60	106.20	103.55	100.85	98.60	95.45
32.0	1.2598	400320	108.15	1	8	3	7/8	11 ½	31.827-33.414	132.65	116.45	111.00	108.35	105.60	103.30	100.15
33.0	1.2992	400330	108.15	1	8	3	7/8	11 ½	-	-	-	-	-	-	-	-
34.0	1.3386	400340	114.20	1	8	3 ¼	7/8	12	33.415-35.001	138.60	122.40	116.95	114.30	111.55	109.30	106.20
35.0	1.3780	400350	114.20	1	8	3 ¼	7/8	12	-	-	-	-	-	-	-	-
36.0	1.4173	400360	126.00	1 ¼	8	3 ¼	7/8	12	35.002-36.589	150.45	134.20	128.80	126.10	123.45	121.15	118.00
37.0	1.4567	400370	132.50	1 ¼	8	3 ½	7/8	12 ½	36.590-38.176	157.05	140.80	135.35	132.70	130.00	127.70	124.60

Modified tool diameters are available up to 50mm - contact us for price.



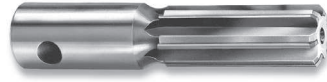
SEMI-FINISHED REAMERS CARBIDE TIPPED TYPES 400, 402, 410, 430, 440, 450, 465



FINISH GRINDING OPERATIONS REQUIRED BEFORE USE



TYPE 400



TYPE 430



TYPE 440



TYPE 402



TYPE 450



TYPE 410



TYPE 465

REAMERS

NOTE:

- Before semi-finished reamers can be used, the tool diameter must be finish ground & relieved and the reamer end must be faced & chamfered
- Semi-finished reamers are purchased by regrind shops, distributors, or users with regrind capabilities
- For detailed description of each specific type, see page indicated in table below

SEMI-FINISHED TOOL DIAMETER RANGE	TYPE 400 PAGE 46		TYPE 402 PAGE 54		TYPE 410 PAGE 68		TYPE 430 PAGE 42	TYPE 440 PAGE 42	TYPE 430 OR 440 PRICE	TYPE 450 PAGE 56		TYPE 465 PAGE 64	
	EDP NO.	PRICE	EDP NO.	PRICE	EDP NO.	PRICE	EDP NO.	EDP NO.		EDP NO.	PRICE	EDP NO.	PRICE
0.1770-0.2040	40006SF	\$27.05	-	-	41006SF	\$38.05	43006SF	44006SF	\$35.25	45006SF	\$32.35	-	-
0.2041-0.2210	40007SF	27.05	-	-	41007SF	38.05	43007SF	44007SF	35.25	45007SF	32.35	-	-
0.2211-0.2380	4002344SF	28.60	-	-	4102344SF	38.05	4302344SF	4402344SF	35.25	4502344SF	32.35	-	-
0.2381-0.2530	40008SF	27.05	40208SF	\$31.20	41008SF	38.05	43008SF	44008SF	35.25	45008SF	32.35	-	-
0.2531-0.2840	40009SF	27.55	40209SF	31.65	41009SF	38.15	43009SF	44009SF	35.25	45009SF	33.10	-	-
0.2841-0.3150	40010SF	27.55	40210SF	31.65	41010SF	38.15	43010SF	44010SF	40.95	45010SF	33.10	46510SF	\$49.90
0.3151-0.3470	40011SF	28.55	40211SF	32.85	41011SF	42.00	43011SF	44011SF	41.35	45011SF	34.25	46511SF	49.90
0.3471-0.3780	40012SF	26.20	40212SF	30.20	41012SF	42.35	43012SF	44012SF	44.80	45012SF	34.25	46512SF	46.70
0.3781-0.4090	40013SF	29.90	40213SF	34.45	41013SF	44.30	43013SF	44013SF	45.40	45013SF	35.90	46513SF	49.55
0.4091-0.4410	40014SF	31.90	40214SF	36.70	41014SF	46.05	43014SF	44014SF	53.85	45014SF	38.85	46514SF	49.55
0.4411-0.4720	40015SF	32.45	40215SF	37.75	41015SF	48.90	43015SF	44015SF	53.85	45015SF	42.00	46515SF	52.55
0.4721-0.5030	40016SF	38.65	40216SF	44.40	41016SF	50.75	43016SF	44016SF	58.85	45016SF	45.05	46516SF	52.55
0.5031-0.5340	40017SF	42.00	40217SF	48.00	41017SF	52.30	43017SF	44017SF	58.85	45017SF	46.20	46517SF	53.85
0.5341-0.5660	40018SF	42.00	40218SF	48.00	41018SF	52.30	43018SF	44018SF	62.10	45018SF	46.20	46518SF	53.85
0.5661-0.5970	40019SF	43.70	40219SF	50.20	41019SF	53.85	43019SF	44019SF	62.10	45019SF	48.05	46519SF	56.25
0.5971-0.6280	40020SF	43.70	40220SF	50.20	41020SF	53.85	43020SF	44020SF	63.75	45020SF	48.05	46520SF	56.25
0.6281-0.6590	40021SF	44.45	40221SF	51.15	41021SF	55.40	43021SF	44021SF	63.75	45021SF	48.90	46521SF	61.50
0.6591-0.6910	40022SF	44.45	40222SF	51.15	41022SF	59.00	43022SF	44022SF	66.70	45022SF	48.90	46522SF	61.50
0.6911-0.7220	40023SF	46.50	40223SF	53.50	41023SF	59.80	43023SF	44023SF	66.70	45023SF	51.15	46523SF	63.85
0.7221-0.7530	40024SF	46.50	40224SF	53.50	41024SF	60.75	43024SF	44024SF	68.40	45024SF	51.15	46524SF	63.85
0.7531-0.7840	40025SF	48.10	40225SF	55.10	41025SF	62.25	43025SF	44025SF	68.40	45025SF	52.85	46525SF	68.80
0.7841-0.8160	40026SF	48.10	40226SF	55.10	41026SF	62.25	43026SF	44026SF	74.30	45026SF	52.85	46526SF	68.80
0.8161-0.8470	40027SF	50.05	40227SF	57.50	41027SF	65.65	43027SF	44027SF	74.30	45027SF	55.00	46527SF	71.45
0.8471-0.8780	40028SF	51.90	40228SF	59.65	41028SF	68.15	43028SF	44028SF	81.20	45028SF	57.10	46528SF	74.15
0.8781-0.9090	40029SF	60.55	40229SF	70.00	41029SF	79.45	43029SF	44029SF	81.20	45029SF	66.45	46529SF	78.90
0.9091-0.9410	40030SF	60.55	40230SF	70.00	41030SF	79.45	43030SF	44030SF	89.40	45030SF	66.45	46530SF	78.90
0.9411-0.9720	40031SF	63.40	40231SF	72.85	41031SF	83.25	43031SF	44031SF	89.40	45031SF	69.65	46531SF	82.00
0.9721-1.0030	40032SF	63.40	40232SF	72.85	41032SF	83.25	43032SF	44032SF	93.85	45032SF	69.65	46532SF	82.00
1.0031-1.0660	40034SF	65.50	40234SF	100.15	41034SF	89.35	43034SF	44034SF	93.85	45034SF	72.10	46534SF	89.90
1.0661-1.1280	40036SF	70.90	40236SF	106.70	41036SF	92.10	43036SF	44036SF	109.80	45036SF	77.95	46536SF	89.90
1.1281-1.1905	40038SF	74.45	40238SF	113.05	41038SF	96.75	43038SF	44038SF	114.50	45038SF	81.55	46538SF	98.05
1.1906-1.2530	40040SF	78.70	40240SF	125.60	41040SF	102.45	43040SF	44040SF	134.15	45040SF	95.25	46540SF	98.05
1.2531-1.3155	40042SF	82.80	40242SF	135.45	41042SF	113.30	43042SF	44042SF	134.15	45042SF	95.25	46542SF	108.75
1.3156-1.3780	40044SF	87.85	40244SF	140.90	41044SF	124.20	43044SF	44044SF	136.00	45044SF	96.60	46544SF	113.80
1.3781-1.4405	40046SF	97.95	40246SF	143.85	41046SF	131.55	43046SF	44046SF	158.60	45046SF	106.75	46546SF	134.45
1.4406-1.5030	40048SF	103.55	40248SF	151.00	41048SF	138.95	43048SF	44048SF	190.45	45048SF	128.20	46548SF	138.45



CHUCKING REAMERS CARBIDE TIPPED TYPE 402 FRACTIONAL



STRAIGHT FLUTES TAPER SHANK



TYPE 402

- Straight polished flutes and taper shank
- Detailed specifications on page 29

USE:

- For general reaming of steels, cast irons, non-ferrous materials, plastics and non-metals

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Modified metric tool diameter - priced on pg. 55
- Closer tool diameter tolerance - pg. 29
- Cutting diam. reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	402/472 ^{MS}
40	NON-FERROUS - SHORT CHIPS	402/472 ^{MS}	
60	CAST IRONS	402/473 ^{MS}	
80	LOW STRENGTH STEELS	402/474 ^{MS}	
100	MEDIUM STRENGTH STEELS	402/474 ^{MS}	
120	HIGH STRENGTH STEELS	402/474 ^{MS}	
140	HIGH TEMPERATURE ALLOYS	474 ^{MS}	

^{MS}See page 80 for material specific reamers

- Increased/decreased tool diam. back taper
- Shank whistle notch for set screw
- Smaller taper shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

NOTE: For semi-finished reamers, see page 53. For shallow holes only (see page 27)

TOOL DIAMETER		TYPE 402 EDP NO.	PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL			TAPER SHANK NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
					FLUTE	CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
1/4	.2500	40208	\$36.60	1	4	1 1/2	1/2	6	0.2381-0.2530	\$66.25	\$51.40	\$46.45	\$44.10	\$41.60	\$39.60
5/32	.2812	40209	37.30	1	4	1 1/2	1/2	6	0.2531-0.2840	66.95	52.10	47.15	44.75	42.25	40.20
3/16	.3125	40210	37.30	1	4	1 1/2	1/2	6	0.2841-0.3150	66.95	52.10	47.15	44.75	42.25	40.20
1/8	.3438	40211	38.70	1	4	1 1/2	5/8	6	0.3151-0.3470	68.35	53.50	48.50	46.15	43.65	41.65
3/8	.3750	40212	35.50	1	4	1 3/4	5/8	7	0.3471-0.3780	62.75	49.10	44.50	42.35	40.00	38.15
7/32	.4062	40213	40.60	1	4	1 3/4	5/8	7	0.3781-0.4090	70.25	55.40	50.40	48.05	45.50	43.50
1/16	.4375	40214	43.20	1	4	1 3/4	5/8	7	0.4091-0.4410	72.85	58.00	53.00	50.65	48.10	46.10
3/32	.4688	40215	44.35	1	4	1 3/4	5/8	7	0.4411-0.4720	74.00	59.15	54.15	51.80	49.25	47.25
1/2	.5000	40216	52.20	1	6	2	5/8	8	0.4721-0.5030	84.85	68.50	63.05	60.45	57.65	55.45
17/32	.5312	40217	56.40	1	6	2	5/8	8	0.5031-0.5340	89.05	72.65	67.15	64.60	61.80	59.55
9/16	.5625	40218	56.40	1	6	2	5/8	8	0.5341-0.5660	89.05	72.65	67.15	64.60	61.80	59.55
19/32	.5938	40219	59.10	1	6	2	5/8	8	0.5661-0.5970	91.75	75.40	69.90	67.35	64.50	62.30
5/8	.6250	40220	59.10	2	6	2 1/4	5/8	9	0.5971-0.6280	91.75	75.40	69.90	67.35	64.50	62.30
21/32	.6562	40221	60.15	2	6	2 1/4	5/8	9	0.6281-0.6590	92.80	76.45	71.05	68.40	65.55	63.35
11/16	.6875	40222	60.15	2	6	2 1/4	5/8	9	0.6591-0.6910	92.80	76.45	71.05	68.40	65.55	63.35
23/32	.7188	40223	62.90	2	6	2 1/4	5/8	9	0.6911-0.7220	95.55	79.15	73.70	71.15	68.35	66.10
3/4	.7500	40224	62.90	2	6	2 1/2	3/4	9 1/2	0.7221-0.7530	95.55	79.15	73.70	71.15	68.35	66.10
25/32	.7812	40225	64.85	2	6	2 1/2	3/4	9 1/2	0.7531-0.7840	97.50	81.10	75.70	73.10	70.25	68.05
13/16	.8125	40226	64.85	2	6	2 1/2	3/4	9 1/2	0.7841-0.8160	97.50	81.10	75.70	73.10	70.25	68.05
27/32	.8438	40227	67.65	2	6	2 1/2	3/4	9 1/2	0.8161-0.8470	100.30	83.90	78.50	75.85	73.10	70.80
7/8	.8750	40228	70.25	2	6	2 5/8	3/4	10	0.8471-0.8780	104.05	87.10	81.45	78.70	75.80	73.50
29/32	.9062	40229	82.35	2	6	2 5/8	3/4	10	0.8781-0.9090	116.20	99.20	93.55	90.80	87.95	85.65
15/16	.9375	40230	82.35	3	8	2 5/8	3/4	10	0.9091-0.9410	116.20	99.20	93.55	90.80	87.95	85.65
31/32	.9688	40231	85.85	3	8	2 5/8	3/4	10	0.9411-0.9720	119.65	102.70	97.00	94.30	91.40	89.10
1	1.0000	40232	85.85	3	8	2 3/4	3/4	10 1/2	0.9721-1.0030	119.65	102.70	97.00	94.30	91.40	89.10
1 1/16	1.0625	40234	117.85	3	8	2 3/4	3/4	10 1/2	1.0031-1.0660	150.35	134.10	128.70	126.05	123.20	121.05
1 1/8	1.1250	40236	125.55	3	8	2 7/8	7/8	11	1.0661-1.1280	158.00	141.70	136.30	133.65	130.95	128.75
1 3/16	1.1875	40238	132.95	3	8	2 7/8	7/8	11	1.1281-1.1905	165.50	149.15	143.75	141.10	138.30	136.20
1 1/4	1.2500	40240	147.80	4	8	3	7/8	11 1/2	1.1906-1.2530	180.25	163.95	158.55	155.90	153.15	150.95
1 5/16	1.3125	40242	159.35	4	8	3	7/8	11 1/2	1.2531-1.3155	191.80	175.50	170.10	167.50	164.70	162.50
1 3/8	1.3750	40244	165.75	4	8	3 1/4	7/8	12	1.3156-1.3780	198.25	181.95	176.55	173.95	171.15	169.00
1 7/16	1.4375	40246	169.20	4	8	3 1/4	7/8	12	1.3781-1.4405	201.70	185.45	179.95	177.40	174.55	172.40
1 1/2	1.5000	40248	177.65	4	8	3 1/2	7/8	12 1/2	1.4406-1.5030	210.15	193.90	188.40	185.85	183.00	180.80
1 9/16	1.5625	40250	191.75	4	8	3 1/2	7/8	12 1/2	1.5031-1.5660	224.20	207.95	202.50	199.90	197.10	194.90
1 5/8	1.6250	40252	198.35	4	8	3 3/4	7/8	13	1.5661-1.6280	230.85	214.60	209.10	206.55	203.75	201.55
1 11/16	1.6875	40254	223.05	4	8	3 3/4	7/8	13	1.6281-1.6910	235.55	239.25	233.85	231.20	228.50	226.30
1 3/4	1.7500	40256	223.05	4	10	4	7/8	13 1/2	1.6911-1.7530	255.55	239.25	233.85	231.20	228.50	226.30
1 13/16	1.8125	40258	223.05	4	10	4	7/8	13 1/2	1.7531-1.8160	255.55	239.25	233.85	231.20	228.50	226.30
1 7/8	1.8750	40260	233.75	4	10	4 1/4	7/8	14	1.8161-1.8780	266.20	249.90	244.45	241.85	239.10	236.90
1 15/16	1.9375	40262	233.75	4	10	4 1/4	7/8	14	1.8781-1.9410	266.20	249.90	244.45	241.85	239.10	236.90
2	2.0000	40264	233.75	4	12	4 1/4	7/8	14	1.9411-2.0030	266.20	249.90	244.45	241.85	239.10	236.90

*Quantities of 15 or more - price of fractional size in same size range.



CHUCKING REAMERS CARBIDE TIPPED TYPE 402 METRIC



STRAIGHT FLUTES TAPER SHANK



For shallow holes only (see page 27)

NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 54).

TOOL DIAMETER		TYPE 402 METRIC EDP NO.	METRIC PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH			TAPER SHANK NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
						FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
6.0	.2362	402060	\$46.45	1	4	1 1/2	1/2	6	6.000-6.426	\$68.80	\$53.95	\$49.05	\$46.55	\$44.10	\$42.00	\$39.15
6.5	.2559	402065	47.15	1	4	1 1/2	1/2	6	6.427-7.214	69.45	54.65	49.70	47.25	44.75	42.70	39.85
7.0	.2756	402070	47.15	1	4	1 1/2	1/2	6	-	-	-	-	-	-	-	
7.5	.2953	402075	47.15	1	4	1 1/2	1/2	6	7.215-8.001	69.45	54.65	49.70	47.25	44.75	42.70	39.85
8.0	.3150	402080	47.15	1	4	1 1/2	1/2	6	-	-	-	-	-	-	-	
8.5	.3346	402085	48.50	1	4	1 1/2	5/8	6	8.002-8.814	70.80	56.00	51.10	48.60	46.15	44.10	41.20
9.0	.3543	402090	44.50	1	4	1 3/4	5/8	7	8.815-9.601	65.00	51.40	46.90	44.60	42.35	40.50	37.85
9.5	.3740	402095	44.50	1	4	1 3/4	5/8	7	-	-	-	-	-	-	-	
10.0	.3937	402100	50.40	1	4	1 3/4	5/8	7	9.602-10.389	72.70	57.90	52.95	50.50	48.05	46.00	43.15
10.5	.4134	402105	53.00	1	4	1 3/4	5/8	7	10.390-11.201	75.35	60.55	55.55	53.15	50.65	48.55	45.75
11.0	.4331	402110	53.00	1	4	1 3/4	5/8	7	-	-	-	-	-	-	-	
11.5	.4528	402115	54.15	1	4	1 3/4	5/8	7	11.202-11.989	76.45	61.75	56.70	54.35	51.80	49.75	46.95
12.0	.4724	402120	63.05	1	6	2	5/8	8	11.990-12.776	87.55	71.35	65.85	63.15	60.45	58.15	55.00
12.5	.4921	402125	63.05	1	6	2	5/8	8	-	-	-	-	-	-	-	
13.0	.5118	402130	67.15	1	6	2	5/8	8	12.777-13.564	91.75	75.45	70.00	67.35	64.60	62.30	59.15
13.5	.5315	402135	67.15	1	6	2	5/8	8	-	-	-	-	-	-	-	
14.0	.5512	402140	67.15	1	6	2	5/8	8	13.565-14.376	91.75	75.45	70.00	67.35	64.60	62.30	59.15
14.5	.5709	402145	69.90	1	6	2	5/8	8	14.377-15.164	94.50	78.15	72.70	70.10	67.35	65.05	61.90
15.0	.5906	402150	69.90	1	6	2	5/8	8	-	-	-	-	-	-	-	
15.5	.6102	402155	69.90	2	6	2 1/4	5/8	9	15.165-15.951	94.50	78.15	72.70	70.10	67.35	65.05	61.90
16.0	.6299	402160	71.05	2	6	2 1/4	5/8	9	15.952-16.739	95.55	79.20	73.80	71.15	68.40	66.10	63.00
16.5	.6496	402165	71.05	2	6	2 1/4	5/8	9	-	-	-	-	-	-	-	
17.0	.6693	402170	71.05	2	6	2 1/4	5/8	9	16.740-17.551	95.55	79.20	73.80	71.15	68.40	66.10	63.00
17.5	.6890	402175	71.05	2	6	2 1/4	5/8	9	-	-	-	-	-	-	-	
18.0	.7087	402180	73.70	2	6	2 1/4	5/8	9	17.552-18.339	98.30	82.00	76.55	73.85	71.15	68.85	65.75
18.5	.7283	402185	73.70	2	6	2 1/2	3/4	9 1/2	18.340-19.126	98.30	82.00	76.55	73.85	71.15	68.85	65.75
19.0	.7480	402190	73.70	2	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	
19.5	.7677	402195	75.70	2	6	2 1/2	3/4	9 1/2	19.127-19.914	100.20	83.90	78.50	75.80	73.10	70.75	67.65
20.0	.7874	402200	75.70	2	6	2 1/2	3/4	9 1/2	19.915-20.726	100.20	83.90	78.50	75.80	73.10	70.75	67.65
20.5	.8071	402205	75.70	2	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	
21.0	.8268	402210	78.50	2	6	2 1/2	3/4	9 1/2	20.727-21.514	103.05	86.80	81.25	78.60	75.85	73.55	70.45
21.5	.8465	402215	78.50	2	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	
22.0	.8661	402220	78.50	2	6	2 5/8	3/4	10	21.515-22.301	103.05	86.80	81.25	78.60	75.85	73.55	70.45
22.5	.8858	402225	93.55	2	6	2 5/8	3/4	10	22.302-23.089	119.05	102.15	96.45	93.65	90.80	88.45	85.25
23.0	.9055	402230	93.55	2	6	2 5/8	3/4	10	-	-	-	-	-	-	-	
23.5	.9252	402235	93.55	3	8	2 5/8	3/4	10	23.090-23.901	119.05	102.15	96.45	93.65	90.80	88.45	85.25
24.0	.9449	402240	97.00	3	8	2 5/8	3/4	10	23.902-24.689	122.55	105.65	99.90	97.10	94.30	91.95	88.70
24.5	.9646	402245	97.00	3	8	2 5/8	3/4	10	-	-	-	-	-	-	-	
25.0	.9843	402250	97.00	3	8	2 3/4	3/4	10 1/2	24.690-25.476	122.55	105.65	99.90	97.10	94.30	91.95	88.70
25.5	1.0039	402255	128.70	3	8	2 3/4	3/4	10 1/2	25.477-27.076	153.10	136.85	131.45	128.80	126.05	123.80	120.70
26.0	1.0236	402260	128.70	3	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	
27.0	1.0630	402270	128.70	3	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	
28.0	1.1024	402280	136.30	3	8	2 7/8	7/8	11	27.077-28.651	160.70	144.50	139.05	136.40	133.65	131.45	128.30
29.0	1.1417	402290	143.75	3	8	2 7/8	7/8	11	28.652-30.239	168.15	151.95	146.55	143.85	141.10	138.90	135.75
30.0	1.1811	402300	143.75	3	8	2 7/8	7/8	11	-	-	-	-	-	-	-	
31.0	1.2205	402310	158.55	4	8	3	7/8	11 1/2	30.240-31.826	182.95	166.80	161.30	158.65	155.90	153.65	150.55
32.0	1.2598	402320	170.10	4	8	3	7/8	11 1/2	31.827-33.414	194.50	178.35	172.85	170.20	167.50	165.20	162.10
33.0	1.2992	402330	170.10	4	8	3	7/8	11 1/2	-	-	-	-	-	-	-	
34.0	1.3386	402340	176.55	4	8	3 1/4	7/8	12	33.415-35.001	200.95	184.75	179.35	176.65	173.95	171.70	168.60
35.0	1.3780	402350	176.55	4	8	3 1/4	7/8	12	-	-	-	-	-	-	-	
36.0	1.4173	402360	179.95	4	8	3 1/4	7/8	12	35.002-36.589	204.45	188.20	182.80	180.15	177.40	175.15	172.00
37.0	1.4567	402370	188.40	4	8	3 1/2	7/8	12 1/2	36.590-38.176	212.90	196.65	191.20	188.60	185.85	183.60	180.50
38.0	1.4961	402380	188.40	4	8	3 1/2	7/8	12 1/2	-	-	-	-	-	-	-	
39.0	1.5354	402390	202.50	4	8	3 1/2	7/8	12 1/2	38.177-39.776	226.95	210.75	205.30	202.65	199.90	197.60	194.50
40.0	1.5748	402400	209.10	4	8	3 3/4	7/8	13	39.777-41.351	233.60	217.35	211.95	209.25	206.55	204.30	201.15
41.0	1.6142	402410	209.10	4	8	3 3/4	7/8	13	-	-	-	-	-	-	-	

Modified tool diameters are available up to 50mm - contact us for price.

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 450 FRACTIONAL



STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK



TYPE 450

- Straight polished flutes with flute long carbide
- Straight shank
- Detailed specifications on page 29

USE:

- For all general reaming - specifically designed with flute long carbide for deep hole reaming to precision tolerances and for long production runs

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Modified metric tool diameter - priced on pg. 57
- Closer tool diameter tolerance - pg. 29
- Cutting diam. reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	450/457 ^{MS}
	40	NON-FERROUS - SHORT CHIPS	450/457 ^{MS}
	60	CAST IRONS	450/458 ^{MS}
	80	LOW STRENGTH STEELS	450/459 ^{MS}
	100	MEDIUM STRENGTH STEELS	450/459 ^{MS}
	120	HIGH STRENGTH STEELS	450/459 ^{MS}
140	HIGH TEMPERATURE ALLOYS	459 ^{MS}	

^{MS}See pages 78 & 79 for material specific reamers

- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:
See page 54

NOTE: For stocked tool diameters in .0005 increments, see pgs. 59-61. For semi-finished reamers, see pg. 53. For smaller tool diameters, see solid carbide reamers on pgs. 58, 105-107.

TOOL DIAMETER		TYPE 450 EDP NO.	PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER							
FRACTIONAL	DECIMAL			SHANK DIAM.	NO. OF FLTS	FLUTE & CARBIDE	OVER-ALL	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED						
										1	2	3	4	5-7	8-14*
3/16	.1875	45006	\$38.00	1 1/64	4	1 1/2	6	0.1770-0.2040	\$68.50	\$53.20	\$48.20	\$45.70	\$43.05	\$41.00	
7/32	.2188	45007	38.00	13/64	4	1 1/2	6	0.2041-0.2210	68.50	53.20	48.20	45.70	43.05	41.00	
15/64	.2344	4502344	38.00	7/32	4	1 1/2	6	0.2211-0.2380	68.50	53.20	48.20	45.70	43.05	41.00	
1/4	.2500	45008	38.00	15/64	4	1 1/2	6	0.2381-0.2530	68.50	53.20	48.20	45.70	43.05	41.00	
9/32	.2812	45009	38.85	15/64	4	1 1/2	6	0.2531-0.2840	69.30	54.00	48.95	46.50	43.85	41.85	
5/16	.3125	45010	38.85	9/32	4	1 1/2	6	0.2841-0.3150	69.30	54.00	48.95	46.50	43.85	41.85	
11/32	.3438	45011	40.25	9/32	4	1 1/2	6	0.3151-0.3470	70.70	55.50	50.35	47.95	45.30	43.25	
3/8	.3750	45012	40.25	5/16	4	1 3/4	7	0.3471-0.3780	70.70	55.50	50.35	47.95	45.30	43.25	
13/32	.4062	45013	42.25	5/16	4	1 3/4	7	0.3781-0.4090	72.70	57.50	52.35	49.95	47.30	45.25	
7/16	.4375	45014	45.70	3/8	4	1 3/4	7	0.4091-0.4410	76.20	60.90	55.75	53.40	50.75	48.70	
15/32	.4688	45015	49.35	3/8	4	1 3/4	7	0.4411-0.4720	79.85	64.60	59.45	57.00	54.45	52.35	
1/2	.5000	45016	52.85	7/16	6	2	8	0.4721-0.5030	85.50	69.20	63.75	61.10	58.35	56.05	
17/32	.5312	45017	54.40	7/16	6	2	8	0.5031-0.5340	87.05	70.65	65.20	62.55	59.75	57.55	
9/16	.5625	45018	54.40	7/16	6	2	8	0.5341-0.5660	87.05	70.65	65.20	62.55	59.75	57.55	
19/32	.5938	45019	56.50	7/16	6	2	8	0.5661-0.5970	89.15	72.75	67.35	64.75	61.90	59.70	
5/8	.6250	45020	56.50	9/16	6	2	9	0.5971-0.6280	89.15	72.75	67.35	64.75	61.90	59.70	
21/32	.6562	45021	57.50	9/16	6	2	9	0.6281-0.6590	90.15	73.80	68.35	65.75	62.90	60.70	
11/16	.6875	45022	57.50	9/16	6	2	9	0.6591-0.6910	90.15	73.80	68.35	65.75	62.90	60.70	
23/32	.7188	45023	60.15	9/16	6	2	9	0.6911-0.7220	92.80	76.45	71.05	68.40	65.55	63.35	
3/4	.7500	45024	60.15	5/8	6	2	9 1/2	0.7221-0.7530	92.80	76.45	71.05	68.40	65.55	63.35	
25/32	.7812	45025	62.20	5/8	6	2	9 1/2	0.7531-0.7840	94.85	78.55	73.10	70.45	67.65	65.45	
13/16	.8125	45026	62.20	5/8	6	2	9 1/2	0.7841-0.8160	94.85	78.55	73.10	70.45	67.65	65.45	
27/32	.8438	45027	64.75	5/8	6	2	9 1/2	0.8161-0.8470	97.40	81.00	75.50	72.90	70.15	67.90	
7/8	.8750	45028	67.15	3/4	6	2 1/4	10	0.8471-0.8780	101.05	84.10	78.40	75.65	72.75	70.45	
29/32	.9062	45029	78.15	3/4	6	2 1/4	10	0.8781-0.9090	112.05	95.10	89.40	86.70	83.80	81.50	
15/16	.9375	45030	78.15	3/4	8	2 1/4	10	0.9091-0.9410	112.05	95.10	89.40	86.70	83.80	81.50	
31/32	.9688	45031	81.90	3/4	8	2 1/4	10	0.9411-0.9720	115.80	98.80	93.15	90.45	87.55	85.25	
1	1.0000	45032	81.90	7/8	8	2 1/4	10 1/2	0.9721-1.0030	115.80	98.80	93.15	90.45	87.55	85.25	
1 1/16	1.0625	45034	84.75	7/8	8	2 1/4	10 1/2	1.0031-1.0660	117.25	100.95	95.50	92.90	90.15	87.95	
1 1/8	1.1250	45036	91.70	7/8	8	2 1/4	11	1.0661-1.1280	124.15	107.95	102.45	99.90	97.05	94.85	
1 3/16	1.1875	45038	95.95	1	8	2 1/4	11	1.1281-1.1905	128.40	112.15	106.75	104.10	101.30	99.15	
1 1/4	1.2500	45040	112.05	1	8	2 1/2	11 1/2	1.1906-1.2530	144.50	128.25	122.80	120.20	117.40	115.20	
1 5/16	1.3125	45042	112.05	1	8	2 1/2	11 1/2	1.2531-1.3155	144.50	128.25	122.80	120.20	117.40	115.20	
1 3/8	1.3750	45044	113.70	1	8	2 1/2	12	1.3156-1.3780	146.15	129.90	124.40	121.85	119.05	116.85	
1 7/16	1.4375	45046	125.60	1 1/4	8	2 1/2	12	1.3781-1.4405	158.10	141.75	136.35	133.75	131.00	128.80	
1 1/2	1.5000	45048	150.75	1 1/4	8	2 1/2	12 1/2	1.4406-1.5030	183.20	166.95	161.55	158.90	156.15	154.00	
1 9/16	1.5625	45050	199.00	1 1/4	8	2 1/2	12 1/2	1.5031-1.5660	231.45	215.20	209.75	207.15	204.40	202.20	
1 5/8	1.6250	45052	205.80	1 1/4	8	2 3/4	13	1.5661-1.6280	238.30	221.95	216.55	214.00	211.20	209.00	
1 11/16	1.6875	45054	225.95	1 1/4	8	2 3/4	13	1.6281-1.6910	258.50	242.20	236.80	234.15	231.40	229.20	
1 3/4	1.7500	45056	225.95	1 1/4	10	3	13 1/2	1.6911-1.7530	258.50	242.20	236.80	234.15	231.40	229.20	
1 13/16	1.8125	45058	231.20	1 1/2	10	3	13 1/2	1.7531-1.8160	263.75	247.50	242.00	239.45	236.60	234.45	
1 7/8	1.8750	45060	242.50	1 1/2	10	3 1/4	14	1.8161-1.8780	274.95	258.65	253.25	250.65	247.85	245.65	
1 15/16	1.9375	45062	257.10	1 1/2	10	3 1/4	14	1.8781-1.9410	289.55	273.25	267.85	265.25	262.50	260.30	
2	2.0000	45064	257.10	1 1/2	12	3 1/4	14	1.9411-2.0030	289.55	273.25	267.85	265.25	262.50	260.30	

*Quantities of 15 or more - price of fractional size in same size range.



CHUCKING REAMERS CARBIDE TIPPED TYPE 450 METRIC



STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 56).

TOOL DIAMETER		TYPE 450 METRIC EDP NO.	METRIC PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH			SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
						FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	450045	\$48.20	1/64	4	1 1/2	6	4.494-5.182	\$71.10	\$55.85	\$50.75	\$48.25	\$45.70	\$43.60	\$40.65
5.0	.1969	450050	48.20	1/64	4	1 1/2	6	-	-	-	-	-	-	-	-
5.5	.2165	450055	48.20	13/64	4	1 1/2	6	5.183-5.613	71.10	55.85	50.75	48.25	45.70	43.60	40.65
6.0	.2362	450060	48.20	7/32	4	1 1/2	6	5.614-6.045	71.10	55.85	50.75	48.25	45.70	43.60	40.65
6.3	.2480	450063	48.20	15/64	4	1 1/2	6	6.046-6.426	71.10	55.85	50.75	48.25	45.70	43.60	40.65
6.5	.2559	450065	48.95	15/64	4	1 1/2	6	6.427-7.214	71.80	56.65	51.55	49.05	46.50	44.35	41.50
7.0	.2756	450070	48.95	15/64	4	1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	450075	48.95	9/32	4	1 1/2	6	7.215-8.001	71.80	56.65	51.55	49.05	46.50	44.35	41.50
8.0	.3150	450080	48.95	9/32	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	450085	50.35	9/32	4	1 1/2	6	8.002-8.814	73.30	58.10	52.95	50.45	47.95	45.80	42.90
9.0	.3543	450090	50.35	5/16	4	1 3/4	7	8.815-9.601	73.30	58.10	52.95	50.45	47.95	45.80	42.90
9.5	.3740	450095	50.35	5/16	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	450100	52.35	5/16	4	1 3/4	7	9.602-10.389	75.30	60.10	54.95	52.50	49.95	47.85	44.85
10.5	.4134	450105	55.75	3/8	4	1 3/4	7	10.390-11.201	78.75	63.45	58.40	55.90	53.40	51.25	48.30
11.0	.4331	450110	55.75	3/8	4	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	450115	59.45	3/8	4	1 3/4	7	11.202-11.989	82.40	67.15	62.10	59.60	57.00	54.90	52.00
12.0	.4724	450120	63.75	7/16	6	2	8	11.990-12.776	88.25	72.05	66.50	63.85	61.10	58.80	55.70
12.5	.4921	450125	63.75	7/16	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	450130	65.20	7/16	6	2	8	12.777-13.564	89.80	73.45	68.00	65.30	62.55	60.30	57.15
13.5	.5315	450135	65.20	7/16	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	450140	65.20	7/16	6	2	8	13.565-14.376	89.80	73.45	68.00	65.30	62.55	60.30	57.15
14.5	.5709	450145	67.35	7/16	6	2	8	14.377-15.164	91.90	75.55	70.15	67.45	64.75	62.40	59.30
15.0	.5906	450150	67.35	7/16	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	450155	67.35	9/16	6	2	9	15.165-15.951	91.90	75.55	70.15	67.45	64.75	62.40	59.30
16.0	.6299	450160	68.35	9/16	6	2	9	15.952-16.739	92.85	76.60	71.15	68.45	65.75	63.40	60.30
16.5	.6496	450165	68.35	9/16	6	2	9	-	-	-	-	-	-	-	-
17.0	.6693	450170	68.35	9/16	6	2	9	16.740-17.551	92.85	76.60	71.15	68.45	65.75	63.40	60.30
17.5	.6890	450175	68.35	9/16	6	2	9	-	-	-	-	-	-	-	-
18.0	.7087	450180	71.05	9/16	6	2	9	17.552-18.339	95.55	79.20	73.80	71.15	68.40	66.10	63.00
18.5	.7283	450185	71.05	5/8	6	2	9 1/2	18.340-19.126	95.55	79.20	73.80	71.15	68.40	66.10	63.00
19.0	.7480	450190	71.05	5/8	6	2	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	450195	73.10	5/8	6	2	9 1/2	19.127-19.914	97.60	81.40	75.85	73.20	70.45	68.15	65.05
20.0	.7874	450200	73.10	5/8	6	2	9 1/2	19.915-20.726	97.60	81.40	75.85	73.20	70.45	68.15	65.05
20.5	.8071	450205	73.10	5/8	6	2	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	450210	75.50	5/8	6	2	9 1/2	20.727-21.514	100.10	83.80	78.35	75.70	72.90	70.65	67.50
21.5	.8465	450215	75.50	5/8	6	2	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	450220	75.50	3/4	6	2 1/4	10	21.515-22.301	100.10	83.80	78.35	75.70	72.90	70.65	67.50
22.5	.8858	450225	89.40	3/4	6	2 1/4	10	22.302-23.089	114.90	98.00	92.30	89.50	86.70	84.30	81.05
23.0	.9055	450230	89.40	3/4	6	2 1/4	10	-	-	-	-	-	-	-	-
23.5	.9252	450235	89.40	3/4	8	2 1/4	10	23.090-23.901	114.90	98.00	92.30	89.50	86.70	84.30	81.05
24.0	.9449	450240	93.15	3/4	8	2 1/4	10	23.902-24.689	118.60	101.75	96.00	93.25	90.45	88.10	84.85
24.5	.9646	450245	93.15	3/4	8	2 1/4	10	-	-	-	-	-	-	-	-
25.0	.9843	450250	93.15	7/8	8	2 1/4	10 1/2	24.690-25.476	118.60	101.75	96.00	93.25	90.45	88.10	84.85
25.5	1.0039	450255	95.50	7/8	8	2 1/4	10 1/2	25.477-27.076	119.95	103.75	98.30	95.65	92.90	90.65	87.55
26.0	1.0236	450260	95.50	7/8	8	2 1/4	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	450270	95.50	7/8	8	2 1/4	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	450280	102.45	7/8	8	2 1/4	11	27.077-28.651	126.95	110.70	105.25	102.65	99.90	97.60	94.50
29.0	1.1417	450290	106.75	1	8	2 1/4	11	28.652-30.239	131.15	115.00	109.50	106.85	104.10	101.85	98.75
30.0	1.1811	450300	106.75	1	8	2 1/4	11	-	-	-	-	-	-	-	-
31.0	1.2205	450310	122.80	1	8	2 1/2	11 1/2	30.240-31.826	147.25	131.05	125.60	122.95	120.20	117.90	114.80
32.0	1.2598	450320	122.80	1	8	2 1/2	11 1/2	31.827-33.414	147.25	131.05	125.60	122.95	120.20	117.90	114.80
33.0	1.2992	450330	122.80	1	8	2 1/2	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	450340	124.40	1	8	2 1/2	12	33.415-35.001	148.90	132.70	127.20	124.60	121.85	119.60	116.50
35.0	1.3780	450350	124.40	1	8	2 1/2	12	-	-	-	-	-	-	-	-
36.0	1.4173	450360	136.35	1 1/4	8	2 1/2	12	35.002-36.589	160.75	144.60	139.10	136.45	133.75	131.50	128.35
37.0	1.4567	450370	161.55	1 1/4	8	2 1/2	12 1/2	36.590-38.176	185.95	169.75	164.30	161.65	158.90	156.65	153.55
38.0	1.4961	450380	161.55	1 1/4	8	2 1/2	12 1/2	-	-	-	-	-	-	-	-

Modified tool diameters are available up to 50mm - contact us for price.

REAMERS



CHUCKING REAMERS SOLID CARBIDE TYPE 804 .0005 INCREMENTS



STOCKED DECIMAL TOOL DIAMETERS (.0280 TO .1765) STRAIGHT FLUTES & SHANK - SHORT SERIES

NOTE: Dimension details on pages 104. Available modifications on page 101. Additional Type 804 sizes on page 105-109.

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.0280	8040280	\$20.20	.0580	8040580	\$20.75	.0880	8040880	\$21.60	.1180	8041180	\$24.35	.1480	8041480	\$26.85
.0285	8040285	21.30	.0585	8040585	20.75	.0885	8040885	21.60	.1185	8041185	24.45	.1485	8041485	26.85
.0290	8040290	21.30	.0590	8040590	18.05	.0890	8040890	20.90	.1190	8041190	24.45	.1490	8041490	26.85
.0295	8040295	20.20	.0595	8040595	19.70	.0895	8040895	22.10	.1195	8041195	24.45	.1495	8041495	25.55
.0300	8040300	21.30	.0600	8040600	21.30	.0900	8040900	22.10	.1200	8041200	23.25	.1500	8041500	26.85
.0305	8040305	21.30	.0605	8040605	21.30	.0905	8040905	22.10	.1205	8041205	24.45	.1505	8041505	26.85
.0310	8040310	20.20	.0610	8040610	20.20	.0910	8040910	22.20	.1210	8041210	24.45	.1510	8041510	26.85
.0315	804008	20.20	.0615	8040615	21.30	.0915	8040915	22.20	.1215	8041215	24.45	.1515	8041515	26.85
.0320	8040320	20.20	.0620	8040620	21.30	.0920	8040920	22.20	.1220	804031	23.25	.1520	8041520	25.55
.0325	8040325	21.30	.0625	80404	18.60	.0925	8040925	21.00	.1225	8041225	24.45	.1525	8041525	28.00
.0330	8040330	20.20	.0630	804016	20.20	.0930	8040930	22.20	.1230	8041230	24.45	.1530	8041530	28.00
.0335	8040335	20.20	.0635	8040635	20.20	.0935	8040935	21.00	.1235	8041235	24.45	.1535	804039	26.60
.0340	8040340	20.55	.0640	8040640	21.30	.0940	8040940	22.20	.1240	8041240	24.45	.1540	8041540	26.60
.0345	8040345	20.55	.0645	8040645	21.30	.0945	804024	21.00	.1245	8041245	24.45	.1545	8041545	28.00
.0350	8040350	19.55	.0650	8040650	21.40	.0950	8040950	22.50	.1250	80408	21.40	.1550	8041550	28.00
.0355	8040355	20.55	.0655	8040655	21.40	.0955	8040955	22.50	.1255	8041255	24.45	.1555	8041555	26.60
.0360	8040360	19.55	.0660	8040660	21.40	.0960	8040960	21.40	.1260	804032	23.25	.1560	8041560	28.00
.0365	8040365	20.55	.0665	8040665	21.40	.0965	8040965	21.40	.1265	8041265	24.55	.1565	8041565	29.00
.0370	8040370	19.55	.0670	8040670	20.40	.0970	8040970	22.50	.1270	8041270	24.55	.1570	8041570	27.50
.0375	8040375	20.55	.0675	8040675	21.40	.0975	8040975	22.50	.1275	8041275	24.55	.1575	804040	25.15
.0380	8040380	19.55	.0680	8040680	21.40	.0980	8040980	21.40	.1280	8041280	23.30	.1580	8041580	29.60
.0385	8040385	20.55	.0685	8040685	21.40	.0985	8040985	22.65	.1285	8041285	23.30	.1585	8041585	29.60
.0390	8040390	19.55	.0690	8040690	21.40	.0990	8040990	22.65	.1290	8041290	24.55	.1590	8041590	28.20
.0395	8040395	20.55	.0695	8040695	21.40	.0995	8040995	21.60	.1295	8041295	24.55	.1595	8041595	30.10
.0400	8040400	19.55	.0700	8040700	20.40	.1000	8041000	22.65	.1300	8041300	24.55	.1600	8041600	30.10
.0405	8040405	20.55	.0705	8040705	21.40	.1005	8041005	22.65	.1305	8041305	24.55	.1605	8041605	30.10
.0410	8040410	19.55	.0710	8040710	21.40	.1010	8041010	22.65	.1310	8041310	24.55	.1610	8041610	28.60
.0415	8040415	20.55	.0715	8040715	21.40	.1015	8041015	21.60	.1315	8041315	24.55	.1615	8041615	30.10
.0420	8040420	19.55	.0720	8040720	21.40	.1020	8041020	22.85	.1320	8041320	24.55	.1620	8041620	30.10
.0425	8040425	20.55	.0725	8040725	21.40	.1025	8041025	22.95	.1325	8041325	24.55	.1625	8041625	30.10
.0430	8040430	19.55	.0730	8040730	20.40	.1030	8041030	22.95	.1330	8041330	24.55	.1630	8041630	30.10
.0435	8040435	20.75	.0735	8040735	21.40	.1035	8041035	22.95	.1335	8041335	24.55	.1635	8041635	30.20
.0440	8040440	20.75	.0740	8040740	21.40	.1040	8041040	22.95	.1340	8041340	24.55	.1640	8041640	30.10
.0445	8040445	20.75	.0745	8040745	21.40	.1045	8041045	22.95	.1345	8041345	24.55	.1645	8041645	30.10
.0450	8040450	20.75	.0750	8040750	21.40	.1050	8041050	22.95	.1350	8041350	24.55	.1650	8041650	30.10
.0455	8040455	20.75	.0755	8040755	21.40	.1055	8041055	22.95	.1355	8041355	24.55	.1655	8041655	30.10
.0460	8040460	20.75	.0760	8040760	20.40	.1060	8041060	22.95	.1360	8041360	23.30	.1660	8041660	28.70
.0465	8040465	19.70	.0765	8040765	21.40	.1065	8041065	21.80	.1365	8041365	24.55	.1665	8041665	30.45
.0470	8040470	20.75	.0770	8040770	21.40	.1070	8041070	23.30	.1370	8041370	24.55	.1670	8041670	30.45
.0475	8040475	20.75	.0775	8040775	21.40	.1075	8041075	23.30	.1375	8041375	24.55	.1675	8041675	30.45
.0480	8040480	20.75	.0780	8040780	21.40	.1080	8041080	23.30	.1380	8041380	24.95	.1680	8041680	30.45
.0485	8040485	20.75	.0785	8040785	20.45	.1085	8041085	23.60	.1385	8041385	24.95	.1685	8041685	30.45
.0490	8040490	20.75	.0790	8040790	21.50	.1090	8041090	23.60	.1390	8041390	24.95	.1690	8041690	30.45
.0495	8040495	20.75	.0795	8040795	21.50	.1095	8041095	23.60	.1395	8041395	24.95	.1695	8041695	29.05
.0500	8040500	20.75	.0800	8040800	21.50	.1100	8041100	22.50	.1400	8041400	24.95	.1700	8041700	31.10
.0505	8040505	20.75	.0805	8040805	21.50	.1105	8041105	23.95	.1405	8041405	23.60	.1705	8041705	31.10
.0510	8040510	20.75	.0810	8040810	20.45	.1110	8041110	22.85	.1410	8041410	25.90	.1710	8041710	31.10
.0515	8040515	20.75	.0815	8040815	21.60	.1115	8041115	24.35	.1415	8041415	25.90	.1715	8041715	31.10
.0520	8040520	19.70	.0820	8040820	20.55	.1120	8041120	24.35	.1420	8041420	25.90	.1720	8041720	31.10
.0525	8040525	20.75	.0825	8040825	21.60	.1125	8041125	24.35	.1425	8041425	25.90	.1725	8041725	31.10
.0530	8040530	20.75	.0830	8040830	21.60	.1130	8041130	23.15	.1430	8041430	25.90	.1730	8041730	29.60
.0535	8040535	20.75	.0835	8040835	21.60	.1135	8041135	24.35	.1435	8041435	25.90	.1735	8041735	31.55
.0540	8040540	20.75	.0840	8040840	21.60	.1140	8041140	24.35	.1440	8041440	24.70	.1740	8041740	31.55
.0545	8040545	20.75	.0845	8040845	21.60	.1145	8041145	24.35	.1445	8041445	26.05	.1745	8041745	31.55
.0550	8040550	19.70	.0850	8040850	21.60	.1150	8041150	24.35	.1450	8041450	26.10	.1750	8041750	31.55
.0555	8040555	20.75	.0855	8040855	21.60	.1155	8041155	24.35	.1455	8041455	26.10	.1755	8041755	31.90
.0560	8040560	20.75	.0860	8040860	20.55	.1160	8041160	23.15	.1460	8041460	26.80	.1760	8041760	31.90
.0565	8040565	20.75	.0865	8040865	21.60	.1165	8041165	24.35	.1465	8041465	26.80	.1765	8041765	31.90
.0570	8040570	20.75	.0870	8040870	21.60	.1170	8041170	24.35	.1470	8041470	25.40	-	-	-
.0575	8040575	20.75	.0875	8040875	21.60	.1175	8041175	24.35	.1475	8041475	26.80	-	-	-

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 450 .0005 INCREMENTS



STOCKED DECIMAL TOOL DIAMETERS (.1770 TO .3265) STRAIGHT FLUTE LONG CARBIDE & STRAIGHT SHANK

NOTE: Dimension details and available modifications listed on page 56.

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.1770	4501770	\$48.20	.2070	4502070	\$48.20	.2370	4502370	\$48.20	.2670	4502670	\$48.95	.2970	4502970	\$48.95
.1775	4501775	48.20	.2075	4502075	48.20	.2375	4502375	48.20	.2675	4502675	48.95	.2975	4502975	48.95
.1780	4501780	48.20	.2080	4502080	48.20	.2380	4502380	48.20	.2680	4502680	48.95	.2980	4502980	48.95
.1785	4501785	48.20	.2085	4502085	48.20	.2385	4502385	48.20	.2685	4502685	48.95	.2985	4502985	48.95
.1790	4501790	48.20	.2090	4502090	48.20	.2390	4502390	48.20	.2690	4502690	48.95	.2990	4502990	48.95
.1795	4501795	48.20	.2095	4502095	48.20	.2395	4502395	48.20	.2695	4502695	48.95	.2995	4502995	48.95
.1800	4501800	48.20	.2100	4502100	48.20	.2400	4502400	48.20	.2700	4502700	48.95	.3000	4503000	48.95
.1805	4501805	48.20	.2105	4502105	48.20	.2405	4502405	48.20	.2705	4502705	48.95	.3005	4503005	48.95
.1810	4501810	48.20	.2110	4502110	48.20	.2410	4502410	48.20	.2710	4502710	48.95	.3010	4503010	48.95
.1815	4501815	48.20	.2115	4502115	48.20	.2415	4502415	48.20	.2715	4502715	48.95	.3015	4503015	48.95
.1820	4501820	48.20	.2120	4502120	48.20	.2420	4502420	48.20	.2720	4502720	48.95	.3020	4503020	48.95
.1825	4501825	48.20	.2125	4502125	48.20	.2425	4502425	48.20	.2725	4502725	48.95	.3025	4503025	48.95
.1830	4501830	48.20	.2130	4502130	48.20	.2430	4502430	48.20	.2730	4502730	48.95	.3030	4503030	48.95
.1835	4501835	48.20	.2135	4502135	48.20	.2435	4502435	48.20	.2735	4502735	48.95	.3035	4503035	48.95
.1840	4501840	48.20	.2140	4502140	48.20	.2440	4502440	48.20	.2740	4502740	48.95	.3040	4503040	48.95
.1845	4501845	48.20	.2145	4502145	48.20	.2445	4502445	48.20	.2745	4502745	48.95	.3045	4503045	48.95
.1850	450047	48.20	.2150	4502150	48.20	.2450	4502450	48.20	.2750	4502750	48.95	.3050	4503050	48.95
.1855	4501855	48.20	.2155	4502155	48.20	.2455	4502455	48.20	.2755	4502755	48.95	.3055	4503055	48.95
.1860	4501860	48.20	.2160	4502160	48.20	.2460	4502460	48.20	.2760	4502760	48.95	.3060	4503060	48.95
.1865	4501865	48.20	.2165	450055	48.20	.2465	4502465	48.20	.2765	4502765	48.95	.3065	4503065	48.95
.1870	4501870	48.20	.2170	4502170	48.20	.2470	4502470	48.20	.2770	4502770	48.95	.3070	4503070	48.95
.1875	450006	38.00	.2175	4502175	48.20	.2475	4502475	48.20	.2775	4502775	48.95	.3075	4503075	48.95
.1880	4501880	48.20	.2180	4502180	48.20	.2480	450063	48.20	.2780	4502780	48.95	.3080	4503080	48.95
.1885	4501885	48.20	.2185	4502185	48.20	.2485	4502485	48.20	.2785	4502785	48.95	.3085	4503085	48.95
.1890	450048	48.20	.2190	4502190	48.20	.2490	4502490	48.20	.2790	4502790	48.95	.3090	4503090	48.95
.1895	4501895	48.20	.2195	4502195	48.20	.2495	4502495	48.20	.2795	450071	48.95	.3095	4503095	48.95
.1900	4501900	48.20	.2200	4502200	48.20	.2500	450008	38.00	.2800	4502800	48.95	.3100	4503100	48.95
.1905	4501905	48.20	.2205	450056	48.20	.2505	4502505	48.20	.2805	4502805	48.95	.3105	4503105	48.95
.1910	4501910	48.20	.2210	4502210	48.20	.2510	4502510	48.20	.2810	4502810	48.95	.3110	450079	48.95
.1915	4501915	48.20	.2215	4502215	48.20	.2515	4502515	48.20	.2815	4502815	48.95	.3115	4503115	48.95
.1920	4501920	48.20	.2220	4502220	48.20	.2520	450064	48.20	.2820	4502820	48.95	.3120	4503120	48.95
.1925	4501925	48.20	.2225	4502225	48.20	.2525	4502525	48.20	.2825	4502825	48.95	.3125	45010	38.85
.1930	4501930	48.20	.2230	4502230	48.20	.2530	4502530	48.20	.2830	4502830	48.95	.3130	4503130	48.95
.1935	4501935	48.20	.2235	4502235	48.20	.2535	4502535	48.95	.2835	450072	48.95	.3135	4503135	48.95
.1940	4501940	48.20	.2240	4502240	48.20	.2540	4502540	48.95	.2840	4502840	48.95	.3140	4503140	48.95
.1945	4501945	48.20	.2245	4502245	48.20	.2545	4502545	48.95	.2845	4502845	48.95	.3145	4503145	48.95
.1950	4501950	48.20	.2250	4502250	48.20	.2550	4502550	48.95	.2850	4502850	48.95	.3150	450080	48.95
.1955	4501955	48.20	.2255	4502255	48.20	.2555	4502555	48.95	.2855	4502855	48.95	.3155	4503155	50.35
.1960	4501960	48.20	.2260	4502260	48.20	.2560	4502560	48.95	.2860	4502860	48.95	.3160	4503160	50.35
.1965	4501965	48.20	.2265	4502265	48.20	.2565	4502565	48.95	.2865	4502865	48.95	.3165	4503165	50.35
.1970	4501970	48.20	.2270	4502270	48.20	.2570	4502570	48.95	.2870	4502870	48.95	.3170	4503170	50.35
.1975	4501975	48.20	.2275	4502275	48.20	.2575	4502575	48.95	.2875	4502875	48.95	.3175	4503175	50.35
.1980	4501980	48.20	.2280	4502280	48.20	.2580	4502580	48.95	.2880	4502880	48.95	.3180	4503180	50.35
.1985	4501985	48.20	.2285	4502285	48.20	.2585	4502585	48.95	.2885	4502885	48.95	.3185	4503185	50.35
.1990	4501990	48.20	.2290	4502290	48.20	.2590	4502590	48.95	.2890	4502890	48.95	.3190	4503190	50.35
.1995	4501995	48.20	.2295	4502295	48.20	.2595	4502595	48.95	.2895	4502895	48.95	.3195	4503195	50.35
.2000	4502000	48.20	.2300	4502300	48.20	.2600	4502600	48.95	.2900	4502900	48.95	.3200	4503200	50.35
.2005	4502005	48.20	.2305	4502305	48.20	.2605	4502605	48.95	.2905	4502905	48.95	.3205	4503205	50.35
.2010	4502010	48.20	.2310	4502310	48.20	.2610	4502610	48.95	.2910	4502910	48.95	.3210	4503210	50.35
.2015	4502015	48.20	.2315	4502315	48.20	.2615	4502615	48.95	.2915	4502915	48.95	.3215	4503215	50.35
.2020	4502020	48.20	.2320	4502320	48.20	.2620	4502620	48.95	.2920	4502920	48.95	.3220	4503220	50.35
.2025	4502025	48.20	.2325	4502325	48.20	.2625	4502625	48.95	.2925	4502925	48.95	.3225	4503225	50.35
.2030	4502030	48.20	.2330	4502330	48.20	.2630	4502630	48.95	.2930	4502930	48.95	.3230	4503230	50.35
.2035	4502035	48.20	.2335	4502335	48.20	.2635	4502635	48.95	.2935	4502935	48.95	.3235	4503235	50.35
.2040	4502040	48.20	.2340	4502340	48.20	.2640	4502640	48.95	.2940	4502940	48.95	.3240	4503240	50.35
.2045	4502045	48.20	.2345	4502345	48.20	.2645	4502645	48.95	.2945	4502945	48.95	.3245	4503245	50.35
.2050	4502050	48.20	.2350	4502350	48.20	.2650	4502650	48.95	.2950	4502950	48.95	.3250	4503250	50.35
.2055	4502055	48.20	.2355	4502355	48.20	.2655	4502655	48.95	.2955	4502955	48.95	.3255	4503255	50.35
.2060	4502060	48.20	.2360	4502360	48.20	.2660	4502660	48.95	.2960	4502960	48.95	.3260	4503260	50.35
.2065	4502065	48.20	.2365	4502365	48.20	.2665	4502665	48.95	.2965	4502965	48.95	.3265	4503265	50.35

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 450 .0005 INCREMENTS



STOCKED DECIMAL TOOL DIAMETERS (.3270 TO .4765) STRAIGHT FLUTE LONG CARBIDE & STRAIGHT SHANK

NOTE: Dimension details and available modifications listed on page 56.

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.3270	4503270	\$50.35	.3570	4503570	\$50.35	.3870	4503870	\$52.35	.4170	4504170	\$55.75	.4470	4504470	\$59.55
.3275	4503275	50.35	.3575	4503575	50.35	.3875	4503875	52.35	.4175	4504175	55.75	.4475	4504475	59.55
.3280	4503280	50.35	.3580	4503580	50.35	.3880	4503880	52.35	.4180	4504180	55.75	.4480	4504480	59.55
.3285	4503285	50.35	.3585	4503585	50.35	.3885	4503885	52.35	.4185	4504185	55.75	.4485	4504485	59.55
.3290	4503290	50.35	.3590	4503590	50.35	.3890	4503890	52.35	.4190	4504190	55.75	.4490	4504490	59.55
.3295	4503295	50.35	.3595	4503595	50.35	.3895	4503895	52.35	.4195	4504195	55.75	.4495	4504495	59.55
.3300	4503300	50.35	.3600	4503600	50.35	.3900	4503900	52.35	.4200	4504200	55.75	.4500	4504500	59.55
.3305	4503305	50.35	.3605	4503605	50.35	.3905	4503905	52.35	.4205	4504205	55.75	.4505	4504505	59.55
.3310	4503310	50.35	.3610	4503610	50.35	.3910	4503910	52.35	.4210	4504210	55.75	.4510	4504510	59.55
.3315	4503315	50.35	.3615	4503615	50.35	.3915	4503915	52.35	.4215	4504215	55.75	.4515	4504515	59.55
.3320	4503320	50.35	.3620	4503620	50.35	.3920	4503920	52.35	.4220	4504220	55.75	.4520	4504520	59.55
.3325	4503325	50.35	.3625	4503625	50.35	.3925	4503925	52.35	.4225	4504225	55.75	.4525	4504525	59.55
.3330	4503330	50.35	.3630	4503630	50.35	.3930	4503930	52.35	.4230	4504230	55.75	.4530	4504530	59.55
.3335	4503335	50.35	.3635	4503635	50.35	.3935	4503935	52.35	.4235	4504235	55.75	.4535	4504535	59.55
.3340	4503340	50.35	.3640	4503640	50.35	.3940	4503940	52.35	.4240	4504240	55.75	.4540	4504540	59.55
.3345	4503345	50.35	.3645	4503645	50.35	.3945	4503945	52.35	.4245	4504245	55.75	.4545	4504545	59.55
.3350	4503350	50.35	.3650	4503650	50.35	.3950	4503950	52.35	.4250	4504250	55.75	.4550	4504550	59.55
.3355	4503355	50.35	.3655	4503655	50.35	.3955	4503955	52.35	.4255	4504255	55.75	.4555	4504555	59.55
.3360	4503360	50.35	.3660	4503660	50.35	.3960	4503960	52.35	.4260	4504260	55.75	.4560	4504560	59.55
.3365	4503365	50.35	.3665	4503665	50.35	.3965	4503965	52.35	.4265	4504265	55.75	.4565	4504565	59.55
.3370	4503370	50.35	.3670	4503670	50.35	.3970	4503970	52.35	.4270	4504270	55.75	.4570	4504570	59.55
.3375	4503375	50.35	.3675	4503675	50.35	.3975	4503975	52.35	.4275	4504275	55.75	.4575	4504575	59.55
.3380	4503380	50.35	.3680	4503680	50.35	.3980	4503980	52.35	.4280	4504280	55.75	.4580	4504580	59.55
.3385	4503385	50.35	.3685	4503685	50.35	.3985	4503985	52.35	.4285	4504285	55.75	.4585	4504585	59.55
.3390	4503390	50.35	.3690	4503690	50.35	.3990	4503990	52.35	.4290	4504290	55.75	.4590	4504590	59.55
.3395	4503395	50.35	.3695	4503695	50.35	.3995	4503995	52.35	.4295	4504295	55.75	.4595	4504595	59.55
.3400	4503400	50.35	.3700	4503700	50.35	.4000	4504000	52.35	.4300	4504300	55.75	.4600	4504600	59.55
.3405	4503405	50.35	.3705	4503705	50.35	.4005	4504005	52.35	.4305	4504305	55.75	.4605	4504605	59.55
.3410	4503410	50.35	.3710	4503710	50.35	.4010	4504010	52.35	.4310	4504310	55.75	.4610	4504610	59.55
.3415	4503415	50.35	.3715	4503715	50.35	.4015	4504015	52.35	.4315	4504315	55.75	.4615	4504615	59.55
.3420	4503420	50.35	.3720	4503720	50.35	.4020	4504020	52.35	.4320	4504320	55.75	.4620	4504620	59.55
.3425	450087	50.35	.3725	4503725	50.35	.4025	4504025	52.35	.4325	4504325	55.75	.4625	4504625	59.55
.3430	4503430	50.35	.3730	4503730	50.35	.4030	4504030	52.35	.4330	4504330	55.75	.4630	4504630	59.55
.3435	4503435	50.35	.3735	4503735	50.35	.4035	4504035	52.35	.4335	4504335	55.75	.4635	4504635	59.55
.3440	4503440	50.35	.3740	450095	50.35	.4040	4504040	52.35	.4340	4504340	55.75	.4640	4504640	59.55
.3445	4503445	50.35	.3745	4503745	50.35	.4045	4504045	52.35	.4345	4504345	55.75	.4645	4504645	59.55
.3450	4503450	50.35	.3750	45012	40.25	.4050	4504050	52.35	.4350	4504350	55.75	.4650	4504650	59.55
.3455	4503455	50.35	.3755	4503755	50.35	.4055	450103	52.35	.4355	4504355	55.75	.4655	4504655	59.55
.3460	4503460	50.35	.3760	4503760	50.35	.4060	4504060	52.35	.4360	4504360	55.75	.4660	4504660	59.55
.3465	450088	50.35	.3765	4503765	50.35	.4065	4504065	52.35	.4365	4504365	55.75	.4665	4504665	59.55
.3470	4503470	50.35	.3770	4503770	50.35	.4070	4504070	52.35	.4370	450111	55.75	.4670	4504670	59.55
.3475	4503475	50.35	.3775	4503775	50.35	.4075	4504075	52.35	.4375	45014	45.70	.4675	4504675	59.55
.3480	4503480	50.35	.3780	450096	50.35	.4080	4504080	52.35	.4380	4504380	55.75	.4680	4504680	59.55
.3485	4503485	50.35	.3785	4503785	52.35	.4085	4504085	52.35	.4385	4504385	55.75	.4685	450119	59.55
.3490	4503490	50.35	.3790	4503790	52.35	.4090	4504090	52.35	.4390	4504390	55.75	.4690	4504690	59.55
.3495	4503495	50.35	.3795	4503795	52.35	.4095	4504095	55.75	.4395	4504395	55.75	.4695	4504695	59.55
.3500	4503500	50.35	.3800	4503800	52.35	.4100	4504100	55.75	.4400	4504400	55.75	.4700	4504700	59.55
.3505	4503505	50.35	.3805	4503805	52.35	.4105	4504105	55.75	.4405	4504405	55.75	.4705	4504705	59.55
.3510	4503510	50.35	.3810	4503810	52.35	.4110	4504110	55.75	.4410	4504410	55.75	.4710	4504710	59.55
.3515	4503515	50.35	.3815	4503815	52.35	.4115	4504115	55.75	.4415	4504415	59.55	.4715	4504715	59.55
.3520	4503520	50.35	.3820	4503820	52.35	.4120	4504120	55.75	.4420	4504420	59.55	.4720	4504720	59.55
.3525	4503525	50.35	.3825	4503825	52.35	.4125	4504125	55.75	.4425	4504425	59.55	.4725	4504725	63.80
.3530	4503530	50.35	.3830	4503830	52.35	.4130	4504130	55.75	.4430	4504430	59.55	.4730	4504730	63.80
.3535	4503535	50.35	.3835	4503835	52.35	.4135	4504135	55.75	.4435	4504435	59.55	.4735	4504735	63.80
.3540	4503540	50.35	.3840	4503840	52.35	.4140	4504140	55.75	.4440	4504440	59.55	.4740	4504740	63.80
.3545	4503545	50.35	.3845	4503845	52.35	.4145	4504145	55.75	.4445	4504445	59.55	.4745	4504745	63.80
.3550	4503550	50.35	.3850	4503850	52.35	.4150	4504150	55.75	.4450	4504450	59.55	.4750	4504750	63.80
.3555	4503555	50.35	.3855	4503855	52.35	.4155	4504155	55.75	.4455	4504455	59.55	.4755	4504755	63.80
.3560	4503560	50.35	.3860	4503860	52.35	.4160	4504160	55.75	.4460	4504460	59.55	.4760	4504760	63.80
.3565	4503565	50.35	.3865	4503865	52.35	.4165	4504165	55.75	.4465	4504465	59.55	.4765	4504765	63.80

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 450 .0005 INCREMENTS



STOCKED DECIMAL TOOL DIAMETERS (.4770 TO .6265) STRAIGHT FLUTE LONG CARBIDE & STRAIGHT SHANK

NOTE: Dimension details and available modifications listed on page 56.

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.4770	4504770	\$63.80	.5070	4505070	\$65.20	.5370	4505370	\$65.20	.5670	4505670	\$67.35	.5970	4505970	\$67.35
.4775	4504775	63.80	.5075	4505075	65.20	.5375	4505375	65.20	.5675	4505675	67.35	.5975	4505975	67.35
.4780	4504780	63.80	.5080	4505080	65.20	.5380	4505380	65.20	.5680	4505680	67.35	.5980	4505980	67.35
.4785	4504785	63.80	.5085	4505085	65.20	.5385	4505385	65.20	.5685	4505685	67.35	.5985	4505985	67.35
.4790	4504790	63.80	.5090	4505090	65.20	.5390	4505390	65.20	.5690	4505690	67.35	.5990	4505990	67.35
.4795	4504795	63.80	.5095	4505095	65.20	.5395	4505395	65.20	.5695	4505695	67.35	.5995	4505995	67.35
.4800	4504800	63.80	.5100	4505100	65.20	.5400	4505400	65.20	.5700	4505700	67.35	.6000	4506000	67.35
.4805	4504805	63.80	.5105	4505105	65.20	.5405	4505405	65.20	.5705	4505705	67.35	.6005	4506005	67.35
.4810	4504810	63.80	.5110	4505110	65.20	.5410	4505410	65.20	.5710	4505710	67.35	.6010	4506010	67.35
.4815	4504815	63.80	.5115	4505115	65.20	.5415	4505415	65.20	.5715	4505715	67.35	.6015	4506015	67.35
.4820	4504820	63.80	.5120	4505120	65.20	.5420	4505420	65.20	.5720	4505720	67.35	.6020	4506020	67.35
.4825	4504825	63.80	.5125	4505125	65.20	.5425	4505425	65.20	.5725	4505725	67.35	.6025	4506025	67.35
.4830	4504830	63.80	.5130	4505130	65.20	.5430	4505430	65.20	.5730	4505730	67.35	.6030	4506030	67.35
.4835	4504835	63.80	.5135	4505135	65.20	.5435	4505435	65.20	.5735	4505735	67.35	.6035	4506035	67.35
.4840	4504840	63.80	.5140	4505140	65.20	.5440	4505440	65.20	.5740	4505740	67.35	.6040	4506040	67.35
.4845	4504845	63.80	.5145	4505145	65.20	.5445	4505445	65.20	.5745	4505745	67.35	.6045	4506045	67.35
.4850	4504850	63.80	.5150	4505150	65.20	.5450	4505450	65.20	.5750	4505750	67.35	.6050	4506050	67.35
.4855	4504855	63.80	.5155	4505155	65.20	.5455	4505455	65.20	.5755	4505755	67.35	.6055	4506055	67.35
.4860	4504860	63.80	.5160	4505160	65.20	.5460	4505460	65.20	.5760	4505760	67.35	.6060	4506060	67.35
.4865	4504865	63.80	.5165	4505165	65.20	.5465	4505465	65.20	.5765	4505765	67.35	.6065	4506065	67.35
.4870	4504870	63.80	.5170	4505170	65.20	.5470	4505470	65.20	.5770	4505770	67.35	.6070	4506070	67.35
.4875	4504875	63.80	.5175	4505175	65.20	.5475	4505475	65.20	.5775	4505775	67.35	.6075	4506075	67.35
.4880	4504880	63.80	.5180	4505180	65.20	.5480	4505480	65.20	.5780	4505780	67.35	.6080	4506080	67.35
.4885	4504885	63.80	.5185	4505185	65.20	.5485	4505485	65.20	.5785	4505785	67.35	.6085	4506085	67.35
.4890	4504890	63.80	.5190	4505190	65.20	.5490	4505490	65.20	.5790	4505790	67.35	.6090	4506090	67.35
.4895	4504895	63.80	.5195	4505195	65.20	.5495	4505495	65.20	.5795	4505795	67.35	.6095	4506095	67.35
.4900	4504900	63.80	.5200	4505200	65.20	.5500	4505500	65.20	.5800	4505800	67.35	.6100	4506100	67.35
.4905	4504905	63.80	.5205	4505205	65.20	.5505	4505505	65.20	.5805	4505805	67.35	.6105	4506105	67.35
.4910	4504910	63.80	.5210	4505210	65.20	.5510	4505510	65.20	.5810	4505810	67.35	.6110	4506110	67.35
.4915	4504915	63.80	.5215	4505215	65.20	.5515	4505515	65.20	.5815	4505815	67.35	.6115	4506115	67.35
.4920	4504920	63.80	.5220	4505220	65.20	.5520	4505520	65.20	.5820	4505820	67.35	.6120	4506120	67.35
.4925	4504925	63.80	.5225	4505225	65.20	.5525	4505525	65.20	.5825	4505825	67.35	.6125	4506125	67.35
.4930	4504930	63.80	.5230	4505230	65.20	.5530	4505530	65.20	.5830	4505830	67.35	.6130	4506130	67.35
.4935	4504935	63.80	.5235	4505235	65.20	.5535	4505535	65.20	.5835	4505835	67.35	.6135	4506135	67.35
.4940	4504940	63.80	.5240	4505240	65.20	.5540	4505540	65.20	.5840	4505840	67.35	.6140	4506140	67.35
.4945	4504945	63.80	.5245	4505245	65.20	.5545	4505545	65.20	.5845	4505845	67.35	.6145	4506145	67.35
.4950	4504950	63.80	.5250	4505250	65.20	.5550	4505550	65.20	.5850	4505850	67.35	.6150	4506150	67.35
.4955	4504955	63.80	.5255	4505255	65.20	.5555	4505555	65.20	.5855	4505855	67.35	.6155	4506155	67.35
.4960	4504960	63.80	.5260	4505260	65.20	.5560	4505560	65.20	.5860	4505860	67.35	.6160	4506160	67.35
.4965	4504965	63.80	.5265	4505265	65.20	.5565	4505565	65.20	.5865	4505865	67.35	.6165	4506165	67.35
.4970	4504970	63.80	.5270	4505270	65.20	.5570	4505570	65.20	.5870	4505870	67.35	.6170	4506170	67.35
.4975	4504975	63.80	.5275	4505275	65.20	.5575	4505575	65.20	.5875	4505875	67.35	.6175	4506175	67.35
.4980	4504980	63.80	.5280	4505280	65.20	.5580	4505580	65.20	.5880	4505880	67.35	.6180	4506180	67.35
.4985	4504985	63.80	.5285	4505285	65.20	.5585	4505585	65.20	.5885	4505885	67.35	.6185	4506185	67.35
.4990	4504990	63.80	.5290	4505290	65.20	.5590	4505590	65.20	.5890	4505890	67.35	.6190	4506190	67.35
.4995	4504995	63.80	.5295	4505295	65.20	.5595	4505595	65.20	.5895	4505895	67.35	.6195	4506195	67.35
.5000	45016	52.85	.5300	4505300	65.20	.5600	4505600	65.20	.5900	4505900	67.35	.6200	4506200	67.35
.5005	4505005	63.80	.5305	4505305	65.20	.5605	4505605	65.20	.5905	4505905	67.35	.6205	4506205	67.35
.5010	4505010	63.80	.5310	4505310	65.20	.5610	4505610	65.20	.5910	4505910	67.35	.6210	4506210	67.35
.5015	4505015	63.80	.5315	450135	65.20	.5615	4505615	65.20	.5915	4505915	67.35	.6215	4506215	67.35
.5020	4505020	63.80	.5320	4505320	65.20	.5620	4505620	65.20	.5920	4505920	67.35	.6220	450158	67.35
.5025	4505025	63.80	.5325	4505325	65.20	.5625	45018	54.40	.5925	4505925	67.35	.6225	4506225	67.35
.5030	4505030	63.80	.5330	4505330	65.20	.5630	450143	65.20	.5930	4505930	67.35	.6230	4506230	67.35
.5035	4505035	65.20	.5335	4505335	65.20	.5635	4505635	65.20	.5935	4505935	67.35	.6235	4506235	67.35
.5040	4505040	65.20	.5340	4505340	65.20	.5640	4505640	65.20	.5940	4505940	67.35	.6240	4506240	67.35
.5045	4505045	65.20	.5345	4505345	65.20	.5645	4505645	65.20	.5945	450151	67.35	.6245	4506245	67.35
.5050	4505050	65.20	.5350	4505350	65.20	.5650	4505650	65.20	.5950	4505950	67.35	.6250	45020	56.50
.5055	4505055	65.20	.5355	4505355	65.20	.5655	4505655	65.20	.5955	4505955	67.35	.6255	4506255	67.35
.5060	4505060	65.20	.5360	4505360	65.20	.5660	4505660	65.20	.5960	4505960	67.35	.6260	450159	67.35
.5065	4505065	65.20	.5365	4505365	65.20	.5665	4505665	67.35	.5965	4505965	67.35	.6265	4506265	67.35

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 452 FRACTIONAL



STRAIGHT FLUTE LONG CARBIDE TAPER SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	452/453 ^{MS}
40	NON-FERROUS - SHORT CHIPS	452/453 ^{MS}	
60	CAST IRONS	452/454 ^{MS}	
80	LOW STRENGTH STEELS	452/455 ^{MS}	
100	MEDIUM STRENGTH STEELS	452/455 ^{MS}	
120	HIGH STRENGTH STEELS	452/455 ^{MS}	
140	HIGH TEMPERATURE ALLOYS	455 ^{MS}	

^{MS}See page 81 for material specific reamers

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Modified metric tool diameter - priced on pg. 63
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shank whistle notch for set screw
- Smaller taper shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

TYPE 452

- Straight polished flutes with flute long carbide
- Taper shank
- Detailed specifications on page 29

USE:

- For all general reaming - specifically designed with flute long carbide for deep hole reaming to precision tolerances and for long production runs

TOOL DIAMETER		TYPE 452 EDP NO.	PRICE	DIMENSIONS				MODIFIED DIAMETER RANGE	FINISHED TO MODIFIED TOOL DIAMETER					
FRACTIONAL	DECIMAL			TAPER SHANK NO.	NO. OF FLTS	LENGTH OF FLUTE & CARBIDE	OVER-ALL		PRICE EACH - BASED ON QUANTITY ORDERED					
								1	2	3	4	5-7	8-14*	
1/4	.2500	45208	\$43.75	1	4	1 1/2	6	0.2381-0.2530	\$74.25	\$59.00	\$53.85	\$51.40	\$48.80	\$46.70
9/32	.2812	45209	44.35	1	4	1 1/2	6	0.2531-0.2840	74.85	59.60	54.50	52.05	49.40	47.35
5/16	.3125	45210	44.35	1	4	1 1/2	6	0.2841-0.3150	74.85	59.60	54.50	52.05	49.40	47.35
11/32	.3438	45211	45.35	1	4	1 1/2	6	0.3151-0.3470	75.85	60.60	55.50	53.00	50.40	48.35
3/8	.3750	45212	45.85	1	4	1 3/4	7	0.3471-0.3780	76.35	61.10	55.95	53.55	50.90	48.90
13/32	.4062	45213	48.30	1	4	1 3/4	7	0.3781-0.4090	78.80	63.45	58.40	55.95	53.40	51.30
7/16	.4375	45214	51.45	1	4	1 3/4	7	0.4091-0.4410	81.95	66.70	61.60	59.15	56.55	54.50
15/32	.4688	45215	52.55	1	4	1 3/4	7	0.4411-0.4720	83.05	67.70	62.70	60.20	57.60	55.55
1/2	.5000	45216	56.65	1	6	2	8	0.4721-0.5030	89.25	72.90	67.45	64.85	62.05	59.85
17/32	.5312	45217	62.05	1	6	2	8	0.5031-0.5340	94.70	78.35	72.85	70.25	67.45	65.20
9/16	.5625	45218	62.05	1	6	2	8	0.5341-0.5660	94.70	78.35	72.85	70.25	67.45	65.20
19/32	.5938	45219	64.90	1	6	2	8	0.5661-0.5970	97.55	81.20	75.75	73.15	70.35	68.10
5/8	.6250	45220	64.90	2	6	2	9	0.5971-0.6280	97.55	81.20	75.75	73.15	70.35	68.10
21/32	.6562	45221	66.10	2	6	2	9	0.6281-0.6590	98.80	82.40	76.90	74.35	71.50	69.35
11/16	.6875	45222	66.10	2	6	2	9	0.6591-0.6910	98.80	82.40	76.90	74.35	71.50	69.35
23/32	.7188	45223	67.05	2	6	2	9	0.6911-0.7220	99.75	83.35	77.85	75.25	72.45	70.25
3/4	.7500	45224	69.20	2	6	2	9 1/2	0.7221-0.7530	101.85	85.45	80.00	77.40	74.55	72.40
25/32	.7812	45225	69.70	2	6	2	9 1/2	0.7531-0.7840	102.40	86.05	80.55	77.90	75.15	72.90
13/16	.8125	45226	71.35	2	6	2	9 1/2	0.7841-0.8160	103.95	87.55	82.15	79.55	76.75	74.50
27/32	.8438	45227	74.45	2	6	2	9 1/2	0.8161-0.8470	107.10	90.75	85.25	82.70	79.85	77.70
7/8	.8750	45228	77.30	2	6	2 1/4	10	0.8471-0.8780	111.20	94.20	88.45	85.85	82.85	80.65
29/32	.9062	45229	87.05	2	6	2 1/4	10	0.8781-0.9090	120.90	103.95	98.30	95.55	92.60	90.40
15/16	.9375	45230	90.50	3	8	2 1/4	10	0.9091-0.9410	124.35	107.40	101.75	99.00	96.10	93.85
31/32	.9688	45231	94.25	3	8	2 1/4	10	0.9411-0.9720	128.15	111.20	105.45	102.80	99.85	97.60
1	1.0000	45232	94.25	3	8	2 1/4	10 1/2	0.9721-1.0030	128.15	111.20	105.45	102.80	99.85	97.60
1 1/16	1.0625	45234	129.20	3	8	2 1/4	10 1/2	1.0031-1.0660	161.65	145.35	139.90	137.35	134.55	132.35
1 1/8	1.1250	45236	139.10	3	8	2 1/4	11	1.0661-1.1280	171.60	155.35	149.95	147.30	144.50	142.30
1 3/16	1.1875	45238	149.50	3	8	2 1/4	11	1.1281-1.1905	181.95	165.70	160.25	157.65	154.90	152.65
1 1/4	1.2500	45240	158.85	4	8	2 1/2	11 1/2	1.1906-1.2530	191.30	175.05	169.65	167.00	164.20	162.05
1 5/16	1.3125	45242	179.40	4	8	2 1/2	11 1/2	1.2531-1.3155	211.85	195.60	190.10	187.60	184.75	182.55
1 3/8	1.3750	45244	204.95	4	8	2 1/2	12	1.3156-1.3780	237.40	221.20	215.65	213.10	210.30	208.10
1 7/16	1.4375	45246	213.90	4	8	2 1/2	12	1.3781-1.4405	246.40	230.15	224.65	222.15	219.30	217.10
1 1/2	1.5000	45248	222.85	4	8	2 1/2	12 1/2	1.4406-1.5030	255.35	239.10	233.70	231.05	228.25	226.05

*Quantities of 15 or more - price of fractional size in same size range.



CHUCKING REAMERS CARBIDE TIPPED TYPE 452 METRIC



STRAIGHT FLUTE LONG CARBIDE TAPER SHANK



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 62).

TOOL DIAMETER		TYPE 452 METRIC EDP NO.	METRIC PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER								
mm	INCH			TAPER SHANK NO.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED							
						FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14	
6.0	.2362	452060	\$53.85	1	4	1 1/2	6	6.000-6.426	\$76.80	\$61.60	\$56.50	\$53.95	\$51.40	\$49.30	\$46.35	
6.5	.2559	452065	54.50	1	4	1 1/2	6	6.427-7.214	77.40	62.20	57.10	54.60	52.05	49.95	47.00	
7.0	.2756	452070	54.50	1	4	1 1/2	6	-	-	-	-	-	-	-	-	
7.5	.2953	452075	54.50	1	4	1 1/2	6	7.215-8.001	77.40	62.20	57.10	54.60	52.05	49.95	47.00	
8.0	.3150	452080	54.50	1	4	1 1/2	6	-	-	-	-	-	-	-	-	
8.5	.3346	452085	55.50	1	4	1 1/2	6	8.002-8.814	78.45	63.20	58.10	55.60	53.00	50.90	48.00	
9.0	.3543	452090	55.95	1	4	1 3/4	7	8.815-9.601	78.90	63.75	58.60	56.05	53.55	51.40	48.45	
9.5	.3740	452095	55.95	1	4	1 3/4	7	-	-	-	-	-	-	-	-	
10.0	.3937	452100	58.40	1	4	1 3/4	7	9.602-10.389	81.40	66.10	61.00	58.55	55.95	53.85	50.90	
10.5	.4134	452105	61.60	1	4	1 3/4	7	10.390-11.201	84.50	69.30	64.20	61.75	59.15	57.00	54.10	
11.0	.4331	452110	61.60	1	4	1 3/4	7	-	-	-	-	-	-	-	-	
11.5	.4528	452115	62.70	1	4	1 3/4	7	11.202-11.989	85.60	70.35	65.25	62.80	60.20	58.10	55.10	
12.0	.4724	452120	67.45	1	6	2	8	11.990-12.776	92.05	75.75	70.25	67.55	64.85	62.55	59.45	
12.5	.4921	452125	67.45	1	6	2	8	-	-	-	-	-	-	-	-	
13.0	.5118	452130	72.85	1	6	2	8	12.777-13.564	97.45	81.10	75.70	73.05	70.25	68.00	64.85	
13.5	.5315	452135	72.85	1	6	2	8	-	-	-	-	-	-	-	-	
14.0	.5512	452140	72.85	1	6	2	8	13.565-14.376	97.45	81.10	75.70	73.05	70.25	68.00	64.85	
14.5	.5709	452145	75.75	1	6	2	8	14.377-15.164	100.30	84.05	78.55	75.85	73.15	70.80	67.70	
15.0	.5906	452150	75.75	1	6	2	8	-	-	-	-	-	-	-	-	
15.5	.6102	452155	75.75	2	6	2	9	15.165-15.951	100.30	84.05	78.55	75.85	73.15	70.80	67.70	
16.0	.6299	452160	76.90	2	6	2	9	15.952-16.739	101.50	85.20	79.75	77.05	74.35	72.10	68.90	
16.5	.6496	452165	76.90	2	6	2	9	-	-	-	-	-	-	-	-	
17.0	.6693	452170	76.90	2	6	2	9	16.740-17.551	101.50	85.20	79.75	77.05	74.35	72.10	68.90	
17.5	.6890	452175	76.90	2	6	2	9	-	-	-	-	-	-	-	-	
18.0	.7087	452180	77.85	2	6	2	9	17.552-18.339	102.45	86.15	80.70	78.00	75.25	73.05	69.80	
18.5	.7283	452185	80.00	2	6	2	9 1/2	18.340-19.126	104.60	88.25	82.80	80.10	77.40	75.15	72.05	
19.0	.7480	452190	80.00	2	6	2	9 1/2	-	-	-	-	-	-	-	-	
19.5	.7677	452195	80.55	2	6	2	9 1/2	19.127-19.914	105.10	88.85	83.35	80.70	77.90	75.70	72.50	
20.0	.7874	452200	82.15	2	6	2	9 1/2	19.915-20.726	106.75	90.40	84.95	82.25	79.55	77.25	74.15	
20.5	.8071	452205	82.15	2	6	2	9 1/2	-	-	-	-	-	-	-	-	
21.0	.8268	452210	85.25	2	6	2	9 1/2	20.727-21.514	109.85	93.55	88.10	85.40	82.70	80.45	77.25	
21.5	.8465	452215	85.25	2	6	2	9 1/2	-	-	-	-	-	-	-	-	
22.0	.8661	452220	85.25	2	6	2 1/4	10	21.515-22.301	109.85	93.55	88.10	85.40	82.70	80.45	77.25	
22.5	.8858	452225	98.30	2	6	2 1/4	10	22.302-23.089	123.75	106.85	101.15	98.40	95.55	93.20	90.00	
23.0	.9055	452230	98.30	2	6	2 1/4	10	-	-	-	-	-	-	-	-	
23.5	.9252	452235	101.75	3	8	2 1/4	10	23.090-23.901	127.20	110.30	104.65	101.85	99.00	96.65	93.45	
24.0	.9449	452240	105.45	3	8	2 1/4	10	23.902-24.689	131.00	114.05	108.40	105.65	102.80	100.45	97.10	
24.5	.9646	452245	105.45	3	8	2 1/4	10	-	-	-	-	-	-	-	-	
25.0	.9843	452250	105.45	3	8	2 1/4	10 1/2	24.690-25.476	131.00	114.05	108.40	105.65	102.80	100.45	97.10	
25.5	1.0039	452255	139.90	3	8	2 1/4	10 1/2	25.477-27.076	164.40	148.20	142.70	140.05	137.35	135.10	132.00	
26.0	1.0236	452260	139.90	3	8	2 1/4	10 1/2	-	-	-	-	-	-	-	-	
27.0	1.0630	452270	139.90	3	8	2 1/4	10 1/2	-	-	-	-	-	-	-	-	
28.0	1.1024	452280	149.95	3	8	2 1/4	11	27.077-28.651	174.35	158.15	152.65	150.05	147.30	145.05	141.95	
29.0	1.1417	452290	160.25	3	8	2 1/4	11	28.652-30.239	184.70	168.50	163.00	160.40	157.65	155.40	152.30	
30.0	1.1811	452300	160.25	3	8	2 1/4	11	-	-	-	-	-	-	-	-	
31.0	1.2205	452310	169.65	4	8	2 1/2	11 1/2	30.240-31.826	194.05	177.85	172.40	169.75	167.00	164.75	161.65	
32.0	1.2598	452320	190.10	4	8	2 1/2	11 1/2	31.827-33.414	214.60	198.35	192.95	190.25	187.60	185.25	182.10	
33.0	1.2992	452330	190.10	4	8	2 1/2	11 1/2	-	-	-	-	-	-	-	-	
34.0	1.3386	452340	215.65	4	8	2 1/2	12	33.415-35.001	240.15	223.95	218.50	215.90	213.10	210.85	207.75	
35.0	1.3780	452350	215.65	4	8	2 1/2	12	-	-	-	-	-	-	-	-	
36.0	1.4173	452360	224.65	4	8	2 1/2	12	35.002-36.589	249.10	232.90	227.50	224.80	222.15	219.80	216.65	
37.0	1.4567	452370	233.70	4	8	2 1/2	12 1/2	36.590-38.176	258.10	241.85	236.40	233.80	231.05	228.80	225.70	
38.0	1.4961	452380	233.70	4	8	2 1/2	12 1/2	-	-	-	-	-	-	-	-	

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 465 FRACTIONAL



EXPANSION REAMERS STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK



TYPE 465

- Expansion screw permits expansion of tool diameter for regrinding after wear without reinserting carbide
- Straight polished flutes with flute long carbide; Straight shank
- Detailed specifications, including minimum expansion, on page 29

USE:

- Expansion reamers are recommended for reaming abrasive materials. As the diameter wears down, the reamers can be expanded many times by tightening the end expansion screw and regrinding to its original size. Expansion reamers should not be considered as adjustable for use in producing holes of different sizes.

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	465/464 ^{MS}
	40	NON-FERROUS - SHORT CHIPS	465/464 ^{MS}
	60	CAST IRONS	465/466 ^{MS}
	80	LOW STRENGTH STEELS	465/468 ^{MS}
	100	MEDIUM STRENGTH STEELS	465/468 ^{MS}
	120	HIGH STRENGTH STEELS	465/468 ^{MS}
140	HIGH TEMPERATURE ALLOYS	468 ^{MS}	

^{MS}See page 82 for material specific reamers

MODIFICATIONS (See list on page 68, except expansion reamers can not be coated; modified metric tool diameters priced on page 65)

NOTE: For semi-finished reamers, see page 53.

TOOL DIAMETER		TYPE 465 EDP NO.	PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL			SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLUTE & CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
5/16	.3125	46510	\$58.65	5/32	4	1	6	0.2841-0.3150	\$89.15	\$73.85	\$68.70	\$66.35	\$63.75	\$61.65
1/32	.3438	46511	58.65	5/32	4	1	6	0.3151-0.3470	89.15	73.85	68.70	66.35	63.75	61.65
3/8	.3750	46512	54.95	5/16	4	1	7	0.3471-0.3780	83.60	69.25	64.40	62.15	59.70	57.75
13/32	.4062	46513	58.35	5/16	4	1	7	0.3781-0.4090	86.90	72.55	67.80	65.50	63.05	61.10
7/16	.4375	46514	58.35	3/8	4	1	7	0.4091-0.4410	86.90	72.55	67.80	65.50	63.05	61.10
15/32	.4688	46515	61.85	3/8	4	1	7	0.4411-0.4720	90.35	76.05	71.30	69.00	66.55	64.65
1/2	.5000	46516	61.85	7/16	6	1	8	0.4721-0.5030	90.35	76.05	71.30	69.00	66.55	64.65
17/32	.5312	46517	63.35	7/16	6	1	8	0.5031-0.5340	92.00	77.65	72.85	70.55	68.10	66.20
9/16	.5625	46518	63.35	7/16	6	1 1/8	8	0.5341-0.5660	92.00	77.65	72.85	70.55	68.10	66.20
19/32	.5938	46519	66.15	7/16	6	1 1/8	8	0.5661-0.5970	94.70	80.45	75.65	73.35	70.90	68.95
5/8	.6250	46520	66.15	9/16	6	1 1/4	9	0.5971-0.6280	94.70	80.45	75.65	73.35	70.90	68.95
21/32	.6562	46521	72.35	9/16	6	1 1/4	9	0.6281-0.6590	100.90	86.55	81.80	79.55	77.05	75.15
11/16	.6875	46522	72.35	9/16	6	1 1/4	9	0.6591-0.6910	100.90	86.55	81.80	79.55	77.05	75.15
23/32	.7188	46523	75.00	9/16	6	1 1/4	9	0.6911-0.7220	103.65	89.25	84.45	82.20	79.75	77.85
3/4	.7500	46524	75.00	5/8	6	1 3/8	9 1/2	0.7221-0.7530	103.65	89.25	84.45	82.20	79.75	77.85
25/32	.7812	46525	80.85	5/8	6	1 3/8	9 1/2	0.7531-0.7840	109.45	95.15	90.30	88.05	85.60	83.70
13/16	.8125	46526	80.85	5/8	6	1 3/8	9 1/2	0.7841-0.8160	109.45	95.15	90.30	88.05	85.60	83.70
27/32	.8438	46527	84.05	5/8	6	1 3/8	9 1/2	0.8161-0.8470	112.55	98.30	93.50	91.20	88.80	86.85
7/8	.8750	46528	87.20	3/4	6	1 1/2	10	0.8471-0.8780	116.80	102.00	97.00	94.65	92.10	90.10
29/32	.9062	46529	92.85	3/4	6	1 1/2	10	0.8781-0.9090	122.50	107.60	102.70	100.35	97.75	95.75
15/16	.9375	46530	92.85	3/4	8	1 1/2	10	0.9091-0.9410	122.50	107.60	102.70	100.35	97.75	95.75
31/32	.9688	46531	96.45	3/4	8	1 1/2	10	0.9411-0.9720	126.05	111.25	106.25	103.90	101.30	99.35
1	1.0000	46532	96.45	7/8	8	1 5/8	10 1/2	0.9721-1.0030	126.05	111.25	106.25	103.90	101.30	99.35
1 1/32	1.0312	46533	105.70	7/8	8	1 5/8	10 1/2	-	-	-	-	-	-	-
1 1/16	1.0625	46534	105.70	7/8	8	1 5/8	10 1/2	1.0031-1.0660	135.35	120.50	115.50	113.15	110.55	108.60
1 3/32	1.0938	46535	105.70	7/8	8	1 3/4	11	-	-	-	-	-	-	-
1 1/8	1.1250	46536	105.70	7/8	8	1 3/4	11	1.0661-1.1280	135.35	120.50	115.50	113.15	110.55	108.60
1 3/16	1.1875	46538	115.35	1	8	1 3/4	11	1.1281-1.1905	145.00	130.10	125.15	122.80	120.20	118.30
1 1/4	1.2500	46540	115.35	1	8	1 7/8	11 1/2	1.1906-1.2530	145.00	130.10	125.15	122.80	120.20	118.30
1 5/16	1.3125	46542	127.85	1	8	1 7/8	11 1/2	1.2531-1.3155	157.55	142.70	137.75	135.35	132.80	130.85
1 3/8	1.3750	46544	133.90	1	8	2	12	1.3156-1.3780	163.55	148.70	143.70	141.40	138.75	136.80
1 7/16	1.4375	46546	158.25	1 1/4	8	2	12	1.3781-1.4405	189.85	174.00	168.70	166.15	163.45	161.30
1 1/2	1.5000	46548	162.85	1 1/4	8	2 1/8	12 1/2	1.4406-1.5030	194.50	178.60	173.35	170.85	168.10	165.95
1 9/16	1.5625	46550	213.85	1 1/4	8	2 1/8	12 1/2	1.5031-1.5660	245.45	229.65	224.30	221.75	219.05	216.95
1 5/8	1.6250	46552	213.85	1 1/4	8	2 1/4	13	1.5661-1.6280	245.45	229.65	224.30	221.75	219.05	216.95
1 11/16	1.6875	46554	236.85	1 1/4	8	2 1/4	13	1.6281-1.6910	268.50	252.65	247.35	244.80	242.10	239.90
1 3/4	1.7500	46556	236.85	1 1/4	10	2 3/8	13 1/2	1.6911-1.7530	268.50	252.65	247.35	244.80	242.10	239.90
1 13/16	1.8125	46558	280.45	1 1/2	10	2 3/8	13 1/2	1.7531-1.8160	312.05	296.25	290.95	288.40	285.70	283.55
1 7/8	1.8750	46560	280.45	1 1/2	10	2 1/2	14	1.8161-1.8780	312.05	296.25	290.95	288.40	285.70	283.55
1 15/16	1.9375	46562	306.40	1 1/2	10	2 1/2	14	1.8781-1.9410	338.00	322.20	316.90	314.30	311.65	309.50
2	2.0000	46564	306.40	1 1/2	12	2 1/2	14	1.9411-2.0030	338.00	322.20	316.90	314.30	311.65	309.50
2 1/8	2.1250	46568	497.70	1 1/2	12	2 3/4	14 1/2	2.0031-2.1280	529.35	513.50	508.20	505.70	502.95	500.80
2 1/4	2.2500	46572	534.55	1 3/4	12	2 3/4	14 1/2	2.1281-2.2530	566.10	550.30	545.00	542.45	539.75	537.60
2 3/8	2.3750	46576	553.15	1 3/4	12	3	15	2.2531-2.3780	584.80	568.95	563.65	561.10	558.40	556.25
2 1/2	2.5000	46580	553.15	1 3/4	12	3	15	2.3781-2.5030	584.80	568.95	563.65	561.10	558.40	556.25

*Quantities of 15 or more - price of fractional size in same size range.

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 465 METRIC



EXPANSION REAMERS STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 68, except no coatings).

TOOL DIAMETER		TYPE 465 METRIC EDP NO.	METRIC PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER								
mm	INCH			SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED							
						FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14	
7.5	.2953	465075	\$68.70	5/32	4	1	6	7.215-8.001	\$91.70	\$76.45	\$71.35	\$68.90	\$66.35	\$64.20	\$61.25	
8.0	.3150	465080	68.70	5/32	4	1	6	-	-	-	-	-	-	-	-	
8.5	.3346	465085	68.70	5/32	4	1	6	8.002-8.814	91.70	76.45	71.35	68.90	66.35	64.20	61.25	
9.0	.3543	465090	64.40	3/16	4	1	7	8.815-9.601	86.00	71.65	66.90	64.60	62.15	60.20	57.45	
9.5	.3740	465095	64.40	5/16	4	1	7	-	-	-	-	-	-	-	-	
10.0	.3937	465100	67.80	5/16	4	1	7	9.602-10.389	89.25	75.00	70.25	67.90	65.50	63.45	60.80	
10.5	.4134	465105	67.80	3/8	4	1	7	10.390-11.201	89.25	75.00	70.25	67.90	65.50	63.45	60.80	
11.0	.4331	465110	67.80	3/8	4	1	7	-	-	-	-	-	-	-	-	
11.5	.4528	465115	71.30	3/8	4	1	7	11.202-11.989	92.75	78.55	73.70	71.40	69.00	67.00	64.25	
12.0	.4724	465120	71.30	7/16	6	1	8	11.990-12.776	92.75	78.55	73.70	71.40	69.00	67.00	64.25	
12.5	.4921	465125	71.30	7/16	6	1	8	-	-	-	-	-	-	-	-	
13.0	.5118	465130	72.85	7/16	6	1	8	12.777-13.564	94.40	80.10	75.30	73.00	70.55	68.60	65.85	
13.5	.5315	465135	72.85	7/16	6	1	8	-	-	-	-	-	-	-	-	
14.0	.5512	465140	72.85	7/16	6	1 1/8	8	13.565-14.376	94.40	80.10	75.30	73.00	70.55	68.60	65.85	
14.5	.5709	465145	75.65	7/16	6	1 1/8	8	14.377-15.164	97.10	82.85	78.05	75.75	73.35	71.35	68.60	
15.0	.5906	465150	75.65	7/16	6	1 1/8	8	-	-	-	-	-	-	-	-	
15.5	.6102	465155	75.65	9/16	6	1 1/4	9	15.165-15.951	97.10	82.85	78.05	75.75	73.35	71.35	68.60	
16.0	.6299	465160	81.80	9/16	6	1 1/4	9	15.952-16.739	103.25	89.05	84.25	81.90	79.55	77.55	74.80	
16.5	.6496	465165	81.80	9/16	6	1 1/4	9	-	-	-	-	-	-	-	-	
17.0	.6693	465170	81.80	9/16	6	1 1/4	9	16.740-17.551	103.25	89.05	84.25	81.90	79.55	77.55	74.80	
17.5	.6890	465175	81.80	9/16	6	1 1/4	9	-	-	-	-	-	-	-	-	
18.0	.7087	465180	84.45	9/16	6	1 1/4	9	17.552-18.339	106.00	91.70	86.95	84.60	82.20	80.25	77.50	
18.5	.7283	465185	84.45	5/8	6	1 3/8	9 1/2	18.340-19.126	106.00	91.70	86.95	84.60	82.20	80.25	77.50	
19.0	.7480	465190	84.45	5/8	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
19.5	.7677	465195	90.30	5/8	6	1 3/8	9 1/2	19.127-19.914	111.90	97.60	92.75	90.40	88.05	86.10	83.30	
20.0	.7874	465200	90.30	5/8	6	1 3/8	9 1/2	19.915-20.726	111.90	97.60	92.75	90.40	88.05	86.10	83.30	
20.5	.8071	465205	90.30	5/8	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
21.0	.8268	465210	93.50	5/8	6	1 3/8	9 1/2	20.727-21.514	115.00	100.75	95.90	93.60	91.20	89.20	86.45	
21.5	.8465	465215	93.50	5/8	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
22.0	.8661	465220	93.50	3/4	6	1 1/2	10	21.515-22.301	115.00	100.75	95.90	93.60	91.20	89.20	86.45	
22.5	.8858	465225	102.70	3/4	6	1 1/2	10	22.302-23.089	124.95	110.20	105.20	102.80	100.35	98.25	95.40	
23.0	.9055	465230	102.70	3/4	6	1 1/2	10	-	-	-	-	-	-	-	-	
23.5	.9252	465235	102.70	3/4	8	1 1/2	10	23.090-23.901	124.95	110.20	105.20	102.80	100.35	98.25	95.40	
24.0	.9449	465240	106.25	3/4	8	1 1/2	10	23.902-24.689	128.55	113.75	108.80	106.35	103.90	101.80	98.95	
24.5	.9646	465245	106.25	3/4	8	1 1/2	10	-	-	-	-	-	-	-	-	
25.0	.9843	465250	106.25	7/8	8	1 5/8	10 1/2	24.690-25.476	128.55	113.75	108.80	106.35	103.90	101.80	98.95	
25.5	1.0039	465255	115.50	7/8	8	1 5/8	10 1/2	25.477-27.076	137.85	123.00	118.00	115.60	113.15	111.10	108.20	
26.0	1.0236	465260	115.50	7/8	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-	
27.0	1.0630	465270	115.50	7/8	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-	
28.0	1.1024	465280	115.50	7/8	8	1 3/4	11	27.077-28.651	137.85	123.00	118.00	115.60	113.15	111.10	108.20	
29.0	1.1417	465290	125.15	1	8	1 3/4	11	28.652-30.239	147.45	132.65	127.70	125.25	122.80	120.75	117.85	
30.0	1.1811	465300	125.15	1	8	1 3/4	11	-	-	-	-	-	-	-	-	
31.0	1.2205	465310	125.15	1	8	1 7/8	11 1/2	30.240-31.826	147.45	132.65	127.70	125.25	122.80	120.75	117.85	
32.0	1.2598	465320	137.75	1	8	1 7/8	11 1/2	31.827-33.414	160.00	145.20	140.30	137.85	135.35	133.30	130.45	
33.0	1.2992	465330	137.75	1	8	1 7/8	11 1/2	-	-	-	-	-	-	-	-	
34.0	1.3386	465340	143.70	1	8	2	12	33.415-35.001	166.00	151.25	146.25	143.85	141.40	139.30	136.40	
35.0	1.3780	465350	143.70	1	8	2	12	-	-	-	-	-	-	-	-	
36.0	1.4173	465360	168.70	1 1/4	8	2	12	35.002-36.589	192.45	176.70	171.40	168.80	166.15	163.95	160.95	
37.0	1.4567	465370	173.35	1 1/4	8	2 1/8	12 1/2	36.590-38.176	197.15	181.35	176.10	173.45	170.85	168.65	165.60	
38.0	1.4961	465380	173.35	1 1/4	8	2 1/8	12 1/2	-	-	-	-	-	-	-	-	
39.0	1.5354	465390	224.30	1 1/4	8	2 1/8	12 1/2	38.177-39.776	248.10	232.30	227.00	224.45	221.75	219.55	216.55	
40.0	1.5748	465400	224.30	1 1/4	8	2 1/4	13	39.777-41.351	248.10	232.30	227.00	224.45	221.75	219.55	216.55	
41.0	1.6142	465410	224.30	1 1/4	8	2 1/4	13	-	-	-	-	-	-	-	-	
42.0	1.6535	465420	247.35	1 1/4	8	2 1/4	13	41.352-42.951	271.10	255.35	250.05	247.50	244.80	242.60	239.55	
43.0	1.6929	465430	247.35	1 1/4	10	2 3/8	13 1/2	42.952-44.526	271.10	255.35	250.05	247.50	244.80	242.60	239.55	
44.0	1.7323	465440	247.35	1 1/4	10	2 3/8	13 1/2	-	-	-	-	-	-	-	-	

Modified tool diameters are available up to 63mm - contact us for price.

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 467 FRACTIONAL



EXPANSION REAMERS STRAIGHT FLUTE LONG CARBIDE TAPER SHANK



TYPE 467

• Same as Type 465, except taper shank (see description and "USE" on page 64)

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Modified metric tool diameter - priced on pg. 67
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shank whistle notch for set screw
- Smaller taper shank
- Expansion reamers can not be coated

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	467/461 ^{MS}
40	NON-FERROUS - SHORT CHIPS	467/461 ^{MS}	
60	CAST IRONS	467/462 ^{MS}	
80	LOW STRENGTH STEELS	467/463 ^{MS}	
100	MEDIUM STRENGTH STEELS	467/463 ^{MS}	
120	HIGH STRENGTH STEELS	467/463 ^{MS}	
140	HIGH TEMPERATURE ALLOYS	463 ^{MS}	

^{MS}See page 83 for material specific reamers

TOOL DIAMETER		TYPE 467 EDP NO.	PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER							
FRACTIONAL	DECIMAL			TAPER SHANK NO.	NO. OF FLTS	FLUTE & CARBIDE	OVER-ALL	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED						
							1	2	3	4	5-7	8-14*			
5/16	.3125	46710	\$66.05	1	4	1	6	0.2841-0.3150	\$96.55	\$81.25	\$76.20	\$73.70	\$71.15	\$69.05	
11/32	.3438	46711	66.05	1	4	1	6	0.3151-0.3470	96.55	81.25	76.20	73.70	71.15	69.05	
3/8	.3750	46712	61.95	1	4	1	7	0.3471-0.3780	90.50	76.20	71.40	69.15	66.70	64.75	
13/32	.4062	46713	63.85	1	4	1	7	0.3781-0.4090	92.40	78.05	73.30	71.05	68.55	66.60	
7/16	.4375	46714	63.85	1	4	1	7	0.4091-0.4410	92.40	78.05	73.30	71.05	68.55	66.60	
15/32	.4688	46715	66.95	1	4	1	7	0.4411-0.4720	95.55	81.25	76.40	74.15	71.65	69.75	
1/2	.5000	46716	66.95	1	6	1	8	0.4721-0.5030	95.55	81.25	76.40	74.15	71.65	69.75	
17/32	.5312	46717	69.00	1	6	1	8	0.5031-0.5340	97.60	83.25	78.50	76.20	73.70	71.75	
9/16	.5625	46718	69.00	1	6	1 1/8	8	0.5341-0.5660	97.60	83.25	78.50	76.20	73.70	71.75	
19/32	.5938	46719	71.75	1	6	1 1/8	8	0.5661-0.5970	100.40	86.10	81.30	79.00	76.60	74.60	
5/8	.6250	46720	71.75	2	6	1 1/4	9	0.5971-0.6280	100.40	86.10	81.30	79.00	76.60	74.60	
21/32	.6562	46721	80.80	2	6	1 1/4	9	0.6281-0.6590	109.40	95.00	90.25	88.00	85.50	83.65	
11/16	.6875	46722	80.80	2	6	1 1/4	9	0.6591-0.6910	109.40	95.00	90.25	88.00	85.50	83.65	
23/32	.7188	46723	81.00	2	6	1 1/4	9	0.6911-0.7220	109.60	95.35	90.50	88.25	85.75	83.85	
3/4	.7500	46724	81.00	2	6	1 3/8	9 1/2	0.7221-0.7530	109.60	95.35	90.50	88.25	85.75	83.85	
25/32	.7812	46725	87.00	2	6	1 3/8	9 1/2	0.7531-0.7840	115.60	101.25	96.50	94.25	91.70	89.85	
13/16	.8125	46726	87.00	2	6	1 3/8	9 1/2	0.7841-0.8160	115.60	101.25	96.50	94.25	91.70	89.85	
27/32	.8438	46727	90.65	2	6	1 3/8	9 1/2	0.8161-0.8470	119.25	104.90	100.10	97.80	95.40	93.45	
7/8	.8750	46728	94.10	2	6	1 1/2	10	0.8471-0.8780	123.70	108.90	103.90	101.55	98.95	96.95	
29/32	.9062	46729	99.50	2	6	1 1/2	10	0.8781-0.9090	129.15	114.30	109.30	106.95	104.40	102.40	
15/16	.9375	46730	99.50	3	8	1 1/2	10	0.9091-0.9410	129.15	114.30	109.30	106.95	104.40	102.40	
31/32	.9688	46731	103.10	3	8	1 1/2	10	0.9411-0.9720	132.70	117.85	112.90	110.50	108.00	105.95	
1	1.0000	46732	103.10	3	8	1 5/8	10 1/2	0.9721-1.0030	132.70	117.85	112.90	110.50	108.00	105.95	
1 1/32	1.0312	46733	112.80	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-	
1 1/16	1.0625	46734	112.80	3	8	1 5/8	10 1/2	1.0031-1.0660	142.55	127.65	122.65	120.30	117.75	115.70	
1 3/32	1.0938	46735	112.80	3	8	1 3/4	11	-	-	-	-	-	-	-	
1 1/8	1.1250	46736	112.80	3	8	1 3/4	11	1.0661-1.1280	142.55	127.65	122.65	120.30	117.75	115.70	
1 3/16	1.1875	46738	126.90	3	8	1 3/4	11	1.1281-1.1905	156.50	141.65	136.70	134.35	131.80	129.80	
1 1/4	1.2500	46740	128.60	4	8	1 7/8	11 1/2	1.1906-1.2530	158.25	143.40	138.45	136.10	133.50	131.50	
1 5/16	1.3125	46742	140.55	4	8	1 7/8	11 1/2	1.2531-1.3155	170.20	155.35	150.35	148.00	145.50	143.45	
1 3/8	1.3750	46744	154.00	4	8	2	12	1.3156-1.3780	183.60	168.75	163.80	161.40	158.85	156.85	
1 7/16	1.4375	46746	172.85	4	8	2	12	1.3781-1.4405	204.45	188.65	183.30	180.75	178.05	175.95	
1 1/2	1.5000	46748	178.95	4	8	2 1/8	12 1/2	1.4406-1.5030	210.65	194.70	189.40	186.95	184.20	182.05	
1 9/16	1.5625	46750	245.90	4	8	2 1/8	12 1/2	1.5031-1.5660	277.55	261.70	256.40	253.90	251.15	249.00	
1 5/8	1.6250	46752	245.90	4	8	2 1/4	13	1.5661-1.6280	277.55	261.70	256.40	253.90	251.15	249.00	
1 11/16	1.6875	46754	272.35	4	8	2 1/4	13	1.6281-1.6910	304.00	288.15	282.85	280.30	277.60	275.45	
1 3/4	1.7500	46756	272.35	4	10	2 3/8	13 1/2	1.6911-1.7530	304.00	288.15	282.85	280.30	277.60	275.45	
1 13/16	1.8125	46758	322.45	4	10	2 3/8	13 1/2	1.7531-1.8160	354.10	338.30	333.00	330.45	327.70	325.60	
1 7/8	1.8750	46760	322.45	4	10	2 1/2	14	1.8161-1.8780	354.10	338.30	333.00	330.45	327.70	325.60	
1 15/16	1.9375	46762	352.40	4	10	2 1/2	14	1.8781-1.9410	384.00	368.15	362.85	360.35	357.60	355.55	
2	2.0000	46764	352.40	4	12	2 1/2	14	1.9411-2.0030	384.00	368.15	362.85	360.35	357.60	355.55	
2 1/8	2.1250	46768	527.60	5	12	2 3/4	14 1/2	2.0031-2.1280	559.25	543.40	538.05	535.55	532.90	530.70	
2 1/4	2.2500	46772	566.60	5	12	2 3/4	14 1/2	2.1281-2.2530	598.25	582.35	577.10	574.55	571.85	569.75	
2 3/8	2.3750	46776	586.30	5	12	3	15	2.2531-2.3780	617.90	602.10	596.75	594.30	591.55	589.45	
2 1/2	2.5000	46780	586.30	5	12	3	15	2.3781-2.5030	617.90	602.10	596.75	594.30	591.55	589.45	

*Quantities of 15 or more - price of fractional size in same size range.

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 467 METRIC



EXPANSION REAMERS STRAIGHT FLUTE LONG CARBIDE TAPER SHANK



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 66).

TOOL DIAMETER		TYPE 467 METRIC EDP NO.	METRIC PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER								
mm	INCH			TAPER SHANK NO.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED							
						FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14	
7.5	.2953	467075	\$76.20	1	4	1	6	7.215-8.001	\$99.10	\$83.90	\$78.80	\$76.30	\$73.70	\$71.60	\$68.65	
8.0	.3150	467080	76.20	1	4	1	6	-	-	-	-	-	-	-	-	
8.5	.3346	467085	76.20	1	4	1	6	8.002-8.814	99.10	83.90	78.80	76.30	73.70	71.60	68.65	
9.0	.3543	467090	71.40	1	4	1	7	8.815-9.601	92.90	78.65	73.85	71.50	69.15	67.10	64.35	
9.5	.3740	467095	71.40	1	4	1	7	-	-	-	-	-	-	-	-	
10.0	.3937	467100	73.30	1	4	1	7	9.602-10.389	94.75	80.55	75.75	73.40	71.05	69.00	66.25	
10.5	.4134	467105	73.30	1	4	1	7	10.390-11.201	94.75	80.55	75.75	73.40	71.05	69.00	66.25	
11.0	.4331	467110	73.30	1	4	1	7	-	-	-	-	-	-	-	-	
11.5	.4528	467115	76.40	1	4	1	7	11.202-11.989	97.95	83.70	78.90	76.60	74.15	72.20	69.40	
12.0	.4724	467120	76.40	1	6	1	8	11.990-12.776	97.95	83.70	78.90	76.60	74.15	72.20	69.40	
12.5	.4921	467125	76.40	1	6	1	8	-	-	-	-	-	-	-	-	
13.0	.5118	467130	78.50	1	6	1	8	12.777-13.564	100.00	85.70	80.90	78.60	76.20	74.25	71.45	
13.5	.5315	467135	78.50	1	6	1	8	-	-	-	-	-	-	-	-	
14.0	.5512	467140	78.50	1	6	1 1/8	8	13.565-14.376	100.00	85.70	80.90	78.60	76.20	74.25	71.45	
14.5	.5709	467145	81.30	1	6	1 1/8	8	14.377-15.164	102.80	88.50	83.75	81.45	79.00	77.00	74.30	
15.0	.5906	467150	81.30	1	6	1 1/8	8	-	-	-	-	-	-	-	-	
15.5	.6102	467155	81.30	2	6	1 1/4	9	15.165-15.951	102.80	88.50	83.75	81.45	79.00	77.00	74.30	
16.0	.6299	467160	90.25	2	6	1 1/4	9	15.952-16.739	111.80	97.50	92.70	90.35	88.00	86.05	83.25	
16.5	.6496	467165	90.25	2	6	1 1/4	9	-	-	-	-	-	-	-	-	
17.0	.6693	467170	90.25	2	6	1 1/4	9	16.740-17.551	111.80	97.50	92.70	90.35	88.00	86.05	83.25	
17.5	.6890	467175	90.25	2	6	1 1/4	9	-	-	-	-	-	-	-	-	
18.0	.7087	467180	90.50	2	6	1 1/4	9	17.552-18.339	112.05	97.75	93.00	90.65	88.25	86.25	83.50	
18.5	.7283	467185	90.50	2	6	1 3/8	9 1/2	18.340-19.126	112.05	97.75	93.00	90.65	88.25	86.25	83.50	
19.0	.7480	467190	90.50	2	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
19.5	.7677	467195	96.50	2	6	1 3/8	9 1/2	19.127-19.914	117.95	103.75	98.95	96.60	94.25	92.20	89.45	
20.0	.7874	467200	96.50	2	6	1 3/8	9 1/2	19.915-20.726	117.95	103.75	98.95	96.60	94.25	92.20	89.45	
20.5	.8071	467205	96.50	2	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
21.0	.8268	467210	100.10	2	6	1 3/8	9 1/2	20.727-21.514	121.60	107.35	102.60	100.20	97.80	95.80	93.10	
21.5	.8465	467215	100.10	2	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
22.0	.8661	467220	100.10	2	6	1 1/2	10	21.515-22.301	121.60	107.35	102.60	100.20	97.80	95.80	93.10	
22.5	.8858	467225	109.30	2	6	1 1/2	10	22.302-23.089	131.65	116.80	111.90	109.40	106.95	104.90	102.05	
23.0	.9055	467230	109.30	2	6	1 1/2	10	-	-	-	-	-	-	-	-	
23.5	.9252	467235	109.30	3	8	1 1/2	10	23.090-23.901	131.65	116.80	111.90	109.40	106.95	104.90	102.05	
24.0	.9449	467240	112.90	3	8	1 1/2	10	23.902-24.689	135.25	120.45	115.45	113.05	110.50	108.45	105.65	
24.5	.9646	467245	112.90	3	8	1 1/2	10	-	-	-	-	-	-	-	-	
25.0	.9843	467250	112.90	3	8	1 5/8	10 1/2	24.690-25.476	135.25	120.45	115.45	113.05	110.50	108.45	105.65	
25.5	1.0039	467255	122.65	3	8	1 5/8	10 1/2	25.477-27.076	145.00	130.15	125.20	122.80	120.30	118.30	115.40	
26.0	1.0236	467260	122.65	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-	
27.0	1.0630	467270	122.65	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-	
28.0	1.1024	467280	122.65	3	8	1 3/4	11	27.077-28.651	145.00	130.15	125.20	122.80	120.30	118.30	115.40	
29.0	1.1417	467290	136.70	3	8	1 3/4	11	28.652-30.239	158.95	144.20	139.25	136.80	134.35	132.25	129.40	
30.0	1.1811	467300	136.70	3	8	1 3/4	11	-	-	-	-	-	-	-	-	
31.0	1.2205	467310	138.45	4	8	1 7/8	11 1/2	30.240-31.826	160.75	145.95	140.95	138.55	136.10	134.00	131.15	
32.0	1.2598	467320	150.35	4	8	1 7/8	11 1/2	31.827-33.414	172.65	157.85	152.95	150.50	148.00	145.95	143.10	
33.0	1.2992	467330	150.35	4	8	1 7/8	11 1/2	-	-	-	-	-	-	-	-	
34.0	1.3386	467340	163.80	4	8	2	12	33.415-35.001	186.05	171.30	166.30	163.90	161.40	159.35	156.50	
35.0	1.3780	467350	163.80	4	8	2	12	-	-	-	-	-	-	-	-	
36.0	1.4173	467360	183.30	4	8	2	12	35.002-36.589	207.10	191.30	186.00	183.45	180.75	178.55	175.55	
37.0	1.4567	467370	189.40	4	8	2 1/8	12 1/2	36.590-38.176	213.25	197.45	192.20	189.60	186.95	184.75	181.70	
38.0	1.4961	467380	189.40	4	8	2 1/8	12 1/2	-	-	-	-	-	-	-	-	
39.0	1.5354	467390	256.40	4	8	2 1/8	12 1/2	38.177-39.776	280.20	264.45	259.15	256.50	253.90	251.70	248.65	
40.0	1.5748	467400	256.40	4	8	2 1/4	13	39.777-41.351	280.20	264.45	259.15	256.50	253.90	251.70	248.65	
41.0	1.6142	467410	256.40	4	8	2 1/4	13	-	-	-	-	-	-	-	-	
42.0	1.6535	467420	282.85	4	8	2 1/4	13	41.352-42.951	306.65	290.90	285.60	283.00	280.30	278.15	275.05	
43.0	1.6929	467430	282.85	4	10	2 3/8	13 1/2	42.952-44.526	306.65	290.90	285.60	283.00	280.30	278.15	275.05	
44.0	1.7323	467440	282.85	4	10	2 3/8	13 1/2	-	-	-	-	-	-	-	-	

Modified tool diameters are available up to 63mm - contact us for price.

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 410 & 420 FRACTIONAL



RIGHT SPIRAL FLUTES STRAIGHT SHANK



TYPE 410

- Polished flutes
- Right spiral flutes have greater chip clearing ability for use with ductile materials, highly abrasive materials, or blind holes
- Finishes are much better as spiral flutes tend to bridge interruptions such as keyways, slots, or intersecting holes
- Detailed specifications on page 29



TYPE 420

- Polished flutes
- Used on thru holes for heat treated steels, hard cast irons and other hard materials
- Finishes are much better as spiral flutes tend to bridge interruptions such as keyways, slots, or intersecting holes
- Left spiral flutes should not be used on blind holes For shallow holes only (see page 27)
- Detailed specifications on page 29

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	410/432 ^{MS}
40	NON-FERROUS - SHORT CHIPS	410/432 ^{MS}	
60	CAST IRONS	410/436 ^{MS}	
80	LOW STRENGTH STEELS	410/438 ^{MS}	
100	MEDIUM STRENGTH STEELS	410/438 ^{MS}	
120	HIGH STRENGTH STEELS	410/438 ^{MS}	
140	HIGH TEMPERATURE ALLOYS	438 ^{MS}	

^{MS}See page 84 for material specific reamers

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Modified metric tool diameter - priced on pg. 69
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available: See page 70

For type 410 semi-finished reamers, see pg. 53.

NOTE: For smaller tool diameters, see solid carbide reamers on pgs. 104 & 111.

TOOL DIAMETER		TYPE 410 RIGHT EDP NO.	TYPE 420 LEFT EDP NO.	PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL				SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLT	CAR-BIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/16	.1875	41006	42006	\$44.75	1 1/64	4	1 1/8	1/2	4 1/2	0.1770-0.2040	\$73.80	\$59.25	\$54.40	\$52.05	\$49.55	\$47.60
7/32	.2188	41007	42007	44.75	1 3/64	4	1 1/4	1/2	5	0.2041-0.2210	73.80	59.25	54.40	52.05	49.55	47.60
15/64	.2344	4102344	4202344	44.75	7/32	4	1 1/2	1/2	6	0.2211-0.2380	73.80	59.25	54.40	52.05	49.55	47.60
1/4	.2500	41008	42008	44.75	15/64	4	1 1/2	1/2	6	0.2381-0.2530	73.80	59.25	54.40	52.05	49.55	47.60
9/32	.2812	41009	42009	44.90	15/64	4	1 1/2	1/2	6	0.2531-0.2840	73.90	59.35	54.50	52.15	49.65	47.70
5/16	.3125	41010	42010	44.90	9/32	4	1 1/2	1/2	6	0.2841-0.3150	73.90	59.35	54.50	52.15	49.65	47.70
11/32	.3438	41011	42011	49.40	9/32	4	1 1/2	5/8	6	0.3151-0.3470	78.45	63.85	59.00	56.70	54.20	52.25
3/8	.3750	41012	42012	49.85	5/16	4	1 3/4	5/8	7	0.3471-0.3780	78.85	64.35	59.45	57.20	54.70	52.75
13/32	.4062	41013	42013	52.10	5/16	4	1 3/4	5/8	7	0.3781-0.4090	81.15	66.60	61.75	59.40	56.90	54.95
7/16	.4375	41014	42014	54.20	3/8	4	1 3/4	5/8	7	0.4091-0.4410	83.20	68.70	63.80	61.50	59.00	57.05
15/32	.4688	41015	42015	57.50	3/8	4	1 3/4	5/8	7	0.4411-0.4720	86.55	72.05	67.15	64.80	62.35	60.35
1/2	.5000	41016	42016	59.70	7/16	6	2	5/8	8	0.4721-0.5030	89.45	74.50	69.55	67.15	64.60	62.60
17/32	.5312	41017	42017	61.50	7/16	6	2	5/8	8	0.5031-0.5340	91.30	76.35	71.40	69.00	66.45	64.45
9/16	.5625	41018	42018	61.50	7/16	6	2	5/8	8	0.5341-0.5660	91.30	76.35	71.40	69.00	66.45	64.45
19/32	.5938	41019	42019	63.35	7/16	6	2	5/8	8	0.5661-0.5970	93.10	78.20	73.20	70.80	68.25	66.25
5/8	.6250	41020	42020	63.35	9/16	6	2 1/4	5/8	9	0.5971-0.6280	93.10	78.20	73.20	70.80	68.25	66.25
21/32	.6562	41021	42021	65.15	9/16	6	2 1/4	5/8	9	0.6281-0.6590	95.00	80.05	75.05	72.65	70.05	68.10
11/16	.6875	41022	42022	69.40	9/16	6	2 1/4	5/8	9	0.6591-0.6910	99.15	84.20	79.25	76.85	74.30	72.30
23/32	.7188	41023	42023	70.35	9/16	6	2 1/4	5/8	9	0.6911-0.7220	100.10	85.20	80.20	77.85	75.25	73.25
3/4	.7500	41024	42024	71.45	5/8	6	2 1/2	3/4	9 1/2	0.7221-0.7530	101.25	86.30	81.30	78.90	76.35	74.35
25/32	.7812	41025	42025	73.25	5/8	6	2 1/2	3/4	9 1/2	0.7531-0.7840	103.10	88.15	83.15	80.75	78.20	76.20
13/16	.8125	41026	42026	73.25	5/8	6	2 1/2	3/4	9 1/2	0.7841-0.8160	103.10	88.15	83.15	80.75	78.20	76.20
27/32	.8438	41027	42027	77.25	5/8	6	2 1/2	3/4	9 1/2	0.8161-0.8470	107.10	92.15	87.15	84.80	82.20	80.20
7/8	.8750	41028	42028	80.20	3/4	6	2 5/8	3/4	10	0.8471-0.8780	111.15	95.65	90.40	88.00	85.30	83.20
29/32	.9062	41029	42029	93.45	3/4	6	2 5/8	3/4	10	0.8781-0.9090	124.35	108.85	103.70	101.20	98.55	96.45
15/16	.9375	41030	42030	93.45	3/4	8	2 5/8	3/4	10	0.9091-0.9410	124.35	108.85	103.70	101.20	98.55	96.45
31/32	.9688	41031	42031	97.95	3/4	8	2 5/8	3/4	10	0.9411-0.9720	128.90	113.40	108.25	105.75	103.05	101.05
1	1.0000	41032	42032	97.95	7/8	8	2 3/4	3/4	10 1/2	0.9721-1.0030	128.90	113.40	108.25	105.75	103.05	101.05
1 1/16	1.0625	41034	42034	105.10	7/8	8	2 3/4	3/4	10 1/2	1.0031-1.0660	136.05	120.55	115.40	112.90	110.20	108.15
1 1/8	1.1250	41036	42036	108.35	7/8	8	2 7/8	7/8	11	1.0661-1.1280	139.25	123.80	118.60	116.10	113.45	111.40
1 3/16	1.1875	41038	42038	113.85	1	8	2 7/8	7/8	11	1.1281-1.1905	144.75	129.30	124.10	121.60	118.95	116.90
1 1/4	1.2500	41040	42040	120.50	1	8	3	7/8	11 1/2	1.1906-1.2530	151.40	135.90	130.75	128.25	125.60	123.55
1 5/16	1.3125	41042	42042	133.30	1	8	3	7/8	11 1/2	1.2531-1.3155	164.30	148.80	143.55	141.15	138.45	136.35
1 3/8	1.3750	41044	42044	146.10	1	8	3 1/4	7/8	12	1.3156-1.3780	177.05	161.55	156.35	153.90	151.25	149.15
1 7/16	1.4375	41046	42046	154.75	1 1/4	8	3 1/4	7/8	12	1.3781-1.4405	185.70	170.20	165.00	162.60	159.90	157.80
1 1/2	1.5000	41048	42048	163.50	1 1/4	8	3 1/2	7/8	12 1/2	1.4406-1.5030	194.40	178.90	173.75	171.25	168.65	166.55

*Quantities of 15 or more - price of fractional size in same size range.

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPE 410 & 420 METRIC



RIGHT SPIRAL FLUTES STRAIGHT SHANK

For shallow holes only (see page 27)



TYPE 410



TYPE 420

NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 68).

TOOL DIAMETER		TYPE 410	TYPE 420	METRIC PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER								
mm	INCH	RIGHT METRIC EDP NO.	LEFT METRIC EDP NO.		SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
				FLT			CAR-BIDE	OVER-ALL	1		2	3	4	5-7	8-14	OVER 14	
4.5	.1772	410045	420045	\$54.40	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2	4.494-5.182	\$76.20	\$61.75	\$56.85	\$54.50	\$52.05	\$50.05	\$47.30
5.0	.1969	410050	420050	54.40	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2	-	-	-	-	-	-	-	
5.5	.2165	410055	420055	54.40	1 ³ / ₆₄	4	1 1/4	1/2	5	5.183-5.613	76.20	61.75	56.85	54.50	52.05	50.05	47.30
6.0	.2362	410060	420060	54.40	7/32	4	1 1/2	1/2	6	5.614-6.045	76.20	61.75	56.85	54.50	52.05	50.05	47.30
-	-	410063	420063	-	1 ⁵ / ₆₄	4	1 1/2	1/2	6	6.046-6.426	76.20	61.75	56.85	54.50	52.05	50.05	47.30
6.5	.2559	410065	420065	54.50	1 ⁵ / ₆₄	4	1 1/2	1/2	6	6.427-7.214	76.30	61.85	57.00	54.60	52.15	50.15	47.40
7.0	.2756	410070	420070	54.50	1 ⁵ / ₆₄	4	1 1/2	1/2	6	-	-	-	-	-	-	-	
7.5	.2953	410075	420075	54.50	9/32	4	1 1/2	1/2	6	7.215-8.001	76.30	61.85	57.00	54.60	52.15	50.15	47.40
8.0	.3150	410080	420080	54.50	9/32	4	1 1/2	1/2	6	-	-	-	-	-	-	-	
8.5	.3346	410085	420085	59.00	9/32	4	1 1/2	5/8	6	8.002-8.814	80.80	66.35	61.50	59.15	56.70	54.70	51.90
9.0	.3543	410090	420090	59.45	5/16	4	1 3/4	5/8	7	8.815-9.601	81.30	66.85	61.95	59.55	57.20	55.10	52.35
9.5	.3740	410095	420095	59.45	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-	
10.0	.3937	410100	420100	61.75	3/16	4	1 3/4	5/8	7	9.602-10.389	83.60	69.10	64.25	61.85	59.40	57.40	54.60
10.5	.4134	410105	420105	63.80	3/8	4	1 3/4	5/8	7	10.390-11.201	85.65	71.20	66.30	63.90	61.50	59.45	56.70
11.0	.4331	410110	420110	63.80	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-	
11.5	.4528	410115	420115	67.15	3/8	4	1 3/4	5/8	7	11.202-11.989	89.00	74.50	69.65	67.25	64.80	62.80	60.00
12.0	.4724	410120	420120	69.55	7/16	6	2	5/8	8	11.990-12.776	91.95	77.10	72.10	69.65	67.15	65.10	62.20
12.5	.4921	410125	420125	69.55	7/16	6	2	5/8	8	-	-	-	-	-	-	-	
13.0	.5118	410130	420130	71.40	7/16	6	2	5/8	8	12.777-13.564	93.80	78.90	73.95	71.50	69.00	66.95	64.10
13.5	.5315	410135	420135	71.40	7/16	6	2	5/8	8	-	-	-	-	-	-	-	
14.0	.5512	410140	420140	71.40	7/16	6	2	5/8	8	13.565-14.376	93.80	78.90	73.95	71.50	69.00	66.95	64.10
14.5	.5709	410145	420145	73.20	7/16	6	2	5/8	8	14.377-15.164	95.60	80.75	75.75	73.30	70.80	68.75	65.90
15.0	.5906	410150	420150	73.20	7/16	6	2	5/8	8	-	-	-	-	-	-	-	
15.5	.6102	410155	420155	73.20	9/16	6	2 1/4	5/8	9	15.165-15.951	95.60	80.75	75.75	73.30	70.80	68.75	65.90
16.0	.6299	410160	420160	75.05	9/16	6	2 1/4	5/8	9	15.952-16.739	97.45	82.55	77.60	75.15	72.65	70.60	67.75
16.5	.6496	410165	420165	75.05	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-	
17.0	.6693	410170	420170	79.25	9/16	6	2 1/4	5/8	9	16.740-17.551	101.65	86.80	81.80	79.35	76.85	74.80	71.90
17.5	.6890	410175	420175	79.25	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-	
18.0	.7087	410180	420180	80.20	9/16	6	2 1/4	5/8	9	17.552-18.339	102.65	87.75	82.80	80.35	77.85	75.75	72.90
18.5	.7283	410185	420185	81.30	5/8	6	2 1/2	3/4	9 1/2	18.340-19.126	103.70	88.90	83.85	81.40	78.90	76.85	74.00
19.0	.7480	410190	420190	81.30	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	
19.5	.7677	410195	420195	83.15	5/8	6	2 1/2	3/4	9 1/2	19.127-19.914	105.60	90.70	85.70	83.25	80.75	78.70	75.85
20.0	.7874	410200	420200	83.15	5/8	6	2 1/2	3/4	9 1/2	19.915-20.726	105.60	90.70	85.70	83.25	80.75	78.70	75.85
20.5	.8071	410205	420205	83.15	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	
21.0	.8268	410210	420210	87.15	5/8	6	2 1/2	3/4	9 1/2	20.727-21.514	109.60	94.70	89.75	87.30	84.80	82.75	79.80
21.5	.8465	410215	420215	87.15	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	
22.0	.8661	410220	420220	87.15	3/4	6	2 5/8	3/4	10	21.515-22.301	109.60	94.70	89.75	87.30	84.80	82.75	79.80
22.5	.8858	410225	420225	103.70	3/4	6	2 5/8	3/4	10	22.302-23.089	126.95	111.50	106.30	103.80	101.20	99.05	96.10
23.0	.9055	410230	420230	103.70	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-	
23.5	.9252	410235	420235	103.70	3/4	8	2 5/8	3/4	10	23.090-23.901	126.95	111.50	106.30	103.80	101.20	99.05	96.10
24.0	.9449	410240	420240	108.25	3/4	8	2 5/8	3/4	10	23.902-24.689	131.50	116.05	110.90	108.35	105.75	103.60	100.65
24.5	.9646	410245	420245	108.25	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-	
25.0	.9843	410250	420250	108.25	7/8	8	2 3/4	3/4	10 1/2	24.690-25.476	131.50	116.05	110.90	108.35	105.75	103.60	100.65
25.5	1.0039	410255	420255	115.40	7/8	8	2 3/4	3/4	10 1/2	25.477-27.076	138.65	123.20	118.05	115.50	112.90	110.75	107.80
26.0	1.0236	410260	420260	115.40	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	
27.0	1.0630	410270	420270	115.40	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	
28.0	1.1024	410280	420280	118.60	7/8	8	2 7/8	7/8	11	27.077-28.651	141.85	126.45	121.30	118.75	116.10	113.95	111.00
29.0	1.1417	410290	420290	124.10	1	8	2 7/8	7/8	11	28.652-30.239	147.40	131.95	126.80	124.25	121.60	119.45	116.50
30.0	1.1811	410300	420300	124.10	1	8	2 7/8	7/8	11	-	-	-	-	-	-	-	
31.0	1.2205	410310	420310	130.75	1	8	3	7/8	11 1/2	30.240-31.826	154.00	138.60	133.40	130.85	128.25	126.10	123.15
32.0	1.2598	410320	420320	143.55	1	8	3	7/8	11 1/2	31.827-33.414	166.85	151.40	146.25	143.70	141.15	139.00	135.95
33.0	1.2992	410330	420330	143.55	1	8	3	7/8	11 1/2	-	-	-	-	-	-	-	
34.0	1.3386	410340	420340	156.35	1	8	3 1/4	7/8	12	33.415-35.001	179.65	164.20	159.00	156.50	153.90	151.75	148.80
35.0	1.3780	410350	420350	156.35	1	8	3 1/4	7/8	12	-	-	-	-	-	-	-	
36.0	1.4173	410360	420360	165.00	1 1/4	8	3 1/4	7/8	12	35.002-36.589	188.30	172.85	167.70	165.15	162.60	160.40	157.40
37.0	1.4567	410370	420370	173.75	1 1/4	8	3 1/2	7/8	12 1/2	36.590-38.176	197.00	181.60	176.40	173.85	171.25	169.10	166.15
38.0	1.4961	410380	420380	173.75	1 1/4	8	3 1/2	7/8	12 1/2	-	-	-	-	-	-	-	

REAMERS



CHUCKING REAMERS CARBIDE TIPPED TYPES 412 & 422 FRACTIONAL



RIGHT OR LEFT SPIRAL FLUTES TAPER SHANK



TYPE 412 - RIGHT SPIRAL FLUTES - TAPER SHANK

- Polished flutes
- Right spiral flutes have greater chip clearing ability for use with ductile materials, highly abrasive materials, or blind holes
- Finishes are much better as spiral flutes tend to bridge interruptions such as keyways, slots, or intersecting holes
- Detailed specifications on page 29



TYPE 422 - LEFT SPIRAL FLUTES - TAPER SHANK

- Polished flutes
- Used on thru holes for heat treated steels, hard cast irons and other hard materials
- Finishes are much better as spiral flutes tend to bridge interruptions such as keyways, slots, or intersecting holes
- Left spiral flutes should not be used on blind holes
- Detailed specifications on page 29

For shallow holes only (see page 27)

TOOL DIAMETER		TYPE 412 RIGHT EDP NO.	TYPE 422 LEFT EDP NO.	BOTH TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL				TAPER SHANK NO.	NO. OF FLUTES	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLUTE	CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
1/4	.2500	41208	42208	\$46.95	1	4	1 1/2	1/2	6	0.2381 - 0.2530	\$75.50	\$61.15	\$56.40	\$54.10	\$51.65	\$49.75
9/32	.2812	41209	42209	46.95	1	4	1 1/2	1/2	6	0.2531 - 0.2840	75.50	61.15	56.40	54.10	51.65	49.75
5/16	.3125	41210	42210	48.00	1	4	1 1/2	1/2	6	0.2841 - 0.3150	76.60	62.20	57.45	55.10	52.70	50.75
11/32	.3438	41211	42211	48.80	1	4	1 1/2	5/8	6	0.3151 - 0.3470	77.35	63.05	58.30	55.95	53.55	51.60
3/8	.3750	41212	42212	49.50	1	4	1 3/4	5/8	7	0.3471 - 0.3780	78.10	63.85	59.00	56.75	54.30	52.35
13/32	.4062	41213	42213	51.90	1	4	1 3/4	5/8	7	0.3781 - 0.4090	80.55	66.20	61.40	59.15	56.65	54.75
7/16	.4375	41214	42214	54.15	1	4	1 3/4	5/8	7	0.4091 - 0.4410	82.75	68.45	63.65	61.30	58.85	56.95
15/32	.4688	41215	42215	56.30	1	4	1 3/4	5/8	7	0.4411 - 0.4720	84.85	70.50	65.75	63.40	61.00	59.10
1/2	.5000	41216	42216	64.85	1	6	2	5/8	8	0.4721 - 0.5030	95.30	80.00	74.90	72.50	69.90	67.85
17/32	.5312	41217	42217	66.55	1	6	2	5/8	8	0.5031 - 0.5340	97.05	81.75	76.70	74.25	71.60	69.55
9/16	.5625	41218	42218	66.55	1	6	2	5/8	8	0.5341 - 0.5660	97.05	81.75	76.70	74.25	71.60	69.55
19/32	.5938	41219	42219	69.20	1	6	2	5/8	8	0.5661 - 0.5970	99.65	84.35	79.30	76.85	74.25	72.20
5/8	.6250	41220	42220	69.20	2	6	2 1/4	5/8	9	0.5971 - 0.6280	99.65	84.35	79.30	76.85	74.25	72.20
11/16	.6875	41222	42222	75.90	2	6	2 1/4	5/8	9	0.6591 - 0.6910	106.40	91.10	86.05	83.60	80.95	78.90
3/4	.7500	41224	42224	80.30	2	6	2 1/2	3/4	9 1/2	0.7221 - 0.7530	110.70	95.50	90.35	87.95	85.30	83.25
13/16	.8125	41226	42226	83.65	2	6	2 1/2	3/4	9 1/2	0.7841 - 0.8160	114.15	98.85	93.70	91.30	88.70	86.60
7/8	.8750	41228	42228	90.05	2	6	2 5/8	3/4	10	0.8471 - 0.8780	121.70	105.80	100.50	98.00	95.30	93.15
15/16	.9375	41230	42230	104.70	3	8	2 5/8	3/4	10	0.9091 - 0.9410	136.35	120.55	115.20	112.65	109.95	107.85
1	1.0000	41232	42232	108.35	3	8	2 3/4	3/4	10 1/2	0.9721 - 1.0030	139.95	124.10	118.80	116.30	113.60	111.45

*Quantities of 15 or more - price of fractional size in same size range.

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	412/422
	40	NON-FERROUS - SHORT CHIPS	412/422
	60	CAST IRONS	412/422
	80	LOW STRENGTH STEELS	422/412
	100	MEDIUM STRENGTH STEELS	422/412
	120	HIGH STRENGTH STEELS	422/412
140	HIGH TEMPERATURE ALLOYS	422/412	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Shank whistle notch for set screw
- Smaller taper shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

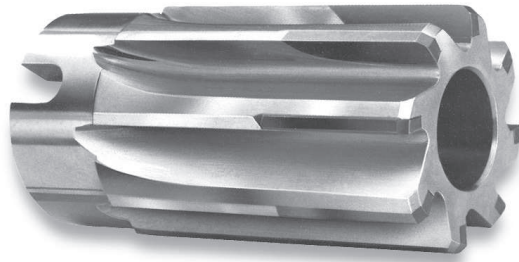
AL TITANIUM NITRIDE - AlTiN



SHELL REAMERS CARBIDE TIPPED TYPE 431 FRACTIONAL



STRAIGHT FLUTES



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	431/441
40	NON-FERROUS - SHORT CHIPS	431/441	
60	CAST IRONS	431/441	
80	LOW STRENGTH STEELS	441/431	
100	MEDIUM STRENGTH STEELS	441/431	
120	HIGH STRENGTH STEELS	441/431	
140	HIGH TEMPERATURE ALLOYS	441/431	

TYPE 431

- Straight polished flutes
- Arbor hole tapered 1/8" per foot with drive slots
- Tool diameter tolerance thru 1": plus .0001", plus .0005"
over 1": plus .0002", plus .0006"

USE:

- For thru or blind holes
- Shell reamers are used with an arbor which is tapered to fit the hole in the reamer. Drive slots in the reamer engage lugs on the arbor to supplement the rotational drive from the tapered arbor. The space between the reamer's drive end and the arbor collar permits easy removal of the shell reamer by prying.

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper

TOOL DIAMETER		TYPE 431 EDP NO.	PRICE	DIMENSIONS						FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL			HOLE DIAM LG. END	FITS ARBOR NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLUTE	CAR-BIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/4	.7500	43124	\$151.15	3/8	4	6	1 3/4	1	2 1/4	0.7221 - 0.7530	\$213.75	\$182.45	\$171.90	\$166.90	\$161.55	\$157.35
25/32	.7812	43125	154.10	3/8	4	6	1 3/4	1	2 1/4	0.7531 - 0.7840	216.70	185.30	174.90	169.85	164.50	160.30
13/16	.8125	43126	154.10	1/2	5	6	1 15/16	1	2 1/2	0.7841 - 0.8160	216.70	185.30	174.90	169.85	164.50	160.30
7/8	.8750	43128	172.20	1/2	5	6	1 15/16	1	2 1/2	0.8161 - 0.8780	237.20	204.60	193.70	188.60	182.95	178.55
15/16	.9375	43130	172.20	1/2	5	8	1 15/16	1	2 1/2	0.8781 - 0.9410	237.20	204.60	193.70	188.60	182.95	178.55
1	1.0000	43132	175.35	1/2	5	8	1 15/16	1	2 1/2	0.9411 - 1.0030	240.30	207.75	196.90	191.70	186.05	181.70
1 1/16	1.0625	43134	181.45	5/8	6	8	2 1/8	1	2 3/4	1.0031 - 1.0660	246.40	213.85	202.90	197.80	192.20	187.80
1 1/8	1.1250	43136	184.50	5/8	6	8	2 1/8	1	2 3/4	1.0661 - 1.1280	249.45	216.95	206.00	200.85	195.25	190.90
1 3/16	1.1875	43138	187.65	5/8	6	8	2 1/8	1 1/8	2 3/4	1.1281 - 1.1905	252.50	220.05	209.10	203.95	198.35	194.00
1 1/4	1.2500	43140	199.90	5/8	6	8	2 1/8	1 1/8	2 3/4	1.1906 - 1.2530	264.85	232.30	221.40	216.20	210.70	206.25
1 5/16	1.3125	43142	202.90	3/4	7	8	2 1/4	1 1/8	3	1.2531 - 1.3155	267.90	235.40	224.50	219.30	213.75	209.35
1 3/8	1.3750	43144	209.05	3/4	7	8	2 1/4	1 1/8	3	1.3156 - 1.3780	274.05	241.45	230.60	225.40	219.80	215.45
1 7/16	1.4375	43146	215.25	3/4	7	8	2 1/4	1 1/8	3	1.3781 - 1.4405	280.20	247.65	236.80	231.60	225.95	221.65
1 1/2	1.5000	43148	224.50	3/4	7	8	2 1/4	1 1/8	3	1.4406 - 1.5030	289.45	256.90	246.00	240.80	235.20	230.85
1 5/8	1.5625	43150	259.90	3/4	7	10	2 1/4	1 1/8	3	1.5031 - 1.5660	327.65	293.75	282.35	276.90	271.05	266.50
1 3/4	1.6250	43152	272.70	3/4	7	10	2 1/4	1 1/8	3	1.5661 - 1.6280	340.50	306.55	295.15	289.75	283.90	279.35
1 11/16	1.6875	43154	295.20	1	8	10	2 3/4	1 1/8	3 1/2	1.6281 - 1.6910	363.05	329.05	317.70	312.25	306.45	301.90
1 3/4	1.7500	43156	295.20	1	8	10	2 3/4	1 1/8	3 1/2	1.6911 - 1.7530	363.05	329.05	317.70	312.25	306.45	301.90
1 13/16	1.8125	43158	317.60	1	8	10	2 3/4	1 1/8	3 1/2	1.7531 - 1.8160	385.35	351.45	340.05	334.65	328.80	324.25
1 7/8	1.8750	43160	317.60	1	8	10	2 3/4	1 1/8	3 1/2	1.8161 - 1.8780	385.35	351.45	340.05	334.65	328.80	324.25
1 15/16	1.9375	43162	340.15	1	8	10	2 3/4	1 1/8	3 1/2	1.8781 - 1.9410	407.85	373.90	362.55	357.20	351.35	346.80
2	2.0000	43164	340.15	1	8	10	2 3/4	1 1/8	3 1/2	1.9411 - 2.0030	407.85	373.90	362.55	357.20	351.35	346.80
2 1/16	2.0625	43166	365.75	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.0031 - 2.0660	433.55	399.60	388.20	382.85	377.00	372.45
2 1/8	2.1250	43168	365.75	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.0661 - 2.1280	433.55	399.60	388.20	382.85	377.00	372.45
2 3/16	2.1875	43170	397.85	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.1281 - 2.1905	465.60	431.65	420.30	414.85	409.10	404.45
2 1/4	2.2500	43172	397.85	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.1906 - 2.2530	465.60	431.65	420.30	414.85	409.10	404.45
2 5/16	2.3125	43174	420.30	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.2531 - 2.3155	488.10	454.10	442.80	437.30	431.50	426.95
2 3/8	2.3750	43176	420.30	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.3156 - 2.3780	488.10	454.10	442.80	437.30	431.50	426.95
2 7/16	2.4375	43178	442.85	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.3781 - 2.4405	510.60	476.65	465.30	459.85	454.00	449.45
2 1/2	2.5000	43180	442.85	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.4406 - 2.5030	510.60	476.65	465.30	459.85	454.00	449.45
2 9/16	2.5625	43182	486.10	1 1/2	10	14	3 1/8	1 1/8	4	2.5031 - 2.5660	553.80	519.85	508.55	503.10	497.30	492.70
2 5/8	2.6250	43184	504.10	1 1/2	10	14	3 1/8	1 1/8	4	2.5661 - 2.6280	571.85	537.85	526.60	521.10	515.30	510.70
2 11/16	2.6875	43186	523.70	1 1/2	10	14	3 1/8	1 1/8	4	2.6281 - 2.6910	591.45	557.50	546.15	540.75	534.90	530.35
2 3/4	2.7500	43188	541.85	1 1/2	10	14	3 1/8	1 1/8	4	2.6911 - 2.7530	609.65	575.65	564.30	558.90	553.10	548.50
2 13/16	2.8125	43190	560.90	1 1/2	10	14	3 1/8	1 1/8	4	2.7531 - 2.8160	628.70	594.70	583.40	577.95	572.15	567.60
2 7/8	2.8750	43192	583.40	1 1/2	10	14	3 1/8	1 1/8	4	2.8161 - 2.8780	651.10	617.20	605.80	600.45	594.60	590.05
2 15/16	2.9375	43194	605.90	1 1/2	10	14	3 1/8	1 1/8	4	2.8781 - 2.9410	673.70	639.70	628.30	622.95	617.15	612.55
3	3.0000	43196	628.40	1 1/2	10	14	3 1/8	1 1/8	4	2.9411 - 3.0030	696.15	662.25	650.85	645.50	639.65	635.10

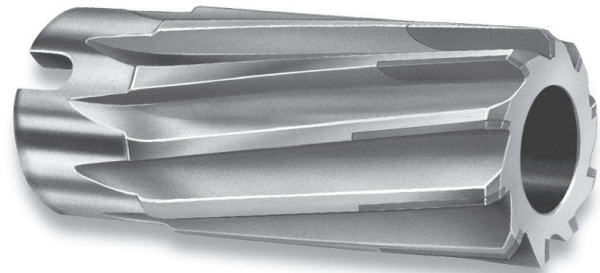
*Quantities of 15 or more - price of fractional size in same size range.



SHELL REAMERS AND ARBORS CARBIDE TIPPED TYPES 441 FRACTIONAL & 481



LEFT SPIRAL FLUTES



TYPE 441

- Left spiral polished flutes
- Arbor hole tapered $\frac{1}{8}$ " per foot with drive slots
- Tool diameter tolerance thru 1": plus .0001", plus .0005"
over 1": plus .0002", plus .0006"

USE:

- See "USE" on page 71 - but used only on thru holes for heat treated steels, hard cast irons and other hard materials; left spiral flutes should not be used on blind holes
- Finishes are much better as spiral flutes tend to bridge interruptions such as keyways, slots, or intersecting holes.

TOOL SELECTOR BOX (See page 71)
MODIFICATIONS (See list on page 71)

TOOL DIAMETER		TYPE 441 EDP NO.	PRICE	DIMENSIONS						FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL			HOLE DIAM. LG. END	FITS ARBOR NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLUTE	CAR-BIDE	OVER-ALL			1	2	3	4	5-7	8-14*
$\frac{3}{4}$	.7500	44124	\$196.45	$\frac{3}{8}$	4	6	1 $\frac{3}{4}$	1	2 $\frac{1}{4}$	0.7221-0.7530	\$259.05	\$227.75	\$217.20	\$212.20	\$206.85	\$202.60
$\frac{25}{32}$	.7812	44125	200.25	$\frac{3}{8}$	4	6	1 $\frac{3}{4}$	1	2 $\frac{1}{4}$	0.7531-0.7840	262.80	231.50	220.95	216.00	210.65	206.45
$\frac{13}{16}$	.8125	44126	200.25	$\frac{1}{2}$	5	6	1 $\frac{15}{16}$	1	2 $\frac{1}{2}$	0.7841-0.8160	262.80	231.50	220.95	216.00	210.65	206.45
$\frac{7}{8}$	.8750	44128	223.90	$\frac{1}{2}$	5	6	1 $\frac{15}{16}$	1	2 $\frac{1}{2}$	0.8161-0.8780	288.80	256.30	245.40	240.25	234.60	230.25
$\frac{15}{16}$	.9375	44130	223.90	$\frac{1}{2}$	5	8	1 $\frac{15}{16}$	1	2 $\frac{1}{2}$	0.8781-0.9410	288.80	256.30	245.40	240.25	234.60	230.25
1	1.0000	44132	227.90	$\frac{1}{2}$	5	8	1 $\frac{15}{16}$	1	2 $\frac{1}{2}$	0.9411-1.0030	292.80	260.30	249.40	244.25	238.60	234.25
1 $\frac{1}{16}$	1.0625	44134	235.00	$\frac{5}{8}$	6	8	2 $\frac{1}{8}$	1	2 $\frac{3}{4}$	1.0031-1.0660	299.90	267.40	256.45	251.30	245.70	241.35
1 $\frac{1}{8}$	1.1250	44136	239.85	$\frac{5}{8}$	6	8	2 $\frac{1}{8}$	1	2 $\frac{3}{4}$	1.0661-1.1280	304.80	272.25	261.40	256.25	250.65	246.20
1 $\frac{3}{16}$	1.1875	44138	243.85	$\frac{5}{8}$	6	8	2 $\frac{1}{8}$	1 $\frac{1}{8}$	2 $\frac{3}{4}$	1.1281-1.1905	308.85	276.25	265.35	260.25	254.60	250.20
1 $\frac{1}{4}$	1.2500	44140	259.80	$\frac{5}{8}$	6	8	2 $\frac{1}{8}$	1 $\frac{1}{8}$	2 $\frac{3}{4}$	1.1906-1.2530	324.75	292.20	281.30	276.15	270.60	266.20
1 $\frac{5}{16}$	1.3125	44142	263.85	$\frac{3}{4}$	7	8	2 $\frac{1}{4}$	1 $\frac{1}{8}$	3	1.2531-1.3155	328.80	296.25	285.40	280.20	274.60	270.20
1 $\frac{3}{8}$	1.3750	44144	271.85	$\frac{3}{4}$	7	8	2 $\frac{1}{4}$	1 $\frac{1}{8}$	3	1.3156-1.3780	336.80	304.25	293.35	288.15	282.55	278.20
1 $\frac{7}{16}$	1.4375	44146	279.80	$\frac{3}{4}$	7	8	2 $\frac{1}{4}$	1 $\frac{1}{8}$	3	1.3781-1.4405	344.75	312.20	301.35	296.15	290.55	286.10
1 $\frac{1}{2}$	1.5000	44148	291.80	$\frac{3}{4}$	7	8	2 $\frac{1}{4}$	1 $\frac{1}{8}$	3	1.4406-1.5030	356.80	324.20	313.35	308.20	302.55	298.20
1 $\frac{5}{8}$	1.5625	44150	337.90	$\frac{3}{4}$	7	10	2 $\frac{1}{4}$	1 $\frac{1}{8}$	3	1.5031-1.5660	405.70	371.75	360.35	354.95	349.20	344.55
1 $\frac{3}{4}$	1.6250	44152	354.55	$\frac{3}{4}$	7	10	2 $\frac{1}{4}$	1 $\frac{1}{8}$	3	1.5661-1.6280	422.30	388.40	377.00	371.55	365.75	361.15
1 $\frac{11}{16}$	1.6875	44154	383.65	1	8	10	2 $\frac{3}{4}$	1 $\frac{1}{8}$	3 $\frac{1}{2}$	1.6281-1.6910	451.50	417.55	406.15	400.80	394.95	390.40
1 $\frac{3}{4}$	1.7500	44156	383.65	1	8	10	2 $\frac{3}{4}$	1 $\frac{1}{8}$	3 $\frac{1}{2}$	1.6911-1.7530	451.50	417.55	406.15	400.80	394.95	390.40
1 $\frac{13}{16}$	1.8125	44158	412.65	1	8	10	2 $\frac{3}{4}$	1 $\frac{1}{8}$	3 $\frac{1}{2}$	1.7531-1.8160	480.40	446.40	435.05	429.65	423.85	419.25
1 $\frac{7}{8}$	1.8750	44160	412.65	1	8	10	2 $\frac{3}{4}$	1 $\frac{1}{8}$	3 $\frac{1}{2}$	1.8161-1.8780	480.40	446.40	435.05	429.65	423.85	419.25
1 $\frac{15}{16}$	1.9375	44162	442.15	1	8	10	2 $\frac{3}{4}$	1 $\frac{1}{8}$	3 $\frac{1}{2}$	1.8781-1.9410	509.95	475.95	464.60	459.15	453.35	448.75
2	2.0000	44164	442.15	1	8	10	2 $\frac{3}{4}$	1 $\frac{1}{8}$	3 $\frac{1}{2}$	1.9411-2.0030	509.95	475.95	464.60	459.15	453.35	448.75
2 $\frac{1}{16}$	2.0625	44166	475.45	1 $\frac{1}{4}$	9	12	2 $\frac{7}{8}$	1 $\frac{1}{8}$	3 $\frac{3}{4}$	2.0031-2.0660	543.25	509.30	497.90	492.50	486.75	482.10
2 $\frac{1}{8}$	2.1250	44168	475.45	1 $\frac{1}{4}$	9	12	2 $\frac{7}{8}$	1 $\frac{1}{8}$	3 $\frac{3}{4}$	2.0661-2.1280	543.25	509.30	497.90	492.50	486.75	482.10
2 $\frac{3}{16}$	2.1875	44170	517.25	1 $\frac{1}{4}$	9	12	2 $\frac{7}{8}$	1 $\frac{1}{8}$	3 $\frac{3}{4}$	2.1281-2.1905	584.95	551.00	539.60	534.25	528.40	523.85
2 $\frac{1}{4}$	2.2500	44172	517.25	1 $\frac{1}{4}$	9	12	2 $\frac{7}{8}$	1 $\frac{1}{8}$	3 $\frac{3}{4}$	2.1906-2.2530	584.95	551.00	539.60	534.25	528.40	523.85
2 $\frac{5}{16}$	2.3125	44174	546.40	1 $\frac{1}{4}$	9	12	2 $\frac{7}{8}$	1 $\frac{1}{8}$	3 $\frac{3}{4}$	2.2531-2.3155	614.25	580.30	568.90	563.50	557.65	553.10
2 $\frac{3}{8}$	2.3750	44176	546.40	1 $\frac{1}{4}$	9	12	2 $\frac{7}{8}$	1 $\frac{1}{8}$	3 $\frac{3}{4}$	2.3156-2.3780	614.25	580.30	568.90	563.50	557.65	553.10
2 $\frac{7}{16}$	2.4375	44178	575.60	1 $\frac{1}{4}$	9	12	2 $\frac{7}{8}$	1 $\frac{1}{8}$	3 $\frac{3}{4}$	2.3781-2.4405	643.40	609.40	598.10	592.60	586.85	582.20
2 $\frac{1}{2}$	2.5000	44180	575.60	1 $\frac{1}{4}$	9	12	2 $\frac{7}{8}$	1 $\frac{1}{8}$	3 $\frac{3}{4}$	2.4406-2.5030	643.40	609.40	598.10	592.60	586.85	582.20
2 $\frac{5}{8}$	2.5625	44182	631.90	1 $\frac{1}{2}$	10	14	3 $\frac{1}{8}$	1 $\frac{1}{8}$	4	2.5031-2.5660	699.60	665.70	654.30	648.95	643.10	638.55
2 $\frac{3}{4}$	2.6250	44184	655.35	1 $\frac{1}{2}$	10	14	3 $\frac{1}{8}$	1 $\frac{1}{8}$	4	2.5661-2.6280	723.15	689.15	677.85	672.40	666.60	662.00

*Quantities of 15 or more - price of fractional size in same size range.

ARBOR NO.	FITS REAMER TOOL DIAM.	OVER-ALL LENGTH	STRAIGHT SHANK			TAPER SHANK		
			SHANK DIAM.	TYPE 481 EDP NO.	PRICE	TAPER SHANK NO.	TYPE 481 EDP NO.	PRICE
4	0.7221-0.7840	9	.500	48104	\$95.95	2	48114	\$114.45
5	0.7841-1.0030	9 $\frac{1}{2}$	.625	48105	107.05	2	48115	136.60
6	1.0031-1.2530	10	.750	48106	118.20	3	48116	147.70
7	1.2531-1.6280	11	.875	48107	129.25	3	48117	162.50
8	1.6281-2.0030	12	1.125	48108	144.00	4	48118	180.95
9	2.0031-2.5030	13	1.375	48109	173.55	4	48119	203.10
10	2.5031-3.0030	14	1.625	48110	225.60	5	48120	257.65

SHELL REAMER ARBORS TYPE 481

STRAIGHT SHANK



TAPER SHANK



Both types hardened and ground

REAMERS



CHUCKING REAMERS - FOR STEELS

CARBIDE TIPPED TYPE 480 METRIC



STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 74).

TOOL DIAMETER		TYPE 480 STEEL METRIC EDP NO.	METRIC PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH			MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
		FLUTE & CARBIDE	OVER-ALL			1	2		3	4	5-7	8-14	OVER 14		
4.5	.1772	480045	\$55.70	.1704	4	1 1/8	4 1/2	4.494 - 4.696	\$78.65	\$63.40	\$58.35	\$55.85	\$53.30	\$51.20	\$48.25
5.0	.1969	480050	55.70	.1805	4	1 1/8	4 1/2	4.697 - 5.182	78.65	63.40	58.35	55.85	53.30	51.20	48.25
5.5	.2165	480055	55.70	.2075	4	1 1/4	5	5.183 - 5.613	78.65	63.40	58.35	55.85	53.30	51.20	48.25
6.0	.2362	480060	55.70	.2265	4	1 1/2	6	5.614 - 6.045	78.65	63.40	58.35	55.85	53.30	51.20	48.25
-	-	480063	-	.2405	4	1 1/2	6	6.046 - 6.426	78.65	63.40	58.35	55.85	53.30	51.20	48.25
6.5	.2559	480065	56.70	.2485	4	1 1/2	6	6.427 - 7.214	79.65	64.40	59.30	56.80	54.35	52.15	49.25
7.0	.2756	480070	56.70	.2485	4	1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	480075	56.70	.2792	4	1 1/2	6	7.215 - 8.001	79.65	64.40	59.30	56.80	54.35	52.15	49.25
8.0	.3150	480080	56.70	.2792	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	480085	58.40	.2792	4	1 1/2	6	8.002 - 8.814	81.40	66.10	61.00	58.55	55.95	53.85	50.90
9.0	.3543	480090	58.40	.3105	4	1 3/4	7	8.815 - 9.601	81.40	66.10	61.00	58.55	55.95	53.85	50.90
9.5	.3740	480095	58.40	.3105	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	480100	60.80	.3105	4	1 3/4	7	9.602 - 10.389	83.70	68.50	63.35	60.90	58.35	56.25	53.30
10.5	.4134	480105	68.80	.3730	6	1 3/4	7	10.390 - 11.201	91.75	76.55	71.45	68.95	66.40	64.25	61.30
11.0	.4331	480110	68.80	.3730	6	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	480115	69.40	.3730	6	1 3/4	7	11.202 - 11.989	92.35	77.05	72.05	69.50	66.95	64.85	61.90
12.0	.4724	480120	74.35	.4355	6	2	8	11.990 - 12.776	98.90	82.60	77.10	74.45	71.70	69.45	66.35
12.5	.4921	480125	74.35	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	480130	76.10	.4355	6	2	8	12.777 - 13.564	100.75	84.40	78.90	76.25	73.50	71.25	68.10
13.5	.5315	480135	76.10	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	480140	76.10	.4355	6	2	8	13.565 - 14.376	100.75	84.40	78.90	76.25	73.50	71.25	68.10
14.5	.5709	480145	78.60	.4355	6	2	8	14.377 - 15.164	103.15	86.90	81.45	78.75	76.00	73.70	70.55
15.0	.5906	480150	78.60	.4355	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	480155	78.60	.5615	6	2 1/4	9	15.165 - 15.951	103.15	86.90	81.45	78.75	76.00	73.70	70.55
16.0	.6299	480160	79.85	.5615	6	2 1/4	9	15.952 - 16.739	104.50	88.15	82.70	80.00	77.25	75.00	71.80
16.5	.6496	480165	79.85	.5615	6	2 1/4	9	-	-	-	-	-	-	-	-
17.0	.6693	480170	79.85	.5615	6	2 1/4	9	16.740 - 17.551	104.50	88.15	82.70	80.00	77.25	75.00	71.80
17.5	.6890	480175	79.85	.5615	6	2 1/4	9	-	-	-	-	-	-	-	-
18.0	.7087	480180	83.05	.5615	6	2 1/2	9	17.552 - 18.339	107.55	91.25	85.85	83.15	80.45	78.10	75.00
18.5	.7283	480185	83.05	.6245	6	2 1/2	9 1/2	18.340 - 19.126	107.55	91.25	85.85	83.15	80.45	78.10	75.00
19.0	.7480	480190	83.05	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	480195	85.45	.6245	6	2 1/2	9 1/2	19.127 - 19.914	110.10	93.75	88.25	85.60	82.85	80.60	77.50
20.0	.7874	480200	85.45	.6245	6	2 1/2	9 1/2	19.915 - 20.726	110.10	93.75	88.25	85.60	82.85	80.60	77.50
20.5	.8071	480205	85.45	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	480210	88.45	.6245	6	2 1/2	9 1/2	20.727 - 21.514	113.10	96.75	91.25	88.60	85.90	83.60	80.50
21.5	.8465	480215	88.45	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	480220	88.45	.7495	6	2 5/8	10	21.515 - 22.301	113.10	96.75	91.25	88.60	85.90	83.60	80.50
22.5	.8858	480225	105.05	.7495	6	2 5/8	10	22.302 - 23.089	130.55	113.65	108.00	105.20	102.30	100.00	96.70
23.0	.9055	480230	105.05	.7495	6	2 5/8	10	-	-	-	-	-	-	-	-
23.5	.9252	480235	105.05	.7495	8	2 5/8	10	23.090 - 23.901	130.55	113.65	108.00	105.20	102.30	100.00	96.70
24.0	.9449	480240	109.55	.7495	8	2 5/8	10	23.902 - 24.689	135.10	118.20	112.50	109.70	106.85	104.55	101.20
24.5	.9646	480245	109.55	.7495	8	2 5/8	10	-	-	-	-	-	-	-	-
25.0	.9843	480250	109.55	.8745	8	2 3/4	10 1/2	24.690 - 25.476	135.10	118.20	112.50	109.70	106.85	104.55	101.20
25.5	1.0039	480255	112.45	.8745	8	2 3/4	10 1/2	25.477 - 27.076	136.85	120.70	115.20	112.55	109.85	107.55	104.50
26.0	1.0236	480260	112.45	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	480270	112.45	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	480280	120.85	.8745	8	2 7/8	11	27.077 - 28.651	145.30	129.15	123.65	120.95	118.30	116.00	112.90
29.0	1.1417	480290	131.35	.9995	8	2 7/8	11	28.652 - 30.239	155.80	139.60	134.15	131.50	128.80	126.50	123.45
30.0	1.1811	480300	131.35	.9995	8	2 7/8	11	-	-	-	-	-	-	-	-
31.0	1.2205	480310	145.15	.9995	8	3	11 1/2	30.240 - 31.826	169.65	153.40	147.95	145.30	142.60	140.35	137.25
32.0	1.2598	480320	145.15	.9995	8	3	11 1/2	31.827 - 33.414	169.65	153.40	147.95	145.30	142.60	140.35	137.25
33.0	1.2992	480330	145.15	.9995	8	3	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	480340	147.15	.9995	8	3 1/4	12	33.415 - 35.001	171.60	155.40	150.00	147.30	144.60	142.30	139.20
35.0	1.3780	480350	147.15	.9995	8	3 1/4	12	-	-	-	-	-	-	-	-
36.0	1.4173	480360	161.50	.9995	8	3 1/4	12	35.002 - 36.589	185.90	169.70	164.20	161.60	158.85	156.60	153.50
37.0	1.4567	480370	191.75	1.2495	8	3 1/2	12 1/2	36.590 - 38.176	216.15	199.95	194.50	191.85	189.10	186.90	183.75
38.0	1.4961	480380	191.75	1.2495	8	3 1/2	12 1/2	-	-	-	-	-	-	-	-

REAMERS



CHUCKING REAMERS - FOR STEELS CARBIDE TIPPED TYPE 480 FRACTIONAL

MATERIAL SPECIFIC

STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK

TYPE 480 - FOR REAMING STEELS, TOUGH STEEL ALLOYS, & CAST STEELS

- Polished straight flutes with steel cutting grade flute long carbide
- Special steel cutting tool geometry:
 - Positive radial rake (behind center)
 - Narrow circular lands
 - Minimum back taper
- Detailed specifications on page 29
- See page 78 for other material specific reamers

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	457 ^{MS}
40	NON-FERROUS - SHORT CHIPS	457 ^{MS} /458 ^{MS}	
60	CAST IRONS	458 ^{MS}	
80	LOW STRENGTH STEELS	480	
100	MEDIUM STRENGTH STEELS	480	
120	HIGH STRENGTH STEELS	480	
140	HIGH TEMPERATURE ALLOYS	459 ^{MS}	

MODIFICATIONS (Prompt delivery)

- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN



USE:

- This carbide tipped reamer design is based on our extensive development and design experience in manufacturing special reamers for reaming steel.
- Traditional steel reaming problems have been reduced by the following HANNIBAL features:
 1. Holds size longer because steel cutting grade carbide is utilized.
 2. Improved surface finish due to this reamer's reduced circular land minimizing possible material buildup that would reduce surface quality.
 3. Straighter holes due to longer flute length and reduced back taper.
 4. Flute long carbide allows for more regrinds.

NOTE: For smaller tool diameters, see solid carbide reamers on pages 58, 105-107.

TOOL DIAMETER		TYPE 480 STEEL EDP NO.	PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL			MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLUTE & CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/16	.1875	48006	\$45.60	.1805	4	1 1/8	4 1/2	0.1770 - 0.2040	\$76.10	\$60.85	\$55.70	\$53.30	\$50.70	\$48.60
13/64	.2031	4802031	45.60	.1805	4	1 1/8	4 1/2	-	-	-	-	-	-	-
7/32	.2188	48007	45.60	.2075	4	1 1/4	5	0.2041 - 0.2210	76.10	60.85	55.70	53.30	50.70	48.60
15/64	.2344	4802344	45.60	.2265	4	1 1/2	6	0.2211 - 0.2380	76.10	60.85	55.70	53.30	50.70	48.60
1/4	.2500	48008	45.60	.2405	4	1 1/2	6	0.2381 - 0.2530	76.10	60.85	55.70	53.30	50.70	48.60
17/64	.2656	4802656	46.60	.2485	4	1 1/2	6	-	-	-	-	-	-	-
9/32	.2812	48009	46.60	.2485	4	1 1/2	6	0.2531 - 0.2840	77.05	61.85	56.70	54.35	51.65	49.65
19/64	.2969	4802969	46.60	.2792	4	1 1/2	6	-	-	-	-	-	-	-
5/16	.3125	48010	46.60	.2792	4	1 1/2	6	0.2841 - 0.3150	77.05	61.85	56.70	54.35	51.65	49.65
21/64	.3281	4803281	48.30	.2792	4	1 1/2	6	-	-	-	-	-	-	-
11/32	.3438	48011	48.30	.2792	4	1 1/2	6	0.3151 - 0.3470	78.80	63.45	58.40	55.95	53.40	51.30
23/64	.3594	4803594	48.30	.3105	4	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	48012	48.30	.3105	4	1 3/4	7	0.3471 - 0.3780	78.80	63.45	58.40	55.95	53.40	51.30
25/64	.3906	4803906	50.70	.3105	4	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	48013	50.70	.3105	4	1 3/4	7	0.3781 - 0.4090	81.10	65.90	60.80	58.35	55.70	53.65
27/64	.4219	4804219	58.70	.3730	6	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	48014	58.70	.3730	6	1 3/4	7	0.4091 - 0.4410	89.20	73.90	68.80	66.40	63.80	61.75
29/64	.4531	4804531	59.25	.3730	6	1 3/4	7	-	-	-	-	-	-	-
15/32	.4688	48015	59.25	.3730	6	1 3/4	7	0.4411 - 0.4720	89.80	74.45	69.40	66.95	64.30	62.25
31/64	.4844	4804844	63.45	.4355	6	2	8	-	-	-	-	-	-	-
1/2	.5000	48016	63.45	.4355	6	2	8	0.4721 - 0.5030	96.20	79.80	74.35	71.70	68.90	66.75
33/64	.5156	4805156	65.30	.4355	6	2	8	-	-	-	-	-	-	-
17/32	.5312	48017	65.30	.4355	6	2	8	0.5031 - 0.5340	97.95	81.60	76.10	73.50	70.70	68.50
35/64	.5469	4805469	65.30	.4355	6	2	8	-	-	-	-	-	-	-
9/16	.5625	48018	65.30	.4355	6	2	8	0.5341 - 0.5660	97.95	81.60	76.10	73.50	70.70	68.50
37/64	.5781	4805781	67.80	.4355	6	2	8	-	-	-	-	-	-	-
19/32	.5938	48019	67.80	.4355	6	2	8	0.5661 - 0.5970	100.45	84.10	78.60	76.00	73.20	71.05
39/64	.6094	4806094	67.80	.5615	6	2 1/4	9	-	-	-	-	-	-	-

CONTINUED ON NEXT PAGE

*Quantities of 15 or more - price of fractional size in same size range.

TOOL DIAMETER		TYPE 480 STEEL EDP NO.	PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL			MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
5/8	.6250	48020	\$67.80	.5615	6	2 1/4	9	0.5971 - 0.6280	\$100.45	\$84.10	\$78.60	\$76.00	\$73.20	\$71.05
41/64	.6406	4806406	69.05	.5615	6	2 1/4	9	-	-	-	-	-	-	-
21/32	.6562	48021	69.05	.5615	6	2 1/4	9	0.6281 - 0.6590	101.75	85.35	79.85	77.25	74.45	72.25
43/64	.6719	4806719	69.05	.5615	6	2 1/4	9	-	-	-	-	-	-	-
11/16	.6875	48022	69.05	.5615	6	2 1/4	9	0.6591 - 0.6910	101.75	85.35	79.85	77.25	74.45	72.25
45/64	.7031	4807031	72.20	.5615	6	2 1/4	9	-	-	-	-	-	-	-
23/32	.7188	48023	72.20	.5615	6	2 1/4	9	0.6911 - 0.7220	104.85	88.45	83.05	80.45	77.60	75.40
47/64	.7344	4807344	72.20	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-
3/4	.7500	48024	72.20	.6245	6	2 1/2	9 1/2	0.7221 - 0.7530	104.85	88.45	83.05	80.45	77.60	75.40
49/64	.7656	4807656	74.70	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-
25/32	.7812	48025	74.70	.6245	6	2 1/2	9 1/2	0.7531 - 0.7840	107.30	90.95	85.45	82.85	80.05	77.85
51/64	.7969	4807969	74.70	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-
13/16	.8125	48026	74.70	.6245	6	2 1/2	9 1/2	0.7841 - 0.8160	107.30	90.95	85.45	82.85	80.05	77.85
53/64	.8281	4808281	77.70	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-
27/32	.8438	48027	77.70	.6245	6	2 1/2	9 1/2	0.8161 - 0.8470	110.30	93.90	88.45	85.90	83.10	80.85
55/64	.8594	4808594	77.70	.7495	6	2 3/8	10	-	-	-	-	-	-	-
7/8	.8750	48028	80.65	.7495	6	2 3/8	10	0.8471 - 0.8780	114.45	97.50	91.80	89.10	86.20	83.90
57/64	.8906	4808906	93.85	.7495	6	2 3/8	10	-	-	-	-	-	-	-
29/32	.9062	48029	93.85	.7495	6	2 3/8	10	0.8781 - 0.9090	127.75	110.80	105.05	102.30	99.45	97.10
59/64	.9219	4809219	93.85	.7495	8	2 3/8	10	-	-	-	-	-	-	-
15/16	.9375	48030	93.85	.7495	8	2 3/8	10	0.9091 - 0.9410	127.75	110.80	105.05	102.30	99.45	97.10
61/64	.9531	4809531	98.35	.7495	8	2 3/8	10	-	-	-	-	-	-	-
31/32	.9688	48031	98.35	.7495	8	2 3/8	10	0.9411 - 0.9720	132.25	115.30	109.55	106.85	103.95	101.65
63/64	.9844	4809844	98.35	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-
1	1.0000	48032	98.35	.8745	8	2 3/4	10 1/2	0.9721 - 1.0030	132.25	115.30	109.55	106.85	103.95	101.65
1 1/16	1.0625	48034	101.70	.8745	8	2 3/4	10 1/2	1.0031 - 1.0660	134.15	117.85	112.45	109.85	107.05	104.90
1 1/8	1.1250	48036	110.15	.8745	8	2 7/8	11	1.0661 - 1.1280	142.60	126.30	120.85	118.30	115.50	113.30
1 3/16	1.1875	48038	120.60	.9995	8	2 7/8	11	1.1281 - 1.1905	153.10	136.80	131.35	128.80	126.00	123.80
1 1/4	1.2500	48040	134.45	.9995	8	3	11 1/2	1.1906 - 1.2530	166.90	150.60	145.15	142.60	139.80	137.60
1 5/16	1.3125	48042	134.45	.9995	8	3	11 1/2	1.2531 - 1.3155	166.90	150.60	145.15	142.60	139.80	137.60
1 3/8	1.3750	48044	136.40	.9995	8	3 1/4	12	1.3156 - 1.3780	168.85	152.60	147.15	144.60	141.75	139.60
1 7/16	1.4375	48046	150.70	.9995	8	3 1/4	12	1.3781 - 1.4405	183.15	166.90	161.50	158.85	156.05	153.95
1 1/2	1.5000	48048	180.95	1.2495	8	3 1/2	12 1/2	1.4406 - 1.5030	213.45	197.15	191.75	189.10	186.40	184.15

*Quantities of 15 or more - price of fractional size in same size range.

OVER & UNDER SIZE REAMERS CARBIDE TIPPED - FOR STEELS



TYPE 488 - STRAIGHT FLUTES & SHANK

- Tool diameter tolerance: plus .0002", minus .0000"
- Same specifications & available modifications as Type 480 (page 74)

USE:

- These precision ground carbide tipped reamers are very convenient for finishing accurate holes in steels, tough steel alloys and cast steels

DECIMAL TOOL DIAMETER	TYPE 488 STEEL EDP NO.	PRICE	DIMENSIONS			
			MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH	
					FLUTE & CARBIDE	OVER-ALL
.1865	48818	\$57.00	.1805	4	1 1/8	4 1/2
.1885	48819	57.00	.1805	4	1 1/8	4 1/2
.2490	48824	57.00	.2405	4	1 1/2	6
.2510	48825	57.00	.2405	4	1 1/2	6
.3115	48831	58.05	.2792	4	1 1/2	6
.3135	48832	58.05	.2792	4	1 1/2	6
.3740	48837	59.70	.3105	4	1 3/4	7
.3760	48838	59.70	.3105	4	1 3/4	7
.4365	48843	70.15	.3730	6	1 3/4	7
.4385	48844	70.15	.3730	6	1 3/4	7
.4990	48849	75.75	.4355	6	2	8
.5010	48850	75.75	.4355	6	2	8
	48800	\$717.60 - CASED SET OF ABOVE 12 REAMERS				

DOWEL PIN SIZE REAMERS CARBIDE TIPPED - FOR STEELS



TYPE 486 - STRAIGHT FLUTES & SHANK

- Special plus .0000", minus .0002" tool diameter tolerance
- Same specifications & available modifications as Type 480 (page 74)

USE:

- These precision ground reamers should be used in pairs, .0005" and .0020" under the dowel pin diameter. The .0020" smaller holes assure a tighter dowel pin fit, so all the pins will remain on the same side upon disassembly. Especially useful in plastic or die cast molds and machines when assembled sections are subject to shearing stress, yet require occasional disassembly.

DECIMAL TOOL DIAMETER	TYPE 486 STEEL EDP NO.	PRICE	DIMENSIONS			
			MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH	
					FLUTE & CARBIDE	OVER-ALL
.1855	48617	\$57.00	.1805	4	1 1/8	4 1/2
.1870	48618	57.00	.1805	4	1 1/8	4 1/2
.2480	48623	57.00	.2405	4	1 1/2	6
.2495	48624	57.00	.2405	4	1 1/2	6
.3105	48630	58.05	.2792	4	1 1/2	6
.3120	48631	58.05	.2792	4	1 1/2	6
.3730	48636	59.70	.3105	4	1 3/4	7
.3745	48637	59.70	.3105	4	1 3/4	7
.4355	48642	70.15	.3730	6	1 3/4	7
.4370	48643	70.15	.3730	6	1 3/4	7
.4980	48648	75.75	.4355	6	2	8
.4995	48649	75.75	.4355	6	2	8
	48600	\$717.60 - CASED SET OF ABOVE 12 REAMERS				

REAMERS



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 407, 408, 409 FRACTIONAL



STRAIGHT FLUTES STRAIGHT SHANK



NATIONAL AEROSPACE STANDARDS - NAS 897
TYPE 407 - FOR NON-FERROUS MATERIALS
TYPE 408 - FOR CAST IRONS & NAS MULTI-PURPOSE
TYPE 409 - FOR STEELS & HIGH TEMP ALLOYS

- Type "C" with short carbide tip
- Straight polished flutes and straight shank
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

For shallow holes only (see page 27)

NOTE: For smaller tool diameters, see solid carbide reamers on pages 58, & 105-107.

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	407
40	NON-FERROUS - SHORT CHIPS	407/408	
60	CAST IRONS	408	
80	LOW STRENGTH STEELS	409/408	
100	MEDIUM STRENGTH STEELS	409	
120	HIGH STRENGTH STEELS	409	
140	HIGH TEMPERATURE ALLOYS	409	

MODIFICATIONS (Prompt delivery)

- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available: See page 81

TOOL DIAMETER		TYPE 407 NON-FERROUS EDP NO.	TYPE 408 NAS/ CAST IRON EDP NO.	TYPE 409 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					MAX SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLT	CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
5/32	.1562	40705	40805	40905	\$41.60	.1510	4	1	1/2	4	0.1560-0.1769	\$72.10	\$56.75	\$51.65	\$49.25	\$46.60	\$44.55
3/16	.1875	40706	40806	40906	38.15	.1805	4	1 1/8	1/2	4 1/2	0.1770-0.2040	67.85	52.95	48.00	45.60	43.05	41.05
7/32	.2188	40707	40807	40907	38.15	.2075	4	1 1/4	1/2	5	0.2041-0.2210	67.85	52.95	48.00	45.60	43.05	41.05
15/64	.2344	4072344	4082344	4092344	40.50	.2265	4	1 1/2	1/2	6	0.2211-0.2380	70.15	55.30	50.30	47.95	45.35	43.35
1/4	.2500	40708	40808	40908	38.40	.2405	4	1 1/2	1/2	6	0.2381-0.2530	68.05	53.20	48.25	45.85	43.30	41.30
9/32	.2812	40709	40809	40909	39.15	.2485	4	1 1/2	1/2	6	0.2531-0.2840	68.85	53.95	49.05	46.60	44.10	42.05
5/16	.3125	40710	40810	40910	39.15	.2792	4	1 1/2	1/2	6	0.2841-0.3150	68.85	53.95	49.05	46.60	44.10	42.05
3/8	.3750	40712	40812	40912	37.30	.3105	4	1 3/4	5/8	7	0.3151-0.3470	70.30	55.45	50.45	48.10	45.55	43.60
11/32	.3438	40711	40811	40911	40.65	.2792	6	1 1/2	5/8	6	0.3151-0.3470	74.30	59.45	54.50	52.10	49.55	47.55
13/32	.4062	40713	40813	40913	42.60	.3105	4	1 3/4	5/8	7	0.3471-0.3780	64.50	50.85	46.30	44.15	41.80	39.95
7/16	.4375	40714	40814	40914	45.40	.3730	6	1 3/4	5/8	7	0.3471-0.3780	68.15	54.55	50.00	47.85	45.45	43.65
15/32	.4688	40715	40815	40915	46.10	.3730	6	1 3/4	5/8	7	0.3781-0.4090	72.25	57.40	52.45	50.05	47.45	45.50
1/2	.5000	40716	40816	40916	54.50	.4355	6	2	5/8	8	0.3781-0.4090	75.10	60.20	55.30	52.85	50.35	48.35
17/32	.5312	40717	40817	40917	59.30	.4355	6	2	5/8	8	0.4091-0.4410	75.10	60.20	55.30	52.85	50.35	48.35
9/16	.5625	40718	40818	40918	59.30	.4355	6	2	5/8	8	0.4411-0.4720	75.75	60.90	55.90	53.55	51.05	49.05
19/32	.5938	40719	40819	40919	61.75	.4355	6	2	5/8	8	0.4721-0.5030	87.15	70.75	65.30	62.75	59.90	57.70
5/8	.6250	40720	40820	40920	61.75	.5615	6	2 1/4	5/8	9	0.5031-0.5340	91.95	75.55	70.15	67.50	64.75	62.50
21/32	.6562	40721	40821	40921	62.80	.5615	6	2 1/4	5/8	9	0.5341-0.5660	91.95	75.55	70.15	67.50	64.75	62.50
11/16	.6875	40722	40822	40922	62.80	.5615	6	2 1/4	5/8	9	0.5661-0.5970	94.40	78.00	72.50	69.90	67.10	64.90
23/32	.7188	40723	40823	40923	65.75	.5615	6	2 1/4	5/8	9	0.5971-0.6280	94.40	78.00	72.50	69.90	67.10	64.90
3/4	.7500	40724	40824	40924	65.75	.6245	6	2 1/2	3/4	9 1/2	0.6281-0.6590	95.45	79.05	73.55	71.05	68.15	66.00
25/32	.7812	40725	40825	40925	67.85	.6245	6	2 1/2	3/4	9 1/2	0.6591-0.6910	95.45	79.05	73.55	71.05	68.15	66.00
13/16	.8125	40726	40826	40926	67.85	.6245	6	2 1/2	3/4	9 1/2	0.6911-0.7220	98.40	82.00	76.55	73.90	71.15	68.90
27/32	.8438	40727	40827	40927	70.55	.6245	6	2 1/2	3/4	9 1/2	0.7221-0.7530	98.40	82.00	76.55	73.90	71.15	68.90
7/8	.8750	40728	40828	40928	73.25	.7495	6	2 5/8	3/4	10	0.7531-0.7840	100.50	84.15	78.70	76.05	73.25	71.10
29/32	.9062	40729	40829	40929	85.30	.7495	6	2 5/8	3/4	10	0.7841-0.8160	100.50	84.15	78.70	76.05	73.25	71.10
15/16	.9375	40730	40830	40930	85.30	.7495	8	2 5/8	3/4	10	0.8161-0.8470	103.20	86.90	81.45	78.80	76.00	73.80
31/32	.9688	40731	40831	40931	89.35	.7495	8	2 5/8	3/4	10	0.8471-0.8780	107.10	90.15	84.45	81.80	78.90	76.60
1	1.0000	40732	40832	40932	89.35	.8745	8	2 3/4	3/4	10 1/2	0.8781-0.9090	119.20	102.20	96.55	93.85	90.90	88.60
1 1/16	1.0625	40734	40834	40934	92.50	.8745	8	2 3/4	3/4	10 1/2	0.9091-0.9410	119.20	102.20	96.55	93.85	90.90	88.60
1 1/8	1.1250	40736	40836	40936	100.00	.8745	8	2 7/8	7/8	11	0.9411-0.9720	123.20	106.25	100.55	97.80	94.90	92.60
1 3/16	1.1875	40738	40838	40938	105.10	.9995	8	2 7/8	7/8	11	0.9721-1.0030	123.20	106.25	100.55	97.80	94.90	92.60
1 1/4	1.2500	40740	40840	40940	111.10	.9995	8	3	7/8	11 1/2	1.0031-1.0660	124.95	108.75	103.25	100.65	97.85	95.70
1 5/16	1.3125	40742	40842	40942	116.95	.9995	8	3	7/8	11 1/2	1.0661-1.1280	132.45	116.20	110.80	108.15	105.40	103.20
1 3/8	1.3750	40744	40844	40944	124.05	.9995	8	3 1/4	7/8	12	1.1281-1.1905	137.60	121.35	115.90	113.30	110.50	108.35
1 7/16	1.4375	40746	40846	40946	138.25	.9995	8	3 1/4	7/8	12	1.1906-1.2530	143.60	127.35	121.85	119.30	116.50	114.30
1 1/2	1.5000	40748	40848	40948	146.15	1.2495	8	3 1/2	7/8	12 1/2	1.2531-1.3155	149.45	133.20	127.70	125.15	122.30	120.10
											1.3156-1.3780	156.55	140.30	134.75	132.25	129.40	127.20
											1.3781-1.4405	170.80	154.45	149.05	146.50	143.65	141.50
											1.4406-1.5030	178.65	162.40	156.90	154.35	151.50	149.35

*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS

CARBIDE TIPPED TYPES 407, 408, 409 METRIC



STRAIGHT FLUTES STRAIGHT SHANK

For shallow holes only (see page 27)



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 76).

TOOL DIAMETER		TYPE 407 NON FERROUS	TYPE 408 NAS/ CAST IRON	TYPE 409 STEEL/ HI-TEMP	ALL TYPES METRIC PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH	METRIC EDP NO.	METRIC EDP NO.	METRIC EDP NO.		MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
								FLT	CAR- BIDE	OVER- ALL		1	2	3	4	5-7	8-14	OVER 14
4.0	.1575	407040	408040	409040	\$51.65	.1510	4	1	1/2	4	3.962-4.493	\$74.60	\$59.40	\$54.35	\$51.80	\$49.25	\$47.15	\$44.20
4.5	.1772	407045	408045	409045	48.00	.1704	4	1 1/8	1/2	4 1/2	4.494-4.696	70.30	55.50	50.50	48.10	45.60	43.60	40.70
5.0	.1969	407050	408050	409050	48.00	.1805	4	1 1/8	1/2	4 1/2	4.697-5.182	70.30	55.50	50.50	48.10	45.60	43.60	40.70
5.5	.2165	407055	408055	409055	48.00	.2075	4	1 1/4	1/2	5	5.183-5.613	70.30	55.50	50.50	48.10	45.60	43.60	40.70
6.0	.2362	407060	408060	409060	50.30	.2265	4	1 1/2	1/2	6	5.614-6.045	72.60	57.80	52.80	50.40	47.95	45.85	43.00
-	-	407063	408063	409063	-	.2405	4	1 1/2	1/2	6	6.046-6.426	70.55	55.75	50.75	48.35	45.85	43.80	40.95
6.5	.2559	407065	408065	409065	49.05	.2485	4	1 1/2	1/2	6	6.427-7.214	71.35	56.55	51.55	49.15	46.60	44.55	41.75
7.0	.2756	407070	408070	409070	49.05	.2485	4	1 1/2	1/2	6	-	-	-	-	-	-	-	
7.5	.2953	407075	408075	409075	49.05	.2792	4	1 1/2	1/2	6	7.215-8.001	71.35	56.55	51.55	49.15	46.60	44.55	41.75
7.5	.2953	407078	408078	409078	52.85	.2792	6	1 1/2	1/2	6	7.215-8.001	75.25	60.45	55.45	53.00	50.50	48.45	45.60
8.0	.3150	407080	408080	409080	49.05	.2792	4	1 1/2	1/2	6	-	-	-	-	-	-	-	
8.0	.3150	407083	408083	409083	52.85	.2792	6	1 1/2	1/2	6	-	-	-	-	-	-	-	
8.5	.3346	407085	408085	409085	50.45	.2792	4	1 1/2	5/8	6	8.002-8.814	72.75	58.00	53.00	50.60	48.10	46.05	43.20
8.5	.3346	407088	408088	409088	54.50	.2792	6	1 1/2	5/8	6	8.002-8.814	76.80	62.00	57.00	54.60	52.10	50.05	47.20
9.0	.3543	407090	408090	409090	46.30	.3105	4	1 3/4	5/8	7	8.815-9.601	66.80	53.20	48.60	46.40	44.15	42.25	39.65
9.0	.3543	407093	408093	409093	50.00	.3105	6	1 3/4	5/8	7	8.815-9.601	70.45	56.85	52.30	50.10	47.85	45.90	43.30
9.5	.3740	407095	408095	409095	46.30	.3105	4	1 3/4	5/8	7	-	-	-	-	-	-	-	
9.5	.3740	407098	408098	409098	50.00	.3105	6	1 3/4	5/8	7	-	-	-	-	-	-	-	
10.0	.3937	407100	408100	409100	52.45	.3105	4	1 3/4	5/8	7	9.602-10.389	74.75	59.95	54.95	52.55	50.05	48.00	45.15
10.0	.3937	407103	408103	409103	55.30	.3105	6	1 3/4	5/8	7	9.602-10.389	77.60	62.80	57.80	55.40	52.85	50.80	48.00
10.5	.4134	407105	408105	409105	55.30	.3730	6	1 3/4	5/8	7	10.390-11.201	77.60	62.80	57.80	55.40	52.85	50.80	48.00
11.0	.4331	407110	408110	409110	55.30	.3730	6	1 3/4	5/8	7	-	-	-	-	-	-	-	
11.5	.4528	407115	408115	409115	55.90	.3730	6	1 3/4	5/8	7	11.202-11.989	78.20	63.40	58.50	56.00	53.55	51.45	48.60
12.0	.4724	407120	408120	409120	65.30	.4355	6	2	5/8	8	11.990-12.776	89.90	73.55	68.10	65.45	62.75	60.45	57.35
12.5	.4921	407125	408125	409125	65.30	.4355	6	2	5/8	8	-	-	-	-	-	-	-	
13.0	.5118	407130	408130	409130	70.15	.4355	6	2	5/8	8	12.777-13.564	94.70	78.45	72.90	70.25	67.50	65.20	62.10
13.5	.5315	407135	408135	409135	70.15	.4355	6	2	5/8	8	-	-	-	-	-	-	-	
14.0	.5512	407140	408140	409140	70.15	.4355	6	2	5/8	8	13.565-14.376	94.70	78.45	72.90	70.25	67.50	65.20	62.10
14.5	.5709	407145	408145	409145	72.50	.4355	6	2	5/8	8	14.377-15.164	97.10	80.80	75.35	72.65	69.90	67.65	64.50
15.0	.5906	407150	408150	409150	72.50	.4355	6	2	5/8	8	-	-	-	-	-	-	-	
15.5	.6102	407155	408155	409155	72.50	.5615	6	2 1/4	5/8	9	15.165-15.951	97.10	80.80	75.35	72.65	69.90	67.65	64.50
16.0	.6299	407160	408160	409160	73.55	.5615	6	2 1/4	5/8	9	15.952-16.739	98.20	81.85	76.40	73.70	71.05	68.70	65.55
16.5	.6496	407165	408165	409165	73.55	.5615	6	2 1/4	5/8	9	-	-	-	-	-	-	-	
17.0	.6693	407170	408170	409170	73.55	.5615	6	2 1/4	5/8	9	16.740-17.551	98.20	81.85	76.40	73.70	71.05	68.70	65.55
17.5	.6890	407175	408175	409175	73.55	.5615	6	2 1/4	5/8	9	-	-	-	-	-	-	-	
18.0	.7087	407180	408180	409180	76.55	.5615	6	2 1/4	5/8	9	17.552-18.339	101.10	84.80	79.40	76.70	73.90	71.65	68.50
19.0	.7480	407190	408190	409190	76.55	.6245	6	2 1/2	3/4	9 1/2	18.340-19.126	101.10	84.80	79.40	76.70	73.90	71.65	68.50
19.5	.7677	407195	408195	409195	78.70	.6245	6	2 1/2	3/4	9 1/2	19.127-19.914	103.20	86.95	81.50	78.80	76.05	73.80	70.65
20.0	.7874	407200	408200	409200	78.70	.6245	6	2 1/2	3/4	9 1/2	19.915-20.726	103.20	86.95	81.50	78.80	76.05	73.80	70.65
21.0	.8268	407210	408210	409210	81.45	.6245	6	2 1/2	3/4	9 1/2	20.727-21.514	105.95	89.70	84.20	81.55	78.80	76.55	73.40
22.0	.8661	407220	408220	409220	81.45	.7495	6	2 5/8	3/4	10	21.515-22.301	105.95	89.70	84.20	81.55	78.80	76.55	73.40
23.0	.9055	407230	408230	409230	96.55	.7495	6	2 5/8	3/4	10	22.302-23.089	122.00	105.10	99.45	96.65	93.85	91.45	88.25
23.5	.9252	407235	408235	409235	96.55	.7495	8	2 5/8	3/4	10	23.090-23.901	122.00	105.10	99.45	96.65	93.85	91.45	88.25
24.0	.9449	407240	408240	409240	100.55	.7495	8	2 5/8	3/4	10	23.902-24.689	126.05	109.15	103.50	100.70	97.80	95.50	92.25
25.0	.9843	407250	408250	409250	100.55	.8745	8	2 3/4	3/4	10 1/2	24.690-25.476	126.05	109.15	103.50	100.70	97.80	95.50	92.25
26.0	1.0236	407260	408260	409260	103.25	.8745	8	2 3/4	3/4	10 1/2	25.477-27.076	127.70	111.50	106.10	103.40	100.65	98.40	95.30
27.0	1.0630	407270	408270	409270	103.25	.8745	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	
28.0	1.1024	407280	408280	409280	110.80	.8745	8	2 7/8	7/8	11	27.077-28.651	135.20	119.00	113.55	110.90	108.15	105.90	102.80
29.0	1.1417	407290	408290	409290	115.90	.9995	8	2 7/8	7/8	11	28.652-30.239	140.35	124.10	118.65	116.00	113.30	111.05	107.95
30.0	1.1811	407300	408300	409300	115.90	.9995	8	2 7/8	7/8	11	-	-	-	-	-	-	-	
31.0	1.2205	407310	408310	409310	121.85	.9995	8	3	7/8	11 1/2	30.240-31.826	146.25	130.10	124.70	122.00	119.30	117.00	113.85
32.0	1.2598	407320	408320	409320	127.70	.9995	8	3	7/8	11 1/2	31.827-33.414	152.15	135.90	130.50	127.85	125.15	122.90	119.70
33.0	1.2992	407330	408330	409330	127.70	.9995	8	3	7/8	11 1/2	-	-	-	-	-	-	-	
34.0	1.3386	407340	408340	409340	134.75	.9995	8	3 1/4	7/8	12	33.415-35.001	159.30	143.05	137.60	135.00	132.25	130.00	126.85
35.0	1.3780	407350	408350	409350	134.75	.9995	8	3 1/4	7/8	12	-	-	-	-	-	-	-	
36.0	1.4173	407360	408360	409360	149.05	.9995	8	3 1/4	7/8	12	35.002-36.589	173.45	157.25	151.85	149.15	146.50	144.20	141.05
37.0	1.4567	407370	408370	409370	156.90	1.2495	8	3 1/2	7/8	12 1/2	36.590-38.176	181.40	165.15	159.75	157.10	154.35	152.10	148.95

REAMERS



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 457, 458, 459 FRACTIONAL



STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	457
	40	NON-FERROUS - SHORT CHIPS	457/458
	60	CAST IRONS	458
	80	LOW STRENGTH STEELS	459/458
	100	MEDIUM STRENGTH STEELS	459
	120	HIGH STRENGTH STEELS	459
140	HIGH TEMPERATURE ALLOYS	459	

NATIONAL AEROSPACE STANDARDS - NAS 897

TYPE 457 - FOR NON-FERROUS MATERIALS

TYPE 458 - FOR CAST IRONS & NAS MULTI-PURPOSE

TYPE 459 - FOR STEELS & HIGH TEMP ALLOYS

- Type "C" with flute long carbide
- Straight polished flutes and straight shank
- Longer flutes than Type 450 on .5971" tool diameter and larger for straight deep holes
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

NOTE: For step reamers, see page 98.
For smaller tool diameters, see solid carbide reamers on pages 58, 105-107.

MODIFICATIONS (See list on page 76; modified metric tool diameters priced on page 79)

TOOL DIAMETER		TYPE 457 NON-FERROUS EDP NO.	TYPE 458 NAS/ CAST IRON EDP NO.	TYPE 459 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLUTE & CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/16	.1875	45706	45806	45906	\$45.60	.1805	4	1 1/8	4 1/2	0.1770-0.2040	\$76.10	\$60.85	\$55.70	\$53.30	\$50.70	\$48.60
7/32	.2188	45707	45807	45907	45.60	.2075	4	1 1/4	5	0.2041-0.2210	76.10	60.85	55.70	53.30	50.70	48.60
15/64	.2344	4572344	4582344	4592344	45.60	.2265	4	1 1/2	6	0.2211-0.2380	76.10	60.85	55.70	53.30	50.70	48.60
1/4	.2500	45708	45808	45908	45.60	.2405	4	1 1/2	6	0.2381-0.2530	76.10	60.85	55.70	53.30	50.70	48.60
9/32	.2812	45709	45809	45909	46.60	.2485	4	1 1/2	6	0.2531-0.2840	77.05	61.85	56.70	54.35	51.65	49.65
5/16	.3125	45710	45810	45910	46.60	.2792	4	1 1/2	6	0.2841-0.3150	77.05	61.85	56.70	54.35	51.65	49.65
11/32	.3438	45711	45811	45911	48.30	.2792	4	1 1/2	6	0.3151-0.3470	78.80	63.45	58.40	55.95	53.40	51.30
3/8	.3750	45712	45812	45912	48.30	.3105	4	1 3/4	7	0.3471-0.3780	78.80	63.45	58.40	55.95	53.40	51.30
13/32	.4062	45713	45813	45913	50.70	.3105	4	1 3/4	7	0.3781-0.4090	81.10	65.90	60.80	58.35	55.70	53.65
7/16	.4375	45714	45814	45914	54.85	.3730	6	1 3/4	7	0.4091-0.4410	85.30	70.10	64.95	62.50	59.90	57.80
15/32	.4688	45715	45815	45915	59.25	.3730	6	1 3/4	7	0.4411-0.4720	89.80	74.45	69.40	66.95	64.30	62.25
1/2	.5000	45716	45816	45916	63.45	.4355	6	2	8	0.4721-0.5030	96.20	79.80	74.35	71.70	68.90	66.75
17/32	.5312	45717	45817	45917	65.30	.4355	6	2	8	0.5031-0.5340	97.95	81.60	76.10	73.50	70.70	68.50
9/16	.5625	45718	45818	45918	65.30	.4355	6	2	8	0.5341-0.5660	97.95	81.60	76.10	73.50	70.70	68.50
19/32	.5938	45719	45819	45919	67.80	.4355	6	2	8	0.5661-0.5970	100.45	84.10	78.60	76.00	73.20	71.05
5/8	.6250	45720	45820	45920	67.80	.5615	6	2 1/4	9	0.5971-0.6280	100.45	84.10	78.60	76.00	73.20	71.05
21/32	.6562	45721	45821	45921	69.05	.5615	6	2 1/4	9	0.6281-0.6590	101.75	85.35	79.85	77.25	74.45	72.25
11/16	.6875	45722	45822	45922	69.05	.5615	6	2 1/4	9	0.6591-0.6910	101.75	85.35	79.85	77.25	74.45	72.25
23/32	.7188	45723	45823	45923	72.20	.5615	6	2 1/4	9	0.6911-0.7220	104.85	88.45	83.05	80.45	77.60	75.40
3/4	.7500	45724	45824	45924	72.20	.6245	6	2 1/2	9 1/2	0.7221-0.7530	104.85	88.45	83.05	80.45	77.60	75.40
25/32	.7812	45725	45825	45925	74.70	.6245	6	2 1/2	9 1/2	0.7531-0.7840	107.30	90.95	85.45	82.85	80.05	77.85
13/16	.8125	45726	45826	45926	74.70	.6245	6	2 1/2	9 1/2	0.7841-0.8160	107.30	90.95	85.45	82.85	80.05	77.85
27/32	.8438	45727	45827	45927	77.70	.6245	6	2 1/2	9 1/2	0.8161-0.8470	110.30	93.90	88.45	85.90	83.10	80.85
7/8	.8750	45728	45828	45928	80.65	.7495	6	2 3/8	10	0.8471-0.8780	114.45	97.50	91.80	89.10	86.20	83.90
29/32	.9062	45729	45829	45929	93.85	.7495	6	2 3/8	10	0.8781-0.9090	127.75	110.80	105.05	102.30	99.45	97.10
15/16	.9375	45730	45830	45930	93.85	.7495	8	2 3/8	10	0.9091-0.9410	127.75	110.80	105.05	102.30	99.45	97.10
31/32	.9688	45731	45831	45931	98.35	.7495	8	2 3/8	10	0.9411-0.9720	132.25	115.30	109.55	106.85	103.95	101.65
1	1.0000	45732	45832	45932	98.35	.8745	8	2 3/4	10 1/2	0.9721-1.0030	132.25	115.30	109.55	106.85	103.95	101.65
1 1/16	1.0625	45734	45834	45934	101.70	.8745	8	2 3/4	10 1/2	1.0031-1.0660	134.15	117.85	112.45	109.85	107.05	104.90
1 1/8	1.1250	45736	45836	45936	110.15	.8745	8	2 7/8	11	1.0661-1.1280	142.60	126.30	120.85	118.30	115.50	113.30
1 3/16	1.1875	45738	45838	45938	115.15	.9995	8	2 7/8	11	1.1281-1.1905	147.65	131.35	125.90	123.40	120.55	118.35
1 1/4	1.2500	45740	45840	45940	124.40	.9995	8	3	11 1/2	1.1906-1.2530	156.90	140.70	135.20	132.65	129.85	127.65
1 5/16	1.3125	45742	45842	45942	127.90	.9995	8	3	11 1/2	1.2531-1.3155	160.40	144.15	138.65	136.10	133.30	131.10
1 3/8	1.3750	45744	45844	45944	136.40	.9995	8	3 1/4	12	1.3156-1.3780	168.85	152.60	147.15	144.60	141.75	139.60
1 7/16	1.4375	45746	45846	45946	147.75	.9995	8	3 1/4	12	1.3781-1.4405	180.20	163.90	158.45	155.85	153.10	150.90
1 1/2	1.5000	45748	45848	45948	152.00	1.2495	8	3 1/2	12 1/2	1.4406-1.5030	184.50	168.20	162.80	160.20	157.45	155.25
1 9/16	1.5625	45750	45850	45950	238.75	1.2495	8	3 1/2	12 1/2	1.5031-1.5660	271.30	255.05	249.60	247.00	244.20	242.00
1 5/8	1.6250	45752	45852	45952	246.95	1.2495	8	3 1/2	13	1.5661-1.6280	279.50	263.25	257.80	255.20	252.35	250.20
1 11/16	1.6875	45754	45854	45954	271.15	1.2495	8	3 1/2	13	1.6281-1.6910	303.70	287.45	282.00	279.40	276.55	274.40
1 3/4	1.7500	45756	45856	45956	271.15	1.2495	10	3 1/2	13 1/2	1.6911-1.7530	303.70	287.45	282.00	279.40	276.55	274.40
1 13/16	1.8125	45758	45858	45958	277.45	1.4995	10	3 1/2	13 1/2	1.7531-1.8160	310.00	293.75	288.30	285.70	282.85	280.70
1 7/8	1.8750	45760	45860	45960	291.00	1.4995	10	3 1/2	14	1.8161-1.8780	323.55	307.30	301.80	299.25	296.40	294.25
1 15/16	1.9375	45762	45862	45962	308.50	1.4995	10	3 1/2	14	1.8781-1.9410	341.05	324.75	319.30	316.75	313.90	311.75
2	2.0000	45764	45864	45964	308.05	1.4995	12	3 1/2	14	1.9411-2.0030	340.60	324.35	318.90	316.30	313.50	311.30
2 1/8	2.1250	45768	45868	45968	572.35	1.4995	12	3 1/2	14 1/2	2.0031-2.1280	604.90	588.65	583.15	580.60	577.75	575.60
2 1/4	2.2500	45772	45872	45972	614.70	1.7495	12	3 1/2	14 1/2	2.1281-2.2530	647.25	631.00	625.55	622.95	620.15	618.00
2 3/8	2.3750	45776	45876	45976	636.10	1.7495	12	3 1/2	15	2.2531-2.3780	668.65	652.35	646.90	644.35	641.50	639.35
2 1/2	2.5000	45780	45880	45980	636.10	1.7495	12	3 1/2	15	2.3781-2.5030	668.65	652.35	646.90	644.35	641.50	639.35

*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS

CARBIDE TIPPED TYPES 457, 458, 459 METRIC



STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 76).

TOOL DIAMETER		TYPE 457 NON FERROUS METRIC EDP NO.	TYPE 458 NAS/ CAST IRON METRIC EDP NO.	TYPE 459 STEEL/ HI-TEMP METRIC EDP NO.	ALL TYPES METRIC PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
								FLT & CARB	OVER-ALL			1	2	3	4	5-7	8-14
4.5	.1772	457045	458045	459045	\$55.70	.1704	4	1 1/8	4 1/2	4.494-4.696	\$78.65	\$63.40	\$58.35	\$55.85	\$53.30	\$51.20	\$48.25
5.0	.1969	457050	458050	459050	55.70	.1805	4	1 1/8	4 1/2	4.697-5.182	78.65	63.40	58.35	55.85	53.30	51.20	48.25
5.5	.2165	457055	458055	459055	55.70	.2075	4	1 1/4	5	5.183-5.613	78.65	63.40	58.35	55.85	53.30	51.20	48.25
6.0	.2362	457060	458060	459060	55.70	.2265	4	1 1/2	6	5.614-6.045	78.65	63.40	58.35	55.85	53.30	51.20	48.25
-	-	457063	458063	459063	-	.2405	4	1 1/2	6	6.046-6.426	78.65	63.40	58.35	55.85	53.30	51.20	48.25
6.5	.2559	457065	458065	459065	56.70	.2485	4	1 1/2	6	6.427-7.214	79.65	64.40	59.30	56.80	54.35	52.15	49.25
7.0	.2756	457070	458070	459070	56.70	.2485	4	1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	457075	458075	459075	56.70	.2792	4	1 1/2	6	7.215-8.001	79.65	64.40	59.30	56.80	54.35	52.15	49.25
8.0	.3150	457080	458080	459080	56.70	.2792	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	457085	458085	459085	58.40	.2792	4	1 1/2	6	8.002-8.814	81.40	66.10	61.00	58.55	55.95	53.85	50.90
9.0	.3543	457090	458090	459090	58.40	.3105	4	1 3/4	7	8.815-9.601	81.40	66.10	61.00	58.55	55.95	53.85	50.90
9.5	.3740	457095	458095	459095	58.40	.3105	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	457100	458100	459100	60.80	.3105	4	1 3/4	7	9.602-10.389	83.70	68.50	63.35	60.90	58.35	56.25	53.30
10.5	.4134	457105	458105	459105	64.95	.3730	6	1 3/4	7	10.390-11.201	87.90	72.65	67.55	65.05	62.50	60.40	57.50
11.0	.4331	457110	458110	459110	64.95	.3730	6	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	457115	458115	459115	69.40	.3730	6	1 3/4	7	11.202-11.989	92.35	77.05	72.05	69.50	66.95	64.85	61.90
12.0	.4724	457120	458120	459120	74.35	.4355	6	2	8	11.990-12.776	98.90	82.60	77.10	74.45	71.70	69.45	66.35
12.5	.4921	457125	458125	459125	74.35	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	457130	458130	459130	76.10	.4355	6	2	8	12.777-13.564	100.75	84.40	78.90	76.25	73.50	71.25	68.10
13.5	.5315	457135	458135	459135	76.10	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	457140	458140	459140	76.10	.4355	6	2	8	13.565-14.376	100.75	84.40	78.90	76.25	73.50	71.25	68.10
14.5	.5709	457145	458145	459145	78.60	.4355	6	2	8	14.377-15.164	103.15	86.90	81.45	78.75	76.00	73.70	70.55
15.0	.5906	457150	458150	459150	78.60	.4355	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	457155	458155	459155	78.60	.5615	6	2 1/4	9	15.165-15.951	103.15	86.90	81.45	78.75	76.00	73.70	70.55
16.0	.6299	457160	458160	459160	79.85	.5615	6	2 1/4	9	15.952-16.739	104.50	88.15	82.70	80.00	77.25	75.00	71.80
16.5	.6496	457165	458165	459165	79.85	.5615	6	2 1/4	9	-	-	-	-	-	-	-	-
17.0	.6693	457170	458170	459170	79.85	.5615	6	2 1/4	9	16.740-17.551	104.50	88.15	82.70	80.00	77.25	75.00	71.80
17.5	.6890	457175	458175	459175	79.85	.5615	6	2 1/4	9	-	-	-	-	-	-	-	-
18.0	.7087	457180	458180	459180	83.05	.6245	6	2 1/2	9 1/2	17.552-18.339	107.55	91.25	85.85	83.15	80.45	78.10	75.00
18.5	.7283	457185	458185	459185	83.05	.6245	6	2 1/2	9 1/2	18.340-19.126	107.55	91.25	85.85	83.15	80.45	78.10	75.00
19.0	.7480	457190	458190	459190	83.05	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	457195	458195	459195	85.45	.6245	6	2 1/2	9 1/2	19.127-19.914	110.10	93.75	88.25	85.60	82.85	80.60	77.50
20.0	.7874	457200	458200	459200	85.45	.6245	6	2 1/2	9 1/2	19.915-20.726	110.10	93.75	88.25	85.60	82.85	80.60	77.50
20.5	.8071	457205	458205	459205	85.45	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	457210	458210	459210	88.45	.6245	6	2 1/2	9 1/2	20.727-21.514	113.10	96.75	91.25	88.60	85.90	83.60	80.50
21.5	.8465	457215	458215	459215	88.45	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	457220	458220	459220	88.45	.7495	6	2 5/8	10	21.515-22.301	113.10	96.75	91.25	88.60	85.90	83.60	80.50
22.5	.8858	457225	458225	459225	105.05	.7495	6	2 5/8	10	22.302-23.089	130.55	113.65	108.00	105.20	102.30	100.00	96.70
23.0	.9055	457230	458230	459230	105.05	.7495	6	2 5/8	10	-	-	-	-	-	-	-	-
23.5	.9252	457235	458235	459235	105.05	.7495	8	2 5/8	10	23.090-23.901	130.55	113.65	108.00	105.20	102.30	100.00	96.70
24.0	.9449	457240	458240	459240	109.55	.7495	8	2 5/8	10	23.902-24.689	135.10	118.20	112.50	109.70	106.85	104.55	101.20
24.5	.9646	457245	458245	459245	109.55	.7495	8	2 5/8	10	-	-	-	-	-	-	-	-
25.0	.9843	457250	458250	459250	109.55	.8745	8	2 3/4	10 1/2	24.690-25.476	135.10	118.20	112.50	109.70	106.85	104.55	101.20
25.5	1.0039	457255	458255	459255	112.45	.8745	8	2 3/4	10 1/2	25.477-27.076	136.85	120.70	115.20	112.55	109.85	107.55	104.50
26.0	1.0236	457260	458260	459260	112.45	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	457270	458270	459270	112.45	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	457280	458280	459280	120.85	.8745	8	2 3/4	11	27.077-28.651	145.30	129.15	123.65	120.95	118.30	116.00	112.90
29.0	1.1417	457290	458290	459290	125.90	.9995	8	2 3/4	11	28.652-30.239	150.35	134.15	128.75	126.05	123.40	121.05	117.90
30.0	1.1811	457300	458300	459300	125.90	.9995	8	2 3/4	11	-	-	-	-	-	-	-	-
31.0	1.2205	457310	458310	459310	135.20	.9995	8	3	11 1/2	30.240-31.826	159.70	143.45	138.00	135.35	132.65	130.35	127.20
32.0	1.2598	457320	458320	459320	138.65	.9995	8	3	11 1/2	31.827-33.414	163.05	146.90	141.50	138.80	136.10	133.80	130.65
33.0	1.2992	457330	458330	459330	138.65	.9995	8	3	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	457340	458340	459340	147.15	.9995	8	3 1/4	12	33.415-35.001	171.60	155.40	150.00	147.30	144.60	142.30	139.20
35.0	1.3780	457350	458350	459350	147.15	.9995	8	3 1/4	12	-	-	-	-	-	-	-	-
36.0	1.4173	457360	458360	459360	158.45	.9995	8	3 1/4	12	35.002-36.589	182.90	166.70	161.25	158.60	155.85	153.60	150.50
37.0	1.4567	457370	458370	459370	162.80	1.2495	8	3 1/2	12 1/2	36.590-38.176	187.20	171.00	165.60	162.90	160.20	157.90	154.80
38.0	1.4961	457380	458380	459380	162.80	1.2495	8	3 1/2	12 1/2	-	-	-	-	-	-	-	-

REAMERS



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 472, 473, 474 FRACTIONAL



STRAIGHT FLUTES TAPER SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	472
	40	NON-FERROUS - SHORT CHIPS	472/473
	60	CAST IRONS	473
	80	LOW STRENGTH STEELS	474/473
	100	MEDIUM STRENGTH STEELS	474
	120	HIGH STRENGTH STEELS	474
140	HIGH TEMPERATURE ALLOYS	474	

MODIFICATIONS (See list on page 81)

NATIONAL AEROSPACE STANDARDS - NAS 897
TYPE 472 - FOR NON-FERROUS MATERIALS
TYPE 473 - FOR CAST IRONS & NAS MULTI-PURPOSE
TYPE 474 - FOR STEELS & HIGH TEMP ALLOYS

- Type "C" with short carbide tip
- Straight polished flutes and taper shank
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

For shallow holes only (see page 27)

TOOL DIAMETER		TYPE 472 NON-FERROUS EDP NO.	TYPE 473 NAS/ CAST IRON EDP NO.	TYPE 474 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					TAPER SHANK NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
							FLT	CAR- BIDE	OVER- ALL			1	2	3	4	5-7	8-14*
1/4	.2500	47208	47308	47408	\$43.95	1	4	1 1/2	1/2	6	0.2381-0.2530	\$73.60	\$58.75	\$53.80	\$51.40	\$48.95	\$46.95
9/32	.2812	47209	47309	47409	44.70	1	4	1 1/2	1/2	6	0.2531-0.2840	74.35	59.50	54.55	52.15	49.65	47.60
5/16	.3125	47210	47310	47410	44.70	1	4	1 1/2	1/2	6	0.2841-0.3150	74.35	59.50	54.55	52.15	49.65	47.60
11/32	.3438	47211	47311	47411	46.10	1	4	1 1/2	5/8	6	0.3151-0.3470	75.75	60.90	55.90	53.55	51.05	49.05
3/8	.3750	47212	47312	47412	42.60	1	4	1 3/4	5/8	7	0.3471-0.3780	69.75	56.20	51.60	49.40	47.10	45.25
13/32	.4062	47213	47313	47413	48.70	1	4	1 3/4	5/8	7	0.3781-0.4090	78.35	63.45	58.55	56.20	53.65	51.65
7/16	.4375	47214	47314	47414	51.85	1	6	1 3/4	5/8	7	0.4091-0.4410	81.55	66.70	61.75	59.30	56.75	54.75
15/32	.4688	47215	47315	47415	53.25	1	6	1 3/4	5/8	7	0.4411-0.4720	82.90	68.05	63.10	60.70	58.15	56.20
1/2	.5000	47216	47316	47416	61.00	1	6	2	5/8	8	0.4721-0.5030	93.60	77.25	71.75	69.20	66.40	64.15
17/32	.5312	47217	47317	47417	64.80	1	6	2	5/8	8	0.5031-0.5340	97.45	81.05	75.55	73.05	70.20	68.00
9/16	.5625	47218	47318	47418	64.80	1	6	2	5/8	8	0.5341-0.5660	97.45	81.05	75.55	73.05	70.20	68.00
19/32	.5938	47219	47319	47419	68.90	1	6	2	5/8	8	0.5661-0.5970	101.55	85.20	79.75	77.10	74.35	72.15
5/8	.6250	47220	47320	47420	68.90	2	6	2 1/4	5/8	9	0.5971-0.6280	101.55	85.20	79.75	77.10	74.35	72.15
21/32	.6562	47221	47321	47421	70.10	2	6	2 1/4	5/8	9	0.6281-0.6590	102.75	86.35	80.85	78.20	75.45	73.25
11/16	.6875	47222	47322	47422	70.10	2	6	2 1/4	5/8	9	0.6591-0.6910	102.75	86.35	80.85	78.20	75.45	73.25
23/32	.7188	47223	47323	47423	72.85	2	6	2 1/4	5/8	9	0.6911-0.7220	105.50	89.15	83.70	81.05	78.20	76.05
3/4	.7500	47224	47324	47424	72.85	2	6	2 1/2	3/4	9 1/2	0.7221-0.7530	105.50	89.15	83.70	81.05	78.20	76.05
25/32	.7812	47225	47325	47425	74.55	2	6	2 1/2	3/4	9 1/2	0.7531-0.7840	107.25	90.90	85.40	82.80	80.00	77.80
13/16	.8125	47226	47326	47426	74.55	2	6	2 1/2	3/4	9 1/2	0.7841-0.8160	107.25	90.90	85.40	82.80	80.00	77.80
27/32	.8438	47227	47327	47427	78.15	2	6	2 1/2	3/4	9 1/2	0.8161-0.8470	110.90	94.50	89.05	86.40	83.60	81.45
7/8	.8750	47228	47328	47428	81.15	2	6	2 5/8	3/4	10	0.8471-0.8780	115.05	98.05	92.40	89.65	86.75	84.45
29/32	.9062	47229	47329	47429	98.75	2	6	2 5/8	3/4	10	0.8781-0.9090	132.65	115.65	109.95	107.30	104.35	102.10
15/16	.9375	47230	47330	47430	98.75	3	8	2 5/8	3/4	10	0.9091-0.9410	132.65	115.65	109.95	107.30	104.35	102.10
31/32	.9688	47231	47331	47431	101.65	3	8	2 5/8	3/4	10	0.9411-0.9720	135.55	118.55	112.90	110.20	107.30	105.00
1	1.0000	47232	47332	47432	101.65	3	8	2 3/4	3/4	10 1/2	0.9721-1.0030	135.55	118.55	112.90	110.20	107.30	105.00
1 1/16	1.0625	47234	47334	47434	125.55	3	8	2 3/4	3/4	10 1/2	1.0031-1.0660	158.00	141.70	136.30	133.65	130.95	128.75
1 1/8	1.1250	47236	47336	47436	133.30	3	8	2 7/8	7/8	11	1.0661-1.1280	165.75	149.50	144.00	141.50	138.65	136.45
1 1/16	1.1875	47238	47338	47438	145.70	3	8	2 7/8	7/8	11	1.1281-1.1905	178.20	161.90	156.45	153.95	151.10	148.90
1 1/4	1.2500	47240	47340	47440	158.25	4	8	3	7/8	11 1/2	1.1906-1.2530	190.75	174.45	169.05	166.40	163.65	161.50
1 5/16	1.3125	47242	47342	47442	167.15	4	8	3	7/8	11 1/2	1.2531-1.3155	199.65	183.35	177.90	175.35	172.55	170.35
1 3/8	1.3750	47244	47344	47444	176.10	4	8	3 1/4	7/8	12	1.3156-1.3780	208.55	192.25	186.80	184.20	181.45	179.25
1 7/16	1.4375	47246	47346	47446	186.10	4	8	3 1/4	7/8	12	1.3781-1.4405	218.65	202.35	196.95	194.35	191.55	189.35
1 1/2	1.5000	47248	47348	47448	196.15	4	8	3 1/2	7/8	12 1/2	1.4406-1.5030	228.60	212.35	206.85	204.30	201.50	199.30
1 9/16	1.5625	47250	47350	47450	230.05	4	8	3 1/2	7/8	12 1/2	1.5031-1.5660	262.55	246.20	240.80	238.25	235.45	233.25
1 5/8	1.6250	47252	47352	47452	238.05	4	8	3 3/4	7/8	13	1.5661-1.6280	270.50	254.20	248.80	246.15	243.40	241.25
1 11/16	1.6875	47254	47354	47454	267.75	4	8	3 3/4	7/8	13	1.6281-1.6910	300.20	283.90	278.45	275.90	273.10	270.90
1 3/4	1.7500	47256	47356	47456	267.75	4	10	4	7/8	13 1/2	1.6911-1.7530	300.20	283.90	278.45	275.90	273.10	270.90
1 13/16	1.8125	47258	47358	47458	267.75	4	10	4	7/8	13 1/2	1.7531-1.8160	300.20	283.90	278.45	275.90	273.10	270.90
1 7/8	1.8750	47260	47360	47460	280.45	4	10	4 1/4	7/8	14	1.8161-1.8780	312.95	296.70	291.20	288.65	285.85	283.65
1 15/16	1.9375	47262	47362	47462	280.45	4	10	4 1/4	7/8	14	1.8781-1.9410	312.95	296.70	291.20	288.65	285.85	283.65
2	2.0000	47264	47364	47464	280.45	4	12	4 1/4	7/8	14	1.9411-2.0030	312.95	296.70	291.20	288.65	285.85	283.65

*Quantities of 15 or more - price of fractional size in same size range.

REAMERS



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 453, 454, 455 FRACTIONAL



STRAIGHT FLUTE LONG CARBIDE TAPER SHANK

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	453
	40	NON-FERROUS - SHORT CHIPS	453/454
	60	CAST IRONS	454
	80	LOW STRENGTH STEELS	455/454
	100	MEDIUM STRENGTH STEELS	455
	120	HIGH STRENGTH STEELS	455
	140	HIGH TEMPERATURE ALLOYS	455



NATIONAL AEROSPACE STANDARDS - NAS 897
TYPE 453 - FOR NON-FERROUS MATERIALS
TYPE 454 - FOR CAST IRONS & NAS MULTI-PURPOSE
TYPE 455 - FOR STEELS & HIGH TEMP ALLOYS

- Type "C" with flute long carbide
- Straight polished flutes and taper shank
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shank whistle notch for set screw
- Smaller taper shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

TOOL DIAMETER		TYPE 453 NON-FERROUS EDP NO.	TYPE 454 NAS/ CAST IRON EDP NO.	TYPE 455 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					TAPER SHANK NO.	NO. OF FLUTES	LENGTH FLUTE & CARBIDE	OVER- ALL	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
							1	2	3	4	5-7	8-14*				
1/4	.2500	45308	45408	45508	\$52.50	1	4	1 1/2	6	0.2381-0.2530	\$82.95	\$67.65	\$62.55	\$60.15	\$57.55	\$55.50
9/32	.2812	45309	45409	45509	53.30	1	4	1 1/2	6	0.2531-0.2840	83.75	68.50	63.35	60.95	58.35	56.30
5/16	.3125	45310	45410	45510	53.30	1	4	1 1/2	6	0.2841-0.3150	83.75	68.50	63.35	60.95	58.35	56.30
11/32	.3438	45311	45411	45511	54.50	1	4	1 1/2	6	0.3151-0.3470	85.00	69.65	64.60	62.15	59.55	57.50
3/8	.3750	45312	45412	45512	55.05	1	4	1 3/4	7	0.3471-0.3780	85.60	70.30	65.20	62.80	60.15	58.10
13/32	.4062	45313	45413	45513	58.00	1	4	1 3/4	7	0.3781-0.4090	88.40	73.20	68.05	65.60	63.00	60.95
7/16	.4375	45314	45414	45514	61.80	1	6	1 3/4	7	0.4091-0.4410	92.25	76.95	71.80	69.45	66.85	64.80
15/32	.4688	45315	45415	45515	63.05	1	6	1 3/4	7	0.4411-0.4720	93.55	78.30	73.20	70.70	68.10	66.05
1/2	.5000	45316	45416	45516	67.90	1	6	2	8	0.4721-0.5030	100.55	84.20	78.75	76.10	73.35	71.15
17/32	.5312	45317	45417	45517	74.45	1	6	2	8	0.5031-0.5340	107.10	90.75	85.25	82.70	79.85	77.70
9/16	.5625	45318	45418	45518	74.45	1	6	2	8	0.5341-0.5660	107.10	90.75	85.25	82.70	79.85	77.70
19/32	.5938	45319	45419	45519	77.90	1	6	2	8	0.5661-0.5970	110.55	94.25	88.80	86.15	83.35	81.10
5/8	.6250	45320	45420	45520	77.90	2	6	2 1/4	9	0.5971-0.6280	110.55	94.25	88.80	86.15	83.35	81.10
21/32	.6562	45321	45421	45521	79.40	2	6	2 1/4	9	0.6281-0.6590	112.00	95.60	90.15	87.50	84.75	82.55
11/16	.6875	45322	45422	45522	79.40	2	6	2 1/4	9	0.6591-0.6910	112.00	95.60	90.15	87.50	84.75	82.55
23/32	.7188	45323	45423	45523	80.45	2	6	2 1/4	9	0.6911-0.7220	113.10	96.70	91.20	88.60	85.85	83.60
3/4	.7500	45324	45424	45524	83.05	2	6	2 1/2	9 1/2	0.7221-0.7530	115.65	99.30	93.80	91.20	88.40	86.20
25/32	.7812	45325	45425	45525	83.70	2	6	2 1/2	9 1/2	0.7531-0.7840	116.30	99.95	94.50	91.90	89.10	86.90
13/16	.8125	45326	45426	45526	85.50	2	6	2 1/2	9 1/2	0.7841-0.8160	118.20	101.85	96.40	93.75	90.95	88.80
27/32	.8438	45327	45427	45527	89.25	2	6	2 1/2	9 1/2	0.8161-0.8470	121.90	105.60	100.10	97.50	94.70	92.50
7/8	.8750	45328	45428	45528	92.60	2	6	2 5/8	10	0.8471-0.8780	126.50	109.55	103.90	101.15	98.30	95.95
29/32	.9062	45329	45429	45529	108.80	2	6	2 5/8	10	0.8781-0.9090	142.70	125.75	120.00	117.35	114.40	112.15
15/16	.9375	45330	45430	45530	108.80	3	8	2 5/8	10	0.9091-0.9410	142.70	125.75	120.00	117.35	114.40	112.15
31/32	.9688	45331	45431	45531	113.20	3	8	2 5/8	10	0.9411-0.9720	147.05	130.05	124.35	121.70	118.80	116.50
1	1.0000	45332	45432	45532	113.20	3	8	2 3/4	10 1/2	0.9721-1.0030	147.05	130.05	124.35	121.70	118.80	116.50
1 1/16	1.0625	45334	45434	45534	144.30	3	8	2 3/4	10 1/2	1.0031-1.0660	176.75	160.55	155.10	152.45	149.70	147.45
1 1/8	1.1250	45336	45436	45536	153.30	3	8	2 7/8	11	1.0661-1.1280	185.85	169.60	164.10	161.55	158.70	156.55
1 3/16	1.1875	45338	45438	45538	167.65	3	8	2 7/8	11	1.1281-1.1905	200.15	183.80	178.40	175.75	173.05	170.85
1 1/4	1.2500	45340	45440	45540	181.90	4	8	3	11 1/2	1.1906-1.2530	214.35	198.10	192.70	190.05	187.25	185.10
1 5/16	1.3125	45342	45442	45542	192.20	4	8	3	11 1/2	1.2531-1.3155	224.65	208.40	202.90	200.40	197.55	195.35
1 3/8	1.3750	45344	45444	45544	203.30	4	8	3 1/4	12	1.3156-1.3780	235.70	219.50	214.05	211.45	208.65	206.45
1 7/16	1.4375	45346	45446	45546	214.00	4	8	3 1/4	12	1.3781-1.4405	246.50	230.20	224.75	222.20	219.35	217.15
1 1/2	1.5000	45348	45448	45548	225.55	4	8	3 1/2	12 1/2	1.4406-1.5030	258.05	241.75	236.30	233.75	230.95	228.75

*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 464, 466, 468 FRACTIONAL



EXPANSION REAMERS STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	464
40	NON-FERROUS - SHORT CHIPS	464/466	
60	CAST IRONS	466	
80	LOW STRENGTH STEELS	468/466	
100	MEDIUM STRENGTH STEELS	468	
120	HIGH STRENGTH STEELS	468	
140	HIGH TEMPERATURE ALLOYS	468	

NATIONAL AEROSPACE STANDARDS - NAS 897

- TYPE 464 - FOR NON-FERROUS MATERIALS
- TYPE 466 - FOR CAST IRONS & NAS MULTI-PURPOSE
- TYPE 468 - FOR STEELS & HIGH TEMP ALLOYS

- Type "C" with flute long carbide
- Straight polished flutes and straight shank
- Expansion screw permits expansion of tool diameter for regrinding after wear without reinserting carbide
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications, including minimum expansion, on page 29

MODIFICATIONS (See list on page 84, except expansion reamers can not be coated)

USE:

- Expansion reamers are recommended for reaming abrasive materials. As the diameter wears down, the reamers can be expanded many times by tightening the end expansion screw and regrinding to its original size. Expansion reamers should not be considered as adjustable for use in producing holes of different sizes.

TOOL DIAMETER		TYPE 464 NON-FERROUS EDP NO.	TYPE 466 NAS/ CAST IRON EDP NO.	TYPE 468 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLUTE & CARBIDE	OVER-ALL									
								1	2	3	4	5-7	8-14*			
5/16	.3125	46410	46610	46810	\$70.35	.2792	4	1	6	0.2841-0.3150	\$100.85	\$85.60	\$80.50	\$78.00	\$75.40	\$73.35
1/32	.3438	46411	46611	46811	70.35	.2792	4	1	6	0.3151-0.3470	100.85	85.60	80.50	78.00	75.40	73.35
3/8	.3750	46412	46612	46812	66.45	.3105	4	1	7	0.3471-0.3780	94.95	80.70	75.90	73.60	71.20	69.25
13/32	.4062	46413	46613	46813	70.00	.3105	4	1	7	0.3781-0.4090	98.55	84.25	79.50	77.20	74.75	72.75
7/16	.4375	46414	46614	46814	70.00	.3730	6	1	7	0.4091-0.4410	98.55	84.25	79.50	77.20	74.75	72.75
15/32	.4688	46415	46615	46815	74.15	.3730	6	1	7	0.4411-0.4720	102.75	88.40	83.65	81.40	78.90	76.95
1/2	.5000	46416	46616	46816	74.15	.4355	6	1	8	0.4721-0.5030	102.75	88.40	83.65	81.40	78.90	76.95
17/32	.5312	46417	46617	46817	76.05	.4355	6	1	8	0.5031-0.5340	104.70	90.30	85.50	83.25	80.80	78.90
9/16	.5625	46418	46618	46818	76.05	.4355	6	1 1/8	8	0.5341-0.5660	104.70	90.30	85.50	83.25	80.80	78.90
19/32	.5938	46419	46619	46819	79.40	.4355	6	1 1/8	8	0.5661-0.5970	107.90	93.60	88.85	86.50	84.10	82.15
5/8	.6250	46420	46620	46820	79.40	.5615	6	1 1/4	9	0.5971-0.6280	107.90	93.60	88.85	86.50	84.10	82.15
21/32	.6562	46421	46621	46821	86.80	.5615	6	1 1/4	9	0.6281-0.6590	115.35	101.00	96.25	93.90	91.50	89.60
11/16	.6875	46422	46622	46822	86.80	.5615	6	1 1/4	9	0.6591-0.6910	115.35	101.00	96.25	93.90	91.50	89.60
23/32	.7188	46423	46623	46823	90.05	.5615	6	1 1/4	9	0.6911-0.7220	118.65	104.25	99.50	97.25	94.75	92.80
3/4	.7500	46424	46624	46824	90.05	.6245	6	1 3/8	9 1/2	0.7221-0.7530	118.65	104.25	99.50	97.25	94.75	92.80
25/32	.7812	46425	46625	46825	97.05	.6245	6	1 3/8	9 1/2	0.7531-0.7840	125.65	111.30	106.50	104.20	101.80	99.85
13/16	.8125	46426	46626	46826	97.05	.6245	6	1 3/8	9 1/2	0.7841-0.8160	125.65	111.30	106.50	104.20	101.80	99.85
27/32	.8438	46427	46627	46827	100.85	.6245	6	1 3/8	9 1/2	0.8161-0.8470	129.45	115.10	110.30	108.00	105.60	103.70
7/8	.8750	46428	46628	46828	104.65	.7495	6	1 1/2	10	0.8471-0.8780	134.35	119.45	114.45	112.10	109.55	107.55
29/32	.9062	46429	46629	46829	111.40	.7495	6	1 1/2	10	0.8781-0.9090	141.00	126.20	121.20	118.85	116.30	114.30
15/16	.9375	46430	46630	46830	111.40	.7495	8	1 1/2	10	0.9091-0.9410	141.00	126.20	121.20	118.85	116.30	114.30
31/32	.9688	46431	46631	46831	115.65	.7495	8	1 1/2	10	0.9411-0.9720	145.35	130.50	125.55	123.15	120.60	118.60
1	1.0000	46432	46632	46832	115.65	.8745	8	1 5/8	10 1/2	0.9721-1.0030	145.35	130.50	125.55	123.15	120.60	118.60
1 1/32	1.0312	46433	46633	46833	126.85	.8745	8	1 5/8	10 1/2	-	-	-	-	-	-	-
1 1/16	1.0625	46434	46634	46834	126.85	.8745	8	1 5/8	10 1/2	1.0031-1.0660	156.45	141.60	136.65	134.30	131.70	129.75
1 3/32	1.0938	46435	46635	46835	126.85	.8745	8	1 3/4	11	-	-	-	-	-	-	-
1 1/8	1.1250	46436	46636	46836	126.85	.8745	8	1 3/4	11	1.0661-1.1280	156.45	141.60	136.65	134.30	131.70	129.75
1 3/16	1.1875	46438	46638	46838	138.45	.9995	8	1 3/4	11	1.1281-1.1905	168.10	153.20	148.25	145.90	143.30	141.40
1 1/4	1.2500	46440	46640	46840	138.45	.9995	8	1 7/8	11 1/2	1.1906-1.2530	168.10	153.20	148.25	145.90	143.30	141.40
1 5/16	1.3125	46442	46642	46842	152.90	.9995	8	1 7/8	11 1/2	1.2531-1.3155	182.50	167.65	162.70	160.35	157.75	155.75
1 3/8	1.3750	46444	46644	46844	160.65	.9995	8	2	12	1.3156-1.3780	190.35	175.50	170.50	168.15	165.65	163.60
1 7/16	1.4375	46446	46646	46846	189.30	.9995	8	2	12	1.3781-1.4405	220.95	205.10	199.80	197.30	194.55	192.40
1 1/2	1.5000	46448	46648	46848	194.65	1.2495	8	2 1/8	12 1/2	1.4406-1.5030	226.35	210.40	205.15	202.65	199.90	197.80
1 9/16	1.5625	46450	46650	46850	255.75	1.2495	8	2 1/8	12 1/2	1.5031-1.5660	287.40	271.55	266.25	263.70	261.00	258.80
1 5/8	1.6250	46452	46652	46852	255.75	1.2495	8	2 1/4	13	1.5661-1.6280	287.40	271.55	266.25	263.70	261.00	258.80
1 11/16	1.6875	46454	46654	46854	283.20	1.2495	8	2 1/4	13	1.6281-1.6910	314.85	299.05	293.75	291.15	288.45	286.35
1 3/4	1.7500	46456	46656	46856	283.20	1.2495	10	2 3/8	13 1/2	1.6911-1.7530	314.85	299.05	293.75	291.15	288.45	286.35
1 13/16	1.8125	46458	46658	46858	335.35	1.4995	10	2 3/8	13 1/2	1.7531-1.8160	367.00	351.10	345.85	343.35	340.60	338.45
1 7/8	1.8750	46460	46660	46860	335.35	1.4995	10	2 1/2	14	1.8161-1.8780	367.00	351.10	345.85	343.35	340.60	338.45
1 15/16	1.9375	46462	46662	46862	366.45	1.4995	10	2 1/2	14	1.8781-1.9410	398.00	382.20	376.90	374.40	371.70	369.55
2	2.0000	46464	46664	46864	366.45	1.4995	12	2 1/2	14	1.9411-2.0030	398.00	382.20	376.90	374.40	371.70	369.55

*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS

CARBIDE TIPPED TYPES 461, 462, 463 FRACTIONAL

MATERIAL SPECIFIC

EXPANSION REAMERS STRAIGHT FLUTE LONG CARBIDE TAPER SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	461
40	NON-FERROUS - SHORT CHIPS	461/462	
60	CAST IRONS	462	
80	LOW STRENGTH STEELS	463/462	
100	MEDIUM STRENGTH STEELS	463	
120	HIGH STRENGTH STEELS	463	
140	HIGH TEMPERATURE ALLOYS	463	

NATIONAL AEROSPACE STANDARDS - NAS 897 TYPE 461 - FOR NON-FERROUS MATERIALS TYPE 462 - FOR CAST IRONS & NAS MULTI-PURPOSE TYPE 463 - FOR STEELS & HIGH TEMP ALLOYS

- Type "C" with flute long carbide
- Straight polished flutes and taper shank
- Expansion screw permits expansion of tool diameter for regrinding after wear without reinserting carbide
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications, including minimum expansion, on page 29

MODIFICATIONS (See list on page 84, except expansion reamers can not be coated)

USE:

- Expansion reamers are recommended for reaming abrasive materials. As the diameter wears down, the reamers can be expanded many times by tightening the end expansion screw and regrinding to its original size. Expansion reamers should not be considered as adjustable for use in producing holes of different sizes.

REAMERS

TOOL DIAMETER		TYPE 461 NON-FERROUS EDP NO.	TYPE 462 NAS/CAST IRON EDP NO.	TYPE 463 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					TAPER SHANK NO.	NO. OF FLUTES	FLUTE & CARBIDE	OVER-ALL	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
											1	2	3	4	5-7	8-14*
3/8	.3750	46112	46212	46312	\$74.35	1	4	1	7	0.3471-0.3780	\$102.90	\$88.60	\$83.80	\$81.55	\$79.05	\$77.10
13/32	.4062	46113	46213	46313	75.45	1	4	1	7	0.3781-0.4090	104.00	89.70	84.95	82.65	80.15	78.20
7/16	.4375	46114	46214	46314	76.60	1	6	1	7	0.4091-0.4410	105.10	90.80	86.05	83.75	81.30	79.40
15/32	.4688	46115	46215	46315	79.85	1	6	1	7	0.4411-0.4720	108.45	94.20	89.30	87.05	84.60	82.70
1/2	.5000	46116	46216	46316	80.40	1	6	1	8	0.4721-0.5030	108.90	94.60	89.85	87.50	85.10	83.15
17/32	.5312	46117	46217	46317	82.85	1	6	1	8	0.5031-0.5340	111.40	97.10	92.35	90.05	87.55	85.65
9/16	.5625	46118	46218	46318	82.85	1	6	1 1/8	8	0.5341-0.5660	111.40	97.10	92.35	90.05	87.55	85.65
19/32	.5938	46119	46219	46319	86.00	1	6	1 1/8	8	0.5661-0.5970	114.50	100.20	95.45	93.15	90.70	88.80
5/8	.6250	46120	46220	46320	86.20	2	6	1 1/4	9	0.5971-0.6280	114.75	100.45	95.65	93.40	90.95	89.00
21/32	.6562	46121	46221	46321	93.60	2	6	1 1/4	9	0.6281-0.6590	122.20	107.85	103.05	100.80	98.35	96.40
11/16	.6875	46122	46222	46322	93.85	2	6	1 1/4	9	0.6591-0.6910	122.50	108.20	103.30	101.05	98.60	96.70
23/32	.7188	46123	46223	46323	97.30	2	6	1 1/4	9	0.6911-0.7220	125.90	111.50	106.75	104.50	102.00	100.10
3/4	.7500	46124	46224	46324	97.30	2	6	1 3/8	9 1/2	0.7221-0.7530	125.90	111.50	106.75	104.50	102.00	100.10
25/32	.7812	46125	46225	46325	104.40	2	6	1 3/8	9 1/2	0.7531-0.7840	133.00	118.70	113.85	111.60	109.15	107.25
13/16	.8125	46126	46226	46326	104.40	2	6	1 3/8	9 1/2	0.7841-0.8160	133.00	118.70	113.85	111.60	109.15	107.25
27/32	.8438	46127	46227	46327	108.75	2	6	1 3/8	9 1/2	0.8161-0.8470	137.35	123.00	118.20	115.90	113.45	111.50
7/8	.8750	46128	46228	46328	112.80	2	6	1 1/2	10	0.8471-0.8780	142.55	127.65	122.65	120.30	117.75	115.70
29/32	.9062	46129	46229	46329	118.85	2	6	1 1/2	10	0.8781-0.9090	148.45	133.60	128.70	126.30	123.75	121.75
15/16	.9375	46130	46230	46330	119.45	3	8	1 1/2	10	0.9091-0.9410	149.10	134.30	129.30	126.95	124.35	122.40
31/32	.9688	46131	46231	46331	123.70	3	8	1 1/2	10	0.9411-0.9720	153.30	138.50	133.50	131.15	128.60	126.60
1	1.0000	46132	46232	46332	123.70	3	8	1 5/8	10 1/2	0.9721-1.0030	153.30	138.50	133.50	131.15	128.60	126.60
1 1/32	1.0312	46133	46233	46333	131.55	3	8	1 5/8	10 1/2	-	-	-	-	-	-	
1 1/16	1.0625	46134	46234	46334	131.55	3	8	1 5/8	10 1/2	1.0031-1.0660	161.25	146.35	141.45	139.05	136.50	134.50
1 3/32	1.0938	46135	46235	46335	135.45	3	8	1 3/4	11	-	-	-	-	-	-	
1 1/8	1.1250	46136	46236	46336	135.45	3	8	1 3/4	11	1.0661-1.1280	165.05	150.20	145.20	142.85	140.35	138.30
1 3/16	1.1875	46138	46238	46338	144.50	3	8	1 3/4	11	1.1281-1.1905	174.20	159.30	154.30	151.95	149.40	147.40
1 1/4	1.2500	46140	46240	46340	154.30	4	8	1 7/8	11 1/2	1.1906-1.2530	184.00	169.10	164.10	161.75	159.25	157.25
1 5/16	1.3125	46142	46242	46342	160.10	4	8	1 7/8	11 1/2	1.2531-1.3155	189.80	174.95	169.95	167.60	165.05	163.00
1 3/8	1.3750	46144	46244	46344	177.55	4	8	2	12	1.3156-1.3780	207.25	192.40	187.50	185.10	182.50	180.55
1 7/16	1.4375	46146	46246	46346	196.80	4	8	2	12	1.3781-1.4405	228.50	212.55	207.30	204.80	202.05	199.90
1 1/2	1.5000	46148	46248	46348	202.75	4	8	2 1/2	12 1/2	1.4406-1.5030	234.40	218.50	213.25	210.75	208.00	205.90
1 5/8	1.5625	46150	46250	46350	284.10	4	8	2 1/2	12 1/2	1.5031-1.5660	315.75	299.85	294.50	292.05	289.35	287.20
1 3/4	1.6250	46152	46252	46352	284.10	4	8	2 1/4	13	1.5661-1.6280	315.75	299.85	294.50	292.05	289.35	287.20
1 11/16	1.6875	46154	46254	46354	314.75	4	8	2 1/4	13	1.6281-1.6910	346.40	330.50	325.20	322.70	320.00	317.85
1 3/4	1.7500	46156	46256	46356	314.75	4	10	2 3/8	13 1/2	1.6911-1.7530	346.40	330.50	325.20	322.70	320.00	317.85
1 13/16	1.8125	46158	46258	46358	372.65	4	10	2 3/8	13 1/2	1.7531-1.8160	404.30	388.50	383.15	380.60	377.90	375.80
1 7/8	1.8750	46160	46260	46360	372.65	4	10	2 1/2	14	1.8161-1.8780	404.30	388.50	383.15	380.60	377.90	375.80
1 15/16	1.9375	46162	46262	46362	407.00	4	10	2 1/2	14	1.8781-1.9410	438.60	422.75	417.45	414.95	412.25	410.10
2	2.0000	46164	46264	46364	407.00	4	12	2 1/2	14	1.9411-2.0030	438.60	422.75	417.45	414.95	412.25	410.10

*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 432, 436, 438 FRACTIONAL



**RIGHT SPIRAL FLUTES
STRAIGHT SHANK**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	432
	40	NON-FERROUS - SHORT CHIPS	432/436
	60	CAST IRONS	436
	80	LOW STRENGTH STEELS	438/436
	100	MEDIUM STRENGTH STEELS	438
	120	HIGH STRENGTH STEELS	438
140	HIGH TEMPERATURE ALLOYS	438	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:
See page 85

NATIONAL AEROSPACE STANDARDS - NAS 897
TYPE 432 - FOR NON-FERROUS MATERIALS
TYPE 436 - FOR CAST IRONS & NAS MULTI-PURPOSE
TYPE 438 - FOR STEELS & HIGH TEMP ALLOYS

- Type "C" with short carbide tip
- Right spiral polished flutes and straight shank
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

NOTE: For smaller tool diameters, see solid carbide reamers on pages 104-111.

For shallow holes only (see page 27)

TOOL DIAMETER		TYPE 432 NON-FERROUS EDP NO.	TYPE 436 NAS/ CAST IRON EDP NO.	TYPE 438 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					MAX SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLT	CAR-BIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/16	.1875	43206	43606	43806	\$48.25	.1805	4	1 1/8	1/2	4 1/2	0.1770-0.2040	\$76.85	\$62.55	\$57.70	\$55.45	\$52.95	\$51.10
7/32	.2188	43207	43607	43807	48.25	.2075	4	1 1/4	1/2	5	0.2041-0.2210	76.85	62.55	57.70	55.45	52.95	51.10
15/64	.2344	4322344	4362344	4382344	48.25	.2265	4	1 1/2	1/2	6	0.2211-0.2380	76.85	62.55	57.70	55.45	52.95	51.10
1/4	.2500	43208	43608	43808	48.25	.2405	4	1 1/2	1/2	6	0.2381-0.2530	76.85	62.55	57.70	55.45	52.95	51.10
9/32	.2812	43209	43609	43809	48.35	.2485	4	1 1/2	1/2	6	0.2531-0.2840	76.95	62.70	57.85	55.60	53.10	51.20
5/16	.3125	43210	43610	43810	48.35	.2792	4	1 1/2	1/2	6	0.2841-0.3150	76.95	62.70	57.85	55.60	53.10	51.20
11/32	.3438	43211	43611	43811	53.30	.2792	4	1 1/2	5/8	6	0.3151-0.3470	81.85	67.55	62.80	60.50	58.05	56.05
3/8	.3750	43212	43612	43812	53.75	.3105	4	1 3/4	5/8	7	0.3471-0.3780	82.30	68.00	63.20	60.95	58.50	56.55
13/32	.4062	43213	43613	43813	56.20	.3105	4	1 3/4	5/8	7	0.3781-0.4090	84.70	70.40	65.60	63.30	60.90	58.95
7/16	.4375	43214	43614	43814	58.35	.3730	6	1 3/4	5/8	7	0.4091-0.4410	86.90	72.55	67.80	65.50	63.05	61.10
15/32	.4688	43215	43615	43815	62.05	.3730	6	1 3/4	5/8	7	0.4411-0.4720	90.65	76.30	71.50	69.25	66.80	64.90
1/2	.5000	43216	43616	43816	66.85	.4355	6	2	5/8	8	0.4721-0.5030	97.30	82.00	76.90	74.45	71.80	69.75
17/32	.5312	43217	43617	43817	68.80	.4355	6	2	5/8	8	0.5031-0.5340	99.30	84.05	78.90	76.45	73.85	71.75
9/16	.5625	43218	43618	43818	68.80	.4355	6	2	5/8	8	0.5341-0.5660	99.30	84.05	78.90	76.45	73.85	71.75
19/32	.5938	43219	43619	43819	71.00	.4355	6	2	5/8	8	0.5661-0.5970	101.40	86.15	81.00	78.60	75.95	73.90
5/8	.6250	43220	43620	43820	71.00	.5615	6	2 1/4	5/8	9	0.5971-0.6280	101.40	86.15	81.00	78.60	75.95	73.90
21/32	.6562	43221	43621	43821	73.10	.5615	6	2 1/4	5/8	9	0.6281-0.6590	103.55	88.25	83.15	80.70	78.05	76.00
11/16	.6875	43222	43622	43822	77.70	.5615	6	2 1/4	5/8	9	0.6591-0.6910	108.15	92.85	87.80	85.30	82.70	80.65
23/32	.7188	43223	43623	43823	78.85	.5615	6	2 1/4	5/8	9	0.6911-0.7220	109.30	94.05	88.95	86.50	83.90	81.85
3/4	.7500	43224	43624	43824	79.95	.6245	6	2 1/2	3/4	9 1/2	0.7221-0.7530	110.45	95.20	90.05	87.70	85.05	82.95
25/32	.7812	43225	43625	43825	82.15	.6245	6	2 1/2	3/4	9 1/2	0.7531-0.7840	112.60	97.35	92.25	89.85	87.20	85.15
13/16	.8125	43226	43626	43826	82.15	.6245	6	2 1/2	3/4	9 1/2	0.7841-0.8160	112.60	97.35	92.25	89.85	87.20	85.15
27/32	.8438	43227	43627	43827	86.50	.6245	6	2 1/2	3/4	9 1/2	0.8161-0.8470	116.95	101.75	96.60	94.20	91.55	89.45
7/8	.8750	43228	43628	43828	89.80	.7495	6	2 5/8	3/4	10	0.8471-0.8780	121.40	105.60	100.30	97.70	95.00	92.85
29/32	.9062	43229	43629	43829	104.60	.7495	6	2 5/8	3/4	10	0.8781-0.9090	136.25	120.35	115.05	112.55	109.85	107.75
15/16	.9375	43230	43630	43830	104.60	.7495	8	2 5/8	3/4	10	0.9091-0.9410	136.25	120.35	115.05	112.55	109.85	107.75
31/32	.9688	43231	43631	43831	109.70	.7495	8	2 5/8	3/4	10	0.9411-0.9720	141.35	125.50	120.15	117.65	114.90	112.75
1	1.0000	43232	43632	43832	109.70	.8745	8	2 3/4	3/4	10 1/2	0.9721-1.0030	141.35	125.50	120.15	117.65	114.90	112.75
1 1/16	1.0625	43234	43634	43834	117.70	.8745	8	2 3/4	3/4	10 1/2	1.0031-1.0660	149.35	133.50	128.20	125.70	122.95	120.80
1 1/8	1.1250	43236	43636	43836	121.35	.8745	8	2 7/8	7/8	11	1.0661-1.1280	153.00	137.10	131.85	129.30	126.60	124.40
1 3/16	1.1875	43238	43638	43838	127.50	.9995	8	2 7/8	7/8	11	1.1281-1.1905	159.10	143.25	137.95	135.45	132.70	130.55
1 1/4	1.2500	43240	43640	43840	135.00	.9995	8	3	7/8	11 1/2	1.1906-1.2530	166.65	150.80	145.50	142.90	140.25	138.10
1 5/16	1.3125	43242	43642	43842	149.35	.9995	8	3	7/8	11 1/2	1.2531-1.3155	180.95	165.10	159.85	157.30	154.60	152.45
1 3/8	1.3750	43244	43644	43844	163.55	.9995	8	3 1/4	7/8	12	1.3156-1.3780	195.20	179.40	174.05	171.50	168.80	166.70
1 7/16	1.4375	43246	43646	43846	173.35	.9995	8	3 1/4	7/8	12	1.3781-1.4405	204.95	189.10	183.80	181.30	178.55	176.40
1 1/2	1.5000	43248	43648	43848	183.10	1.2495	8	3 1/2	7/8	12 1/2	1.4406-1.5030	214.70	198.85	193.55	191.05	188.30	186.15

*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS

CARBIDE TIPPED TYPES 442, 443, 444 FRACTIONAL



**RIGHT SPIRAL FLUTES
FLUTE LONG CARBIDE
STRAIGHT SHANK**



NATIONAL AEROSPACE STANDARDS - NAS 897
TYPE 442 - FOR NON-FERROUS MATERIALS
TYPE 443 - FOR CAST IRONS & NAS MULTI-PURPOSE
TYPE 444 - FOR STEELS & HIGH TEMP ALLOYS

- Type "C" with flute long carbide
- Right spiral polished flutes and straight shank
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	442
40	NON-FERROUS - SHORT CHIPS	442/443	
60	CAST IRONS	443	
80	LOW STRENGTH STEELS	444/443	
100	MEDIUM STRENGTH STEELS	444	
120	HIGH STRENGTH STEELS	444	
140	HIGH TEMPERATURE ALLOYS	444	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

NOTE: For step reamers, see page 99. For smaller tool diameters, see solid carbide reamers on pages 104 & 111.

TOOL DIAMETER		TYPE 442 NON-FERROUS EDP NO.	TYPE 443 NAS/ CAST IRON EDP NO.	TYPE 444 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH FLUTE & CARBIDE	OVER-ALL	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						1						2	3	4	5-7	8-14*
5/16	.3125	44210	44310	44410	\$58.05	.2792	4	1 1/2	6	0.2841 - 0.3150	\$86.55	\$72.30	\$67.50	\$65.20	\$62.80	\$60.85
1/32	.3438	44211	44311	44411	63.95	.2792	4	1 1/2	6	0.3151 - 0.3470	92.50	78.15	73.40	71.15	68.65	66.75
3/8	.3750	44212	44312	44412	64.50	.3105	4	1 3/4	7	0.3471 - 0.3780	93.10	78.75	73.95	71.65	69.25	67.35
13/32	.4062	44213	44313	44413	67.40	.3105	4	1 3/4	7	0.3781 - 0.4090	95.90	81.65	76.85	74.55	72.15	70.20
7/16	.4375	44214	44314	44414	70.00	.3730	6	1 3/4	7	0.4091 - 0.4410	98.55	84.25	79.50	77.20	74.75	72.75
15/32	.4688	44215	44315	44415	74.45	.3730	6	1 3/4	7	0.4411 - 0.4720	103.00	88.70	83.90	81.65	79.15	77.25
1/2	.5000	44216	44316	44416	80.30	.4355	6	2	8	0.4721 - 0.5030	110.70	95.50	90.35	87.95	85.30	83.25
17/32	.5312	44217	44317	44417	82.60	.4355	6	2	8	0.5031 - 0.5340	113.10	97.75	92.65	90.25	87.70	85.60
9/16	.5625	44218	44318	44418	82.60	.4355	6	2	8	0.5341 - 0.5660	113.10	97.75	92.65	90.25	87.70	85.60
19/32	.5938	44219	44319	44419	85.05	.4355	6	2	8	0.5661 - 0.5970	115.50	100.20	95.15	92.65	90.05	88.00
5/8	.6250	44220	44320	44420	85.05	.5615	6	2 1/4	9	0.5971 - 0.6280	115.50	100.20	95.15	92.65	90.05	88.00
21/32	.6562	44221	44321	44421	87.75	.5615	6	2 1/4	9	0.6281 - 0.6590	118.20	102.90	97.75	95.40	92.75	90.70
11/16	.6875	44222	44322	44422	93.10	.5615	6	2 1/4	9	0.6591 - 0.6910	123.60	108.35	103.20	100.80	98.20	96.15
23/32	.7188	44223	44323	44423	94.55	.5615	6	2 1/4	9	0.6911 - 0.7220	125.05	109.70	104.65	102.20	99.60	97.55
3/4	.7500	44224	44324	44424	95.95	.6245	6	2 1/2	9 1/2	0.7221 - 0.7530	126.40	111.20	106.05	103.70	101.05	99.00
25/32	.7812	44225	44325	44425	98.55	.6245	6	2 1/2	9 1/2	0.7531 - 0.7840	129.00	113.75	108.60	106.15	103.60	101.50
13/16	.8125	44226	44326	44426	98.55	.6245	6	2 1/2	9 1/2	0.7841 - 0.8160	129.00	113.75	108.60	106.15	103.60	101.50
27/32	.8438	44227	44327	44427	103.85	.6245	6	2 1/2	9 1/2	0.8161 - 0.8470	134.35	119.00	113.90	111.50	108.90	106.85
7/8	.8750	44228	44328	44428	107.80	.7495	6	2 5/8	10	0.8471 - 0.8780	139.40	123.55	118.25	115.70	113.05	110.90
29/32	.9062	44229	44329	44429	125.55	.7495	6	2 5/8	10	0.8781 - 0.9090	157.20	141.35	136.00	133.50	130.85	128.70
15/16	.9375	44230	44330	44430	125.55	.7495	8	2 5/8	10	0.9091 - 0.9410	157.20	141.35	136.00	133.50	130.85	128.70
31/32	.9688	44231	44331	44431	131.65	.7495	8	2 5/8	10	0.9411 - 0.9720	163.35	147.45	142.15	139.65	136.90	134.75
1	1.0000	44232	44332	44432	131.65	.8745	8	2 3/4	10 1/2	0.9721 - 1.0030	163.35	147.45	142.15	139.65	136.90	134.75
1 1/16	1.0625	44234	44334	44434	154.75	.8745	8	2 3/4	10 1/2	1.0031 - 1.0660	186.45	170.50	165.25	162.75	160.00	157.85
1 1/8	1.1250	44236	44336	44436	159.55	.8745	8	2 7/8	11	1.0661 - 1.1280	191.20	175.35	170.00	167.55	164.80	162.70
1 3/16	1.1875	44238	44338	44438	167.70	.9995	8	2 7/8	11	1.1281 - 1.1905	199.35	183.50	178.25	175.65	172.95	170.85
1 1/4	1.2500	44240	44340	44440	177.45	.9995	8	3	11 1/2	1.1906 - 1.2530	209.10	193.30	187.95	185.45	182.70	180.60
1 5/16	1.3125	44242	44342	44442	196.35	.9995	8	3	11 1/2	1.2531 - 1.3155	228.00	212.15	206.85	204.35	201.60	199.45
1 3/8	1.3750	44244	44344	44444	215.15	.9995	8	3 1/4	12	1.3156 - 1.3780	246.75	230.90	225.65	223.05	220.40	218.25
1 7/16	1.4375	44246	44346	44446	227.95	.9995	8	3 1/4	12	1.3781 - 1.4405	259.55	243.70	238.40	235.95	233.20	231.05
1 1/2	1.5000	44248	44348	44448	240.80	1.2495	8	3 1/2	12 1/2	1.4406 - 1.5030	272.40	256.55	251.25	248.80	246.00	243.90

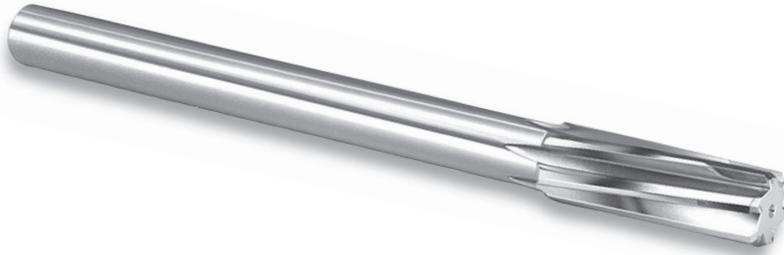
*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 433, 437, 439 FRACTIONAL



**LEFT SPIRAL FLUTES
STRAIGHT SHANK**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	433
40	NON-FERROUS - SHORT CHIPS	433/437	
60	CAST IRONS	437	
80	LOW STRENGTH STEELS	439/437	
100	MEDIUM STRENGTH STEELS	439	
120	HIGH STRENGTH STEELS	439	
140	HIGH TEMPERATURE ALLOYS	439	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:
See page 87

**NATIONAL AEROSPACE STANDARDS - NAS 897
TYPE 433 - FOR NON-FERROUS MATERIALS
TYPE 437 - FOR CAST IRONS & NAS MULTI-PURPOSE
TYPE 439 - FOR STEELS & HIGH TEMP ALLOYS**

- Type "C" with short carbide tip
- Left spiral polished flutes and straight shank
- Tool geometry and carbide grade appropriate for material being machined
- Left spiral flutes should not be used on blind holes
- Detailed specifications on page 29

NOTE: For smaller tool diameters, see solid carbide reamers on pages 104 & 111.

For shallow holes only (see page 27)

TOOL DIAMETER		TYPE 433 NON-FERROUS EDP NO.	TYPE 437 NAS/ CAST IRON EDP NO.	TYPE 439 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLT	CAR-BIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/16	.1875	43306	43706	43906	\$51.45	.1805	4	1 1/8	1/2	4 1/2	0.1770-0.2040	\$81.95	\$66.70	\$61.60	\$59.15	\$56.55	\$54.50
7/32	.2188	43307	43707	43907	51.45	.2075	4	1 1/4	1/2	5	0.2041-0.2210	81.95	66.70	61.60	59.15	56.55	54.50
15/64	.2344	4332344	4372344	4392344	51.45	.2265	4	1 1/2	1/2	6	0.2211-0.2380	81.95	66.70	61.60	59.15	56.55	54.50
1/4	.2500	43308	43708	43908	51.45	.2405	4	1 1/2	1/2	6	0.2381-0.2530	81.95	66.70	61.60	59.15	56.55	54.50
9/32	.2812	43309	43709	43909	51.60	.2485	4	1 1/2	1/2	6	0.2531-0.2840	82.10	66.85	61.75	59.25	56.65	54.60
5/16	.3125	43310	43710	43910	51.60	.2792	4	1 1/2	1/2	6	0.2841-0.3150	82.10	66.85	61.75	59.25	56.65	54.60
11/32	.3438	43311	43711	43911	56.80	.2792	4	1 1/2	5/8	6	0.3151-0.3470	87.30	72.10	66.95	64.50	61.90	59.85
3/8	.3750	43312	43712	43912	57.35	.3105	4	1 3/4	5/8	7	0.3471-0.3780	87.85	72.55	67.45	65.00	62.35	60.30
13/32	.4062	43313	43713	43913	59.90	.3105	4	1 3/4	5/8	7	0.3781-0.4090	90.35	75.15	70.00	67.55	64.95	62.90
7/16	.4375	43314	43714	43914	62.20	.3730	6	1 3/4	5/8	7	0.4091-0.4410	92.65	77.40	72.30	69.90	67.20	65.20
15/32	.4688	43315	43715	43915	66.15	.3730	6	1 3/4	5/8	7	0.4411-0.4720	96.65	81.45	76.30	73.85	71.25	69.20
1/2	.5000	43316	43716	43916	68.60	.4355	6	2	5/8	8	0.4721-0.5030	99.90	84.20	78.95	76.45	73.80	71.65
17/32	.5312	43317	43717	43917	70.65	.4355	6	2	5/8	8	0.5031-0.5340	101.95	86.25	81.00	78.55	75.85	73.70
9/16	.5625	43318	43718	43918	70.65	.4355	6	2	5/8	8	0.5341-0.5660	101.95	86.25	81.00	78.55	75.85	73.70
19/32	.5938	43319	43719	43919	72.85	.4355	6	2	5/8	8	0.5661-0.5970	104.10	88.40	83.20	80.70	78.00	75.90
5/8	.6250	43320	43720	43920	72.85	.5615	6	2 1/4	5/8	9	0.5971-0.6280	104.10	88.40	83.20	80.70	78.00	75.90
21/32	.6562	43321	43721	43921	75.00	.5615	6	2 1/4	5/8	9	0.6281-0.6590	106.30	90.60	85.35	82.85	80.15	78.05
11/16	.6875	43322	43722	43922	79.75	.5615	6	2 1/4	5/8	9	0.6591-0.6910	111.05	95.40	90.10	87.55	84.95	82.80
23/32	.7188	43323	43723	43923	80.95	.5615	6	2 1/4	5/8	9	0.6911-0.7220	112.25	96.55	91.30	88.85	86.15	84.05
3/4	.7500	43324	43724	43924	82.10	.6245	6	2 1/2	3/4	9 1/2	0.7221-0.7530	113.40	97.70	92.50	90.00	87.30	85.20
25/32	.7812	43325	43725	43925	84.35	.6245	6	2 1/2	3/4	9 1/2	0.7531-0.7840	115.65	99.95	94.70	92.20	89.55	87.40
13/16	.8125	43326	43726	43926	84.35	.6245	6	2 1/2	3/4	9 1/2	0.7841-0.8160	115.65	99.95	94.70	92.20	89.55	87.40
27/32	.8438	43327	43727	43927	88.85	.6245	6	2 1/2	3/4	9 1/2	0.8161-0.8470	120.15	104.50	99.15	96.70	94.00	91.90
7/8	.8750	43328	43728	43928	92.20	.7495	6	2 5/8	3/4	10	0.8471-0.8780	124.70	108.40	102.90	100.40	97.55	95.35
29/32	.9062	43329	43729	43929	107.40	.7495	6	2 5/8	3/4	10	0.8781-0.9090	139.85	123.60	118.20	115.55	112.75	110.55
15/16	.9375	43330	43730	43930	107.40	.7495	8	2 5/8	3/4	10	0.9091-0.9410	139.85	123.60	118.20	115.55	112.75	110.55
31/32	.9688	43331	43731	43931	112.60	.7495	8	2 5/8	3/4	10	0.9411-0.9720	145.10	128.85	123.45	120.80	118.00	115.85
1	1.0000	43332	43732	43932	112.60	.8745	8	2 3/4	3/4	10 1/2	0.9721-1.0030	145.10	128.85	123.45	120.80	118.00	115.85
1 1/16	1.0625	43334	43734	43934	120.85	.8745	8	2 3/4	3/4	10 1/2	1.0031-1.0660	153.30	137.10	131.60	129.00	126.25	124.05
1 1/8	1.1250	43336	43736	43936	124.60	.8745	8	2 7/8	7/8	11	1.0661-1.1280	157.10	140.80	135.35	132.75	130.00	127.80
1 3/16	1.1875	43338	43738	43938	130.95	.9995	8	2 7/8	7/8	11	1.1281-1.1905	163.40	147.10	141.65	139.05	136.30	134.10
1 1/4	1.2500	43340	43740	43940	138.60	.9995	8	3	7/8	11 1/2	1.1906-1.2530	171.05	154.80	149.35	146.80	143.95	141.75
1 5/16	1.3125	43342	43742	43942	153.30	.9995	8	3	7/8	11 1/2	1.2531-1.3155	185.85	169.60	164.10	161.55	158.70	156.55
1 3/8	1.3750	43344	43744	43944	167.95	.9995	8	3 1/4	7/8	12	1.3156-1.3780	200.45	184.15	178.70	176.15	173.35	171.15
1 7/16	1.4375	43346	43746	43946	178.00	.9995	8	3 1/4	7/8	12	1.3781-1.4405	210.40	194.20	188.75	186.10	183.35	181.20
1 1/2	1.5000	43348	43748	43948	188.05	1.2495	8	3 1/2	7/8	12 1/2	1.4406-1.5030	220.50	204.20	198.75	196.20	193.40	191.20

*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 482, 483, 484 FRACTIONAL



**LEFT SPIRAL FLUTES
FLUTE LONG CARBIDE
STRAIGHT SHANK**



**NATIONAL AEROSPACE STANDARDS - NAS 897
TYPE 482 - FOR NON-FERROUS MATERIALS
TYPE 483 - FOR CAST IRONS & NAS MULTI-PURPOSE
TYPE 484 - FOR STEELS & HIGH TEMP ALLOYS**

- Type "C" with flute long carbide
- Left spiral polished flutes and straight shank
- Tool geometry and carbide grade appropriate for material being machined
- Left spiral flutes should not be used on blind holes
- Detailed specifications on page 29

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	482
	40	NON-FERROUS - SHORT CHIPS	482/483
	60	CAST IRONS	483
	80	LOW STRENGTH STEELS	484/483
	100	MEDIUM STRENGTH STEELS	484
	120	HIGH STRENGTH STEELS	484
	140	HIGH TEMPERATURE ALLOYS	484

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

NOTE: For step reamers, see page 100. For smaller tool diameter, see solid carbide reamers on pages 104 & 111.

TOOL DIAMETER		TYPE 482 NON-FERROUS EDP NO.	TYPE 483 NAS/ CAST IRON EDP NO.	TYPE 484 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLUTE & CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
5/16	.3125	48210	48310	48410	\$61.90	.2792	4	1 1/2	6	0.2841-0.3150	\$92.40	\$77.05	\$72.05	\$69.55	\$66.95	\$64.90
1/32	.3438	48211	48311	48411	68.15	.2792	4	1 1/2	6	0.3151-0.3470	98.65	83.40	78.30	75.85	73.25	71.20
3/8	.3750	48212	48312	48412	68.80	.3105	4	1 3/4	7	0.3471-0.3780	99.30	84.05	78.90	76.45	73.85	71.75
13/32	.4062	48213	48313	48413	71.80	.3105	4	1 3/4	7	0.3781-0.4090	102.30	87.10	81.95	79.55	76.90	74.85
7/16	.4375	48214	48314	48414	74.70	.3730	6	1 3/4	7	0.4091-0.4410	105.10	89.90	84.75	82.35	79.70	77.70
15/32	.4688	48215	48315	48415	79.45	.3730	6	1 3/4	7	0.4411-0.4720	109.95	94.60	89.45	87.10	84.45	82.40
1/2	.5000	48216	48316	48416	82.40	.4355	6	2	8	0.4721-0.5030	113.75	98.05	92.80	90.30	87.55	85.45
17/32	.5312	48217	48317	48417	84.80	.4355	6	2	8	0.5031-0.5340	116.10	100.40	95.20	92.65	90.00	87.90
9/16	.5625	48218	48318	48418	84.80	.4355	6	2	8	0.5341-0.5660	116.10	100.40	95.20	92.65	90.00	87.90
19/32	.5938	48219	48319	48419	87.30	.4355	6	2	8	0.5661-0.5970	118.60	102.90	97.65	95.20	92.50	90.35
5/8	.6250	48220	48320	48420	87.30	.5615	6	2 1/4	9	0.5971-0.6280	118.60	102.90	97.65	95.20	92.50	90.35
21/32	.6562	48221	48321	48421	90.05	.5615	6	2 1/4	9	0.6281-0.6590	121.35	105.70	100.40	97.95	95.25	93.10
11/16	.6875	48222	48322	48422	95.60	.5615	6	2 1/4	9	0.6591-0.6910	126.90	111.25	105.95	103.55	100.80	98.65
23/32	.7188	48223	48323	48423	97.10	.5615	6	2 1/4	9	0.6911-0.7220	128.35	112.65	107.45	104.95	102.25	100.15
3/4	.7500	48224	48324	48424	98.55	.6245	6	2 1/2	9 1/2	0.7221-0.7530	129.85	114.20	108.90	106.40	103.75	101.65
25/32	.7812	48225	48325	48425	101.15	.6245	6	2 1/2	9 1/2	0.7531-0.7840	132.45	116.80	111.50	109.10	106.35	104.20
13/16	.8125	48226	48326	48426	101.15	.6245	6	2 1/2	9 1/2	0.7841-0.8160	132.45	116.80	111.50	109.10	106.35	104.20
27/32	.8438	48227	48327	48427	106.65	.6245	6	2 1/2	9 1/2	0.8161-0.8470	137.90	122.20	116.95	114.45	111.80	109.65
7/8	.8750	48228	48328	48428	110.65	.7495	6	2 5/8	10	0.8471-0.8780	143.10	126.85	121.40	118.80	116.00	113.80
29/32	.9062	48229	48329	48429	128.90	.7495	6	2 5/8	10	0.8781-0.9090	161.35	145.10	139.65	137.10	134.30	132.10
15/16	.9375	48230	48330	48430	128.90	.7495	8	2 5/8	10	0.9091-0.9410	161.35	145.10	139.65	137.10	134.30	132.10
31/32	.9688	48231	48331	48431	135.20	.7495	8	2 5/8	10	0.9411-0.9720	167.70	151.40	146.00	143.40	140.60	138.45
1	1.0000	48232	48332	48432	135.20	.8745	8	2 3/4	10 1/2	0.9721-1.0030	167.70	151.40	146.00	143.40	140.60	138.45
1 1/16	1.0625	48234	48334	48434	158.90	.8745	8	2 3/4	10 1/2	1.0031-1.0660	191.35	175.15	169.70	167.05	164.30	162.10
1 1/8	1.1250	48236	48336	48436	163.85	.8745	8	2 7/8	11	1.0661-1.1280	196.30	180.10	174.55	172.00	169.20	167.00
1 3/16	1.1875	48238	48338	48438	172.20	.9995	8	2 7/8	11	1.1281-1.1905	204.65	188.40	182.95	180.35	177.55	175.40
1 1/4	1.2500	48240	48340	48440	182.30	.9995	8	3	11 1/2	1.1906-1.2530	214.70	198.45	193.00	190.40	187.65	185.45
1 5/16	1.3125	48242	48342	48442	201.60	.9995	8	3	11 1/2	1.2531-1.3155	234.10	217.80	212.40	209.80	207.05	204.85
1 3/8	1.3750	48244	48344	48444	220.90	.9995	8	3 1/4	12	1.3156-1.3780	253.35	237.15	231.65	229.05	226.30	224.05
1 7/16	1.4375	48246	48346	48446	234.05	.9995	8	3 1/4	12	1.3781-1.4405	266.50	250.20	244.80	242.20	239.45	237.25
1 1/2	1.5000	48248	48348	48448	247.20	1.2495	8	3 1/2	12 1/2	1.4406-1.5030	279.70	263.45	258.05	255.40	252.65	250.50

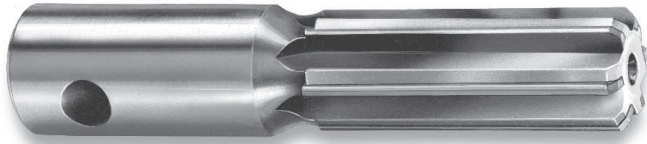
*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 470, 471, 475 FRACTIONAL



CNC STUB STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	470
	40	NON-FERROUS - SHORT CHIPS	470/471
	60	CAST IRONS	471
	80	LOW STRENGTH STEELS	475/471
	100	MEDIUM STRENGTH STEELS	475
	120	HIGH STRENGTH STEELS	475
	140	HIGH TEMPERATURE ALLOYS	475

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Reduced shank diameter
- Flat(s) on shank
- Coatings available:
See page 87

TYPE 470 - FOR NON-FERROUS MATERIALS
TYPE 471 - FOR CAST IRONS & NAS MULTI-PURPOSE
TYPE 475 - FOR STEELS & HIGH TEMP ALLOYS

- Straight polished flutes
- Flute long carbide on .2841" tool diameter and larger
- Straight shank fits into standard holders
- Pin cross hole permits use in pin drive floating holders
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

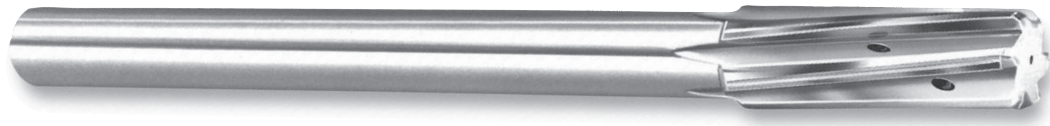
TOOL DIAMETER		TYPE 470 NON-FERROUS EDP NO.	TYPE 471 NAS/ CAST IRON EDP NO.	TYPE 475 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICES	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
FRACTIONAL	DECIMAL					SHANK DIAM.	NO. OF FLTS	LENGTH			PIN HOLE DIAM.	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
		FLT	CAR- BIDE	OVER- ALL	1			2	3	4			5-7	8-14*				
3/16	.1875	47006	47106	47506	\$49.75	1/4	4	1	1/2	2 1/4	3/32	0.1770-0.2040	\$80.15	\$64.95	\$59.85	\$57.45	\$54.75	\$52.75
7/32	.2188	47007	47107	47507	49.75	1/4	4	1	1/2	2 1/4	3/32	0.2041-0.2210	80.15	64.95	59.85	57.45	54.75	52.75
15/64	.2344	4702344	4712344	4752344	49.75	1/4	4	1	1/2	2 1/4	3/32	0.2211-0.2380	80.15	64.95	59.85	57.45	54.75	52.75
1/4	.2500	47008	47108	47508	49.75	1/4	4	1	1/2	2 1/4	3/32	0.2381-0.2530	80.15	64.95	59.85	57.45	54.75	52.75
9/32	.2812	47009	47109	47509	49.75	3/8	4	1	1/2	2 1/4	1/8	0.2531-0.2840	80.15	64.95	59.85	57.45	54.75	52.75
5/16	.3125	47010	47110	47510	57.80	3/8	4	1	1	2 1/4	1/8	0.2841-0.3150	88.30	73.10	67.95	65.50	62.90	60.85
11/32	.3438	47011	47111	47511	58.35	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3151-0.3470	88.85	73.55	68.45	66.00	63.35	61.30
3/8	.3750	47012	47112	47512	63.25	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3471-0.3780	93.70	78.50	73.35	71.00	68.35	66.25
13/32	.4062	47013	47113	47513	64.20	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.3781-0.4090	94.65	79.45	74.30	71.80	69.25	67.15
7/16	.4375	47014	47114	47514	75.95	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4091-0.4410	106.45	91.20	86.10	83.65	81.00	78.95
15/32	.4688	47015	47115	47515	75.95	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4411-0.4720	106.45	91.20	86.10	83.65	81.00	78.95
1/2	.5000	47016	47116	47516	86.80	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4721-0.5030	119.45	103.05	97.55	94.90	92.15	89.95
17/32	.5312	47017	47117	47517	86.80	5/8	6	1 1/2	1 1/2	3	1/4	0.5031-0.5340	119.45	103.05	97.55	94.90	92.15	89.95
9/16	.5625	47018	47118	47518	91.45	5/8	6	1 1/2	1 1/2	3	1/4	0.5341-0.5660	124.10	107.75	102.20	99.60	96.80	94.60
19/32	.5938	47019	47119	47519	91.45	5/8	6	1 1/2	1 1/2	3	1/4	0.5661-0.5970	124.10	107.75	102.20	99.60	96.80	94.60
5/8	.6250	47020	47120	47520	93.85	5/8	6	1 1/2	1 1/2	3	1/4	0.5971-0.6280	126.50	110.20	104.75	102.10	99.30	97.10
21/32	.6562	47021	47121	47521	93.85	5/8	6	1 1/2	1 1/2	3	1/4	0.6281-0.6590	126.50	110.20	104.75	102.10	99.30	97.10
11/16	.6875	47022	47122	47522	98.30	5/8	6	1 1/2	1 1/2	3	1/4	0.6591-0.6910	130.95	114.60	109.15	106.50	103.75	101.50
23/32	.7188	47023	47123	47523	98.30	3/4	6	1 1/2	1 1/2	3	5/16	0.6911-0.7220	130.95	114.60	109.15	106.50	103.75	101.50
3/4	.7500	47024	47124	47524	100.80	3/4	6	1 1/2	1 1/2	3	5/16	0.7221-0.7530	133.45	117.10	111.55	108.95	106.15	103.95
25/32	.7812	47025	47125	47525	100.80	3/4	6	1 1/2	1 1/2	3	5/16	0.7531-0.7840	133.45	117.10	111.55	108.95	106.15	103.95
13/16	.8125	47026	47126	47526	109.45	3/4	6	1 1/2	1 1/2	3	5/16	0.7841-0.8160	142.10	125.80	120.30	117.65	114.85	112.60
27/32	.8438	47027	47127	47527	109.45	3/4	6	1 1/2	1 1/2	3	5/16	0.8161-0.8470	142.10	125.80	120.30	117.65	114.85	112.60
7/8	.8750	47028	47128	47528	119.60	3/4	6	1 1/2	1 1/2	3	5/16	0.8471-0.8780	153.50	136.50	130.90	128.15	125.20	122.95
29/32	.9062	47029	47129	47529	119.60	3/4	6	1 1/2	1 1/2	3	5/16	0.8781-0.9090	153.50	136.50	130.90	128.15	125.20	122.95
15/16	.9375	47030	47130	47530	131.70	3/4	6	1 1/2	1 1/2	3	5/16	0.9091-0.9410	165.65	148.65	143.00	140.30	137.35	135.10
31/32	.9688	47031	47131	47531	131.70	3/4	8	1 1/2	1 1/2	3	5/16	0.9411-0.9720	165.65	148.65	143.00	140.30	137.35	135.10
1	1.0000	47032	47132	47532	138.25	3/4	8	1 1/2	1 1/2	3	5/16	0.9721-1.0030	172.15	155.20	149.45	146.80	143.85	141.60
1 1/16	1.0625	47034	47134	47534	132.45	3/4	8	1 1/2	1 1/2	3	5/16	1.0031-1.0660	165.00	148.70	143.25	140.70	137.85	135.65
1 1/8	1.1250	47036	47136	47536	155.00	3/4	8	1 1/2	1 1/2	3	5/16	1.0661-1.1280	187.50	171.25	165.75	163.20	160.40	158.20
1 3/16	1.1875	47038	47138	47538	161.65	3/4	8	1 1/2	1 1/2	3	5/16	1.1281-1.1905	194.10	177.85	172.40	169.85	167.00	164.80
1 1/4	1.2500	47040	47140	47540	189.40	3/4	8	1 1/2	1 1/2	3	5/16	1.1906-1.2530	221.85	205.60	200.20	197.55	194.80	192.55
1 5/16	1.3125	47042	47142	47542	189.40	3/4	8	1 1/2	1 1/2	3	5/16	1.2531-1.3155	221.85	205.60	200.20	197.55	194.80	192.55
1 3/8	1.3750	47044	47144	47544	192.05	3/4	8	1 1/2	1 1/2	3	5/16	1.3156-1.3780	224.50	208.20	202.75	200.20	197.40	195.20
1 7/16	1.4375	47046	47146	47546	223.90	3/4	8	1 1/2	1 1/2	3	5/16	1.3781-1.4405	256.35	240.10	234.60	232.05	229.25	227.05
1 1/2	1.5000	47048	47148	47548	268.90	3/4	8	1 1/2	1 1/2	3	5/16	1.4406-1.5030	301.40	285.15	279.65	277.10	274.30	272.10

*Quantities of 15 or more - price of fractional size in same size range.



COOLANT FED REAMERS SUPERIOR HOLE FINISH, FEEDS & SPEEDS & TOOL LIFE

ADVANTAGES & APPLICATION RECOMMENDATIONS



SUPERIOR SURFACE FINISHES

- Tool's ability to flush chips away from the cutting edge prevents recutting of chips
- Coolant's constant presence at the cutting edge reduces heat in both the reamer and workpiece
- Extremely fine ground finish of the reamer's chamfer reduces buildup of material on the cutting edges

HIGHER FEEDS AND SPEEDS

- Maximum utilization of the coolant's lubricating properties
- Material specific geometries ensure optimum feed and speed capability

MAXIMUM TOOL LIFE

- Use of premium carbide grades based on material specific application

BLIND HOLE APPLICATIONS

- Select tool with center coolant outlet to flush chips out of the hole
- Available in straight and right spiral flutes (pgs. 90, 91, 94, 102, 103)

THRU HOLE APPLICATIONS

- Select tool with flute coolant outlets which enable the coolant to flush the chips ahead of the tool
- Available in straight, right spiral, and left spiral flutes (pgs. 92, 93, 95, 102, 103)

REAMING A HOLE WITH INTERRUPTIONS

- Select the proper spiral based on hole condition (blind or thru)
- Spiral flutes will help bridge the interruption (i.e., crosshole, keyway, etc.)
- Do not use straight flute reamer



STEP REAMERS CUTTING OR NON-CUTTING PILOT



LOW COST & PROMPT DELIVERY



HANNIBAL SERVICES MARKET DEMAND FOR MATERIAL SPECIFIC STEP AND PILOT REAMERS

- 9 types available in straight, right spiral, and left spiral flute designs (pgs. 98-100)
- Reduce tooling cost and costly setup time by reaming multi-diameter holes in one operation
- Eliminate problems caused by heavy stock removal – use a step reamer to remove excess material with minor diameter, while setting up the finish diameter to remove adequate stock to obtain size and best finish
- When alignment is critical, rely on a piloted reamer; the pilot is non-cutting and acts as a guide to ensure alignment of multi-diameter holes

STEP REAMER MODIFICATIONS

- Modified tool diameter
- Metric tool diameter
- Closer tool diameter tolerance
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

STEP REAMER SPECIFICATIONS

- Geometry and carbide grade appropriate for material being machined
- Carbide tips brazed to tough hardened alloy steel body
- Polished flutes for easy chip flow
- Reamer shanks are ground to next smallest shank diameter listed in NAS 897 if tool diameter is within .005" of shank diameter

STEP REAMER TOLERANCES

- Tool diameter tolerance:
 - Major cutting diameter: plus .0003", minus .0000"
 - Minor cutting diameter: plus .0003", minus .0000"
 - If non-cutting pilot: plus .000", minus .001"
- Shank diameter tolerance thru ²³/₃₂" tool diameter: plus .0000", minus .0010"
- over ²³/₃₂" tool diameter: plus .0000", minus .0015"
- Step or pilot length tolerance: plus .005", minus .005"



COOLANT FED REAMERS CARBIDE TIPPED TYPES 414, 424, 434 FRACTIONAL



CENTER FED FOR BLIND HOLES STRAIGHT FLUTES & SHANK

TYPE 414 - FOR NON-FERROUS MATERIALS

TYPE 424 - FOR CAST IRONS

TYPE 434 - FOR STEELS & HIGH TEMP ALLOYS

- Center coolant outlet
- Polished flutes; flute long carbide on .2841" tool diameter and larger
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

USE:

- Center coolant outlet for reaming blind holes as chips are flushed *back* towards the shank
- Improves hole finish and permits higher feeds & speeds with longer tool life

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	414
	40	NON-FERROUS - SHORT CHIPS	414/424
	60	CAST IRONS	424
	80	LOW STRENGTH STEELS	434/424
	100	MEDIUM STRENGTH STEELS	434
	120	HIGH STRENGTH STEELS	434
140	HIGH TEMPERATURE ALLOYS	434	

MODIFICATIONS (See list on page 94)



REAMERS

TOOL DIAMETER		TYPE 414 NON-FERROUS EDP NO.	TYPE 424 CAST IRON EDP NO.	TYPE 434 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER							
FRACTIONAL	DECIMAL					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
							FLT	CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/16	.1875	41406	42406	43406	\$104.55	.1805	4	1 1/4	1/2	5	0.1770 - 0.2040	\$137.20	\$120.80	\$115.30	\$112.75	\$109.95	\$107.75
13/64	.2031	4142031	4242031	4342031	104.55	.1805	4	1 1/4	1/2	5	-	-	-	-	-	-	-
7/32	.2188	41407	42407	43407	104.55	.2075	4	1 1/4	1/2	5	0.2041 - 0.2210	137.20	120.80	115.30	112.75	109.95	107.75
15/64	.2344	4142344	4242344	4342344	104.55	.2265	4	1 1/2	1/2	6	0.2211 - 0.2380	137.20	120.80	115.30	112.75	109.95	107.75
1/4	.2500	41408	42408	43408	104.55	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	137.20	120.80	115.30	112.75	109.95	107.75
17/64	.2656	4142656	4242656	4342656	110.95	.2485	4	1 1/2	1/2	6	-	-	-	-	-	-	-
9/32	.2812	41409	42409	43409	110.95	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	143.60	127.20	121.75	119.10	116.30	114.15
19/64	.2969	4142969	4242969	4342969	117.15	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
5/16	.3125	41410	42410	43410	117.15	.2792	4	1 1/2	1 1/2	6	0.2841 - 0.3150	149.85	133.45	127.95	125.30	122.55	120.35
21/64	.3281	4143281	4243281	4343281	118.05	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
11/32	.3438	41411	42411	43411	118.05	.2792	4	1 1/2	1 1/2	6	0.3151 - 0.3470	150.70	134.35	128.90	126.25	123.50	121.30
23/64	.3594	4143594	4243594	4343594	119.30	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	41412	42412	43412	119.30	.3105	4	1 3/4	1 3/4	7	0.3471 - 0.3780	151.95	135.55	130.10	127.45	124.65	122.50
25/64	.3906	4143906	4243906	4343906	119.65	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	41413	42413	43413	119.65	.3105	4	1 3/4	1 3/4	7	0.3781 - 0.4090	152.30	136.00	130.50	127.90	125.10	122.85
27/64	.4219	4144219	4244219	4344219	120.85	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	41414	42414	43414	120.85	.3730	6	1 3/4	1 3/4	7	0.4091 - 0.4410	153.55	137.20	131.65	129.10	126.25	124.10
29/64	.4531	4144531	4244531	4344531	121.90	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
15/32	.4688	41415	42415	43415	121.90	.3730	6	1 3/4	1 3/4	7	0.4411 - 0.4720	154.60	138.25	132.75	130.15	127.30	125.15
31/64	.4844	4144844	4244844	4344844	123.30	.4355	6	2	2	8	-	-	-	-	-	-	-
1/2	.5000	41416	42416	43416	123.30	.4355	6	2	2	8	0.4721 - 0.5030	156.00	139.65	134.20	131.55	128.80	126.50
33/64	.5156	4145156	4245156	4345156	126.10	.4355	6	2	2	8	-	-	-	-	-	-	-
17/32	.5312	41417	42417	43417	126.10	.4355	6	2	2	8	0.5031 - 0.5340	158.70	142.35	136.90	134.30	131.50	129.25
9/16	.5625	41418	42418	43418	127.90	.4355	6	2	2	8	0.5341 - 0.5660	160.55	144.15	138.70	136.15	133.30	131.10
19/32	.5938	41419	42419	43419	130.55	.4355	6	2	2	8	0.5661 - 0.5970	163.20	146.85	141.35	138.80	136.00	133.75
5/8	.6250	41420	42420	43420	133.00	.5615	6	2 1/4	2 1/4	9	0.5971 - 0.6280	165.70	149.30	143.85	141.20	138.45	136.25
21/32	.6562	41421	42421	43421	147.25	.5615	6	2 1/4	2 1/4	9	0.6281 - 0.6590	179.90	163.55	158.00	155.50	152.65	150.45
11/16	.6875	41422	42422	43422	150.25	.5615	6	2 1/4	2 1/4	9	0.6591 - 0.6910	182.90	166.60	161.05	158.50	155.65	153.45
23/32	.7188	41423	42423	43423	156.70	.5615	6	2 1/4	2 1/4	9	0.6911 - 0.7220	189.35	173.05	167.60	164.95	162.15	159.90
3/4	.7500	41424	42424	43424	156.70	.6245	6	2 1/2	2 1/2	9 1/2	0.7221 - 0.7530	189.35	173.05	167.60	164.95	162.15	159.90
25/32	.7812	41425	42425	43425	161.35	.6245	6	2 1/2	2 1/2	9 1/2	0.7531 - 0.7840	194.00	177.65	172.20	169.60	166.75	164.55
13/16	.8125	41426	42426	43426	161.35	.6245	6	2 1/2	2 1/2	9 1/2	0.7841 - 0.8160	194.00	177.65	172.20	169.60	166.75	164.55
27/32	.8438	41427	42427	43427	166.90	.6245	6	2 1/2	2 1/2	9 1/2	0.8161 - 0.8470	199.55	183.20	177.70	175.10	172.30	170.05
7/8	.8750	41428	42428	43428	173.20	.7495	6	2 5/8	2 5/8	10	0.8471 - 0.8780	207.10	190.10	184.40	181.70	178.80	176.50
29/32	.9062	41429	42429	43429	192.30	.7495	6	2 5/8	2 5/8	10	0.8781 - 0.9090	226.20	209.20	203.50	200.85	197.90	195.65
15/16	.9375	41430	42430	43430	192.30	.7495	8	2 5/8	2 5/8	10	0.9091 - 0.9410	226.20	209.20	203.50	200.85	197.90	195.65
31/32	.9688	41431	42431	43431	193.05	.7495	8	2 5/8	2 5/8	10	0.9411 - 0.9720	226.95	210.00	204.35	201.60	198.65	196.40
1	1.0000	41432	42432	43432	193.05	.8745	8	2 3/4	2 3/4	10 1/2	0.9721 - 1.0030	226.95	210.00	204.35	201.60	198.65	196.40
1 1/16	1.0625	41434	42434	43434	198.55	.8745	8	2 3/4	2 3/4	10 1/2	1.0031 - 1.0660	232.45	215.45	209.75	207.10	204.10	201.90
1 1/8	1.1250	41436	42436	43436	205.45	.8745	8	2 7/8	2 7/8	11	1.0661 - 1.1280	239.30	222.35	216.60	213.90	211.00	208.70
1 3/16	1.1875	41438	42438	43438	220.05	.9995	8	2 7/8	2 7/8	11	1.1281 - 1.1905	253.95	236.95	231.20	228.60	225.65	223.40
1 1/4	1.2500	41440	42440	43440	222.90	.9995	8	3	3	11 1/2	1.1906 - 1.2530	256.85	239.80	234.15	231.45	228.60	226.30
1 5/16	1.3125	41442	42442	43442	229.30	.9995	8	3	3	11 1/2	1.2531 - 1.3155	263.25	246.20	240.55	237.80	234.95	232.65
1 3/8	1.3750	41444	42444	43444	238.60	.9995	8	3 1/4	3 1/4	12	1.3156 - 1.3780	272.50	255.45	249.85	247.10	244.25	241.90
1 7/16	1.4375	41446	42446	43446	246.05	.9995	8	3 1/4	3 1/4	12	1.3781 - 1.4405	280.00	262.95	257.35	254.60	251.70	249.45
1 1/2	1.5000	41448	42448	43448	254.30	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406 - 1.5030	288.20	271.25	265.55	262.85	259.95	257.65

*Quantities of 15 or more - price of fractional size in same size range.

TOOL DIAMETER		TYPE 414 NON-FERROUS EDP NO.	TYPE 424 CAST IRON EDP NO.	TYPE 434 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRAC.	DEC.					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
1 1/16	1.5625	41450	42450	43450	\$270.75	1.2495	8	3 1/2	3 1/2	12 1/2	1.5031 - 1.5660	\$303.05	\$286.90	\$281.50	\$278.90	\$276.10	\$273.95
1 5/8	1.6250	41452	42452	43452	296.40	1.2495	8	3 1/2	3 1/2	13	1.5661 - 1.6280	328.70	312.55	307.15	304.55	301.75	299.60
1 11/16	1.6875	41454	42454	43454	302.70	1.2495	8	3 1/2	3 1/2	13	1.6281 - 1.6910	335.00	318.85	313.45	310.85	308.05	305.90
1 3/4	1.7500	41456	42456	43456	331.50	1.2495	10	3 1/2	3 1/2	13 1/2	1.6911 - 1.7530	363.80	347.65	342.25	339.65	336.85	334.70
1 13/16	1.8125	41458	42458	43458	345.05	1.4995	10	3 1/2	3 1/2	13 1/2	1.7531 - 1.8160	377.35	361.20	355.80	353.20	350.40	348.25
1 7/8	1.8750	41460	42460	43460	364.25	1.4995	10	3 1/2	3 1/2	14	1.8161 - 1.8780	396.55	380.40	375.00	372.40	369.60	367.45
1 15/16	1.9375	41462	42462	43462	386.20	1.4995	10	3 1/2	3 1/2	14	1.8781 - 1.9410	418.50	402.35	396.95	394.35	391.55	389.40
2	2.0000	41464	42464	43464	401.05	1.4995	12	3 1/2	3 1/2	14	1.9411 - 2.0030	433.35	417.20	411.80	409.20	406.40	404.25



COOLANT FED REAMERS CARBIDE TIPPED TYPES 414, 424, 434 METRIC



**CENTER FED FOR BLIND HOLES
STRAIGHT FLUTES & SHANK**



REAMERS

NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 94).

TOOL DIAMETER		TYPE 414 NON-FERROUS EDP NO.	TYPE 424 CAST IRON EDP NO.	TYPE 434 STEEL/ HI-TEMP EDP NO.	ALL TYPES METRIC PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
								FLT & CARB	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	414045	424045	434045	\$115.30	.1704	4	*1 1/4	5	4.494-4.696	\$139.90	\$123.60	\$118.10	\$115.50	\$112.75	\$110.45	\$107.30
5.0	.1969	414050	424050	434050	115.30	.1805	4	*1 1/4	5	4.697-5.182	139.90	123.60	118.10	115.50	112.75	110.45	107.30
5.5	.2165	414055	424055	434055	115.30	.2075	4	*1 1/4	5	5.183-5.613	139.90	123.60	118.10	115.50	112.75	110.45	107.30
6.0	.2362	414060	424060	434060	115.30	.2265	4	*1 1/2	6	5.614-6.045	139.90	123.60	118.10	115.50	112.75	110.45	107.30
-	-	414063	424063	434063	-	.2405	4	*1 1/2	6	6.046-6.426	139.90	123.60	118.10	115.50	112.75	110.45	107.30
6.5	.2559	414065	424065	434065	121.75	.2485	4	*1 1/2	6	6.427-7.214	146.30	130.00	124.55	121.85	119.10	116.85	113.75
7.0	.2756	414070	424070	434070	121.75	.2485	4	*1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	414075	424075	434075	127.95	.2792	4	1 1/2	6	7.215-8.001	152.50	136.25	130.80	128.10	125.30	123.10	119.90
8.0	.3150	414080	424080	434080	127.95	.2792	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	414085	424085	434085	128.90	.2792	4	1 1/2	6	8.002-8.814	153.45	137.20	131.65	129.00	126.25	124.00	120.85
9.0	.3543	414090	424090	434090	130.10	.3105	4	1 3/4	7	8.815-9.601	154.65	138.35	132.90	130.20	127.45	125.20	122.10
9.5	.3740	414095	424095	434095	130.10	.3105	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	414100	424100	434100	130.50	.3105	4	1 3/4	7	9.602-10.389	155.05	138.80	133.30	130.60	127.90	125.60	122.50
10.5	.4134	414105	424105	434105	131.65	.3730	6	1 3/4	7	10.390-11.201	156.25	139.95	134.50	131.85	129.10	126.85	123.65
11.0	.4331	414110	424110	434110	131.65	.3730	6	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	414115	424115	434115	132.75	.3730	6	1 3/4	7	11.202-11.989	157.35	141.00	135.55	132.90	130.15	127.90	124.80
12.0	.4724	414120	424120	434120	134.20	.4355	6	2	8	11.990-12.776	158.70	142.50	136.95	134.30	131.55	129.25	126.15
12.5	.4921	414125	424125	434125	134.20	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	414130	424130	434130	136.90	.4355	6	2	8	12.777-13.564	161.50	145.20	139.70	137.00	134.30	132.00	128.90
13.5	.5315	414135	424135	434135	136.90	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	414140	424140	434140	138.70	.4355	6	2	8	13.565-14.376	163.30	146.95	141.55	138.85	136.15	133.80	130.65
14.5	.5709	414145	424145	434145	141.35	.4355	6	2	8	14.377-15.164	165.95	149.60	144.15	141.55	138.80	136.50	133.35
15.5	.6102	414155	424155	434155	143.85	.5615	6	2 1/4	9	15.165-15.951	168.40	152.15	146.65	143.95	141.20	138.95	135.80
16.0	.6299	414160	424160	434160	158.00	.5615	6	2 1/4	9	15.952-16.739	182.65	166.30	160.85	158.25	155.50	153.20	150.05
17.0	.6693	414170	424170	434170	161.05	.5615	6	2 1/4	9	16.740-17.551	185.65	169.35	163.90	161.25	158.50	156.20	153.05
18.0	.7087	414180	424180	434180	167.60	.6245	6	2 1/2	9	17.552-18.339	192.10	175.90	170.35	167.70	164.95	162.65	159.55
18.5	.7283	414185	424185	434185	167.60	.6245	6	2 1/2	9 1/2	18.340-19.126	192.10	175.90	170.35	167.70	164.95	162.65	159.55
19.5	.7677	414195	424195	434195	172.20	.6245	6	2 1/2	9 1/2	19.127-19.914	196.70	180.45	175.00	172.30	169.60	167.25	164.15
20.0	.7874	414200	424200	434200	172.20	.6245	6	2 1/2	9 1/2	19.915-20.726	196.70	180.45	175.00	172.30	169.60	167.25	164.15
21.0	.8268	414210	424210	434210	177.70	.6245	6	2 1/2	9 1/2	20.727-21.514	202.30	186.00	180.55	177.85	175.10	172.85	169.70
22.0	.8661	414220	424220	434220	177.70	.7495	6	2 5/8	10	21.515-22.301	202.30	186.00	180.55	177.85	175.10	172.85	169.70
22.5	.8858	414225	424225	434225	203.50	.7495	6	2 5/8	10	22.302-23.089	229.05	212.10	206.45	203.70	200.85	198.50	195.20
23.5	.9252	414235	424235	434235	203.50	.7495	8	2 5/8	10	23.090-23.901	229.05	212.10	206.45	203.70	200.85	198.50	195.20
24.0	.9449	414240	424240	434240	204.35	.7495	8	2 5/8	10	23.902-24.689	229.80	212.90	207.20	204.45	201.60	199.25	196.00
25.0	.9843	414250	424250	434250	204.35	.8745	8	2 3/4	10 1/2	24.690-25.476	229.80	212.90	207.20	204.45	201.60	199.25	196.00
25.5	1.0039	414255	424255	434255	209.75	.8745	8	2 3/4	10 1/2	25.477-27.076	235.25	218.35	212.70	209.90	207.10	204.75	201.45
28.0	1.1024	414280	424280	434280	216.60	.8745	8	2 7/8	11	27.077-28.651	242.15	225.20	219.55	216.75	213.90	211.60	208.30
29.0	1.1417	414290	424290	434290	231.20	.9995	8	2 7/8	11	28.652-30.239	256.80	239.80	234.15	231.40	228.60	226.20	222.90
31.0	1.2205	414310	424310	434310	234.15	.9995	8	3	11 1/2	30.240-31.826	259.65	242.75	237.10	234.30	231.45	229.10	225.85
32.0	1.2598	414320	424320	434320	240.55	.9995	8	3	11 1/2	31.827-33.414	266.05	249.10	243.50	240.70	237.80	235.50	232.20
34.0	1.3386	414340	424340	434340	249.85	.9995	8	3 1/4	12	33.415-35.001	275.35	258.40	252.75	249.95	247.10	244.75	241.50
36.0	1.4173	414360	424360	434360	257.35	.9995	8	3 1/4	12	35.002-36.589	282.80	265.85	260.25	257.45	254.60	252.25	249.00
37.0	1.4567	414370	424370	434370	265.55	1.2495	8	3 1/2	12 1/2	36.590-38.176	291.05	274.15	268.50	265.70	262.85	260.50	257.20

*1/2" carbide length



COOLANT FED REAMERS CARBIDE TIPPED TYPES 416, 426, 435 FRACTIONAL



FLUTE FED FOR THRU HOLES STRAIGHT FLUTES & SHANK

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	416
	40	NON-FERROUS - SHORT CHIPS	416/426
	60	CAST IRONS	426
	80	LOW STRENGTH STEELS	435/426
	100	MEDIUM STRENGTH STEELS	435
	120	HIGH STRENGTH STEELS	435
140	HIGH TEMPERATURE ALLOYS	435	

- TYPE 416 - FOR NON-FERROUS MATERIALS**
- TYPE 426 - FOR CAST IRONS**
- TYPE 435 - FOR STEELS & HIGH TEMP ALLOYS**

- Coolant outlets in *each* flute
- Polished flutes; flute long carbide on .2841" tool diameter and larger
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

MODIFICATIONS (See list on page 94)

USE:

- Flute coolant outlets for reaming thru holes as chips are flushed *forward* through the hole being reamed
- Improves hole finish and permits higher feeds & speeds with longer tool life



REAMERS

TOOL DIAMETER		TYPE 416 NON-FERROUS EDP NO.	TYPE 426 CAST IRON EDP NO.	TYPE 435 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER							
FRACTIONAL	DECIMAL					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLT	CARBIDE	OVER-ALL		1		2	3	4	5-7	8-14*	
3/16	.1875	41606	42606	43506	\$108.45	.1805	4	1 1/4	1/2	5	0.1770 - 0.2040	\$141.10	\$124.80	\$119.30	\$116.65	\$113.85	\$111.60
13/64	.2031	4162031	4262031	4352031	108.45	.1805	4	1 1/4	1/2	5	-	-	-	-	-	-	
7/32	.2188	41607	42607	43507	108.45	.2075	4	1 1/4	1/2	5	0.2041 - 0.2210	141.10	124.80	119.30	116.65	113.85	111.60
15/64	.2344	4162344	4262344	4352344	108.45	.2265	4	1 1/2	1/2	6	0.2211 - 0.2380	141.10	124.80	119.30	116.65	113.85	111.60
1/4	.2500	41608	42608	43508	108.45	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	141.10	124.80	119.30	116.65	113.85	111.60
17/64	.2656	4162656	4262656	4352656	110.95	.2485	4	1 1/2	1/2	6	-	-	-	-	-	-	
9/32	.2812	41609	42609	43509	110.95	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	143.60	127.20	121.75	119.10	116.30	114.15
19/64	.2969	4162969	4262969	4352969	120.35	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	
5/16	.3125	41610	42610	43510	120.35	.2792	4	1 1/2	1 1/2	6	0.2841 - 0.3150	153.00	136.60	131.15	128.55	125.80	123.55
21/64	.3281	4163281	4263281	4353281	120.35	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	
11/32	.3438	41611	42611	43511	120.35	.2792	4	1 1/2	1 1/2	6	0.3151 - 0.3470	153.00	136.60	131.15	128.55	125.80	123.55
23/64	.3594	4163594	4263594	4353594	120.35	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	
3/8	.3750	41612	42612	43512	120.35	.3105	4	1 3/4	1 3/4	7	0.3471 - 0.3780	153.00	136.60	131.15	128.55	125.80	123.55
25/64	.3906	4163906	4263906	4353906	123.30	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	
13/32	.4062	41613	42613	43513	123.30	.3105	4	1 3/4	1 3/4	7	0.3781 - 0.4090	156.00	139.65	134.20	131.55	128.80	126.50
27/64	.4219	4164219	4264219	4354219	126.30	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	
7/16	.4375	41614	42614	43514	126.30	.3730	6	1 3/4	1 3/4	7	0.4091 - 0.4410	158.95	142.65	137.20	134.55	131.80	129.55
29/64	.4531	4164531	4264531	4354531	126.30	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	
15/32	.4688	41615	42615	43515	126.30	.3730	6	1 3/4	1 3/4	7	0.4411 - 0.4720	158.95	142.65	137.20	134.55	131.80	129.55
31/64	.4844	4164844	4264844	4354844	126.30	.4355	6	2	2	8	-	-	-	-	-	-	
1/2	.5000	41616	42616	43516	126.30	.4355	6	2	2	8	0.4721 - 0.5030	158.95	142.65	137.20	134.55	131.80	129.55
33/64	.5156	4165156	4265156	4355156	133.60	.4355	6	2	2	8	-	-	-	-	-	-	
17/32	.5312	41617	42617	43517	133.60	.4355	6	2	2	8	0.5031 - 0.5340	166.25	149.95	144.50	141.85	139.00	136.85
9/16	.5625	41618	42618	43518	135.50	.4355	6	2	2	8	0.5341 - 0.5660	168.15	151.85	146.30	143.70	140.90	138.70
19/32	.5938	41619	42619	43519	136.75	.4355	6	2	2	8	0.5661 - 0.5970	169.40	153.05	147.60	144.95	142.15	139.95
5/8	.6250	41620	42620	43520	136.75	.5615	6	2 1/4	2 1/4	9	0.5971 - 0.6280	169.40	153.05	147.60	144.95	142.15	139.95
21/32	.6562	41621	42621	43521	151.55	.5615	6	2 1/4	2 1/4	9	0.6281 - 0.6590	184.30	167.90	162.40	159.80	157.00	154.80
11/16	.6875	41622	42622	43522	151.55	.5615	6	2 1/4	2 1/4	9	0.6591 - 0.6910	184.30	167.90	162.40	159.80	157.00	154.80
23/32	.7188	41623	42623	43523	162.00	.5615	6	2 1/2	2 1/2	9	0.6911 - 0.7220	194.65	178.30	172.85	170.25	167.35	165.20
3/4	.7500	41624	42624	43524	162.00	.6245	6	2 1/2	2 1/2	9 1/2	0.7221 - 0.7530	194.65	178.30	172.85	170.25	167.35	165.20
25/32	.7812	41625	42625	43525	162.00	.6245	6	2 1/2	2 1/2	9 1/2	0.7531 - 0.7840	194.65	178.30	172.85	170.25	167.35	165.20
13/16	.8125	41626	42626	43526	162.00	.6245	6	2 1/2	2 1/2	9 1/2	0.7841 - 0.8160	194.65	178.30	172.85	170.25	167.35	165.20
27/32	.8438	41627	42627	43527	166.90	.6245	6	2 1/2	2 1/2	9 1/2	0.8161 - 0.8470	199.55	183.20	177.70	175.10	172.30	170.05
7/8	.8750	41628	42628	43528	173.20	.7495	6	2 3/8	2 3/8	10	0.8471 - 0.8780	207.10	190.10	184.40	181.70	178.80	176.50
29/32	.9062	41629	42629	43529	194.45	.7495	6	2 3/8	2 3/8	10	0.8781 - 0.9090	228.30	211.35	205.70	202.95	200.00	197.80
15/16	.9375	41630	42630	43530	199.00	.7495	8	2 3/8	2 3/8	10	0.9091 - 0.9410	232.85	215.90	210.20	207.50	204.55	202.30
31/32	.9688	41631	42631	43531	199.00	.7495	8	2 3/8	2 3/8	10	0.9411 - 0.9720	232.85	215.90	210.20	207.50	204.55	202.30
1	1.0000	41632	42632	43532	199.00	.8745	8	2 3/4	2 3/4	10 1/2	0.9721 - 1.0030	232.85	215.90	210.20	207.50	204.55	202.30
1 1/16	1.0625	41634	42634	43534	210.40	.8745	8	2 3/4	2 3/4	10 1/2	1.0031 - 1.0660	244.35	227.40	221.70	219.00	216.10	213.80
1 1/8	1.1250	41636	42636	43536	211.30	.8745	8	2 3/4	2 3/4	11	1.0661 - 1.1280	245.25	228.20	222.50	219.80	216.95	214.60
1 3/16	1.1875	41638	42638	43538	220.05	.9995	8	2 7/8	2 7/8	11	1.1281 - 1.1905	253.95	236.95	231.20	228.60	225.65	223.40
1 1/4	1.2500	41640	42640	43540	222.90	.9995	8	3	3	11 1/2	1.1906 - 1.2530	256.85	239.80	234.15	231.45	228.60	226.30
1 5/16	1.3125	41642	42642	43542	229.30	.9995	8	3	3	11 1/2	1.2531 - 1.3155	263.25	246.20	240.55	237.80	234.95	232.65
1 3/8	1.3750	41644	42644	43544	238.60	.9995	8	3 1/4	3 1/4	12	1.3156 - 1.3780	272.50	255.45	249.85	247.10	244.25	241.90
1 7/16	1.4375	41646	42646	43546	246.05	.9995	8	3 1/4	3 1/4	12	1.3781 - 1.4405	280.00	262.95	257.35	254.60	251.70	249.45
1 1/2	1.5000	41648	42648	43548	254.30	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406 - 1.5030	288.20	271.25	265.55	262.85	259.95	257.65

*Quantities of 15 or more - price of fractional size in same size range.

TOOL DIAMETER		TYPE 416 NON-FERROUS EDP NO.	TYPE 426 CAST IRON EDP NO.	TYPE 435 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRAC.	DEC.					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
1 1/16	1.5625	41650	42650	43550	\$285.90	1.2495	8	3 1/2	3 1/2	12 1/2	1.5031 - 1.5660	\$318.20	\$302.05	\$296.60	\$294.05	\$291.25	\$289.10
1 5/8	1.6250	41652	42652	43552	314.35	1.2495	8	3 1/2	3 1/2	13	1.5661 - 1.6280	346.65	330.50	325.05	322.50	319.70	317.55
1 11/16	1.6875	41654	42654	43554	319.80	1.2495	8	3 1/2	3 1/2	13	1.6281 - 1.6910	352.10	335.95	330.50	327.95	325.15	323.00
1 3/4	1.7500	41656	42656	43556	349.50	1.2495	10	3 1/2	3 1/2	13 1/2	1.6911 - 1.7530	381.80	365.65	360.20	357.65	354.85	352.70
1 13/16	1.8125	41658	42658	43558	363.90	1.4995	10	3 1/2	3 1/2	13 1/2	1.7531 - 1.8160	396.20	380.05	374.60	372.05	369.25	367.10
1 7/8	1.8750	41660	42660	43560	383.15	1.4995	10	3 1/2	3 1/2	14	1.8161 - 1.8780	415.45	399.30	393.85	391.30	388.50	386.35
1 15/16	1.9375	41662	42662	43562	407.60	1.4995	10	3 1/2	3 1/2	14	1.8781 - 1.9410	439.90	423.75	418.30	415.75	412.95	410.80
2	2.0000	41664	42664	43564	422.40	1.4995	12	3 1/2	3 1/2	14	1.9411 - 2.0030	454.70	438.55	433.10	430.55	427.75	425.60



COOLANT FED REAMERS

CARBIDE TIPPED TYPES 416, 426, 435 METRIC



FLUTE FED FOR THRU HOLES
STRAIGHT FLUTES & SHANK



REAMERS

NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 94).

TOOL DIAMETER		TYPE 416 NON-FERROUS METRIC EDP NO.	TYPE 426 CAST IRON METRIC EDP NO.	TYPE 435 STEEL/ HI-TEMP METRIC EDP NO.	ALL TYPES METRIC PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
								FLT & CARB.	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	416045	426045	435045	\$119.30	.1704	4	*1 1/4	5	4.494-4.696	\$143.85	\$127.60	\$122.10	\$119.45	\$116.65	\$114.40	\$111.25
5.0	.1969	416050	426050	435050	119.30	.1805	4	*1 1/4	5	4.697-5.182	143.85	127.60	122.10	119.45	116.65	114.40	111.25
5.5	.2165	416055	426055	435055	119.30	.2075	4	*1 1/4	5	5.183-5.613	143.85	127.60	122.10	119.45	116.65	114.40	111.25
6.0	.2362	416060	426060	435060	119.30	.2265	4	*1 1/2	6	5.614-6.045	143.85	127.60	122.10	119.45	116.65	114.40	111.25
-	-	416063	426063	435063	-	.2405	4	*1 1/2	6	6.046-6.426	143.85	127.60	122.10	119.45	116.65	114.40	111.25
6.5	.2559	416065	426065	435065	121.75	.2485	4	*1 1/2	6	6.427-7.214	146.30	130.00	124.55	121.85	119.10	116.85	113.75
7.0	.2756	416070	426070	435070	121.75	.2485	4	*1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	416075	426075	435075	131.15	.2792	4	1 1/2	6	7.215-8.001	155.70	139.45	133.95	131.30	128.55	126.25	123.15
8.0	.3150	416080	426080	435080	131.15	.2792	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	416085	426085	435085	131.15	.2792	4	1 1/2	6	8.002-8.814	155.70	139.45	133.95	131.30	128.55	126.25	123.15
9.0	.3543	416090	426090	435090	131.15	.3105	4	1 3/4	7	8.815-9.601	155.70	139.45	133.95	131.30	128.55	126.25	123.15
9.5	.3740	416095	426095	435095	131.15	.3105	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	416100	426100	435100	134.20	.3105	4	1 3/4	7	9.602-10.389	158.70	142.50	136.95	134.30	131.55	129.25	126.15
10.5	.4134	416105	426105	435105	137.20	.3730	6	1 3/4	7	10.390-11.201	161.70	145.50	139.95	137.30	134.55	132.30	129.15
11.0	.4331	416110	426110	435110	137.20	.3730	6	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	416115	426115	435115	137.20	.3730	6	1 3/4	7	11.202-11.989	161.70	145.50	139.95	137.30	134.55	132.30	129.15
12.0	.4724	416120	426120	435120	137.20	.4355	6	2	8	11.990-12.776	161.70	145.50	139.95	137.30	134.55	132.30	129.15
12.5	.4921	416125	426125	435125	137.20	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	416130	426130	435130	144.50	.4355	6	2	8	12.777-13.564	169.00	152.70	147.25	144.60	141.85	139.55	136.45
13.5	.5315	416135	426135	435135	144.50	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	416140	426140	435140	146.30	.4355	6	2	8	13.565-14.376	170.90	154.60	149.15	146.50	143.70	141.50	138.30
14.5	.5709	416145	426145	435145	147.60	.4355	6	2	8	14.377-15.164	172.20	155.85	150.35	147.70	144.95	142.70	139.55
15.5	.6102	416155	426155	435155	147.60	.5615	6	2 1/4	9	15.165-15.951	172.20	155.85	150.35	147.70	144.95	142.70	139.55
16.0	.6299	416160	426160	435160	162.40	.5615	6	2 1/4	9	15.952-16.739	187.00	170.70	165.20	162.55	159.80	157.55	154.35
17.0	.6693	416170	426170	435170	162.40	.5615	6	2 1/4	9	16.740-17.551	187.00	170.70	165.20	162.55	159.80	157.55	154.35
18.0	.7087	416180	426180	435180	172.85	.5615	6	2 1/4	9	17.552-18.339	197.40	181.05	175.60	172.95	170.25	167.95	164.85
18.5	.7283	416185	426185	435185	172.85	.6245	6	2 1/2	9 1/2	18.340-19.126	197.40	181.05	175.60	172.95	170.25	167.95	164.85
19.5	.7677	416195	426195	435195	172.85	.6245	6	2 1/2	9 1/2	19.127-19.914	197.40	181.05	175.60	172.95	170.25	167.95	164.85
20.0	.7874	416200	426200	435200	172.85	.6245	6	2 1/2	9 1/2	19.915-20.726	197.40	181.05	175.60	172.95	170.25	167.95	164.85
21.0	.8268	416210	426210	435210	177.70	.6245	6	2 1/2	9 1/2	20.727-21.514	202.30	186.00	180.55	177.85	175.10	172.85	169.70
22.0	.8661	416220	426220	435220	177.70	.7495	6	2 5/8	10	21.515-22.301	202.30	186.00	180.55	177.85	175.10	172.85	169.70
22.5	.8858	416225	426225	435225	205.70	.7495	6	2 5/8	10	22.302-23.089	231.15	214.25	208.60	205.80	202.95	200.60	197.40
23.5	.9252	416235	426235	435235	210.20	.7495	8	2 5/8	10	23.090-23.901	235.65	218.75	213.10	210.30	207.50	205.10	201.90
24.0	.9449	416240	426240	435240	210.20	.7495	8	2 5/8	10	23.902-24.689	235.65	218.75	213.10	210.30	207.50	205.10	201.90
25.0	.9843	416250	426250	435250	210.20	.8745	8	2 3/4	10 1/2	24.690-25.476	235.65	218.75	213.10	210.30	207.50	205.10	201.90
25.5	1.0039	416255	426255	435255	221.70	.8745	8	2 3/4	10 1/2	25.477-27.076	247.15	230.30	224.60	221.80	219.00	216.60	213.35
28.0	1.1024	416280	426280	435280	222.55	.8745	8	2 7/8	11	27.077-28.651	248.00	231.10	225.45	222.70	219.80	217.50	214.20
29.0	1.1417	416290	426290	435290	231.20	.9995	8	2 7/8	11	28.652-30.239	256.80	239.80	234.15	231.40	228.60	226.20	222.90
31.0	1.2205	416310	426310	435310	234.15	.9995	8	3	11 1/2	30.240-31.826	259.65	242.75	237.10	234.30	231.45	229.10	225.85
32.0	1.2598	416320	426320	435320	240.55	.9995	8	3	11 1/2	31.827-33.414	266.05	249.10	243.50	240.70	237.80	235.50	232.20
34.0	1.3386	416340	426340	435340	249.85	.9995	8	3 1/4	12	33.415-35.001	275.35	258.40	252.75	249.95	247.10	244.75	241.50
36.0	1.4173	416360	426360	435360	257.35	.9995	8	3 1/4	12	35.002-36.589	282.80	265.85	260.25	257.45	254.60	252.25	249.00
37.0	1.4567	416370	426370	435370	265.55	1.2495	8	3 1/2	12 1/2	36.590-38.176	291.05	274.15	268.50	265.70	262.85	260.50	257.20

*1/2" carbide length



COOLANT FED REAMERS CARBIDE TIPPED TYPES 411 413, 415 FRACTIONAL



**CENTER FED FOR BLIND HOLES
RIGHT SPIRAL FLUTES
STRAIGHT SHANK**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	411
	40	NON-FERROUS - SHORT CHIPS	411/413
	60	CAST IRONS	413
	80	LOW STRENGTH STEELS	415/413
	100	MEDIUM STRENGTH STEELS	415
	120	HIGH STRENGTH STEELS	415
	140	HIGH TEMPERATURE ALLOYS	415

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

- TITANIUM NITRIDE - TiN
- TITANIUM CARBONITRIDE - TiCN
- ZIRCONIUM NITRIDE - ZrN
- AL TITANIUM NITRIDE - AlTiN

**TYPE 411 - FOR NON-FERROUS MATERIALS
TYPE 413 - FOR CAST IRONS
TYPE 415 - FOR STEELS & HIGH TEMP ALLOYS**

- Center coolant outlet
- Polished flutes; flute long carbide on .2841" tool diameter and larger
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

USE:

- Center coolant outlet for reaming blind holes as chips are flushed *back* towards the shank
- Improves hole finish and permits higher feeds & speeds with longer tool life

TOOL DIAMETER		TYPE 411 NON-FERROUS EDP NO.	TYPE 413 CAST IRON EDP NO.	TYPE 415 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLT	CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
1/4	.2500	41108	41308	41508	\$107.35	.2405	4	1 1/2	1/2	6	0.2381-0.2530	\$137.80	\$122.55	\$117.45	\$115.00	\$112.35	\$110.30
9/32	.2812	41109	41309	41509	109.80	.2485	4	1 1/2	1/2	6	0.2531-0.2840	139.20	124.50	119.55	117.20	114.70	112.65
5/16	.3125	41110	41310	41510	120.35	.2792	4	1 1/2	1 1/2	6	0.2841-0.3150	150.80	135.50	130.40	127.95	125.30	123.25
11/32	.3438	41111	41311	41511	121.20	.2792	4	1 1/2	1 1/2	6	0.3151-0.3470	151.70	136.45	131.35	128.90	126.25	124.20
3/8	.3750	41112	41312	41512	122.50	.3105	4	1 3/4	1 3/4	7	0.3471-0.3780	152.95	137.65	132.55	130.15	127.60	125.50
13/32	.4062	41113	41313	41513	122.85	.3105	4	1 3/4	1 3/4	7	0.3781-0.4090	153.30	138.10	132.95	130.50	127.90	125.85
7/16	.4375	41114	41314	41514	124.10	.3730	6	1 3/4	1 3/4	7	0.4091-0.4410	154.60	139.30	134.20	131.80	129.15	127.10
15/32	.4688	41115	41315	41515	125.20	.3730	6	1 3/4	1 3/4	7	0.4411-0.4720	155.70	140.40	135.35	132.90	130.25	128.20
1/2	.5000	41116	41316	41516	130.05	.4355	6	2	2	8	0.4721-0.5030	161.35	145.65	140.40	137.90	135.25	133.15
17/32	.5312	41117	41317	41517	134.75	.4355	6	2	2	8	0.5031-0.5340	166.05	150.35	145.10	142.65	139.95	137.85
9/16	.5625	41118	41318	41518	134.75	.4355	6	2	2	8	0.5341-0.5660	166.05	150.35	145.10	142.65	139.95	137.85
19/32	.5938	41119	41319	41519	140.10	.4355	6	2	2	8	0.5661-0.5970	171.45	155.75	150.50	148.05	145.35	143.20
5/8	.6250	41120	41320	41520	140.10	.5615	6	2 1/4	2 1/4	9	0.5971-0.6280	171.45	155.75	150.50	148.05	145.35	143.20
21/32	.6562	41121	41321	41521	158.35	.5615	6	2 1/4	2 1/4	9	0.6281-0.6590	189.60	174.00	168.70	166.20	163.50	161.40
11/16	.6875	41122	41322	41522	158.35	.5615	6	2 1/4	2 1/4	9	0.6591-0.6910	189.60	174.00	168.70	166.20	163.50	161.40
23/32	.7188	41123	41323	41523	165.20	.5615	6	2 1/4	2 1/4	9	0.6911-0.7220	196.55	180.85	175.60	173.15	170.40	168.25
3/4	.7500	41124	41324	41524	155.20	.6245	6	2 1/2	2 1/2	9 1/2	0.7221-0.7530	184.60	169.85	164.95	162.55	160.05	158.00
25/32	.7812	41125	41325	41525	178.05	.6245	6	2 1/2	2 1/2	9 1/2	0.7531-0.7840	209.35	193.65	188.40	185.90	183.20	181.05
13/16	.8125	41126	41326	41526	180.20	.6245	6	2 1/2	2 1/2	9 1/2	0.7841-0.8160	211.50	195.80	190.60	188.10	185.45	183.35
27/32	.8438	41127	41327	41527	183.60	.6245	6	2 1/2	2 1/2	9 1/2	0.8161-0.8470	214.95	199.25	194.00	191.45	188.80	186.70
7/8	.8750	41128	41328	41528	193.50	.7495	6	2 3/8	2 3/8	10	0.8471-0.8780	225.95	209.75	204.30	201.70	198.85	196.70
29/32	.9062	41129	41329	41529	205.00	.7495	6	2 3/8	2 3/8	10	0.8781-0.9090	237.45	221.25	215.80	213.20	210.35	208.20
15/16	.9375	41130	41330	41530	214.85	.7495	8	2 3/8	2 3/8	10	0.9091-0.9410	247.35	231.05	225.65	223.00	220.20	218.00
31/32	.9688	41131	41331	41531	215.45	.7495	8	2 3/8	2 3/8	10	0.9411-0.9720	247.90	231.65	226.20	223.60	220.80	218.65
1	1.0000	41132	41332	41532	215.80	.8745	8	2 3/4	2 3/4	10 1/2	0.9721-1.0030	248.25	232.00	226.55	223.95	221.20	219.00
1 1/16	1.0625	41134	41334	41534	221.80	.8745	8	2 3/4	2 3/4	10 1/2	1.0031-1.0660	254.25	238.05	232.60	229.95	227.15	225.00
1 1/8	1.1250	41136	41336	41536	229.50	.8745	8	2 7/8	2 7/8	11	1.0661-1.1280	262.05	245.70	240.30	237.70	234.95	232.75
1 3/16	1.1875	41138	41338	41538	245.85	.9995	8	2 7/8	2 7/8	11	1.1281-1.1905	278.35	262.10	256.60	254.05	251.20	249.00
1 1/4	1.2500	41140	41340	41540	249.00	.9995	8	3	3	11 1/2	1.1906-1.2530	281.50	265.25	259.80	257.20	254.45	252.25
1 5/16	1.3125	41142	41342	41542	256.25	.9995	8	3	3	11 1/2	1.2531-1.3155	288.70	272.40	266.95	264.40	261.60	259.40
1 3/8	1.3750	41144	41344	41544	266.65	.9995	8	3 1/4	3 1/4	12	1.3156-1.3780	299.15	282.85	277.40	274.85	272.00	269.80
1 7/16	1.4375	41146	41346	41546	274.95	.9995	8	3 1/4	3 1/4	12	1.3781-1.4405	307.40	291.15	285.70	283.10	280.30	278.15
1 1/2	1.5000	41148	41348	41548	284.25	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406-1.5030	316.70	300.45	295.00	292.35	289.60	287.45

*Quantities of 15 or more - price of fractional size in same size range.



COOLANT FED REAMERS CARBIDE TIPPED TYPES 417, 418, 419 FRACTIONAL



**FLUTE FED FOR THRU HOLES
RIGHT SPIRAL FLUTES
STRAIGHT SHANK**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	417
	40	NON-FERROUS - SHORT CHIPS	417/418
	60	CAST IRONS	418
	80	LOW STRENGTH STEELS	419/418
	100	MEDIUM STRENGTH STEELS	419
	120	HIGH STRENGTH STEELS	419
	140	HIGH TEMPERATURE ALLOYS	419

**TYPE 417 - FOR NON-FERROUS MATERIALS
TYPE 418 - FOR CAST IRONS
TYPE 419 - FOR STEELS & HIGH TEMP ALLOYS**

- Coolant outlets in *each* flute
- Polished flutes; flute long carbide on .2841" tool diameter and larger
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

USE:

- Flute coolant outlets for reaming thru holes as chips are flushed *forward* through the hole being reamed
- Improves hole finish and permits higher feeds & speeds with longer tool life

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

TOOL DIAMETER		TYPE 417 NON-FERROUS EDP NO.	TYPE 418 CAST IRON EDP NO.	TYPE 419 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRAC.	DEC.					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLT	CAR- BIDE	OVER- ALL		1	2	3	4	5-7	8-14*
1/4	.2500	41708	41808	41908	\$115.00	.2405	4	1 1/2	1/2	6	0.2381-0.2530	\$147.65	\$131.30	\$125.85	\$123.20	\$120.45	\$118.20
9/32	.2812	41709	41809	41909	122.00	.2485	4	1 1/2	1/2	6	0.2531-0.2840	154.65	138.30	132.80	130.20	127.40	125.20
5/16	.3125	41710	41810	41910	128.90	.2792	4	1 1/2	1 1/2	6	0.2841-0.3150	161.55	145.20	139.70	137.15	134.30	132.10
11/32	.3438	41711	41811	41911	129.90	.2792	4	1 1/2	1 1/2	6	0.3151-0.3470	162.55	146.20	140.70	138.15	135.30	133.15
3/8	.3750	41712	41812	41912	131.20	.3105	4	1 3/4	1 3/4	7	0.3471-0.3780	163.90	147.50	142.00	139.45	136.60	134.45
13/32	.4062	41713	41813	41913	131.60	.3105	4	1 3/4	1 3/4	7	0.3781-0.4090	164.25	147.90	142.50	139.85	137.00	134.80
7/16	.4375	41714	41814	41914	132.95	.3730	6	1 3/4	1 3/4	7	0.4091-0.4410	165.65	149.25	143.80	141.15	138.35	136.20
15/32	.4688	41715	41815	41915	134.20	.3730	6	1 3/4	1 3/4	7	0.4411-0.4720	166.85	150.45	144.95	142.35	139.55	137.35
1/2	.5000	41716	41816	41916	135.65	.4355	6	2	2	8	0.4721-0.5030	168.30	152.00	146.55	143.90	141.10	138.90
17/32	.5312	41717	41817	41917	140.65	.4355	6	2	2	8	0.5031-0.5340	173.30	156.90	151.45	148.90	146.00	143.85
9/16	.5625	41718	41818	41918	140.65	.4355	6	2	2	8	0.5341-0.5660	173.30	156.90	151.45	148.90	146.00	143.85
19/32	.5938	41719	41819	41919	146.25	.4355	6	2	2	8	0.5661-0.5970	178.90	162.55	157.05	154.50	151.60	149.45
5/8	.6250	41720	41820	41920	146.25	.5615	6	2 1/4	2 1/4	9	0.5971-0.6280	178.90	162.55	157.05	154.50	151.60	149.45
21/32	.6562	41721	41821	41921	165.20	.5615	6	2 1/4	2 1/4	9	0.6281-0.6590	197.85	181.55	176.05	173.40	170.60	168.40
11/16	.6875	41722	41822	41922	165.20	.5615	6	2 1/4	2 1/4	9	0.6591-0.6910	197.85	181.55	176.05	173.40	170.60	168.40
23/32	.7188	41723	41823	41923	172.40	.5615	6	2 1/4	2 1/4	9	0.6911-0.7220	205.05	188.70	183.30	180.65	177.85	175.60
3/4	.7500	41724	41824	41924	172.40	.6245	6	2 1/2	2 1/2	9 1/2	0.7221-0.7530	205.05	188.70	183.30	180.65	177.85	175.60
25/32	.7812	41725	41825	41925	185.75	.6245	6	2 1/2	2 1/2	9 1/2	0.7531-0.7840	218.40	202.05	196.60	194.00	191.20	189.00
13/16	.8125	41726	41826	41926	188.05	.6245	6	2 1/2	2 1/2	9 1/2	0.7841-0.8160	220.70	204.35	198.85	196.30	193.45	191.25
27/32	.8438	41727	41827	41927	191.60	.6245	6	2 1/2	2 1/2	9 1/2	0.8161-0.8470	224.30	207.90	202.40	199.75	197.00	194.80
7/8	.8750	41728	41828	41928	201.95	.7495	6	2 5/8	2 5/8	10	0.8471-0.8780	235.85	218.85	213.15	210.40	207.55	205.20
29/32	.9062	41729	41829	41929	213.90	.7495	6	2 5/8	2 5/8	10	0.8781-0.9090	247.80	230.85	225.15	222.45	219.55	217.25
15/16	.9375	41730	41830	41930	224.20	.7495	8	2 5/8	2 5/8	10	0.9091-0.9410	258.10	241.10	235.40	232.75	229.80	227.55
31/32	.9688	41731	41831	41931	224.80	.7495	8	2 5/8	2 5/8	10	0.9411-0.9720	258.70	241.75	236.05	233.30	230.40	228.10
1	1.0000	41732	41832	41932	225.15	.8745	8	2 3/4	2 3/4	10 1/2	0.9721-1.0030	259.10	242.10	236.35	233.70	230.80	228.50
1 1/16	1.0625	41734	41834	41934	259.65	.8745	8	2 3/4	2 3/4	10 1/2	1.0031-1.0660	293.55	276.55	270.90	268.15	265.30	262.95
1 1/8	1.1250	41736	41836	41936	260.80	.8745	8	2 7/8	2 7/8	11	1.0661-1.1280	294.65	277.65	272.00	269.25	266.40	264.10
1 3/16	1.1875	41738	41838	41938	271.55	.9995	8	2 7/8	2 7/8	11	1.1281-1.1905	305.40	288.40	282.75	280.05	277.15	274.85
1 1/4	1.2500	41740	41840	41940	275.10	.9995	8	3	3	11 1/2	1.1906-1.2530	309.00	292.05	286.35	283.65	280.70	278.45
1 5/16	1.3125	41742	41842	41942	283.05	.9995	8	3	3	11 1/2	1.2531-1.3155	316.95	299.95	294.20	291.55	288.65	286.35
1 3/8	1.3750	41744	41844	41944	294.45	.9995	8	3 1/4	3 1/4	12	1.3156-1.3780	328.40	311.40	305.65	303.00	300.10	297.80
1 7/16	1.4375	41746	41846	41946	303.65	.9995	8	3 1/4	3 1/4	12	1.3781-1.4405	337.60	320.55	314.90	312.20	309.35	307.00
1 1/2	1.5000	41748	41848	41948	313.85	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406-1.5030	347.75	330.80	325.10	322.35	319.45	317.15

*Quantities of 15 or more - price of fractional size in same size range.

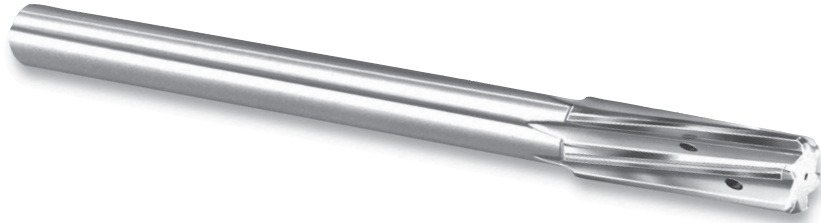
REAMERS



COOLANT FED REAMERS CARBIDE TIPPED TYPES 427, 428, 429 FRACTIONAL



**FLUTE FED FOR THRU HOLES
LEFT SPIRAL FLUTES
STRAIGHT SHANK**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	427
	40	NON-FERROUS - SHORT CHIPS	427/428
	60	CAST IRONS	428
	80	LOW STRENGTH STEELS	429/428
	100	MEDIUM STRENGTH STEELS	429
	120	HIGH STRENGTH STEELS	429
	140	HIGH TEMPERATURE ALLOYS	429

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

TYPE 427 - FOR NON-FERROUS MATERIALS

TYPE 428 - FOR CAST IRONS

TYPE 429 - FOR STEELS & HIGH TEMP ALLOYS

- Coolant outlets in *each* flute
- Polished flutes; flute long carbide on .2841" tool diameter and larger
- Left spiral flutes should not be used on blind holes
- Tool geometry and carbide grade appropriate for material being machined
- Detailed specifications on page 29

USE:

- Flute coolant outlets for reaming thru holes as chips are flushed *forward* through the hole being reamed
- Improves hole finish and permits higher feeds & speeds with longer tool life

TOOL DIAMETER		TYPE 427 NON-FERROUS EDP NO.	TYPE 428 CAST IRON EDP NO.	TYPE 429 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	CARBIDE	OVER-ALL	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						1	2	3	4	5-7	8-14*						
1/4	.2500	42708	42808	42908	\$132.95	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	\$165.65	\$149.25	\$143.80	\$141.15	\$138.35	\$136.20
9/32	.2812	42709	42809	42909	141.00	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	173.65	157.35	151.90	149.25	146.50	144.25
5/16	.3125	42710	42810	42910	149.00	.2792	4	1 1/2	1 1/2	6	0.2841 - 0.3150	181.65	165.25	159.80	157.20	154.35	152.20
11/32	.3438	42711	42811	42911	150.15	.2792	4	1 1/2	1 1/2	6	0.3151 - 0.3470	182.75	166.35	160.95	158.35	155.55	153.30
3/8	.3750	42712	42812	42912	151.60	.3105	4	1 3/4	1 3/4	7	0.3471 - 0.3780	184.35	167.95	162.50	159.85	157.05	154.90
13/32	.4062	42713	42813	42913	152.25	.3105	4	1 3/4	1 3/4	7	0.3781 - 0.4090	184.90	168.60	163.05	160.50	157.65	155.50
7/16	.4375	42714	42814	42914	153.70	.3730	6	1 3/4	1 3/4	7	0.4091 - 0.4410	186.40	170.00	164.55	161.95	159.20	156.90
15/32	.4688	42715	42815	42915	155.05	.3730	6	1 3/4	1 3/4	7	0.4411 - 0.4720	187.70	171.35	165.90	163.30	160.50	158.30
1/2	.5000	42716	42816	42916	157.05	.4355	6	2	2	8	0.4721 - 0.5030	189.75	173.35	167.90	165.25	162.50	160.30
17/32	.5312	42717	42817	42917	160.35	.4355	6	2	2	8	0.5031 - 0.5340	193.00	176.60	171.20	168.60	165.75	163.55
9/16	.5625	42718	42818	42918	162.65	.4355	6	2	2	8	0.5341 - 0.5660	195.35	178.95	173.50	170.90	168.05	165.90
19/32	.5938	42719	42819	42919	166.05	.4355	6	2	2	8	0.5661 - 0.5970	198.70	182.40	176.90	174.30	171.50	169.30
5/8	.6250	42720	42820	42920	169.15	.5615	6	2 1/4	2 1/4	9	0.5971 - 0.6280	201.80	185.45	179.95	177.35	174.55	172.35
21/32	.6562	42721	42821	42921	187.30	.5615	6	2 1/4	2 1/4	9	0.6281 - 0.6590	220.00	203.65	198.15	195.55	192.75	190.50
11/16	.6875	42722	42822	42922	191.10	.5615	6	2 1/4	2 1/4	9	0.6591 - 0.6910	223.75	207.45	201.95	199.35	196.55	194.35
23/32	.7188	42723	42823	42923	195.20	.5615	6	2 1/4	2 1/4	9	0.6911 - 0.7220	227.85	211.45	206.00	203.40	200.60	198.40
3/4	.7500	42724	42824	42924	199.35	.6245	6	2 1/2	2 1/2	9 1/2	0.7221 - 0.7530	232.00	215.65	210.15	207.60	204.75	202.55
25/32	.7812	42725	42825	42925	202.75	.6245	6	2 1/2	2 1/2	9 1/2	0.7531 - 0.7840	235.40	219.05	213.55	210.95	208.10	205.95
13/16	.8125	42726	42826	42926	205.20	.6245	6	2 1/2	2 1/2	9 1/2	0.7841 - 0.8160	237.80	221.50	216.05	213.40	210.65	208.40
27/32	.8438	42727	42827	42927	208.95	.6245	6	2 1/2	2 1/2	9 1/2	0.8161 - 0.8470	241.65	225.30	219.75	217.15	214.35	212.15
7/8	.8750	42728	42828	42928	220.30	.7495	6	2 5/8	2 5/8	10	0.8471 - 0.8780	254.20	237.25	231.50	228.80	225.90	223.60
29/32	.9062	42729	42829	42929	233.25	.7495	6	2 5/8	2 5/8	10	0.8781 - 0.9090	267.15	250.15	244.50	241.80	238.90	236.60
15/16	.9375	42730	42830	42930	244.65	.7495	8	2 5/8	2 5/8	10	0.9091 - 0.9410	278.50	261.55	255.85	253.15	250.20	247.95
31/32	.9688	42731	42831	42931	245.30	.7495	8	2 5/8	2 5/8	10	0.9411 - 0.9720	279.15	262.20	256.45	253.75	250.85	248.55
1	1.0000	42732	42832	42932	245.60	.8745	8	2 3/4	2 3/4	10 1/2	0.9721 - 1.0030	279.50	262.55	256.85	254.10	251.20	248.90
1 1/16	1.0625	42734	42834	42934	259.65	.8745	8	2 3/4	2 3/4	10 1/2	1.0031 - 1.0660	293.55	276.55	270.90	268.15	265.30	262.95
1 1/8	1.1250	42736	42836	42936	260.80	.8745	8	2 7/8	2 7/8	11	1.0661 - 1.1280	294.65	277.65	272.00	269.25	266.40	264.10
1 3/16	1.1875	42738	42838	42938	271.55	.9995	8	2 7/8	2 7/8	11	1.1281 - 1.1905	305.40	288.40	282.75	280.05	277.15	274.85
1 1/4	1.2500	42740	42840	42940	275.10	.9995	8	3	3	11 1/2	1.1906 - 1.2530	309.00	292.05	286.35	283.65	280.70	278.45
1 5/16	1.3125	42742	42842	42942	283.05	.9995	8	3	3	11 1/2	1.2531 - 1.3155	316.95	299.95	294.20	291.55	288.65	286.35
1 3/8	1.3750	42744	42844	42944	294.45	.9995	8	3 1/4	3 1/4	12	1.3156 - 1.3780	328.40	311.40	305.65	303.00	300.10	297.80
1 7/16	1.4375	42746	42846	42946	303.65	.9995	8	3 1/4	3 1/4	12	1.3781 - 1.4405	337.60	320.55	314.90	312.20	309.35	307.00
1 1/2	1.5000	42748	42848	42948	313.85	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406 - 1.5030	347.75	330.80	325.10	322.35	319.45	317.15

*Quantities of 15 or more - price of fractional size in same size range.



COOLANT FED REAMERS CARBIDE TIPPED TYPE 490 FRACTIONAL



**SIMILAR TO BARBER-COLMAN
AND METCUT OFC REAMER**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	490
	40	NON-FERROUS - SHORT CHIPS	490
	60	CAST IRONS	490
	80	LOW STRENGTH STEELS	490
	100	MEDIUM STRENGTH STEELS	490
	120	HIGH STRENGTH STEELS	490
	140	HIGH TEMPERATURE ALLOYS	490

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Cutting diameter reduced for step or pilot
- End chamfer other than 45° included
- End cutting or corner radius
- Increased circular margin
- Increased/decreased tool diameter back taper
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

TYPE 490

- Center coolant outlet
- Flute long carbide
- Right spiral polished flutes: 2° to 5°
- Positive face rake angles (behind center)
- Tool diameter tolerance: plus .0003", minus .0000"
- Pin cross hole
- Radial edged for cutting smooth, accurate holes while maximizing tool life

TOOL DIAMETER		TYPE 490 EDP NO.	PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
FRAC.	DEC.			SHANK DIAM.	SHANK LENGTH	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED						
							FLUTE & CARBIDE	OVER- ALL		1	2	3	4	5-7	8-14*	
3/8	.3750	49012	\$101.55	3/8	3/4	6	1/2	2 1/2	0.3181 - 0.3800	\$164.15	\$132.75	\$122.30	\$117.30	\$111.95	\$107.70	
13/32	.4062	49013	103.05	3/8	3/4	6	1/2	2 5/8	0.3801 - 0.4090	165.65	134.30	123.75	118.75	113.40	109.20	
7/16	.4375	49014	103.05	3/8	3/4	6	1/2	2 5/8	0.4091 - 0.4410	165.65	134.30	123.75	118.75	113.40	109.20	
15/32	.4688	49015	105.85	5/8	1	6	5/8	3 1/2	0.4411 - 0.4720	168.45	137.10	126.65	121.60	116.20	112.00	
1/2	.5000	49016	105.85	5/8	1	6	5/8	3 1/2	0.4721 - 0.5050	168.45	137.10	126.65	121.60	116.20	112.00	
9/16	.5625	49018	115.70	5/8	1	6	3/4	3 3/4	0.5051 - 0.5660	178.30	146.90	136.45	131.45	126.10	121.85	
5/8	.6250	49020	115.70	5/8	1	6	3/4	3 3/4	0.5661 - 0.6300	178.30	146.90	136.45	131.45	126.10	121.85	
11/16	.6875	49022	128.35	5/8	1	6	3/4	4 1/4	0.6301 - 0.6910	191.00	159.60	149.15	144.10	138.75	134.50	
3/4	.7500	49024	128.35	5/8	1	6	3/4	4 1/4	0.6911 - 0.7550	191.00	159.60	149.15	144.10	138.75	134.50	
13/16	.8125	49026	135.40	5/8	1	6	7/8	4 3/4	0.7551 - 0.8160	198.00	166.70	156.15	151.15	145.80	141.60	
7/8	.8750	49028	140.50	5/8	1	6	7/8	4 3/4	0.8161 - 0.8800	205.50	172.95	162.05	156.85	151.30	146.90	
15/16	.9375	49030	168.40	1	1 1/2	8	1	5 1/2	0.8801 - 0.9410	233.35	200.85	189.95	184.75	179.20	174.80	
1	1.0000	49032	168.40	1	1 1/2	8	1	5 1/2	0.9411 - 1.0050	233.35	200.85	189.95	184.75	179.20	174.80	
1 1/16	1.0625	49034	186.40	1	1 1/2	8	1 1/4	6	1.0051 - 1.0660	254.10	220.15	208.85	203.40	197.55	193.00	
1 1/8	1.1250	49036	186.40	1	1 1/2	8	1 1/4	6	1.0661 - 1.1300	254.10	220.15	208.85	203.40	197.55	193.00	
1 3/16	1.1875	49038	191.00	1	1 1/2	8	1 1/4	6	1.1301 - 1.1900	258.75	224.80	213.45	208.00	202.25	197.60	
1 1/4	1.2500	49040	191.00	1	1 1/2	8	1 1/4	6	1.1901 - 1.2550	258.75	224.80	213.45	208.00	202.25	197.60	
1 5/16	1.3125	49042	204.80	1	1 1/2	8	1 1/4	6	1.2551 - 1.3155	272.60	238.60	227.20	221.80	216.00	211.40	
1 3/8	1.3750	49044	204.80	1	1 1/2	8	1 1/4	6	1.3156 - 1.3800	272.60	238.60	227.20	221.80	216.00	211.40	
1 7/16	1.4375	49046	218.50	1	1 1/2	8	1 1/4	6	1.3801 - 1.4405	286.30	252.30	240.90	235.55	229.75	225.15	
1 1/2	1.5000	49048	218.50	1	1 1/2	8	1 1/4	6	1.4406 - 1.5050	286.30	252.30	240.90	235.55	229.75	225.15	
1 9/16	1.5625	49050	229.15	1	1 1/2	10	1 1/4	6	1.5051 - 1.5660	296.95	262.95	251.65	246.20	240.40	235.85	
1 5/8	1.6250	49052	229.15	1	1 1/2	10	1 1/4	6	1.5661 - 1.6300	296.95	262.95	251.65	246.20	240.40	235.85	
1 11/16	1.6875	49054	242.95	1	1 1/2	10	1 1/4	6	1.6301 - 1.6910	310.75	276.80	265.45	260.00	254.20	249.60	
1 3/4	1.7500	49056	242.95	1	1 1/2	10	1 1/4	6	1.6911 - 1.7550	310.75	276.80	265.45	260.00	254.20	249.60	
1 13/16	1.8125	49058	255.15	1	1 1/2	10	1 1/4	6	1.7551 - 1.8160	322.95	288.95	277.60	272.20	266.40	261.80	
1 7/8	1.8750	49060	255.15	1	1 1/2	10	1 1/4	6	1.8161 - 1.8800	322.95	288.95	277.60	272.20	266.40	261.80	
1 15/16	1.9375	49062	267.40	1	1 1/2	10	1 1/4	6	1.8801 - 1.9410	335.10	301.15	289.80	284.45	278.55	274.05	
2	2.0000	49064	267.40	1	1 1/2	10	1 1/4	6	1.9411 - 2.0150	335.10	301.15	289.80	284.45	278.55	274.05	

*Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC STEP REAMERS CARBIDE TIPPED TYPES 457ST, 458ST, 459ST



STRAIGHT FLUTES FLUTE LONG CARBIDE CUTTING OR NON-CUTTING PILOT

TYPE 457ST - FOR NON-FERROUS MATERIALS

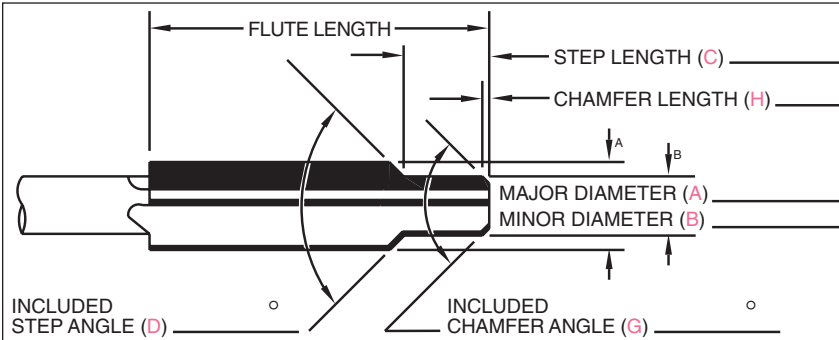
TYPE 458ST - FOR CAST IRONS

TYPE 459ST - FOR STEELS & HIGH TEMP ALLOYS

- Polished flutes; straight flute long carbide and straight shank
- Tool geometry & carbide grade appropriate for material being machined
- Detailed specifications and available modifications on page 89

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	457ST
	40	NON-FERROUS - SHORT CHIPS	457ST/458ST
	60	CAST IRONS	458ST
	80	LOW STRENGTH STEELS	459ST/458ST
	100	MEDIUM STRENGTH STEELS	459ST
	120	HIGH STRENGTH STEELS	459ST
140	HIGH TEMPERATURE ALLOYS	459ST	

NOTE: See pgs. 78 & 79 for non-step reamers (457/458/459)



ORDERING INSTRUCTIONS:

Specify dimensions according to the letters (A, B, C, D, G & H) indicated on line drawing. Also, indicate if pilot is cutting or non-cutting and describe material being machined.

NOTE: Recommended stock removal is 3% per cutting diameter. Maximum between major and minor diameter (cutting or non-cutting pilot) should not exceed 6%. Both major and minor cutting diameter must be within cutting diameter range listed. Non-cutting pilot diameter can be smaller than cutting diameter range as indicated in the "non-cutting pilot minimum diameter" column.

MAJOR & MINOR CUTTING DIAMETER RANGE	DIMENSIONS					TYPE 457ST NON-FERROUS EDP NO.	TYPE 458ST CAST IRON EDP NO.	TYPE 459ST STEEL/ HI-TEMP EDP NO.	FINISHED TO MODIFIED TOOL DIAMETER						
	NON-CUT PILOT MIN. DIAM.	MAX. SHANK DIAM.	NO. OF FLTS	LENGTH					PRICE EACH - BASED ON QUANTITY ORDERED						
				FLUTE & CARB.	OVER-ALL				1	2	3	4	5-7	8-14	OVER 14
0.1770-0.2040	.1660	.1805	4	1 1/8	4 1/2	45706ST	45806ST	45906ST	\$122.55	\$92.00	\$81.75	\$76.90	\$71.65	\$67.55	\$61.60
0.2041-0.2210	.1920	.2075	4	1 1/4	5	45707ST	45807ST	45907ST	122.55	92.00	81.75	76.90	71.65	67.55	61.60
0.2211-0.2380	.2080	.2265	4	1 1/2	6	4572344ST	4582344ST	4592344ST	122.55	92.00	81.75	76.90	71.65	67.55	61.60
0.2381-0.2530	.2240	.2405	4	1 1/2	6	45708ST	45808ST	45908ST	122.55	92.00	81.75	76.90	71.65	67.55	61.60
0.2531-0.2840	.2380	.2485	4	1 1/2	6	45709ST	45809ST	45909ST	123.95	93.40	83.15	78.30	73.10	68.95	62.95
0.2841-0.3150	.2670	.2792	4	1 1/2	6	45710ST	45810ST	45910ST	123.95	93.40	83.15	78.30	73.10	68.95	62.95
0.3151-0.3470	.2960	.2792	4	1 1/2	6	45711ST	45811ST	45911ST	126.15	95.60	85.35	80.55	75.30	71.20	65.20
0.3471-0.3780	.3260	.3105	4	1 3/4	7	45712ST	45812ST	45912ST	126.15	95.60	85.35	80.55	75.30	71.20	65.20
0.3781-0.4090	.3550	.3105	4	1 3/4	7	45713ST	45813ST	45913ST	129.35	98.85	88.65	83.75	78.55	74.40	68.45
0.4091-0.4410	.3850	.3730	6	1 3/4	7	45714ST	45814ST	45914ST	135.05	104.50	94.25	89.35	84.15	80.00	74.10
0.4411-0.4720	.4150	.3730	6	1 3/4	7	45715ST	45815ST	45915ST	140.90	110.40	100.15	95.30	90.05	85.95	79.95
0.4721-0.5030	.4440	.4355	6	2	8	45716ST	45816ST	45916ST	151.00	118.25	107.30	102.10	96.50	92.10	85.70
0.5031-0.5340	.4730	.4355	6	2	8	45717ST	45817ST	45917ST	153.45	120.75	109.80	104.60	98.95	94.55	88.15
0.5341-0.5660	.5020	.4355	6	2	8	45718ST	45818ST	45918ST	153.45	120.75	109.80	104.60	98.95	94.55	88.15
0.5661-0.5970	.5320	.4355	6	2	8	45719ST	45819ST	45919ST	156.85	124.15	113.20	107.95	102.40	97.95	91.55
0.5971-0.6280	.5610	.5615	6	2 1/4	9	45720ST	45820ST	45920ST	156.85	124.15	113.20	107.95	102.40	97.95	91.55
0.6281-0.6590	.5900	.5615	6	2 1/4	9	45721ST	45821ST	45921ST	158.55	125.85	114.85	109.60	104.05	99.60	93.25
0.6591-0.6910	.6200	.5615	6	2 1/4	9	45722ST	45822ST	45922ST	158.55	125.85	114.85	109.60	104.05	99.60	93.25
0.6911-0.7220	.6500	.5615	6	2 1/4	9	45723ST	45823ST	45923ST	162.70	130.00	119.05	113.85	108.25	103.85	97.45
0.7221-0.7530	.6790	.6245	6	2 1/2	9 1/2	45724ST	45824ST	45924ST	162.70	130.00	119.05	113.85	108.25	103.85	97.45
0.7531-0.7840	.7080	.6245	6	2 1/2	9 1/2	45725ST	45825ST	45925ST	166.05	133.35	122.45	117.20	111.55	107.20	100.80
0.7841-0.8160	.7370	.6245	6	2 1/2	9 1/2	45726ST	45826ST	45926ST	166.05	133.35	122.45	117.20	111.55	107.20	100.80
0.8161-0.8470	.7670	.6245	6	2 1/2	9 1/2	45727ST	45827ST	45927ST	170.05	137.35	126.40	121.20	115.60	111.20	104.80
0.8471-0.8780	.7970	.7495	6	2 3/8	10	45728ST	45828ST	45928ST	176.50	142.55	131.20	125.80	119.95	115.40	108.75
0.8781-0.9090	.8260	.7495	6	2 3/8	10	45729ST	45829ST	45929ST	194.45	160.50	149.10	143.75	137.90	133.35	126.70
0.9091-0.9410	.8550	.7495	8	2 3/8	10	45730ST	45830ST	45930ST	194.45	160.50	149.10	143.75	137.90	133.35	126.70
0.9411-0.9720	.8850	.7495	8	2 3/8	10	45731ST	45831ST	45931ST	200.50	166.55	155.20	149.75	143.90	139.35	132.70
0.9721-1.0030	.9140	.8745	8	2 3/4	10 1/2	45732ST	45832ST	45932ST	200.50	166.55	155.20	149.75	143.90	139.35	132.70
1.0031-1.0660	.9430	.8745	8	2 3/4	10 1/2	45734ST	45834ST	45934ST	202.20	169.65	158.70	153.55	147.95	143.60	137.25
1.0661-1.1280	1.0020	.8745	8	2 3/4	11	45736ST	45836ST	45936ST	213.55	181.00	170.15	165.00	159.40	155.00	148.65
1.1281-1.1905	1.0610	.9995	8	2 3/4	11	45738ST	45838ST	45938ST	220.40	187.80	176.90	171.75	166.15	161.75	155.40
1.1906-1.2530	1.1200	.9995	8	3	11 1/2	45740ST	45840ST	45940ST	232.95	200.45	189.50	184.35	178.80	174.40	168.05
1.2531-1.3155	1.1780	.9995	8	3	11 1/2	45742ST	45842ST	45942ST	237.60	205.05	194.20	189.00	183.45	179.00	172.65
1.3156-1.3780	1.2370	.9995	8	3 1/4	12	45744ST	45844ST	45944ST	249.10	216.55	205.70	200.50	194.90	190.50	184.15
1.3781-1.4405	1.2960	.9995	8	3 1/4	12	45746ST	45846ST	45946ST	264.30	231.70	220.80	215.60	210.05	205.70	199.30
1.4406-1.5030	1.3550	1.2495	8	3 1/2	12 1/2	45748ST	45848ST	45948ST	270.15	237.60	226.75	221.55	216.00	211.60	205.20



MATERIAL SPECIFIC STEP REAMERS CARBIDE TIPPED TYPES 442ST, 443ST, 444ST



**RIGHT SPIRAL FLUTES
FLUTE LONG CARBIDE
CUTTING OR NON-CUTTING PILOT**

TYPE 442ST - FOR NON-FERROUS MATERIALS

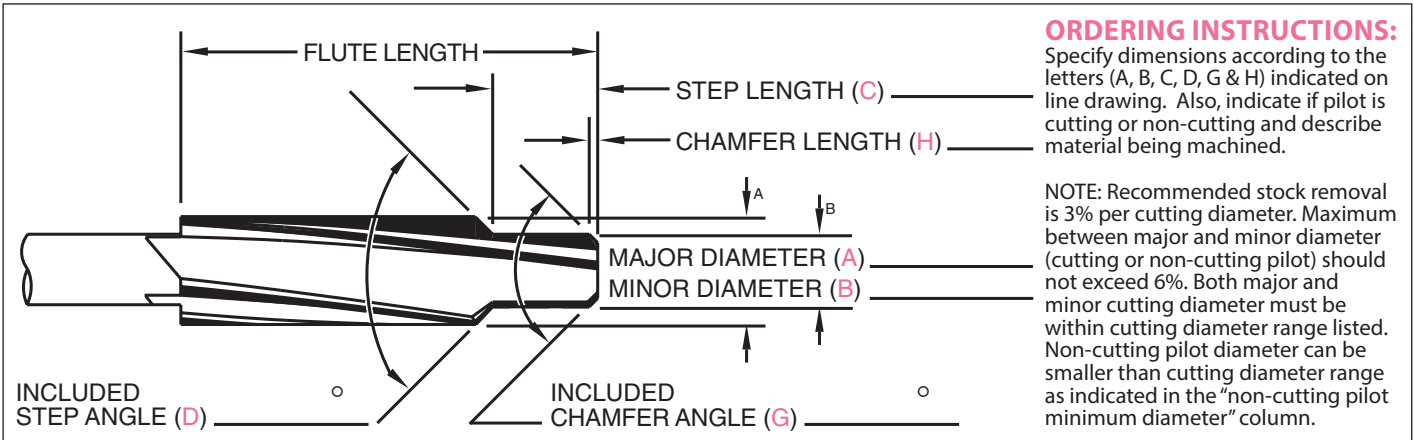
TYPE 443ST - FOR CAST IRONS

TYPE 444ST - FOR STEELS & HIGH TEMP ALLOYS

- Polished flutes; right spiral flute long carbide and straight shank
- Tool geometry & carbide grade appropriate for material being machined
- Detailed specifications and available modifications on page 89

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	442ST
	40	NON-FERROUS - SHORT CHIPS	442ST/443ST
	60	CAST IRONS	443ST
	80	LOW STRENGTH STEELS	444ST/443ST
	100	MEDIUM STRENGTH STEELS	444ST
	120	HIGH STRENGTH STEELS	444ST
140	HIGH TEMPERATURE ALLOYS	444ST	

NOTE: See page 85 for non-step reamers (442/443/444)



MAJOR & MINOR CUTTING DIAMETER RANGE	DIMENSIONS					TYPE 442ST NON-FERROUS EDP NO.	TYPE 443ST CAST IRON EDP NO.	TYPE 444ST STEEL/ HI-TEMP EDP NO.	FINISHED TO MODIFIED TOOL DIAMETER						
	NON-CUT PILOT MIN. DIAM.	MAX. SHANK DIAM.	NO. OF FLTS	LENGTH					PRICE EACH - BASED ON QUANTITY ORDERED						
				FLT & CARB.	OVER-ALL				1	2	3	4	5-7	8-14	OVER 14
0.2841 - 0.3150	.2670	.2792	4	1 1/2	6	44210ST	44310ST	44410ST	\$135.50	\$106.85	\$97.30	\$92.70	\$87.85	\$84.00	\$78.35
0.3151 - 0.3470	.2960	.2792	4	1 1/2	6	44211ST	44311ST	44411ST	143.50	114.80	105.20	100.70	95.75	91.95	86.30
0.3471 - 0.3780	.3260	.3105	4	1 3/4	7	44212ST	44312ST	44412ST	144.25	115.65	106.05	101.50	96.60	92.70	87.15
0.3781 - 0.4090	.3550	.3105	4	1 3/4	7	44213ST	44313ST	44413ST	148.15	119.50	109.95	105.35	100.45	96.60	91.00
0.4091 - 0.4410	.3850	.3730	6	1 3/4	7	44214ST	44314ST	44414ST	151.60	123.00	113.40	108.85	103.95	100.10	94.50
0.4411 - 0.4720	.4150	.3730	6	1 3/4	7	44215ST	44315ST	44415ST	157.65	129.00	119.45	114.85	110.00	106.10	100.50
0.4721 - 0.5030	.4440	.4355	6	2	8	44216ST	44316ST	44416ST	169.30	138.75	128.50	123.65	118.45	114.30	108.35
0.5031 - 0.5340	.4730	.4355	6	2	8	44217ST	44317ST	44417ST	172.45	141.90	131.70	126.85	121.60	117.50	111.50
0.5341 - 0.5660	.5020	.4355	6	2	8	44218ST	44318ST	44418ST	172.45	141.90	131.70	126.85	121.60	117.50	111.50
0.5661 - 0.5970	.5320	.4355	6	2	8	44219ST	44319ST	44419ST	175.70	145.25	135.05	130.15	124.90	120.80	114.80
0.5971 - 0.6280	.5610	.5615	6	2 1/4	9	44220ST	44320ST	44420ST	175.70	145.25	135.05	130.15	124.90	120.80	114.80
0.6281 - 0.6590	.5900	.5615	6	2 1/4	9	44221ST	44321ST	44421ST	179.35	148.90	138.60	133.75	128.50	124.40	118.45
0.6591 - 0.6910	.6200	.5615	6	2 1/4	9	44222ST	44322ST	44422ST	186.75	156.20	145.95	141.10	135.90	131.80	125.80
0.6911 - 0.7220	.6500	.5615	6	2 1/4	9	44223ST	44323ST	44423ST	188.65	158.10	147.90	143.00	137.80	133.65	127.75
0.7221 - 0.7530	.6790	.6245	6	2 1/2	9 1/2	44224ST	44324ST	44424ST	190.50	160.00	149.75	144.90	139.70	135.55	129.55
0.7531 - 0.7840	.7080	.6245	6	2 1/2	9 1/2	44225ST	44325ST	44425ST	193.95	163.45	153.20	148.35	143.10	139.00	133.00
0.7841 - 0.8160	.7370	.6245	6	2 1/2	9 1/2	44226ST	44326ST	44426ST	193.95	163.45	153.20	148.35	143.10	139.00	133.00
0.8161 - 0.8470	.7670	.6245	6	2 1/2	9 1/2	44227ST	44327ST	44427ST	201.20	170.70	160.45	155.60	150.30	146.25	140.25
0.8471 - 0.8780	.7970	.7495	6	2 5/8	10	44228ST	44328ST	44428ST	208.75	177.15	166.50	161.50	156.00	151.85	145.55
0.8781 - 0.9090	.8260	.7495	6	2 5/8	10	44229ST	44329ST	44429ST	232.75	201.00	190.40	185.40	179.95	175.65	169.40
0.9091 - 0.9410	.8550	.7495	8	2 5/8	10	44230ST	44330ST	44430ST	232.75	201.00	190.40	185.40	179.95	175.65	169.40
0.9411 - 0.9720	.8850	.7495	8	2 5/8	10	44231ST	44331ST	44431ST	241.05	209.35	198.75	193.65	188.25	184.00	177.80
0.9721 - 1.0030	.9140	.8745	8	2 3/4	10 1/2	44232ST	44332ST	44432ST	241.05	209.35	198.75	193.65	188.25	184.00	177.80
1.0031 - 1.0660	.9430	.8745	8	2 3/4	10 1/2	44234ST	44334ST	44434ST	272.15	240.45	229.85	224.80	219.40	215.15	208.95
1.0661 - 1.1280	1.0020	.8745	8	2 7/8	11	44236ST	44336ST	44436ST	278.65	246.95	236.30	231.30	225.85	221.60	215.40
1.1281 - 1.1905	1.0610	.9995	8	2 7/8	11	44238ST	44338ST	44438ST	289.70	258.05	247.40	242.40	236.95	232.70	226.45
1.1906 - 1.2530	1.1200	.9995	8	3	11 1/2	44240ST	44340ST	44440ST	302.75	271.05	260.45	255.40	250.00	245.70	239.50
1.2531 - 1.3155	1.1780	.9995	8	3	11 1/2	44242ST	44342ST	44442ST	328.40	296.70	286.05	281.05	275.55	271.30	265.10
1.3156 - 1.3780	1.2370	.9995	8	3 1/4	12	44244ST	44344ST	44444ST	353.65	321.95	311.40	306.30	300.90	296.60	290.45
1.3781 - 1.4405	1.2960	.9995	8	3 1/4	12	44246ST	44346ST	44446ST	370.90	339.20	328.65	323.55	318.15	313.85	307.70
1.4406 - 1.5030	1.3550	1.2495	8	3 1/2	12 1/2	44248ST	44348ST	44448ST	388.30	356.70	346.05	341.05	335.60	331.35	325.10

REAMERS

MATERIAL SPECIFIC STEP REAMERS CARBIDE TIPPED TYPES 482ST, 483ST, 484ST

LEFT SPIRAL FLUTES FLUTE LONG CARBIDE CUTTING OR NON-CUTTING PILOT

TYPE 482ST - FOR NON-FERROUS MATERIALS

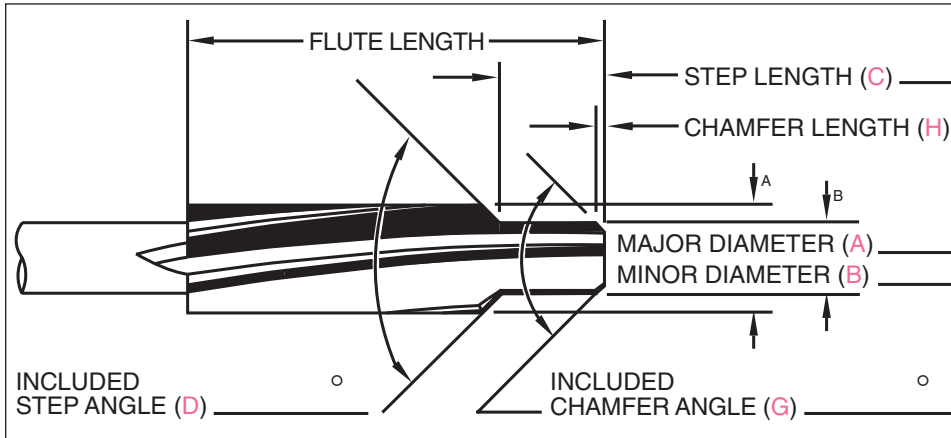
TYPE 483ST - FOR CAST IRONS

TYPE 484ST - FOR STEELS & HIGH TEMP ALLOYS

- Polished flutes; left spiral flute long carbide and straight shank
- Left spiral flutes should not be used on blind holes
- Tool geometry & carbide grade appropriate for material being machined
- Detailed specifications and available modifications on page 89

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	482ST
	40	NON-FERROUS - SHORT CHIPS	482ST/483ST
	60	CAST IRONS	483ST
	80	LOW STRENGTH STEELS	484ST/483ST
	100	MEDIUM STRENGTH STEELS	484ST
	120	HIGH STRENGTH STEELS	484ST
140	HIGH TEMPERATURE ALLOYS	484ST	

NOTE: See page 87 for non-step reamers (482/483/484)



ORDERING INSTRUCTIONS:

Specify dimensions according to the letters (A, B, C, D, G & H) indicated on line drawing. Also, indicate if pilot is cutting or non-cutting and describe material being machined.

NOTE: Recommended stock removal is 3% per cutting diameter. Maximum between major and minor diameter (cutting or non-cutting pilot) should not exceed 6%. Both major and minor cutting diameter must be within cutting diameter range listed. Non-cutting pilot diameter can be smaller than cutting diameter range as indicated in the "non-cutting pilot minimum diameter" column.

MAJOR & MINOR CUTTING DIAMETER RANGE	DIMENSIONS					TYPE 482ST NON-FERROUS EDP NO.	TYPE 483ST CAST IRON EDP NO.	TYPE 484ST STEEL/ HI-TEMP EDP NO.	FINISHED TO MODIFIED TOOL DIAMETER						
	NON-CUT PILOT MIN. DIAM.	MAX. SHANK DIAM.	NO. OF FLTS	LENGTH					PRICE EACH - BASED ON QUANTITY ORDERED						
				FLT & CARB.	OVER-ALL				1	2	3	4	5-7	8-14	OVER 14
0.2841 - 0.3150	.2670	.2792	4	1 1/2	6	48210ST	48310ST	48410ST	\$144.55	\$114.00	\$103.80	\$98.90	\$93.65	\$89.55	\$83.60
0.3151 - 0.3470	.2960	.2792	4	1 1/2	6	48211ST	48311ST	48411ST	153.05	122.50	112.25	107.40	102.15	98.05	92.05
0.3471 - 0.3780	.3260	.3105	4	1 3/4	7	48212ST	48312ST	48412ST	153.90	123.30	113.15	108.25	103.00	98.90	92.90
0.3781 - 0.4090	.3550	.3105	4	1 3/4	7	48213ST	48313ST	48413ST	157.95	127.40	117.25	112.35	107.10	103.00	97.05
0.4091 - 0.4410	.3850	.3730	6	1 3/4	7	48214ST	48314ST	48414ST	161.70	131.20	120.95	116.15	110.90	106.80	100.80
0.4411 - 0.4720	.4150	.3730	6	1 3/4	7	48215ST	48315ST	48415ST	168.15	137.60	127.35	122.55	117.30	113.20	107.20
0.4721 - 0.5030	.4440	.4355	6	2	8	48216ST	48316ST	48416ST	173.80	142.50	131.95	127.00	121.60	117.40	111.25
0.5031 - 0.5340	.4730	.4355	6	2	8	48217ST	48317ST	48417ST	177.10	145.75	135.25	130.20	124.90	120.65	114.45
0.5341 - 0.5660	.5020	.4355	6	2	8	48218ST	48318ST	48418ST	177.10	145.75	135.25	130.20	124.90	120.65	114.45
0.5661 - 0.5970	.5320	.4355	6	2	8	48219ST	48319ST	48419ST	180.50	149.15	138.60	133.60	128.25	124.05	117.85
0.5971 - 0.6280	.5610	.5615	6	2 1/4	9	48220ST	48320ST	48420ST	180.50	149.15	138.60	133.60	128.25	124.05	117.85
0.6281 - 0.6590	.5900	.5615	6	2 1/4	9	48221ST	48321ST	48421ST	184.20	152.85	142.35	137.35	131.95	127.75	121.60
0.6591 - 0.6910	.6200	.5615	6	2 1/4	9	48222ST	48322ST	48422ST	191.75	160.40	149.90	144.90	139.50	135.30	129.15
0.6911 - 0.7220	.6500	.5615	6	2 1/4	9	48223ST	48323ST	48423ST	193.70	162.40	151.90	146.85	141.55	137.30	131.10
0.7221 - 0.7530	.6790	.6245	6	2 1/2	9 1/2	48224ST	48324ST	48424ST	195.65	164.25	153.75	148.80	143.45	139.20	133.05
0.7531 - 0.7840	.7080	.6245	6	2 1/2	9 1/2	48225ST	48325ST	48425ST	199.20	167.80	157.35	152.30	146.90	142.70	136.55
0.7841 - 0.8160	.7370	.6245	6	2 1/2	9 1/2	48226ST	48326ST	48426ST	199.20	167.80	157.35	152.30	146.90	142.70	136.55
0.8161 - 0.8470	.7670	.6245	6	2 1/2	9 1/2	48227ST	48327ST	48427ST	206.60	175.25	164.75	159.70	154.35	150.15	144.00
0.8471 - 0.8780	.7970	.7495	6	2 5/8	10	48228ST	48328ST	48428ST	214.35	181.85	170.95	165.75	160.20	155.80	149.45
0.8781 - 0.9090	.8260	.7495	6	2 5/8	10	48229ST	48329ST	48429ST	239.00	206.40	195.55	190.35	184.75	180.35	174.00
0.9091 - 0.9410	.8550	.7495	8	2 5/8	10	48230ST	48330ST	48430ST	239.00	206.40	195.55	190.35	184.75	180.35	174.00
0.9411 - 0.9720	.8850	.7495	8	2 5/8	10	48231ST	48331ST	48431ST	247.55	215.00	204.05	198.85	193.35	188.95	182.55
0.9721 - 1.0030	.9140	.8745	8	2 3/4	10 1/2	48232ST	48332ST	48432ST	247.55	215.00	204.05	198.85	193.35	188.95	182.55
1.0031 - 1.0660	.9430	.8745	8	2 3/4	10 1/2	48234ST	48334ST	48434ST	279.45	246.95	236.05	230.85	225.30	220.90	214.45
1.0661 - 1.1280	1.0020	.8745	8	2 7/8	11	48236ST	48336ST	48436ST	286.05	253.60	242.65	237.45	231.95	227.55	221.20
1.1281 - 1.1905	1.0610	.9995	8	2 7/8	11	48238ST	48338ST	48438ST	297.45	264.90	254.05	248.85	243.25	238.95	232.50
1.1906 - 1.2530	1.1200	.9995	8	3	11 1/2	48240ST	48340ST	48440ST	310.85	278.35	267.45	262.25	256.70	252.30	245.90
1.2531 - 1.3155	1.1780	.9995	8	3	11 1/2	48242ST	48342ST	48442ST	337.20	304.60	293.75	288.60	283.00	278.55	272.20
1.3156 - 1.3780	1.2370	.9995	8	3 1/4	12	48244ST	48344ST	48444ST	363.15	330.65	319.70	314.55	308.95	304.55	298.20
1.3781 - 1.4405	1.2960	.9995	8	3 1/4	12	48246ST	48346ST	48446ST	380.85	348.35	337.40	332.20	326.70	322.30	315.95
1.4406 - 1.5030	1.3550	1.2495	8	3 1/2	12 1/2	48248ST	48348ST	48448ST	398.80	366.20	355.25	350.10	344.55	340.15	333.80



SOLID CARBIDE REAMERS



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REAMERS



SOLID CARBIDE REAMERS TECHNICAL INFORMATION

REAMER BASICS

- The reamer is used to finish machine a previously formed hole to an exact diameter with a smooth finish. It should **not** be used to significantly enlarge a hole (max. 5% – depending on material and hardness).
- Carbide reamers are especially appropriate for close tolerance reaming. Because carbide is very highly resistant to wear, the reamer will produce accurate hole size and a smooth finish far longer than high speed steel or cobalt.
- The reamer is an end cutting tool, cutting only on the chamfer's edge at the outside diameter of the preformed hole.

The standard 45° chamfer angle provides effective cutting action for most materials.

• Reamer Types:

- General Purpose** – Superior performance over high speed steel and cobalt; good in a wide variety of materials
- Material Specific** – Excellent in large production runs due to material specific tool geometry
- Coolant Fed** – Exceptional performance and tool life using material specific reamer technology and coolant fed capabilities; maximizes feeds & speeds

TECHNICAL REAMING GUIDE INFORMATION PAGES 23-29

Contact us for a PDF copy of "HANNIBAL'S Guide to Cost Effective Reaming." It includes:

Reamer Expedite Fees: Order must be received by 2:00 PM CST
18 pieces max per diameter
Does NOT require air shipment of the product

Reamer Diameter	Service	Fee
Up to 1.0000"	24 Hour	75.00
Up to 1.0000"	48 Hour	50.00
Over 1.0000"	48 Hour	75.00
Over 1.0000"	72 Hour	50.00

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank

• Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

- Solid carbide head and straight shank
- Tool diameter tolerance - thru .2500": plus .0002", minus .0000"
over .2500": plus .0003", minus .0000"
- Shank diameter tolerance: plus .0000", minus .0010"



COOLANT FED MATERIAL SPECIFIC REAMERS

SOLID CARBIDE TYPES 806, 807, 808, & 809



SHORT SERIES CENTER AND FLUTE FED COOLANT STRAIGHT FLUTES



Center Fed Coolant Holes



Flute Fed Coolant Holes

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	807/809
	40	NON-FERROUS - SHORT CHIPS	807/809
	60	CAST IRONS	806/808
	80	LOW STRENGTH STEELS	806/808
	100	MEDIUM STRENGTH STEELS	806/808
	120	HIGH STRENGTH STEELS	806/808
	140	HIGH TEMPERATURE ALLOYS	806/808

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available: See page 101

TYPE 806 - STRAIGHT FLUTES - FOR CAST IRONS & STEELS TYPE 807 - STRAIGHT FLUTES - FOR NON-FERROUS MATERIALS

- Solid carbide head and straight shank
- Tool diameter tolerance - thru .2500": plus .0002", minus .0000"
over .2500": plus .0003", minus .0000"
- Shank diameter tolerance: plus .0000", minus .0010"
- Tool geometry appropriate for material being machined

CENTER FED COOLANT

TOOL DIAMETER RANGE	DIMENSIONS				STRAIGHT - CENTER FED		FINISHED TO MODIFIED TOOL DIAMETER						
	MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH		TYPE 807 NON-FERROUS	TYPE 806 CAST IRON/STEEL	PRICE EACH - BASED ON QUANTITY ORDERED						
			FLT	OVER-ALL			1	2	3	4	5-7	8-14	OVER 14
.1121-.1280	.1099	4	5/8	2 1/4	80708	80608	\$112.30	\$97.25	\$92.25	\$89.85	\$87.20	\$85.20	\$82.25
.1281-.1435	.1255	4	3/4	2 1/2	80709	80609	113.10	98.00	93.10	90.60	88.05	86.00	83.05
.1436-.1590	.1411	4	3/4	2 1/2	80710	80610	113.55	98.55	93.55	91.10	88.50	86.45	83.55
.1591-.1750	.1567	4	7/8	2 3/4	80711	80611	114.65	99.65	94.65	92.20	89.60	87.55	84.65
.1751-.1910	.1724	4	7/8	2 3/4	80712	80612	119.25	104.15	99.20	96.75	94.20	92.15	89.20
.1911-.2210	.1880	6	1	3	80714	80614	121.00	105.95	100.95	98.55	95.95	93.90	91.00
.2211-.2530	.2193	6	1	3	80716	80616	123.15	108.10	103.10	100.70	98.05	96.10	93.15
.2531-.2840	.2505	6	1 1/8	3 1/4	80718	80618	126.70	111.60	106.65	104.15	101.60	99.60	96.60
.2841-.3150	.2817	6	1 1/8	3 1/4	80720	80620	129.60	114.55	109.55	107.10	104.55	102.55	99.60
.3151-.3470	.3130	6	1 1/4	3 1/2	80722	80622	133.20	118.10	113.15	110.65	108.10	106.10	103.10
.3471-.3780	.3443	6	1 1/4	3 1/2	80724	80624	137.25	122.15	117.20	114.75	112.15	110.15	107.20
.3781-.4090	.3755	6	1 3/8	3 3/4	80726	80626	143.60	128.55	123.60	121.10	118.55	116.50	113.55

TYPE 808 - STRAIGHT FLUTES - FOR CAST IRONS & STEELS TYPE 809 - STRAIGHT FLUTES - FOR NON-FERROUS MATERIALS

FLUTE FED COOLANT

TOOL DIAMETER RANGE	DIMENSIONS				STRAIGHT - FLUTE FED		FINISHED TO MODIFIED TOOL DIAMETER						
	MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH		TYPE 809 NON-FERROUS	TYPE 808 CAST IRON/STEEL	PRICE EACH - BASED ON QUANTITY ORDERED						
			FLT	OVER-ALL			1	2	3	4	5-7	8-14	OVER 14
.1121-.1280	.1099	4	5/8	2 1/4	80908	80808	\$158.90	\$143.85	\$138.85	\$136.45	\$133.80	\$131.85	\$128.90
.1281-.1435	.1255	4	3/4	2 1/2	80909	80809	150.95	135.85	130.90	128.40	125.85	123.85	120.90
.1436-.1590	.1411	4	3/4	2 1/2	80910	80810	160.45	145.35	140.45	137.95	135.40	133.35	130.40
.1591-.1750	.1567	4	7/8	2 3/4	80911	80811	161.85	146.80	141.85	139.40	136.80	134.75	131.85
.1751-.1910	.1724	4	7/8	2 3/4	80912	80812	162.85	147.80	142.80	140.35	137.75	135.75	132.80
.1911-.2210	.1880	6	1	3	80914	80814	195.70	180.65	175.65	173.20	170.60	168.65	165.65
.2211-.2530	.2193	6	1	3	80916	80816	198.10	183.05	178.10	175.60	173.05	171.00	168.05
.2531-.2840	.2505	6	1 1/8	3 1/4	80918	80818	202.35	187.25	182.35	179.85	177.30	175.25	172.30
.2841-.3150	.2817	6	1 1/8	3 1/4	80920	80820	205.70	190.70	185.70	183.20	180.65	178.60	175.65
.3151-.3470	.3130	6	1 1/4	3 1/2	80922	80822	218.80	203.75	198.75	196.30	193.70	191.75	188.75
.3471-.3780	.3443	6	1 1/4	3 1/2	80924	80824	223.45	208.40	203.45	200.95	198.40	196.35	193.40
.3781-.4090	.3755	6	1 3/8	3 3/4	80926	80826	231.10	216.05	211.05	208.60	206.00	204.00	201.00



COOLANT FED MATERIAL SPECIFIC REAMERS

SOLID CARBIDE TYPES 816, 817, 828, & 829



SHORT SERIES CENTER AND FLUTE FED COOLANT RIGHT OR LEFT SPIRAL FLUTES



Right Spiral Flutes for Blind Holes



Left Spiral Flutes for Through Holes

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	817/829
40	NON-FERROUS - SHORT CHIPS	817/829	
60	CAST IRONS	816/828	
80	LOW STRENGTH STEELS	816/828	
100	MEDIUM STRENGTH STEELS	816/828	
120	HIGH STRENGTH STEELS	816/828	
140	HIGH TEMPERATURE ALLOYS	816/828	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available: See page 101

REAMERS

TYPE 816 - RIGHT SPIRAL FLUTES - FOR CAST IRONS & STEELS TYPE 817 - RIGHT SPIRAL FLUTES - FOR NON-FERROUS MATERIALS CENTER FED COOLANT

TOOL DIAMETER RANGE	DIMENSIONS				RIGHT - CENTER FED		FINISHED TO MODIFIED TOOL DIAMETER						
	MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH		TYPE 817 NON-FERROUS	TYPE 816 CAST IRON/STEEL	PRICE EACH - BASED ON QUANTITY ORDERED						
			FLT	OVER-ALL			1	2	3	4	5-7	8-14	OVER 14
.1121-.1280	.1099	4	5/8	2 1/4	81708	81608	\$115.15	\$100.05	\$95.10	\$92.60	\$90.05	\$88.05	\$85.05
.1281-.1435	.1255	4	3/4	2 1/2	81709	81609	115.90	100.85	95.85	93.45	90.80	88.85	85.90
.1436-.1590	.1411	4	3/4	2 1/2	81710	81610	116.40	101.30	96.40	93.90	91.35	89.30	86.35
.1591-.1750	.1567	4	7/8	2 3/4	81711	81611	117.50	102.50	97.50	95.00	92.45	90.40	87.45
.1751-.1910	.1724	4	7/8	2 3/4	81712	81612	122.05	107.00	102.00	99.60	96.95	94.95	92.05
.1911-.2210	.1880	6	1	3	81714	81614	123.80	108.75	103.75	101.25	98.70	96.70	93.70
.2211-.2530	.2193	6	1	3	81716	81616	125.90	110.90	105.90	103.40	100.85	98.85	95.85
.2531-.2840	.2505	6	1 1/8	3 1/4	81718	81618	129.40	114.40	109.40	106.95	104.35	102.30	99.40
.2841-.3150	.2817	6	1 1/8	3 1/4	81720	81620	132.35	117.35	112.35	109.90	107.30	105.25	102.30
.3151-.3470	.3130	6	1 1/4	3 1/2	81722	81622	136.00	120.95	115.95	113.50	110.95	108.90	105.95
.3471-.3780	.3443	6	1 1/4	3 1/2	81724	81624	140.85	125.80	120.80	118.40	115.75	113.75	110.85
.3781-.4090	.3755	6	1 3/8	3 3/4	81726	81626	147.30	132.25	127.25	124.80	122.20	120.20	117.30

TYPE 828 - LEFT SPIRAL FLUTES - FOR CAST IRONS & STEELS TYPE 829 - LEFT SPIRAL FLUTES - FOR NON-FERROUS MATERIALS FLUTE FED COOLANT

TOOL DIAMETER RANGE	DIMENSIONS				LEFT - FLUTE FED		FINISHED TO MODIFIED TOOL DIAMETER						
	MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH		TYPE 829 NON-FERROUS	TYPE 828 CAST IRON/STEEL	PRICE EACH - BASED ON QUANTITY ORDERED						
			FLT	OVER-ALL			1	2	3	4	5-7	8-14	OVER 14
.1121-.1280	.1099	4	5/8	2 1/4	82908	82808	\$181.75	\$166.70	\$161.75	\$159.30	\$156.70	\$154.65	\$151.70
.1281-.1435	.1255	4	3/4	2 1/2	82909	82809	182.75	167.70	162.70	160.30	157.65	155.65	152.70
.1436-.1590	.1411	4	3/4	2 1/2	82910	82810	183.30	168.25	163.30	160.80	158.25	156.25	153.25
.1591-.1750	.1567	4	7/8	2 3/4	82911	82811	184.60	169.50	164.55	162.10	159.50	157.50	154.55
.1751-.1910	.1724	4	7/8	2 3/4	82912	82812	185.45	170.40	165.45	162.95	160.40	158.35	155.40
.1911-.2210	.1880	6	1	3	82914	82814	239.80	224.75	219.75	217.30	214.70	212.75	209.80
.2211-.2530	.2193	6	1	3	82916	82816	239.60	224.60	219.60	217.15	214.55	212.50	209.60
.2531-.2840	.2505	6	1 1/8	3 1/4	82918	82818	243.80	228.75	223.75	221.35	218.70	216.70	213.80
.2841-.3150	.2817	6	1 1/8	3 1/4	82920	82820	247.20	232.20	227.20	224.75	222.20	220.15	217.20
.3151-.3470	.3130	6	1 1/4	3 1/2	82922	82822	260.25	245.25	240.25	237.75	235.20	233.15	230.20
.3471-.3780	.3443	6	1 1/4	3 1/2	82924	82824	264.95	249.95	244.95	242.50	239.90	237.90	234.95
.3781-.4090	.3755	6	1 3/8	3 3/4	82926	82826	272.75	257.65	252.70	250.25	247.65	245.65	242.70



MATERIAL SPECIFIC REAMERS

SOLID CARBIDE TYPES 802, 803, 812, 813, 822, 823



SHORT SERIES STRAIGHT, RIGHT SPIRAL, OR LEFT SPIRAL FLUTES STRAIGHT SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	803/813/823
40	NON-FERROUS - SHORT CHIPS	803/813/823	
60	CAST IRONS	802/812/822	
80	LOW STRENGTH STEELS	802/812/822	
100	MEDIUM STRENGTH STEELS	802/812/822	
120	HIGH STRENGTH STEELS	802/812/822	
140	HIGH TEMPERATURE ALLOYS	802/812/822	

TYPE 803 - STRAIGHT FLUTES - FOR NON-FERROUS MATERIALS
TYPE 802 - STRAIGHT FLUTES - FOR CAST IRONS & STEELS

- Solid carbide head and straight shank
- Tool diameter tolerance thru .2500": plus .0002", minus .0000"
over .2500": plus .0003", minus .0000"

MODIFICATIONS (See list on page 101)

- Shank diameter tolerance: plus .0000", minus .0010"
- Tool geometry appropriate for material being machined

TOOL DIAMETER RANGE	DIMENSIONS				EDP NO. - STRAIGHT		FINISHED TO MODIFIED TOOL DIAMETER						
	MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH		TYPE 803 NON-FERROUS	TYPE 802 CAST IRON/STEEL	PRICE EACH - BASED ON QUANTITY ORDERED						
			FLT	OVER-ALL			1	2	3	4	5-7	8-14	OVER 14
*0.0591 - 0.0660	.0580	4	3/8	1 1/2	-	80204	\$62.30	\$38.75	\$30.90	\$27.20	\$23.20	\$20.00	\$15.40
*0.0661 - 0.0740	.0650	4	1/2	1 3/4	-	80245	62.50	38.95	31.10	27.35	23.35	20.20	15.60
*0.0741 - 0.0810	.0730	4	1/2	1 3/4	-	80205	62.55	39.05	31.15	27.50	23.40	20.30	15.65
*0.0811 - 0.0890	.0800	4	1/2	2	-	80255	62.95	39.45	31.60	27.90	23.90	20.70	16.10
*0.0891 - 0.0970	.0880	4	1/2	2	-	80206	63.35	39.80	31.95	28.25	24.25	21.00	16.45
*0.0971 - 0.1120	.0943	4	5/8	2 1/4	80307	80207	63.60	40.05	32.20	28.50	24.45	21.30	16.70
0.1121 - 0.1280	.1099	4	5/8	2 1/4	80308	80208	64.70	41.15	33.30	29.60	25.55	22.40	17.80
0.1281 - 0.1435	.1255	4	3/4	2 1/2	80309	80209	65.15	41.65	33.75	30.10	26.05	22.90	18.25
0.1436 - 0.1590	.1411	4	3/4	2 1/2	80310	80210	66.25	42.70	34.85	31.15	27.15	23.95	19.35
0.1591 - 0.1750	.1567	4	7/8	2 3/4	80311	80211	68.75	45.20	37.35	33.65	29.65	26.45	21.85
0.1751 - 0.1910	.1724	4	7/8	2 3/4	80312	80212	70.40	46.90	39.05	35.35	31.25	28.15	23.50
0.1911 - 0.2210	.1880	6	1	3	80314	80214	73.30	49.80	41.95	38.25	34.25	31.05	26.45
0.2211 - 0.2530	.2193	6	1	3	80316	80216	78.30	54.80	46.95	43.25	39.25	36.05	31.45
0.2531 - 0.2840	.2505	6	1 1/8	3 1/4	80318	80218	84.15	60.60	52.75	49.05	45.05	41.85	37.25
0.2841 - 0.3150	.2817	6	1 1/8	3 1/4	80320	80220	90.55	67.00	59.10	55.45	51.45	48.25	43.65
0.3151 - 0.3470	.3130	6	1 1/4	3 1/2	80322	80222	100.00	76.55	68.70	65.00	60.95	57.70	53.20
0.3471 - 0.3780	.3443	6	1 1/4	3 1/2	80324	80224	101.30	77.80	70.00	66.25	62.25	59.00	54.45
0.3781 - 0.4090	.3755	6	1 3/8	3 3/4	80326	80226	109.70	86.15	78.30	74.55	70.55	67.40	62.75
0.4091 - 0.4410	.4067	6	1 3/8	3 3/4	80328	80228	110.60	87.05	79.20	75.50	71.50	68.30	63.70
0.4411 - 0.4720	.4380	6	1 1/2	4	80330	80230	117.35	93.80	85.95	82.25	78.25	75.10	70.45
0.4721 - 0.5150	.4693	6	1 1/2	4	80332	80232	123.85	100.35	92.45	88.80	84.75	81.60	76.95

TYPE 813 - RIGHT SPIRAL FLUTES - FOR NON-FERROUS MATERIALS
TYPE 812 - RIGHT SPIRAL FLUTES - FOR CAST IRONS & STEELS
TYPE 823 - LEFT SPIRAL FLUTES - FOR NON-FERROUS MATERIALS
TYPE 822 - LEFT SPIRAL FLUTES - FOR CAST IRONS & STEELS



- See description under Type 802-803 above
- Left spiral flutes should not be used on blind holes

TOOL DIAMETER RANGE	DIMENSIONS				EDP NO. - R SPIRAL		EDP NO. - L SPIRAL		FINISHED TO MODIFIED TOOL DIAMETER						
	MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		TYPE 813 NON-FERROUS	TYPE 812 CAST IRON/STEEL	TYPE 823 NON-FERROUS	TYPE 822 CAST IRON/STEEL	PRICE EACH - BASED ON QUANTITY ORDERED						
			FLT	OVER-ALL					1	2	3	4	5-7	8-14	OVER 14
*0.0971 - 0.1120	.0943	4	5/8	2 1/4	81307	81207	82307	82207	\$62.70	\$40.15	\$32.55	\$29.00	\$25.10	\$22.05	\$17.60
0.1121 - 0.1280	.1099	4	5/8	2 1/4	81308	81208	82308	82208	63.90	41.30	33.70	30.20	26.25	23.20	18.80
0.1281 - 0.1435	.1255	4	3/4	2 1/2	81309	81209	82309	82209	67.60	43.95	36.00	32.25	28.20	24.95	20.30
0.1436 - 0.1590	.1411	4	3/4	2 1/2	81310	81210	82310	82210	68.90	45.15	37.20	33.50	29.40	26.15	21.60
0.1591 - 0.1750	.1567	4	7/8	2 3/4	81311	81211	82311	82211	71.65	47.95	40.00	36.20	32.20	28.95	24.30
0.1751 - 0.1910	.1724	4	7/8	2 3/4	81312	81212	82312	82212	73.45	49.75	41.80	38.05	33.95	30.75	26.10
0.1911 - 0.2210	.1880	6	1	3	81314	81214	82314	82214	80.30	55.50	47.20	43.25	39.00	35.60	30.75
0.2211 - 0.2530	.2193	6	1	3	81316	81216	82316	82216	86.25	61.30	53.00	49.10	44.80	41.50	36.65
0.2531 - 0.2840	.2505	6	1 1/8	3 1/4	81318	81218	82318	82218	93.00	68.10	59.80	55.90	51.60	48.30	43.40
0.2841 - 0.3150	.2817	6	1 1/8	3 1/4	81320	81220	82320	82220	100.30	75.45	67.15	63.25	59.00	55.60	50.75
0.3151 - 0.3470	.3130	6	1 1/4	3 1/2	81322	81222	82322	82222	111.40	86.55	78.25	74.30	70.05	66.65	61.80
0.3471 - 0.3780	.3443	6	1 1/4	3 1/2	81324	81224	82324	82224	112.90	88.05	79.75	75.80	71.55	68.15	63.30
0.3781 - 0.4090	.3755	6	1 3/8	3 3/4	81326	81226	82326	82226	116.05	91.15	82.85	78.85	74.65	71.30	66.40
0.4091 - 0.4410	.4067	6	1 3/8	3 3/4	81328	81228	82328	82228	117.00	92.05	83.75	79.85	75.60	72.20	67.40
0.4411 - 0.4720	.4380	6	1 1/2	4	81330	81230	82330	82230	124.15	99.20	90.90	87.00	82.80	79.40	74.50
0.4721 - 0.5150	.4693	6	1 1/2	4	81332	81232	82332	82232	131.00	106.15	97.80	93.95	89.65	86.30	81.40

*Designed with male centers



CHUCKING REAMERS SOLID CARBIDE TYPE 804 FRACTIONAL, WIRE/LETTER & METRIC



SHORT SERIES STRAIGHT FLUTES & SHANK



NOTE: Dimension details (.0591" and larger) on pg. 104. Available modifications on pg. 101. Additional Type 804 sizes on pg. 58, including Wire #52-70.

TOOL DIAMETER					TOOL DIAMETER					TOOL DIAMETER					TOOL DIAMETER				
FRACTIONAL/WIRE	(mm)	DEC.	TYPE 804 EDP NO.	PRICE	FRACTIONAL/WIRE	(mm)	DEC.	TYPE 804 EDP NO.	PRICE	FRACTIONAL/LETTER	(mm)	DEC.	TYPE 804 EDP NO.	PRICE	FRACTIONAL/LETTER	(mm)	DEC.	TYPE 804 EDP NO.	PRICE
*1/32		.0312	80402	\$18.60	*5/64		.1406	80409	\$24.35	B	6.0	.2362	804060	\$38.95	23/64		.3594	80423	\$71.10
	*1.0	.0394	804010	17.80		3.6	.1417	804036	24.70			.2380	8042380	42.85		9.2	.3622	804092	75.60
	*1.1	.0433	804011	19.55	27		.1440	8041440	24.70	C	6.1	.2402	804061	42.85		9.3	.3661	804093	75.60
*3/64		.0469	80403	19.70		3.7	.1457	804037	24.95			.2420	8042420	42.85	U		.3680	8043680	72.00
	*1.2	.0472	804012	19.70	26		.1470	8041470	25.40	D	6.2	.2441	804062	42.85		9.4	.3701	804094	76.00
	*1.3	.0512	804013	19.70	25		.1495	8041495	25.55			.2460	8042460	42.85		9.5	.3740	804095	72.45
	*1.4	.0551	804014	19.70		3.8	.1496	804038	26.85	1/4, E	6.3	.2480	804063	42.85	V		.3750	80424	66.30
	1.5	.0591	804015	18.05	24		.1520	8041520	25.55			.2500	80416	38.95			.3770	8043770	86.00
1/16		.0625	80404	18.60		3.9	.1535	804039	26.60	F	6.4	.2520	804064	47.20		9.6	.3780	804096	90.45
	1.6	.0630	804016	20.20			.1540	8041540	26.60		6.5	.2559	804065	47.15		9.7	.3819	804097	90.45
	1.7	.0669	804017	20.40	23	5/32	.1562	80410	25.15		6.6	.2570	8042570	47.15	W		.3858	804098	90.45
51		.0670	8040670	20.40	22		.1570	8041570	27.50			.2598	804066	49.45		9.8	.3860	8043860	86.25
50		.0700	8040700	20.40		4.0	.1575	804040	25.15	G	6.7	.2610	8042610	47.15		9.9	.3898	804099	95.25
	1.8	.0709	804018	20.40	21		.1590	8041590	28.20		17/64	.2638	804067	49.45	25/64		.3906	80425	90.70
49		.0730	8040730	20.40	20		.1610	8041610	28.60	H		.2656	80417	47.15		10.0	.3937	804100	90.70
	1.9	.0748	804019	20.40		4.1	.1614	804041	28.60			.2660	8042660	47.15	X		.3970	8043970	90.70
48		.0760	8040760	20.40		4.2	.1654	804042	28.70	I	6.8	.2677	804068	49.45		10.1	.3976	804101	95.25
5/64		.0781	80405	20.40	19		.1660	8041660	28.70		6.9	.2717	804069	49.45		10.2	.4016	804102	95.25
47		.0785	8040785	20.45		4.3	.1693	804043	29.05		7.0	.2720	8042720	47.15	Y		.4040	8044040	90.70
	2.0	.0787	804020	18.80	18		.1695	8041695	29.05			.2756	804070	43.05		10.3	.4055	804103	95.25
46		.0810	8040810	20.45		11/64	.1719	80411	29.60	J	7.1	.2770	8042770	47.15		10.4	.4062	80426	90.70
45		.0820	8040820	20.55	17		.1730	8041730	29.60			.2795	804071	53.70	13/32		.4094	804104	95.25
	2.1	.0827	804021	20.55		4.4	.1732	804044	29.60	K		.2810	8042810	51.10	Z		.4130	8044130	90.70
44		.0860	8040860	20.55	16		.1770	8041770	30.30	5/32		.2812	80418	46.75		10.5	.4134	804105	90.70
43	2.2	.0866	804022	20.55		4.5	.1772	804045	27.50		7.2	.2835	804072	58.05		10.6	.4173	804106	97.75
	2.3	.0890	8040890	20.90	15		.1800	8041800	30.45	L	7.3	.2874	804073	58.05		10.7	.4213	804107	97.75
42		.0906	804023	20.90		4.6	.1811	804046	30.85		7.4	.2900	8042900	55.35	27/64		.4219	80427	93.10
		.0935	8040935	21.00	14		.1820	8041820	30.90			.2913	804074	58.05		10.8	.4252	804108	97.75
3/32		.0938	80406	19.35		4.7	.1850	804047	31.10	M		.2950	8042950	55.35		10.9	.4291	804109	97.75
	2.4	.0945	804024	21.00	13	3/16	.1875	80412	29.85		7.5	.2953	804075	55.35		11.0	.4331	804110	93.10
41		.0960	8040960	21.40	12	4.8	.1890	804048	32.80	19/64		.2969	80419	55.35		11.1	.4370	804111	97.80
40		.0980	8040980	21.40	11		.1910	8041910	33.20		7.6	.2992	804076	60.55	7/16		.4375	80428	93.10
39	2.5	.0984	804025	19.55		4.9	.1929	804049	33.20	N		.3020	8043020	57.65		11.2	.4409	804112	106.20
		.0995	8040995	21.60	10		.1935	8041935	33.40		7.7	.3031	804077	60.55		11.3	.4449	804113	106.20
38		.1015	8041015	21.60	9		.1960	8041960	34.60		7.8	.3071	804078	60.55		11.4	.4488	804114	106.20
	2.6	.1024	804026	21.70		5.0	.1969	804050	31.55		7.9	.3110	804079	60.55		11.5	.4528	804115	101.15
37	2.7	.1040	8041040	22.95	8		.1990	8041990	34.75	5/16		.3125	80420	52.70	29/64		.4531	80429	101.15
		.1063	804027	21.80		5.1	.2008	804051	35.85		8.0	.3150	804080	52.70		11.6	.4567	804116	106.20
36		.1065	8041065	21.80	7		.2010	8042010	35.85	O		.3160	8043160	60.55		11.7	.4606	804117	106.20
7/64		.1094	80407	22.50	13/64		.2031	80413	35.85		8.1	.3189	804081	64.45		11.8	.4646	804118	106.20
35	2.8	.1100	8041100	22.50	6		.2040	8042040	35.85	P	8.2	.3228	804082	64.45		11.9	.4685	804119	107.10
		.1102	804028	22.50		5.2	.2047	804052	35.85			.3230	8043230	61.30	15/32		.4688	80430	101.15
34		.1110	8041110	22.85	5		.2055	8042055	35.85		8.3	.3268	804083	73.70		12.0	.4724	804120	101.15
33		.1130	8041130	23.15		5.3	.2087	804053	35.85	21/64		.3281	80421	70.15		12.1	.4764	804121	115.80
32	2.9	.1142	804029	23.15	4		.2090	8042090	37.70		8.4	.3307	804084	73.70		12.2	.4803	804122	115.80
		.1160	8041160	23.15		5.4	.2126	804054	35.85	Q		.3320	8043320	70.15		12.3	.4843	804123	115.80
31	3.0	.1181	804030	21.40	3		.2130	8042130	35.85		8.5	.3346	804085	70.15			.4844	80431	110.25
		.1200	8041200	23.25		5.5	.2165	804055	32.80		8.6	.3386	804086	73.70	31/64		.4882	804124	115.80
1/8	3.1	.1220	804031	23.25	7/32		.2188	80414	32.70	R		.3390	8043390	70.15		12.5	.4921	804125	110.25
		.1250	80408	21.40		5.6	.2205	804056	40.00		8.7	.3425	804087	73.70		12.6	.4961	804126	115.80
	3.2	.1260	804032	23.25	2		.2210	8042210	40.00	11/32		.3438	80422	70.15	1/2		.5000	80432	110.25
30		.1285	8041285	23.30		5.7	.2244	804057	41.50		8.8	.3465	804088	74.00		12.8	.5039	804128	115.80
	3.3	.1299	804033	23.30	1		.2280	8042280	42.00	S		.3480	8043480	70.45		12.9	.5079	804129	115.80
	3.4	.1339	804034	23.30		5.8	.2283	804058	42.00		8.9	.3504	804089	74.00		13.0	.5118	804130	131.10
		.1360	8041360	23.30		5.9	.2323	804059	42.00	T		.3543	804090	64.75					
	3.5	.1378	804035	21.70		A	.2340	8042340	42.00		9.0	.3580	8043580	70.75					
28		.1405	8041405	23.60	15/64		.2344	80415	42.00		9.1	.3583	804091	74.70					

*Dimensions thru .0590" tool diameter: # of flutes = 4; flute length = 3/8" (except for .0312" & .0394" tool diameters, flute = 1/4"); overall length = 1 1/2"

REAMERS



CHUCKING REAMERS SOLID CARBIDE TYPE 804 .0005 INCREMENTS



SHORT SERIES STRAIGHT FLUTES STRAIGHT SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	804
	40	NON-FERROUS - SHORT CHIPS	804
	60	CAST IRONS	804
	80	LOW STRENGTH STEELS	804
	100	MEDIUM STRENGTH STEELS	804
	120	HIGH STRENGTH STEELS	804
	140	HIGH TEMPERATURE ALLOYS	804

TYPE 804 - STRAIGHT FLUTES

- Solid carbide head and straight shank
- Tool diameter tolerance thru .2500": plus .0002"/minus .0000"
over .2500": plus .0003"/minus .0000"
- Shank diameter tolerance: plus .0000"/minus .0010"
- Tool geometry appropriate for material being machined

MODIFICATIONS (See list on page 101)

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.0280	8040280	\$20.20	.0520	8040520	\$19.70	.0760	8040760	\$20.40	.1000	8041000	\$22.65	.1240	8041240	\$24.45
.0285	8040285	21.30	.0525	8040525	20.75	.0765	8040765	21.40	.1005	8041005	22.65	.1245	8041245	24.45
.0290	8040290	21.30	.0530	8040530	20.75	.0770	8040770	21.40	.1010	8041010	22.65	.1250	8040808	21.40
.0295	8040295	20.20	.0535	8040535	20.75	.0775	8040775	21.40	.1015	8041015	21.60	.1255	8041255	24.45
.0300	8040300	21.30	.0540	8040540	20.75	.0780	8040780	21.40	.1020	8041020	22.85	.1260	804032	23.25
.0305	8040305	21.30	.0545	8040545	20.75	.0785	8040785	20.45	.1025	8041025	22.95	.1265	8041265	24.55
.0310	8040310	20.20	.0550	8040550	19.70	.0790	8040790	21.50	.1030	8041030	22.95	.1270	8041270	24.55
.0315	804008	20.20	.0555	8040555	20.75	.0795	8040795	21.50	.1035	8041035	22.95	.1275	8041275	24.55
.0320	8040320	20.20	.0560	8040560	20.75	.0800	8040800	21.50	.1040	8041040	22.95	.1280	8041280	23.30
.0325	8040325	21.30	.0565	8040565	20.75	.0805	8040805	21.50	.1045	8041045	22.95	.1285	8041285	23.30
.0330	8040330	20.20	.0570	8040570	20.75	.0810	8040810	20.45	.1050	8041050	22.95	.1290	8041290	24.55
.0335	8040335	20.20	.0575	8040575	20.75	.0815	8040815	21.60	.1055	8041055	22.95	.1295	8041295	24.55
.0340	8040340	20.55	.0580	8040580	20.75	.0820	8040820	20.55	.1060	8041060	22.95	.1300	8041300	24.55
.0345	8040345	20.55	.0585	8040585	20.75	.0825	8040825	21.60	.1065	8041065	21.80	.1305	8041305	24.55
.0350	8040350	19.55	.0590	8040590	18.05	.0830	8040830	21.60	.1070	8041070	23.30	.1310	8041310	24.55
.0355	8040355	20.55	.0595	8040595	19.70	.0835	8040835	21.60	.1075	8041075	23.30	.1315	8041315	24.55
.0360	8040360	19.55	.0600	8040600	21.30	.0840	8040840	21.60	.1080	8041080	23.30	.1320	8041320	24.55
.0365	8040365	20.55	.0605	8040605	21.30	.0845	8040845	21.60	.1085	8041085	23.60	.1325	8041325	24.55
.0370	8040370	19.55	.0610	8040610	20.20	.0850	8040850	21.60	.1090	8041090	23.60	.1330	8041330	24.55
.0375	8040375	20.55	.0615	8040615	21.30	.0855	8040855	21.60	.1095	8041095	23.60	.1335	8041335	24.55
.0380	8040380	19.55	.0620	8040620	21.30	.0860	8040860	20.55	.1100	8041100	22.50	.1340	8041340	24.55
.0385	8040385	20.55	.0625	80404	18.60	.0865	8040865	21.60	.1105	8041105	23.95	.1345	8041345	24.55
.0390	8040390	19.55	.0630	804016	20.20	.0870	8040870	21.60	.1110	8041110	22.85	.1350	8041350	24.55
.0395	8040395	20.55	.0635	8040635	20.20	.0875	8040875	21.60	.1115	8041115	24.35	.1355	8041355	24.55
.0400	8040400	19.55	.0640	8040640	21.30	.0880	8040880	21.60	.1120	8041120	24.35	.1360	8041360	23.30
.0405	8040405	20.55	.0645	8040645	21.30	.0885	8040885	21.60	.1125	8041125	24.35	.1365	8041365	24.55
.0410	8040410	19.55	.0650	8040650	21.40	.0890	8040890	20.90	.1130	8041130	23.15	.1370	8041370	24.55
.0415	8040415	20.55	.0655	8040655	21.40	.0895	8040895	22.10	.1135	8041135	24.35	.1375	8041375	24.55
.0420	8040420	19.55	.0660	8040660	21.40	.0900	8040900	22.10	.1140	8041140	24.35	.1380	8041380	24.95
.0425	8040425	20.55	.0665	8040665	21.40	.0905	8040905	22.10	.1145	8041145	24.35	.1385	8041385	24.95
.0430	8040430	19.55	.0670	8040670	20.40	.0910	8040910	22.20	.1150	8041150	24.35	.1390	8041390	24.95
.0435	8040435	20.75	.0675	8040675	21.40	.0915	8040915	22.20	.1155	8041155	24.35	.1395	8041395	24.95
.0440	8040440	20.75	.0680	8040680	21.40	.0920	8040920	22.20	.1160	8041160	23.15	.1400	8041400	24.95
.0445	8040445	20.75	.0685	8040685	21.40	.0925	8040925	21.00	.1165	8041165	24.35	.1405	8041405	23.60
.0450	8040450	20.75	.0690	8040690	21.40	.0930	8040930	22.20	.1170	8041170	24.35	.1410	8041410	25.90
.0455	8040455	20.75	.0695	8040695	21.40	.0935	8040935	21.00	.1175	8041175	24.35	.1415	8041415	25.90
.0460	8040460	20.75	.0700	8040700	20.40	.0940	8040940	22.20	.1180	8041180	24.35	.1420	8041420	25.90
.0465	8040465	19.70	.0705	8040705	21.40	.0945	804024	21.00	.1185	8041185	24.45	.1425	8041425	25.90
.0470	8040470	20.75	.0710	8040710	21.40	.0950	8040950	22.50	.1190	8041190	24.45	.1430	8041430	25.90
.0475	8040475	20.75	.0715	8040715	21.40	.0955	8040955	22.50	.1195	8041195	24.45	.1435	8041435	25.90
.0480	8040480	20.75	.0720	8040720	21.40	.0960	8040960	21.40	.1200	8041200	23.25	.1440	8041440	24.70
.0485	8040485	20.75	.0725	8040725	21.40	.0965	8040965	21.40	.1205	8041205	24.45	.1445	8041445	26.05
.0490	8040490	20.75	.0730	8040730	20.40	.0970	8040970	22.50	.1210	8041210	24.45	.1450	8041450	26.10
.0495	8040495	20.75	.0735	8040735	21.40	.0975	8040975	22.50	.1215	8041215	24.45	.1455	8041455	26.10
.0500	8040500	20.75	.0740	8040740	21.40	.0980	8040980	21.40	.1220	804031	23.25	.1460	8041460	26.80
.0505	8040505	20.75	.0745	8040745	21.40	.0985	8040985	22.65	.1225	8041225	24.45	.1465	8041465	26.80
.0510	8040510	20.75	.0750	8040750	21.40	.0990	8040990	22.65	.1230	8041230	24.45	.1470	8041470	25.40
.0515	8040515	20.75	.0755	8040755	21.40	.0995	8040995	21.60	.1235	8041235	24.45	.1475	8041475	26.80



CHUCKING REAMERS SOLID CARBIDE TYPE 804 .0005 INCREMENTS



SHORT SERIES STRAIGHT FLUTES STRAIGHT SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	804
	40	NON-FERROUS - SHORT CHIPS	804
	60	CAST IRONS	804
	80	LOW STRENGTH STEELS	804
	100	MEDIUM STRENGTH STEELS	804
	120	HIGH STRENGTH STEELS	804
	140	HIGH TEMPERATURE ALLOYS	804

TYPE 804 - STRAIGHT FLUTES

- Solid carbide head and straight shank
- Tool diameter tolerance thru .2500": plus .0002"/minus .0000"
over .2500": plus.0003"/minus .0000"
- Shank diameter tolerance: plus .0000"/minus .0010"
- Tool geometry appropriate for material being machined

MODIFICATIONS (See list on page 101)

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.1480	8041480	\$26.85	.1720	8041720	\$31.10	.1960	8041960	\$34.60	.2200	8042200	\$42.15	.2440	8042440	\$45.00
.1485	8041485	26.85	.1725	8041725	31.10	.1965	8041965	36.25	.2205	804056	40.00	.2445	8042445	45.00
.1490	8041490	26.85	.1730	8041730	29.60	.1970	8041970	36.60	.2210	8042210	40.00	.2450	8042450	45.00
.1495	8041495	25.55	.1735	8041735	31.55	.1975	8041975	36.60	.2215	8042215	43.80	.2455	8042455	45.00
.1500	8041500	26.85	.1740	8041740	31.55	.1980	8041980	36.60	.2220	8042220	43.80	.2460	8042460	42.85
.1505	8041505	26.85	.1745	8041745	31.55	.1985	8041985	36.60	.2225	8042225	43.80	.2465	8042465	45.00
.1510	8041510	26.85	.1750	8041750	31.55	.1990	8041990	34.75	.2230	8042230	43.80	.2470	8042470	45.00
.1515	8041515	26.85	.1755	8041755	31.90	.1995	8041995	37.70	.2235	8042235	43.80	.2475	8042475	45.00
.1520	8041520	25.55	.1760	8041760	31.90	.2000	8042000	37.70	.2240	8042240	43.80	.2480	804063	42.85
.1525	8041525	28.00	.1765	8041765	31.90	.2005	8042005	37.70	.2245	8042245	43.80	.2485	8042485	45.00
.1530	8041530	28.00	.1770	8041770	30.30	.2010	8042010	35.85	.2250	8042250	43.80	.2490	8042490	45.00
.1535	804039	26.60	.1775	8041775	31.95	.2015	8042015	37.70	.2255	8042255	43.80	.2495	8042495	45.00
.1540	8041540	26.60	.1780	8041780	31.95	.2020	8042020	37.70	.2260	8042260	43.80	.2500	80416	38.95
.1545	8041545	28.00	.1785	8041785	31.95	.2025	8042025	37.70	.2265	8042265	44.25	.2505	8042505	45.00
.1550	8041550	28.00	.1790	8041790	31.95	.2030	8042030	37.70	.2270	8042270	44.25	.2510	8042510	45.00
.1555	8041555	26.60	.1795	8041795	31.95	.2035	8042035	37.70	.2275	8042275	44.25	.2515	8042515	45.00
.1560	8041560	28.00	.1800	8041800	30.45	.2040	8042040	35.85	.2280	8042280	42.00	.2520	804064	47.20
.1565	8041565	29.00	.1805	8041805	32.20	.2045	8042045	37.70	.2285	8042285	44.25	.2525	8042525	47.20
.1570	8041570	27.50	.1810	8041810	32.25	.2050	8042050	37.70	.2290	8042290	44.25	.2530	8042530	45.00
.1575	804040	25.15	.1815	8041815	32.45	.2055	8042055	35.85	.2295	8042295	44.25	.2535	8042535	49.70
.1580	8041580	29.60	.1820	8041820	30.90	.2060	8042060	37.70	.2300	8042300	44.25	.2540	8042540	49.70
.1585	8041585	29.60	.1825	8041825	32.60	.2065	8042065	37.70	.2305	8042305	44.25	.2545	8042545	49.70
.1590	8041590	28.20	.1830	8041830	32.60	.2070	8042070	37.70	.2310	8042310	44.25	.2550	8042550	49.70
.1595	8041595	30.10	.1835	8041835	32.70	.2075	8042075	37.70	.2315	8042315	44.25	.2555	8042555	49.70
.1600	8041600	30.10	.1840	8041840	32.70	.2080	8042080	37.70	.2320	8042320	44.25	.2560	8042560	49.70
.1605	8041605	30.10	.1845	8041845	32.70	.2085	8042085	37.70	.2325	8042325	44.25	.2565	8042565	49.70
.1610	8041610	28.60	.1850	804047	31.10	.2090	8042090	37.70	.2330	8042330	44.25	.2570	8042570	47.15
.1615	8041615	30.10	.1855	8041855	34.40	.2095	8042095	37.70	.2335	8042335	44.25	.2575	8042575	49.70
.1620	8041620	30.10	.1860	8041860	34.40	.2100	8042100	37.70	.2340	8042340	42.00	.2580	8042580	49.70
.1625	8041625	30.10	.1865	8041865	34.40	.2105	8042105	37.70	.2345	8042345	44.25	.2585	8042585	49.70
.1630	8041630	30.10	.1870	8041870	32.80	.2110	8042110	37.70	.2350	8042350	44.25	.2590	8042590	49.70
.1635	8041635	30.20	.1875	80412	29.85	.2115	8042115	37.70	.2355	8042355	44.25	.2595	8042595	49.70
.1640	8041640	30.10	.1880	8041880	34.50	.2120	8042120	37.70	.2360	8042360	44.25	.2600	8042600	49.70
.1645	8041645	30.10	.1885	8041885	34.50	.2125	8042125	37.70	.2365	8042365	45.00	.2605	8042605	49.70
.1650	8041650	30.10	.1890	804048	32.80	.2130	8042130	35.85	.2370	8042370	45.00	.2610	8042610	47.15
.1655	8041655	30.10	.1895	8041895	34.85	.2135	8042135	37.70	.2375	8042375	45.00	.2615	8042615	49.70
.1660	8041660	28.70	.1900	8041900	34.85	.2140	8042140	37.70	.2380	8042380	42.85	.2620	8042620	49.70
.1665	8041665	30.45	.1905	8041905	34.85	.2145	8042145	37.70	.2385	8042385	45.00	.2625	8042625	49.70
.1670	8041670	30.45	.1910	8041910	33.20	.2150	8042150	37.70	.2390	8042390	45.00	.2630	8042630	49.70
.1675	8041675	30.45	.1915	8041915	34.95	.2155	8042155	37.70	.2395	8042395	45.00	.2635	8042635	49.70
.1680	8041680	30.45	.1920	8041920	34.95	.2160	8042160	37.70	.2400	8042400	45.00	.2640	8042640	49.70
.1685	8041685	30.45	.1925	8041925	34.95	.2165	804055	32.80	.2405	8042405	45.00	.2645	8042645	49.70
.1690	8041690	30.45	.1930	8041930	35.30	.2170	8042170	37.70	.2410	8042410	45.00	.2650	8042650	49.70
.1695	8041695	29.05	.1935	8041935	33.40	.2175	8042175	37.70	.2415	8042415	45.00	.2655	8042655	49.70
.1700	8041700	31.10	.1940	8041940	35.30	.2180	8042180	37.70	.2420	8042420	42.85	.2660	8042660	47.15
.1705	8041705	31.10	.1945	8041945	35.30	.2185	8042185	35.85	.2425	8042425	45.00	.2665	8042665	49.70
.1710	8041710	31.10	.1950	8041950	36.25	.2190	8042190	42.15	.2430	8042430	45.00	.2670	8042670	49.70
.1715	8041715	31.10	.1955	8041955	36.25	.2195	8042195	42.15	.2435	8042435	45.00	.2675	8042675	49.70



CHUCKING REAMERS SOLID CARBIDE TYPE 804 .0005 INCREMENTS



SHORT SERIES STRAIGHT FLUTES STRAIGHT SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	804
40	NON-FERROUS - SHORT CHIPS	804	
60	CAST IRONS	804	
80	LOW STRENGTH STEELS	804	
100	MEDIUM STRENGTH STEELS	804	
120	HIGH STRENGTH STEELS	804	
140	HIGH TEMPERATURE ALLOYS	804	

TYPE 804 - STRAIGHT FLUTES

- Solid carbide head and straight shank
- Tool diameter tolerance thru .2500": plus .0002"/minus .0000"
over .2500": plus .0003"/minus .0000"
- Shank diameter tolerance: plus .0000"/minus .0010"
- Tool geometry appropriate for material being machined

MODIFICATIONS (See list on page 101)

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.2680	8042680	\$49.70	.2920	8042920	\$58.20	.3160	8043160	\$60.55	.3400	8043400	\$73.85	.3640	8043640	\$75.75
.2685	8042685	49.70	.2925	8042925	58.20	.3165	8043165	64.50	.3405	8043405	73.85	.3645	8043645	75.75
.2690	8042690	49.70	.2930	8042930	58.20	.3170	8043170	64.50	.3410	8043410	73.85	.3650	8043650	75.75
.2695	8042695	49.70	.2935	8042935	58.20	.3175	8043175	64.50	.3415	8043415	73.85	.3655	8043655	75.75
.2700	8042700	49.70	.2940	8042940	58.20	.3180	8043180	64.50	.3420	8043420	73.85	.3660	8043660	75.75
.2705	8042705	49.70	.2945	8042945	58.20	.3185	8043185	64.50	.3425	804087	73.70	.3665	8043665	75.75
.2710	8042710	49.70	.2950	8042950	55.35	.3190	8043190	64.50	.3430	8043430	73.85	.3670	8043670	75.75
.2715	8042715	49.70	.2955	8042955	58.20	.3195	8043195	64.50	.3435	8043435	73.85	.3675	8043675	75.75
.2720	8042720	47.15	.2960	8042960	58.20	.3200	8043200	64.50	.3440	8043440	74.00	.3680	8043680	72.00
.2725	8042725	49.70	.2965	8042965	58.20	.3205	8043205	64.50	.3445	8043445	74.00	.3685	8043685	76.45
.2730	8042730	49.70	.2970	8042970	60.55	.3210	8043210	64.50	.3450	8043450	74.00	.3690	8043690	76.65
.2735	8042735	49.70	.2975	8042975	60.55	.3215	8043215	64.50	.3455	8043455	74.00	.3695	8043695	76.45
.2740	8042740	49.70	.2980	8042980	60.55	.3220	8043220	64.50	.3460	8043460	74.00	.3700	8043700	76.45
.2745	8042745	49.70	.2985	8042985	60.55	.3225	8043225	64.50	.3465	804088	74.00	.3705	8043705	76.45
.2750	8042750	49.70	.2990	8042990	60.55	.3230	8043230	61.30	.3470	8043470	74.00	.3710	8043710	76.45
.2755	8042755	49.70	.2995	8042995	60.55	.3235	8043235	64.50	.3475	8043475	74.00	.3715	8043715	76.45
.2760	8042760	49.70	.3000	8043000	60.55	.3240	8043240	73.85	.3480	8043480	70.45	.3720	8043720	76.45
.2765	8042765	49.70	.3005	8043005	60.55	.3245	8043245	73.85	.3485	8043485	74.00	.3725	8043725	76.45
.2770	8042770	47.15	.3010	8043010	60.55	.3250	8043250	73.85	.3490	8043490	74.00	.3730	8043730	76.45
.2775	8042775	49.70	.3015	8043015	60.55	.3255	8043255	73.85	.3495	8043495	74.00	.3735	8043735	76.45
.2780	8042780	53.75	.3020	8043020	57.65	.3260	8043260	73.85	.3500	8043500	74.00	.3740	804095	72.45
.2785	8042785	53.75	.3025	8043025	60.55	.3265	8043265	73.85	.3505	8043505	74.00	.3745	8043745	76.45
.2790	8042790	53.75	.3030	8043030	60.55	.3270	8043270	73.85	.3510	8043510	74.00	.3750	80424	66.30
.2795	804071	53.70	.3035	8043035	60.55	.3275	8043275	73.85	.3515	8043515	74.00	.3755	8043755	90.60
.2800	8042800	53.75	.3040	8043040	60.55	.3280	8043280	73.85	.3520	8043520	74.00	.3760	8043760	90.70
.2805	8042805	53.75	.3045	8043045	60.55	.3285	8043285	73.85	.3525	8043525	74.00	.3765	8043765	90.60
.2810	8042810	51.10	.3050	8043050	60.55	.3290	8043290	73.85	.3530	8043530	74.00	.3770	8043770	86.00
.2815	8042815	53.75	.3055	8043055	60.55	.3295	8043295	73.85	.3535	8043535	74.00	.3775	8043775	90.60
.2820	8042820	58.20	.3060	8043060	60.55	.3300	8043300	73.85	.3540	8043540	74.00	.3780	804096	90.45
.2825	8042825	58.20	.3065	8043065	60.55	.3305	8043305	73.85	.3545	8043545	74.00	.3785	8043785	90.60
.2830	8042830	58.20	.3070	8043070	60.55	.3310	8043310	71.30	.3550	8043550	74.35	.3790	8043790	90.60
.2835	804072	58.05	.3075	8043075	60.55	.3315	8043315	73.85	.3555	8043555	74.35	.3795	8043795	90.60
.2840	8042840	58.20	.3080	8043080	60.55	.3320	8043320	70.15	.3560	8043560	74.35	.3800	8043800	90.60
.2845	8042845	58.20	.3085	8043085	60.55	.3325	8043325	73.85	.3565	8043565	74.35	.3805	8043805	90.60
.2850	8042850	58.20	.3090	8043090	60.55	.3330	8043330	73.85	.3570	8043570	74.35	.3810	8043810	90.60
.2855	8042855	58.20	.3095	8043095	60.55	.3335	8043335	73.85	.3575	8043575	74.35	.3815	8043815	90.60
.2860	8042860	58.20	.3100	8043100	60.55	.3340	8043340	73.85	.3580	8043580	70.75	.3820	8043820	90.60
.2865	8042865	58.20	.3105	8043105	60.55	.3345	8043345	73.85	.3585	8043585	74.35	.3825	8043825	90.60
.2870	8042870	58.20	.3110	804079	60.55	.3350	8043350	73.85	.3590	8043590	74.90	.3830	8043830	90.60
.2875	8042875	58.20	.3115	8043115	60.55	.3355	8043355	73.85	.3595	8043595	75.75	.3835	8043835	90.60
.2880	8042880	58.20	.3120	8043120	60.55	.3360	8043360	73.85	.3600	8043600	75.75	.3840	8043840	90.60
.2885	8042885	58.20	.3125	80420	52.70	.3365	8043365	73.85	.3605	8043605	75.75	.3845	8043845	90.60
.2890	8042890	58.20	.3130	8043130	60.55	.3370	8043370	73.85	.3610	8043610	75.75	.3850	8043850	90.60
.2895	8042895	58.20	.3135	8043135	60.55	.3375	8043375	73.85	.3615	8043615	75.75	.3855	8043855	90.60
.2900	8042900	55.35	.3140	8043140	60.55	.3380	8043380	73.85	.3620	8043620	75.75	.3860	8043860	86.25
.2905	8042905	58.20	.3145	8043145	60.55	.3385	8043385	73.85	.3625	8043625	75.75	.3865	8043865	95.25
.2910	8042910	58.20	.3150	804080	52.70	.3390	8043390	70.15	.3630	8043630	75.75	.3870	8043870	95.25
.2915	8042915	58.20	.3155	8043155	60.55	.3395	8043395	73.85	.3635	8043635	75.75	.3875	8043875	95.25



CHUCKING REAMERS SOLID CARBIDE TYPE 804 .0005 INCREMENTS



SHORT SERIES STRAIGHT FLUTES STRAIGHT SHANK



TYPE 804 - STRAIGHT FLUTES

- Solid carbide head and straight shank
- Tool diameter tolerance thru .2500": plus .0002"/minus .0000"
over .2500": plus.0003"/minus .0000"
- Shank diameter tolerance: plus .0000"/minus .0010"
- Tool geometry appropriate for material being machined

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	804
	40	NON-FERROUS - SHORT CHIPS	804
	60	CAST IRONS	804
	80	LOW STRENGTH STEELS	804
	100	MEDIUM STRENGTH STEELS	804
	120	HIGH STRENGTH STEELS	804
	140	HIGH TEMPERATURE ALLOYS	804

MODIFICATIONS (See list on page 101)

TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE	TOOL DIAM.	EDP NO.	PRICE
.3880	8043880	\$95.25	.4135	8044135	\$97.80	.4390	8044390	\$107.10	.4645	8044645	\$107.10	.4900	8044900	\$116.55
.3885	8043885	95.25	.4140	8044140	97.80	.4395	8044395	107.10	.4650	8044650	107.10	.4905	8044905	116.55
.3890	8043890	95.25	.4145	8044145	97.80	.4400	8044400	107.10	.4655	8044655	107.10	.4910	8044910	116.55
.3895	8043895	95.25	.4150	8044150	97.80	.4405	8044405	107.10	.4660	8044660	107.10	.4915	8044915	116.55
.3900	8043900	95.25	.4155	8044155	97.80	.4410	8044410	107.10	.4665	8044665	107.10	.4920	8044920	116.55
.3905	8043905	95.25	.4160	8044160	97.80	.4415	8044415	107.10	.4670	8044670	107.10	.4925	8044925	116.55
.3910	8043910	95.25	.4165	8044165	97.80	.4420	8044420	107.10	.4675	8044675	107.10	.4930	8044930	116.55
.3915	8043915	95.25	.4170	8044170	97.80	.4425	8044425	107.10	.4680	8044680	107.10	.4935	8044935	116.55
.3920	8043920	95.25	.4175	8044175	97.80	.4430	8044430	107.10	.4685	804119	107.10	.4940	8044940	116.55
.3925	8043925	95.25	.4180	8044180	97.80	.4435	8044435	107.10	.4690	8044690	107.10	.4945	8044945	116.55
.3930	8043930	95.25	.4185	8044185	97.80	.4440	8044440	107.10	.4695	8044695	107.10	.4950	8044950	116.55
.3935	8043935	95.25	.4190	8044190	97.80	.4445	8044445	107.10	.4700	8044700	107.10	.4955	8044955	116.55
.3940	8043940	95.25	.4195	8044195	97.80	.4450	8044450	107.10	.4705	8044705	107.10	.4960	8044960	116.55
.3945	8043945	95.25	.4200	8044200	97.80	.4455	8044455	107.10	.4710	8044710	107.10	.4965	8044965	116.55
.3950	8043950	95.25	.4205	8044205	97.80	.4460	8044460	107.10	.4715	8044715	107.10	.4970	8044970	116.55
.3955	8043955	95.25	.4210	8044210	97.80	.4465	8044465	107.10	.4720	8044720	107.10	.4975	8044975	116.55
.3960	8043960	95.25	.4215	8044215	97.80	.4470	8044470	107.10	.4725	8044725	116.55	.4980	8044980	116.55
.3965	8043965	95.25	.4220	8044220	97.80	.4475	8044475	107.10	.4730	8044730	116.55	.4985	8044985	116.55
.3970	8043970	90.70	.4225	8044225	97.80	.4480	8044480	107.10	.4735	8044735	116.55	.4990	8044990	116.55
.3975	8043975	95.25	.4230	8044230	97.80	.4485	8044485	107.10	.4740	8044740	116.55	.4995	8044995	110.25
.3980	8043980	95.25	.4235	8044235	97.80	.4490	8044490	107.10	.4745	8044745	116.55	.5000	80432	110.25
.3985	8043985	95.25	.4240	8044240	97.80	.4495	8044495	107.10	.4750	8044750	116.55	.5005	8045005	138.35
.3990	8043990	95.25	.4245	8044245	97.80	.4500	8044500	107.10	.4755	8044755	116.55	.5010	8045010	138.35
.3995	8043995	95.25	.4250	8044250	97.80	.4505	8044505	107.10	.4760	8044760	116.55	.5015	8045015	138.35
.4000	8044000	95.25	.4255	8044255	97.80	.4510	8044510	107.10	.4765	8044765	116.55	.5020	8045020	138.35
.4005	8044005	95.25	.4260	8044260	97.80	.4515	8044515	107.10	.4770	8044770	116.55	.5025	8045025	138.35
.4010	8044010	95.25	.4265	8044265	97.80	.4520	8044520	107.10	.4775	8044775	116.55	.5030	8045030	138.35
.4015	8044015	95.25	.4270	8044270	97.80	.4525	8044525	107.10	.4780	8044780	116.55	.5035	8045035	138.35
.4020	8044020	95.25	.4275	8044275	97.80	.4530	8044530	107.10	.4785	8044785	116.55	.5040	8045040	138.35
.4025	8044025	95.25	.4280	8044280	97.80	.4535	8044535	107.10	.4790	8044790	116.55	.5045	8045045	138.35
.4030	8044030	95.25	.4285	8044285	97.80	.4540	8044540	107.10	.4795	8044795	116.55	.5050	8045050	138.35
.4035	8044035	95.25	.4290	8044290	97.80	.4545	8044545	107.10	.4800	8044800	116.55	.5055	8045055	138.35
.4040	8044040	90.70	.4295	8044295	97.80	.4550	8044550	107.10	.4805	8044805	116.55	.5060	8045060	138.35
.4045	8044045	95.25	.4300	8044300	97.80	.4555	8044555	107.10	.4810	8044810	116.55	.5065	8045065	138.35
.4050	8044050	95.25	.4305	8044305	97.80	.4560	8044560	107.10	.4815	8044815	116.55	.5070	8045070	138.35
.4055	804103	95.25	.4310	8044310	97.80	.4565	8044565	107.10	.4820	8044820	116.55	.5075	8045075	138.35
.4060	8044060	95.25	.4315	8044315	97.80	.4570	8044570	107.10	.4825	8044825	116.55	.5080	8045080	138.35
.4065	8044065	95.25	.4320	8044320	97.80	.4575	8044575	107.10	.4830	8044830	116.55	.5085	8045085	138.35
.4070	8044070	95.25	.4325	8044325	97.80	.4580	8044580	107.10	.4835	8044835	116.55	.5090	8045090	138.35
.4075	8044075	95.25	.4330	8044330	97.80	.4585	8044585	107.10	.4840	8044840	116.55	.5095	8045095	138.35
.4080	8044080	95.25	.4335	8044335	97.80	.4590	8044590	107.10	.4845	8044845	116.55	.5100	8045100	138.35
.4085	8044085	95.25	.4340	8044340	97.80	.4595	8044595	107.10	.4850	8044850	116.55	.5105	8045105	138.35
.4090	8044090	95.25	.4345	8044345	97.80	.4600	8044600	107.10	.4855	8044855	116.55	.5110	8045110	138.35
.4095	8044095	95.25	.4350	8044350	97.80	.4605	8044605	107.10	.4860	8044860	116.55	.5115	8045115	138.35
.4100	8044100	95.25	.4355	8044355	97.80	.4610	8044610	107.10	.4865	8044865	116.55	.5120	8045120	138.35
.4105	8044105	95.25	.4360	8044360	97.80	.4615	8044615	107.10	.4870	8044870	116.55	.5125	8045125	138.35
.4110	8044110	95.25	.4365	8044365	97.80	.4620	8044620	107.10	.4875	8044875	116.55	.5130	8045130	138.35
.4115	8044115	95.25	.4370	804111	97.80	.4625	8044625	107.10	.4880	8044880	116.55	.5135	8045135	138.35
.4120	8044120	95.25	.4375	80428	93.10	.4630	8044630	107.10	.4885	8044885	116.55	.5140	8045140	138.35
.4125	8044125	95.25	.4380	8044380	107.10	.4635	8044635	107.10	.4890	8044890	116.55	.5145	8045145	138.35
.4130	8044130	90.70	.4385	8044385	107.10	.4640	8044640	107.10	.4895	8044895	116.55	.5150	8045150	138.35

REAMERS



MATERIAL SPECIFIC REAMERS SOLID CARBIDE HEAD TYPES 800 & 801 FRACTIONAL

MATERIAL SPECIFIC

STRAIGHT FLUTES STRAIGHT STEEL SHANK

TYPE 801 - STRAIGHT FLUTES - FOR NON-FERROUS MATERIALS
TYPE 800 - STRAIGHT FLUTES - FOR CAST IRONS & STEELS

- Solid carbide head
- Straight steel shank on .1911" tool diameter and larger (smaller sizes have a straight solid carbide shank)
- Tolerances are listed on page 101
- Tool geometry appropriate for material being machined
- Diameters 7/64" and below furnished with male centers



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	801/821/811
40	NON-FERROUS - SHORT CHIPS	801/821/811	
60	CAST IRONS	800/820/810	
80	LOW STRENGTH STEELS	800/820/810	
100	MEDIUM STRENGTH STEELS	800/820/810	
120	HIGH STRENGTH STEELS	800/820/810	
140	HIGH TEMPERATURE ALLOYS	800/820/810	

MODIFICATIONS (See list on page 101)

NOTE: See NOTE on page 111

TOOL DIAMETER		TYPE 801 NON-FERROUS EDP NO.	TYPE 800 CAST IRON/STEEL EDP NO.	BOTH TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						FLUTE	OVER-ALL			1	2	3	4	5-7	8-14**
* -	-	-	80099	-	.0800	4	3/4	3	0.0811 - 0.0890	\$60.45	\$44.70	\$39.30	\$36.85	\$34.05	\$32.00
* 3/32	.0938	-	80006	\$28.90	.0880	4	3/4	3	0.0891 - 0.0970	60.45	44.70	39.30	36.85	34.05	32.00
* 7/64	.1094	-	80007	28.90	.0943	4	7/8	3 1/2	0.0971 - 0.1120	60.45	44.70	39.30	36.85	34.05	32.00
* 1/8	.1250	80108	80008	28.90	.1099	4	7/8	3 1/2	0.1121 - 0.1280	60.45	44.70	39.30	36.85	34.05	32.00
* 9/64	.1406	80109	80009	33.00	.1255	4	7/8	3 1/2	0.1281 - 0.1435	64.60	48.75	43.45	40.95	38.25	36.10
* 5/32	.1562	80110	80010	33.95	.1411	4	1	4	0.1436 - 0.1590	65.50	49.75	44.40	41.90	39.15	37.10
* 11/64	.1719	80111	80011	38.30	.1567	4	1	4	0.1591 - 0.1750	69.80	54.10	48.75	46.25	43.60	41.40
* 3/16	.1875	80112	80012	39.10	.1724	4	1 1/8	4 1/2	0.1751 - 0.1910	70.70	54.90	49.55	47.05	44.35	42.25
13/64	.2031	80113	80013	41.70	.1880	6	1 1/4	5	-	-	-	-	-	-	-
7/32	.2188	80114	80014	41.70	.1880	6	1 1/4	5	0.1911 - 0.2210	73.30	57.50	52.15	49.60	46.95	44.85
15/64	.2344	80115	80015	44.35	.2193	6	1 1/2	6	-	-	-	-	-	-	-
1/4	.2500	80116	80016	44.35	.2193	6	1 1/2	6	0.2211 - 0.2530	75.90	60.10	54.80	52.35	49.55	47.45
17/64	.2656	80117	80017	47.70	.2505	6	1 1/2	6	-	-	-	-	-	-	-
9/32	.2812	80118	80018	47.70	.2505	6	1 1/2	6	0.2531 - 0.2840	79.20	63.45	58.15	55.65	52.95	50.80
19/64	.2969	80119	80019	49.60	.2817	6	1 5/8	6	-	-	-	-	-	-	-
5/16	.3125	80120	80020	49.60	.2817	6	1 5/8	6	0.2841 - 0.3150	81.20	65.40	60.10	57.60	54.90	52.75
21/64	.3281	80121	80021	53.10	.3130	6	1 5/8	6	-	-	-	-	-	-	-
11/32	.3438	80122	80022	53.10	.3130	6	1 5/8	6	0.3151 - 0.3470	84.65	68.80	63.50	61.00	58.30	56.25
23/64	.3594	80123	80023	57.10	.3443	6	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	80124	80024	57.10	.3443	6	1 3/4	7	0.3471 - 0.3780	88.65	72.85	67.55	65.05	62.35	60.25
25/64	.3906	80125	80025	65.30	.3755	6	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	80126	80026	65.30	.3755	6	1 3/4	7	0.3781 - 0.4090	96.80	81.00	75.75	73.25	70.50	68.35
27/64	.4219	80127	80027	69.35	.4067	6	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	80128	80028	69.35	.4067	6	1 3/4	7	0.4091 - 0.4410	100.85	85.05	79.80	77.30	74.55	72.40
29/64	.4531	80129	80029	73.50	.4380	6	1 3/4	8	-	-	-	-	-	-	-
15/32	.4688	80130	80030	73.50	.4380	6	1 3/4	8	0.4411 - 0.4720	105.05	89.25	83.95	81.45	78.75	76.60
31/64	.4844	80131	80031	78.90	.4693	6	1 3/4	8	-	-	-	-	-	-	-
1/2	.5000	80132	80032	78.90	.4693	6	1 3/4	8	0.4721 - 0.5030	110.50	94.65	89.35	86.85	84.15	82.05
33/64	.5156	80133	80033	101.80	.5005	6	1 7/8	9	-	-	-	-	-	-	-
17/32	.5312	80134	80034	101.80	.5005	6	1 7/8	9	0.5031 - 0.5340	133.30	117.50	112.25	109.70	107.00	104.85
35/64	.5469	80135	80035	120.15	.5005	6	1 7/8	9	-	-	-	-	-	-	-
9/16	.5625	80136	80036	120.15	.5005	6	1 7/8	9	0.5341 - 0.5660	151.70	135.85	130.55	128.05	125.35	123.25
37/64	.5781	80137	80037	136.35	.5630	6	1 7/8	9	-	-	-	-	-	-	-
19/32	.5938	80138	80038	136.35	.5630	6	1 7/8	9	0.5661 - 0.5970	167.90	152.10	146.80	144.25	141.60	139.45
39/64	.6094	80139	80039	137.90	.5630	6	1 7/8	9	-	-	-	-	-	-	-
5/8	.6250	80140	80040	137.90	.5630	6	1 7/8	9	0.5971 - 0.6280	169.40	153.60	148.35	145.85	143.10	140.95
21/32	.6562	80142	80042	199.50	.6255	6	2	9 1/2	0.6281 - 0.6590	229.50	214.45	209.45	207.05	204.75	202.40
11/16	.6875	80144	80044	199.50	.6255	6	2	9 1/2	0.6591 - 0.6910	229.50	214.45	209.45	207.05	204.75	202.40
23/32	.7188	80146	80046	224.45	.6880	6	2	9 1/2	0.6911 - 0.7220	254.45	239.40	234.40	232.00	229.70	227.35
3/4	.7500	80148	80048	224.45	.6880	6	2	9 1/2	0.7221 - 0.7530	254.45	239.40	234.40	232.00	229.70	227.35
25/32	.7812	80150	80050	249.15	.7505	8	2	10	0.7531 - 0.7840	279.15	264.10	259.10	256.70	254.40	252.05
13/16	.8125	80152	80052	271.85	.7817	8	2	10	0.7841 - 0.8160	301.85	286.80	281.80	279.40	277.10	274.75
27/32	.8438	80154	80054	286.70	.8130	8	2	10	0.8161 - 0.8470	316.70	301.65	296.65	294.25	291.95	289.60
7/8	.8750	80156	80056	280.70	.8440	8	2	10	0.8471 - 0.8780	310.70	295.65	290.65	288.25	285.95	283.60
29/32	.9062	80158	80058	328.45	.8755	8	2	10	0.8781 - 0.9090	358.45	343.40	338.40	336.00	333.70	331.35
15/16	.9375	80160	80060	345.25	.9067	8	2	10	0.9091 - 0.9410	375.25	360.20	355.20	352.80	350.50	348.15
31/32	.9688	80162	80062	361.65	.9380	8	2	10	0.9411 - 0.9720	391.65	376.60	371.60	369.20	366.90	364.55
1	1.0000	80164	80064	375.30	.9693	8	2	10	0.9721 - 1.0030	405.30	390.25	385.25	382.85	380.55	378.20

*Solid carbide head and shank (.0811" - .1910" tool diameters)

**Quantities of 15 or more - price of fractional size in same size range.



MATERIAL SPECIFIC REAMERS

SOLID CARBIDE HEAD TYPES 810, 811, 820, 821 FRACTIONAL



RIGHT OR LEFT SPIRAL FLUTES
STRAIGHT STEEL SHANK



- TYPE 811 - RIGHT SPIRAL FLUTES - FOR NON-FERROUS MATERIALS**
- TYPE 810 - RIGHT SPIRAL FLUTES - FOR CAST IRONS & STEELS**
- TYPE 821 - LEFT SPIRAL FLUTES - FOR NON-FERROUS MATERIALS**
- TYPE 820 - LEFT SPIRAL FLUTES - FOR CAST IRONS & STEELS**

MODIFICATIONS (See list on page 101)

Use the tool selector on page 110 to determine which tool is appropriate for the material you are reaming.

- Solid carbide head
- Straight steel shank on .1911" tool diameter and larger (smaller sizes have a straight solid carbide shank)
- Tool diameter tolerance thru .2500": plus .0002", minus .0000"
over .2500": plus .0003", minus .0000"
- Shank diameter tolerance: plus .0000", minus .0010"
- Left spiral flutes should not be used on blind holes
- Tool geometry appropriate for material being machined

NO COATINGS

NOTE: For best results in reaming tough steel alloys and cast steels, we recommend Type 480 Carbide Tipped Reamer (page 74) or Type 459 Carbide Tipped Reamer (page 78). They utilize special steel cutting grade carbides with excellent cutting and wear characteristics.

REAMERS

TOOL DIAMETER		EDP NO. - R SPIRAL		EDP NO. - L SPIRAL		ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
FRAC.	DEC.	TYPE 811 NON-FERROUS	TYPE 810 CAST IRON/STEEL	TYPE 821 NON-FERROUS	TYPE 820 CAST IRON/STEEL		MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
									FLT	OVER-ALL		1	2	3	4	5-7	8-14**
* 1/8	.1250	81108	81008	82108	82008	\$35.20	.1099	4	7/8	3 1/2	0.1121-0.1280	\$66.80	\$51.00	\$45.60	\$43.10	\$40.40	\$38.30
* 9/64	.1406	81109	81009	82109	82009	40.20	.1255	4	7/8	3 1/2	0.1281-0.1435	71.80	55.95	50.65	48.15	45.45	43.35
* 5/32	.1562	81110	81010	82110	82010	41.50	.1411	4	1	4	0.1436-0.1590	73.05	57.15	51.90	49.40	46.65	44.55
* 11/64	.1719	81111	81011	82111	82011	46.70	.1567	4	1	4	0.1591-0.1750	78.35	62.50	57.15	54.65	52.00	49.90
* 3/16	.1875	81112	81012	82112	82012	47.70	.1724	4	1 1/8	4 1/2	0.1751-0.1910	79.20	63.45	58.15	55.65	52.95	50.80
13/64	.2031	81113	81013	82113	82013	50.80	.1880	6	1 1/4	5	-	-	-	-	-	-	-
7/32	.2188	81114	81014	82114	82014	50.80	.1880	6	1 1/4	5	0.1911-0.2210	82.35	66.55	61.30	58.80	56.00	53.90
15/64	.2344	81115	81015	82115	82015	54.15	.2193	6	1 1/2	6	-	-	-	-	-	-	-
1/4	.2500	81116	81016	82116	82016	54.15	.2193	6	1 1/2	6	0.2211-0.2530	85.65	69.80	64.60	62.05	59.30	57.15
17/64	.2656	81117	81017	82117	82017	58.15	.2505	6	1 1/2	6	-	-	-	-	-	-	-
9/32	.2812	81118	81018	82118	82018	58.15	.2505	6	1 1/2	6	0.2531-0.2840	89.70	73.90	68.60	66.10	63.35	61.30
19/64	.2969	81119	81019	82119	82019	60.60	.2817	6	1 5/8	6	-	-	-	-	-	-	-
5/16	.3125	81120	81020	82120	82020	60.60	.2817	6	1 5/8	6	0.2841-0.3150	92.10	76.30	71.05	68.50	65.80	63.65
21/64	.3281	81121	81021	82121	82021	64.70	.3130	6	1 5/8	6	-	-	-	-	-	-	-
11/32	.3438	81122	81022	82122	82022	64.70	.3130	6	1 5/8	6	0.3151-0.3470	96.25	80.45	75.15	72.60	69.90	67.85
23/64	.3594	81123	81023	82123	82023	69.65	.3443	6	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	81124	81024	82124	82024	69.65	.3443	6	1 3/4	7	0.3471-0.3780	101.15	85.35	80.10	77.60	74.85	72.70
25/64	.3906	81125	81025	82125	82025	79.60	.3755	6	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	81126	81026	82126	82026	79.60	.3755	6	1 3/4	7	0.3781-0.4090	111.15	95.35	90.05	87.50	84.85	82.70
27/64	.4219	81127	81027	82127	82027	84.50	.4067	6	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	81128	81028	82128	82028	84.50	.4067	6	1 3/4	7	0.4091-0.4410	116.00	100.20	94.95	92.45	89.70	87.55
29/64	.4531	81129	81029	82129	82029	89.65	.4380	6	1 3/4	8	-	-	-	-	-	-	-
15/32	.4688	81130	81030	82130	82030	89.65	.4380	6	1 3/4	8	0.4411-0.4720	121.15	105.40	100.10	97.60	94.90	92.75
31/64	.4844	81131	81031	82131	82031	96.20	.4693	6	1 3/4	8	-	-	-	-	-	-	-
1/2	.5000	81132	81032	82132	82032	96.20	.4693	6	1 3/4	8	0.4721-0.5030	127.70	111.95	106.65	104.10	101.45	99.30
33/64	.5156	81133	81033	82133	82033	124.00	.5005	6	1 7/8	9	-	-	-	-	-	-	-
17/32	.5312	81134	81034	82134	82034	124.00	.5005	6	1 7/8	9	0.5031-0.5340	155.60	139.75	134.45	131.95	129.25	127.15
35/64	.5469	81135	81035	82135	82035	146.50	.5005	6	1 7/8	9	-	-	-	-	-	-	-
9/16	.5625	81136	81036	82136	82036	146.50	.5005	6	1 7/8	9	0.5341-0.5660	178.05	162.20	156.90	154.40	151.70	149.55
37/64	.5781	81137	81037	82137	82037	166.20	.5630	6	1 7/8	9	-	-	-	-	-	-	-
19/32	.5938	81138	81038	82138	82038	166.20	.5630	6	1 7/8	9	0.5661-0.5970	197.70	181.95	176.65	174.15	171.40	169.30
39/64	.6094	81139	81039	82139	82039	168.10	.5630	6	1 7/8	9	-	-	-	-	-	-	-
5/8	.6250	81140	81040	82140	82040	168.10	.5630	6	1 7/8	9	0.5971-0.6280	199.70	183.90	178.55	176.05	173.35	171.25
21/32	.6562	81142	81042	82142	82042	243.40	.6255	6	2	9 1/2	0.6281-0.6590	280.00	261.65	255.55	252.60	249.80	246.95
11/16	.6875	81144	81044	82144	82044	243.40	.6255	6	2	9 1/2	0.6591-0.6910	280.00	261.65	255.55	252.60	249.80	246.95
23/32	.7188	81146	81046	82146	82046	273.85	.6880	6	2	9 1/2	0.6911-0.7220	310.45	292.05	285.95	283.05	280.25	277.35
3/4	.7500	81148	81048	82148	82048	273.85	.6880	6	2	9 1/2	0.7221-0.7530	310.45	292.05	285.95	283.05	280.25	277.35
25/32	.7812	81150	81050	82150	82050	303.95	.7505	8	2	10	0.7531-0.7840	340.55	322.20	316.10	313.15	310.35	307.50
13/16	.8125	81152	81052	82152	82052	331.65	.7817	8	2	10	0.7841-0.8160	368.25	349.90	343.80	340.85	338.05	335.20
27/32	.8438	81154	81054	82154	82054	349.75	.8130	8	2	10	0.8161-0.8470	386.35	368.00	361.90	359.00	356.20	353.30
7/8	.8750	81156	81056	82156	82056	342.45	.8440	8	2	10	0.8471-0.8780	379.05	360.70	354.60	351.65	348.85	346.00
29/32	.9062	81158	81058	82158	82058	400.70	.8755	8	2	10	0.8781-0.9090	437.30	418.95	412.85	409.90	407.10	404.25
15/16	.9375	81160	81060	82160	82060	421.20	.9067	8	2	10	0.9091-0.9410	457.80	439.45	433.35	430.40	427.60	424.75
31/32	.9688	81162	81062	82162	82062	441.20	.9380	8	2	10	0.9411-0.9720	477.80	459.45	453.35	450.40	447.60	444.75
1	1.0000	81164	81064	82164	82064	457.85	.9693	8	2	10	0.9721-1.0030	494.45	476.10	470.00	467.10	464.25	461.40

*Solid carbide head and shank (.1121" - .1910" tool diameters)

**Quantities of 15 or more - price of fractional size in same size range.



CARBIDE TIPPED DRILLS TECHNICAL INFORMATION

DRILL BASICS

- Drills are end cutting tools used to produce holes when rapid removal of material is desired
- Use shortest drill available for accurate hole location and minimum runout for maximum tool life
- Non-coolant fed drills (conventional twist drills) are generally effective in holes up to 3 tool diameters deep. Peck cycles should be used for deeper holes to achieve better chip evacuation
- Coolant fed drills should be used for production drilling of holes greater than 3 tool diameters deep
- Coolant fed drills offer higher penetration rates, reduced cycle times, and straighter/rounder holes with better finishes
- If non-centering drill is used, HANNIBAL recommends using a spotting drill for improved hole location
- Spotting drill's point angle should be greater than production drill's point angle to prevent edge chipping and to ensure accurate hole location

DRILL SELECTION GUIDE

TWIST DRILLS – NON-COOLANT

- Excellent up to 3 tool diameters deep
- Use shortest length available
- Excellent in non-ferrous materials and cast irons
- Generally not recommended for drilling steels (use die drill or coolant drill instead)
- See page 113 for point selection

DIE DRILLS

- Excellent in hardened steel 35 to 65 Rockwell C
- Will cut without annealing the workpiece
- See page 113 for point selection

COOLANT FED DRILLS – STRAIGHT FLUTES

- Longer flutes for deep hole drilling
- Produce straighter holes and better finishes
- Excellent performance in many materials
- See page 113 for point selection

COOLANT FED TWIST DRILLS

- Better chip clearing ability in ductile materials and high density alloys
- Spiral flutes permit higher feed rates
- Excellent performance in most materials
- See page 113 for point selection

CORE DRILLS

- Used to enlarge cored, punched, drilled, or preformed holes
- Capable of removing up to 30% of tool diameter
- Produces near-reamed surface finish
- Often eliminates need for final reaming or boring operation

DRILL SPECIFICATIONS

- Carbide tip brazed to hardened tool steel body
- Smooth flutes for effective chip flow
- Precision ground to ensure concentricity of tip & body
- Dimension & element tolerances conform to following standard, unless otherwise specified on selected styles:
ASME/ANSIB94.11M * ISO * NAS 907 * USCTI
- "Taper Shank No." refers to American Standard taper series (formerly Morse taper series) per ASME/ANSIB5.10
- Jobber length & taper length drills ½" diameter and smaller are manufactured with an overall length tolerance of plus ¼", minus ⅛"

DRILL TOLERANCES

Tool Diameter	Diameter		Included Angle		Lip Height T.I.V.
	Plus	Minus	Plus	Minus	
Thru ⅛"	.0000"	.0005"	5°	5°	.0020"
Over ⅛" thru ¼"	.0000"	.0007"	5°	5°	.0030"
Over ¼" thru ½"	.0000"	.0010"	5°	5°	.0040"
Over ½" thru 1"	.0000"	.0012"	3°	3°	.0050"
Over 1" thru 1¼"	.0000"	.0015"	3°	3°	.0060"

DRILL PROBLEM SOLVING GUIDE – CARBIDE TIPPED

AVOID PROBLEMS BY CAREFUL ORIGINAL SET-UP

- MACHINE CONDITION Tool holder in good condition and secure part holding fixture.
- TOOL CONDITION Use cutting tool recommended for material being machined. Avoid excessive tool overhang.
- FEEDS & SPEEDS Start with feeds and speeds recommended for material being machined (see page 8 & 9).
- COOLANT Coolant flow must be adequate to avoid intermittent quenching and to flush chips promptly, avoid the recutting of hardened chips.

DRILLING PROBLEMS	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. CHIPPED CUTTING EDGE	Excessive feed Excessive lip relief Vibration Thermal cracking carbide	Reduce feed Reduce lip relief to provide smaller chisel angle Frequently a worn drill bushing – Replace Maintain adequate coolant flow at all times
2. SHORT TOOL LIFE	Drill dwelling Only one lip cutting	Maintain adequate feed at all times Regrind with equal lip heights and chisel in center
3. DRILL WALKS OR DRIFTS	Unequal lip heights Worn drill bushing	Regrind with equal lip heights and chisel in center Replace drill bushing
4. OVERSIZED HOLES	Unequal lip heights Excessive lip relief Worn drill bushing	Regrind with equal lip heights and chisel in center Reduce lip relief to provide smaller chisel angle Replace drill bushing
5. ROUGH FINISH	Dull cutting edge Inadequate coolant	Regrind with fine grit diamond wheel Review type of coolant and maintain adequate flow

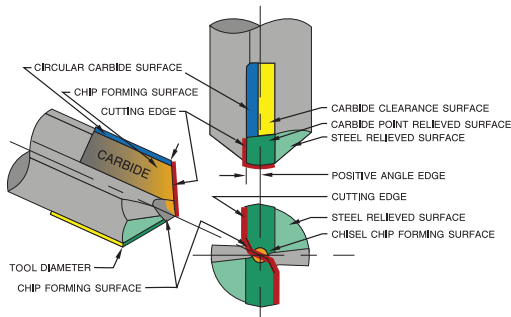


DRILL POINT SELECTION GUIDE TWIST DRILLS, DIE DRILLS & COOLANT FED DRILLS

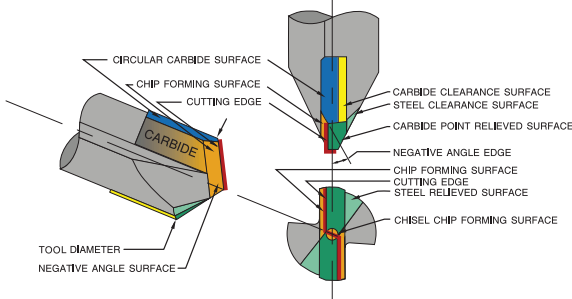
**FOR HIGHER PENETRATION RATES, LONGER TOOL LIFE
& MORE ACCURATE HOLES**

TWIST DRILLS (NON-COOLANT)	AVAILABILITY	POINT GEOMETRY & USE	ADVANTAGES
90° Included point (not spotting type)	Special Order	Cam relieved. Produces thinner chips for very ductile, soft materials (Chip Class 20 & 40)	High lip relief for faster penetration. Less abrasive wear at corners.
118° Standard point	Standard	Cam relieved. For variety of materials.	Easily resharpened on standard equipment
118° Split point	Modified Standard	Cam relieved. Excellent web thinned point.	Self centering. Split point acts as chipbreaker.
118° x 45° Double angle point	Modified Standard	Both angles cam relieved.	Reduces corner wear at point.
135° Split point	Standard	For cast irons and abrasive materials.	Reduces breakthrough burrs.
135° x 45° Double angle point	Modified Standard	Cam relieved and split to NAS 907 standard. Excellent web thinning point.	Self centering. Split point acts as chipbreaker.
		Both angles cam relieved.	Reduces corner wear at point.
		For cast irons and abrasive materials.	Reduces breakthrough burrs.
DIE DRILLS FOR HARD STEEL	AVAILABILITY	POINT GEOMETRY & USE	ADVANTAGES
118° Negative edge point	Standard	For very hard materials (50 Rc to 65 Rc).	Longer tool life.
118° Positive edge point	Standard	For less hard materials (35 Rc to 50 Rc).	Permits higher feed rates.
140° Negative edge point	Standard	For extremely tough materials (50 Rc to 65 Rc).	Longer tool life.
140° Positive edge point	Standard	For less hard materials (35 Rc to 50 Rc).	Permits higher feed rates.
COOLANT FED DRILLS – STRAIGHT FLUTES	AVAILABILITY	POINT GEOMETRY & USE	ADVANTAGES
125° Four facet point	Standard	Flat relieved point. Self centering - free cutting.	Permits higher feed rates. Longer tool life. Closer hole tolerance.
125° x 45° Double angle, Four facet point	Modified Standard	Both angles flat relieved. Self centering - free cutting.	Reduces corner wear at point. Reduces breakthrough burrs.
COOLANT FED TWIST DRILLS	AVAILABILITY	POINT GEOMETRY & USE	ADVANTAGES
125° Four facet point	Standard	Flat relieved point. Self centering - free cutting.	Permits higher feed rates. Longer tool life. Closer hole tolerances.
125° x 45° Double angle, Four facet point	Modified Standard	Both angles flat relieved. Self centering - free cutting.	Reduces corner wear at point. Reduces breakthrough burrs.
135° Split point	Standard	Cam relieved point. Excellent web thinned point.	Self centering. Split point acts as chipbreaker.
135° x 45° Double angle, Split point	Modified Standard	Both angles cam relieved. Excellent web thinning point.	Reduces corner wear at point. Reduces breakthrough burrs.

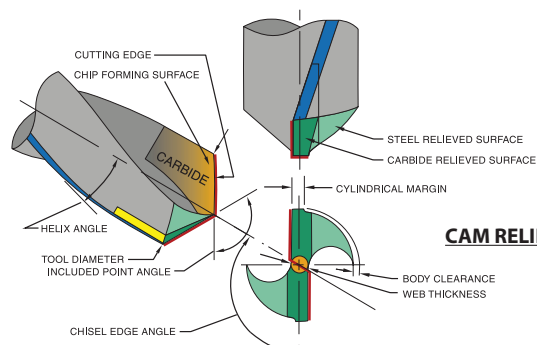
DRILLS



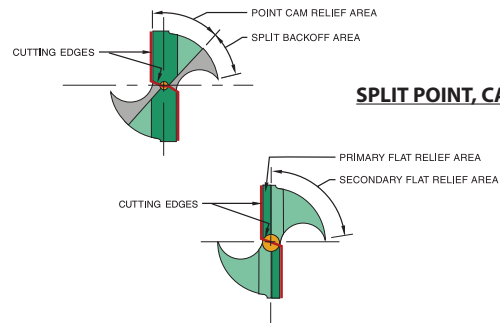
POSITIVE ANGLE CUTTING EDGE DIE DRILL (PG. 134)



NEGATIVE ANGLE CUTTING EDGE DIE DRILL (PG. 134)



CAM RELIEVED POINT



SPLIT POINT, CAM RELIEVED

FOUR FACET POINT, FLAT RELIEVED



DRILLS INDEX AND COMPARISON CHART



DESCRIPTION	HANNIBAL			CJT	CLEVELAND	FULLERTON	CHICAGO/ LATROBE	IMCO	MORSE	NYTD	PTD/DORMER
	FRAC. PAGE	METRIC PAGE	TOOL TYPE								
AIRCRAFT EXTENSION DRILLS											
6" Length, 135° Split Point	133	-	610	-	-	-	-	-	-	-	-
12" Length, 135° Split Point	133	-	611	129	-	-	-	-	-	-	-
COOLANT FED DRILLS											
Short Length, Straight, 125° 4 Facet Pt.	116	116	652	171	-	-	-	-	-	-	-
Long Length, Straight, 125° 4 Facet Pt.	117	117	650	170	-	-	-	-	-	-	-
Extra Long, Straight, 125° 4 Facet Pt.	115	115	658	172	-	-	-	-	-	-	-
Short Length, Twist, 125° 4 Facet Pt.	118	118	654	295	-	-	-	-	-	-	-
Short Length, Twist, 135° Split Pt.	118	118	655	296	-	-	-	-	-	-	-
Long Length, Twist, 125° 4 Facet Pt.	119	119	656	290	-	-	-	-	-	-	-
Long Length, Twist, 135° Split Pt.	119	119	657	-	-	-	-	-	-	-	-
CORE DRILLS											
Straight Shank	140	141	620	-	-	-	-	-	5456	-	-
Taper Shank	140	141	622	410	-	-	CD	-	5454	-	-
Straight Shank - For Steels	142	143	621	-	-	-	-	-	-	-	-
Taper Shank - For Steels	142	143	623	-	-	-	-	-	-	-	-
GLASS & TILE DRILLS	144	-	680	162	-	-	-	-	5467	-	PG6
HARD STEEL DIE DRILLS											
Negative Cutting Edge, 118° Pt.	134	134	670	-	-	-	HD	-	5423	-	D000
Negative Cutting Edge, 140° Pt.	134	-	671	-	-	-	-	-	-	-	-
Positive Cutting Edge, 118° Pt.	134	134	672	150	760	40HD	-	DT40	-	4041	-
Positive Cutting Edge, 140° Pt.	134	-	673	-	-	-	-	-	-	-	-
Spade Type, 120° Pt.	135	-	674	152	-	-	-	-	5420	-	-
Spade Type 140° Pt.	135	-	675	-	-	-	-	-	-	-	-
SOLID CARBIDE DRILLS											
118° Split Point, Jobber Length	126-127	-	860	-	-	-	-	D20	-	-	-
140° Die Drill	135	-	893	-	-	-	-	D40	-	-	-
JOBBER LENGTH DRILLS											
118° Standard Point	122	123	600	120	2727	40CT	CTD	DT20	5330	4011	D444
135° Split Point	122	123	601	125	-	-	-	-	-	-	-
118° Standard Point - Tanged	124	125	690	-	-	-	-	-	-	-	-
135° Split Point - Tanged	124	125	691	-	-	-	-	-	-	-	-
MASONRY DRILLS	144	-	681-684	-	Yes	-	-	Yes	Yes	Yes	Yes
REDUCED SHANK DIAMETER DRILLS											
Hard Steel Die	136	-	670/672	-	-	-	-	-	-	-	-
Jobbers Length	136	-	600/601	-	-	-	-	-	-	-	-
Stub Length	136	-	640/641	-	-	-	-	-	-	-	-
Silver & Deming, 118° Std. Pt.	137	-	616	163	-	-	-	-	-	-	-
Silver & Deming, 135° Split Pt.	137	-	618	-	-	-	-	-	-	-	-
SPOTTING/CENTERING (CNC) DRILLS											
90° Short or Regular Length	137	-	647/677	-	-	-	-	D23	-	-	-
120° Short or Regular Length	137	-	648/678	-	-	-	-	D23	-	-	-
140° Short or Regular Length	137	-	649/679	-	-	-	-	-	-	-	-
STUB LENGTH (CNC) DRILLS											
118° Standard Point	120	121	640	110	-	-	-	DT21	-	-	-
135° Split Point	120	121	641	115	-	-	-	-	-	-	-
TAPER LENGTH DRILLS											
118° Standard Point	128	129	630	130	2745	40TL	TLD	DT22	5314	4013	D555
135° Split Point	128	129	631	-	-	-	-	-	-	-	-
TAPER SHANK DRILLS											
118° Standard Point	130	131	660	140	2740	40TLT	TSD	6850	5302	4451	D999
135° Split Point	130	131	661	-	-	-	-	-	-	-	-
Smaller Taper Shank, 118° Std. Pt.	131	-	668	-	-	-	-	-	-	-	-
8" Extra Long Flute, 118° Std. Pt.	132	-	664	-	-	-	-	-	-	-	-
11" Extra Long Flute, 118° Std. Pt.	132	-	665	-	-	-	-	-	-	-	-
CENTERS											
Brown & Sharpe - Half or Full	139	-	593/596	-	-	-	-	-	5293/6	-	-
Jarno - Half or Full	139	-	594/597	-	-	-	-	-	5294/7	-	-
Morse - Half or Full	139	-	592/595	-	790	-	-	-	5292/5	-	-
COBALT DRILLS											
135° Split Point	138	-	699	-	-	-	-	-	-	-	-



COOLANT FED DRILLS – EXTRA LONG LENGTH CARBIDE TIPPED TYPE 658 FRACTIONAL & METRIC



125° FOUR FACET POINT

TYPE 658 – 125° FOUR FACET POINT

- Extra long length
- Flat relieved, self centering point
- Polished straight flutes
- Two coolant outlets
- Drill body diameter smaller than tool diameter to prevent gauling; shank diameter same size as tool diameter
- Shank and tool diameter tolerances: plus .000"; minus .001"
- Carbide high temperature brazed to hardened tool steel body
- Extra long carbide tip for additional regrinds
- Straight flutes for superior hole straightness, improved finish and maximum chip capacity

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	658
	40	NON-FERROUS - SHORT CHIPS	658
	60	CAST IRONS	658
	80	LOW STRENGTH STEELS	CALL US
	100	MEDIUM STRENGTH STEELS	658
	120	HIGH STRENGTH STEELS	658
	140	HIGH TEMPERATURE ALLOYS	CALL US

MODIFICATIONS (See list on page 117)

USE:

- For drilling most materials, including some stainless steels
- For very deep holes, 12-24 tool diameters deep



TOOL DIAMETER		LENGTH		TYPE 658 EDP NO.	PRICE	DECIMAL DIAMETER RANGE*
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL			
1/16	.3125	8	10	65820	\$201.70	0.3100-0.3160
1/32	.3438	8	10	65822	201.70	0.3281-0.3460
3/16	.3750	9	11	65824	213.15	0.3594-0.3770
1/2	.4062	9	11	65826	242.65	0.3906-0.4080
7/16	.4375	9	11	65828	242.65	0.4200-0.4390
15/32	.4688	9 3/4	12	65830	256.25	0.4531-0.4710
1/2	.5000	9 3/4	12	65832	256.25	0.4800-0.5030
9/16	.5312	9 3/4	12	65834	275.05	0.5118-0.5330
5/16	.5625	10 3/4	13	65836	296.25	0.5430-0.5650
3/8	.6250	10 3/4	13	65840	312.80	0.6070-0.6270
11/16	.6875	11 3/4	14	65844	325.70	0.6693-0.6900
23/32	.7188	11 3/4	14	65846	340.60	0.7031-0.7220
3/4	.7500	11 3/4	14	65848	344.70	0.7320-0.7530
13/16	.8125	12 3/4	15	65852	366.10	0.7953-0.8160
7/8	.8750	12 3/4	15	65856	394.50	0.8570-0.8780
15/16	.9375	13 3/4	16	65860	421.45	0.9180-0.9390
1	1.0000	13 3/4	16	65864	456.45	0.9820-1.0030

*Contact us for decimal diameter range prices

TECHNICAL INFORMATION

WHY - WHEN - HOW

WHY USE CARBIDE TIPPED COOLANT FED DRILLS?

- Deep hole capability
- Higher feeds & speeds result in reduced drilling cycle times
- Increased tool life versus non-coolant carbide or coolant high speed steel
- Better quality holes - straighter, rounder & better finish
- More efficient chip evacuation
- Superior to solid carbide drills because tough tool steel bodies absorb shock loads

WHEN TO USE CARBIDE TIPPED COOLANT FED DRILLS

- Especially effective for holes greater than three tool diameters deep
- Use on non-ferrous materials (chip classes 20 & 40), cast irons (chip class 60), medium & high strength steels (chip classes 100 & 120), and some high temp alloys (chip class 140) & stainless steels
- When improved hole size & finish could eliminate secondary finishing operations (reaming or boring)

HOW TO SELECT COOLANT PRESSURE

- Inadequate coolant pressure or volume can lead to tool failure - contact HANNIBAL for recommendations
- High coolant pressure results in higher stock removal rates & longer tool life
- High coolant pressure required to break through point vapor barrier created by chip forming heat at drill point
- High coolant pressure required to effectively evacuate the high volume of chips produced by faster feeds & speeds
- Coolant pressure requirement decreases with increase in drill diameter but requires more volume of coolant
- Coolant pressure requirement increases with decrease in drill diameter but requires less volume of coolant
- Strongly recommend automatic drilling operation shutdown if coolant flow is interrupted
- Use continuous coolant pressure system (non-pulsating)

TOOL DIAMETER		LENGTH				TYPE 658 METRIC EDP NO.	METRIC PRICE	METRIC DIAMETER RANGE**
mm	INCH	FLUTE		OVERALL				
mm	INCH	mm	INCH	mm	INCH			
8.0	.3150	203	8	254	10	658080	\$268.80	-
8.5	.3346	203	8	254	10	658085	268.80	8.280 - 8.788
9.0	.3543	229	9	279	11	658090	284.00	8.992 - 9.576
9.5	.3740	229	9	279	11	658095	284.00	-
10.0	.3937	229	9	279	11	658100	312.10	9.779 - 10.363
10.5	.4134	229	9	279	11	658105	312.10	10.414 - 11.151
11.0	.4331	229	9	279	11	658110	312.10	-
11.5	.4528	248	9 3/4	305	12	658115	329.70	11.153 - 12.000
12.0	.4724	248	9 3/4	305	12	658120	329.70	-
12.5	.4921	248	9 3/4	305	12	658125	329.70	12.002 - 12.776

**Contact us for metric diameter range prices



COOLANT FED DRILLS - SHORT LENGTH CARBIDE TIPPED TYPE 652 FRACTIONAL & METRIC



125° FOUR FACET POINT



TYPE 652 - 125° FOUR FACET POINT

- Short length
- Flat relieved, self centering point
- Polished straight flutes
- Two coolant outlets
- Drill body diameter smaller than tool diameter to prevent gauling; shank diameter same size as tool diameter
- Shank and tool diameter tolerances: plus .000", minus .001"
- Carbide tips brazed to hardened tool steel body
- Extra long carbide tip for additional regrinds
- Straight flutes for superior hole straightness, improved finish and maximum chip capacity.

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	652
	40	NON-FERROUS - SHORT CHIPS	652
	60	CAST IRONS	652
	80	LOW STRENGTH STEELS	CALL US
	100	MEDIUM STRENGTH STEELS	652
	120	HIGH STRENGTH STEELS	652
140	HIGH TEMPERATURE ALLOYS	CALL US	

MODIFICATIONS (Prompt delivery)

- Decimal diameter ranges
- Metric diameter ranges
- Modified point and/or angle
- Flat(s) on shank
- Tanged shank
- Coatings available:

- TITANIUM NITRIDE - TiN
- TITANIUM CARBONITRIDE - TiCN
- ZIRCONIUM NITRIDE - ZrN
- AL TITANIUM NITRIDE - AlTiN

USE:

- For drilling most materials, including some stainless steels
- For intermediate depth holes, 5-8 tool diameters deep

TOOL DIAMETER		LENGTH		TYPE 652 EDP NO.	PRICE	DECIMAL DIAMETER RANGE*
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL			
1/4	.2500	2 1/2	4 29/32	65216	\$127.65	.2490-.2530
17/64	.2656	2 3/4	5 5/32	65217	127.65	-
9/32	.2812	2 3/4	5 5/32	65218	127.65	.2640-.2840
19/64	.2969	3 3/16	5 19/32	65219	127.65	-
5/16	.3125	3 3/16	5 19/32	65220	127.65	.2950-.3160
21/64	.3281	3 7/16	5 27/32	65221	127.65	-
11/32	.3438	3 7/16	5 27/32	65222	127.65	.3260-.3460
23/64	.3594	3 5/8	6 1/32	65223	128.95	-
3/8	.3750	3 5/8	6 1/32	65224	128.95	.3540-.3770
25/64	.3906	3 7/8	6 9/32	65225	132.20	-
13/32	.4062	3 7/8	6 9/32	65226	132.20	.3850-.4080
27/64	.4219	4 1/16	6 15/32	65227	136.65	-
7/16	.4375	4 1/16	6 15/32	65228	136.65	.4100-.4390
29/64	.4531	4 3/16	6 23/32	65229	145.50	-
15/32	.4688	4 3/16	6 23/32	65230	145.50	.4391-.4724
31/64	.4844	4 1/2	6 29/32	65231	149.75	-
1/2	.5000	4 1/2	6 29/32	65232	149.75	.4725-.5030
33/64	.5156	4 13/16	7 7/32	65233	156.05	-
17/32	.5312	4 13/16	7 7/32	65234	158.70	.5031-.5330
35/64	.5469	4 13/16	7 7/32	65235	164.60	-
9/16	.5625	4 13/16	7 7/32	65236	167.50	.5331-.5650
37/64	.5781	5 3/16	7 19/32	65237	197.30	-
19/32	.5938	5 3/16	7 19/32	65238	200.60	.5651-.5950
39/64	.6094	5 3/16	7 19/32	65239	197.30	-
5/8	.6250	5 3/16	7 19/32	65240	200.60	.5951-.6270
41/64	.6406	5 3/16	7 19/32	65241	211.50	-
21/32	.6562	5 3/16	7 19/32	65242	211.50	.6271-.6570
43/64	.6719	5 5/8	8 1/32	65243	228.85	-
11/16	.6875	5 5/8	8 1/32	65244	229.15	.6571-.6900
45/64	.7031	5 5/8	8 1/32	65245	235.65	-
23/32	.7188	5 5/8	8 1/32	65246	235.65	.6901-.7220
47/64	.7344	6 1/16	8 15/32	65247	238.00	-
3/4	.7500	6 1/16	8 15/32	65248	238.00	.7221-.7530
49/64	.7656	6 1/16	8 9/16	65249	249.15	-
25/32	.7812	6 1/16	8 9/16	65250	253.45	.7531-.7840
13/16	.8125	6 1/16	8 9/16	65252	257.70	.7841-.8160
27/32	.8438	6 1/2	9	65254	273.25	.8161-.8470
7/8	.8750	6 1/2	9	65256	279.80	.8471-.8780
29/32	.9062	6 15/16	9 7/16	65258	299.45	.8781-.9090
15/16	.9375	6 15/16	9 7/16	65260	321.65	.9091-.9390
31/32	.9688	6 15/16	9 7/16	65262	334.85	.9391-.9700
1	1.0000	7 3/8	9 7/8	65264	343.65	.9701-1.0030

TOOL DIAMETER		LENGTH				TYPE 652 METRIC EDP NO.	METRIC PRICE	METRIC DIAMETER RANGE*
mm	INCH	FLUTE		OVERALL				
**6.5	.2559	64	2 1/2	125	4 29/32	652065	\$164.85	-
7.0	.2756	70	2 3/4	131	5 5/32	652070	164.85	6.706 - 7.214
7.5	.2953	81	3 3/16	142	5 19/32	652075	164.85	7.493 - 8.026
8.0	.3150	81	3 3/16	142	5 19/32	652080	164.85	-
8.5	.3346	87	3 7/16	148	5 27/32	652085	159.20	8.280 - 8.788
9.0	.3543	92	3 5/8	153	6 1/32	652090	159.20	8.992 - 9.576
9.5	.3740	92	3 5/8	153	6 1/32	652095	159.20	-
10.0	.3937	98	3 7/8	159	6 9/32	652100	159.20	9.779 - 10.363
10.5	.4134	103	4 1/16	164	6 15/32	652105	164.85	10.414 - 11.151
11.0	.4331	103	4 1/16	164	6 15/32	652110	164.85	-
11.5	.4528	109	4 3/16	171	6 23/32	652115	178.20	11.153 - 12.000
12.0	.4724	109	4 3/16	171	6 23/32	652120	178.20	-
12.5	.4921	114	4 1/2	175	6 29/32	652125	182.00	12.002 - 12.776
13.0	.5118	122	4 13/16	183	7 7/32	652130	193.30	12.779 - 13.538
13.5	.5315	122	4 13/16	183	7 7/32	652135	193.30	-
14.0	.5512	122	4 13/16	183	7 7/32	652140	202.80	13.541 - 14.351
14.5	.5709	131	5 3/16	193	7 19/32	652145	246.35	14.354 - 15.113
15.0	.5906	131	5 3/16	193	7 19/32	652150	246.35	-
15.5	.6102	131	5 3/16	193	7 19/32	652155	246.35	15.116 - 15.926
16.0	.6299	131	5 3/16	193	7 19/32	652160	252.05	15.928 - 16.688
16.5	.6496	131	5 3/16	193	7 19/32	652165	252.05	-
17.0	.6693	143	5 5/8	204	8 1/32	652170	269.10	16.690 - 17.526
17.5	.6890	143	5 5/8	204	8 1/32	652175	269.10	-
18.0	.7087	143	5 5/8	204	8 1/32	652180	282.45	17.529 - 18.339
18.5	.7283	154	6 1/16	215	8 15/32	652185	284.25	18.341 - 19.126
19.0	.7480	154	6 1/16	215	8 15/32	652190	284.25	-
19.5	.7677	154	6 1/16	217	8 9/16	652195	301.40	19.129 - 19.914
20.0	.7874	154	6 1/16	217	8 9/16	652200	305.20	19.916 - 20.726
20.5	.8071	154	6 1/16	217	8 9/16	652205	305.20	-
21.0	.8268	165	6 1/2	229	9	652210	322.20	20.729 - 21.514
21.5	.8465	165	6 1/2	229	9	652215	322.20	-
22.0	.8661	165	6 1/2	229	9	652220	329.80	21.516 - 22.301
22.5	.8858	176	6 15/16	240	9 7/16	652225	363.90	22.304 - 23.089
23.0	.9055	176	6 15/16	240	9 7/16	652230	363.90	-
23.5	.9252	176	6 15/16	240	9 7/16	652235	377.15	23.091 - 23.851
24.0	.9449	176	6 15/16	240	9 7/16	652240	392.30	23.853 - 24.638
24.5	.9646	176	6 15/16	240	9 7/16	652245	389.00	-
25.0	.9843	187	7 3/8	251	9 7/8	652250	392.30	24.641 - 25.476

*Contact us for decimal and metric diameter range prices

**6.5mm tool diameter has 6.35mm shank diameter



COOLANT FED DRILLS - LONG LENGTH CARBIDE TIPPED TYPE 650 FRACTIONAL & METRIC



125° FOUR FACET POINT



TYPE 650 - 125° FOUR FACET POINT

- Same description as Type 652 on page 116, except long length

USE:

- For drilling most materials, including some stainless steels
- For deep holes, 7-15 tool diameters deep

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	650
40	NON-FERROUS - SHORT CHIPS	650	
60	CAST IRONS	650	
80	LOW STRENGTH STEELS	CALL US	
100	MEDIUM STRENGTH STEELS	650	
120	HIGH STRENGTH STEELS	650	
140	HIGH TEMPERATURE ALLOYS	CALL US	

MODIFICATIONS (Prompt delivery)

- Decimal diameter ranges
- Metric diameter ranges
- Modified point and/or angle
- Flat(s) on shank
- Tanged shank
- Coatings available:

TITANIUM NITRIDE - TiN
TITANIUM CARBONITRIDE - TiCN
ZIRCONIUM NITRIDE - ZrN
AL TITANIUM NITRIDE - AlTiN

TOOL DIAMETER		LENGTH		TYPE 650 EDP NO.	PRICE	DECIMAL DIAMETER RANGE*
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL			
1/4	.2500	4 5/8	6 1/8	65016	\$139.75	0.2490 - 0.2530
17/64	.2656	4 3/4	6 1/4	65017	139.75	-
9/32	.2812	4 3/4	6 1/4	65018	139.75	0.2640 - 0.2840
19/64	.2969	4 7/8	6 3/8	65019	139.75	-
5/16	.3125	4 7/8	6 3/8	65020	139.75	0.2950 - 0.3160
21/64	.3281	5	6 1/2	65021	134.55	-
11/32	.3438	5	6 1/2	65022	134.55	0.3260 - 0.3460
23/64	.3594	5 1/4	6 3/4	65023	131.10	-
3/8	.3750	5 1/4	6 3/4	65024	136.15	0.3540 - 0.3770
25/64	.3906	5 1/2	7	65025	134.55	-
13/32	.4062	5 1/2	7	65026	134.55	0.3850 - 0.4080
27/64	.4219	5 3/4	7 1/4	65027	138.85	-
7/16	.4375	5 3/4	7 1/4	65028	138.85	0.4100 - 0.4390
29/64	.4531	5 3/4	7 1/2	65029	147.65	-
15/32	.4688	5 3/4	7 1/2	65030	147.65	0.4391 - 0.4724
31/64	.4844	5 3/4	7 3/4	65031	152.05	-
1/2	.5000	5 3/4	7 3/4	65032	152.05	0.4725 - 0.5030
33/64	.5156	6	8	65033	163.10	-
17/32	.5312	6	8	65034	163.10	0.5031 - 0.5330
35/64	.5469	6 1/4	8 1/4	65035	168.95	-
9/16	.5625	6 1/4	8 1/4	65036	171.85	0.5331 - 0.5650
37/64	.5781	6 3/4	8 3/4	65037	203.45	-
19/32	.5938	6 3/4	8 3/4	65038	206.90	0.5651 - 0.5950
39/64	.6094	6 3/4	8 3/4	65039	203.45	-
5/8	.6250	6 3/4	8 3/4	65040	206.90	0.5951 - 0.6270
41/64	.6406	7	9	65041	214.40	-
21/32	.6562	7	9	65042	218.10	0.6271 - 0.6570
43/64	.6719	7 1/4	9 1/4	65043	229.55	-
11/16	.6875	7 1/4	9 1/4	65044	233.60	0.6571 - 0.6900
45/64	.7031	7 1/2	9 1/2	65045	238.30	-
23/32	.7188	7 1/2	9 1/2	65046	242.30	0.6901 - 0.7220
47/64	.7344	7 3/4	9 3/4	65047	240.30	-
3/4	.7500	7 3/4	9 3/4	65048	244.50	0.7221 - 0.7530
49/64	.7656	7 7/8	9 7/8	65049	259.95	-
25/32	.7812	7 7/8	9 7/8	65050	259.95	0.7531 - 0.7840
13/16	.8125	8	10	65052	264.35	0.7841 - 0.8160
27/32	.8438	8	10	65054	279.80	0.8161 - 0.8470
7/8	.8750	8	10	65056	286.40	0.8471 - 0.8780
29/32	.9062	8	10	65058	317.30	0.8781 - 0.9090
15/16	.9375	8 3/4	10 3/4	65060	330.45	0.9091 - 0.9390
31/32	.9688	9	11	65062	333.65	0.9391 - 0.9700
1	1.0000	9	11	65064	333.65	0.9701 - 1.0030

*Contact us for decimal and metric diameter range prices

TOOL DIAMETER		LENGTH				TYPE 650 METRIC EDP NO.	METRIC PRICE	METRIC DIAMETER RANGE*
mm	INCH	FLUTE		OVERALL				
6.5	.2559	117	4 5/8	156	6 1/8	650065	\$145.65	-
7.0	.2756	121	4 3/4	159	6 1/4	650070	145.65	6.706 - 7.214
7.5	.2953	124	4 7/8	162	6 3/8	650075	145.65	7.493 - 8.026
8.0	.3150	124	4 7/8	162	6 3/8	650080	145.65	-
8.5	.3346	127	5	165	6 1/2	650085	140.65	8.280 - 8.788
9.0	.3543	133	5 1/4	171	6 3/4	650090	140.65	8.992 - 9.576
9.5	.3740	133	5 1/4	171	6 3/4	650095	140.65	-
10.0	.3937	140	5 1/2	178	7	650100	140.65	9.779 - 10.363
10.5	.4134	146	5 3/4	184	7 1/4	650105	145.65	10.414 - 11.151
11.0	.4331	146	5 3/4	184	7 1/4	650110	145.65	-
11.5	.4528	146	5 3/4	191	7 1/2	650115	157.40	11.153 - 12.000
12.0	.4724	146	5 3/4	191	7 1/2	650120	157.40	-
12.5	.4921	146	5 3/4	197	7 3/4	650125	160.75	12.002 - 12.776
13.0	.5118	152	6	203	8	650130	170.75	12.779 - 13.538
13.5	.5315	152	6	203	8	650135	170.75	-
14.0	.5512	159	6 1/4	210	8 1/4	650140	179.15	13.541 - 14.351
14.5	.5709	171	6 3/4	222	8 3/4	650145	217.60	14.354 - 15.113
15.0	.5906	171	6 3/4	222	8 3/4	650150	217.60	-
15.5	.6102	171	6 3/4	222	8 3/4	650155	217.60	15.116 - 15.926
16.0	.6299	178	7	229	9	650160	222.65	15.928 - 16.688
16.5	.6496	178	7	229	9	650165	222.65	-
17.0	.6693	184	7 1/4	235	9 1/4	650170	237.70	16.690 - 17.526
17.5	.6890	184	7 1/4	235	9 1/4	650175	237.70	-
18.0	.7087	191	7 1/2	241	9 1/2	650180	249.50	17.529 - 18.339
18.5	.7283	197	7 3/4	248	9 3/4	650185	251.10	18.341 - 19.126
19.0	.7480	197	7 3/4	248	9 3/4	650190	251.10	-
19.5	.7677	200	7 7/8	251	9 7/8	650195	266.25	19.129 - 19.914
20.0	.7874	203	8	254	10	650200	269.60	19.916 - 20.726
20.5	.8071	203	8	254	10	650205	269.60	-
21.0	.8268	203	8	254	10	650210	284.60	20.729 - 21.514
21.5	.8465	203	8	254	10	650215	284.60	-
22.0	.8661	203	8	254	10	650220	291.30	21.516 - 22.301
22.5	.8858	203	8	254	10	650225	321.45	22.304 - 23.089
23.0	.9055	203	8	254	10	650230	321.45	-
23.5	.9252	222	8 3/4	273	10 3/4	650235	333.15	23.091 - 23.851
24.0	.9449	229	9	279	11	650240	346.55	23.853 - 24.638
24.5	.9646	229	9	279	11	650245	346.55	-
25.0	.9843	229	9	279	11	650250	346.55	24.641 - 25.476

*6.5mm tool diameter has 6.35mm shank diameter



COOLANT FED TWIST DRILLS - SHORT LENGTH CARBIDE TIPPED TYPES 654 & 655 FRACTIONAL & METRIC



125° FOUR FACET POINT OR 135° SPLIT POINT



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	654
	40	NON-FERROUS - SHORT CHIPS	654
	60	CAST IRONS	654
	80	LOW STRENGTH STEELS	CALL US
	100	MEDIUM STRENGTH STEELS	655
	120	HIGH STRENGTH STEELS	655
140	HIGH TEMPERATURE ALLOYS	CALL US	

MODIFICATIONS (See list on page 119)

TYPE 654 - 125° FLAT RELIEVED FOUR FACET POINT TYPE 655 - 135° CAM RELIEVED SPLIT POINT

- Same descriptions as Type 656 & 657 on pg. 119, except short length
- Shank & body diameter smaller than tool diameter to prevent gauling (for modified tool diameter orders, shank & body diameter will be reduced when appropriate)

USE:

- For drilling most materials, including some stainless steels and high temperature alloys
- For intermediate depth holes, up to approximately 4 tool diameters deep

TOOL DIAMETER		DIMENSIONS		TYPE 654 - 125° PT.		TYPE 655 - 135° PT.		DECIMAL DIAMETER RANGE*
FRACTIONAL	DECIMAL	SHANK & BODY DIAM.	LENGTH	EDP NO.	PRICE	EDP NO.	PRICE	
			FLUTE OVER-ALL					
1/4	.2500	.2344	1 17/32 3 15/16	65416	\$130.05	65516	\$159.90	.2420 - .2610
17/64	.2656	.2500	1 19/32 4	65417	148.30	65517	170.75	-
9/32	.2812	.2656	1 19/32 4	65418	139.35	65518	168.80	.2611 - .2953
19/64	.2969	.2812	1 3/4 4 5/32	65419	148.30	65519	170.75	-
5/16	.3125	.2969	1 3/4 4 5/32	65420	139.35	65520	168.80	.2954 - .3230
21/64	.3281	.3125	1 15/16 4 11/32	65421	148.30	65521	170.75	-
11/32	.3438	.3281	1 15/16 4 11/32	65422	139.35	65522	168.80	.3231 - .3550
23/64	.3594	.3438	2 1/8 4 17/32	65423	148.30	65523	177.65	-
3/8	.3750	.3594	2 1/8 4 17/32	65424	139.35	65524	168.80	.3551 - .3850
25/64	.3906	.3750	2 9/32 4 11/16	65425	148.30	65525	188.00	-
13/32	.4062	.3906	2 9/32 4 11/16	65426	139.35	65526	181.00	.3851 - .4170
27/64	.4219	.4062	2 1/2 4 29/32	65427	148.30	65527	188.00	-
7/16	.4375	.4219	2 1/2 4 29/32	65428	139.35	65528	181.00	.4171 - .4430
29/64	.4531	.4375	2 21/32 5 1/16	65429	156.90	65529	188.00	-
15/32	.4688	.4531	2 21/32 5 1/16	65430	148.35	65530	181.00	.4431 - .4740
31/64	.4844	.4688	2 13/16 5 7/32	65431	160.40	65531	188.00	-
1/2	.5000	.4844	2 13/16 5 7/32	65432	152.80	65532	181.00	.4741 - .5060
33/64	.5156	.5000	3 5 19/32	65433	158.60	65533	188.00	-
17/32	.5312	.5156	3 5 19/32	65434	152.80	65534	181.00	.5061 - .5360
35/64	.5469	.5312	3 1/8 5 17/32	65435	158.60	65535	188.00	-
9/16	.5625	.5469	3 1/8 5 17/32	65436	152.80	65536	181.00	.5361 - .5680
37/64	.5781	.5625	3 9/32 5 11/16	65437	170.75	65537	196.55	-
19/32	.5938	.5781	3 9/32 5 11/16	65438	163.50	65538	191.70	.5681 - .5990
39/64	.6094	.5938	3 7/16 5 27/32	65439	170.75	65539	196.55	-
5/8	.6250	.6094	3 7/16 5 27/32	65440	163.50	65540	191.70	.5991 - .6310
41/64	.6406	.6250	3 23/32 6 1/16	65441	170.75	65541	196.55	-
21/32	.6562	.6406	3 23/32 6 1/16	65442	163.50	65542	191.70	.6311 - .6710
43/64	.6719	.6562	3 13/16 6 7/32	65443	170.75	65543	196.55	-
11/16	.6875	.6719	3 13/16 6 7/32	65444	163.50	65544	191.70	.6711 - .6930
45/64	.7031	.6875	3 15/16 6 11/32	65445	189.75	65545	217.30	-
23/32	.7188	.7031	3 15/16 6 11/32	65446	182.80	65546	210.95	.6931 - .7300
47/64	.7344	.7188	4 1/8 6 17/32	65447	189.75	65547	217.30	-
3/4	.7500	.7344	4 1/8 6 17/32	65448	182.80	65548	210.95	.7301 - .7560
49/64	.7656	.7500	4 9/32 6 29/32	65449	189.75	65549	217.30	-
25/32	.7812	.7656	4 9/32 6 29/32	65450	182.80	65550	210.95	.7561 - .7890
51/64	.7969	.7812	4 7/16 6 15/16	65451	225.95	65551	251.80	-
13/16	.8125	.7969	4 7/16 6 15/16	65452	218.05	65552	246.05	.7891 - .8180
53/64	.8281	.8125	4 19/32 7 3/32	65453	225.95	65553	251.80	-
27/32	.8438	.8281	4 19/32 7 3/32	65454	218.05	65554	246.05	.8181 - .8590
55/64	.8594	.8438	4 11/16 7 3/16	65455	225.95	65555	251.80	-
7/8	.8750	.8594	4 11/16 7 3/16	65456	218.05	65556	246.05	.8591 - .8810
57/64	.8906	.8750	4 7/8 7 3/8	65457	239.65	65557	267.35	-
29/32	.9062	.8906	4 7/8 7 3/8	65458	232.10	65558	260.20	.8811 - .9190
59/64	.9219	.9062	5 1/32 7 17/32	65459	239.65	65559	267.35	-
15/16	.9375	.9219	5 1/32 7 17/32	65460	232.10	65560	260.20	.9191 - .9420
61/64	.9531	.9375	5 3/16 7 11/16	65461	253.50	65561	281.10	-
31/32	.9688	.9531	5 3/16 7 11/16	65462	244.35	65562	272.40	.9421 - .9830
63/64	.9844	.9688	5 5/16 7 13/16	65463	253.50	65563	281.10	-
1	1.0000	.9844	5 5/16 7 13/16	65464	244.35	65564	272.40	.9831 - 1.0060
1 1/32	1.0312	1.0000	5 11/16 8 3/16	65466	263.70	65566	291.80	-
1 1/16	1.0625	1.0000	5 11/16 8 3/16	65468	272.40	65568	300.60	-
1 3/32	1.0938	1.0000	5 11/16 8 3/16	65470	279.50	65570	307.65	-
1 1/8	1.1250	1.0000	5 11/16 8 3/16	65472	290.05	65572	318.20	1.0061 - 1.1320

*Contact us for decimal diameter prices

Contact us for metric diameter ranges & prices

TOOL DIAMETER		SHANK & BODY DIAM.		LENGTH				TYPE 654 - 125° PT.		TYPE 655 - 135° PT.	
mm	INCH	mm	INCH	FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
				mm	INCH	mm	INCH				
6.5	.2559	6.0	.2362	39	1 17/32	100	3 15/16	654065	\$139.75	655065	\$163.80
7.0	.2756	6.5	.2559	40	1 19/32	102	4	654070	148.30	655070	170.75
7.5	.2953	7.0	.2756	40	1 19/32	102	4	654075	148.30	655075	170.75
8.0	.3150	7.5	.2953	44	1 3/4	106	4 5/32	654080	148.30	655080	170.75
8.5	.3346	8.0	.3150	49	1 15/16	110	4 11/32	654085	148.30	655085	177.65
9.0	.3543	8.5	.3346	49	1 15/16	110	4 11/32	654090	148.30	655090	177.65
9.5	.3740	9.0	.3543	54	2 1/8	115	4 17/32	654095	148.30	655095	177.65
10.0	.3937	9.5	.3740	58	2 9/32	119	4 11/16	654100	148.30	655100	188.00
10.5	.4134	10.0	.3937	58	2 9/32	119	4 11/16	654105	148.30	655105	188.00
11.0	.4331	10.5	.4134	64	2 1/2	125	4 29/32	654110	148.30	655110	188.00
11.5	.4528	11.0	.4331	67	2 21/32	129	5 1/16	654115	156.90	655115	188.00
12.0	.4724	11.5	.4528	67	2 21/32	129	5 1/16	654120	156.90	655120	188.00
12.5	.4921	12.0	.4724	71	2 13/16	133	5 7/32	654125	160.40	655125	188.00
13.0	.5118	12.5	.4921	76	3	137	5 13/32	654130	158.60	655130	188.00
13.5	.5315	13.0	.5118	76	3	137	5 13/32	654135	158.60	655135	188.00
14.0	.5512	13.5	.5315	79	3 1/8	140	5 17/32	654140	158.60	655140	188.00
14.5	.5709	14.0	.5512	83	3 9/32	144	5 11/16	654145	170.75	655145	196.55
15.0	.5906	14.5	.5709	83	3 9/32	144	5 11/16	654150	170.75	655150	196.55
15.5	.6102	15.0	.5906	87	3 7/16	148	5 27/32	654155	170.75	655155	196.55
16.0	.6299	15.5	.6102	87	3 7/16	148	5 27/32	654160	170.75	655160	196.55
16.5	.6496	16.0	.6299	93	3 23/32	154	6 1/16	654165	170.75	655165	196.55
17.0	.6693	16.5	.6496	93	3 23/32	154	6 1/16	654170	170.75	655170	196.55
17.5	.6890	17.0	.6693	97	3 13/16	158	6 7/32	654175	170.75	655175	217.30
18.0	.7087	17.5	.6890	100	3 15/16	161	6 11/32	654180	189.75	655180	217.30
18.5	.7283	18.0	.7087	100	3 15/16	161	6 11/32	654185	189.75	655185	217.30
19.0	.7480	18.5	.7283	105	4 1/8	166	6 17/32	654190	189.75	655190	217.30
19.5	.7677	19.0	.7480	109	4 9/32	172	6 25/32	654195	189.75	655195	217.30
20.0	.7874	19.5	.7677	109	4 9/32	172	6 25/32	654200	189.75	655200	251.80
20.5	.8071	20.0	.7874	113	4 7/16	176	6 15/16	654205	225.95	655205	251.80
21.0	.8268	20.5	.8071	117	4 19/32	180	7 3/32	654210	225.95	655210	251.80
21.5	.8465	21.0	.8268	117	4 19/32	180	7 3/32	654215	225.95	655215	251.80
22.0	.8661	21.5	.8465	119	4 11/16	183	7 3/16	654220	225.95	655220	251.80
22.5	.8858	22.0	.8661	124	4 7/8	187	7 3/8	654225	239.65	655225	267.35
23.0	.9055	22.5	.8858	124	4 7/8	187	7 3/8	654230	239.65	655230	267.35
2											



COOLANT FED TWIST DRILLS – LONG LENGTH CARBIDE TIPPED TYPES 656 & 657 FRACTIONAL



125° FOUR FACET POINT OR 135° SPLIT POINT

TYPE 656 – 125° FLAT RELIEVED FOUR FACET POINT

- Long length
- Polished right spiral flutes
- Self centering 125° point
- Two coolant outlets
- Shank & body diameter same size as tool diameter
- Shank and tool diameter tolerances: plus .000", minus .001"
- Carbide high temperature brazed to hardened tool steel body
- Extra heavy web for higher torsional strength and rigidity
- Spiral flutes for improved chip removal in vertical applications

TYPE 657 – 135° CAM RELIEVED SPLIT POINT

- Same as Type 656 above, except with 135° cam relieved split point designed for drilling tough abrasive or high tensile materials

USE:

- For drilling most materials, including some stainless steels and high temperature alloys
- For deep holes, up to approximately 8 tool diameters deep

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	656
	40	NON-FERROUS - SHORT CHIPS	656
	60	CAST IRONS	656
	80	LOW STRENGTH STEELS	CALL US
	100	MEDIUM STRENGTH STEELS	657
	120	HIGH STRENGTH STEELS	657
	140	HIGH TEMPERATURE ALLOYS	CALL US

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified point and/or angle
- Flat(s) on shank
- Tanged shank
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN



TOOL DIAMETER		LENGTH		TYPE 656 - 125° PT.		TYPE 657 - 135° PT.		DECIMAL DIAMETER RANGE*
FRAC.	DEC.	FLUTE	OVERALL	EDP NO.	PRICE	EDP NO.	PRICE	
1/4	.2500	3 3/4	6 1/8	65616	\$140.20	65716	\$175.45	-
5/32	.2812	3 7/8	6 1/4	65618	140.20	65718	172.70	0.2650 - 0.2840
3/16	.3125	4	6 3/8	65620	140.20	65720	172.70	0.2953 - 0.3150
1/32	.3438	4 1/8	6 1/2	65622	140.20	65722	172.70	0.3280 - 0.3460
3/8	.3750	4 1/4	6 3/4	65624	140.20	65724	172.70	0.3543 - 0.3770
13/32	.4062	4 3/8	7	65626	140.20	65726	185.35	0.3900 - 0.4080
7/16	.4375	4 7/8	7 1/4	65628	140.20	65728	185.35	0.4130 - 0.4390
15/32	.4688	4 7/8	7 1/2	65630	149.05	65730	185.00	0.4391 - 0.4710
1/2	.5000	5	7 3/4	65632	153.40	65732	185.15	0.4711 - 0.5020
17/32	.5312	5 1/4	8	65634	164.75	65734	198.60	0.5021 - 0.5330
9/16	.5625	5 3/8	8 1/4	65636	173.55	65736	209.30	0.5331 - 0.5640
19/32	.5938	5 3/8	8 1/2	65638	206.95	65738	246.80	0.5641 - 0.5940
5/8	.6250	5 3/4	8 3/4	65640	206.95	65740	246.80	0.5941 - 0.6260
21/32	.6562	5 7/8	9	65642	220.15	65742	262.50	0.6261 - 0.6570
11/16	.6875	6	9 1/4	65644	235.85	65744	281.15	0.6571 - 0.6900
23/32	.7188	6 3/16	9 1/2	65646	245.70	65746	288.40	0.6901 - 0.7210
3/4	.7500	6 3/8	9 3/4	65648	247.00	65748	289.95	0.7211 - 0.7520

*Contact us for decimal and metric diameter prices



CNC STUB LENGTH DRILLS CARBIDE TIPPED TYPES 640 & 641 FRACTIONAL/WIRE/LETTER



118° STANDARD OR 135° SPLIT POINT



TYPE 640 – 118° STANDARD POINT

- Stub length - 118° standard point
- Detailed specifications on page 112

TYPE 641 – 135° SPLIT POINT

- Same as Type 640 above, except with 135° split point designed for drilling tough abrasive or high tensile materials

USE:

- For exact location shallow drilling
- Excellent starting drill
- Often used in CNC machining centers
- Short length results in a very rigid and sturdy drill

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	640
	40	NON-FERROUS - SHORT CHIPS	640/641
	60	CAST IRONS	641/640
	80	LOW STRENGTH STEELS	CALL US
100	MEDIUM STRENGTH STEELS	CALL US	
120	HIGH STRENGTH STEELS	CALL US	
140	HIGH TEMPERATURE ALLOYS	CALL US	

MODIFICATIONS (See list on page 123)

NOTE: For stocked reduced shank diameters, see page 136.

TOOL DIAMETER			LENGTH		TYPE 640 - 118° PT.		TYPE 641 - 135° PT.	
FRACTIONAL	WIRE/LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
1/8	32	.1160	7/8	1 7/8	64232	\$16.20	64332	\$17.95
	31	.1200	7/8	1 7/8	64231	16.20	64331	17.95
	30	.1285	15/16	1 15/16	64008	12.10	64108	13.10
3/64	29	.1360	15/16	1 15/16	64229	17.10	64329	18.85
	28	.1405	15/16	1 15/16	64228	17.10	64328	18.85
	27	.1406	15/16	1 15/16	64009	14.65	64109	17.25
1/4	26	.1470	1	2 1/16	64226	17.10	64326	18.85
	25	.1495	1	2 1/16	64225	17.10	64325	18.85
	24	.1520	1	2 1/16	64224	17.10	64324	18.85
	23	.1540	1	2 1/16	64223	17.10	64323	18.85
5/32	22	.1562	1	2 1/16	64010	12.85	64110	13.95
	21	.1570	1 1/16	2 1/8	64222	17.10	64322	18.85
	20	.1590	1 1/16	2 1/8	64221	17.10	64321	18.85
	20	.1610	1 1/16	2 1/8	64220	19.85	64320	22.10
11/64	19	.1660	1 1/16	2 1/8	64219	19.85	64319	22.10
	18	.1695	1 1/16	2 1/8	64218	19.85	64318	22.10
	17	.1719	1 1/16	2 1/8	64011	17.45	64111	18.75
3/16	16	.1730	1 1/8	2 3/16	64217	20.30	64317	22.50
	15	.1770	1 1/8	2 3/16	64216	20.30	64316	22.50
	14	.1800	1 1/8	2 3/16	64215	20.30	64315	22.50
	13	.1820	1 1/8	2 3/16	64214	20.30	64314	22.50
1/2	12	.1850	1 1/2	2 3/16	64213	20.30	64313	22.50
	12	.1875	1 1/2	2 3/16	64012	13.50	64112	14.80
	11	.1890	1 3/16	2 1/4	64212	20.15	64312	22.30
	10	.1910	1 3/16	2 1/4	64211	20.15	64311	22.30
13/64	9	.1935	1 3/16	2 1/4	64210	20.15	64310	22.30
	9	.1960	1 3/16	2 1/4	64209	20.15	64309	22.30
	8	.1990	1 3/16	2 1/4	64208	20.15	64308	22.30
	7	.2010	1 3/16	2 1/4	64207	17.70	64307	21.25
7/32	6	.2031	1 3/16	2 1/4	64013	17.45	64113	18.75
	6	.2040	1 1/4	2 3/8	64206	20.30	64306	22.50
	5	.2055	1 1/4	2 3/8	64205	20.30	64305	22.50
	4	.2090	1 1/4	2 3/8	64204	20.30	64304	22.50
1/2	3	.2130	1 1/4	2 3/8	64203	17.70	64303	21.25
	2	.2188	1 1/2	2 3/8	64014	14.50	64114	16.10
	2	.2210	1 1/2	2 3/8	64202	20.15	64302	22.30
	1	.2280	1 1/2	2 3/8	64201	17.70	64301	22.30
15/64	A	.2340	1 1/2	2 3/8	64401	20.15	64501	22.30
	B	.2344	1 5/16	2 7/16	64015	16.10	64115	19.20
	C	.2380	1 5/16	2 1/2	64402	20.15	64502	22.30
	D	.2420	1 3/8	2 1/2	64403	20.15	64503	22.30
1/4	E	.2460	1 3/8	2 1/2	64404	17.70	64504	21.25
	F	.2500	1 3/8	2 1/2	64016	14.75	64116	17.05
	G	.2570	1 7/16	2 5/8	64406	20.55	64506	24.70
17/64	H	.2610	1 7/16	2 5/8	64407	20.55	64507	24.70
	I	.2656	1 7/16	2 5/8	64017	17.95	64117	21.30
	J	.2660	1 1/2	2 11/16	64408	19.90	64508	25.85
	K	.2720	1 1/2	2 11/16	64409	20.55	64509	24.70

TOOL DIAMETER			LENGTH		TYPE 640 - 118° PT.		TYPE 641 - 135° PT.	
FRACTIONAL	LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
9/32	L	.2812	1 1/2	2 11/16	64018	\$17.00	64118	\$19.75
		.2900	1 1/16	2 3/4	64412	24.00	64512	26.60
19/64	M	.2950	1 1/16	2 3/4	64413	24.00	64513	26.60
		.2969	1 1/16	2 3/4	64019	20.55	64119	24.40
5/16	N	.3020	1 5/8	2 13/16	64414	27.50	64514	30.60
		.3125	1 5/8	2 13/16	64020	18.05	64120	21.05
		.3160	1 11/16	2 15/16	64415	25.35	64515	30.55
21/64	O	.3230	1 11/16	2 15/16	64416	28.75	64516	32.00
		.3281	1 11/16	2 15/16	64021	22.30	64121	25.95
		.3320	1 11/16	3	64417	25.35	64517	30.55
11/32	P	.3390	1 11/16	3	64418	25.35	64518	30.55
		.3438	1 11/16	3	64022	21.10	64122	24.40
		.3480	1 3/4	3 1/16	64419	29.10	64519	32.35
23/64	Q	.3580	1 3/4	3 1/16	64420	29.10	64520	32.35
		.3594	1 3/4	3 1/16	64023	23.00	64123	26.80
		.3680	1 13/16	3 1/8	64421	26.05	64521	31.30
3/8	R	.3750	1 13/16	3 1/8	64024	21.60	64124	25.05
		.3770	1 7/8	3 1/4	64422	33.55	64522	37.20
		.3860	1 7/8	3 1/4	64423	29.60	64523	35.60
25/64	S	.3906	1 7/8	3 1/4	64025	25.60	64125	29.75
		.3970	1 15/16	3 5/16	64424	29.60	64524	37.20
		.4040	1 15/16	3 5/16	64425	33.55	64525	37.20
13/32	T	.4062	1 15/16	3 5/16	64026	25.60	64126	29.75
		.4130	2	3 3/8	64426	38.10	64526	42.40
		.4219	2	3 3/8	64027	28.40	64127	32.35
7/16	U	.4375	2 1/16	3 7/16	64028	27.40	64128	30.40
		.4531	2 1/8	3 9/16	64029	36.50	64129	46.90
		.4688	2 1/8	3 9/16	64030	38.95	64130	45.30
1/2	V	.4844	2 3/16	3 11/16	64031	34.95	64131	44.90
		.5000	2 1/4	3 3/4	64032	37.30	64132	43.35
		.5156	2 3/8	3 7/8	64033	55.65	64133	61.95
33/64	W	.5312	2 3/8	3 7/8	64034	46.45	64134	52.45
		.5469	2 1/2	4	64035	55.65	64135	61.95
		.5625	2 1/2	4	64036	46.45	64136	52.45
19/32	X	.5781	2 5/8	4 1/8	64037	65.00	64137	72.25
		.5938	2 5/8	4 1/8	64038	53.30	64138	60.10
		.6094	2 3/4	4 1/4	64039	65.00	64139	72.25
39/64	Y	.6250	2 3/4	4 1/4	64040	53.30	64140	60.10
		.6406	2 7/8	4 1/2	64041	77.55	64141	86.30
		.6562	2 7/8	4 1/2	64042	64.05	64142	72.30
41/64	Z	.6719	2 7/8	4 5/8	64043	79.55	64143	88.45
		.6875	2 7/8	4 5/8	64044	65.80	64144	74.20
		.7031	3	4 3/4	64045	89.90	64145	99.90
23/32		.7188	3	4 3/4	64046	74.55	64146	86.55
		.7344	3 1/8	5	64047	90.00	64147	100.15
		.7500	3 1/8	5	64048	74.75	64148	84.20
49/64		.7656	3 1/4	5 1/8	64049	96.30	64149	107.15
		.7812	3 1/4	5 1/8	64050	92.35	64150	107.20
		.7969	3 3/8	5 1/4	64051	107.80	64151	119.90
51/64		.8125	3 3/8	5 1/4	64052	92.45	64152	104.25
		.8281	3 1/2	5 3/8	64053	105.60	64153	117.40
		.8438	3 1/2	5 3/8	64054	101.20	64154	117.55

CONTINUED ON NEXT PAGE



CNC STUB LENGTH DRILLS

CARBIDE TIPPED TYPES 640 & 641 METRIC



118° STANDARD OR 135° SPLIT POINT

CONTINUED FROM PAGE 120 - TYPE 640 & 641 FRACTIONAL

TOOL DIAMETER		LENGTH		TYPE 640 - 118° PT.		TYPE 641 - 135° PT.	
FRACTIONAL	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
5/64	.8594	3 1/2	5 1/2	64055	\$118.25	64155	\$131.55
7/8	.8750	3 1/2	5 1/2	64056	101.40	64156	114.30
57/64	.8906	3 3/8	5 3/8	64057	113.45	64157	126.15
29/32	.9062	3 3/8	5 3/8	64058	108.75	64158	126.20
59/64	.9219	3 3/4	5 3/4	64059	126.95	64159	141.25
15/16	.9375	3 3/4	5 3/4	64060	108.85	64160	122.80
61/64	.9531	3 7/8	5 7/8	64061	126.95	64161	141.25
31/32	.9688	3 7/8	5 7/8	64062	114.85	64162	133.40
63/64	.9844	4	6	64063	134.15	64163	149.30
1	1.0000	4	6	64064	115.05	64164	129.80
*1 1/32	1.0312	4	6 1/4	64066	168.10	64166	186.95
*1 1/16	1.0625	4	6 1/4	64068	144.10	64168	162.55
*1 3/32	1.0938	4	6 3/8	64070	186.55	64170	207.55
*1 1/8	1.1250	4	6 3/8	64072	160.00	64172	180.35
*1 5/32	1.1562	4 1/4	6 5/8	64074	227.70	64174	253.35
*1 3/16	1.1875	4 1/4	6 5/8	64076	195.30	64176	218.85
*1 7/32	1.2188	4 3/8	6 3/4	64078	227.70	64178	253.35
*1 1/4	1.2500	4 3/8	6 3/4	64080	195.30	64180	218.85

*Shank: 1" diameter, 2 1/4" long

METRIC TOOL DIAMETERS

NOTE: Modifications available (see list on page 123)

TOOL DIAMETER		LENGTH				TYPE 640 - 118° PT.		TYPE 641 - 135° PT.	
mm	INCH	FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
3.0	.1181	22	7/8	48	1 7/8	640030	\$17.60	641030	\$19.40
3.1	.1220	22	7/8	48	1 7/8	640031	17.60	641031	19.40
3.2	.1260	24	15/16	49	1 15/16	640032	17.60	641032	19.40
3.3	.1299	24	15/16	49	1 15/16	640033	17.60	641033	19.40
3.4	.1339	24	15/16	49	1 15/16	640034	17.60	641034	19.40
3.5	.1378	24	15/16	49	1 15/16	640035	15.05	641035	17.25
3.6	.1417	25	1	52	2 1/16	640036	17.60	641036	19.40
3.7	.1457	25	1	52	2 1/16	640037	17.60	641037	19.40
3.8	.1496	25	1	52	2 1/16	640038	17.60	641038	19.40
3.9	.1535	25	1	52	2 1/16	640039	17.60	641039	19.40
4.0	.1575	27	1 1/16	54	2 1/8	640040	15.05	641040	17.30
4.1	.1614	27	1 1/16	54	2 1/8	640041	21.00	641041	23.10
4.2	.1654	27	1 1/16	54	2 1/8	640042	21.00	641042	23.10
4.3	.1693	27	1 1/16	54	2 1/8	640043	21.00	641043	23.10
4.4	.1732	29	1 1/8	56	2 3/16	640044	21.00	641044	23.10
4.5	.1772	29	1 1/8	56	2 3/16	640045	17.95	641045	20.60
4.6	.1811	29	1 1/8	56	2 3/16	640046	21.00	641046	23.10
4.7	.1850	29	1 1/8	56	2 3/16	64213	20.30	64313	22.50
4.8	.1890	30	1 3/16	57	2 1/4	64212	20.15	64312	22.30
4.9	.1929	30	1 3/16	57	2 1/4	640049	21.00	641049	23.10
5.0	.1969	30	1 3/16	57	2 1/4	640050	17.95	641050	20.60
5.1	.2008	30	1 3/16	57	2 1/4	640051	21.00	641051	23.10
5.2	.2047	32	1 1/4	60	2 3/8	640052	21.00	641052	23.10
5.3	.2087	32	1 1/4	60	2 3/8	640053	21.00	641053	23.10
5.4	.2126	32	1 1/4	60	2 3/8	640054	21.00	641054	23.10
5.5	.2165	32	1 1/4	60	2 3/8	640055	17.95	641055	20.60
5.6	.2205	33	1 5/16	62	2 7/16	640056	21.00	641056	23.10
5.7	.2244	33	1 5/16	62	2 7/16	640057	21.00	641057	23.10
5.8	.2283	33	1 5/16	62	2 7/16	640058	21.00	641058	23.10
5.9	.2323	33	1 5/16	62	2 7/16	640059	21.00	641059	23.10
6.0	.2362	35	1 3/8	64	2 1/2	640060	16.80	641060	19.20
6.1	.2402	35	1 3/8	64	2 1/2	640061	21.65	641061	24.00
6.2	.2441	35	1 3/8	64	2 1/2	640062	21.65	641062	24.00
6.3	.2480	35	1 3/8	64	2 1/2	640063	21.65	641063	24.00
6.4	.2520	37	1 7/16	67	2 5/8	640064	21.65	641064	24.00
6.5	.2559	37	1 7/16	67	2 5/8	640065	18.60	641065	21.30

TOOL DIAMETER		LENGTH				TYPE 640 - 118° PT.		TYPE 641 - 135° PT.	
mm	INCH	FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
6.6	.2598	37	1 7/16	67	2 5/8	640066	\$21.65	641066	\$24.00
6.7	.2638	37	1 7/16	67	2 5/8	640067	21.65	641067	24.00
6.8	.2677	38	1 1/2	68	2 11/16	640068	21.65	641068	24.00
6.9	.2717	38	1 1/2	68	2 11/16	640069	21.65	641069	24.00
7.0	.2756	38	1 1/2	68	2 11/16	640070	18.60	641070	21.30
7.1	.2795	38	1 1/2	68	2 11/16	640071	21.65	641071	24.00
7.2	.2835	40	1 9/16	70	2 3/4	640072	24.90	641072	27.45
7.3	.2874	40	1 9/16	70	2 3/4	640073	24.90	641073	27.45
7.4	.2913	40	1 9/16	70	2 3/4	640074	24.90	641074	27.45
7.5	.2953	40	1 9/16	70	2 3/4	640075	21.35	641075	24.40
7.6	.2992	41	1 5/8	71	2 13/16	640076	24.90	641076	27.45
7.7	.3031	41	1 5/8	71	2 13/16	640077	24.90	641077	27.45
7.8	.3071	41	1 5/8	71	2 13/16	640078	24.90	641078	27.45
7.9	.3110	41	1 5/8	71	2 13/16	640079	24.90	641079	27.45
8.0	.3150	43	1 11/16	75	2 15/16	640080	21.35	641080	24.40
8.1	.3189	43	1 11/16	75	2 15/16	640081	26.80	641081	29.35
8.2	.3228	43	1 11/16	75	2 15/16	640082	26.80	641082	29.35
8.3	.3268	43	1 11/16	75	2 15/16	640083	26.80	641083	29.35
8.4	.3307	43	1 11/16	76	3	640084	26.80	641084	29.35
8.5	.3346	43	1 11/16	76	3	640085	22.95	641085	25.95
8.6	.3386	43	1 11/16	76	3	640086	26.80	641086	29.35
8.7	.3425	43	1 11/16	76	3	640087	27.20	641087	30.00
8.8	.3465	44	1 3/4	78	3 1/16	640088	27.20	641088	30.00
8.9	.3504	44	1 3/4	78	3 1/16	640089	27.20	641089	30.00
9.0	.3543	44	1 3/4	78	3 1/16	640090	23.35	641090	26.80
9.1	.3583	44	1 3/4	78	3 1/16	640091	27.20	641091	30.00
9.2	.3622	46	1 13/16	79	3 1/8	640092	27.20	641092	30.00
9.3	.3661	46	1 13/16	79	3 1/8	640093	27.20	641093	30.00
9.4	.3701	46	1 13/16	79	3 1/8	640094	27.20	641094	30.00
9.5	.3740	46	1 13/16	79	3 1/8	640095	23.35	641095	26.80
9.6	.3780	48	1 7/8	83	3 1/4	640096	30.30	641096	33.40
9.7	.3819	48	1 7/8	83	3 1/4	640097	30.30	641097	33.40
9.8	.3858	48	1 7/8	83	3 1/4	640098	30.30	641098	33.40
9.9	.3898	48	1 7/8	83	3 1/4	640099	30.30	641099	33.40
10.0	.3937	49	1 15/16	84	3 5/16	640100	26.00	641100	29.75
10.5	.4134	51	2	86	3 3/8	640105	29.05	641105	32.35
11.0	.4331	52	2 1/16	87	3 7/16	640110	29.05	641110	32.35
11.5	.4528	54	2 1/8	90	3 9/16	640115	40.90	641115	45.30
12.0	.4724	56	2 3/16	94	3 11/16	640120	39.10	641120	43.35
12.5	.4921	57	2 1/4	95	3 3/4	640125	39.10	641125	43.35
13.0	.5118	60	2 3/8	98	3 7/8	640130	48.30	641130	52.45
13.5	.5315	60	2 3/8	98	3 7/8	640135	47.40	641135	52.45
14.0	.5512	64	2 1/2	102	4	640140	47.40	641140	52.45
14.5	.5709	67	2 5/8	105	4 1/8	640145	66.75	641145	73.55
15.0	.5906	67	2 5/8	105	4 1/8	640150	66.75	641150	73.55
15.5	.6102	70	2 3/4	108	4 1/4	640155	75.25	641155	82.95
16.0	.6299	73	2 7/8	114	4 1/2	640160	84.80	641160	93.50
16.5	.6496	73	2 7/8	114	4 1/2	640165	84.80	641165	93.50
17.0	.6693	73	2 7/8	117	4 5/8	640170	84.80	641170	93.50
17.5	.6890	76	3	121	4 3/4	640175	93.55	641175	103.05
18.0	.7087	76	3	121	4 3/4	640180	93.55	641180	103.05
18.5	.7283	79	3 1/8	127	5	640185	102.20	641185	112.65
19.0	.7480	79	3 1/8	127	5	640190	102.20	641190	112.65
19.5	.7677	83	3 1/4	130	5 1/8	640195	113.00	641195	124.60
20.0	.7874	86	3 3/8	133	5 1/4	640200	126.40	641200	139.20
20.5	.8071	86	3 3/8	133	5 1/4	640205	126.40	641205	139.20
21.0	.8268	89	3 1/2	137	5 3/8	640210	138.75	641210	152.85
21.5	.8465	89	3 1/2	140	5 1/2	640215	138.75	641215	152.85
22.0	.8661	89	3 1/2	140	5 1/2	640220	138.75	641220	152.85
22.5	.8858	92	3 3/8	143	5 3/8	640225	142.80	641225	157.25
23.0	.9055	92	3 3/8	143	5 3/8	640230	142.80	641230	157.25
23.5	.9252	95	3 3/4	146	5 3/4	640235	146.30	641235	161.15
24.0	.9449	98	3 7/8	149	5 7/8	640240	149.00	641240	



JOBBER LENGTH DRILLS

CARBIDE TIPPED TYPES 600 & 601 FRACTIONAL



118° STANDARD OR 135° SPLIT POINT

TYPE 600 – 118° STANDARD POINT

- Jobbers length - 118° standard point
- Detailed specifications on page 112

TYPE 601 – 135° SPLIT POINT

- Same as Type 600 above, except with 135° split point designed for drilling tough abrasive or high tensile materials

USE:

- The most popular carbide tipped drill - will perform satisfactorily under a variety of conditions

MODIFICATIONS (See list on page 123)

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	600
	40	NON-FERROUS - SHORT CHIPS	600/601
	60	CAST IRONS	601/600
	80	LOW STRENGTH STEELS	699/860
	100	MEDIUM STRENGTH STEELS	699/860
	120	HIGH STRENGTH STEELS	699/860
140	HIGH TEMPERATURE ALLOYS	CALL US	

NOTE: For stocked reduced shank diameters, see page 136. For jobbers length drills with tang (Types 690/691), see pages 124 & 125.

TOOL DIAMETER			LENGTH		TYPE 600 - 118° PT.		TYPE 601 - 135° PT.	
FRACTIONAL	WIRE/LTR.	DEC.	FLUTE	OAL	EDP NO.	PRICE	EDP NO.	PRICE
	*40	.0980	1	2	60240	\$14.40	-	-
	*39	.0995	1 ¼	2 ¼	60239	14.40	-	-
	*38	.1015	1 ¼	2 ¼	60238	14.40	-	-
	*37	.1040	1 ¼	2 ¼	60237	14.40	-	-
	*36	.1065	1 ¼	2 ¼	60236	14.40	-	-
*7/64		.1094	1 ¼	2 ¼	60007	14.40	-	-
	*35	.1100	1 ¼	2 ¼	60235	14.40	-	-
	*34	.1110	1 ¼	2 ¼	60234	14.40	-	-
1/8	*33	.1130	1 ¼	2 ¼	60233	14.40	-	-
	32	.1160	1 ½	2 ¾	60232	11.60	60332	\$13.60
	31	.1200	1 ½	2 ¾	60231	10.45	60331	12.20
9/64		.1250	1 ½	2 ¾	60008	10.75	60108	12.55
	30	.1285	1 ½	2 ¾	60230	10.95	60330	12.70
	29	.1360	1 ¾	2 7/8	60229	11.35	60329	13.10
	28	.1405	1 ¾	2 7/8	60228	11.45	60328	13.35
1/4		.1406	1 ¾	2 7/8	60009	11.60	60109	13.55
	27	.1440	1 7/8	3	60227	11.75	60327	13.65
	26	.1470	1 7/8	3	60226	10.90	60326	12.70
	25	.1495	1 7/8	3	60225	10.90	60325	12.70
5/16		.1520	2	3 1/8	60224	11.75	60324	13.65
	23	.1540	2	3 1/8	60223	11.45	60323	13.35
		.1562	2	3 1/8	60010	11.40	60110	13.35
	22	.1570	2	3 1/8	60222	12.65	60322	14.75
3/8		.1590	2 1/8	3 1/4	60221	12.10	60321	14.10
	20	.1610	2 1/8	3 1/4	60220	12.45	60320	14.40
	19	.1660	2 1/8	3 1/4	60219	12.45	60319	14.40
	18	.1695	2 1/8	3 1/4	60218	12.45	60318	14.40
1/2		.1719	2 1/8	3 1/4	60011	12.45	60111	14.40
	17	.1730	2 3/16	3 3/8	60217	12.45	60317	14.40
	16	.1770	2 3/16	3 3/8	60216	12.10	60316	14.10
	15	.1800	2 3/16	3 3/8	60215	12.65	60315	14.75
5/8		.1820	2 3/16	3 3/8	60214	12.10	60314	14.10
	13	.1850	2 5/16	3 1/2	60213	13.35	60313	14.10
		.1875	2 5/16	3 1/2	60012	12.10	60112	14.10
	12	.1890	2 5/16	3 1/2	60212	13.95	60312	14.75
3/4		.1910	2 5/16	3 1/2	60211	12.90	60311	14.90
	10	.1935	2 7/16	3 5/8	60210	12.65	60310	14.75
	9	.1960	2 7/16	3 5/8	60209	12.90	60309	14.90
	8	.1990	2 7/16	3 5/8	60208	12.90	60308	14.90
7/8		.2010	2 7/16	3 5/8	60207	12.90	60307	14.90
	6	.2031	2 7/16	3 5/8	60013	13.30	60113	15.35
		.2040	2 1/2	3 3/4	60206	13.15	60306	15.30
	5	.2055	2 1/2	3 3/4	60205	13.30	60305	14.90
1 1/8		.2090	2 1/2	3 3/4	60204	13.15	60304	15.30
	3	.2130	2 1/2	3 3/4	60203	13.30	60303	14.90
		.2188	2 1/2	3 3/4	60014	13.30	60114	15.35
	2	.2210	2 5/8	3 7/8	60202	13.85	60302	16.05
1 1/4		.2280	2 5/8	3 7/8	60201	13.60	60301	15.80
	A	.2340	2 5/8	3 7/8	60401	15.05	60501	17.45
	B	.2344	2 5/8	3 7/8	60015	14.30	60115	16.65
		.2380	2 3/4	4	60402	15.05	60502	17.45
1 1/2	C	.2420	2 3/4	4	60403	15.05	60503	17.45
	D	.2460	2 3/4	4	60404	14.70	60504	17.10
1 3/4		.2500	2 3/4	4	60016	14.30	60116	16.65

TOOL DIAMETER			LENGTH		TYPE 600 - 118° PT.		TYPE 601 - 135° PT.		
FRACTIONAL	LTR.	DEC.	FLUTE	OAL	EDP NO.	PRICE	EDP NO.	PRICE	
17/64	F	.2570	2 7/8	4 1/8	60406	\$16.90	60506	\$19.60	
	G	.2610	2 7/8	4 1/8	60407	17.35	60507	20.05	
	H		.2656	2 7/8	4 1/8	60017	15.90	60117	18.20
			.2660	2 7/8	4 1/8	60408	17.70	60508	20.50
9/32	I	.2720	2 7/8	4 1/8	60409	17.35	60509	20.05	
	J	.2770	2 7/8	4 1/8	60410	17.70	60510	20.50	
	K		.2810	2 15/16	4 1/4	60411	17.70	60511	20.50
			.2812	2 15/16	4 1/4	60018	16.85	60118	19.55
19/64	L	.2900	2 15/16	4 1/4	60412	17.70	60512	20.50	
	M		.2950	3 1/16	4 3/8	60413	19.50	60513	22.70
			.2969	3 1/16	4 3/8	60019	18.65	60119	21.60
			.3020	3 1/16	4 3/8	60414	19.05	60514	22.15
5/16	O		3 3/16	4 1/2	60020	18.25	60120	21.20	
			3 3/16	4 1/2	60415	18.75	60515	21.70	
21/64	P		3 3/16	4 5/8	60416	20.00	60516	23.15	
			3 5/16	4 5/8	60021	19.35	60121	22.50	
11/32	Q		3 7/16	4 3/4	60417	20.40	60517	23.75	
			3 7/16	4 3/4	60418	20.00	60518	23.15	
	R		3 7/16	4 3/4	60022	19.35	60122	22.50	
			3 7/16	4 3/4	60419	21.50	60519	25.00	
23/64	T		3 1/2	4 7/8	60420	21.95	60520	25.55	
			3 1/2	4 7/8	60023	20.60	60123	23.95	
	U		3 5/8	5	60421	21.10	60521	24.50	
			3 5/8	5	60024	20.60	60124	23.95	
3/8	V		3 5/8	5	60422	21.50	60522	25.00	
			3 3/4	5 1/8	60423	23.65	60523	27.35	
	W		3 3/4	5 1/8	60025	22.40	60125	26.10	
			3 3/4	5 1/8	60424	22.65	60524	26.25	
13/32	Y		3 7/8	5 1/4	60425	23.65	60525	27.35	
			3 7/8	5 1/4	60026	22.40	60126	26.10	
	Z		3 7/8	5 1/4	60426	26.15	60526	30.25	
			3 15/16	5 3/8	60027	24.40	60127	28.30	
7/16		.4375	4 1/16	5 1/2	60028	24.40	60128	28.30	
	29/64	.4531	4 3/16	5 5/8	60029	28.00	60129	32.45	
	15/32	.4688	4 5/16	5 3/4	60030	27.40	60130	31.75	
	31/64	.4844	4 3/8	5 7/8	60031	30.65	60131	35.55	
1/2		.5000	4 1/2	6	60032	33.70	60132	35.55	
	33/64	.5156	4 13/16	6 5/8	60033	43.90	60133	51.00	
	17/32	.5312	4 13/16	6 5/8	60034	43.90	60134	51.00	
	35/64	.5469	4 13/16	6 5/8	60035	44.30	60135	51.40	
9/16		.5625	4 13/16	6 5/8	60036	44.30	60136	51.40	
	37/64	.5781	4 13/16	6 5/8	60037	48.90	60137	56.85	
	19/32	.5938	5 3/16	7 1/8	60038	47.55	60138	55.25	
	39/64	.6094	5 3/16	7 1/8	60039	56.25	60139	65.25	
5/8		.6250	5 3/16	7 1/8	60040	53.90	60140	62.50	
	41/64	.6406	5 3/16	7 1/8	60041	62.15	60141	72.20	
	21/32	.6562	5 3/16	7 1/8	60042	54.80	60142	63.60	
	43/64	.6719	5 5/8	7 3/8	60043	71.30	60143	82.85	
11/16		.6875	5 5/8	7 3/8	60044	55.85	60144	64.80	
	45/64	.7031	5 5/8	7 3/8	60045	65.25	60145	72.60	
	23/32	.7188	5 5/8	7 3/8	60046	65.95	60146	73.30	
	47/64	.7344	5 5/8	7 3/8	60047	66.30	60147	73.70	
3/4		.7500	5 13/16	8	60048	67.30	60148	74.80	

*Solid carbide



JOBBER'S LENGTH DRILLS

CARBIDE TIPPED TYPES 600 & 601 METRIC



118° STANDARD OR 135° SPLIT POINT



MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Modified metric tool diameter
- Modified point and/or angle
- Reduced shank diameter
- Flats on shank
- Tanged shank
- 4 coatings available (see list on pg. 125)

TOOL DIAMETER		LENGTH				TYPE 600 - 118° PT.		TYPE 601 - 135° PT.	
mm	INCH	mm	INCH	mm	INCH	METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
3.0	.1181	41	1 5/8	70	2 3/4	600030	\$14.45	601030	\$14.75
3.1	.1220	41	1 5/8	70	2 3/4	600031	15.10	601031	15.30
3.2	.1260	41	1 5/8	70	2 3/4	600032	15.10	601032	15.30
3.3	.1299	44	1 3/4	73	2 7/8	600033	15.10	601033	15.30
3.4	.1339	44	1 3/4	73	2 7/8	600034	15.10	601034	15.30
3.5	.1378	44	1 3/4	73	2 7/8	600035	13.95	601035	14.45
3.6	.1417	48	1 7/8	76	3	600036	14.45	601036	14.75
3.7	.1457	48	1 7/8	76	3	600037	14.45	601037	14.75
3.8	.1496	48	1 7/8	76	3	600038	14.45	601038	14.75
3.9	.1535	51	2	79	3 1/8	600039	14.45	601039	14.75
4.0	.1575	54	2 1/8	83	3 1/4	600040	13.60	601040	13.95
4.1	.1614	54	2 1/8	83	3 1/4	600041	13.10	601041	14.90
4.2	.1654	54	2 1/8	83	3 1/4	600042	13.95	601042	14.90
4.3	.1693	54	2 1/8	83	3 1/4	600043	13.95	601043	14.90
4.4	.1732	56	2 3/16	86	3 3/8	600044	13.95	601044	14.90
4.5	.1772	56	2 3/16	86	3 3/8	600045	14.45	601045	14.90
4.6	.1811	56	2 3/16	86	3 3/8	600046	15.75	601046	15.95
4.7	.1850	59	2 3/16	89	3 1/2	60213	13.35	60313	14.10
4.8	.1890	59	2 3/16	89	3 1/2	60212	13.95	60312	14.75
4.9	.1929	62	2 3/16	92	3 5/8	600049	15.75	601049	15.95
5.0	.1969	62	2 3/16	92	3 5/8	600050	15.10	601050	15.55
5.1	.2008	62	2 3/16	92	3 5/8	600051	16.40	601051	16.65
5.2	.2047	64	2 1/2	95	3 3/4	600052	16.40	601052	16.65
5.3	.2087	64	2 1/2	95	3 3/4	600053	16.40	601053	16.65
5.4	.2126	64	2 1/2	95	3 3/4	600054	16.40	601054	16.65
5.5	.2165	64	2 1/2	95	3 3/4	600055	16.05	601055	16.20
5.6	.2205	67	2 5/8	98	3 7/8	600056	16.85	601056	17.15
5.7	.2244	67	2 5/8	98	3 7/8	600057	16.85	601057	17.15
5.8	.2283	67	2 5/8	98	3 7/8	600058	16.85	601058	17.15
5.9	.2323	67	2 5/8	98	3 7/8	600059	16.85	601059	17.15
6.0	.2362	70	2 3/4	102	4	600060	16.65	601060	17.60
6.1	.2402	70	2 3/4	102	4	600061	17.60	601061	18.05
6.2	.2441	70	2 3/4	102	4	600062	17.60	601062	18.05
6.3	.2480	70	2 3/4	102	4	600063	17.60	601063	18.05
6.4	.2520	73	2 7/8	105	4 1/8	600064	17.60	601064	18.05
6.5	.2559	73	2 7/8	105	4 1/8	600065	17.20	601065	17.60
6.6	.2598	73	2 7/8	105	4 1/8	600066	18.40	601066	20.60
6.7	.2638	73	2 7/8	105	4 1/8	600067	18.40	601067	20.60
6.8	.2677	73	2 7/8	105	4 1/8	600068	18.40	601068	20.60
6.9	.2717	73	2 7/8	105	4 1/8	600069	18.40	601069	20.60
7.0	.2756	73	2 7/8	105	4 1/8	600070	18.00	601070	20.60
7.1	.2795	75	2 15/16	108	4 1/4	600071	18.85	601071	20.60
7.2	.2835	75	2 15/16	108	4 1/4	600072	18.85	601072	20.60
7.3	.2874	75	2 15/16	108	4 1/4	600073	18.85	601073	20.60
7.4	.2913	78	3 1/16	111	4 3/8	600074	18.85	601074	22.30
7.5	.2953	78	3 1/16	111	4 3/8	600075	18.85	601075	22.30
7.6	.2992	78	3 1/16	111	4 3/8	600076	19.75	601076	22.30
7.7	.3031	81	3 3/16	114	4 1/2	600077	19.75	601077	22.30
7.8	.3071	81	3 3/16	114	4 1/2	600078	19.75	601078	22.30
7.9	.3110	81	3 3/16	114	4 1/2	600079	19.75	601079	22.30
8.0	.3150	81	3 3/16	114	4 1/2	600080	19.30	601080	22.30
8.1	.3189	84	3 5/16	117	4 5/8	600081	21.10	601081	23.75
8.2	.3228	84	3 5/16	117	4 5/8	600082	21.10	601082	23.75
8.3	.3268	84	3 5/16	117	4 5/8	600083	21.10	601083	23.75
8.4	.3307	87	3 7/16	121	4 3/4	600084	21.10	601084	23.75
8.5	.3346	87	3 7/16	121	4 3/4	600085	20.20	601085	23.75
8.6	.3386	87	3 7/16	121	4 3/4	600086	21.10	601086	23.75

TOOL DIAMETER		LENGTH				TYPE 600 - 118° PT.		TYPE 601 - 135° PT.	
mm	INCH	mm	INCH	mm	INCH	METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
8.7	.3425	87	3 7/16	121	4 3/4	600087	\$21.10	601087	\$23.75
8.8	.3465	89	3 1/2	124	4 7/8	600088	21.10	601088	23.75
8.9	.3504	89	3 1/2	124	4 7/8	600089	21.10	601089	25.30
9.0	.3543	89	3 1/2	124	4 7/8	600090	20.60	601090	25.30
9.1	.3583	89	3 1/2	124	4 7/8	600091	22.85	601091	25.30
9.2	.3622	92	3 5/8	127	5	600092	22.85	601092	25.30
9.3	.3661	92	3 5/8	127	5	600093	22.85	601093	25.30
9.4	.3701	92	3 5/8	127	5	600094	22.85	601094	25.30
9.5	.3740	92	3 5/8	127	5	600095	22.40	601095	25.30
9.6	.3780	95	3 3/4	130	5 1/8	600096	23.20	601096	27.55
9.7	.3819	95	3 3/4	130	5 1/8	600097	23.20	601097	27.55
9.8	.3858	95	3 3/4	130	5 1/8	600098	23.20	601098	27.55
9.9	.3898	95	3 3/4	130	5 1/8	600099	23.20	601099	27.55
10.0	.3937	95	3 3/4	130	5 1/8	600100	23.20	601100	27.55
10.1	.3976	98	3 7/8	133	5 1/4	600101	27.65	601101	28.40
10.2	.4016	98	3 7/8	133	5 1/4	600102	27.65	601102	28.40
10.3	.4055	98	3 7/8	133	5 1/4	600103	27.65	601103	28.40
10.4	.4094	98	3 7/8	133	5 1/4	600104	27.65	601104	29.80
10.5	.4134	98	3 7/8	133	5 1/4	600105	26.75	601105	29.80
10.6	.4173	100	3 15/16	137	5 3/8	600106	30.30	601106	30.85
10.7	.4213	100	3 15/16	137	5 3/8	600107	30.30	601107	30.85
10.8	.4252	103	4 1/16	140	5 1/2	600108	30.30	601108	30.85
10.9	.4291	103	4 1/16	140	5 1/2	600109	30.30	601109	30.85
11.0	.4331	103	4 1/16	140	5 1/2	600110	29.00	601110	29.80
11.1	.4370	103	4 1/16	140	5 1/2	600111	33.80	601111	34.35
11.2	.4409	106	4 3/16	143	5 3/8	600112	33.80	601112	34.60
11.3	.4449	106	4 3/16	143	5 3/8	600113	33.80	601113	34.60
11.4	.4488	106	4 3/16	143	5 3/8	600114	33.80	601114	33.60
11.5	.4528	106	4 3/16	143	5 3/8	600115	32.50	601115	33.60
11.6	.4567	110	4 5/16	146	5 3/4	600116	36.85	601116	37.40
11.7	.4606	110	4 5/16	146	5 3/4	600117	36.85	601117	37.40
11.8	.4646	110	4 5/16	146	5 3/4	600118	36.85	601118	37.40
11.9	.4685	110	4 5/16	146	5 3/4	600119	36.85	601119	37.40
12.0	.4724	111	4 3/8	149	5 7/8	600120	35.20	601120	37.60
12.1	.4764	111	4 3/8	149	5 7/8	600121	38.30	601121	38.85
12.2	.4803	111	4 3/8	149	5 7/8	600122	38.30	601122	38.85
12.3	.4843	111	4 3/8	149	5 7/8	600123	38.30	601123	38.85
12.4	.4882	114	4 1/2	152	6	600124	38.30	601124	38.85
12.5	.4921	114	4 1/2	152	6	600125	36.50	601125	37.60
12.6	.4961	114	4 1/2	152	6	600126	39.65	601126	40.15
12.7	.5000	114	4 1/2	152	6	60032	33.70	60132	35.55
12.8	.5039	114	4 1/2	152	6	600128	43.50	601128	55.40
12.9	.5079	114	4 1/2	152	6	600129	43.50	601129	55.40
13.0	.5118	114	4 1/2	152	6	600130	43.50	601130	55.40
13.5	.5315	122	4 13/16	168	6 5/8	600135	56.30	601135	60.75
14.0	.5512	122	4 13/16	168	6 5/8	600140	59.70	601140	64.40
14.5	.5709	122	4 13/16	168	6 5/8	600145	64.00	601145	69.20
15.0	.5906	132	5 3/16	181	7 1/8	600150	64.00	601150	69.20
15.5	.6102	132	5 3/16	181	7 1/8	600155	64.85	601155	70.05
16.0	.6299	132	5 3/16	181	7 1/8	600160	66.05	601160	71.30
16.5	.6496	132	5 3/16	181	7 1/8	600165	66.05	601165	71.30
17.0	.6693	143	5 5/8	194	7 5/8	600170	68.60	601170	74.10
17.5	.6890	143	5 5/8	194	7 5/8	600175	68.60	601175	74.10
18.0	.7087	143	5 5/8	194	7 5/8	600180	69.40	601180	74.80
18.5	.7283	143	5 5/8	194	7 5/8	600185	69.75	601185	75.30
19.0	.7480	148	5 9/16	203	8	600190	70.65	601190	76.35

DRILLS



JOBBERS LENGTH DRILLS - TANGED CARBIDE TIPPED TYPES 690 & 691 FRACTIONAL



118° STANDARD OR 135° SPLIT POINT

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	690
	40	NON-FERROUS - SHORT CHIPS	690/691
	60	CAST IRONS	691/690
	80	LOW STRENGTH STEELS	CALL US
	100	MEDIUM STRENGTH STEELS	CALL US
	120	HIGH STRENGTH STEELS	CALL US
140	HIGH TEMPERATURE ALLOYS	CALL US	

TYPE 690 – 118° STANDARD POINT

- Tanged jobbers length - 118° standard point
- Detailed specifications on page 112

TYPE 691 – 135° SPLIT POINT

- Same as Type 690 above, except with 135° split point designed for drilling tough abrasive or high tensile materials

USE:

- For use in ASA split sleeve drill drivers

MODIFICATIONS (See list on page 125)

NOTE: For lower priced jobbers length drills without tang (Types 600 & 601), see pages 122 & 123.

TOOL DIAMETER			LENGTH		TYPE 690 - 118° PT.		TYPE 691 - 135° PT.		TOOL DIAMETER			LENGTH		TYPE 690 - 118° PT.		TYPE 691 - 135° PT.		
FRACTIONAL	WIRE/LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE	FRACTIONAL	LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE	
1/8	30	.1250	1 3/8	2 3/4	69008	\$12.90	69108	\$15.15	3/32	J	.2770	2 7/8	4 1/8	69410	\$21.35	69510	\$24.80	
	29	.1360	1 3/8	2 3/4	69230	13.25	69330	15.40		K	.2810	2 15/16	4 1/4	69411	21.35	69511	24.80	
	28	.1405	1 3/8	2 7/8	69229	13.70	69329	15.80		L	.2812	2 15/16	4 1/4	69018	20.35	69118	23.55	
9/64	27	.1406	1 3/4	2 7/8	69009	14.00	69109	16.40	1/16	M	.2950	3 1/16	4 3/8	69413	23.50	69513	27.40	
		.1440	1 7/8	3	69227	14.20	69327	16.55			N	.2969	3 1/16	4 3/8	69019	22.60	69119	26.10
		.1470	1 7/8	3	69226	13.20	69326	15.40			O	.3020	3 1/16	4 3/8	69414	23.00	69514	26.80
		.1495	1 7/8	3	69225	13.20	69325	15.40			P	.3125	3 3/16	4 1/2	69020	22.05	69120	25.60
5/32	24	.1520	2	3 1/8	69224	14.20	69324	16.55	3/16	Q	.3160	3 3/16	4 1/2	69415	22.65	69515	26.15	
		.1540	2	3 1/8	69223	13.80	69323	16.15			R	.3230	3 3/16	4 3/8	69416	24.15	69516	28.00
		.1562	2	3 1/8	69010	13.75	69110	16.15			S	.3281	3 5/16	4 5/8	69021	23.35	69121	27.20
		.1570	2	3 1/8	69222	15.35	69322	17.80			T	.3320	3 7/16	4 3/4	69417	24.70	69517	28.65
3/16	21	.1590	2 1/8	3 1/4	69221	14.60	69321	17.00	1/8	U	.3390	3 7/16	4 3/4	69418	24.15	69518	28.00	
		.1610	2 1/8	3 1/4	69220	15.00	69320	17.45			V	.3438	3 7/16	4 3/4	69022	23.35	69122	27.20
		.1660	2 1/8	3 1/4	69219	15.00	69319	17.45			W	.3480	3 1/2	4 7/8	69419	26.00	69519	30.25
		.1695	2 1/8	3 1/4	69218	15.00	69318	17.45			X	.3580	3 1/2	4 7/8	69420	26.50	69520	30.80
1/4	17	.1719	2 1/8	3 1/4	69011	15.00	69111	17.45	5/16	Y	.3594	3 1/2	4 7/8	69023	24.90	69123	28.95	
		.1730	2 3/16	3 3/8	69217	15.00	69317	17.45			Z	.3680	3 3/8	5	69421	25.55	69521	29.55
		.1770	2 3/16	3 3/8	69216	14.60	69316	17.00			1/32	.4062	3 7/8	5 1/4	69026	27.05	69126	31.50
		.1800	2 3/16	3 3/8	69215	15.35	69315	17.80			27/64	.4130	3 7/8	5 1/4	69426	31.55	69526	36.55
5/16	14	.1820	2 3/16	3 3/8	69214	14.60	69314	17.00	7/16	Z	.4219	3 15/16	5 3/8	69027	29.45	69127	34.20	
		.1850	2 3/16	3 1/2	69213	16.15	69313	17.00			29/64	.4375	4 1/16	5 1/2	69028	29.45	69128	34.20
		.1875	2 5/16	3 1/2	69012	14.60	69112	17.00			1/8	.4531	4 3/16	5 5/8	69029	33.75	69129	39.15
		.1890	2 5/16	3 1/2	69212	16.80	69312	17.80			15/32	.4688	4 3/16	5 3/4	69030	33.15	69130	38.30
3/8	11	.1910	2 5/16	3 1/2	69211	15.55	69311	17.95	3/8	W	.3860	3 3/4	5 1/8	69423	28.55	69523	33.00	
		.1935	2 7/16	3 5/8	69210	15.35	69310	17.80			X	.3906	3 3/4	5 1/8	69025	27.05	69125	31.50
		.1960	2 7/16	3 5/8	69209	15.55	69309	17.95			Y	.3970	3 3/4	5 1/8	69424	27.30	69524	31.65
		.1990	2 7/16	3 5/8	69208	15.55	69308	17.95			25/64	.4040	3 3/4	5 1/4	69425	28.55	69525	33.00
7/16	7	.2010	2 7/16	3 5/8	69207	15.55	69307	17.95	1/2	V	.4062	4 1/16	6 3/8	69033	52.95	69133	61.55	
		.2031	2 7/16	3 5/8	69013	16.05	69113	18.55			17/32	.5312	4 13/16	6 5/8	69034	52.95	69134	61.55
		.2040	2 1/2	3 3/4	69206	15.85	69306	18.50			35/64	.5469	4 13/16	6 5/8	69035	53.50	69135	62.15
		.2055	2 1/2	3 3/4	69205	16.10	69305	17.95			1/4	.5625	4 13/16	6 5/8	69036	53.50	69136	62.15
1/2	4	.2090	2 1/2	3 3/4	69204	15.85	69304	18.50	3/4	U	.5781	4 13/16	6 5/8	69037	59.05	69137	68.65	
		.2130	2 1/2	3 3/4	69203	16.10	69303	17.95			19/32	.5938	5 3/16	7 1/8	69038	57.50	69138	66.70
		.2188	2 1/2	3 3/4	69014	16.05	69114	18.65			39/64	.6094	5 3/16	7 1/8	69039	67.90	69139	78.80
		.2210	2 5/8	3 7/8	69202	16.70	69302	19.35			5/8	.6250	5 3/16	7 1/8	69040	65.10	69140	75.45
3/4	1	.2280	2 5/8	3 7/8	69201	16.50	69301	19.10	7/8	W	.6406	5 3/16	7 1/8	69041	75.10	69141	87.15	
		.2340	2 5/8	3 7/8	69401	18.20	69501	21.05			21/32	.6562	5 3/16	7 1/8	69042	66.15	69142	76.80
		.2344	2 5/8	3 7/8	69015	17.25	69115	20.10			43/64	.6719	5 5/8	7 5/8	69043	86.20	69143	100.00
		.2380	2 3/4	4	69402	18.20	69502	21.05			1/2	.6875	5 5/8	7 5/8	69044	67.45	69144	78.20
5/8	A	.2420	2 3/4	4	69403	18.20	69503	21.05	1 1/8	Z	.7031	5 5/8	7 5/8	69045	78.85	69145	87.70	
		.2460	2 3/4	4	69404	17.75	69504	20.60			23/32	.7188	5 5/8	7 5/8	69046	79.65	69146	88.45
		.2500	2 3/4	4	69016	17.25	69116	20.10			47/64	.7344	5 5/8	7 5/8	69047	80.05	69147	89.05
		.2570	2 7/8	4 1/8	69406	20.40	69506	23.80			3/4	.7500	5 13/16	8	69048	81.40	69148	90.35
3/4	C	.2610	2 7/8	4 1/8	69407	20.95	69507	24.20	1 1/4	U	.7031	5 5/8	7 5/8	69045	78.85	69145	87.70	
		.2656	2 7/8	4 1/8	69017	19.20	69117	21.95			23/32	.7188	5 5/8	7 5/8	69046	79.65	69146	88.45
		.2660	2 7/8	4 1/8	69408	21.35	69508	24.80			47/64	.7344	5 5/8	7 5/8	69047	80.05	69147	89.05
		.2720	2 7/8	4 1/8	69409	20.95	69509	24.20			3/4	.7500	5 13/16	8	69048	81.40	69148	90.35



JOBBER'S LENGTH DRILLS - TANGED CARBIDE TIPPED TYPES 690 & 691 METRIC



118° STANDARD OR 135° SPLIT POINT

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Modified metric tool diameter
- Modified point and/or angle
- Reduced shank diameter
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN



TOOL DIAMETER		LENGTH				TYPE 690 - 118° PT.		TYPE 691 - 135° PT.	
		FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
mm	INCH	mm	INCH	mm	INCH				
3.2	.1260	41	1 3/4	70	2 3/4	690032	\$18.30	691032	\$18.50
3.3	.1299	44	1 3/4	73	2 7/8	690033	18.30	691033	18.50
3.4	.1339	44	1 3/4	73	2 7/8	690034	18.30	691034	18.50
3.5	.1378	44	1 3/4	73	2 7/8	690035	16.80	691035	17.45
3.6	.1417	48	1 7/8	76	3	690036	17.50	691036	17.80
3.7	.1457	48	1 7/8	76	3	690037	17.50	691037	17.80
3.8	.1496	48	1 7/8	76	3	690038	17.50	691038	17.80
3.9	.1535	51	2	79	3 1/8	690039	17.50	691039	17.80
4.0	.1575	54	2 1/8	83	3 1/4	690040	16.50	691040	16.90
4.1	.1614	54	2 1/8	83	3 1/4	690041	15.80	691041	17.95
4.2	.1654	54	2 1/8	83	3 1/4	690042	16.80	691042	17.95
4.3	.1693	54	2 1/8	83	3 1/4	690043	16.80	691043	17.95
4.4	.1732	56	2 3/16	86	3 3/8	690044	16.80	691044	17.95
4.5	.1772	56	2 3/16	86	3 3/8	690045	17.50	691045	17.95
4.6	.1811	56	2 3/16	86	3 3/8	690046	19.05	691046	19.25
4.7	.1850	59	2 3/16	89	3 1/2	69213	16.15	69313	17.00
4.8	.1890	59	2 3/16	89	3 1/2	69212	16.80	69312	17.80
4.9	.1929	62	2 7/16	92	3 5/8	690049	19.05	691049	19.25
5.0	.1969	62	2 7/16	92	3 5/8	690050	18.25	691050	18.75
5.1	.2008	62	2 7/16	92	3 5/8	690051	19.75	691051	20.10
5.2	.2047	64	2 1/2	95	3 3/4	690052	19.75	691052	20.10
5.3	.2087	64	2 1/2	95	3 3/4	690053	19.75	691053	20.10
5.4	.2126	64	2 1/2	95	3 3/4	690054	19.75	691054	20.10
5.5	.2165	64	2 1/2	95	3 3/4	690055	19.30	691055	19.60
5.6	.2205	67	2 5/8	98	3 7/8	690056	20.35	691056	20.80
5.7	.2244	67	2 5/8	98	3 7/8	690057	20.35	691057	20.80
5.8	.2283	67	2 5/8	98	3 7/8	690058	20.35	691058	20.80
5.9	.2323	67	2 5/8	98	3 7/8	690059	20.35	691059	20.80
6.0	.2362	70	2 3/4	102	4	690060	20.10	691060	21.25
6.1	.2402	70	2 3/4	102	4	690061	21.25	691061	21.85
6.2	.2441	70	2 3/4	102	4	690062	21.25	691062	21.85
6.3	.2480	70	2 3/4	102	4	690063	21.25	691063	21.85
6.4	.2520	73	2 7/8	105	4 1/8	690064	21.25	691064	21.85
6.5	.2559	73	2 7/8	105	4 1/8	690065	20.90	691065	21.25
6.6	.2598	73	2 7/8	105	4 1/8	690066	22.20	691066	24.95
6.7	.2638	73	2 7/8	105	4 1/8	690067	22.20	691067	24.95
6.8	.2677	73	2 7/8	105	4 1/8	690068	22.20	691068	24.95
6.9	.2717	73	2 7/8	105	4 1/8	690069	22.20	691069	24.95
7.0	.2756	73	2 7/8	105	4 1/8	690070	21.75	691070	24.95
7.1	.2795	75	2 15/16	108	4 1/4	690071	22.80	691071	24.95
7.2	.2835	75	2 15/16	108	4 1/4	690072	22.80	691072	24.95
7.3	.2874	75	2 15/16	108	4 1/4	690073	22.80	691073	24.95
7.4	.2913	78	3 1/16	111	4 3/8	690074	22.80	691074	26.95
7.5	.2953	78	3 1/16	111	4 3/8	690075	22.80	691075	26.95
7.6	.2992	78	3 1/16	111	4 3/8	690076	23.90	691076	26.95
7.7	.3031	81	3 3/16	114	4 1/2	690077	23.90	691077	26.95
7.8	.3071	81	3 3/16	114	4 1/2	690078	23.90	691078	26.95
7.9	.3110	81	3 3/16	114	4 1/2	690079	23.90	691079	26.95
8.0	.3150	81	3 3/16	114	4 1/2	690080	23.35	691080	26.95
8.1	.3189	84	3 5/16	117	4 5/8	690081	25.45	691081	28.65
8.2	.3228	84	3 5/16	117	4 5/8	690082	25.45	691082	28.65
8.3	.3268	84	3 5/16	117	4 5/8	690083	25.45	691083	28.65

TOOL DIAMETER		LENGTH				TYPE 690 - 118° PT.		TYPE 691 - 135° PT.	
		FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
mm	INCH	mm	INCH	mm	INCH				
8.4	.3307	87	3 7/16	121	4 3/4	690084	\$25.45	691084	\$28.65
8.5	.3346	87	3 7/16	121	4 3/4	690085	24.35	691085	28.65
8.6	.3386	87	3 7/16	121	4 3/4	690086	25.45	691086	28.65
8.7	.3425	87	3 7/16	121	4 3/4	690087	25.45	691087	28.65
8.8	.3465	89	3 1/2	124	4 7/8	690088	25.45	691088	28.65
8.9	.3504	89	3 1/2	124	4 7/8	690089	25.45	691089	30.45
9.0	.3543	89	3 1/2	124	4 7/8	690090	24.90	691090	30.45
9.1	.3583	89	3 1/2	124	4 7/8	690091	27.60	691091	30.45
9.2	.3622	92	3 5/8	127	5	690092	27.60	691092	30.45
9.3	.3661	92	3 5/8	127	5	690093	27.60	691093	30.45
9.4	.3701	92	3 5/8	127	5	690094	27.60	691094	30.45
9.5	.3740	92	3 5/8	127	5	690095	27.05	691095	30.45
9.6	.3780	95	3 3/4	130	5 1/8	690096	28.05	691096	33.30
9.7	.3819	95	3 3/4	130	5 1/8	690097	28.05	691097	33.30
9.8	.3858	95	3 3/4	130	5 1/8	690098	28.05	691098	33.30
9.9	.3898	95	3 3/4	130	5 1/8	690099	28.05	691099	33.30
10.0	.3937	95	3 3/4	130	5 1/8	690100	28.05	691100	33.30
10.1	.3976	98	3 7/8	133	5 1/4	690101	33.35	691101	34.25
10.2	.4016	98	3 7/8	133	5 1/4	690102	33.35	691102	34.25
10.3	.4055	98	3 7/8	133	5 1/4	690103	33.35	691103	34.25
10.4	.4094	98	3 7/8	133	5 1/4	690104	33.40	691104	35.95
10.5	.4134	98	3 7/8	133	5 1/4	690105	32.35	691105	35.95
10.6	.4173	100	3 15/16	137	5 3/8	690106	36.70	691106	37.20
10.7	.4213	100	3 15/16	137	5 3/8	690107	36.70	691107	37.20
10.8	.4252	103	4 1/16	140	5 1/2	690108	36.70	691108	37.20
10.9	.4291	103	4 1/16	140	5 1/2	690109	36.70	691109	37.20
11.0	.4331	103	4 1/16	140	5 1/2	690110	35.00	691110	35.95
11.1	.4370	103	4 1/16	140	5 1/2	690111	40.80	691111	41.40
11.2	.4409	106	4 3/16	143	5 5/8	690112	40.85	691112	41.80
11.3	.4449	106	4 3/16	143	5 5/8	690113	40.85	691113	41.80
11.4	.4488	106	4 3/16	143	5 5/8	690114	40.80	691114	40.55
11.5	.4528	106	4 3/16	143	5 5/8	690115	39.20	691115	40.55
11.6	.4567	110	4 5/16	146	5 3/4	690116	44.35	691116	45.15
11.7	.4606	110	4 5/16	146	5 3/4	690117	44.35	691117	45.15
11.8	.4646	110	4 5/16	146	5 3/4	690118	44.35	691118	45.15
11.9	.4685	110	4 5/16	146	5 3/4	690119	44.35	691119	45.15
12.0	.4724	111	4 3/8	149	5 7/8	690120	42.50	691120	45.40
12.5	.4921	114	4 1/2	152	6	690125	44.10	691125	45.40
13.0	.5118	114	4 1/2	152	6	690130	52.55	691130	66.95
13.5	.5315	122	4 13/16	168	6 5/8	690135	67.95	691135	73.35
14.0	.5512	122	4 13/16	168	6 5/8	690140	72.10	691140	77.75
14.5	.5709	122	4 13/16	168	6 5/8	690145	77.30	691145	83.60
15.0	.5906	132	5 3/16	181	7 1/8	690150	77.30	691150	83.60
15.5	.6102	132	5 3/16	181	7 1/8	690155	78.35	691155	84.60
16.0	.6299	132	5 3/16	181	7 1/8	690160	79.75	691160	86.10
16.5	.6496	132	5 3/16	181	7 1/8	690165	79.75	691165	86.10
17.0	.6693	143	5 5/8	194	7 3/8	690170	82.80	691170	89.55
17.5	.6890	143	5 5/8	194	7 3/8	690175	82.80	691175	89.55
18.0	.7087	143	5 5/8	194	7 3/8	690180	83.70	691180	90.35
18.5	.7283	143	5 5/8	194	7 3/8	690185	84.20	691185	90.90
19.0	.7480	148	5 13/16	203	8	690190	85.30	691190	92.20

DRILLS



JOBBER LENGTH DRILLS

SOLID CARBIDE TYPE 860 METRIC



118° SPLIT POINT

TYPE 860 – 118° SPLIT POINT

- Solid Carbide Jobber Length
- 20-25° Helix - 118° Split Point
- Chisel Point Centrality is within .001"

USE:

- For general purpose drilling of aluminum, plastics, other non-ferrous materials, cast iron, and steels.



MODIFICATIONS (Prompt delivery)

- Coatings available:

TITANIUM NITRIDE – TiN
TITANIUM CARBONITRIDE – TiCN
ZIRCONIUM NITRIDE – ZrN
AL TITANIUM NITRIDE – AlTiN

Lip Height TIV: plus .0015", minus .0015"
 Included angle tolerance: plus 2°, minus 2°
 Tool diameter tolerance: plus .0000", minus .0005"

NOTE: For carbide tipped jobbers length drills (Types 600 & 601), see pages 122 & 123.

TOOL DIAMETER		LENGTH		TYPE 860 - 118° PT.	
mm	INCH	mm	OAL	METRIC EDP NO.	METRIC PRICE
1.0	.0394	16	38	860010	\$13.45
1.1	.0433	19	38	860011	16.55
1.2	.0472	19	38	860012	16.70
1.3	.0512	19	38	860013	17.05
1.4	.0551	19	38	860014	17.30
1.5	.0591	19	38	860015	13.40
1.6	.0630	19	38	860016	16.65
1.7	.0669	19	38	860017	16.90
1.8	.0709	22	44	860018	17.10
1.9	.0748	22	44	860019	17.30
2.0	.0787	22	44	860020	14.25
2.1	.0827	22	44	860021	13.95
2.2	.0866	25	50	860022	13.95
2.3	.0906	25	50	860023	14.25
2.4	.0945	25	50	860024	14.45
2.5	.0984	25	50	860025	14.65
2.6	.1024	31	57	860026	15.65
2.7	.1063	31	57	860027	15.65
2.8	.1102	31	57	860028	15.90
2.9	.1142	31	57	860029	16.50
3.0	.1181	32	57	860030	16.30
3.1	.1220	31	57	860031	16.90
3.2	.1260	31	57	860032	17.15
3.3	.1299	31	57	860033	17.30
3.4	.1339	34	63	860034	17.30
3.5	.1378	35	63	860035	17.15
3.6	.1417	34	63	860036	17.70
3.7	.1457	34	63	860037	18.45
3.8	.1496	34	63	860038	19.25
3.9	.1535	34	63	860039	20.05
4.0	.1575	35	63	860040	20.50
4.1	.1614	34	63	860041	21.15
4.2	.1654	41	70	860042	21.70
4.3	.1693	41	70	860043	22.00
4.4	.1732	41	70	860044	22.40
4.5	.1772	41	70	860045	22.70
4.6	.1811	41	70	860046	23.20
4.7	.1850	41	70	860047	23.35
4.8	.1890	41	70	860048	24.15
4.9	.1929	41	70	860049	24.90
5.0	.1969	44	75	860050	25.30
5.1	.2008	44	76	860051	26.80
5.2	.2047	44	76	860052	27.15
5.3	.2087	44	76	860053	28.35

TOOL DIAMETER		LENGTH		TYPE 860 - 118° PT.	
mm	INCH	mm	OAL	METRIC EDP NO.	METRIC PRICE
5.4	.2126	44	76	860054	\$29.00
5.5	.2165	44	75	860055	28.55
5.6	.2205	44	76	860056	30.30
5.7	.2244	44	76	860057	30.25
5.8	.2283	44	76	860058	30.85
5.9	.2323	51	82	860059	32.10
6.0	.2362	50	82	860060	31.65
6.1	.2402	51	82	860061	34.20
6.2	.2441	51	82	860062	34.90
6.3	.2480	51	82	860063	35.70
6.4	.2520	51	82	860064	40.15
6.5	.2559	50	82	860065	37.55
6.6	.2598	54	89	860066	37.65
6.7	.2638	54	89	860067	36.75
6.8	.2677	54	89	860068	38.75
6.9	.2717	54	89	860069	39.55
7.0	.2756	54	89	860070	42.00
7.1	.2795	54	89	860071	40.60
7.2	.2835	54	89	860072	42.90
7.3	.2874	54	89	860073	44.95
7.4	.2913	60	95	860074	45.85
7.5	.2953	60	95	860075	45.85
7.6	.2992	60	95	860076	47.00
7.7	.3031	60	95	860077	47.50
7.8	.3071	60	95	860078	50.15
7.9	.3110	60	95	860079	50.15
8.0	.3150	60	95	860080	46.60
8.1	.3189	60	95	860081	51.05
8.2	.3228	60	95	860082	51.75
8.3	.3268	63	101	860083	53.60
8.4	.3307	63	101	860084	54.45
8.5	.3346	63	100	860085	55.30
8.6	.3386	63	101	860086	56.25
8.7	.3425	63	101	860087	56.85
8.8	.3465	63	101	860088	59.10
8.9	.3504	63	101	860089	61.00
9.0	.3543	70	100	860090	62.95
9.1	.3583	70	108	860091	64.90
9.2	.3622	70	108	860092	64.90
9.3	.3661	70	108	860093	67.25
9.4	.3701	70	108	860094	68.85
9.5	.3740	70	108	860095	65.15
9.6	.3780	70	108	860096	72.45
9.7	.3819	70	108	860097	74.60

TOOL DIAMETER		LENGTH		TYPE 860 - 118° PT.	
mm	INCH	mm	OAL	METRIC EDP NO.	METRIC PRICE
9.8	.3858	70	108	860098	\$77.60
9.9	.3900	73	114	860099	79.35
10.0	.3937	73	114	860100	77.50
10.1	.3976	73	114	860101	82.75
10.2	.4016	73	114	860102	84.60
10.3	.4055	73	114	860103	87.95
10.4	.4094	73	114	860104	90.10
10.5	.4134	73	114	860105	88.70
10.6	.4173	73	114	860106	94.20
10.7	.4213	73	114	860107	96.35
10.8	.4252	73	114	860108	99.80
10.9	.4291	73	114	860109	101.50
11.0	.4331	73	114	860110	98.95
11.1	.4370	73	114	860111	104.80
11.2	.4409	76	120	860112	105.95
11.3	.4449	76	120	860113	109.45
11.4	.4488	76	120	860114	111.25
11.5	.4528	76	120	860115	108.05
11.6	.4567	76	120	860116	114.75
11.7	.4606	76	120	860117	116.45
11.8	.4646	76	120	860118	119.90
11.9	.4685	76	120	860119	121.70
12.0	.4724	76	120	860120	114.90
12.1	.4764	76	120	860121	123.45
12.2	.4803	76	120	860122	124.25
12.3	.4843	76	120	860123	125.85
12.4	.4882	76	120	860124	126.85
12.5	.4921	76	120	860125	127.65
12.6	.4961	76	120	860126	128.55
12.7	.5000	76	120	860127	129.85
13.0	.5118	82	127	860130	152.05
13.5	.5315	82	127	860135	199.75
14.0	.5512	82	127	860140	191.45
14.5	.5709	82	127	860145	247.15
15.0	.5906	82	127	860150	236.50
15.5	.6102	82	127	860155	236.50
16.0	.6299	82	127	860160	214.00
16.5	.6496	89	140	860165	320.95
17.0	.6693	89	140	860170	320.95
17.5	.6890	89	140	860175	298.45
18.0	.7087	89	140	860180	371.65
18.5	.7283	89	140	860185	371.65
19.0	.7480	95	152	860190	349.10
-	-	-	-	-	-

DRILLS



TAPER LENGTH DRILLS

CARBIDE TIPPED TYPES 630 & 631 FRACTIONAL



118° STANDARD OR 135° SPLIT POINT

USE:

- The longer length of these drills increases their effective reach through drill bushings
- For use in ASA split sleeve drill drivers

TYPE 630 – 118° STANDARD POINT

- Tanged, straight shank, taper length
- Longer flute and overall lengths than jobbers length drills
- Detailed specifications on page 112

TYPE 631 – 135° SPLIT POINT

- Same as Type 630 above, except with 135° split point designed for drilling tough abrasive or high tensile materials

TOOL SELECTOR BOX (Shown on page 129)

MODIFICATIONS (See list on page 125)

TOOL DIAMETER			LENGTH		TYPE 630 - 118° PT.		TYPE 631 - 135° PT.	
FRACTIONAL	WIRE/LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
1/8	30 29 28	.1250	2 3/4	5 1/8	63008	\$14.45	63108	\$17.95
		.1285	3	5 3/8	63230	20.15	63330	21.75
		.1360	3	5 3/8	63229	20.15	63329	21.75
		.1405	3	5 3/8	63228	20.15	63328	21.75
3/64	27 26 25	.1406	3	5 3/8	63009	16.65	63109	18.95
		.1440	3	5 3/8	63227	20.15	63327	21.75
		.1470	3	5 3/8	63226	20.15	63326	21.75
		.1495	3	5 3/8	63225	20.15	63325	21.75
1/2	24 23	.1520	3	5 3/8	63224	20.15	63324	21.75
		.1540	3	5 3/8	63223	20.15	63323	21.75
		.1562	3	5 3/8	63010	15.30	63110	18.95
		.1570	3 3/8	5 3/4	63222	20.90	63322	22.60
5/32	21 20 19 18	.1590	3 3/8	5 3/4	63221	20.90	63321	22.60
		.1610	3 3/8	5 3/4	63220	20.90	63320	22.60
		.1660	3 3/8	5 3/4	63219	20.90	63319	22.60
		.1695	3 3/8	5 3/4	63218	20.90	63318	22.60
11/64	17 16 15	.1719	3 3/8	5 3/4	63011	15.55	63111	19.65
		.1730	3 3/8	5 3/4	63217	20.90	63317	22.60
		.1770	3 3/8	5 3/4	63216	20.90	63316	22.60
		.1800	3 3/8	5 3/4	63215	20.90	63315	22.60
3/16	14 13	.1820	3 3/8	5 3/4	63214	20.90	63314	22.60
		.1850	3 3/8	5 3/4	63213	20.90	63313	22.60
		.1875	3 3/8	5 3/4	63012	15.55	63112	19.65
		.1890	3 3/8	6	63212	22.05	63312	23.80
1/4	11 10 9 8	.1910	3 3/8	6	63211	22.05	63311	23.80
		.1935	3 3/8	6	63210	22.05	63310	23.80
		.1960	3 3/8	6	63209	22.05	63309	23.80
		.1990	3 3/8	6	63208	22.05	63308	23.80
13/64	7 6 5	.2010	3 3/8	6	63207	22.05	63307	23.80
		.2031	3 3/8	6	63013	16.45	63113	20.70
		.2040	3 3/8	6	63206	22.05	63306	23.80
		.2055	3 3/8	6	63205	22.05	63305	23.80
7/32	4 3	.2090	3 3/8	6	63204	22.05	63304	23.80
		.2130	3 3/8	6	63203	22.05	63303	23.80
		.2188	3 3/8	6	63014	16.45	63114	20.70
		.2210	3 3/4	6 1/8	63202	24.95	63302	27.00
15/64	1 A B	.2280	3 3/4	6 1/8	63201	24.95	63301	27.00
		.2340	3 3/4	6 1/8	63401	24.95	63501	27.00
		.2344	3 3/4	6 1/8	63015	18.65	63115	23.40
		.2380	3 3/4	6 1/8	63402	24.95	63502	27.00
1/4	C D E F	.2420	3 3/4	6 1/8	63403	24.95	63503	27.00
		.2460	3 3/4	6 1/8	63404	24.95	63504	27.00
		.2500	3 3/4	6 1/8	63016	18.65	63116	23.40
		.2570	3 7/8	6 1/4	63406	27.90	63506	30.20
17/64	G H I	.2610	3 7/8	6 1/4	63407	27.90	63507	30.20
		.2656	3 7/8	6 1/4	63017	20.90	63117	26.25
		.2660	3 7/8	6 1/4	63408	27.90	63508	30.20
		.2720	3 7/8	6 1/4	63409	27.90	63509	30.20
9/32	J K L	.2770	3 7/8	6 1/4	63410	27.90	63510	30.20
		.2810	3 7/8	6 1/4	63411	27.90	63511	30.20
		.2812	3 7/8	6 1/4	63018	20.90	63118	26.25
		.2900	4	6 3/8	63412	30.25	63512	32.60
19/64	M N	.2950	4	6 3/8	63413	30.25	63513	32.60
		.2969	4	6 3/8	63019	22.50	63119	28.35
		.3020	4	6 3/8	63414	30.25	63514	32.60
		.3125	4	6 3/8	63020	22.50	63120	28.35
5/16	O P	.3160	4 1/8	6 1/2	63415	34.30	63515	37.05
		.3230	4 1/8	6 1/2	63416	34.30	63516	37.05
		.3281	4 1/8	6 1/2	63021	24.80	63121	32.25

TOOL DIAMETER			LENGTH		TYPE 630 - 118° PT.		TYPE 631 - 135° PT.	
FRACTIONAL	LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
11/32	Q	.3320	4 1/8	6 1/2	63417	\$34.30	63517	\$37.05
	R	.3390	4 1/8	6 1/2	63418	34.30	63518	37.05
	S	.3438	4 1/8	6 1/2	63022	24.80	63122	32.60
23/64	T	.3580	4 1/4	6 3/4	63419	37.50	63519	40.55
	U	.3594	4 1/4	6 3/4	63023	27.95	63123	35.30
		.3680	4 1/4	6 3/4	63421	37.50	63521	40.55
3/8	V W X	.3750	4 1/4	6 3/4	63024	27.95	63124	35.30
		.3770	4 3/8	7	63422	40.20	63522	43.45
		.3860	4 3/8	7	63423	40.20	63523	43.45
25/64	Y Z	.3906	4 3/8	7	63025	30.00	63125	37.85
		.3970	4 3/8	7	63424	40.20	63524	43.45
		.4040	4 3/8	7	63425	40.20	63525	43.45
13/32	7 8	.4062	4 3/8	7	63026	30.00	63126	37.85
		.4130	4 3/8	7 1/4	63426	46.30	63526	50.00
		.4219	4 3/8	7 1/4	63027	34.60	63127	43.45
7/16	29/64 15/32 31/64	.4375	4 3/8	7 1/4	63028	34.60	63128	43.45
		.4531	4 3/4	7 1/2	63029	38.10	63129	48.05
		.4688	4 3/4	7 1/2	63030	38.10	63130	48.05
1/2	33/64 17/32 35/64	.4844	4 3/4	7 3/4	63031	40.00	63131	50.35
		.5000	4 3/4	7 3/4	63032	40.00	63132	50.35
		.5156	4 3/4	8	63033	44.95	63133	55.65
9/16	37/64 19/32 39/64	.5312	4 3/4	8	63034	45.95	63134	55.65
		.5469	4 7/8	8 1/4	63035	46.40	63135	58.50
		.5625	4 7/8	8 1/4	63036	46.40	63136	58.50
5/8	41/64 21/32 43/64	.5781	4 7/8	8 3/4	63037	48.90	63137	61.85
		.5938	4 7/8	8 3/4	63038	49.80	63138	61.85
		.6094	4 7/8	8 3/4	63039	56.45	63139	71.15
11/16	45/64 23/32 47/64	.6250	4 7/8	8 3/4	63040	56.45	63140	71.15
		.6406	5 1/8	9	63041	58.55	63141	72.45
		.6562	5 1/8	9	63042	57.55	63142	69.20
3/4	49/64 25/32 51/64	.6719	5 3/8	9 1/4	63043	60.55	63143	73.25
		.6875	5 3/8	9 1/4	63044	58.50	63144	73.25
		.7031	5 3/8	9 1/2	63045	59.10	63145	74.55
13/16	53/64 27/32 55/64	.7188	5 3/8	9 1/2	63046	59.70	63146	75.30
		.7344	5 3/8	9 3/4	63047	60.05	63147	75.75
		.7500	5 7/8	9 3/4	63048	61.00	63148	76.85
7/8	57/64 29/32 59/64	.7656	6	9 7/8	63049	77.50	63149	83.70
		.7812	6	9 7/8	63050	77.50	63150	83.70
		.7969	6 1/8	10	63051	77.80	63151	84.05
15/8	61/64 31/32 63/64	.8125	6 1/8	10	63052	66.55	63152	84.05
		.8281	6 1/8	10	63053	77.80	63153	84.05
		.8438	6 1/8	10	63054	77.80	63154	84.05
1 1/8	65/64 33/32 67/64	.8594	6 1/8	10	63055	82.35	63155	88.95
		.8750	6 1/8	10	63056	70.45	63156	88.95
		.8906	6 1/8	10	63057	85.15	63157	92.00
1 1/4	69/64 35/32 71/64	.9062	6 1/8	10	63058	85.15	63158	92.00
		.9219	6 1/8	10 3/4	63059	86.40	63159	93.35
		.9375	6 1/8	10 3/4	63060	73.95	63160	93.35
1 3/8	73/64 37/32 75/64	.9531	6 3/8	11	63061	90.50	63161	97.70
		.9688	6 3/8	11	63062	90.50	63162	97.70
		.9844	6 3/8	11	63063	93.35	63163	100.75
1 1/2		1.0000	6 3/8	11	63064	79.80	63164	100.75

DRILLS



TAPER LENGTH DRILLS CARBIDE TIPPED TYPES 630 & 631 METRIC



118° STANDARD OR 135° SPLIT POINT



NOTE: Modifications available (see list on page 125).

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	630
	40	NON-FERROUS - SHORT CHIPS	630/631
	60	CAST IRONS	631/630
	80	LOW STRENGTH STEELS	CALL US
	100	MEDIUM STRENGTH STEELS	CALL US
	120	HIGH STRENGTH STEELS	CALL US
	140	HIGH TEMPERATURE ALLOYS	CALL US

TOOL DIAMETER		LENGTH				TYPE 630 - 118° PT.		TYPE 631 - 135° PT.	
		FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
mm	INCH	mm	INCH	mm	INCH				
3.2	.1260	76	3	137	5 3/8	630032	\$18.60	631032	\$20.05
3.3	.1299	76	3	137	5 3/8	630033	18.60	631033	20.05
3.4	.1339	76	3	137	5 3/8	630034	18.60	631034	20.05
3.5	.1378	76	3	137	5 3/8	630035	18.00	631035	19.60
3.6	.1417	76	3	137	5 3/8	630036	18.00	631036	19.60
3.7	.1457	76	3	137	5 3/8	630037	18.00	631037	19.60
3.8	.1496	76	3	137	5 3/8	630038	18.00	631038	19.60
3.9	.1535	76	3	137	5 3/8	630039	18.00	631039	19.60
4.0	.1575	86	3 3/8	146	5 3/4	630040	17.65	631040	19.10
4.1	.1614	86	3 3/8	146	5 3/4	630041	18.60	631041	20.05
4.2	.1654	86	3 3/8	146	5 3/4	630042	18.60	631042	20.05
4.3	.1693	86	3 3/8	146	5 3/4	630043	18.60	631043	20.05
4.4	.1732	86	3 3/8	146	5 3/4	630044	19.60	631044	21.10
4.5	.1772	86	3 3/8	146	5 3/4	630045	19.60	631045	21.10
4.6	.1811	86	3 3/8	146	5 3/4	630046	19.60	631046	21.10
4.7	.1850	86	3 3/8	146	5 3/4	63213	20.90	63313	22.60
4.8	.1890	92	3 3/8	152	6	63212	22.05	63312	23.80
4.9	.1929	92	3 3/8	152	6	630049	19.60	631049	21.10
5.0	.1969	92	3 3/8	152	6	630050	19.55	631050	21.10
5.1	.2008	92	3 3/8	152	6	630051	20.35	631051	22.00
5.2	.2047	92	3 3/8	152	6	630052	17.45	631052	22.00
5.3	.2087	92	3 3/8	152	6	630053	20.35	631053	22.00
5.4	.2126	92	3 3/8	152	6	630054	20.35	631054	22.00
5.5	.2165	92	3 3/8	152	6	630055	20.85	631055	22.00
5.6	.2205	95	3 3/4	156	6 1/8	630056	20.35	631056	22.00
5.7	.2244	95	3 3/4	156	6 1/8	630057	20.35	631057	22.00
5.8	.2283	95	3 3/4	156	6 1/8	630058	20.35	631058	22.00
5.9	.2323	95	3 3/4	156	6 1/8	630059	21.20	631059	22.95
6.0	.2362	95	3 3/4	156	6 1/8	630060	21.60	631060	23.85
6.1	.2402	95	3 3/4	156	6 1/8	630061	22.60	631061	24.35
6.2	.2441	95	3 3/4	156	6 1/8	630062	22.60	631062	24.35
6.3	.2480	95	3 3/4	156	6 1/8	630063	22.60	631063	24.35
6.4	.2520	98	3 7/8	159	6 1/4	630064	24.80	631064	26.80
6.5	.2559	98	3 7/8	159	6 1/4	630065	22.40	631065	26.80
6.6	.2598	98	3 7/8	159	6 1/4	630066	25.55	631066	27.50
6.7	.2638	98	3 7/8	159	6 1/4	630067	25.55	631067	27.50
6.8	.2677	98	3 7/8	159	6 1/4	630068	25.55	631068	27.50
6.9	.2717	98	3 7/8	159	6 1/4	630069	25.55	631069	27.50
7.0	.2756	98	3 7/8	159	6 1/4	630070	23.35	631070	26.80
7.1	.2795	98	3 7/8	159	6 1/4	630071	25.55	631071	27.50
7.2	.2835	102	4	162	6 3/8	630072	25.55	631072	27.50
7.3	.2874	102	4	162	6 3/8	630073	25.55	631073	27.50
7.4	.2913	102	4	162	6 3/8	630074	25.55	631074	27.50
7.5	.2953	102	4	162	6 3/8	630075	24.75	631075	28.95
7.6	.2992	102	4	162	6 3/8	630076	26.80	631076	28.95
7.7	.3031	102	4	162	6 3/8	630077	26.80	631077	28.95
7.8	.3071	102	4	162	6 3/8	630078	26.80	631078	28.95
7.9	.3110	102	4	162	6 3/8	630079	26.80	631079	28.95
8.0	.3150	105	4 1/8	165	6 1/2	630080	25.10	631080	28.95
8.1	.3189	105	4 1/8	165	6 1/2	630081	26.80	631081	28.95
8.2	.3228	105	4 1/8	165	6 1/2	630082	28.55	631082	30.75
8.3	.3268	105	4 1/8	165	6 1/2	630083	28.55	631083	30.75
8.4	.3307	105	4 1/8	165	6 1/2	630084	28.55	631084	30.75
8.5	.3346	105	4 1/8	165	6 1/2	630085	26.30	631085	32.80
8.6	.3386	105	4 1/8	165	6 1/2	630086	30.40	631086	32.80
8.7	.3425	105	4 1/8	165	6 1/2	630087	30.40	631087	32.80

TOOL DIAMETER		LENGTH				TYPE 630 - 118° PT.		TYPE 631 - 135° PT.	
		FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
mm	INCH	mm	INCH	mm	INCH				
8.8	.3465	108	4 1/4	171	6 3/4	630088	\$30.40	631088	\$32.80
8.9	.3504	108	4 1/4	171	6 3/4	630089	30.40	631089	32.80
9.0	.3543	108	4 1/4	171	6 3/4	630090	28.45	631090	36.00
9.1	.3583	108	4 1/4	171	6 3/4	630091	33.30	631091	36.00
9.2	.3622	108	4 1/4	171	6 3/4	630092	33.30	631092	36.00
9.3	.3661	108	4 1/4	171	6 3/4	630093	33.30	631093	36.00
9.4	.3701	108	4 1/4	171	6 3/4	630094	33.30	631094	36.00
9.5	.3740	108	4 1/4	171	6 3/4	630095	29.15	631095	36.00
9.6	.3780	111	4 3/8	178	7	630096	34.95	631096	37.75
9.7	.3819	111	4 3/8	178	7	630097	34.95	631097	37.75
9.8	.3858	111	4 3/8	178	7	630098	34.95	631098	37.75
9.9	.3898	111	4 3/8	178	7	630099	34.95	631099	37.75
10.0	.3937	111	4 3/8	178	7	630100	30.60	631100	38.65
10.1	.3976	111	4 3/8	178	7	630101	35.75	631101	38.65
10.2	.4016	111	4 3/8	178	7	630102	37.30	631102	40.30
10.3	.4055	111	4 3/8	178	7	630103	37.30	631103	40.30
10.4	.4094	117	4 5/8	184	7 1/4	630104	38.95	631104	42.00
10.5	.4134	117	4 5/8	184	7 1/4	630105	34.85	631105	42.00
10.6	.4173	117	4 5/8	184	7 1/4	630106	40.80	631106	44.10
10.7	.4213	117	4 5/8	184	7 1/4	630107	40.80	631107	44.10
10.8	.4252	117	4 5/8	184	7 1/4	630108	40.80	631108	44.10
10.9	.4291	117	4 5/8	184	7 1/4	630109	40.80	631109	44.10
11.0	.4331	117	4 5/8	184	7 1/4	630110	37.70	631110	44.30
11.5	.4528	121	4 3/4	190	7 1/2	630115	42.30	631115	49.00
12.0	.4724	121	4 3/4	197	7 3/4	630120	45.75	631120	51.35
12.5	.4921	121	4 3/4	197	7 3/4	630125	47.40	631125	51.35
13.0	.5118	121	4 3/4	203	8	630130	48.60	631130	54.20
13.5	.5315	121	4 3/4	203	8	630135	51.60	631135	54.20
14.0	.5512	124	4 7/8	210	8 1/4	630140	54.80	631140	60.05
14.5	.5709	124	4 7/8	222	8 3/4	630145	58.80	631145	64.30
15.0	.5906	124	4 7/8	222	8 3/4	630150	58.80	631150	64.30
15.5	.6102	124	4 7/8	222	8 3/4	630155	66.65	631155	73.05
16.0	.6299	130	5 1/8	229	9	630160	66.65	631160	73.45
16.5	.6496	130	5 1/8	229	9	630165	71.20	631165	73.45
17.0	.6693	137	5 3/8	235	9 1/4	630170	69.05	631170	75.75
17.5	.6890	143	5 5/8	241	9 1/2	630175	69.05	631175	75.75
18.0	.7087	143	5 5/8	241	9 1/2	630180	70.55	631180	77.25
18.5	.7283	149	5 7/8	248	9 3/4	630185	72.10	631185	78.85
19.0	.7480	149	5 7/8	248	9 3/4	630190	72.10	631190	78.85
19.5	.7677	152	6	251	9 7/8	630195	86.95	631195	93.85
20.0	.7874	156	6 1/8	254	10	630200	87.30	631200	94.30
20.5	.8071	156	6 1/8	254	10	630205	87.30	631205	94.30
21.0	.8268	156	6 1/8	254	10	630210	87.30	631210	94.30
21.5	.8465	156	6 1/8	254	10	630215	87.30	631215	94.30
22.0	.8661	156	6 1/8	254	10	630220	92.40	631220	99.75
22.5	.8858	156	6 1/8	254	10	630225	95.60	631225	103.20
23.0	.9055	156	6 1/8	254	10	630230	95.60	631230	103.20
23.5	.9252	156	6 1/8	273	10 3/4	630235	96.95	631235	104.70
24.0	.9449	162	6 3/8	279	11	630240	101.50	631240	109.65
24.5	.9646	162	6 3/8	279	11	630245	101.50	631245	109.65
25.0	.9843	162	6 3/8	279	11	630250	104.70	631250	113.10

DRILLS



TAPER SHANK DRILLS CARBIDE TIPPED TYPES 660 & 661 FRACTIONAL



118° STANDARD OR 135° SPLIT POINT



TYPE 660 – 118° STANDARD POINT

- Standard taper shank
- Heavy duty construction
- Detailed specifications on page 112

TYPE 661 – 135° SPLIT POINT

- Same as Type 660 above, except with 135° split point designed for drilling abrasive or high tensile materials

NOTE: For extra long flute length with 118° standard point, see pg. 132.
For stocked smaller taper shank with 118° standard point, see pg. 131.

TOOL DIAMETER		LENGTH		TAPER SHANK NO.	TYPE 660 118° PT.		TYPE 661 135° PT.	
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL		EDP NO.	PRICE	EDP NO.	PRICE
1/4	.2500	2 7/8	6 1/8	1	66016	\$36.30	66116	\$41.20
17/64	.2656	3	6 1/4	1	66017	37.15	66117	42.10
9/32	.2812	3	6 1/4	1	66018	37.15	66118	42.10
19/64	.2969	3 1/8	6 3/8	1	66019	37.15	66119	42.10
5/16	.3125	3 1/8	6 3/8	1	66020	37.15	66120	42.10
21/64	.3281	3 3/4	6 1/2	1	66021	47.30	66121	53.45
11/32	.3438	3 3/4	6 1/2	1	66022	47.30	66122	53.45
23/64	.3594	3 1/2	6 3/4	1	66023	47.30	66123	53.45
3/8	.3750	3 1/2	6 3/4	1	66024	47.30	66124	53.45
25/64	.3906	3 5/8	7	1	66025	54.70	66125	62.05
13/32	.4062	3 5/8	7	1	66026	54.70	66126	62.05
27/64	.4219	3 7/8	7 1/4	1	66027	54.70	66127	62.05
7/16	.4375	3 7/8	7 1/4	1	66028	47.90	66128	54.30
29/64	.4531	4 1/8	7 1/2	1	66029	58.15	66129	65.95
15/32	.4688	4 1/8	7 1/2	1	66030	58.15	66130	65.95
31/64	.4844	4 3/8	8 1/4	2	66031	58.15	66131	65.95
1/2	.5000	4 3/8	8 1/4	2	66032	45.75	66132	61.00
33/64	.5156	4 5/8	8 1/2	2	66033	59.10	66133	70.95
17/32	.5312	4 5/8	8 1/2	2	66034	48.30	66134	62.75
35/64	.5469	4 7/8	8 3/4	2	66035	59.95	66135	71.95
9/16	.5625	4 7/8	8 3/4	2	66036	48.70	66136	63.60
37/64	.5781	4 7/8	8 3/4	2	66037	62.75	66137	75.35
19/32	.5938	4 7/8	8 3/4	2	66038	50.85	66138	66.60
39/64	.6094	4 7/8	8 3/4	2	66039	72.70	66139	87.25
5/8	.6250	4 7/8	8 3/4	2	66040	59.20	66140	77.05
41/64	.6406	5 1/8	9	2	66041	73.85	66141	88.65
21/32	.6562	5 1/8	9	2	66042	57.70	66142	78.35
43/64	.6719	5 3/8	9 1/4	2	66043	74.70	66143	89.75
11/16	.6875	5 3/8	9 1/4	2	66044	59.55	66144	79.30
45/64	.7031	5 5/8	9 1/2	2	66045	76.80	66145	92.10
23/32	.7188	5 5/8	9 1/2	2	66046	61.00	66146	81.45
47/64	.7344	5 7/8	9 3/4	2	66047	78.30	66147	94.00
3/4	.7500	5 7/8	9 3/4	2	66048	65.85	66148	83.10
49/64	.7656	6	9 7/8	2	66049	83.30	66149	100.00
25/32	.7812	6	9 7/8	2	66050	71.25	66150	88.30
51/64	.7969	6 1/8	10 3/4	3	66051	84.15	66151	101.00
13/16	.8125	6 1/8	10 3/4	3	66052	72.05	66152	89.25
53/64	.8281	6 1/8	10 3/4	3	66053	84.15	66153	101.00
27/32	.8438	6 1/8	10 3/4	3	66054	73.55	66154	89.25
55/64	.8594	6 1/8	10 3/4	3	66055	88.90	66155	106.70

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	660
	40	NON-FERROUS - SHORT CHIPS	660/661
	60	CAST IRONS	661/660
	80	LOW STRENGTH STEELS	CALL US
	100	MEDIUM STRENGTH STEELS	CALL US
	120	HIGH STRENGTH STEELS	CALL US
140	HIGH TEMPERATURE ALLOYS	CALL US	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Modified metric tool diameter
- Modified point and/or angle
- Shank whistle notch for set screw
- Coatings available:

- TITANIUM NITRIDE – TiN
- TITANIUM CARBONITRIDE – TiCN
- ZIRCONIUM NITRIDE – ZrN
- AL TITANIUM NITRIDE – AlTiN

TOOL DIAMETER		LENGTH		TAPER SHANK NO.	TYPE 660 118° PT.		TYPE 661 135° PT.	
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL		EDP NO.	PRICE	EDP NO.	PRICE
7/8	.8750	6 1/8	10 3/4	3	66056	\$78.20	66156	\$94.30
57/64	.8906	6 1/8	10 3/4	3	66057	91.85	66157	110.15
29/32	.9062	6 1/8	10 3/4	3	66058	84.10	66158	97.45
59/64	.9219	6 1/8	10 3/4	3	66059	93.55	66159	112.20
15/16	.9375	6 1/8	10 3/4	3	66060	89.80	66160	99.20
61/64	.9531	6 3/8	11	3	66061	98.10	66161	117.70
31/32	.9688	6 3/8	11	3	66062	89.80	66162	104.00
63/64	.9844	6 3/8	11	3	66063	100.65	66163	120.80
1	1.0000	6 3/8	11	3	66064	88.35	66164	106.80
1 1/64	1.0156	6 1/2	11 1/8	3	66065	155.80	66165	176.55
1 1/32	1.0312	6 1/2	11 1/8	3	66066	129.30	66166	146.60
1 1/64	1.0469	6 5/8	11 1/4	3	66067	159.70	66167	180.90
1 1/16	1.0625	6 5/8	11 1/4	3	66068	109.70	66168	139.05
1 1/64	1.0781	6 7/8	12 1/2	4	66069	173.20	66169	196.30
1 1/32	1.0938	6 7/8	12 1/2	4	66070	143.80	66170	162.95
1 1/64	1.1094	7 1/8	12 3/4	4	66071	177.10	66171	200.60
1 1/8	1.1250	7 1/8	12 3/4	4	66072	121.50	66172	154.20
1 1/64	1.1406	7 1/4	12 7/8	4	66073	198.75	66173	225.20
1 5/32	1.1562	7 1/4	12 7/8	4	66074	165.00	66174	186.95
1 1/64	1.1719	7 3/8	13	4	66075	202.70	66175	229.45
1 3/16	1.1875	7 3/8	13	4	66076	139.20	66176	176.45
1 13/64	1.2031	7 1/2	13 1/8	4	66077	213.35	66177	241.60
1 7/32	1.2188	7 1/2	13 1/8	4	66078	177.05	66178	200.55
1 15/64	1.2344	7 7/8	13 1/2	4	66079	217.10	66179	246.00
1 1/4	1.2500	7 7/8	13 1/2	4	66080	148.95	66180	189.05
1 9/32	1.2812	8 1/2	14 1/8	4	66082	252.85	66182	286.45
1 5/16	1.3125	8 5/8	14 1/4	4	66084	219.85	66184	249.05
1 11/32	1.3438	8 3/4	14 3/8	4	66086	271.55	66186	307.65
1 3/8	1.3750	8 7/8	14 1/2	4	66088	236.15	66188	267.50
1 13/32	1.4062	9	14 5/8	4	66090	292.15	66190	331.10
1 7/16	1.4375	9 1/8	14 3/4	4	66092	254.10	66192	287.85
1 15/32	1.4688	9 1/4	14 7/8	4	66094	310.95	66194	352.30
1 1/2	1.5000	9 3/8	15	4	66096	270.30	66196	306.30



TAPER SHANK DRILLS CARBIDE TIPPED TYPE 660 METRIC



118° STANDARD POINT

NOTE: Modifications available (see list on page 130).

TOOL DIAMETER		LENGTH				TAPER SHANK NO.	TYPE 660 - 118° PT.	
		FLUTE		OVERALL			METRIC EDP NO.	METRIC PRICE
mm	INCH	mm	INCH	mm	INCH			
13.0	.5118	117	4 5/8	216	8 1/2	2	660130	\$60.30
13.5	.5315	117	4 5/8	216	8 1/2	2	660135	55.80
14.0	.5512	124	4 7/8	222	8 3/4	2	660140	56.60
14.5	.5709	124	4 7/8	222	8 3/4	2	660145	63.95
15.0	.5906	124	4 7/8	222	8 3/4	2	660150	59.30
15.5	.6102	124	4 7/8	222	8 3/4	2	660155	74.15
16.0	.6299	130	5 1/8	229	9	2	660160	75.35
16.5	.6496	130	5 1/8	229	9	2	660165	69.85
17.0	.6693	137	5 3/8	235	9 1/4	2	660170	76.20
17.5	.6890	143	5 5/8	241	9 1/2	2	660175	78.30
18.0	.7087	143	5 5/8	241	9 1/2	2	660180	72.55
18.5	.7283	149	5 7/8	248	9 3/4	2	660185	79.85
19.0	.7480	149	5 7/8	248	9 3/4	2	660190	73.90
20.0	.7874	156	6 1/8	273	10 3/4	3	660200	85.75
21.0	.8268	156	6 1/8	273	10 3/4	3	660210	85.75
22.0	.8661	156	6 1/8	273	10 3/4	3	660220	83.95
23.0	.9055	156	6 1/8	273	10 3/4	3	660230	86.75
24.0	.9449	162	6 3/8	279	11	3	660240	100.10
25.0	.9843	162	6 3/8	279	11	3	660250	102.70
26.0	1.0236	165	6 1/2	283	11 1/8	3	660260	153.80
28.0	1.1024	181	7 1/8	324	12 3/4	4	660280	170.50
30.0	1.1811	187	7 3/8	330	13	4	660300	205.35
32.0	1.2598	216	8 1/2	359	14 1/8	4	660320	255.00
34.0	1.3386	222	8 3/4	365	14 3/8	4	660340	273.90
36.0	1.4173	232	9 1/8	375	14 3/4	4	660360	313.65
38.0	1.4961	238	9 3/8	381	15	4	660380	326.15

DRILLS



TAPER SHANK DRILLS CARBIDE TIPPED TYPE 668 FRACTIONAL

SMALLER TAPER SHANK NUMBER 118° STANDARD POINT



TYPE 668

- Same as Type 660 on page 130, except taper shank is one number smaller
- Heavy duty construction
- Detailed specifications on page 112

USE:

- For tool holders that require a smaller taper shank

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified point and/or angle
- Shank whistle notch for set screw
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

While supplies last

TOOL DIAMETER		LENGTH		TAPER SHANK NO.	TYPE 668 118° PT.	
FRACTION	DECIMAL	FLUTE	OVERALL		EDP NO.	PRICE
3/64	.4844	4 3/8	7 3/4	1	66831	\$66.50
1/2	.5000	4 3/8	7 3/4	1	66832	52.25
33/64	.5156	4 5/8	8	1	66833	64.50
17/32	.5312	4 5/8	8	1	66834	55.25
35/64	.5469	4 7/8	8 1/4	1	66835	65.40
9/16	.5625	4 7/8	8 1/4	1	66836	55.65
51/64	.7969	6 1/8	10	2	66851	91.80
13/16	.8125	6 1/8	10	2	66852	77.90
53/64	.8281	6 1/8	10	2	66853	91.80
27/32	.8438	6 1/8	10	2	66854	79.55
55/64	.8594	6 1/8	10	2	66855	97.00
7/8	.8750	6 1/8	10	2	66856	84.65
29/32	.9062	6 1/8	10	2	66858	91.00
1 3/32	1.0938	6 7/8	11 1/2	3	66870	193.25
1 1/8	1.1250	7 1/8	11 3/4	3	66872	138.85
1 5/32	1.1562	7 1/4	11 7/8	3	66874	188.50
1 3/16	1.1875	7 3/8	12	3	66876	159.05
1 1/4	1.2500	7 7/8	12 1/2	3	66880	170.20



TAPER SHANK DRILLS CARBIDE TIPPED TYPES 664 & 665 FRACTIONAL



**EXTRA LONG FLUTE LENGTH: 8" OR 11"
118° STANDARD POINT**

**TYPE 664 – 8" FLUTE LENGTH – 118° STANDARD POINT
TYPE 665 – 11" FLUTE LENGTH – 118° STANDARD POINT**

- Same carbide tipped heavy duty construction as standard flute length taper shank drill (Type 660 on page 130)
- Detailed specifications on page 112

USE:

- The longer flute length of these drills increases their effective reach through drill bushings

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	664 or 665
	40	NON-FERROUS - SHORT CHIPS	664 or 665
	60	CAST IRONS	664 or 665
	80	LOW STRENGTH STEELS	CALL US
	100	MEDIUM STRENGTH STEELS	CALL US
	120	HIGH STRENGTH STEELS	CALL US
140	HIGH TEMPERATURE ALLOYS	CALL US	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified point and/or angle
- Shank whistle notch for set screw
- Coatings available:

- TITANIUM NITRIDE – TiN
- TITANIUM CARBONITRIDE – TiCN
- ZIRCONIUM NITRIDE – ZrN
- AL TITANIUM NITRIDE – AlTiN

DRILLS



TYPE 665 – 11" FLUTE LENGTH

TYPE 664 – 8" FLUTE LENGTH

TOOL DIAMETER		LENGTH		TAPER SHANK NO.	TYPE 664 – 8" 118° POINT	
FRACTIONAL	DECIMAL	FLUTE	OVERALL		EDP NO.	PRICE
1/2	.5000	8	12	2	66432	\$112.90
17/32	.5312	8	12	2	66434	130.50
9/16	.5625	8	12	2	66436	130.50
19/32	.5938	8	12	2	66438	130.50
5/8	.6250	8	12	2	66440	172.80
21/32	.6562	8	12	2	66442	181.35
11/16	.6875	8	12	2	66444	181.35
23/32	.7188	8	12	2	66446	190.50
3/4	.7500	8	12	2	66448	190.50
25/32	.7812	8	12	2	66450	200.00

While supplies last

TOOL DIAMETER		LENGTH		TAPER SHANK NO.	TYPE 665 – 11" 118° POINT	
FRACTIONAL	DECIMAL	FLUTE	OVERALL		EDP NO.	PRICE
5/8	.6250	11	14 3/4	2	66540	\$184.90
21/32	.6562	11	14 3/4	2	66542	194.10
43/64	.6719	11	14 3/4	2	66543	205.75
11/16	.6875	11	14 3/4	2	66544	194.10
23/32	.7188	11	14 3/4	2	66546	203.80
3/4	.7500	11	14 3/4	2	66548	203.80
25/32	.7812	11	14 3/4	2	66550	214.00
13/16	.8125	11	15 1/2	3	66552	233.85
27/32	.8438	11	15 1/2	3	66554	233.85
7/8	.8750	11	15 1/2	3	66556	233.85
29/32	.9062	11	15 1/2	3	66558	285.65
15/16	.9375	11	15 1/2	3	66560	285.65
31/32	.9688	11	15 1/2	3	66562	300.00
1	1.0000	11	15 1/2	3	66564	300.00
1 1/32	1.0312	11	15 1/2	3	66566	309.00
1 1/16	1.0625	11	15 1/2	3	66568	318.25

While supplies last



AIRCRAFT EXTENSION DRILLS CARBIDE TIPPED TYPES 610 & 611 FRACTIONAL



135° SPLIT POINT



TYPE 610 – AIRCRAFT EXTENSION DRILLS – 6" OVERALL LENGTH

- 135° split point per NAS 907 specifications
- Detailed specifications on page 112



TYPE 611 – AIRCRAFT EXTENSION DRILLS – 12" OVERALL LENGTH

- Same as Type 610 above, except 12" long

USE (BOTH TYPES):

- For drilling holes not accessible with shorter drills
- Feeds should be light to medium
- Not recommended for deep hole applications

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	610 or 611
40	NON-FERROUS - SHORT CHIPS	610 or 611	
60	CAST IRONS	610 or 611	
80	LOW STRENGTH STEELS	CALL US	
100	MEDIUM STRENGTH STEELS	CALL US	
120	HIGH STRENGTH STEELS	CALL US	
140	HIGH TEMPERATURE ALLOYS	CALL US	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Extra long shank
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

TOOL DIAMETER			FLUTE LENGTH	TYPE 610 - 6"		TYPE 611 - 12"	
FRAC.	WIRE/LETTER	DECIMAL EQUIV.		EDP NO.	PRICE	EDP NO.	PRICE
1/8	32	.1160	1 3/8	61232	\$20.35	61332	\$24.00
	31	.1200	1 3/8	61231	18.20	61331	21.40
		.1250	1 3/8	61008	14.10	61108	16.65
	30	.1285	1 3/8	61230	19.20	61330	22.60
9/64	29	.1360	1 3/4	61229	19.80	61329	23.30
	28	.1405	1 3/4	61228	20.15	61328	23.75
		.1406	1 3/4	61009	15.35	61109	18.00
	27	.1440	1 7/8	61227	20.60	61327	24.20
5/32	26	.1470	1 7/8	61226	20.15	61326	23.75
	25	.1495	1 7/8	61225	20.15	61325	23.75
	24	.1520	2	61224	20.60	61324	24.20
	23	.1540	2	61223	20.15	61323	23.75
3/16	22	.1562	2	61010	15.00	61110	17.70
		.1570	2	61222	22.05	61322	25.95
	21	.1590	2 1/8	61221	21.35	61321	25.15
	20	.1610	2 1/8	61220	21.90	61320	25.70
11/64	19	.1660	2 1/8	61219	21.90	61319	25.70
	18	.1695	2 1/8	61218	21.90	61318	25.70
		.1719	2 1/8	61011	16.40	61111	19.25
	17	.1730	2 3/16	61217	21.90	61317	25.70
7/32	16	.1770	2 3/16	61216	21.35	61316	25.15
	15	.1800	2 3/16	61215	22.05	61315	25.95
	14	.1820	2 3/16	61214	21.35	61314	25.15
	13	.1850	2 3/16	61213	21.35	61313	25.15
5/16	12	.1875	2 5/16	61012	16.00	61112	18.85
		.1890	2 5/16	61212	22.25	61312	26.20
	11	.1910	2 5/16	61211	22.50	61311	26.55
	10	.1935	2 5/16	61210	22.25	61310	26.20
3/8	9	.1960	2 7/16	61209	22.50	61309	26.55
	8	.1990	2 7/16	61208	22.50	61308	26.55
	7	.2010	2 7/16	61207	22.50	61307	26.55
		.2031	2 7/16	61013	17.55	61113	20.60
7/16	6	.2040	2 1/2	61206	23.15	61306	27.25
	5	.2055	2 1/2	61205	22.50	61305	26.55
	4	.2090	2 1/2	61204	21.20	61304	24.95
	3	.2130	2 1/2	61203	22.50	61303	26.55
1 1/4	2	.2188	2 1/2	61014	17.55	61114	20.60
		.2210	2 3/8	61202	22.15	61302	26.05
	1	.2280	2 3/8	61201	21.90	61301	25.70
	A	.2340	2 3/8	61401	26.30	61501	30.90
1 1/2		.2344	2 3/8	61015	18.85	61115	22.20

TOOL DIAMETER			FLUTE LENGTH	TYPE 610 - 6"		TYPE 611 - 12"	
FRAC.	LETTER	DECIMAL EQUIV.		EDP NO.	PRICE	EDP NO.	PRICE
1/4	B	.2380	2 3/4	61402	\$26.30	61502	\$30.90
	C	.2420	2 3/4	61403	26.30	61503	30.90
	D	.2460	2 3/4	61404	25.85	61504	30.40
	E	.2500	2 3/4	61016	18.85	61116	22.20
5/16	F	.2570	2 7/8	61406	27.00	61506	31.75
	G	.2610	2 7/8	61407	27.60	61507	32.50
		.2656	2 7/8	61017	20.15	61117	23.75
	H	.2660	2 7/8	61408	28.20	61508	33.20
3/8	I	.2720	2 7/8	61409	27.60	61509	32.50
	J	.2770	2 7/8	61410	28.20	61510	33.20
	K	.2810	2 15/16	61411	28.20	61511	33.20
		.2812	2 15/16	61018	20.15	61118	23.75
7/16	L	.2900	2 15/16	61412	28.20	61512	33.20
	M	.2950	3 1/16	61413	31.05	61513	36.55
		.2969	3 1/16	61019	21.90	61119	25.70
	N	.3020	3 1/16	61414	30.40	61514	35.75
1 1/8	O	.3125	3 3/16	61020	21.90	61120	25.70
		.3160	3 3/16	61415	28.90	61515	33.95
	P	.3230	3 5/16	61416	30.75	61516	36.15
		.3281	3 5/16	61021	23.25	61121	27.40
1 1/4	Q	.3320	3 7/16	61417	31.55	61517	37.10
	R	.3390	3 7/16	61418	30.75	61518	36.15
		.3438	3 7/16	61022	23.25	61122	27.40
	S	.3480	3 1/2	61419	33.25	61519	39.05
1 3/8	T	.3580	3 1/2	61420	34.05	61520	40.05
		.3594	3 1/2	61023	24.80	61123	29.10
	U	.3680	3 5/8	61421	32.75	61521	38.60
		.3750	3 5/8	61024	24.80	61124	29.10
1 1/2	V	.3770	3 5/8	61422	33.25	61522	39.05
	W	.3860	3 3/4	61423	35.65	61523	41.95
		.3906	3 3/4	61025	25.45	61125	30.00
	X	.3970	3 3/4	61424	33.75	61524	39.75
1 3/4	Y	.4040	3 7/8	61425	35.05	61525	41.20
		.4062	3 7/8	61026	25.10	61126	29.55
	Z	.4130	3 7/8	61426	39.55	61526	46.45
		.4219	3 15/16	61027	27.60	61127	32.50
1 7/8		.4375	4 1/16	61028	27.60	61128	32.50
		.4531	4 3/16	61029	31.70	61129	37.35
		.4688	4 3/16	61030	31.05	61130	36.55
		.4844	4 3/8	61031	34.85	61131	41.00
2		.5000	4 1/2	61032	34.85	61132	41.00

DRILLS



HARD STEEL DIE DRILLS CARBIDE TIPPED TYPES 670, 671, 672 & 673 FRACTIONAL, 670 & 672 METRIC

MATERIAL SPECIFIC

NEGATIVE OR POSITIVE EDGE 118° OR 140° POINT



TYPE 670 & 671 - NEGATIVE ANGLE CUTTING EDGE

USE: TYPE 672 & 673 - POSITIVE ANGLE CUTTING EDGE

- For drilling hardened steel in the range of 35 to 65 Rockwell C
- Will cut without annealing the workpiece
- Light feed with steady pressure – clear chips frequently
- Flood the cutting point with coolant

NOTE: For stocked reduced shank diameters (Types 670/672), see pg. 136.

TOOL DIAMETER		LENGTH		NEGATIVE EDGE		POSITIVE EDGE		ALL TYPES PRICE
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL	TYPE 670 118° PT EDP NO.	TYPE 671 140° PT EDP NO.	TYPE 672 118° PT EDP NO.	TYPE 673 140° PT EDP NO.	
* 1/16	.0625	-	1 1/2	67004	67104	-	-	\$21.65
* 5/64	.0781	-	1 1/2	67005	67105	-	-	21.65
* 3/32	.0938	-	2	67006	67106	-	-	23.80
* 7/64	.1094	-	2	67007	67107	-	-	23.80
* 1/8	.1250	-	2	67008	67108	-	-	24.50
* 9/64	.1406	-	2	67009	67109	-	-	24.50
* 5/32	.1562	-	2	67010	67110	-	-	25.80
* 11/64	.1719	-	2 3/8	67011	67111	-	-	25.80
3/16	.1875	1 1/2	3 1/2	67012	67112	67212	67312	23.40
13/64	.2031	1 1/2	3 1/2	67013	67113	67213	67313	23.40
7/32	.2188	1 3/4	3 3/4	67014	67114	67214	67314	24.15
15/64	.2344	1 3/4	3 3/4	67015	67115	67215	67315	24.95
1/4	.2500	2	4	67016	67116	67216	67316	24.95
17/64	.2656	2	4	67017	67117	67217	67317	26.35
9/32	.2812	2 1/4	4 1/4	67018	67118	67218	67318	26.35
19/64	.2969	2 1/4	4 1/4	67019	67119	67219	67319	27.60
5/16	.3125	2 1/2	4 1/2	67020	67120	67220	67320	27.60
21/64	.3281	2 1/2	4 1/2	67021	67121	67221	67321	29.40
11/32	.3438	2 3/4	4 3/4	67022	67122	67222	67322	29.40
23/64	.3594	2 3/4	4 3/4	67023	67123	67223	67323	31.60
3/8	.3750	3	5	67024	67124	67224	67324	31.60
25/64	.3906	3	5	67025	67125	67225	67325	35.65
13/32	.4062	3	5 1/4	67026	67126	67226	67326	37.00
27/64	.4219	3	5 1/4	67027	67127	67227	67327	39.95
7/16	.4375	3	5 1/2	67028	67128	67228	67328	42.95
29/64	.4531	3	5 1/2	67029	67129	67229	67329	45.05
15/32	.4688	3 1/4	5 3/4	67030	67130	67230	67330	47.15
31/64	.4844	3 1/4	5 3/4	67031	67131	67231	67331	57.20
1/2	.5000	3 1/2	6	67032	67132	67232	67332	55.35
17/32	.5312	3 1/2	6	67034	67134	67234	67334	63.40
9/16	.5625	3 1/2	6	67036	67136	67236	67336	65.60
19/32	.5938	4	7	67038	67138	67238	67338	69.45
5/8	.6250	4	7	67040	67140	67240	67340	71.55
21/32	.6562	4 1/2	7 1/2	67042	67142	67242	67342	76.60
11/16	.6875	4 1/2	7 1/2	67044	67144	67244	67344	78.65
23/32	.7188	4 3/4	8	67046	67146	67246	67346	82.40
3/4	.7500	4 3/4	8	67048	67148	67248	67348	84.65
25/32	.7812	4 3/4	8	67050	67150	67250	67350	163.50
13/16	.8125	4 3/4	8	67052	67152	67252	67352	151.80
7/8	.8750	4 3/4	8	67056	67156	67256	67356	154.90
15/16	.9375	4 3/4	8	67060	67160	67260	67360	172.55
1	1.0000	4 3/4	8	67064	67164	67264	67364	183.05

*Solid carbide

CHIP CLASS	MATERIAL MACHINED		TOOL TYPE
	60	80	
60	CAST IRONS	673/672	
80	LOW STRENGTH STEELS	672/673	
100	MEDIUM STRENGTH STEELS (UP TO 50 Rc)	672/673	
100	MEDIUM STRENGTH STEELS (OVER 50 Rc)	670/671	
120	HIGH STRENGTH STEELS (UP TO 50 Rc)	673/672	
120	HIGH STRENGTH STEELS (OVER 50 Rc)	671/670	
140	HIGH TEMPERATURE ALLOYS	673/672	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Modified metric tool diameter
- Modified point and/or angle
- Shortened shank or reduced shank diameter
- Reduced shank diameter
- Flat(s) on shank
- Coatings available:

- TITANIUM NITRIDE – TiN
- TITANIUM CARBONITRIDE – TiCN
- ZIRCONIUM NITRIDE – ZrN
- AL TITANIUM NITRIDE – AlTiN

TYPE 670 – 118° POINT WITH NEGATIVE EDGE

- Die drill - negative angle cutting edge
- Drill body diameter smaller than tool diameter to prevent gauling (see die drill diagrams on page 113)
- Detailed specifications on page 112

TYPE 671 – 140° POINT WITH NEGATIVE EDGE

- Same as Type 670 above, except with 140° point designed for drilling tough abrasive or high tensile materials

TYPE 672 – 118° POINT WITH POSITIVE EDGE

- Die drill - positive angle cutting edge
- Same as Type 670 above, except with thinned web which permits higher feed rates with less spindle power

TYPE 673 – 140° POINT WITH POSITIVE EDGE

- Same as Type 672 above, except with 140° point designed for drilling tough abrasive or high tensile materials

METRIC TOOL DIAMETERS

TOOL DIAMETER	LENGTH				TYPE 670 NEG. 118° PT METRIC EDP NO.	TYPE 672 POS. 118° PT METRIC EDP NO.	BOTH TYPES METRIC PRICE	
	FLUTE		OVERALL					
mm	INCH	mm	INCH	mm	INCH			
5.0	.1969	38	1 1/2	89	3 1/2	670050	672050	\$23.90
5.5	.2165	45	1 3/4	95	3 3/4	670055	672055	26.60
6.0	.2362	51	2	102	4	670060	672060	26.80
6.5	.2559	51	2	102	4	670065	672065	28.35
7.0	.2756	57	2 1/4	108	4 1/4	670070	672070	28.35
7.5	.2953	57	2 1/4	108	4 1/4	670075	672075	29.60
8.0	.3150	64	2 1/2	114	4 1/2	670080	672080	32.00
8.5	.3346	70	2 3/4	121	4 3/4	670085	672085	32.00
9.0	.3543	70	2 3/4	121	4 3/4	670090	672090	34.05
9.5	.3740	76	3	127	5	670095	672095	32.30
10.0	.3937	76	3	133	5 1/4	670100	672100	39.75
10.5	.4134	76	3	133	5 1/4	670105	672105	46.10
11.0	.4331	76	3	140	5 1/2	670110	672110	64.85
11.5	.4528	76	3	140	5 1/2	670115	672115	48.55
12.0	.4724	83	3 1/4	146	5 3/4	670120	672120	59.30
12.5	.4921	89	3 1/2	152	6	670125	672125	59.30
13.0	.5118	89	3 1/2	152	6	670130	672130	68.05
13.5	.5315	89	3 1/2	152	6	670135	672135	68.05
14.0	.5512	89	3 1/2	152	6	670140	672140	70.45



HARD STEEL DIE DRILLS CARBIDE TIPPED TYPES 674 & 675 FRACTIONAL

MATERIAL SPECIFIC

SPADE TYPE 120° OR 140° POINT



TYPE 674 – 120° POINT SPADE TYPE

- Cam relieved 120° point
- Carbide tip brazed to tool steel body
- Precision ground to ensure concentricity of tip and shank body
- Drill body diameter smaller than tool diameter to prevent gauling
- Detailed specifications on page 112

TYPE 675 – 140° POINT SPADE TYPE

- Same as Type 674 above, except with cam relieved 140° point designed for drilling tough abrasive or high tensile materials

USE:

- For shallow holes, approximately 2 tool diameters deep
- Short heavy construction allows more rigidity for tough applications where longer length drills are not needed

TOOL DIAMETER		OVER-ALL LENGTH	TYPE 674 120° PT. EDP NO.	TYPE 675 140° PT. EDP NO.	BOTH TYPES PRICE
FRACTIONAL	DECIMAL				
* 3/32	.0938	2	67406	67506	\$15.15
* 7/64	.1094	2	67407	67507	15.45
* 1/8	.1250	2	67408	67508	15.45
* 9/64	.1406	2	67409	67509	16.75
* 5/32	.1562	2	67410	67510	19.25
* 11/64	.1719	3	67411	67511	20.55
* 3/16	.1875	3	67412	67512	24.35
* 13/64	.2031	3	67413	67513	27.40
7/32	.2188	3 1/2	67414	67514	27.70
19/64	.2344	3 1/2	67415	67515	28.15
1/4	.2500	4	67416	67516	28.95
17/64	.2656	4	67417	67517	29.40
9/32	.2812	4	67418	67518	30.30
19/64	.2969	4	67419	67519	30.80
5/16	.3125	4	67420	67520	31.60
21/64	.3281	4	67421	67521	33.20

*Solid carbide

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	-
	40	NON-FERROUS - SHORT CHIPS	-
	60	CAST IRONS	675
	80	LOW STRENGTH STEELS	674
	100	MEDIUM STRENGTH STEELS	674 or 675
	120	HIGH STRENGTH STEELS	675 or 893
140	HIGH TEMPERATURE ALLOYS	675 or 893	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified point and/or angle
- Shortened shank or reduced shank diameter
- Flat(s) on shank
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

TOOL DIAMETER		OVER-ALL LENGTH	TYPE 674 120° PT. EDP NO.	TYPE 675 140° PT. EDP NO.	BOTH TYPES PRICE
FRACTIONAL	DECIMAL				
11/32	.3438	4	67422	67522	\$34.30
23/64	.3594	4	67423	67523	35.40
3/8	.3750	4	67424	67524	36.55
25/64	.3906	4	67425	67525	37.45
13/32	.4062	4	67426	67526	42.50
27/64	.4219	4	67427	67527	44.10
7/16	.4375	4 1/2	67428	67528	49.45
29/64	.4531	4 1/2	67429	67529	51.55
15/32	.4688	4 1/2	67430	67530	53.85
31/64	.4844	4 1/2	67431	67531	59.15
1/2	.5000	5	67432	67532	63.95

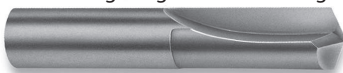


SOLID CARBIDE DIE DRILLS TYPE 893 FRACTIONAL

MATERIAL SPECIFIC

TYPE 893

- 140° point
- Two straight flutes
- Designed for drilling tough abrasive or high tensile materials



TOOL DIAMETER		LENGTH		TYPE 893 140° PT. EDP NO.	PRICE
FRACTIONAL	DECIMAL	FLUTE	OVERALL		
3/64	.0469	1/2	1 1/2	89303	\$10.90
1/16	.0625	5/8	1 3/4	89304	10.90
5/64	.0781	3/4	1 3/4	89305	11.30
3/32	.0938	3/4	1 3/4	89306	11.70
7/64	.1094	7/8	1 7/8	89307	12.30
1/8	.1250	7/8	1 7/8	89308	12.95
9/64	.1406	1	2	89309	15.20
5/32	.1562	1	2 1/8	89310	15.95
11/64	.1719	1 1/8	2 1/8	89311	19.60
3/16	.1875	1 1/8	2 1/4	89312	21.30
13/64	.2031	1 3/16	2 1/4	89313	23.50
7/32	.2188	1 1/4	2 1/2	89314	24.55

TOOL DIAMETER		LENGTH		TYPE 893 140° PT. EDP NO.	PRICE
FRACTIONAL	DECIMAL	FLUTE	OVERALL		
15/64	.2344	1 1/16	2 1/2	89315	\$28.50
1/4	.2500	1 3/8	2 1/2	89316	26.85
17/64	.2656	1 7/16	2 3/4	89317	43.95
9/32	.2812	1 1/2	2 3/4	89318	45.45
19/64	.2969	1 9/16	2 3/4	89319	47.80
5/16	.3125	1 5/8	2 3/4	89320	41.80
21/64	.3281	1 3/4	3	89321	49.75
11/32	.3438	1 3/4	3	89322	52.15
23/64	.3594	1 3/4	3	89323	57.75
3/8	.3750	1 7/8	3	89324	55.00
25/64	.3906	2	3 1/4	89325	64.70
13/32	.4062	2	3 1/4	89326	71.80
27/64	.4219	2	3 1/2	89327	73.65
7/16	.4375	2 1/16	3 1/2	89328	73.75
29/64	.4531	2 1/8	3 3/4	89329	90.55
15/32	.4688	2 1/8	3 3/4	89330	90.95
31/64	.4844	2 1/4	3 3/4	89331	91.50
1/2	.5000	2 1/4	3 3/4	89332	81.60

DRILLS



REDUCED SHANK DIAMETER DRILLS

CARBIDE TIPPED TYPES 600, 601, 640, 641, 670, 672 FRACTIONAL



1/4", 3/8", 1/2" OR 3/4" SHANK DIAMETER
STUB LENGTH, JOBBERS LENGTH, AND HARD STEEL DIE DRILLS

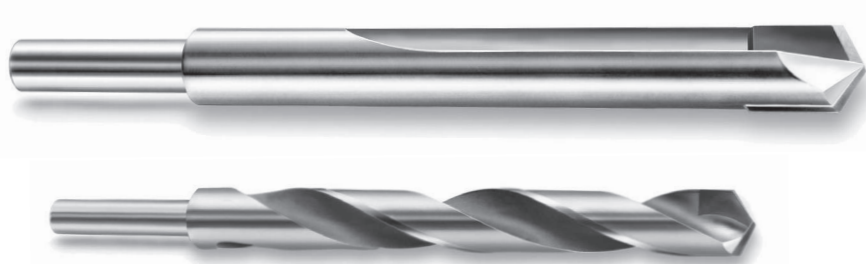
MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified point and/or angle
- Flat(s) on shank
- Coatings available:

- TITANIUM NITRIDE - TiN
- TITANIUM CARBONITRIDE - TiCN
- ZIRCONIUM NITRIDE - ZrN
- AL TITANIUM NITRIDE - AlTiN

USE:

- Can be used in drill chucks with diameter limitations



DRILLS

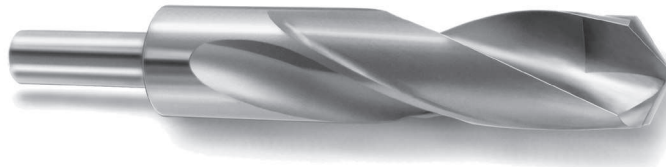
SHANK DIAM.	TOOL DIAMETER		STUB LENGTH DRILLS (reference pg. 120)						JOBBER'S LENGTH DRILLS (reference pg. 122)						HARD STEEL DIE DRILLS (reference pg. 134)			
			OVER-ALL LENGTH	TYPE 640 118° PT.		TYPE 641 135° PT.		OVER-ALL LENGTH	TYPE 600 118° PT.		TYPE 601 135° PT.		OVER-ALL LENGTH	TYPE 670 NEG. 118° PT.	TYPE 672 POS. 118° PT.	BOTH TYPES PRICE		
	FRAC.	DEC.		EDP NO.	PRICE	EDP NO.	PRICE		EDP NO.	PRICE	EDP NO.	PRICE		EDP NO.	EDP NO.			
1/4	9/32	.2812	2 1/16	640618	\$25.55	641618	\$29.65	4 1/4	600618	\$25.30	601618	\$29.30	-	-	-	-		
	5/16	.3125	2 13/16	640620	27.15	641620	31.55	4 1/2	600620	27.35	601620	31.80	4 1/2	670620	672620	\$41.40		
	11/32	.3438	3	640622	31.60	641622	36.60	4 3/4	600622	29.05	601622	33.80	4 3/4	670622	672622	44.10		
	3/8	.3750	3 1/8	640624	32.40	641624	37.60	5	600624	30.90	601624	35.95	5	670624	672624	47.40		
	13/32	.4062	3 5/16	640626	38.40	641626	44.70	5 1/4	600626	33.60	601626	39.10	5 1/4	670626	672626	55.55		
	7/16	.4375	3 7/16	640628	41.05	641628	45.55	5 1/2	600628	36.55	601628	42.45	5 1/2	670628	672628	64.40		
	15/32	.4688	3 5/8	640630	58.45	641630	67.95	5 3/4	600630	41.15	601630	47.60	5 3/4	670630	672630	70.70		
	1/2	.5000	3 3/4	640632	55.90	641632	65.05	6	600632	50.55	601632	53.30	6	670632	672632	82.95		
3/8	13/32	.4062	3 5/16	640726	38.40	641726	44.70	5 1/4	600726	33.60	601726	39.10	-	-	-	-		
	7/16	.4375	3 7/16	640728	41.05	641728	45.55	5 1/2	600728	36.55	601728	42.45	5 1/2	670728	672728	64.40		
	15/32	.4688	3 5/8	640730	58.45	641730	67.95	5 3/4	600730	41.15	601730	47.60	5 3/4	670730	672730	70.70		
	1/2	.5000	3 3/4	640732	55.90	641732	65.05	6	600732	50.55	601732	53.30	6	670732	672732	82.95		
	17/32	.5312	3 7/8	640734	69.70	641734	78.55	6 5/8	600734	65.85	601734	76.50	6	670734	672734	95.20		
	9/16	.5625	4	640736	69.70	641736	78.55	6 3/4	600736	66.45	601736	77.15	6	670736	672736	98.45		
	19/32	.5938	4 1/8	640738	79.95	641738	90.15	7 1/8	600738	71.40	601738	82.85	7	670738	672738	104.15		
	5/8	.6250	4 1/4	640740	79.95	641740	90.15	7 1/4	600740	80.90	601740	93.75	7	670740	672740	107.35		
	21/32	.6562	4 1/2	640742	96.20	641742	108.45	7 3/8	600742	82.20	601742	95.40	7 1/2	670742	672742	114.85		
	11/16	.6875	4 5/8	640744	98.65	641744	111.30	7 5/8	600744	83.80	601744	97.20	7 1/2	670744	672744	117.95		
	23/32	.7188	4 3/4	640746	111.90	641746	129.90	7 7/8	600746	98.90	601746	110.00	8	670746	672746	123.60		
	3/4	.7500	5	640748	112.15	641748	126.30	8	600748	101.00	601748	112.25	8	670748	672748	126.95		
1/2	17/32	.5312	3 7/8	640834	69.70	641834	78.55	6 5/8	600834	65.85	601834	76.50	-	-	-	-		
	9/16	.5625	4	640836	69.70	641836	78.55	6 3/4	600836	66.45	601836	77.15	6	670836	672836	98.45		
	19/32	.5938	4 1/8	640838	79.95	641838	90.15	7 1/8	600838	71.40	601838	82.85	7	670838	672838	104.15		
	5/8	.6250	4 1/4	640840	79.95	641840	90.15	7 1/4	600840	80.90	601840	93.75	7	670840	672840	107.35		
	21/32	.6562	4 1/2	640842	96.20	641842	108.45	7 3/8	600842	82.20	601842	95.40	7 1/2	670842	672842	114.85		
	11/16	.6875	4 5/8	640844	98.65	641844	111.30	7 5/8	600844	83.80	601844	97.20	7 1/2	670844	672844	117.95		
	23/32	.7188	4 3/4	640846	111.90	641846	129.90	7 7/8	600846	98.90	601846	110.00	8	670846	672846	123.60		
	3/4	.7500	5	640848	112.15	641848	126.30	8	600848	101.00	601848	112.25	8	670848	672848	126.95		
	13/16	.8125	5 1/4	640852	138.60	641852	156.45	-	-	-	-	-	8	670852	672852	227.60		
	7/8	.8750	5 1/2	640856	152.10	641856	171.45	-	-	-	-	-	8	670856	672856	232.35		
	15/16	.9375	5 3/4	640860	163.30	641860	184.20	-	-	-	-	-	8	670860	672860	258.90		
	1	1.0000	6	640864	172.50	641864	194.65	-	-	-	-	-	8	670864	672864	274.65		
3/4	13/16	.8125	5 1/4	640952	138.60	641952	156.45	-	-	-	-	-	8	670952	672952	227.60		
	7/8	.8750	5 1/2	640956	152.10	641956	171.45	-	-	-	-	-	8	670956	672956	232.35		
	15/16	.9375	5 3/4	640960	163.30	641960	184.20	-	-	-	-	-	8	670960	672960	258.90		
	1	1.0000	6	640964	172.50	641964	194.65	-	-	-	-	-	8	670964	672964	274.65		
	1 1/16	1.0625	6 1/4	640968	216.20	641968	243.75	-	-	-	-	-	-	-	-	-		
	1 1/8	1.1250	6 3/8	640972	240.05	641972	270.60	-	-	-	-	-	-	-	-	-		
	1 3/16	1.1875	6 5/8	640976	292.90	641976	328.35	-	-	-	-	-	-	-	-	-		
	1 1/4	1.2500	6 3/4	640980	292.90	641980	328.35	-	-	-	-	-	-	-	-	-		



SILVER & DEMING DRILLS CARBIDE TIPPED TYPES 616 & 618 FRACTIONAL



118° STANDARD OR 135° SPLIT POINT



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	616
	40	NON-FERROUS - SHORT CHIPS	616/618
	60	CAST IRONS	618/616
	80	LOW STRENGTH STEELS	CALL US
	100	MEDIUM STRENGTH STEELS	CALL US
	120	HIGH STRENGTH STEELS	CALL US
	140	HIGH TEMPERATURE ALLOYS	CALL US

TYPE 616 – 118° STANDARD POINT

- Shank : 1/2" diameter, 2 1/4" long
- 118° point - 6" overall length
- Heavy duty quality construction
- Detailed specifications on page 112

TYPE 618 – 135° SPLIT POINT

- Same as Type 616 above, except 135° split point designed for drilling tough abrasive or high tensile materials

USE:

- Allows larger tool diameter drilling using a 1/2" drill chuck

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified point and/or angle
- Flat(s) on shank
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

TOOL DIAMETER		LENGTH		TYPE 616 - 118° PT.		TYPE 618 - 135° PT.	
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
1/2	.5000	3 3/8	6	61632	\$42.40	61832	\$48.75
17/32	.5312	3 3/8	6	61634	62.05	61834	71.35
9/16	.5625	3 3/8	6	61636	64.30	61836	73.95
19/32	.5938	3 3/8	6	61638	66.90	61838	76.90
5/8	.6250	3 3/8	6	61640	74.30	61840	85.40
21/32	.6562	3 3/8	6	61642	80.55	61842	92.60
11/16	.6875	3 3/8	6	61644	83.70	61844	96.30
23/32	.7188	3 3/8	6	61646	86.85	61846	99.85
3/4	.7500	3 3/8	6	61648	91.00	61848	104.65
25/32	.7812	3 3/8	6	61650	100.35	61850	115.35
13/16	.8125	3 3/8	6	61652	100.55	61852	115.65
27/32	.8438	3 3/8	6	61654	100.55	61854	115.65
7/8	.8750	3 3/8	6	61656	104.60	61856	120.30

TOOL DIAMETER		LENGTH		TYPE 616 - 118° PT.		TYPE 618 - 135° PT.	
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
29/32	.9062	3 3/8	6	61658	\$107.10	61858	\$123.20
15/16	.9375	3 3/8	6	61660	108.20	61860	124.40
31/32	.9688	3 3/8	6	61662	111.90	61862	128.60
1	1.0000	3 3/8	6	61664	114.25	61864	131.40
1 1/32	1.0312	3 3/8	6	61666	110.30	61866	126.85
1 1/16	1.0625	3 3/8	6	61668	119.60	61868	137.50
1 3/32	1.0938	3 3/8	6	61670	122.45	61870	140.80
1 1/8	1.1250	3 3/8	6	61672	124.85	61872	143.55
1 5/32	1.1562	3 3/8	6	61674	151.50	61874	174.25
1 3/16	1.1875	3 3/8	6	61676	154.25	61876	177.40
1 7/32	1.2188	3 3/8	6	61678	162.00	61878	186.30
1 1/4	1.2500	3 3/8	6	61680	147.90	61880	170.10



CNC SPOTTING/CENTERING DRILLS CARBIDE TIPPED TYPES 647, 648, 649 & 677, 678, 679 FRACTIONAL



ALL TYPES:

- Tool diameter not cleared
- Accurately ground point
- Polished flutes

USE:

- For accurate centering and chamfering
- Drill wandering minimized
- Cuts only to depth of point

- Not for drilling holes
- Ideal for CNC machining



TYPE 677 – 90° POINT REGULAR LENGTH

TYPE 678 – 120° POINT REGULAR LENGTH

TYPE 679 – 140° POINT REGULAR LENGTH

TYPE 647 – 90° POINT SHORT LENGTH

TYPE 648 – 120° POINT SHORT LENGTH

TYPE 649 – 140° POINT SHORT LENGTH

TOOL DIAMETER		LENGTH		TYPE 677 90° PT. EDP NO.	TYPE 678 120° PT. EDP NO.	TYPE 679 140° PT. EDP NO.	ALL TYPES PRICE
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL				
1/4	.2500	1	4	67716	67816	67916	\$65.70
3/8	.3750	1 1/8	5	67724	67824	67924	76.70
1/2	.5000	1 1/2	6	67732	67832	67932	103.10
5/8	.6250	1 3/8	7	67740	67840	67940	149.35
3/4	.7500	1 7/8	8	67748	67848	67948	173.25
1	1.0000	2 1/4	8	67764	67864	67964	229.65

TOOL DIAMETER		LENGTH		TYPE 647 90° PT. EDP NO.	TYPE 648 120° PT. EDP NO.	TYPE 649 140° PT. EDP NO.	ALL TYPES PRICE
FRACTIONAL	DECIMAL	FLUTE	OVER-ALL				
1/4	.2500	1	2 1/2	64716	64816	64916	\$62.40
3/8	.3750	1 1/8	3 1/8	64724	64824	64924	72.85
1/2	.5000	1 1/2	3 3/4	64732	64832	64932	98.00
5/8	.6250	1 3/8	4 1/4	64740	64840	64940	141.90
3/4	.7500	1 7/8	5	64748	64848	64948	164.60
1	1.0000	2 1/4	6	64764	64864	64964	218.15



COBALT DRILLS FOR STEEL

COBALT TYPES 699 FRACTIONAL, WIRE, LETTER, & NUMBER

135° SPLIT POINT



TYPE 699 – 135° SPLIT POINT

- Manufactured from Industrial Grade NAS Cobalt Steel
- CNC machined for accuracy, improved chip evacuation and premium performance
- 135° split point improves accuracy and control - prevents drill from "walking"
- Hardened for high temperature applications

USE:

- For drilling hardened steel and steel alloys

NOTES:

Diameters .0400" to .3020" sold in packages of 12
 Diameters .3125" and larger sold in packages of 6

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	600/601
40	NON-FERROUS - SHORT CHIPS	600/601	
60	CAST IRONS	600/601	
80	LOW STRENGTH STEELS	699	
100	MEDIUM STRENGTH STEELS	699	
120	HIGH STRENGTH STEELS	699	
140	HIGH TEMPERATURE ALLOYS	699	

MODIFICATIONS (Prompt delivery)

- Coatings available:

TITANIUM NITRIDE - TiN
TITANIUM CARBONITRIDE - TiCN
ZIRCONIUM NITRIDE - ZrN
AL TITANIUM NITRIDE - AlTiN

TOOL DIAMETER		LENGTH		135° POINT		
FRAC.	DEC.	WIRE LETTER	FLT.	OAL	TYPE 699 EDP NO.	PRICE EACH
	.0400	60	1 1/16	1 3/8	6990400	\$1.95
	.0410	59	1 1/16	1 5/8	6990410	1.95
	.0420	58	1 1/16	1 7/8	6990420	1.95
	.0430	57	3/4	1 3/4	6990430	1.95
	.0465	56	3/4	1 3/4	6990465	1.95
	.0520	55	7/8	1 7/8	6990520	1.70
	.0550	54	7/8	1 7/8	6990550	1.70
	.0595	53	7/8	1 7/8	6990595	1.70
1/16	.0625		7/8	1 7/8	69904	1.55
	.0635	52	7/8	1 7/8	6990635	1.55
	.0670	51	1	2	6990670	1.55
	.0700	50	1	2	6990700	1.55
5/64	.0730	49	1	2	6990730	1.55
	.0760	48	1	2	6990760	1.55
	.0781		1	2	69905	1.55
	.0785	47	1	2	6990785	1.55
	.0810	46	1 1/8	2 1/8	6990810	1.55
	.0820	45	1 1/8	2 1/8	6990820	1.55
	.0860	44	1 1/8	2 1/8	6990860	1.55
	.0890	43	1 1/4	2 1/4	6990890	1.55
3/32	.0935	42	1 1/4	2 1/4	6990935	1.55
	.0938		1 1/4	2 1/4	69906	1.55
	.0960	41	1 3/8	2 3/8	6990960	1.55
	.0980	40	1 3/8	2 3/8	6990980	1.60
	.0995	39	1 3/8	2 3/8	6990995	1.60
	.1015	38	1 7/16	2 1/2	6991015	1.60
	.1040	37	1 7/16	2 1/2	6991040	1.70
	.1065	36	1 7/16	2 1/2	6991065	1.70
7/64	.1094		1 1/2	2 5/8	69907	1.65
	.1100	35	1 1/2	2 5/8	6991100	1.70
	.1110	34	1 1/2	2 5/8	6991110	1.70
	.1130	33	1 1/2	2 5/8	6991130	1.70
1/8	.1160	32	1 5/8	2 3/4	6991160	1.80
	.1200	31	1 5/8	2 3/4	6991200	1.80
	.1250		1 5/8	2 3/4	69908	2.00
	.1285	30	1 5/8	2 3/4	6991285	1.85
	.1360	29	1 3/4	2 7/8	6991360	1.95
	.1405	28	1 3/4	2 7/8	6991405	2.00

TOOL DIAMETER		LENGTH		135° POINT		
FRAC.	DEC.	WIRE LETTER	FLT.	OAL	TYPE 699 EDP NO.	PRICE EACH
9/64	.1406		1 3/4	2 7/8	69909	\$2.00
	.1440	27	1 7/8	3	6991440	2.15
	.1470	26	1 7/8	3	6991470	2.15
	.1495	25	1 7/8	3	6991495	2.15
5/32	.1520	24	2	3 1/8	6991520	2.40
	.1540	23	2	3 1/8	6991540	2.40
	.1562		2	3 1/8	69910	2.25
	.1570	22	2	3 1/8	6991570	2.40
	.1590	21	2 1/8	3 1/4	6991590	2.40
	.1610	20	2 1/8	3 1/4	6991610	2.40
	.1660	19	2 1/8	3 1/4	6991660	2.40
	.1695	18	2 1/8	3 1/4	6991695	2.45
11/64	.1719		2 1/8	3 1/4	69911	2.35
	.1730	17	2 3/8	3 3/8	6991730	2.70
	.1770	16	2 3/8	3 3/8	6991770	2.75
	.1800	15	2 3/8	3 3/8	6991800	2.95
3/16	.1820	14	2 3/8	3 3/8	6991820	2.95
	.1850	13	2 5/8	3 1/2	6991850	2.95
	.1875		2 5/8	3 1/2	69912	2.65
	.1890	12	2 5/8	3 1/2	6991890	3.10
	.1910	11	2 5/8	3 1/2	6991910	3.10
	.1935	10	2 7/8	3 5/8	6991935	3.10
	.1960	9	2 7/8	3 5/8	6991960	3.10
	.1990	8	2 7/8	3 5/8	6991990	3.10
13/64	.2010	7	2 7/8	3 5/8	6992010	3.10
	.2031		2 7/8	3 5/8	69913	3.20
	.2040	6	2 1/2	3 3/4	6992040	4.00
	.2055	5	2 1/2	3 3/4	6992055	4.00
7/32	.2090	4	2 1/2	3 3/4	6992090	4.00
	.2130	3	2 1/2	3 3/4	6992130	4.00
	.2188		2 1/2	3 3/4	69914	3.50
	.2210	2	2 5/8	3 7/8	6992210	4.25
15/64	.2280	1	2 5/8	3 7/8	6992280	4.25
	.2340	A	2 5/8	3 7/8	6992340	4.90
	.2344		2 5/8	3 7/8	69915	3.70
	.2380	B	2 3/4	4	6992380	5.65
	.2420	C	2 3/4	4	6992420	5.65
	.2460	D	2 3/4	4	6992460	5.70

TOOL DIAMETER		LENGTH		135° POINT		
FRAC.	DEC.	WIRE LETTER	FLT.	OAL	TYPE 699 EDP NO.	PRICE EACH
1/4	.2500	E	2 3/4	4	69916	\$3.95
	.2570	F	2 7/8	4 1/8	6992570	5.95
	.2610	G	2 7/8	4 1/8	6992610	6.15
17/64	.2656		2 7/8	4 1/8	69917	4.50
	.2660	H	2 7/8	4 1/8	6992660	6.35
	.2720	I	2 7/8	4 1/8	6992720	6.40
	.2770	J	2 7/8	4 1/8	6992770	6.55
	.2810	K	2 15/16	4 1/4	6992810	6.70
9/32	.2812		2 15/16	4 1/4	69918	4.70
	.2900	L	2 15/16	4 1/4	6992900	7.20
	.2950	M	3 1/16	4 3/8	6992950	7.65
19/64	.2969		3 1/16	4 3/8	69919	5.75
5/16	.3020	N	3 1/8	4 3/8	6993020	7.65
	.3125		3 1/8	4 1/2	69920	6.10
	.3160	O	3 1/8	4 1/2	6993160	8.45
	.3230	P	3 5/16	4 5/8	6993230	9.00
21/64	.3281		3 5/16	4 5/8	69921	6.75
	.3320	Q	3 7/16	4 3/4	6993320	9.30
	.3390	R	3 7/16	4 3/4	6993390	9.30
11/32	.3438		3 7/16	4 3/4	69922	7.40
23/64	.3480	S	3 1/2	4 7/8	6993480	11.40
	.3594		3 1/2	4 7/8	69923	8.15
	.3580	T	3 1/2	4 7/8	6993580	11.40
	.3680	U	3 5/8	5	6993680	11.40
3/8	.3750		3 5/8	5	69924	8.45
	.3770	V	3 5/8	5	6993770	12.55
	.3860	W	3 3/4	5 1/8	6993860	12.55
25/64	.3960		3 3/4	5 1/8	69925	9.70
13/32	.3970	X	3 3/4	5 1/8	6993970	12.55
	.4040	Y	3 7/8	5 1/4	6994040	13.30
	.4062		3 7/8	5 1/4	69926	10.10
	.4130	Z	3 7/8	5 1/4	6994130	14.50
27/64	.4210		3 15/16	5 3/8	69927	11.15
	.4375		4 1/16	5 1/2	69928	11.40
29/64	.4531		4 3/16	5 5/8	69929	13.70
	.4688		4 5/16	5 3/4	69930	13.95
31/64	.4844		4 3/8	5 7/8	69931	14.40
	.5000		4 1/2	6	69932	14.50



FULL CENTERS & HALF CENTERS CARBIDE TIPPED TYPES 592, 593, 594, 595, 596, 597

MORSE - BROWN & SHARPE - JARNO TAPERS



FULL CENTERS:

- TYPE 595 - MORSE TAPER
- TYPE 596 - BROWN & SHARPE TAPER
- TYPE 597 - JARNO TAPER

- Carbide tip brazed to hardened alloy steel body
- Center precision ground to 60° included angle
- Center tip concentric to precision ground taper

USE (ALL TYPES):

- Carbide tipped center holds point angle and overall concentricity so parts can be held securely and accurately for precision turning and grinding
- When operating at high speed, carbide tipped center will not wear as rapidly, avoiding burning or scoring of workpiece's center hole

HALF CENTERS:

- TYPE 592 - MORSE TAPER
- TYPE 593 - BROWN & SHARPE TAPER
- TYPE 594 - JARNO TAPER

- Same construction as full centers
- Half center provides clearance for the grinding wheel or turning tool when machining a small diameter near the end of the part

MORSE TAPER SHANK	OVERALL LENGTH	TYPE 595 - FULL CENTER - MORSE TAPER				TYPE 592 - HALF CENTER - MORSE TAPER					
		CARBIDE		EDP NO.	PRICE	CARBIDE		UNDERCUT LENGTH	HEIGHT ABOVE CENTER	EDP NO.	PRICE
		LENGTH	DIAMETER			LENGTH	DIAMETER				
1	3 5/16	7/16	1/4	59501	\$31.45	7/16	1/4	1	9/64	59201	\$57.95
2	4 3/16	9/16	3/16	59502	37.45	9/16	3/16	1 3/8	1 1/64	59202	71.80
3	5 1/4	7/8	1/2	59503	68.70	1 1/16	3/8	1 1 1/16	1 3/64	59203	108.45
4	6 3/4	7/8	1/2	59504	104.40	7/8	1/2	2 1/4	1 1/64	59204	158.60
5	8 1/2	1 1/16	5/8	59505	170.80	1 1/16	5/8	2 3/4	2 1/64	59205	265.05

BROWN & SHARPE TAPER SHANK	OVERALL LENGTH	TYPE 596 - FULL CENTER - B & S TAPER				TYPE 593 - HALF CENTER - B & S TAPER					
		CARBIDE		EDP NO.	PRICE	CARBIDE		UNDERCUT LENGTH	HEIGHT ABOVE CENTER	EDP NO.	PRICE
		LENGTH	DIAMETER			LENGTH	DIAMETER				
7	4 1/2	9/16	5/16	59607	\$48.00	9/16	5/16	1 1/8	1 1/64	59307	\$81.35
8	5 1 1/32	1 1/16	3/8	59608	67.40	9/16	5/16	1 5/16	1 1/64	59308	106.85
9	6	7/8	1/2	59609	85.45	1 1/16	3/8	1 1/2	1 3/64	59309	127.20
10	8 1 1/32	7/8	1/2	59610	122.15	7/8	1/2	2 1/4	1 1/64	59310	178.20
11	10 1/8	1 1/16	5/8	59611	162.25	1 1/16	5/8	2 1/2	3/8	59311	244.80

JARNO TAPER SHANK	OVERALL LENGTH	TYPE 597 - FULL CENTER - JARNO TAPER				TYPE 594 - HALF CENTER - JARNO TAPER					
		CARBIDE		EDP NO.	PRICE	CARBIDE		UNDERCUT LENGTH	HEIGHT ABOVE CENTER	EDP NO.	PRICE
		LENGTH	DIAMETER			LENGTH	DIAMETER				
4	3	7/16	1/4	59704	\$34.40	7/16	1/4	2 5/32	9/64	59404	\$63.25
5	3 3/8	7/16	1/4	59705	38.00	7/16	1/4	1 5/16	9/64	59405	70.00
6	4 1/2	9/16	5/16	59706	46.95	9/16	5/16	1 1/8	1 1/64	59406	78.00
7	5 1/4	1 1/16	3/8	59707	60.80	1 1/16	3/8	1 3/16	1 3/64	59407	102.25
8	6	7/8	1/2	59708	78.65	7/8	1/2	1 3/8	1 1/64	59408	126.30
9	6 3/4	7/8	1/2	59709	85.35	7/8	1/2	1 5/8	1 1/64	59409	142.30
10	7 1/2	7/8	1/2	59710	108.45	7/8	1/2	2	1 1/64	59410	168.50
11	8 1/4	7/8	1/2	59711	122.05	7/8	1/2	2	1 1/64	59411	186.50
12	9	1 1/16	5/8	59712	135.00	1 1/16	5/8	2 1/4	2 1/64	59412	210.10



CORE DRILLS CARBIDE TIPPED TYPES 620 & 622 FRACTIONAL



FOUR RIGHT SPIRAL FLUTES STRAIGHT OR TAPER SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	620 or 622
40	NON-FERROUS - SHORT CHIPS	620 or 622	
60	CAST IRONS	620 or 622	
80	LOW STRENGTH STEELS	621 ^{MS} or 623 ^{MS}	
100	MEDIUM STRENGTH STEELS	621 ^{MS} or 623 ^{MS}	
120	HIGH STRENGTH STEELS	621 ^{MS} or 623 ^{MS}	
140	HIGH TEMPERATURE ALLOYS	620 or 622	

^{MS}Types 621 & 623 on page 142

MODIFICATIONS (See list on page 141)

TYPE 620 – STRAIGHT SHANK

- Four large right spiral polished flutes permit higher feeds and speeds
- Carbide tips brazed to hardened tool steel body
- 118° included chamfer angle
- Rigid design provides maximum support for the carbide tips
- Tool diameter tolerance: plus .000", minus .001"

TYPE 622 – TAPER SHANK

- Same as Type 620 above, except with taper shank

USE:

- Designed for economically enlarging cored, punched, drilled, or preformed holes - can remove up to 30% of the tool diameter
- The balanced cutting action of the core drill removes considerably more material than a reamer, often eliminating the need for a final reaming or boring operation

TOOL DIAMETER		DIMENSIONS				TYPE 620		TYPE 622		BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL	MIN. CUT DIAM.	LENGTH			SHANK DIAM.	EDP NO.	TAPER SHANK NO.	EDP NO.		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
			CARBIDE	FLT	OVER-ALL						1	2	3	4	5-7	8-14**	
* 3/8	.3750	.262	5/8	3 1/2	6 3/4	3/8	62012	1	62212	\$84.20	0.3471 - 0.3780	\$114.95	\$99.50	\$94.40	\$91.95	\$89.25	\$87.25
* 13/32	.4062	.284	5/8	3 5/8	7	13/32	62013	1	62213	84.20	0.3781 - 0.4090	114.95	99.50	94.40	91.95	89.25	87.25
* 7/16	.4375	.306	3/4	3 7/8	7 1/4	7/16	62014	1	62214	84.20	0.4091 - 0.4410	114.95	99.50	94.40	91.95	89.25	87.25
* 15/32	.4688	.328	3/4	4 1/8	7 1/2	15/32	62015	1	62215	84.20	0.4411 - 0.4720	114.95	99.50	94.40	91.95	89.25	87.25
1/2	.5000	.350	3/4	4 3/8	8 1/4	1/2	62016	2	62216	84.20	0.4721 - 0.5030	114.95	99.50	94.40	91.95	89.25	87.25
17/32	.5312	.372	3/4	4 3/8	8 1/4	17/32	62017	2	62217	84.55	0.5031 - 0.5340	115.40	99.95	94.70	92.30	89.65	87.55
9/16	.5625	.394	3/4	4 3/8	8 1/4	9/16	62018	2	62218	84.55	0.5341 - 0.5660	115.40	99.95	94.70	92.30	89.65	87.55
19/32	.5938	.416	3/4	4 3/8	8 1/4	19/32	62019	2	62219	88.75	0.5661 - 0.5970	119.55	104.10	99.00	96.50	93.90	91.85
5/8	.6250	.438	3/4	4 3/8	8 1/4	5/8	62020	2	62220	88.75	0.5971 - 0.6280	119.55	104.10	99.00	96.50	93.90	91.85
21/32	.6562	.459	3/4	4 3/8	8 1/4	21/32	62021	2	62221	89.80	0.6281 - 0.6590	120.60	105.20	100.05	97.55	95.00	92.90
11/16	.6875	.481	7/8	4 3/8	8 1/4	11/16	62022	2	62222	90.60	0.6591 - 0.6910	121.40	106.00	100.80	98.35	95.75	93.60
23/32	.7188	.503	7/8	4 3/8	8 1/4	23/32	62023	2	62223	90.60	0.6911 - 0.7220	121.40	106.00	100.80	98.35	95.75	93.60
3/4	.7500	.525	7/8	4 3/8	8 1/4	3/4	62024	2	62224	90.60	0.7221 - 0.7530	121.40	106.00	100.80	98.35	95.75	93.60
25/32	.7812	.547	7/8	4 3/8	8 1/4	25/32	62025	2	62225	92.60	0.7531 - 0.7840	123.40	107.95	102.85	100.40	97.75	95.65
13/16	.8125	.569	7/8	4 7/8	9 1/2	13/16	62026	3	62226	95.20	0.7841 - 0.8160	126.00	110.55	105.40	102.95	100.25	98.25
27/32	.8438	.591	7/8	4 7/8	9 1/2	27/32	62027	3	62227	100.25	0.8161 - 0.8470	131.10	115.65	110.50	108.00	105.40	103.30
7/8	.8750	.612	7/8	4 7/8	9 1/2	7/8	62028	3	62228	100.25	0.8471 - 0.8780	131.10	115.65	110.50	108.00	105.40	103.30
29/32	.9062	.634	7/8	4 7/8	9 1/2	29/32	62029	3	62229	100.90	0.8781 - 0.9090	131.70	116.30	111.10	108.70	106.05	103.95
15/16	.9375	.656	7/8	4 7/8	9 1/2	15/16	62030	3	62230	100.90	0.9091 - 0.9410	131.70	116.30	111.10	108.70	106.05	103.95
31/32	.9688	.678	7/8	4 7/8	9 1/2	31/32	62031	3	62231	104.65	0.9411 - 0.9720	135.40	119.95	114.85	112.40	109.70	107.70
1	1.0000	.700	7/8	4 7/8	9 1/2	1	62032	3	62232	106.60	0.9721 - 1.0030	137.40	122.00	116.75	114.35	111.70	109.60
1 1/32	1.0312	.722	7/8	4 7/8	9 1/2	1 1/32	62033	3	62233	107.50	1.0031 - 1.0340	138.25	122.80	117.70	115.20	112.60	110.50
1 1/16	1.0625	.744	7/8	4 7/8	9 1/2	1 1/16	62034	3	62234	108.95	1.0341 - 1.0660	139.80	124.35	119.20	116.70	114.05	112.00
1 1/32	1.0938	.766	1	4 7/8	10 1/2	1 1/32	62035	4	62235	126.95	1.0661 - 1.0970	157.70	142.30	137.10	134.70	132.05	129.95
1 1/8	1.1250	.787	1	4 7/8	10 1/2	1 1/8	62036	4	62236	126.95	1.0971 - 1.1280	157.70	142.30	137.10	134.70	132.05	129.95
1 5/32	1.1562	.809	1	4 7/8	10 1/2	1 5/32	62037	4	62237	138.60	1.1281 - 1.1590	169.35	153.95	148.80	146.35	143.70	141.60
1 3/16	1.1875	.831	1	4 7/8	10 1/2	1 3/16	62038	4	62238	142.60	1.1591 - 1.1905	173.35	158.00	152.80	150.35	147.75	145.65
1 7/32	1.2188	.853	1	4 7/8	10 1/2	1 7/32	62039	4	62239	143.10	1.1906 - 1.2220	173.90	158.45	153.35	150.85	148.20	146.15
1 1/4	1.2500	.875	1	4 7/8	10 1/2	1 1/4	62040	4	62240	143.70	1.2221 - 1.2530	174.50	159.05	153.90	151.40	148.80	146.70
1 9/32	1.2812	.897	1	4 7/8	10 1/2	1 9/32	62041	4	62241	153.95	1.2531 - 1.2840	184.75	169.30	164.20	161.65	159.05	156.95
1 5/16	1.3125	.919	1	4 7/8	10 1/2	1 5/16	62042	4	62242	158.25	1.2841 - 1.3150	189.05	173.65	168.40	166.00	163.35	161.25
1 11/32	1.3438	.940	1	4 7/8	10 1/2	1 11/32	62043	4	62243	161.55	1.3151 - 1.3470	192.35	176.95	171.75	169.30	166.70	164.55
1 3/8	1.3750	.962	1	4 7/8	10 1/2	1 3/8	62044	4	62244	165.45	1.3471 - 1.3780	196.25	180.85	175.65	173.20	170.60	168.45
1 13/32	1.4062	.984	1	4 7/8	10 1/2	1 13/32	62045	4	62245	169.25	1.3781 - 1.4090	200.05	184.65	179.45	177.00	174.35	172.25
1 7/16	1.4375	1.006	1	4 7/8	10 1/2	1 7/16	62046	4	62246	174.20	1.4091 - 1.4410	205.00	189.60	184.40	181.95	179.35	177.20
1 15/32	1.4688	1.025	1	4 7/8	10 1/2	1 15/32	62047	4	62247	179.40	1.4411 - 1.4720	210.15	194.70	189.60	187.15	184.45	182.45
1 1/2	1.5000	1.050	1	4 7/8	10 1/2	1 1/2	62048	4	62248	183.25	1.4721 - 1.5030	214.00	198.55	193.45	191.00	188.30	186.30

*3 flutes

**Quantities of 15 or more - price of fractional size in same size range.



CORE DRILLS CARBIDE TIPPED TYPES 620 & 622 METRIC



FOUR RIGHT SPIRAL FLUTES STRAIGHT OR TAPER SHANK



MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced on pg. 140
- Modified metric tool diameter - priced below
- Closer tool diameter tolerance
- End chamfer other than 118° included angle
- End cutting or corner radius
- Shortened shank or reduced shank diameter (for Type 620)
- Flat(s) or tang on shank (for Type 620)
- Shank whistle notch for set screw (for Type 622)
- Smaller taper shank (for Type 622)
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

NOTE: Tool diameter in millimeters (mm); all other dimensions in inches.

TOOL DIAMETER		DIMENSIONS				TYPE 620		TYPE 622		BOTH TYPES METRIC PRICE	FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH	MIN. CUT DIAM.	CARBIDE	LENGTH FLT	OVER-ALL	SHANK DIAM.	METRIC EDP NO.	TAPER SHANK NO.	METRIC EDP NO.		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
											1	2	3	4	5-7	8-14	OVER 14	
* 9.0	.3543	.262	5/8	3 1/2	6 3/4	3/8	620090	1	622090	\$94.40	8.815 - 9.601	\$117.55	\$102.20	\$97.00	\$94.50	\$91.95	\$89.75	\$86.80
*10.0	.3937	.284	5/8	3 5/8	7	13/32	620100	1	622100	94.40	9.602 - 10.389	117.55	102.20	97.00	94.50	91.95	89.75	86.80
*11.0	.4331	.306	3/4	3 7/8	7 1/4	7/16	620110	1	622110	94.40	10.390 - 11.201	117.55	102.20	97.00	94.50	91.95	89.75	86.80
*	-	.328	3/4	4 1/8	7 1/2	15/32	620119	1	622119	-	11.202 - 11.989	117.55	102.20	97.00	94.50	91.95	89.75	86.80
12.0	.4724	.350	3/4	4 3/8	8 1/4	1/2	620120	2	622120	94.40	11.990 - 12.776	117.55	102.20	97.00	94.50	91.95	89.75	86.80
13.0	.5118	.372	3/4	4 3/8	8 1/4	17/32	620130	2	622130	94.70	12.777 - 13.564	117.90	102.60	97.40	94.95	92.30	90.20	87.25
14.0	.5512	.394	3/4	4 3/8	8 1/4	9/16	620140	2	622140	94.70	13.565 - 14.376	117.90	102.60	97.40	94.95	92.30	90.20	87.25
15.0	.5906	.416	3/4	4 3/8	8 1/4	19/32	620150	2	622150	99.00	14.377 - 15.164	122.15	106.80	101.65	99.10	96.50	94.40	91.40
-	-	.438	3/4	4 3/8	8 1/4	5/8	620159	2	622159	-	15.165 - 15.951	122.15	106.80	101.65	99.10	96.50	94.40	91.40
16.0	.6299	.459	3/4	4 3/8	8 1/4	21/32	620160	2	622160	100.05	15.952 - 16.739	123.25	107.85	102.70	100.15	97.55	95.40	92.50
17.0	.6693	.481	7/8	4 3/8	8 1/4	11/16	620170	2	622170	100.80	16.740 - 17.551	124.00	108.60	103.40	100.90	98.35	96.20	93.20
18.0	.7087	.503	7/8	4 3/8	8 1/4	23/32	620180	2	622180	100.80	17.552 - 18.339	124.00	108.60	103.40	100.90	98.35	96.20	93.20
19.0	.7480	.525	7/8	4 3/8	8 1/4	3/4	620190	2	622190	100.80	18.340 - 19.126	124.00	108.60	103.40	100.90	98.35	96.20	93.20
-	-	.547	7/8	4 3/8	8 1/4	25/32	620199	2	622199	-	19.127 - 19.914	126.00	110.65	105.50	102.95	100.40	98.25	95.25
20.0	.7874	.569	7/8	4 7/8	9 1/2	13/16	620200	3	622200	105.40	19.915 - 20.726	128.55	113.25	108.00	105.55	102.95	100.80	97.85
21.0	.8268	.591	7/8	4 7/8	9 1/2	27/32	620210	3	622210	110.50	20.727 - 21.514	133.70	118.30	113.15	110.65	108.00	105.95	102.95
22.0	.8661	.612	7/8	4 7/8	9 1/2	7/8	620220	3	622220	110.50	21.515 - 22.301	133.70	118.30	113.15	110.65	108.00	105.95	102.95
23.0	.9055	.634	7/8	4 7/8	9 1/2	29/32	620230	3	622230	111.10	22.302 - 23.089	134.30	118.90	113.80	111.20	108.70	106.55	103.60
-	-	.656	7/8	4 7/8	9 1/2	15/16	620239	3	622239	-	23.090 - 23.901	134.30	118.90	113.80	111.20	108.70	106.55	103.60
24.0	.9449	.678	7/8	4 7/8	9 1/2	31/32	620240	3	622240	114.85	23.902 - 24.689	138.00	122.65	117.50	114.95	112.40	110.20	107.25
25.0	.9843	.700	7/8	4 7/8	9 1/2	1	620250	3	622250	116.75	24.690 - 25.476	140.00	124.60	119.45	116.95	114.35	112.20	109.25
26.0	1.0236	.722	7/8	4 7/8	9 1/2	1 1/32	620260	3	622260	117.70	25.477 - 26.264	140.85	125.45	120.35	117.80	115.20	113.10	110.10
27.0	1.0630	.744	7/8	4 7/8	9 1/2	1 1/16	620270	3	622270	119.20	26.265 - 27.076	142.40	127.00	121.80	119.35	116.70	114.60	111.65
-	-	.766	1	4 7/8	10 1/2	1 3/32	620279	4	622279	-	27.077 - 27.864	160.30	144.90	139.80	137.20	134.70	132.50	129.60
28.0	1.1024	.787	1	4 7/8	10 1/2	1 1/8	620280	4	622280	137.10	27.865 - 28.651	160.30	144.90	139.80	137.20	134.70	132.50	129.60
29.0	1.1417	.809	1	4 7/8	10 1/2	1 5/32	620290	4	622290	148.80	28.652 - 29.439	171.95	156.60	151.40	148.90	146.35	144.15	141.20
30.0	1.1811	.831	1	4 7/8	10 1/2	1 3/16	620300	4	622300	152.80	29.440 - 30.239	176.00	160.60	155.50	152.90	150.35	148.20	145.30
31.0	1.2205	.853	1	4 7/8	10 1/2	1 7/32	620310	4	622310	153.35	30.240 - 31.039	176.50	161.15	156.00	153.45	150.85	148.70	145.75
-	-	.875	1	4 7/8	10 1/2	1 1/4	620319	4	622319	-	31.040 - 31.826	177.05	161.65	156.55	154.05	151.40	149.30	146.35
32.0	1.2598	.897	1	4 7/8	10 1/2	1 9/32	620320	4	622320	164.20	31.827 - 32.614	187.35	171.95	166.80	164.30	161.65	159.55	156.60
33.0	1.2992	.919	1	4 7/8	10 1/2	1 5/16	620330	4	622330	168.40	32.615 - 33.401	191.55	176.20	171.05	168.50	166.00	163.85	160.90
34.0	1.3386	.940	1	4 7/8	10 1/2	1 11/32	620340	4	622340	171.75	33.402 - 34.214	195.00	179.60	174.45	171.90	169.30	167.15	164.25
35.0	1.3780	.962	1	4 7/8	10 1/2	1 3/8	620350	4	622350	175.65	34.215 - 35.001	198.90	183.50	178.35	175.80	173.20	171.05	168.15
-	-	.984	1	4 7/8	10 1/2	1 13/32	620359	4	622359	-	35.002 - 35.789	202.60	187.30	182.05	179.60	177.00	174.85	171.90
36.0	1.4173	1.006	1	4 7/8	10 1/2	1 7/16	620360	4	622360	184.40	35.790 - 36.601	207.60	192.20	187.10	184.50	181.95	179.80	176.90
37.0	1.4567	1.025	1	4 7/8	10 1/2	1 15/32	620370	4	622370	189.60	36.602 - 37.389	212.75	197.40	192.20	189.70	187.15	184.95	182.00
38.0	1.4961	1.050	1	4 7/8	10 1/2	1 1/2	620380	4	622380	193.45	37.390 - 38.176	216.60	201.25	196.10	193.55	191.00	188.80	185.85

*3 flutes



CORE DRILLS - FOR STEELS CARBIDE TIPPED TYPES 621 & 623 FRACTIONAL



FOUR RIGHT SPIRAL FLUTES STRAIGHT OR TAPER SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	620* or 622*
40	NON-FERROUS - SHORT CHIPS	620* or 622*	
60	CAST IRONS	620* or 622*	
80	LOW STRENGTH STEELS	621 or 623	
100	MEDIUM STRENGTH STEELS	621 or 623	
120	HIGH STRENGTH STEELS	621 or 623	
140	HIGH TEMPERATURE ALLOYS	620* or 622*	

*Types 620 & 622 on page 140

TYPE 621 - STRAIGHT SHANK FOR MACHINING STEELS

- Special carbide grade & tool geometry permit the heavy chip loads and speeds required for machining steel
- **Not** to be used for machining non-ferrous materials, cast irons, or high temp alloys
- Four large right spiral polished flutes permit higher feeds and speeds
- Carbide tips brazed to hardened tool steel body
- 118° included chamfer angle
- Rigid design provides maximum support for the carbide tips
- Tool diameter tolerance: plus .000", minus .001"

TYPE 623 - TAPER SHANK FOR MACHINING STEELS

- Same as Type 621 above, except with taper shank

MODIFICATIONS (See list on page 143)

USE:

- Designed for economically enlarging cored, punched, drilled, or preformed holes - can remove up to 30% of the tool diameter
- The balanced cutting action of the core drill removes considerably more material than a reamer, often eliminating the need for a final reaming or boring operation

TOOL DIAMETER		DIMENSIONS				TYPE 621		TYPE 623		BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
FRAC.	DEC.	MIN. CUT DIAM.	LENGTH			SHANK DIAM.	STEEL EDP NO.	TAPER SHANK NO.	STEEL EDP NO.		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
			CAR-BIDE	FLT	OVER-ALL					1		2	3	4	5-7	8-14**	
* 3/8	.3750	.262	5/8	3 1/2	6 3/4	3/8	62112	1	62312	\$92.70	0.3471 - 0.3780	\$123.50	\$108.00	\$102.90	\$100.45	\$97.80	\$95.75
* 13/32	.4062	.284	5/8	3 5/8	7	13/32	62113	1	62313	92.70	0.3781 - 0.4090	123.50	108.00	102.90	100.45	97.80	95.75
* 7/16	.4375	.306	3/4	3 7/8	7 1/4	7/16	62114	1	62314	92.70	0.4091 - 0.4410	123.50	108.00	102.90	100.45	97.80	95.75
* 15/32	.4688	.328	3/4	4 1/8	7 1/2	15/32	62115	1	62315	92.70	0.4411 - 0.4720	123.50	108.00	102.90	100.45	97.80	95.75
1/2	.5000	.350	3/4	4 3/8	8 1/4	1/2	62116	2	62316	92.70	0.4721 - 0.5030	123.50	108.00	102.90	100.45	97.80	95.75
17/32	.5312	.372	3/4	4 3/8	8 1/4	17/32	62117	2	62317	93.00	0.5031 - 0.5340	123.75	108.40	103.20	100.75	98.10	96.05
9/16	.5625	.394	3/4	4 3/8	8 1/4	9/16	62118	2	62318	93.00	0.5341 - 0.5660	123.75	108.40	103.20	100.75	98.10	96.05
19/32	.5938	.416	3/4	4 3/8	8 1/4	19/32	62119	2	62319	97.75	0.5661 - 0.5970	128.50	113.10	107.90	105.50	102.85	100.75
5/8	.6250	.438	3/4	4 3/8	8 1/4	5/8	62120	2	62320	97.75	0.5971 - 0.6280	128.50	113.10	107.90	105.50	102.85	100.75
21/32	.6562	.459	3/4	4 3/8	8 1/4	21/32	62121	2	62321	98.85	0.6281 - 0.6590	129.60	114.10	108.95	106.55	103.90	101.80
11/16	.6875	.481	7/8	4 3/8	8 1/4	11/16	62122	2	62322	99.70	0.6591 - 0.6910	130.45	115.00	109.90	107.40	104.80	102.70
23/32	.7188	.503	7/8	4 3/8	8 1/4	23/32	62123	2	62323	99.70	0.6911 - 0.7220	130.45	115.00	109.90	107.40	104.80	102.70
3/4	.7500	.525	7/8	4 3/8	8 1/4	3/4	62124	2	62324	99.70	0.7221 - 0.7530	130.45	115.00	109.90	107.40	104.80	102.70
25/32	.7812	.547	7/8	4 3/8	8 1/4	25/32	62125	2	62325	101.80	0.7531 - 0.7840	132.55	117.20	112.00	109.55	106.90	104.85
13/16	.8125	.569	7/8	4 7/8	9 1/2	13/16	62126	3	62326	104.70	0.7841 - 0.8160	135.45	120.10	114.90	112.50	109.85	107.75
27/32	.8438	.591	7/8	4 7/8	9 1/2	27/32	62127	3	62327	110.35	0.8161 - 0.8470	141.10	125.70	120.50	118.05	115.45	113.35
7/8	.8750	.612	7/8	4 7/8	9 1/2	7/8	62128	3	62328	110.35	0.8471 - 0.8780	141.10	125.70	120.50	118.05	115.45	113.35
29/32	.9062	.634	7/8	4 7/8	9 1/2	29/32	62129	3	62329	111.00	0.8781 - 0.9090	141.80	126.40	121.20	118.75	116.15	114.00
15/16	.9375	.656	7/8	4 7/8	9 1/2	15/16	62130	3	62330	111.00	0.9091 - 0.9410	141.80	126.40	121.20	118.75	116.15	114.00
31/32	.9688	.678	7/8	4 7/8	9 1/2	31/32	62131	3	62331	115.05	0.9411 - 0.9720	145.85	130.45	125.30	122.80	120.25	118.15
1	1.0000	.700	7/8	4 7/8	9 1/2	1	62132	3	62332	117.30	0.9721 - 1.0030	148.05	132.70	127.50	125.05	122.45	120.35
1 1/32	1.0312	.722	7/8	4 7/8	9 1/2	1 1/32	62133	3	62333	118.20	1.0031 - 1.0340	148.95	133.55	128.35	125.95	123.30	121.20
1 1/16	1.0625	.744	7/8	4 7/8	9 1/2	1 1/16	62134	3	62334	119.80	1.0341 - 1.0660	150.60	135.20	130.00	127.55	124.95	122.80
1 1/8	1.0938	.766	1	4 7/8	10 1/2	1 1/8	62135	4	62335	139.60	1.0661 - 1.0970	170.35	154.95	149.75	147.35	144.70	142.60
1 1/8	1.1250	.787	1	4 7/8	10 1/2	1 1/8	62136	4	62336	145.90	1.0971 - 1.1280	176.75	161.30	156.15	153.65	151.05	148.95
1 5/32	1.1562	.809	1	4 7/8	10 1/2	1 5/32	62137	4	62337	152.45	1.1281 - 1.1590	183.25	167.80	162.65	160.20	157.50	155.50
1 3/16	1.1875	.831	1	4 7/8	10 1/2	1 3/16	62138	4	62338	156.85	1.1591 - 1.1905	187.65	172.25	167.10	164.60	162.05	159.95
1 7/32	1.2188	.853	1	4 7/8	10 1/2	1 7/32	62139	4	62339	157.45	1.1906 - 1.2220	188.25	172.85	167.70	165.20	162.60	160.50
1 1/4	1.2500	.875	1	4 7/8	10 1/2	1 1/4	62140	4	62340	158.05	1.2221 - 1.2530	188.80	173.35	168.25	165.80	163.15	161.10
1 9/32	1.2812	.897	1	4 7/8	10 1/2	1 9/32	62141	4	62341	169.30	1.2531 - 1.2840	200.10	184.70	179.50	177.05	174.45	172.30
1 5/16	1.3125	.919	1	4 7/8	10 1/2	1 5/16	62142	4	62342	174.00	1.2841 - 1.3150	204.80	189.40	184.25	181.80	179.15	177.05
1 11/32	1.3438	.940	1	4 7/8	10 1/2	1 11/32	62143	4	62343	177.75	1.3151 - 1.3470	208.55	193.10	187.95	185.50	182.80	180.80
1 3/8	1.3750	.962	1	4 7/8	10 1/2	1 3/8	62144	4	62344	182.00	1.3471 - 1.3780	212.80	197.40	192.20	189.75	187.15	185.00
1 13/32	1.4062	.984	1	4 7/8	10 1/2	1 13/32	62145	4	62345	186.30	1.3781 - 1.4090	217.05	201.60	196.45	194.00	191.35	189.25
1 7/16	1.4375	1.006	1	4 7/8	10 1/2	1 7/16	62146	4	62346	191.70	1.4091 - 1.4410	222.50	207.00	201.85	199.40	196.80	194.65
1 15/32	1.4688	1.025	1	4 7/8	10 1/2	1 15/32	62147	4	62347	197.35	1.4411 - 1.4720	228.15	212.70	207.55	205.10	202.40	200.35
1 1/2	1.5000	1.050	1	4 7/8	10 1/2	1 1/2	62148	4	62348	201.50	1.4721 - 1.5030	232.30	216.90	211.75	209.30	206.70	204.60

*3 flutes

**Quantities of 15 or more - price of fractional size in same size range.



CORE DRILLS - FOR STEELS

CARBIDE TIPPED TYPES 621 & 623 METRIC

MATERIAL SPECIFIC

FOUR RIGHT SPIRAL FLUTES STRAIGHT OR TAPER SHANK



MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced on pg. 142
- Modified metric tool diameter - priced below
- Closer tool diameter tolerance
- End chamfer other than 118° included angle
- End cutting or corner radius
- Shortened shank or reduced shank diameter (for Type 621)
- Flat(s) or tang on shank (for Type 621)
- Shank whistle notch for set screw (for Type 623)
- Smaller taper shank (for Type 623)
- Coatings available:

- TITANIUM NITRIDE - TiN
- TITANIUM CARBONITRIDE - TiCN
- ZIRCONIUM NITRIDE - ZrN
- AL TITANIUM NITRIDE - AlTiN

NOTE: Tool diameter in millimeters (mm); all other dimensions in inches.

TOOL DIAMETER		DIMENSIONS				TYPE 621		TYPE 623		BOTH TYPES METRIC PRICE	FINISHED TO MODIFIED TOOL DIAMETER							
mm	INCH	MIN. CUT DIAM.	CAR-BIDE	FLUTE	OVER-ALL	SHANK DIAM.	STEEL METRIC EDP NO.	TAPER SHANK NO.	STEEL METRIC EDP NO.		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
											1	2	3	4	5-7	8-14	OVER 14	
* 9.0	.3543	.262	3/8	3 1/2	6 3/4	3/8	621090	1	623090	\$102.90	8.815-9.601	\$126.05	\$110.70	\$105.55	\$103.00	\$100.45	\$98.30	\$95.30
*10.0	.3937	.284	3/8	3 5/8	7	13/32	621100	1	623100	102.90	9.602-10.389	126.05	110.70	105.55	103.00	100.45	98.30	95.30
*11.0	.4331	.306	3/4	3 7/8	7 1/4	7/16	621110	1	623110	102.90	10.390-11.201	126.05	110.70	105.55	103.00	100.45	98.30	95.30
* -	-	.328	3/4	4 1/8	7 1/2	15/32	621119	1	623119	-	11.202-11.989	126.05	110.70	105.55	103.00	100.45	98.30	95.30
12.0	.4724	.350	3/4	4 3/8	8 1/4	1/2	621120	2	623120	102.90	11.990-12.776	126.05	110.70	105.55	103.00	100.45	98.30	95.30
13.0	.5118	.372	3/4	4 3/8	8 1/4	17/32	621130	2	623130	103.20	12.777-13.564	126.40	111.00	105.80	103.30	100.75	98.55	95.65
14.0	.5512	.394	3/4	4 3/8	8 1/4	9/16	621140	2	623140	103.20	13.565-14.376	126.40	111.00	105.80	103.30	100.75	98.55	95.65
15.0	.5906	.416	3/4	4 3/8	8 1/4	19/32	621150	2	623150	107.90	14.377-15.164	131.10	115.70	110.55	108.00	105.50	103.30	100.40
-	-	.438	3/4	4 3/8	8 1/4	5/8	621159	2	623159	-	15.165-15.951	131.10	115.70	110.55	108.00	105.50	103.30	100.40
16.0	.6299	.459	3/4	4 3/8	8 1/4	21/32	621160	2	623160	108.95	15.952-16.739	132.15	116.75	111.65	109.10	106.55	104.40	101.40
17.0	.6693	.481	7/8	4 3/8	8 1/4	11/16	621170	2	623170	109.90	16.740-17.551	133.05	117.70	112.55	110.00	107.40	105.25	102.30
18.0	.7087	.503	7/8	4 3/8	8 1/4	23/32	621180	2	623180	109.90	17.552-18.339	133.05	117.70	112.55	110.00	107.40	105.25	102.30
19.0	.7480	.525	7/8	4 3/8	8 1/4	3/4	621190	2	623190	109.90	18.340-19.126	133.05	117.70	112.55	110.00	107.40	105.25	102.30
-	-	.547	7/8	4 3/8	8 1/4	25/32	621199	2	623199	-	19.127-19.914	135.20	119.80	114.70	112.10	109.55	107.40	104.50
20.0	.7874	.569	7/8	4 7/8	9 1/2	13/16	621200	3	623200	114.90	19.915-20.726	138.05	122.70	117.55	115.00	112.50	110.35	107.30
21.0	.8268	.591	7/8	4 7/8	9 1/2	27/32	621210	3	623210	120.50	20.727-21.514	143.70	128.30	123.15	120.60	118.05	115.90	112.95
22.0	.8661	.612	7/8	4 7/8	9 1/2	7/8	621220	3	623220	120.50	21.515-22.301	143.70	128.30	123.15	120.60	118.05	115.90	112.95
23.0	.9055	.634	7/8	4 7/8	9 1/2	29/32	621230	3	623230	121.20	22.302-23.089	144.40	129.05	123.80	121.35	118.75	116.60	113.65
-	-	.656	7/8	4 7/8	9 1/2	15/16	621239	3	623239	-	23.090-23.901	144.40	129.05	123.80	121.35	118.75	116.60	113.65
24.0	.9449	.678	7/8	4 7/8	9 1/2	31/32	621240	3	623240	125.30	23.902-24.689	148.50	133.10	128.00	125.40	122.80	120.65	117.75
25.0	.9843	.700	7/8	4 7/8	9 1/2	1	621250	3	623250	127.50	24.690-25.476	150.65	135.30	130.15	127.60	125.05	122.85	119.90
26.0	1.0236	.722	7/8	4 7/8	9 1/2	1 1/32	621260	3	623260	128.35	25.477-26.264	151.60	136.20	131.00	128.50	125.95	123.75	120.85
27.0	1.0630	.744	7/8	4 7/8	9 1/2	1 1/16	621270	3	623270	130.00	26.265-27.076	153.25	137.85	132.70	130.15	127.55	125.40	122.50
-	-	.766	1	4 7/8	10 1/2	1 3/32	621279	4	623279	-	27.077-27.864	173.00	157.60	152.45	149.90	147.35	145.15	142.25
28.0	1.1024	.787	1	4 7/8	10 1/2	1 1/8	621280	4	623280	156.15	27.865-28.651	179.35	163.95	158.80	156.30	153.65	151.60	148.60
29.0	1.1417	.809	1	4 7/8	10 1/2	1 5/32	621290	4	623290	162.65	28.652-29.439	185.80	170.45	165.30	162.80	160.20	158.05	155.10
30.0	1.1811	.831	1	4 7/8	10 1/2	1 3/16	621300	4	623300	167.10	29.440-30.239	190.30	174.90	169.80	167.20	164.60	162.45	159.55
31.0	1.2205	.853	1	4 7/8	10 1/2	1 7/32	621310	4	623310	167.70	30.240-31.039	190.80	175.50	170.30	167.80	165.20	163.10	160.10
-	-	.875	1	4 7/8	10 1/2	1 1/4	621319	4	623319	-	31.040-31.826	191.40	176.05	170.90	168.35	165.80	163.60	160.65
32.0	1.2598	.897	1	4 7/8	10 1/2	1 9/32	621320	4	623320	179.50	31.827-32.614	202.75	187.35	182.10	179.65	177.05	174.90	171.95
33.0	1.2992	.919	1	4 7/8	10 1/2	1 5/16	621330	4	623330	184.25	32.615-33.401	207.40	192.05	186.85	184.35	181.80	179.65	176.65
34.0	1.3386	.940	1	4 7/8	10 1/2	1 11/32	621340	4	623340	187.95	33.402-34.214	211.10	195.75	190.60	188.10	185.50	183.35	180.40
35.0	1.3780	.962	1	4 7/8	10 1/2	1 3/8	621350	4	623350	192.20	34.215-35.001	215.45	200.05	194.90	192.35	189.75	187.60	184.70
-	-	.984	1	4 7/8	10 1/2	1 13/32	621359	4	623359	-	35.002-35.789	219.60	204.25	199.10	196.55	194.00	191.85	188.85
36.0	1.4173	1.006	1	4 7/8	10 1/2	1 7/16	621360	4	623360	201.85	35.790-36.601	225.05	209.65	204.50	202.00	199.40	197.30	194.30
37.0	1.4567	1.025	1	4 7/8	10 1/2	1 15/32	621370	4	623370	207.55	36.602-37.389	230.65	215.40	210.15	207.70	205.10	202.95	200.00
38.0	1.4961	1.050	1	4 7/8	10 1/2	1 1/2	621380	4	623380	211.75	37.390-38.176	234.90	219.55	214.40	211.85	209.30	207.15	204.15

*3 flutes

DRILLS



MASONRY DRILLS CARBIDE TIPPED TYPES 681, 682, 683, 684 FRACTIONAL



FOUR TYPES FOR MOST APPLICATIONS



TYPE 681 – REGULAR HELIX (WIDE SPIRAL)

- Fast feeding with large open flutes

TYPE 682 – HIGH HELIX (FAST SPIRAL)

TYPE 683 – HIGH HELIX (FAST SPIRAL) – 13" LENGTH

TYPE 684 – HIGH HELIX (FAST SPIRAL) – 18" LENGTH

TOOL DIAMETER	SHANK DIAMETER	OVERALL LENGTH	TYPE 681 REGULAR HELIX EDP NO.	TYPE 682 HIGH HELIX EDP NO.	BOTH TYPES PRICE
1/8	1/8	3	68108	68208	\$4.45
3/16	3/16	3	68112	68212	4.45
1/4	1/4	4	68116	68216	4.45
1/4	1/4	6	68117	68217	5.05
5/16	1/4	4	68120	68220	5.05
5/16	1/4	6	68121	68221	5.50
3/8	1/4	4	68124	68224	5.50
3/8	1/4	6	68125	68225	5.50
7/16	1/4	4	68128	68228	6.10
7/16	1/4	6	68129	68229	6.25
1/2	1/4	4	68132	68232	6.75
1/2	1/4	6	68133	68233	6.75
1/2	3/8	6	68134	68234	6.75
9/16	3/8	6	68136	68236	9.10
5/8	1/2	6	68140	68240	9.65
11/16	1/2	6	68144	68244	10.95
3/4	1/2	6	68148	68248	12.00
7/8	1/2	6	68156	68256	14.95
1	1/2	6	68164	68264	18.50

ALL TYPES:

- Carbide tip brazed to tough steel body
- Carbide tip is larger than the tool diameter listed to provide clearance for installation of anchor screws, expansion shields and toggle bolts

USE:

- Designed for use in portable electric drills
- For drilling masonry including concrete, plaster, wall board, stone, brick, marble, slate, carbon, asphalt and cement
- Performs best at moderate pressure and slow speeds
- Keep drill cutting rather than rubbing
- On deep holes, withdraw frequently to prevent clogging
- Use punch or star type hand drill to shatter obstructions such as glazed rock

TOOL DIAMETER	SHANK DIAMETER	TYPE 683 – HIGH HELIX 13" OVERALL LENGTH		TYPE 684 – HIGH HELIX 18" OVERALL LENGTH	
		EDP NO.	PRICE	EDP NO.	PRICE
1/4	1/4	68316	\$11.55	68416	\$15.60
3/16	1/4	68320	13.25	68420	18.05
3/8	1/4	68324	14.55	68424	19.10
7/16	1/4	68328	15.95	68428	20.90
1/2	3/8	68332	18.25	68432	21.45
9/16	3/8	68336	20.90	68436	23.35
5/8	1/2	68340	23.35	68440	26.25
11/16	1/2	68344	26.20	68444	28.25
3/4	1/2	68348	26.85	68448	30.25
7/8	1/2	68356	33.15	68456	37.80
1	1/2	68364	36.70	68464	41.35



GLASS & TILE DRILLS CARBIDE TIPPED TYPE 680 FRACTIONAL



TYPE 680 – CARBIDE SPEAR POINT – STRAIGHT SHANK

- Carbide tip brazed to hardened tool steel body
- Long carbide tip permits many regrinds

USE:

- For drilling glass, tile, porcelain, ceramic and other hard, fragile materials without chipping or cracking the material when properly used
- Speed should be approx. 25 surface feet per minute (150 to 760 RPM based on tool diameter) using a steady, moderate hand feed
- Constant flow of coolant important
- Material being drilled should be backed with wood or rubber to support material during drill break-through
- Avoid vibration and excessive stress
- Keep drill sharp to eliminate excessive pressure

TOOL DIAMETER		SHANK DIAMETER	OVERALL LENGTH	TYPE 680 EDP NO.	PRICE EACH
FRACTIONAL	DECIMAL				
1/8	.1250	7/64	2 1/2	68008	\$17.45
3/16	.1875	5/32	2 1/2	68012	17.45
1/4	.2500	7/32	2 1/2	68016	20.05
5/16	.3125	1/4	3	68020	25.80
3/8	.3750	5/16	3 1/2	68024	28.70
7/16	.4375	3/8	3 1/2	68028	32.55
1/2	.5000	7/16	3 1/2	68032	35.50
9/16	.5625	1/2	4	68036	49.90
5/8	.6250	9/16	4	68040	60.15

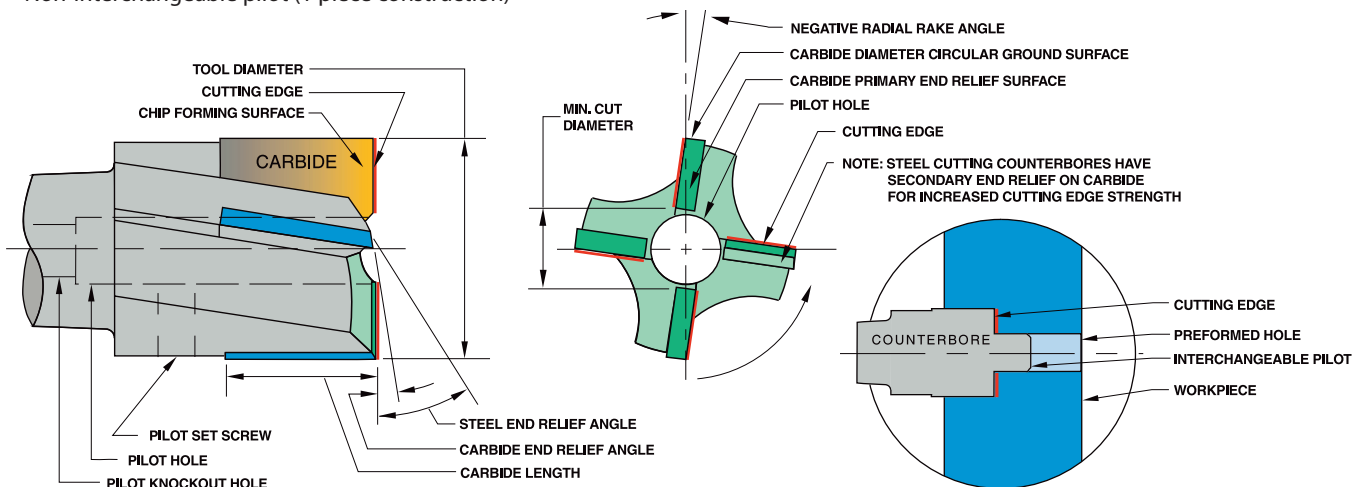


CARBIDE TIPPED COUNTERBORES INDEX AND TECHNICAL INFORMATION

MOST TYPES FOR INTERCHANGEABLE PILOTS

DESCRIPTION	HANNIBAL			CLEVELAND	ECLIPSE	METCUT	MORSE	WHITNEY
	FRAC. PAGE	METRIC PAGE	TOOL TYPE					
AIRCRAFT COUNTERBORES 3 Flutes (similar to Craig 850 series)	147	-	522	-	-	-	-	-
STRAIGHT SHANK COUNTERBORES 4 Flutes 3 - 4 Flutes 3 - 4 Flutes - For Steels	148 148 152	149 149 153	512 514 510	- 779 -	- - -	- - -	- 5779 -	- - -
TAPER SHANK COUNTERBORES 4 Flutes 3 - 4 Flutes 3 - 4 Flutes - For Steels	150 150 152	151 151 153	518 516 511	- - -	- - -	- - -	- 5780 -	- - -
STUB LENGTH COUNTERBORES Pin Drive - For Non-Ferrous & Cast Irons Pin Drive - For Steels Stub Taper - For Non-Ferrous & Cast Irons Stub Taper - For Steels Radial Drive - For Non-Ferrous & Cast Irons Radial Drive - For Steels	155 155 154 154 156 156	- - - - - -	573 574 575 576 577 578	- - - - - -	412 - 427 - 402 -	200 - 210 - 220 -	- - - - - -	- - - - - -
*CAPSCREW COUNTERBORES Straight Shank - For Non-Ferrous & Cast Iron Straight Shank - For Steels	157 157	157 157	513 515	- -	- -	- -	- -	- -
PILOTS Short Shank	158	-	500	Yes	-	410	776	Yes

*Non-interchangeable pilot (1 piece construction)



COUNTERBORE BASICS

- The counterbore is used to enlarge a preformed hole when a flat bottom is required or to spotface when a machine finish is required
- The counterbore is an end cutting tool which may utilize a pilot to align the enlarged hole being machined with the preformed hole
- The three flute counterbore tends to reduce chatter & improve finish
- Coatings are especially effective (see "Coating Selector" on page 10)

COUNTERBORE PROBLEM SOLVING GUIDE

- Refer to guide shown on page 188

COUNTERBORE SPECIFICATIONS & TOLERANCES

- Geometry and carbide grade appropriate for material being machined
- Carbide tips brazed to tough hardened alloy steel body, except aircraft counterbores which are not hardened
- Precision ground cutting edges
- USCTI
- "Taper Shank No." refers to American Standard taper series (formerly Morse taper series) per ASME/ANSI B5.10
- Tool diameter tolerance: plus .001", minus .000"
- Shank diameter tolerance: plus .0000", minus .0005"
- Steel cutting counterbores have secondary end relief on carbide for increased cutting edge strength

C'BORES



FEEDS & SPEEDS - COUNTERBORES CARBIDE TIPPED

Speeds & feeds are starting recommendations only. Factors such as machine, fixture and tooling rigidity, horsepower available, coolant application and others will affect the performance significantly. Please read machine operators instructions and use all safety shields and glasses before performing these operations. Use this chart for carbide tipped counterbores.



$$\text{RPM} = \text{SFPM} * 3.82 / \text{CUTTER DIAMETER}$$

CHIP CLASS	MATERIAL	COUNTERBORING		FEED RATE (INCHES PER REVOLUTION) FINISHED HOLE DIAMETER IN INCHES					
		BRINELL	SFPM	¼	½	¾	1	1 ½	2
20	ALUMINUM ALLOY - WROUGHT	30-150	750-900	.006	.006	.007	.007	.009	.010
	MAGNESIUM ALLOY	50-90	875-1000	.006	.006	.007	.007	.009	.010
	LEAD	10-20	875-1000	.006	.006	.007	.007	.009	.010
	NON-METAL AND PLASTIC	-	700-1200	.006	.006	.007	.007	.009	.010
	ZINC ALLOY - DIE CAST	80-100	700-850	.005	.005	.006	.006	.007	.009
40	ALUMINUM BRONZE	40-175	700-850	.006	.006	.007	.007	.009	.010
	BRASS ALLOY - LEADED AND FREE CUTTING	10-100Rb	850-1000	.006	.006	.007	.007	.009	.010
	CHROMIUM - NICKEL	10-100Rb	75-85	.003	.003	.003	.003	.004	.005
	COPPER ALLOY - TOUGH	40-200*	275-350	.005	.005	.006	.006	.007	.009
60	DUCTILE CAST IRON - AUSTENITIC	120-275	85-110	.002	.002	.002	.002	.003	.004
	DUCTILE CAST IRON - FERRITIC	140-270	200-250	.006	.006	.007	.007	.009	.010
	DUCTILE CAST IRON - MARTENSITIC	270-400	75-95	.002	.002	.002	.002	.003	.004
	GRAY - PEARLITIC	220-320	125-200	.004	.004	.004	.005	.006	.007
	GRAY - FERRITIC	110-240	200-250	.004	.004	.004	.005	.006	.007
	MALLEABLE CAST IRON - MARTENSITIC	200-320	60-85	.004	.004	.004	.005	.006	.007
80	LOW AND MEDIUM CARBON STEEL - FREE MACHINING	100-250	200-250	.006	.006	.007	.007	.009	.010
	LOW AND MEDIUM CARBON STEEL - WROUGHT	100-375	150-200	.006	.006	.007	.007	.009	.010
100	LOW AND MEDIUM CARBON ALLOY STEEL - FREE MACHINING	100-275	145-185	.004	.004	.004	.005	.006	.007
	LOW AND MEDIUM CARBON ALLOY STEEL	85-375	130-165	.004	.004	.004	.005	.006	.007
	STAINLESS STEEL - 400 SERIES	135-325	150-200	.003	.003	.003	.003	.004	.005
	STAINLESS STEEL - 400 SERIES FREE MACHINING	135-275	155-205	.003	.003	.003	.003	.004	.005
120	HIGH STRENGTH STEEL - WROUGHT & TOOL STEEL	175-400	90-135	.002	.002	.002	.002	.003	.003
140	HIGH TEMP ALLOYS NICKEL & IRON BASE ALLOY	140-300	40-65	.002	.002	.002	.002	.003	.003
	STAINLESS STEEL - 300 SERIES	135-375	150-300	.003	.003	.003	.003	.004	.005
	STAINLESS STEEL - PH SERIES	150-440	115-175	.003	.003	.003	.003	.004	.005
	TITANIUM ALLOY	110-380	125-175	.002	.002	.002	.002	.003	.003

C/BORES



AIRCRAFT COUNTERBORES CARBIDE TIPPED TYPE 522 FRACTIONAL



INTERCHANGEABLE PILOT TYPE STRAIGHT SHANK



TYPE 522 – STRAIGHT SHANK

- 3 flutes
- Furnished with 1/64" corner radius
- Carbide tips brazed to tough alloy steel body
- Tool diameter tolerance: plus .001", minus .000"
- Shank diameter tolerance: plus .0000", minus .001"
- Detailed specifications on page 145

USE:

- For counterboring and spotfacing non-ferrous materials, composites, and non-metals used in airframe manufacturing

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	522
	40	NON-FERROUS - SHORT CHIPS	522
	60	CAST IRONS	522
	80	LOW STRENGTH STEELS	522
	100	MEDIUM STRENGTH STEELS	522
	120	HIGH STRENGTH STEELS	522
	140	HIGH TEMPERATURE ALLOYS	522

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Cutting diameter reduced for step
- Corner chamfer or corner radius
- 4 coatings available (listed on page 154)

TOOL DIAMETER		DIMENSIONS				TYPE 522 EDP NO.	PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
FRACTION	DECIMAL	MIN CUT DIAM.	PILOT HOLE DIAM.	SMALL SHANK DIAM.	OVERALL LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								1	2	3	4	5-7	8-14*	
1/4	.2500	.1250	.0938	1/4	2 3/8	52208	\$46.70	0.2381-0.2530	\$79.40	\$63.10	\$57.60	\$55.00	\$52.20	\$49.90
9/32	.2812	.1250	.0938	1/4	2 3/8	52209	46.75	0.2531-0.2840	79.45	63.15	57.70	55.05	52.25	50.00
5/16	.3125	.1250	.0938	1/4	2 3/8	52210	47.95	0.2841-0.3150	80.70	64.30	58.80	56.15	53.40	51.20
11/32	.3438	.1250	.0938	1/4	2 3/8	52211	48.90	0.3151-0.3470	81.65	65.25	59.80	57.10	54.40	52.15
3/8	.3750	.1250	.0938	1/4	2 3/8	52212	49.05	0.3471-0.3780	81.75	65.40	60.00	57.25	54.50	52.25
13/32	.4062	.1560	.1250	1/4	2 3/4	52213	55.80	0.3781-0.4090	88.40	72.15	66.65	64.00	61.20	59.00
7/16	.4375	.1560	.1250	1/4	2 3/4	52214	60.15	0.4091-0.4410	92.85	76.45	71.05	68.30	65.60	63.35
15/32	.4688	.1560	.1250	1/4	2 3/4	52215	61.15	0.4411-0.4720	93.85	77.50	72.05	69.40	66.60	64.35
1/2	.5000	.1560	.1250	1/4	2 3/4	52216	61.90	0.4721-0.5030	94.60	78.25	72.80	70.05	67.30	65.05
17/32	.5312	.1560	.1250	1/4	2 3/4	52217	62.20	0.5031-0.5340	94.85	78.50	73.10	70.40	67.60	65.40
9/16	.5625	.1560	.1250	1/4	2 3/4	52218	62.45	0.5341-0.5660	95.15	78.80	73.35	70.60	67.95	65.65
19/32	.5938	.1560	.1250	1/4	2 3/4	52219	62.80	0.5661-0.5970	95.55	79.20	73.75	71.05	68.25	66.00
5/8	.6250	.1560	.1250	1/4	2 3/4	52220	63.50	0.5971-0.6280	96.20	79.90	74.40	71.80	69.00	66.70
21/32	.6562	.2190	.1875	1/4	2 3/4	52221	70.55	0.6281-0.6590	103.25	86.90	81.50	78.80	76.05	73.80
11/16	.6875	.2190	.1875	1/4	2 3/4	52222	74.10	0.6591-0.6910	106.80	90.45	85.00	82.30	79.50	77.30
23/32	.7188	.2190	.1875	1/4	2 3/4	52223	76.60	0.6911-0.7220	109.25	92.95	87.45	84.85	82.05	79.85
3/4	.7500	.2190	.1875	1/4	2 3/4	52224	77.55	0.7221-0.7530	110.25	93.90	88.40	85.80	83.05	80.80
25/32	.7812	.2190	.1875	1/4	2 3/4	52225	77.90	0.7531-0.7840	110.60	94.25	88.80	86.05	83.35	81.10
13/16	.8125	.2190	.1875	1/4	2 3/4	52226	78.55	0.7841-0.8160	111.35	94.90	89.50	86.80	84.05	81.80
27/32	.8438	.2190	.1875	1/4	2 3/4	52227	79.15	0.8161-0.8470	111.85	95.40	90.00	87.30	84.55	82.30
7/8	.8750	.2190	.1875	1/4	2 3/4	52228	79.90	0.8471-0.8780	112.55	96.20	90.80	88.10	85.30	83.10
29/32	.9062	.2190	.1875	1/4	2 3/4	52229	80.40	0.8781-0.9090	113.10	96.80	91.35	88.70	85.90	83.65
15/16	.9375	.2190	.1875	1/4	2 3/4	52230	81.20	0.9091-0.9410	113.90	97.60	92.10	89.45	86.70	84.40
31/32	.9688	.2190	.1875	1/4	2 3/4	52231	81.75	0.9411-0.9720	114.45	98.05	92.70	89.95	87.20	84.95
1	1.0000	.2190	.1875	1/4	2 3/4	52232	82.00	0.9721-1.0030	114.70	98.35	92.90	90.20	87.40	85.20
1 1/16	1.0625	.2190	.1875	3/8	2 3/4	52234	104.65	1.0031-1.0660	137.30	120.95	115.55	112.85	110.05	107.85
1 1/8	1.1250	.2190	.1875	3/8	2 3/4	52236	111.65	1.0661-1.1280	144.35	128.00	122.60	119.90	117.10	114.85
1 3/16	1.1875	.2190	.1875	3/8	2 3/4	52238	113.05	1.1281-1.1905	145.75	129.45	124.00	121.30	118.55	116.30
1 1/4	1.2500	.2810	.2500	3/8	2 3/4	52240	115.20	1.1906-1.2530	147.95	131.55	126.05	123.40	120.70	118.45
1 5/16	1.3125	.2810	.2500	3/8	2 3/4	52242	117.30	1.2531-1.3155	150.00	133.65	128.25	125.55	122.75	120.50
1 3/8	1.3750	.2810	.2500	3/8	2 3/4	52244	118.70	1.3156-1.3780	151.40	135.15	129.65	126.90	124.20	121.90
1 7/16	1.4375	.2810	.2500	3/8	2 3/4	52246	120.10	1.3781-1.4405	152.90	136.45	131.05	128.35	125.60	123.35
1 1/2	1.5000	.2810	.2500	3/8	2 3/4	52248	126.45	1.4406-1.5030	160.35	143.40	137.75	134.95	132.05	129.75
1 9/16	1.5625	.3430	.3125	1/2	3 1/16	52250	140.65	1.5031-1.5660	174.55	157.65	152.00	149.20	146.35	144.05
1 5/8	1.6250	.3430	.3125	1/2	3 1/16	52252	142.50	1.5661-1.6280	176.40	159.50	153.90	151.10	148.20	145.80
1 11/16	1.6875	.3430	.3125	1/2	3 1/16	52254	144.40	1.6281-1.6910	178.30	161.35	155.70	152.95	150.10	147.75
1 3/4	1.7500	.3430	.3125	1/2	3 1/16	52256	146.60	1.6911-1.7530	180.50	163.50	157.90	155.10	152.25	149.95
1 13/16	1.8125	.3430	.3125	1/2	3 1/16	52258	148.35	1.7531-1.8160	181.95	165.05	159.40	156.60	153.65	151.35
1 7/8	1.8750	.3430	.3125	1/2	3 1/16	52260	149.45	1.8161-1.8780	183.35	166.40	160.70	158.00	155.10	152.75
1 15/16	1.9375	.3430	.3125	1/2	3 1/16	52262	164.90	1.8781-1.9410	198.80	181.85	176.20	173.40	170.50	168.20
2	2.0000	.3430	.3125	1/2	3 1/16	52264	205.20	1.9411-2.0030	239.20	222.20	216.55	213.75	210.90	208.55

*Quantities of 15 or more - price of fractional size in same size range.

C'BORES



COUNTERBORES CARBIDE TIPPED TYPES 512 & 514 FRACTIONAL



INTERCHANGEABLE PILOT TYPE STRAIGHT SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	512 or 514
	40	NON-FERROUS - SHORT CHIPS	512 or 514
	60	CAST IRONS	512 or 514
	80	LOW STRENGTH STEELS	510 ^{MS}
	100	MEDIUM STRENGTH STEELS	510 ^{MS}
	120	HIGH STRENGTH STEELS	510 ^{MS}
140	HIGH TEMPERATURE ALLOYS	512 or 514	

^{MS}See page 152 for Type 510

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Modified metric tool diameter - priced on pg. 149
- Cutting diameter reduced for step
- Corner chamfer or corner radius
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- 4 coatings available (listed on page 154)

TYPE 512 - FOUR FLUTES - STRAIGHT SHANK TYPE 514 - THREE/FOUR FLUTES - STRAIGHT SHANK

- Right spiral flutes
- Carbide tips brazed to tough hardened alloy steel body
- Tool diameter tolerance: plus .001", minus .000"
- Shank diameter tolerance: plus .0000", minus .0005"
- Detailed specifications on page 145

TOOL DIAMETER		DIMENSIONS				TYPE 512		TYPE 514		BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL	MIN CUT DIAM.	PILOT HOLE DIAM.	SHANK DIAM.	OVER-ALL LENGTH	NO. OF FLTS	EDP NO.	NO. OF FLTS	EDP NO.		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
											1	2	3	4	5-7	8-14*	
1/4	.2500	.1140	.0938	15/64	3 13/16	-	-	3	51408	\$57.90	0.2381-0.2530	\$90.55	\$74.25	\$68.80	\$66.10	\$63.30	\$61.10
5/32	.2812	.1140	.0938	17/64	3 13/16	-	-	3	51409	70.75	0.2531-0.2840	103.35	87.10	81.65	78.95	76.25	73.95
3/16	.3125	.1140	.0938	19/64	3 13/16	-	-	3	51410	64.30	0.2841-0.3150	96.95	80.65	75.20	72.50	69.75	67.50
1/32	.3438	.1140	.0938	5/16	3 13/16	-	-	3	51411	81.40	0.3151-0.3470	114.00	97.65	92.20	89.55	86.80	84.50
3/8	.3750	.1820	.1562	5/16	4 1/16	-	-	3	51412	68.15	0.3471-0.3780	98.30	83.25	78.20	75.75	73.20	71.15
7/32	.4062	.1820	.1562	3/8	4 1/16	-	-	3	51413	76.90	0.3781-0.4090	107.00	92.00	86.95	84.45	81.90	79.85
1/16	.4375	.1820	.1562	3/8	4 1/16	-	-	3	51414	69.95	0.4091-0.4410	100.05	85.00	79.95	77.55	74.95	72.90
15/32	.4688	.2280	.1875	7/16	4 3/16	-	-	3	51415	85.40	0.4411-0.4720	115.50	100.45	95.45	93.00	90.40	88.35
1/2	.5000	.2280	.1875	7/16	4 3/16	4	51216	3	51416	77.65	0.4721-0.5030	107.75	92.65	87.70	85.20	82.65	80.60
17/32	.5312	.2280	.1875	1/2	4 3/16	4	51217	3	51417	87.90	0.5031-0.5340	117.95	102.95	97.95	95.45	92.90	90.80
9/16	.5625	.2280	.1875	1/2	4 3/16	4	51218	3	51418	79.90	0.5341-0.5660	110.05	94.95	89.95	87.45	84.95	82.85
19/32	.5938	.2280	.1875	1/2	5 1/8	4	51219	3	51419	88.80	0.5661-0.5970	118.85	103.85	98.85	96.35	93.75	91.70
5/8	.6250	.2280	.1875	1/2	5 1/8	4	51220	3	51420	80.70	0.5971-0.6280	110.80	95.70	90.70	88.25	85.70	83.65
21/32	.6562	.2280	.1875	1/2	5 1/8	4	51221	3	51421	94.00	0.6281-0.6590	124.05	109.05	104.00	101.50	99.00	96.95
11/16	.6875	.2280	.1875	1/2	5 1/8	4	51222	3	51422	85.45	0.6591-0.6910	115.60	100.50	95.50	93.05	90.50	88.40
23/32	.7188	.2900	.2500	1/2	5 3/8	4	51223	3	51423	96.25	0.6911-0.7220	126.25	111.25	106.25	103.80	101.20	99.15
3/4	.7500	.2900	.2500	1/2	5 3/8	4	51224	3	51424	87.40	0.7221-0.7530	117.55	102.45	97.45	94.95	92.45	90.35
25/32	.7812	.2900	.2500	5/8	5 3/8	4	51225	3	51425	98.25	0.7531-0.7840	128.30	113.25	108.25	105.80	103.20	101.15
13/16	.8125	.2900	.2500	5/8	5 3/8	4	51226	3	51426	89.25	0.7841-0.8160	119.35	104.25	99.30	96.75	94.30	92.20
27/32	.8438	.2900	.2500	3/4	5 3/8	4	51227	3	51427	104.05	0.8161-0.8470	134.15	119.05	114.10	111.60	109.10	107.00
7/8	.8750	.2900	.2500	3/4	5 3/8	4	51228	3	51428	94.60	0.8471-0.8780	124.70	109.65	104.65	102.15	99.60	97.55
29/32	.9062	.2900	.2500	3/4	6 1/8	4	51229	3	51429	106.15	0.8781-0.9090	136.30	121.20	116.20	113.75	111.20	109.15
15/16	.9375	.2900	.2500	3/4	6 1/8	4	51230	3	51430	96.55	0.9091-0.9410	126.70	111.60	106.60	104.10	101.55	99.50
31/32	.9688	.3530	.3125	3/4	6 3/8	4	51231	3	51431	109.25	0.9411-0.9720	139.35	124.25	119.30	116.80	114.25	112.20
1	1.0000	.3530	.3125	3/4	6 3/8	4	51232	3	51432	99.35	0.9721-1.0030	129.45	114.35	109.35	106.90	104.35	102.25
1 1/16	1.0625	.3530	.3125	3/4	6 3/8	4	51234	3	51434	100.40	1.0031-1.0660	130.50	115.40	110.40	107.95	105.40	103.30
1 1/8	1.1250	.3530	.3125	1	6 3/8	4	51236	3	51436	102.95	1.0661-1.1280	133.00	117.95	113.00	110.45	107.95	105.90
1 3/16	1.1875	.3530	.3125	1	6 3/8	4	51238	3	51438	107.50	1.1281-1.1905	137.60	122.60	117.60	115.10	112.50	110.45
1 1/4	1.2500	.4260	.3750	1	6 3/8	-	-	4	51440	119.75	1.1906-1.2530	152.35	136.10	130.60	127.95	125.15	122.95
1 5/16	1.3125	.4260	.3750	1	6 3/8	-	-	4	51442	129.25	1.2531-1.3155	161.95	145.60	140.10	137.45	134.70	132.45
1 3/8	1.3750	.4260	.3750	1	6 3/8	-	-	4	51444	136.00	1.3156-1.3780	168.60	152.25	146.80	144.10	141.35	139.10
1 7/16	1.4375	.4260	.3750	1 1/4	7 7/8	-	-	4	51446	149.05	1.3781-1.4405	184.50	166.75	160.80	157.90	154.95	152.45
1 1/2	1.5000	.4260	.3750	1 1/4	7 7/8	-	-	4	51448	166.05	1.4406-1.5030	201.50	183.75	177.85	175.00	171.95	169.50
1 9/16	1.5625	.4890	.4375	1 1/4	8 1/8	-	-	4	51450	170.90	1.5031-1.5660	206.45	188.65	182.75	179.80	176.85	174.40
1 5/8	1.6250	.4890	.4375	1 1/4	8 1/8	-	-	4	51452	174.50	1.5661-1.6280	210.00	192.25	186.40	183.45	180.45	178.05
1 11/16	1.6875	.4890	.4375	1 1/4	8 1/8	-	-	4	51454	208.80	1.6281-1.6910	247.05	227.95	221.55	218.35	215.15	212.50
1 3/4	1.7500	.4890	.4375	1 1/4	8 1/8	-	-	4	51456	208.80	1.6911-1.7530	247.05	227.95	221.55	218.35	215.15	212.50
1 13/16	1.8125	.4890	.4375	1 1/2	8 1/8	-	-	4	51458	247.20	1.7531-1.8160	285.50	266.35	259.95	256.80	253.50	250.95
1 7/8	1.8750	.4890	.4375	1 1/2	8 1/8	-	-	4	51460	247.20	1.8161-1.8780	285.50	266.35	259.95	256.80	253.50	250.95
1 15/16	1.9375	.4890	.4375	1 1/2	8 1/8	-	-	4	51462	270.15	1.8781-1.9410	308.50	289.35	282.90	279.75	276.50	273.90
2	2.0000	.5510	.5000	1 1/2	8 3/8	-	-	4	51464	270.15	1.9411-2.0030	308.50	289.35	282.90	279.75	276.50	273.90

*Quantities of 15 or more - price of fractional size in same size range.



COUNTERBORES CARBIDE TIPPED TYPES 512 & 514 METRIC



INTERCHANGEABLE PILOT TYPE STRAIGHT SHANK



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 148).

TOOL DIAMETER		DIMENSIONS				TYPE 512		TYPE 514		BOTH TYPES METRIC PRICE	FINISHED TO MODIFIED TOOL DIAMETER							
		MIN CUT DIAM.	PILOT HOLE DIAM.	SHANK DIAM.	OVER-ALL LENGTH	NO. OF FLTS	METRIC EDP NO.	NO. OF FLTS	METRIC EDP NO.		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH										1	2	3	4	5-7	8-14	OVER 14	
6.0	.2362	.1140	.0938	15/64	3 13/16	-	-	3	514060	\$68.80	6.000-6.426	\$93.15	\$76.85	\$71.40	\$68.80	\$66.05	\$63.85	\$60.60
6.5	.2559	.1140	.0938	17/64	3 13/16	-	-	3	514065	81.65	6.427-7.214	106.05	89.70	84.30	81.65	78.90	76.70	73.45
7.0	.2756	.1140	.0938	17/64	3 13/16	-	-	3	514070	81.65	-	-	-	-	-	-	-	
7.5	.2953	.1140	.0938	19/64	3 13/16	-	-	3	514075	75.20	7.215-8.001	99.55	83.25	77.80	75.20	72.45	70.25	67.00
8.0	.3150	.1140	.0938	19/64	3 13/16	-	-	3	514080	75.20	-	-	-	-	-	-	-	
8.5	.3346	.1140	.0938	3/16	3 13/16	-	-	3	514085	92.20	8.002-8.814	116.60	100.30	94.80	92.20	89.45	87.20	84.05
9.0	.3543	.1820	.1562	5/16	4 1/16	-	-	3	514090	78.20	8.815-9.601	100.70	85.65	80.65	78.20	75.70	73.60	70.65
9.5	.3740	.1820	.1562	5/16	4 1/16	-	-	3	514095	78.20	-	-	-	-	-	-	-	
10.0	.3937	.1820	.1562	3/8	4 1/16	-	-	3	514100	86.95	9.602-10.389	109.40	94.40	89.35	86.95	84.40	82.35	79.45
10.5	.4134	.1820	.1562	3/8	4 1/16	-	-	3	514105	79.95	10.390-11.201	102.45	87.40	82.40	79.95	77.50	75.40	72.45
11.0	.4331	.1820	.1562	3/8	4 1/16	-	-	3	514110	79.95	-	-	-	-	-	-	-	
11.5	.4528	.2280	.1875	7/16	4 5/16	-	-	3	514115	95.45	11.202-11.989	117.90	102.90	97.90	95.45	92.90	90.80	87.90
12.0	.4724	.2280	.1875	7/16	4 5/16	4	512120	3	514120	87.70	11.990-12.776	110.15	95.15	90.10	87.70	85.15	83.05	80.05
12.5	.4921	.2280	.1875	7/16	4 5/16	4	512125	3	514125	87.70	-	-	-	-	-	-	-	
13.0	.5118	.2280	.1875	1/2	4 5/16	4	512130	3	514130	97.95	12.777-13.564	120.40	105.35	100.35	97.95	95.40	93.35	90.35
13.5	.5315	.2280	.1875	1/2	4 5/16	4	512135	3	514135	97.95	-	-	-	-	-	-	-	
14.0	.5512	.2280	.1875	1/2	4 5/16	4	512140	3	514140	89.95	13.565-14.376	112.40	97.40	92.40	89.95	87.40	85.35	82.40
14.5	.5709	.2280	.1875	1/2	5 1/8	4	512145	3	514145	98.85	14.377-15.164	121.30	106.25	101.20	98.85	96.30	94.25	91.25
15.0	.5906	.2280	.1875	1/2	5 1/8	4	512150	3	514150	98.85	-	-	-	-	-	-	-	
15.5	.6102	.2280	.1875	1/2	5 1/8	4	512155	3	514155	90.70	15.165-15.951	113.20	98.20	93.15	90.70	88.20	86.15	83.20
16.0	.6299	.2280	.1875	1/2	5 1/8	4	512160	3	514160	104.00	15.952-16.739	126.45	111.40	106.40	104.00	101.45	99.40	96.45
16.5	.6496	.2280	.1875	1/2	5 1/8	4	512165	3	514165	104.00	-	-	-	-	-	-	-	
17.0	.6693	.2280	.1875	1/2	5 1/8	4	512170	3	514170	95.50	16.740-17.551	117.95	102.95	97.95	95.50	93.00	90.90	87.95
17.5	.6890	.2280	.1875	1/2	5 1/8	4	512175	3	514175	95.50	-	-	-	-	-	-	-	
18.0	.7087	.2900	.2500	1/2	5 3/8	4	512180	3	514180	106.25	17.552-18.339	128.75	113.70	108.70	106.25	103.70	101.65	98.65
18.5	.7283	.2900	.2500	1/2	5 3/8	4	512185	3	514185	97.45	18.340-19.126	119.90	104.90	99.90	97.45	94.90	92.80	89.90
19.0	.7480	.2900	.2500	1/2	5 3/8	4	512190	3	514190	97.45	-	-	-	-	-	-	-	
19.5	.7677	.2900	.2500	5/8	5 3/8	4	512195	3	514195	108.25	19.127-19.914	130.70	115.70	110.65	108.25	105.75	103.65	100.70
20.0	.7874	.2900	.2500	5/8	5 3/8	4	512200	3	514200	99.30	19.915-20.726	121.75	106.75	101.70	99.30	96.70	94.65	91.70
20.5	.8071	.2900	.2500	5/8	5 3/8	4	512205	3	514205	99.30	-	-	-	-	-	-	-	
21.0	.8268	.2900	.2500	3/4	5 3/8	4	512210	3	514210	114.10	20.727-21.514	136.55	121.55	116.55	114.10	111.50	109.45	106.50
21.5	.8465	.2900	.2500	3/4	5 3/8	4	512215	3	514215	114.10	-	-	-	-	-	-	-	
22.0	.8661	.2900	.2500	3/4	5 3/8	4	512220	3	514220	104.65	21.515-22.301	127.10	112.10	107.05	104.65	102.10	100.05	97.10
22.5	.8858	.2900	.2500	3/4	6 1/8	4	512225	3	514225	116.20	22.302-23.089	138.70	123.65	118.65	116.20	113.70	111.60	108.70
23.0	.9055	.2900	.2500	3/4	6 1/8	4	512230	3	514230	116.20	-	-	-	-	-	-	-	
23.5	.9252	.2900	.2500	3/4	6 1/8	4	512235	3	514235	106.60	23.090-23.901	129.05	114.05	109.05	106.60	104.05	102.00	99.05
24.0	.9449	.3530	.3125	3/4	6 3/8	4	512240	3	514240	119.30	23.902-24.689	141.75	126.75	121.70	119.30	116.75	114.70	111.70
24.5	.9646	.3530	.3125	3/4	6 3/8	4	512245	3	514245	119.30	-	-	-	-	-	-	-	
25.0	.9843	.3530	.3125	3/4	6 3/8	4	512250	3	514250	109.35	24.690-25.476	131.85	116.80	111.80	109.35	106.85	104.80	101.85
25.5	1.0039	.3530	.3125	3/4	6 3/8	4	512255	3	514255	110.40	25.477-27.076	132.90	117.85	112.90	110.40	107.90	105.85	102.90
26.0	1.0236	.3530	.3125	3/4	6 3/8	4	512260	3	514260	110.40	-	-	-	-	-	-	-	
27.0	1.0630	.3530	.3125	3/4	6 3/8	4	512270	3	514270	110.40	-	-	-	-	-	-	-	
28.0	1.1024	.3530	.3125	1	6 3/8	4	512280	3	514280	113.00	27.077-28.651	135.45	120.40	115.35	113.00	110.40	108.35	105.40
29.0	1.1417	.3530	.3125	1	6 3/8	4	512290	3	514290	117.60	28.652 30.239	140.00	125.00	119.95	117.60	115.05	113.00	110.05
30.0	1.1811	.3530	.3125	1	6 3/8	4	512300	3	514300	117.60	-	-	-	-	-	-	-	
31.0	1.2205	.4260	.3750	1	6 3/8	-	-	4	514310	130.60	30.240-31.826	155.00	138.70	133.25	130.60	127.90	125.60	122.45
32.0	1.2598	.4260	.3750	1	6 3/8	-	-	4	514320	140.10	31.827-33.414	164.55	148.20	142.80	140.10	137.40	135.20	131.95
33.0	1.2992	.4260	.3750	1	6 3/8	-	-	4	514330	140.10	-	-	-	-	-	-	-	
34.0	1.3386	.4260	.3750	1	6 3/8	-	-	4	514340	146.80	33.415-35.001	171.20	154.90	149.40	146.80	144.05	141.80	138.60
35.0	1.3780	.4260	.3750	1	6 3/8	-	-	4	514350	146.80	-	-	-	-	-	-	-	
36.0	1.4173	.4260	.3750	1 1/4	7 7/8	-	-	4	514360	160.80	35.002-36.589	187.30	169.65	163.65	160.80	157.80	155.40	151.95
37.0	1.4567	.4260	.3750	1 1/4	7 7/8	-	-	4	514370	177.85	36.590-38.176	204.35	186.65	180.75	177.85	174.90	172.45	168.95
38.0	1.4961	.4260	.3750	1 1/4	7 7/8	-	-	4	514380	177.85	-	-	-	-	-	-	-	

Modified tool diameters are available up to 50mm-contact us for price.

C'BORES



COUNTERBORES CARBIDE TIPPED TYPES 516 & 518 FRACTIONAL



INTERCHANGEABLE PILOT TYPE TAPER SHANK



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	516 or 518
	40	NON-FERROUS - SHORT CHIPS	516 or 518
	60	CAST IRONS	516 or 518
	80	LOW STRENGTH STEELS	511 ^{MS}
	100	MEDIUM STRENGTH STEELS	511 ^{MS}
	120	HIGH STRENGTH STEELS	511 ^{MS}
140	HIGH TEMPERATURE ALLOYS	516 or 518	

^{MS}See page 152 for Type 511

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Modified metric tool diameter - priced on pg. 151
- Cutting diameter reduced for step
- Corner chamfer or corner radius
- Shank whistle notch for set screw
- Smaller taper shank
- 4 coatings available (listed on page 154)

TYPE 518 – FOUR FLUTES – TAPER SHANK TYPE 516 – THREE/FOUR FLUTES – TAPER SHANK

- Right spiral flutes
- Carbide tips brazed to tough hardened alloy steel body
- Tool diameter tolerance: plus .001", minus .000"
- Detailed specifications on page 145

TOOL DIAMETER		DIMENSIONS					TYPE 518		TYPE 516		BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER					
		MIN CUT DIAM.	PILOT HOLE DIAM.	TAPER SHANK NO.	OVER-ALL LENGTH	NO. OF FLTS	EDP NO.	NO. OF FLTS	EDP NO.	MODIFIED DIAMETER RANGE		PRICE EACH - BASED ON QUANTITY ORDERED					
FRACTIONAL	DECIMAL											1	2	3	4	5-7	8-14*
1/4	.2500	.1140	.0938	1	3 13/16	-	-	3	51608	\$67.70	0.2381-0.2530	\$100.35	\$84.05	\$78.60	\$75.90	\$73.15	\$70.90
5/32	.2812	.1140	.0938	1	3 13/16	-	-	3	51609	81.45	0.2531-0.2840	114.05	97.70	92.25	89.60	86.90	84.60
3/16	.3125	.1140	.0938	1	3 13/16	-	-	3	51610	74.10	0.2841-0.3150	106.70	90.35	84.95	82.25	79.50	77.25
11/32	.3438	.1140	.0938	1	3 13/16	-	-	3	51611	91.25	0.3151-0.3470	123.90	107.55	102.10	99.45	96.70	94.45
3/8	.3750	.1820	.1562	1	4 1/16	-	-	3	51612	76.45	0.3471-0.3780	106.50	91.50	86.45	84.00	81.50	79.45
13/32	.4062	.1820	.1562	1	4 1/16	-	-	3	51613	86.35	0.3781-0.4090	116.45	101.40	96.40	93.90	91.40	89.30
7/16	.4375	.1820	.1562	1	4 1/16	-	-	3	51614	78.55	0.4091-0.4410	108.55	93.55	88.50	86.10	83.55	81.50
15/32	.4688	.2280	.1875	1	4 5/16	-	-	3	51615	95.35	0.4411-0.4720	125.40	110.35	105.35	102.90	100.35	98.30
1/2	.5000	.2280	.1875	1	4 5/16	4	51816	3	51616	86.70	0.4721-0.5030	116.80	101.75	96.70	94.30	91.70	89.65
17/32	.5312	.2280	.1875	1	4 5/16	4	51817	3	51617	97.10	0.5031-0.5340	127.15	112.15	107.10	104.65	102.10	100.05
9/16	.5625	.2280	.1875	1	4 5/16	4	51818	3	51618	88.30	0.5341-0.5660	118.40	103.30	98.35	95.80	93.35	91.25
19/32	.5938	.2280	.1875	2	5 1/8	4	51819	3	51619	99.75	0.5661-0.5970	129.85	114.80	109.80	107.30	104.80	102.70
5/8	.6250	.2280	.1875	2	5 1/8	4	51820	3	51620	90.65	0.5971-0.6280	120.75	105.75	100.70	98.25	95.65	93.60
21/32	.6562	.2280	.1875	2	5 1/8	4	51821	3	51621	105.30	0.6281-0.6590	135.40	120.35	115.30	112.90	110.30	108.25
11/16	.6875	.2280	.1875	2	5 1/8	4	51822	3	51622	95.65	0.6591-0.6910	125.80	110.70	105.75	103.20	100.70	98.60
23/32	.7188	.2900	.2500	2	5 3/8	4	51823	3	51623	107.05	0.6911-0.7220	137.15	122.10	117.10	114.65	112.10	110.05
3/4	.7500	.2900	.2500	2	5 3/8	4	51824	3	51624	97.30	0.7221-0.7530	127.35	112.30	107.30	104.85	102.25	100.20
25/32	.7812	.2900	.2500	2	5 3/8	4	51825	3	51625	108.85	0.7531-0.7840	138.90	123.90	118.85	116.35	113.85	111.80
13/16	.8125	.2900	.2500	2	5 3/8	4	51826	3	51626	99.00	0.7841-0.8160	129.05	114.05	109.05	106.50	104.00	101.95
27/32	.8438	.2900	.2500	2	5 3/8	4	51827	3	51627	114.45	0.8161-0.8470	144.60	129.55	124.55	122.05	119.55	117.45
7/8	.8750	.2900	.2500	2	5 3/8	4	51828	3	51628	104.05	0.8471-0.8780	134.15	119.05	114.10	111.60	109.10	107.00
29/32	.9062	.2900	.2500	3	6 1/8	4	51829	3	51629	117.60	0.8781-0.9090	147.65	132.60	127.65	125.10	122.60	120.55
15/16	.9375	.2900	.2500	3	6 1/8	4	51830	3	51630	106.90	0.9091-0.9410	136.95	121.90	116.90	114.40	111.95	109.85
31/32	.9688	.3530	.3125	3	6 3/8	4	51831	3	51631	120.30	0.9411-0.9720	150.35	135.35	130.35	127.85	125.25	123.20
1	1.0000	.3530	.3125	3	6 3/8	4	51832	3	51632	113.50	0.9721-1.0030	144.75	129.15	123.90	121.35	118.65	116.55
1 1/16	1.0625	.3530	.3125	3	6 3/8	4	51834	3	51634	115.00	1.0031-1.0660	146.15	130.55	125.35	122.80	120.15	118.00
1 1/8	1.1250	.3530	.3125	3	6 3/8	4	51836	3	51636	118.60	1.0661-1.1280	149.85	134.30	129.00	126.45	123.80	121.70
1 3/16	1.1875	.3530	.3125	3	6 3/8	4	51838	3	51638	122.65	1.1281-1.1905	153.95	138.30	133.05	130.50	127.85	125.75
1 1/4	1.2500	.4260	.3750	3	6 5/8	-	-	4	51640	136.35	1.1906-1.2530	170.20	153.25	147.65	144.85	142.00	139.65
1 5/16	1.3125	.4260	.3750	3	6 5/8	-	-	4	51642	146.15	1.2531-1.3155	180.10	163.05	157.50	154.65	151.85	149.50
1 3/8	1.3750	.4260	.3750	3	6 5/8	-	-	4	51644	153.15	1.3156-1.3780	187.00	170.10	164.45	161.65	158.80	156.45
1 7/16	1.4375	.4260	.3750	4	7 7/8	-	-	4	51646	170.35	1.3781-1.4405	207.20	188.80	182.60	179.60	176.50	173.95
1 1/2	1.5000	.4260	.3750	4	7 7/8	-	-	4	51648	188.90	1.4406-1.5030	225.75	207.30	201.20	198.15	195.10	192.50
1 9/16	1.5625	.4890	.4375	4	8 1/8	-	-	4	51650	202.95	1.5031-1.5660	241.50	225.25	215.90	212.65	209.40	206.80
1 5/8	1.6250	.4890	.4375	4	8 1/8	-	-	4	51652	206.60	1.5661-1.6280	245.15	222.90	219.50	216.25	213.00	210.45
1 11/16	1.6875	.4890	.4375	4	8 1/8	-	-	4	51654	247.20	1.6281-1.6910	288.85	268.05	261.15	257.70	254.15	251.30
1 3/4	1.7500	.4890	.4375	4	8 1/8	-	-	4	51656	247.20	1.6911-1.7530	288.85	268.05	261.15	257.70	254.15	251.30
1 13/16	1.8125	.4890	.4375	4	8 1/8	-	-	4	51658	292.60	1.7531-1.8160	334.20	313.40	306.45	303.00	299.50	296.60
1 7/8	1.8750	.4890	.4375	4	8 1/8	-	-	4	51660	292.60	1.8161-1.8780	334.20	313.40	306.45	303.00	299.50	296.60
1 15/16	1.9375	.4890	.4375	4	8 1/8	-	-	4	51662	319.65	1.8781-1.9410	361.30	340.50	333.50	330.15	326.65	323.75
2	2.0000	.5510	.5000	4	8 3/8	-	-	4	51664	319.65	1.9411-2.0030	361.30	340.50	333.50	330.15	326.65	323.75

*Quantities of 15 or more - price of fractional size in same size range.



COUNTERBORES CARBIDE TIPPED TYPES 516 & 518 METRIC



INTERCHANGEABLE PILOT TYPE TAPER SHANK



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 150).

TOOL DIAMETER		DIMENSIONS				TYPE 518		TYPE 516		BOTH TYPES METRIC PRICE	FINISHED TO MODIFIED TOOL DIAMETER							
		MIN CUT DIAM.	PILOT HOLE DIAM.	TAPER SHANK NO.	OVER-ALL LENGTH	NO. OF FLTS	METRIC EDP NO.	NO. OF FLTS	METRIC EDP NO.		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH										1	2	3	4	5-7	8-14	OVER 14	
6.0	.2362	.1140	.0938	1	3 1/16	-	-	3	516060	\$78.60	6.000-6.426	\$102.95	\$86.60	\$81.20	\$78.60	\$75.85	\$73.55	\$70.40
6.5	.2559	.1140	.0938	1	3 1/16	-	-	3	516065	92.25	6.427-7.214	116.65	100.35	94.85	92.25	89.55	87.30	84.10
7.0	.2756	.1140	.0938	1	3 1/16	-	-	3	516070	92.25	-	-	-	-	-	-	-	
7.5	.2953	.1140	.0938	1	3 1/16	-	-	3	516075	84.95	7.215-8.001	109.30	93.00	87.50	84.95	82.20	79.90	76.75
8.0	.3150	.1140	.0938	1	3 1/16	-	-	3	516080	84.95	-	-	-	-	-	-	-	
8.5	.3346	.1140	.0938	1	3 1/16	-	-	3	516085	102.10	8.002-8.814	126.50	110.20	104.80	102.10	99.40	97.20	93.90
9.0	.3543	.1820	.1562	1	4 1/16	-	-	3	516090	86.45	8.815-9.601	108.95	93.90	88.90	86.45	83.90	81.85	78.90
9.5	.3740	.1820	.1562	1	4 1/16	-	-	3	516095	86.45	-	-	-	-	-	-	-	
10.0	.3937	.1820	.1562	1	4 1/16	-	-	3	516100	96.40	9.602-10.389	118.85	103.85	98.85	96.40	93.80	91.75	88.85
10.5	.4134	.1820	.1562	1	4 1/16	-	-	3	516105	88.50	10.390-11.201	111.05	95.95	91.00	88.50	86.00	83.90	80.95
11.0	.4331	.1820	.1562	1	4 1/16	-	-	3	516110	88.50	-	-	-	-	-	-	-	
11.5	.4528	.2280	.1875	1	4 3/16	-	-	3	516115	105.35	11.202-11.989	127.85	112.80	107.80	105.35	102.85	100.75	97.75
12.0	.4724	.2280	.1875	1	4 3/16	4	518120	3	516120	96.70	11.990-12.776	119.25	104.15	99.15	96.70	94.25	92.15	89.20
12.5	.4921	.2280	.1875	1	4 3/16	4	518125	3	516125	96.70	-	-	-	-	-	-	-	
13.0	.5118	.2280	.1875	1	4 3/16	4	518130	3	516130	107.10	12.777-13.564	129.60	114.60	109.50	107.10	104.60	102.55	99.55
13.5	.5315	.2280	.1875	1	4 3/16	4	518135	3	516135	107.10	-	-	-	-	-	-	-	
14.0	.5512	.2280	.1875	1	4 3/16	4	518140	3	516140	98.35	13.565-14.376	120.80	105.80	100.75	98.35	95.75	93.70	90.75
14.5	.5709	.2280	.1875	2	5 1/8	4	518145	3	516145	109.80	14.377-15.164	132.30	117.20	112.20	109.80	107.25	105.15	102.20
15.0	.5906	.2280	.1875	2	5 1/8	4	518150	3	516150	109.80	-	-	-	-	-	-	-	
15.5	.6102	.2280	.1875	2	5 1/8	4	518155	3	516155	100.70	15.165-15.951	123.15	108.15	103.10	100.70	98.20	96.15	93.15
16.0	.6299	.2280	.1875	2	5 1/8	4	518160	3	516160	115.30	15.952-16.739	137.80	122.75	117.75	115.30	112.80	110.70	107.80
16.5	.6496	.2280	.1875	2	5 1/8	4	518165	3	516165	115.30	-	-	-	-	-	-	-	
17.0	.6693	.2280	.1875	2	5 1/8	4	518170	3	516170	105.75	16.740-17.551	128.15	113.15	108.15	105.75	103.15	101.10	98.20
17.5	.6890	.2280	.1875	2	5 1/8	4	518175	3	516175	105.75	-	-	-	-	-	-	-	
18.0	.7087	.2900	.2500	2	5 3/8	4	518180	3	516180	117.10	17.552-18.339	139.55	124.55	119.55	117.10	114.60	112.45	109.50
18.5	.7283	.2900	.2500	2	5 3/8	4	518185	3	516185	107.30	18.340-19.126	129.80	114.75	109.70	107.30	104.80	102.70	99.75
19.0	.7480	.2900	.2500	2	5 3/8	4	518190	3	516190	107.30	-	-	-	-	-	-	-	
19.5	.7677	.2900	.2500	2	5 3/8	4	518195	3	516195	118.85	19.127-19.914	141.35	126.25	121.30	118.85	116.30	114.25	111.30
20.0	.7874	.2900	.2500	2	5 3/8	4	518200	3	516200	109.05	19.915-20.726	131.50	116.45	111.40	109.05	106.45	104.40	101.45
20.5	.8071	.2900	.2500	2	5 3/8	4	518205	3	516205	109.05	-	-	-	-	-	-	-	
21.0	.8268	.2900	.2500	2	5 3/8	4	518210	3	516210	124.55	20.727-21.514	147.05	131.95	126.95	124.55	122.00	119.90	116.95
21.5	.8465	.2900	.2500	2	5 3/8	4	518215	3	516215	124.55	-	-	-	-	-	-	-	
22.0	.8661	.2900	.2500	2	5 3/8	4	518220	3	516220	114.10	21.515-22.301	136.55	121.55	116.55	114.10	111.50	109.45	106.50
22.5	.8858	.2900	.2500	3	6 1/8	4	518225	3	516225	127.65	22.302-23.089	150.10	135.05	130.00	127.65	125.05	123.00	120.00
23.0	.9055	.2900	.2500	3	6 1/8	4	518230	3	516230	127.65	-	-	-	-	-	-	-	
23.5	.9252	.2900	.2500	3	6 1/8	4	518235	3	516235	116.90	23.090-23.901	139.40	124.30	119.35	116.90	114.35	112.30	109.35
24.0	.9449	.3530	.3125	3	6 3/8	4	518240	3	516240	130.35	23.902-24.689	152.80	137.75	132.70	130.35	127.80	125.75	122.75
24.5	.9646	.3530	.3125	3	6 3/8	4	518245	3	516245	130.35	-	-	-	-	-	-	-	
25.0	.9843	.3530	.3125	3	6 3/8	4	518250	3	516250	119.40	24.690-25.476	141.85	126.85	121.80	119.40	116.85	114.80	111.90
25.5	1.0039	.3530	.3125	3	6 3/8	4	518255	3	516255	125.35	25.477-27.076	148.70	133.05	127.85	125.35	122.75	120.60	117.50
26.0	1.0236	.3530	.3125	3	6 3/8	4	518260	3	516260	125.35	-	-	-	-	-	-	-	
27.0	1.0630	.3530	.3125	3	6 3/8	4	518270	3	516270	125.35	-	-	-	-	-	-	-	
28.0	1.1024	.3530	.3125	3	6 3/8	4	518280	3	516280	129.00	27.077-28.651	152.35	136.75	131.55	129.00	126.40	124.25	121.20
29.0	1.1417	.3530	.3125	3	6 3/8	4	518290	3	516290	133.05	28.652-30.239	156.40	140.80	135.60	133.05	130.45	128.30	125.25
30.0	1.1811	.3530	.3125	3	6 3/8	4	518300	3	516300	133.05	-	-	-	-	-	-	-	
31.0	1.2205	.4260	.3750	3	6 5/8	-	-	4	516310	147.65	30.240-31.826	172.95	156.00	150.35	147.65	144.80	142.50	139.10
32.0	1.2598	.4260	.3750	3	6 5/8	-	-	4	516320	157.50	31.827-33.414	182.80	165.85	160.20	157.50	154.60	152.30	148.95
33.0	1.2992	.4260	.3750	3	6 5/8	-	-	4	516330	157.50	-	-	-	-	-	-	-	
34.0	1.3386	.4260	.3750	3	6 5/8	-	-	4	516340	164.45	33.415-35.001	189.80	172.80	167.15	164.45	161.60	159.30	155.90
35.0	1.3780	.4260	.3750	3	6 5/8	-	-	4	516350	164.45	-	-	-	-	-	-	-	
36.0	1.4173	.4260	.3750	4	7 7/8	-	-	4	516360	182.60	35.002-36.589	210.15	191.75	185.60	182.60	179.55	177.05	173.35
37.0	1.4567	.4260	.3750	4	7 7/8	-	-	4	516370	201.20	36.590-38.176	228.70	210.25	204.10	201.20	198.10	195.55	191.95
38.0	1.4961	.4260	.3750	4	7 7/8	-	-	4	516380	201.20	-	-	-	-	-	-	-	

Modified tool diameters are available up to 50mm-contact us for price.

C'BORES



COUNTERBORES - FOR STEELS

CARBIDE TIPPED TYPES 510 & 511 FRACTIONAL

MATERIAL SPECIFIC

INTERCHANGEABLE PILOT TYPE STRAIGHT OR TAPER SHANK



TYPE 510 - STRAIGHT SHANK FOR MACHINING STEELS



TYPE 511 - TAPER SHANK FOR MACHINING STEELS
BOTH TYPES:

- Right spiral flutes
- Carbide tips brazed to tough hardened alloy steel body
- Tool diameter tolerance: plus .001", minus .000"
- Shank diameter tolerance: plus .0000", minus .0005" (Type 510)
- Detailed specifications on page 145

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	514 ^{GP} or 516 ^{GP}
40	NON-FERROUS - SHORT CHIPS	514 ^{GP} or 516 ^{GP}	
60	CAST IRONS	514 ^{GP} or 516 ^{GP}	
80	LOW STRENGTH STEELS	510 or 511	
100	MEDIUM STRENGTH STEELS	510 or 511	
120	HIGH STRENGTH STEELS	510 or 511	
140	HIGH TEMPERATURE ALLOYS	514 ^{GP} or 516 ^{GP}	

^{GP}See page 148 for Type 514, page 150 for Type 516

MODIFICATIONS (For Type 510, see list on page 148. For Type 511, see list on page 150)

USE:

- Special steel cutting grade of carbide and appropriate tool geometry permit the machining of steels, tough steel alloys, and cast steels

TOOL DIAMETER		DIMENSIONS				TYPE 510		TYPE 511		BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
		MIN CUT DIAM.	PILOT HOLE DIAM.	OVER-ALL LENGTH	NO. OF FLTS	SHANK DIAM.	STEEL EDP NO.	TAPER SHANK NO.	STEEL EDP NO.		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRACTIONAL	DECIMAL										1	2	3	4	5-7	8-14*	
1/4	.2500	.1140	.0938	3 13/16	3	15/64	51008	1	51108	\$67.70	0.2381-0.2530	\$100.35	\$84.05	\$78.60	\$75.90	\$73.15	\$70.90
9/32	.2812	.1140	.0938	3 13/16	3	17/64	51009	1	51109	81.45	0.2531-0.2840	114.05	97.70	92.25	89.60	86.90	84.60
5/16	.3125	.1140	.0938	3 13/16	3	19/64	51010	1	51110	74.10	0.2841-0.3150	106.70	90.35	84.95	82.25	79.50	77.25
11/32	.3438	.1140	.0938	3 13/16	3	5/16	51011	1	51111	91.25	0.3151-0.3470	123.90	107.55	102.10	99.45	96.70	94.45
3/8	.3750	.1820	.1562	4 1/16	3	5/16	51012	1	51112	76.45	0.3471-0.3780	106.50	91.50	86.45	84.00	81.50	79.45
13/32	.4062	.1820	.1562	4 1/16	3	3/8	51013	1	51113	86.35	0.3781-0.4090	116.45	101.40	96.40	93.90	91.40	89.30
7/16	.4375	.1820	.1562	4 1/16	3	3/8	51014	1	51114	78.55	0.4091-0.4410	108.55	93.55	88.50	86.10	83.55	81.50
15/32	.4688	.2280	.1875	4 5/16	3	7/16	51015	1	51115	95.35	0.4411-0.4720	125.40	110.35	105.35	102.90	100.35	98.30
1/2	.5000	.2280	.1875	4 5/16	3	7/16	51016	1	51116	86.70	0.4721-0.5030	116.80	101.75	96.70	94.30	91.70	89.65
17/32	.5312	.2280	.1875	4 5/16	3	1/2	51017	1	51117	97.10	0.5031-0.5340	127.15	112.15	107.10	104.65	102.10	100.05
9/16	.5625	.2280	.1875	4 5/16	3	1/2	51018	1	51118	88.30	0.5341-0.5660	118.40	103.30	98.35	95.80	93.35	91.25
19/32	.5938	.2280	.1875	5 1/8	3	1/2	51019	2	51119	99.75	0.5661-0.5970	129.85	114.80	109.80	107.30	104.80	102.70
5/8	.6250	.2280	.1875	5 1/8	3	1/2	51020	2	51120	90.65	0.5971-0.6280	120.75	105.75	100.70	98.25	95.65	93.60
21/32	.6562	.2280	.1875	5 1/8	3	1/2	51021	2	51121	105.30	0.6281-0.6590	135.40	120.35	115.30	112.90	110.30	108.25
11/16	.6875	.2280	.1875	5 1/8	3	1/2	51022	2	51122	95.65	0.6591-0.6910	125.80	110.70	105.75	103.20	100.70	98.60
23/32	.7188	.2900	.2500	5 3/8	3	1/2	51023	2	51123	107.05	0.6911-0.7220	137.15	122.10	117.10	114.65	112.10	110.05
3/4	.7500	.2900	.2500	5 3/8	3	1/2	51024	2	51124	97.30	0.7221-0.7530	127.35	112.30	107.30	104.85	102.25	100.20
25/32	.7812	.2900	.2500	5 3/8	3	5/8	51025	2	51125	108.85	0.7531-0.7840	138.90	123.90	118.85	116.35	113.85	111.80
13/16	.8125	.2900	.2500	5 3/8	3	5/8	51026	2	51126	99.00	0.7841-0.8160	129.05	114.05	109.05	106.50	104.00	101.95
27/32	.8438	.2900	.2500	5 3/8	3	3/4	51027	2	51127	114.45	0.8161-0.8470	144.60	129.55	124.55	122.05	119.55	117.45
7/8	.8750	.2900	.2500	5 3/8	3	3/4	51028	2	51128	104.05	0.8471-0.8780	134.15	119.05	114.10	111.60	109.10	107.00
29/32	.9062	.2900	.2500	6 1/8	3	3/4	51029	3	51129	117.60	0.8781-0.9090	147.65	132.60	127.65	125.10	122.60	120.55
15/16	.9375	.2900	.2500	6 1/8	3	3/4	51030	3	51130	106.90	0.9091-0.9410	136.95	121.90	116.90	114.40	111.95	109.85
31/32	.9688	.3530	.3125	6 3/8	3	3/4	51031	3	51131	120.30	0.9411-0.9720	150.35	135.35	130.35	127.85	125.25	123.20
1	1.0000	.3530	.3125	6 3/8	3	3/4	51032	3	51132	113.50	0.9721-1.0030	144.75	129.15	123.90	121.35	118.65	116.55
1 1/16	1.0625	.3530	.3125	6 3/8	3	3/4	51034	3	51134	115.00	1.0031-1.0660	146.15	130.55	125.35	122.80	120.15	118.00
1 1/8	1.1250	.3530	.3125	6 3/8	3	1	51036	3	51136	118.60	1.0661-1.1280	149.85	134.30	129.00	126.45	123.80	121.70
1 3/16	1.1875	.3530	.3125	6 3/8	3	1	51038	3	51138	122.65	1.1281-1.1905	153.95	138.30	133.05	130.50	127.85	125.75
1 1/4	1.2500	.4260	.3750	6 5/8	4	1	51040	3	51140	136.35	1.1906-1.2530	170.20	153.25	147.65	144.85	142.00	139.65
1 5/16	1.3125	.4260	.3750	6 5/8	4	1	51042	3	51142	146.15	1.2531-1.3155	180.10	163.05	157.50	154.65	151.85	149.50
1 3/8	1.3750	.4260	.3750	6 5/8	4	1	51044	3	51144	153.15	1.3156-1.3780	187.00	170.10	164.45	161.65	158.80	156.45
1 7/16	1.4375	.4260	.3750	7 7/8	4	1 1/4	51046	4	51146	170.35	1.3781-1.4405	207.20	188.80	182.60	179.60	176.50	173.95
1 1/2	1.5000	.4260	.3750	7 7/8	4	1 1/4	51048	4	51148	188.90	1.4406-1.5030	225.75	207.30	201.20	198.15	195.10	192.50
1 9/16	1.5625	.4890	.4375	8 1/8	4	1 1/4	51050	4	51150	202.95	1.5031-1.5660	241.50	222.25	215.90	212.65	209.40	206.80
1 5/8	1.6250	.4890	.4375	8 1/8	4	1 1/4	51052	4	51152	206.60	1.5661-1.6280	245.15	225.90	219.50	216.25	213.00	210.45
1 11/16	1.6875	.4890	.4375	8 1/8	4	1 1/4	51054	4	51154	247.20	1.6281-1.6910	288.85	268.05	261.15	257.70	254.15	251.30
1 3/4	1.7500	.4890	.4375	8 1/8	4	1 1/4	51056	4	51156	247.20	1.6911-1.7530	288.85	268.05	261.15	257.70	254.15	251.30
1 13/16	1.8125	.4890	.4375	8 1/8	4	1 1/2	51058	4	51158	292.60	1.7531-1.8160	334.20	313.40	306.45	303.00	299.50	296.60
1 7/8	1.8750	.4890	.4375	8 1/8	4	1 1/2	51060	4	51160	292.60	1.8161-1.8780	334.20	313.40	306.45	303.00	299.50	296.60
1 15/16	1.9375	.4890	.4375	8 1/8	4	1 1/2	51062	4	51162	319.65	1.8781-1.9410	361.30	340.50	333.50	330.15	326.65	323.75
2	2.0000	.5510	.5000	8 3/8	4	1 1/2	51064	4	51164	319.65	1.9411-2.0030	361.30	340.50	333.50	330.15	326.65	323.75

*Quantities of 15 or more - price of fractional size in same size range.



COUNTERBORES - FOR STEELS

CARBIDE TIPPED TYPES 510 & 511 METRIC

MATERIAL SPECIFIC

INTERCHANGEABLE PILOT TYPE STRAIGHT OR TAPER SHANK



NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Modifications available (Type 510 see page 148, type 511 see page 150).

TOOL DIAMETER		DIMENSIONS				TYPE 510		TYPE 511		BOTH TYPES METRIC PRICE	FINISHED TO MODIFIED TOOL DIAMETER							
		MIN CUT DIAM.	PILOT HOLE DIAM.	OVER-ALL LENGTH	NO. OF FLTS	SHANK DIAM.	STEEL METRIC EDP NO.	TAPER SHANK NO.	STEEL METRIC EDP NO.		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH										1	2	3	4	5-7	8-14	OVER 14	
6.0	.2362	.1140	.0938	3 1/16	3	15/64	510060	1	511060	\$78.60	6.000-6.426	\$102.95	\$86.60	\$81.20	\$78.60	\$75.85	\$73.55	\$70.40
6.5	.2559	.1140	.0938	3 1/16	3	17/64	510065	1	511065	92.25	6.427-7.214	116.65	100.35	94.85	92.25	89.55	87.30	84.10
7.0	.2756	.1140	.0938	3 1/16	3	17/64	510070	1	511070	92.25	-	-	-	-	-	-	-	
7.5	.2953	.1140	.0938	3 1/16	3	19/64	510075	1	511075	84.95	7.215-8.001	109.30	93.00	87.50	84.95	82.20	79.90	76.75
8.0	.3150	.1140	.0938	3 1/16	3	19/64	510080	1	511080	84.95	-	-	-	-	-	-	-	
8.5	.3346	.1140	.0938	3 1/16	3	5/16	510085	1	511085	102.10	8.002-8.814	126.50	110.20	104.80	102.10	99.40	97.20	93.90
9.0	.3543	.1820	.1562	4 1/16	3	5/16	510090	1	511090	86.45	8.815-9.601	108.95	93.90	88.90	86.45	83.90	81.85	78.90
9.5	.3740	.1820	.1562	4 1/16	3	5/16	510095	1	511095	86.45	-	-	-	-	-	-	-	
10.0	.3937	.1820	.1562	4 1/16	3	3/8	510100	1	511100	96.40	9.602-10.389	118.85	103.85	98.85	96.40	93.80	91.75	88.85
10.5	.4134	.1820	.1562	4 1/16	3	3/8	510105	1	511105	88.50	10.390-11.201	111.05	95.95	91.00	88.50	86.00	83.90	80.95
11.0	.4331	.1820	.1562	4 1/16	3	3/8	510110	1	511110	88.50	-	-	-	-	-	-	-	
11.5	.4528	.2280	.1875	4 5/16	3	7/16	510115	1	511115	105.35	11.202-11.989	127.85	112.80	107.80	105.35	102.85	100.75	97.75
12.0	.4724	.2280	.1875	4 5/16	3	7/16	510120	1	511120	96.70	11.990-12.776	119.25	104.15	99.15	96.70	94.25	92.15	89.20
12.5	.4921	.2280	.1875	4 5/16	3	7/16	510125	1	511125	96.70	-	-	-	-	-	-	-	
13.0	.5118	.2280	.1875	4 5/16	3	1/2	510130	1	511130	107.10	12.777-13.564	129.60	114.60	109.50	107.10	104.60	102.55	99.55
13.5	.5315	.2280	.1875	4 5/16	3	1/2	510135	1	511135	107.10	-	-	-	-	-	-	-	
14.0	.5512	.2280	.1875	4 5/16	3	1/2	510140	1	511140	98.35	13.565-14.376	120.80	105.80	100.75	98.35	95.75	93.70	90.75
14.5	.5709	.2280	.1875	5 1/8	3	1/2	510145	2	511145	109.80	14.377-15.164	132.30	117.20	112.20	109.80	107.25	105.15	102.20
15.0	.5906	.2280	.1875	5 1/8	3	1/2	510150	2	511150	109.80	-	-	-	-	-	-	-	
15.5	.6102	.2280	.1875	5 1/8	3	1/2	510155	2	511155	100.70	15.165-15.951	123.15	108.15	103.10	100.70	98.20	96.15	93.15
16.0	.6299	.2280	.1875	5 1/8	3	1/2	510160	2	511160	100.70	15.952-16.739	123.15	108.15	103.10	100.70	98.20	96.15	93.15
16.5	.6496	.2280	.1875	5 1/8	3	1/2	510165	2	511165	115.30	-	-	-	-	-	-	-	
17.0	.6693	.2280	.1875	5 1/8	3	1/2	510170	2	511170	105.75	16.740-17.551	128.15	113.15	108.15	105.75	103.15	101.10	98.20
17.5	.6890	.2280	.1875	5 1/8	3	1/2	510175	2	511175	105.75	-	-	-	-	-	-	-	
18.0	.7087	.2900	.2500	5 3/8	3	1/2	510180	2	511180	117.10	17.552-18.339	139.55	124.55	119.55	117.10	114.60	112.45	109.50
18.5	.7283	.2900	.2500	5 3/8	3	1/2	510185	2	511185	107.30	18.340-19.126	129.80	114.75	109.70	107.30	104.80	102.70	99.75
19.0	.7480	.2900	.2500	5 3/8	3	1/2	510190	2	511190	107.30	-	-	-	-	-	-	-	
19.5	.7677	.2900	.2500	5 3/8	3	5/8	510195	2	511195	118.85	19.127-19.914	141.35	126.25	121.30	118.85	116.30	114.25	111.30
20.0	.7874	.2900	.2500	5 3/8	3	5/8	510200	2	511200	109.05	19.915-20.726	131.50	116.45	111.40	109.05	106.45	104.40	101.45
20.5	.8071	.2900	.2500	5 3/8	3	5/8	510205	2	511205	109.05	-	-	-	-	-	-	-	
21.0	.8268	.2900	.2500	5 3/8	3	3/4	510210	2	511210	124.55	20.727-21.514	147.05	131.95	126.95	124.55	122.00	119.90	116.95
21.5	.8465	.2900	.2500	5 3/8	3	3/4	510215	2	511215	124.55	-	-	-	-	-	-	-	
22.0	.8661	.2900	.2500	5 3/8	3	3/4	510220	2	511220	114.10	21.515-22.301	136.55	121.55	116.55	114.10	111.50	109.45	106.50
22.5	.8858	.2900	.2500	6 1/8	3	3/4	510225	3	511225	127.65	22.302-23.089	150.10	135.05	130.00	127.65	125.05	123.00	120.00
23.0	.9055	.2900	.2500	6 1/8	3	3/4	510230	3	511230	127.65	-	-	-	-	-	-	-	
23.5	.9252	.2900	.2500	6 1/8	3	3/4	510235	3	511235	116.90	23.090-23.901	139.40	124.30	119.35	116.90	114.35	112.30	109.35
24.0	.9449	.3530	.3125	6 3/8	3	3/4	510240	3	511240	130.35	23.902-24.689	152.80	137.75	132.70	130.35	127.80	125.75	122.75
24.5	.9646	.3530	.3125	6 3/8	3	3/4	510245	3	511245	130.35	-	-	-	-	-	-	-	
25.0	.9843	.3530	.3125	6 3/8	3	3/4	510250	3	511250	119.40	24.690-25.476	141.85	126.85	121.80	119.40	116.85	114.80	111.90
25.5	1.0039	.3530	.3125	6 3/8	3	3/4	510255	3	511255	125.35	25.477-27.076	148.70	133.05	127.85	125.35	122.75	120.60	117.50
26.0	1.0236	.3530	.3125	6 3/8	3	3/4	510260	3	511260	125.35	-	-	-	-	-	-	-	
27.0	1.0630	.3530	.3125	6 3/8	3	3/4	510270	3	511270	125.35	-	-	-	-	-	-	-	
28.0	1.1024	.3530	.3125	6 3/8	3	1	510280	3	511280	129.00	27.077-28.651	152.35	136.75	131.55	129.00	126.40	124.25	121.20
29.0	1.1417	.3530	.3125	6 3/8	3	1	510290	3	511290	133.05	28.652-30.239	156.40	140.80	135.60	133.05	130.45	128.30	125.25
30.0	1.1811	.3530	.3125	6 3/8	3	1	510300	3	511300	133.05	-	-	-	-	-	-	-	
31.0	1.2205	.4260	.3750	6 5/8	4	1	510310	3	511310	147.65	30.240-31.826	172.95	156.00	150.35	147.65	144.80	142.50	139.10
32.0	1.2598	.4260	.3750	6 5/8	4	1	510320	3	511320	157.50	31.827-33.414	182.80	165.85	160.20	157.50	154.60	152.30	148.95
33.0	1.2992	.4260	.3750	6 5/8	4	1	510330	3	511330	157.50	-	-	-	-	-	-	-	
34.0	1.3386	.4260	.3750	6 5/8	4	1	510340	3	511340	164.45	33.415-35.001	189.80	172.80	167.15	164.45	161.60	159.30	155.90
35.0	1.3780	.4260	.3750	6 5/8	4	1	510350	3	511350	164.45	-	-	-	-	-	-	-	
36.0	1.4173	.4260	.3750	7 7/8	4	1 1/4	510360	4	511360	182.60	35.002-36.589	210.15	191.75	185.60	182.60	179.55	177.05	173.35
37.0	1.4567	.4260	.3750	7 7/8	4	1 1/4	510370	4	511370	201.20	36.590-38.176	228.70	210.25	204.10	201.20	198.10	195.55	191.95
38.0	1.4961	.4260	.3750	7 7/8	4	1 1/4	510380	4	511380	201.20	-	-	-	-	-	-	-	

Modified tool diameters are available up to 50mm-contact us for price.

C'BORES



COUNTERBORES CARBIDE TIPPED TYPES 575 & 576 FRACTIONAL

MATERIAL SPECIFIC

STUB TAPER SHANK - TWO TYPES: FOR NON-FERROUS & CAST IRONS OR FOR STEELS



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	575
	40	NON-FERROUS - SHORT CHIPS	575
	60	CAST IRONS	575
	80	LOW STRENGTH STEELS	576
	100	MEDIUM STRENGTH STEELS	576
	120	HIGH STRENGTH STEELS	576
140	HIGH TEMPERATURE ALLOYS	575	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Cutting diameter reduced for step
- Corner chamfer or corner radius
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

STUB TAPER SHANK: TYPE 575 - FOR NON-FERROUS MATERIALS AND CAST IRONS TYPE 576 - FOR STEELS

- 10° right spiral flutes
- Body length = 1/4" through 1.9410" tool diameter; 1/2" above 1.9410" tool diameter
- Tool diameter tolerance: plus .001", minus .000"
- Both types will accept only short shank pilots (see page 158)
- Stub taper dimensions conform to ASME/ANSI B5.10 specifications
- Tool geometry and carbide grade appropriate for material being machined

TOOL DIAMETER		DIMENSIONS						TYPE 575 N-F/CI EDP NO.	TYPE 576 STEEL EDP NO.	BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL	MIN. CUT DIAM.	PILOT HOLE DIAM.	STUB TAPER NO.	LENGTH		NO. OF FLTS				MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
					CARBIDE	OVER-ALL					1	2	3	4	5-7	8-14*	
1/2	.5000	.2188	.1875	1	3/4	2 9/16	3	57516	57616	\$153.10	0.4721-0.5030	\$211.45	\$182.30	\$172.55	\$167.75	\$162.85	\$158.80
9/16	.5625	.2188	.1875	1	3/4	2 9/16	3	57518	57618	153.10	0.5341-0.5660	211.45	182.30	172.55	167.75	162.85	158.80
5/8	.6250	.2188	.1875	1	3/4	2 9/16	3	57520	57620	153.10	0.5971-0.6280	211.45	182.30	172.55	167.75	162.85	158.80
11/16	.6875	.2188	.1875	1	3/4	2 9/16	3	57522	57622	153.10	0.6591-0.6910	211.45	182.30	172.55	167.75	162.85	158.80
3/4	.7500	.2969	.2500	2	3/4	2 7/8	4	57524	57624	143.50	0.7221-0.7530	201.80	172.75	162.95	158.20	153.30	149.25
13/16	.8125	.2969	.2500	2	3/4	2 7/8	4	57526	57626	143.50	0.7841-0.8160	201.80	172.75	162.95	158.20	153.30	149.25
7/8	.8750	.2969	.2500	2	3/4	2 7/8	4	57528	57628	143.50	0.8471-0.8780	201.80	172.75	162.95	158.20	153.30	149.25
15/16	.9375	.2969	.2500	2	3/4	2 7/8	4	57530	57630	138.40	0.9091-0.9410	196.75	167.60	157.85	153.05	148.20	144.15
1	1.0000	.3594	.3125	2	3/4	2 7/8	4	57532	57632	138.40	0.9721-1.0030	196.75	167.60	157.85	153.05	148.20	144.15
1 1/16	1.0625	.3594	.3125	2	3/4	2 7/8	4	57534	57634	138.40	1.0031-1.0660	196.75	167.60	157.85	153.05	148.20	144.15
1 1/8	1.1250	.3594	.3125	2	3/4	2 7/8	4	57536	57636	138.40	1.0661-1.1280	196.75	167.60	157.85	153.05	148.20	144.15
1 3/16	1.1875	.3594	.3125	2	3/4	2 7/8	4	57538	57638	143.50	1.1281-1.1905	201.80	172.75	162.95	158.20	153.30	149.25
1 1/4	1.2500	.3594	.3125	2	3/4	2 7/8	4	57540	57640	143.50	1.1906-1.2530	201.80	172.75	162.95	158.20	153.30	149.25
1 5/16	1.3125	.3594	.3125	2	3/4	2 7/8	4	57542	57642	145.80	1.2531-1.3155	204.10	174.95	165.25	160.40	155.55	151.50
1 3/8	1.3750	.3594	.3125	2	3/4	2 7/8	4	57544	57644	160.65	1.3156-1.3780	218.95	189.85	180.10	175.30	170.45	166.40
1 7/16	1.4375	.3594	.3125	2	1/2	2 7/8	4	57546	57646	175.50	1.3781-1.4405	233.75	204.65	194.90	190.10	185.20	181.10
1 1/2	1.5000	.3594	.3125	2	1/2	2 7/8	4	57548	57648	190.20	1.4406-1.5030	248.55	219.40	209.65	204.85	200.00	195.95
1 5/8	1.5625	.4844	.4375	3	1/2	3 3/16	6	57550	57650	202.55	1.5031-1.5660	260.90	231.70	222.00	217.25	212.35	208.30
1 5/8	1.6250	.4844	.4375	3	1/2	3 3/16	6	57552	57652	227.30	1.5661-1.6280	285.55	256.45	246.75	241.90	237.00	232.95
1 11/16	1.6875	.4844	.4375	3	1/2	3 3/16	6	57554	57654	246.95	1.6281-1.6910	305.30	276.15	266.40	261.60	256.75	252.70
1 3/4	1.7500	.4844	.4375	3	1/2	3 3/16	6	57556	57656	266.75	1.6911-1.7530	325.00	295.90	286.20	281.35	276.45	272.45
1 13/16	1.8125	.4844	.4375	3	1/2	3 3/16	6	57558	57658	281.65	1.7531-1.8160	340.00	310.85	301.05	296.30	291.40	287.40
1 7/8	1.8750	.4844	.4375	3	1/2	3 3/16	6	57560	57660	296.35	1.8161-1.8780	354.65	325.50	315.80	310.95	306.05	302.05
1 15/16	1.9375	.4844	.4375	3	1/2	3 3/16	6	57562	57662	311.30	1.8781-1.9410	369.60	340.45	330.75	325.95	321.10	317.00
2	2.0000	.5625	.5000	4	1/2	3 3/4	6	57564	57664	326.00	1.9411-2.0030	384.25	355.25	345.45	340.65	335.80	331.70
2 1/8	2.1250	.5625	.5000	4	1/2	3 3/4	6	57568	57668	335.90	2.0661-2.1280	394.20	365.05	355.35	350.50	345.65	341.60
2 1/4	2.2500	.5625	.5000	4	1/2	3 3/4	6	57572	57672	345.60	2.1906-2.2530	403.90	374.80	365.00	360.25	355.35	351.30
2 3/8	2.3750	.5625	.5000	4	1/2	3 3/4	6	57576	57676	371.70	2.3156-2.3780	432.10	401.90	391.80	386.85	381.80	377.60
2 1/2	2.5000	.5625	.5000	4	1/2	3 3/4	6	57580	57680	384.60	2.4406-2.5030	445.15	414.90	404.80	399.80	394.75	390.55
2 3/4	2.7500	.5625	.5000	4	1/2	3 3/4	6	57588	57688	405.05	2.6911-2.7530	465.50	435.30	425.15	420.20	415.15	411.00
3	3.0000	.5625	.5000	4	1/2	3 3/4	6	57596	57696	425.45	2.9411-3.0030	485.90	455.75	445.60	440.60	435.55	431.35

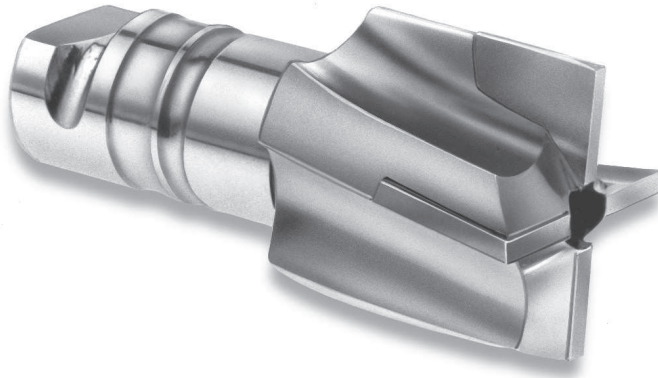
*Quantities of 15 or more - price of fractional size in same size range.



COUNTERBORES CARBIDE TIPPED TYPES 573 & 574 FRACTIONAL



**PIN DRIVE - TWO TYPES:
FOR NON-FERROUS & CAST IRONS OR
FOR STEELS**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	573
	40	NON-FERROUS - SHORT CHIPS	573
	60	CAST IRONS	573
	80	LOW STRENGTH STEELS	574
	100	MEDIUM STRENGTH STEELS	574
	120	HIGH STRENGTH STEELS	574
	140	HIGH TEMPERATURE ALLOYS	573

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Cutting diameter reduced for step
- Coatings available:

TITANIUM NITRIDE - TiN
TITANIUM CARBONITRIDE - TiCN
ZIRCONIUM NITRIDE - ZrN
AL TITANIUM NITRIDE - AlTiN

**PIN DRIVE:
TYPE 573 - FOR NON-FERROUS MATERIALS AND CAST IRONS
TYPE 574 - FOR STEELS**

- 10° right spiral flutes
- Body length = 1 3/8"
- Tool diameter tolerance: plus .001", minus .000"
- Counterbore's set screw design accepts short shank pilots (see page 158)
- Tool geometry and carbide grade appropriate for material being machined

USE:

- Pin drive shank may also be used in straight shank holder or collet

TOOL DIAMETER		DIMENSIONS							TYPE 573 N-F/CI EDP NO.	TYPE 574 STEEL EDP NO.	BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL	MIN. CUT DIAM.	PILOT HOLE DIAM.	PIN DRIVE NO.	SHANK DIAM.	LENGTH		NO. OF FLTS				MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						CARBIDE	OVER-ALL					1	2	3	4	5-7	8-14*	
1/2	.5000	.2188	.1875	1	3/16	3/4	2 7/8	3	57316	57416	\$126.00	0.4721-.05030	\$186.65	\$156.35	\$146.15	\$141.20	\$136.10	\$131.90
5/16	.5625	.2188	.1875	1	3/16	3/4	2 7/8	3	57318	57418	126.00	0.5341-.05660	186.65	156.35	146.15	141.20	136.10	131.90
3/8	.6250	.2188	.1875	1	3/16	3/4	2 7/8	3	57320	57420	126.00	0.5971-.06280	186.65	156.35	146.15	141.20	136.10	131.90
1/4	.6875	.2969	.2500	1	3/16	3/4	2 7/8	3	57322	57422	118.40	0.6591-.06910	179.00	148.70	138.60	133.65	128.55	124.30
3/4	.7500	.2969	.2500	1	3/16	3/4	2 7/8	3	57324	57424	118.40	0.7221-.07530	179.00	148.70	138.60	133.65	128.55	124.30
13/16	.8125	.2969	.2500	1	3/16	3/4	2 7/8	4	57326	57426	118.40	0.7841-.08160	179.00	148.70	138.60	133.65	128.55	124.30
7/8	.8750	.2969	.2500	1	3/16	3/4	2 7/8	4	57328	57428	118.40	0.8471-.08780	179.00	148.70	138.60	133.65	128.55	124.30
15/16	.9375	.2969	.2500	1	3/16	3/4	2 7/8	4	57330	57430	121.05	0.9091-.09410	181.70	151.40	141.30	136.30	131.20	127.00
1	1.0000	.2969	.2500	1	3/16	3/4	2 7/8	4	57332	57432	123.30	0.9721-.10030	183.90	153.65	143.45	138.45	133.40	129.20
1 1/16	1.0625	.2969	.2500	1	3/16	3/4	2 7/8	4	57334	57434	136.30	1.0031-.10660	196.90	166.65	156.50	151.50	146.40	142.25
1 1/8	1.1250	.3594	.3125	2	7/8	3/4	3	4	57335	57435	144.00	1.0031-.10660	204.60	174.35	164.20	159.20	154.10	149.95
1 1/4	1.1250	.2969	.2500	1	3/16	3/4	2 7/8	4	57336	57436	136.30	1.0661-.11280	196.90	166.65	156.50	151.50	146.40	142.25
1 1/8	1.1250	.3594	.3125	2	7/8	3/4	3	4	57337	57437	144.00	1.0661-.11280	204.60	174.35	164.20	159.20	154.10	149.95
1 1/16	1.1875	.3594	.3125	2	7/8	3/4	3	4	57338	57438	149.25	1.1281-.11905	209.95	179.65	169.50	164.50	159.45	155.25
1 1/4	1.2500	.3594	.3125	2	7/8	3/4	3	4	57340	57440	149.25	1.1906-.12530	209.95	179.65	169.50	164.50	159.45	155.25
1 1/8	1.3125	.3594	.3125	2	7/8	3/4	3	4	57342	57442	151.65	1.2531-.13155	212.30	182.00	171.85	166.85	161.80	157.60
1 3/8	1.3750	.3594	.3125	2	7/8	3/4	3	4	57344	57444	151.65	1.3156-.13780	212.30	182.00	171.85	166.85	161.80	157.60
1 1/16	1.4375	.3594	.3125	2	7/8	1/2	3	4	57346	57446	159.30	1.3781-.14405	219.90	189.65	179.45	174.50	169.40	165.20
1 1/2	1.5000	.3594	.3125	2	7/8	1/2	3	4	57348	57448	167.15	1.4406-.15030	227.70	197.45	187.30	182.30	177.20	173.00
1 1/8	1.5625	.3594	.3125	2	7/8	1/2	3	4	57350	57450	179.70	1.5031-.15660	240.35	210.05	199.95	194.90	189.85	185.65
1 5/8	1.6250	.3594	.3125	2	7/8	1/2	3	4	57352	57452	187.55	1.5661-.16280	248.15	217.90	207.80	202.80	197.75	193.55
1 1/16	1.6875	.3594	.3125	2	7/8	1/2	3	4	57354	57454	195.20	1.6281-.16910	255.90	225.50	215.45	210.45	205.40	201.20
1 3/4	1.7500	.3594	.3125	2	7/8	1/2	3	4	57356	57456	205.60	1.6911-.17530	266.20	235.90	225.80	220.80	215.75	211.55
1 3/8	1.7500	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57357	57457	234.00	1.6911-.17530	294.70	264.40	254.25	249.25	244.20	240.00
1 7/8	1.8750	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57360	57460	234.00	1.8161-.18780	294.70	264.40	254.25	249.25	244.20	240.00
2	2.0000	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57364	57464	264.90	1.9411-.20030	325.45	295.25	285.10	280.15	275.00	270.80
2 1/8	2.1250	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57368	57468	272.25	2.0661-.21280	332.85	302.60	292.45	287.45	282.40	278.20
2 1/4	2.2500	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57372	57472	282.60	2.1906-.22530	343.30	312.95	302.85	297.85	292.80	288.60
2 3/8	2.3750	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57376	57476	317.10	2.3156-.23780	380.10	348.60	338.15	332.90	327.65	323.30
2 1/2	2.5000	.5625	.5000	3	1 1/4	1/2	3 1/16	6	57380	57480	341.05	2.4406-.25030	404.00	372.55	362.00	356.85	351.60	347.25
2 3/4	2.7500	.5625	.5000	3	1 1/4	1/2	3 1/16	6	57388	57488	378.60	2.6911-.27530	441.50	410.05	399.55	394.35	389.10	384.75
3	3.0000	.5625	.5000	3	1 1/4	1/2	3 1/16	6	57396	57496	399.95	2.9411-.30030	462.95	431.50	421.00	415.80	410.55	406.20

*Quantities of 15 or more - price of fractional size in same size range.

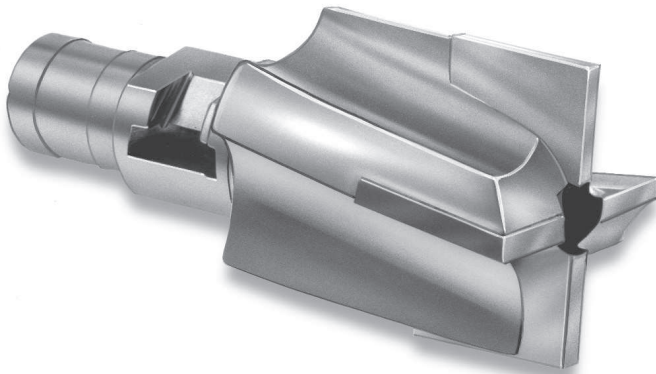
C'BORES



COUNTERBORES CARBIDE TIPPED TYPES 577 & 578 FRACTIONAL



**RADIAL DRIVE - TWO TYPES:
FOR NON-FERROUS & CAST IRONS OR
FOR STEELS**



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	577
	40	NON-FERROUS - SHORT CHIPS	577
	60	CAST IRONS	577
	80	LOW STRENGTH STEELS	578
	100	MEDIUM STRENGTH STEELS	578
	120	HIGH STRENGTH STEELS	578
140	HIGH TEMPERATURE ALLOYS	577	

MODIFICATIONS (Prompt delivery)

- Modified tool diameter - priced below
- Metric tool diameter
- Cutting diameter reduced for step
- Corner chamfer or corner radius
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

**RADIAL DRIVE:
TYPE 577 - FOR NON-FERROUS MATERIALS AND CAST IRONS
TYPE 578 - FOR STEELS**

- 10° right spiral flutes
- Body length = 1 1/2"
- Tool diameter tolerance: plus .001", minus .000"
- Counterbore's set screw design accepts short shank pilots (see page 158)
- Tool geometry and carbide grade appropriate for material being machined

C'BORES

TOOL DIAMETER		DIMENSIONS							TYPE 577 N-F/CI EDP NO.	TYPE 578 STEEL EDP NO.	BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL	MIN. CUT DIAM.	PILOT HOLE DIAM.	RADIAL DRIVE SIZE	LARGE SHANK DIAM.	CARBIDE	OVER-ALL	NO. OF FLTS				MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
											1	2	3	4	5-7	8-14*		
1/2	.5000	.2188	.1875	RB	5/8	3/4	2 7/8	3	57716	57816	\$131.20	0.4721-0.5030	\$191.80	\$161.60	\$151.40	\$146.40	\$141.35	\$137.15
9/16	.5625	.2188	.1875	RB	5/8	3/4	2 7/8	3	57718	57818	131.20	0.5341-0.5660	191.80	161.60	151.40	146.40	141.35	137.15
5/8	.6250	.2188	.1875	RB	5/8	3/4	2 7/8	3	57720	57820	131.20	0.5971-0.6280	191.80	161.60	151.40	146.40	141.35	137.15
11/16	.6875	.2969	.2500	RB	5/8	3/4	2 7/8	3	57722	57822	131.20	0.6591-0.6910	191.80	161.60	151.40	146.40	141.35	137.15
3/4	.7500	.2969	.2500	RB	5/8	3/4	2 7/8	4	57724	57824	131.20	0.7221-0.7530	191.80	161.60	151.40	146.40	141.35	137.15
13/16	.8125	.2969	.2500	RB	5/8	3/4	2 7/8	4	57726	57826	133.70	0.7841-0.8160	194.30	164.00	153.85	148.90	143.85	139.60
7/8	.8750	.2969	.2500	RB	5/8	3/4	2 7/8	4	57728	57828	133.70	0.8471-0.8780	194.30	164.00	153.85	148.90	143.85	139.60
15/16	.9375	.2969	.2500	RB	5/8	3/4	2 7/8	4	57730	57830	141.50	0.9091-0.9410	202.10	171.85	161.70	156.70	151.65	147.45
1	1.0000	.2969	.2500	RB	5/8	3/4	2 7/8	4	57732	57832	141.50	0.9721-1.0030	202.10	171.85	161.70	156.70	151.65	147.45
1	1.0000	.3594	.3125	RC	3/4	3/4	2 7/8	4	57733	57833	144.00	0.9721-1.0030	204.60	174.35	164.20	159.20	154.10	149.95
1 1/16	1.0625	.3594	.3125	RC	3/4	3/4	2 7/8	4	57734	57834	144.00	1.0031-1.0660	204.60	174.35	164.20	159.20	154.10	149.95
1 1/8	1.1250	.3594	.3125	RC	3/4	3/4	2 7/8	4	57736	57836	144.00	1.0661-1.1280	204.60	174.35	164.20	159.20	154.10	149.95
1 1/16	1.1875	.3594	.3125	RC	3/4	3/4	2 7/8	4	57738	57838	154.10	1.1281-1.1905	214.70	184.45	174.35	169.35	164.30	160.10
1 1/4	1.2500	.3594	.3125	RC	3/4	3/4	2 7/8	4	57740	57840	154.10	1.1906-1.2530	214.70	184.45	174.35	169.35	164.30	160.10
1 5/16	1.3125	.3594	.3125	RC	3/4	3/4	2 7/8	4	57742	57842	154.10	1.2531-1.3155	214.70	184.45	174.35	169.35	164.30	160.10
1 3/8	1.3750	.3594	.3125	RC	3/4	3/4	2 7/8	4	57744	57844	154.10	1.3156-1.3780	214.70	184.45	174.35	169.35	164.30	160.10
1 3/8	1.3750	.3594	.3125	RE	1	3/4	3	4	57745	57845	167.15	1.3151-1.3780	227.70	197.45	187.30	182.30	177.20	173.00
1 1/2	1.5000	.3594	.3125	RE	1	1/2	3	4	57748	57848	187.55	1.4406-1.5030	248.15	217.90	207.80	202.80	197.75	193.55
1 1/2	1.5000	.4844	.4375	RF	1 1/8	1/2	3 1/16	4	57749	57849	195.20	1.4406-1.5030	255.90	225.55	215.45	210.45	205.40	201.20
1 5/8	1.6250	.3594	.3125	RE	1	1/2	3	4	57752	57852	195.20	1.5661-1.6280	255.90	225.55	215.45	210.45	205.40	201.20
1 5/8	1.6250	.4844	.4375	RF	1 1/8	1/2	3 1/16	4	57753	57853	200.50	1.5661-1.6280	261.15	230.85	220.75	215.75	210.70	206.50
1 3/4	1.7500	.4844	.4375	RF	1 1/8	1/2	3 1/16	6	57756	57856	246.50	1.6911-1.7530	307.10	276.85	266.75	261.75	256.70	252.50
1 7/8	1.8750	.4844	.4375	RF	1 1/8	1/2	3 1/16	6	57760	57860	259.50	1.8161-1.8780	320.10	289.80	279.70	274.70	269.60	265.40
2	2.0000	.4844	.4375	RF	1 1/8	1/2	3 1/16	6	57764	57864	282.60	1.9411-2.0030	343.30	312.95	302.85	297.85	292.80	288.60
2	2.0000	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57765	57865	282.60	1.9411-2.0030	343.30	312.95	302.85	297.85	292.80	288.60
2 1/8	2.1250	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57768	57868	290.30	2.0661-2.1280	350.90	320.70	310.55	305.55	300.50	296.30
2 1/4	2.2500	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57772	57872	303.00	2.1906-2.2530	363.70	333.40	323.25	318.25	313.20	309.00
2 3/8	2.3750	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57776	57876	319.85	2.3156-2.3780	382.80	351.30	340.80	335.70	330.35	325.95
2 1/2	2.5000	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57780	57880	333.35	2.4406-2.5030	396.30	364.85	354.30	349.15	343.90	339.55
2 5/8	2.6250	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57784	57884	341.05	2.5661-2.6280	404.00	372.55	362.00	356.85	351.60	347.25
2 3/4	2.7500	.5625	.5000	RS	1 3/4	1/2	3 1/8	6	57788	57888	346.50	2.6911-2.7530	409.40	378.00	367.50	362.30	357.10	352.70
2 7/8	2.8750	.5625	.5000	RS	1 3/4	1/2	3 1/8	6	57792	57892	365.25	2.8161-2.8780	428.15	396.70	386.25	381.00	375.75	371.40
3	3.0000	.5625	.5000	RS	1 3/4	1/2	3 1/8	6	57796	57896	391.90	2.9411-3.0030	454.75	423.35	412.85	407.70	402.40	398.00

*Quantities of 15 or more - price of fractional size in same size range.



CAPSCREW COUNTERBORES CARBIDE TIPPED TYPES 513 & 515 FRACTIONAL & METRIC



STRAIGHT SHANK FOR NON-FERROUS, CAST IRON AND STEEL



TYPE 513 - STRAIGHT SHANK - FOR NON-FERROUS AND CAST IRONS
TYPE 515 - STRAIGHT SHANK - FOR STEELS

- Right spiral smooth flutes
- Carbide tips brazed to tough hardened alloy steel bodies
- Integral pilot types
- Tools are designed with appropriate carbide grade and tool geometry for material being machined. The pilot is manufactured in nominal screw body diameters as well as 1/64" and 1/32" over size diameters

USE:

- To form a recess for a capscREW head

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	513
	40	NON-FERROUS - SHORT CHIPS	513
	60	CAST IRONS	513
	80	LOW STRENGTH STEELS	515
	100	MEDIUM STRENGTH STEELS	515
	120	HIGH STRENGTH STEELS	515
	140	HIGH TEMPERATURE ALLOYS	513

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Corner radius or corner chamfer
- Flat(s) or tang on shank
- Shortened shank or reduced shank diameter
- Coatings available (see pg 156)

TOOL DIAMETER		PILOT DIAMETER	PILOT LENGTH	SHANK DIAMETER	OVERALL LENGTH	NO. OF FLUTES	TYPE 513		TYPE 515	
DECIMAL	SCREW SIZE						NON-FERR/CI EDP NO.	PRICE EACH	STEEL EDP NO.	PRICE EACH
.3820	1/4	.2500	.3125	5/16	5 5/8	3	5132500	\$71.65	5152500	\$78.80
.3980	1/4	.2650	.3125	5/16	5 5/8	3	5132650	79.60	5152650	87.60
.4140	1/4	.2810	.3125	5/16	5 5/8	3	5132810	79.60	5152810	87.60
.4750	5/16	.3125	.3750	3/8	6 1/8	3	5133125	80.15	5153125	88.20
.4910	5/16	.3280	.3750	3/8	6 1/8	3	5133280	80.15	5153280	88.20
.5070	5/16	.3430	.3750	3/8	6 1/8	3	5133430	80.15	5153430	88.20
.5720	3/8	.3750	.5000	1/2	6 1/2	3	5133750	90.40	5153750	99.45
.5880	3/8	.3900	.5000	1/2	6 1/2	3	5133900	90.40	5153900	99.45
.6040	3/8	.4060	.5000	1/2	6 1/2	3	5134060	90.40	5154060	99.45
.6630	7/16	.4375	.5000	1/2	7	3	5134375	87.30	5154375	96.05
.6790	7/16	.4530	.5000	1/2	7	3	5134530	87.30	5154530	96.05
.6950	7/16	.4680	.5000	1/2	7	3	5134680	87.30	5154680	96.05
.7570	1/2	.5000	.5000	1/2	7 1/2	3	5135000	99.00	5155000	108.95
.7730	1/2	.5150	.5000	1/2	7 1/2	3	5135150	99.00	5155150	108.95
.7890	1/2	.5310	.5000	1/2	7 1/2	3	5135310	99.00	5155310	108.95
.8510	9/16	.5625	.5625	5/8	7 5/8	3	5135625	95.70	5155625	105.30
.8670	9/16	.5780	.5625	5/8	7 5/8	3	5135780	95.70	5155780	105.30
.8830	9/16	.5930	.5625	5/8	7 5/8	3	5135930	95.70	5155930	105.30
.9450	5/8	.6250	.6250	5/8	7 5/8	3	5136250	109.10	5156250	120.00
.9610	5/8	.6400	.6250	5/8	7 5/8	3	5136400	109.10	5156400	120.00
.9770	5/8	.6560	.6250	5/8	7 5/8	3	5136560	109.10	5156560	120.00
1.1330	3/4	.7500	.7500	3/4	7 3/4	3	5137500	107.55	5157500	118.30
1.1490	3/4	.7650	.7500	3/4	7 3/4	3	5137650	107.55	5157650	118.30
1.1650	3/4	.7810	.7500	3/4	7 3/4	3	5137810	107.55	5157810	118.30
1.3220	7/8	.8750	.8750	7/8	8 1/8	4	5138750	119.55	5158750	131.60
1.3380	7/8	.8910	.8750	7/8	8 1/8	4	5138910	119.55	5158910	131.60
1.3540	7/8	.9060	.8750	7/8	8 1/8	4	5139060	119.55	5159060	131.60
1.5100	1	1.0000	1.0000	1	8 1/2	4	5130000	136.90	5150000	150.60
1.5260	1	1.0150	1.0000	1	8 1/2	4	5130156	136.90	5150156	150.60
1.5420	1	1.0310	1.0000	1	8 1/2	4	5130313	136.90	5150313	150.60

TYPE 513 - STRAIGHT SHANK - FOR NON-FERROUS AND CAST IRONS - METRIC
TYPE 515 - STRAIGHT SHANK - FOR STEELS - METRIC

USE:

- Same as above except metric sizes.

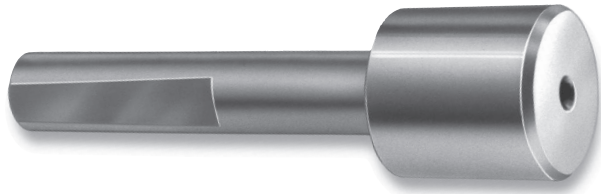
TOOL DIAMETER		PILOT DIAMETER mm	PILOT LENGTH	SHANK DIAMETER	OVERALL LENGTH	NO. OF FLUTES	TYPE 513		TYPE 515	
DECIMAL	SCREW SIZE mm						NON-FERR/CI EDP NO.	PRICE EACH	STEEL EDP NO.	PRICE EACH
.3543	5	5.5	9/32	5/16	5 5/8	3	513055	\$79.40	515055	\$87.30
.4134	6	6.5	5/16	5/16	5 5/8	3	513065	83.80	515065	92.20
.5315	8	8.5	3/8	1/2	6 1/2	3	513085	99.55	515085	109.45
.6496	10	10.5	1/2	1/2	7	3	513105	108.25	515105	119.10
.7283	12	12.5	1/2	1/2	7 1/2	3	513125	101.60	515125	111.70
.8465	14	14.5	9/16	5/8	7 5/8	3	513145	118.45	515145	130.25
.9646	16	16.5	5/8	5/8	7 5/8	3	513165	123.75	515165	136.15
1.2008	20	20.5	3/4	7/8	8	3	513205	114.75	515205	126.25

C'BORES



INTERCHANGEABLE COUNTERBORE PILOTS TYPE 500 FRACTIONAL

SHORT SHANK PILOTS



PILOT HEAD DIAMETER	TOLERANCE
1/8" thru 1/4"	minus .001"; minus .002"
over 1/4" thru 7/8"	minus .003"; minus .004"
over 7/8" thru 1 1/4"	minus .005"; minus .006"
over 1 1/4"	minus .006"; minus .007"

MODIFICATIONS (prompt delivery)

- Modified pilot head diameter - priced below (ground down from finished pilot)
- Corner radius

TYPE 500

- Shank diameter tolerance: plus .0000", minus .0005"
- Shank diameter ordered must be the same as pilot hole diameter in the counterbore to be used
- Pilot head diameter must be larger than the counterbore's minimum cut diameter

PILOT HEAD DIAMETER		SHANK DIAMETER									ALL TYPES PRICE	FINISHED TO MODIFIED PILOT HEAD DIAMETER					
FRACTIONAL	DECIMAL	3/32	1/8	5/32	3/16	1/4	5/16	3/8	7/16	1/2		PRICE EACH - BASED ON QUANTITY ORDERED					
		EDP NO.	EDP NO.	EDP NO.	EDP NO.	EDP NO.	EDP NO.	EDP NO.	EDP NO.	EDP NO.		1	2	3	4	5-7	OVER 7
1/8	.1250	50104	-	-	-	-	-	-	-	-	\$18.35	\$72.90	\$45.65	\$36.55	\$32.10	\$27.45	\$23.70
5/32	.1562	50105	50205	-	-	-	-	-	-	-	14.90	69.40	42.15	33.05	28.50	24.00	20.25
3/16	.1875	50106	50206	50306	-	-	-	-	-	-	15.20	69.70	42.45	33.35	28.85	24.25	20.45
7/32	.2188	50107	50207	50307	50407	-	-	-	-	-	17.20	71.75	44.45	35.35	30.95	26.30	22.55
1/4	.2500	50108	50208	50308	50408	-	-	-	-	-	17.20	71.75	44.45	35.35	30.95	26.30	22.55
9/32	.2812	50109	50209	50309	50409	50509	-	-	-	-	18.35	72.90	45.65	36.55	32.10	27.45	23.70
5/16	.3125	50110	50210	50310	50410	50510	-	-	-	-	18.35	72.90	45.65	36.55	32.10	27.45	23.70
11/32	.3438	50111	50211	50311	50411	50511	50611	-	-	-	18.35	72.90	45.65	36.55	32.10	27.45	23.70
3/8	.3750	-	50212	50312	50412	50512	50612	-	-	-	20.25	74.75	47.50	38.40	33.85	29.30	25.60
13/32	.4062	-	50213	50313	50413	50513	50613	-	-	-	20.25	74.75	47.50	38.40	33.85	29.30	25.60
7/16	.4375	-	50214	50314	50414	50514	50614	50714	-	-	20.70	75.20	47.95	38.85	34.35	29.80	26.05
15/32	.4688	-	50215	-	50415	50515	50615	-	-	-	20.70	75.20	47.95	38.85	34.35	29.80	26.05
1/2	.5000	-	50216	-	50416	50516	50616	50716	50816	-	23.70	78.25	51.00	41.85	37.45	32.80	29.05
17/32	.5312	-	50217	-	50417	50517	50617	-	50817	-	27.60	82.15	54.90	45.85	41.30	36.75	33.00
9/16	.5625	-	50218	-	50418	50518	50618	50718	50818	50918	31.00	85.55	58.30	49.20	44.75	40.15	36.35
19/32	.5938	-	50219	-	-	50519	50619	-	50819	50919	34.05	88.60	61.30	52.20	47.65	43.10	39.40
5/8	.6250	-	50220	-	50420	50520	50620	50720	50820	50920	34.05	88.60	61.30	52.20	47.65	43.10	39.40
21/32	.6562	-	-	-	50421	50521	50621	-	50821	-	34.85	89.40	62.10	53.00	48.60	43.95	40.20
11/16	.6875	-	-	-	50422	50522	50622	50722	50822	50922	34.85	89.40	62.10	53.00	48.60	43.95	40.20
23/32	.7188	-	-	-	-	50523	50623	-	50823	50923	39.50	94.00	66.75	57.65	53.15	48.60	44.85
3/4	.7500	-	-	-	50424	50524	50624	50724	50824	50924	39.50	94.00	66.75	57.65	53.15	48.60	44.85
25/32	.7812	-	-	-	-	50525	50625	-	50825	50925	44.40	98.90	71.65	62.55	58.15	53.50	49.75
13/16	.8125	-	-	-	50426	50526	50626	50726	50826	50926	44.40	98.90	71.65	62.55	58.15	53.50	49.75
27/32	.8438	-	-	-	-	50527	-	-	-	-	49.10	103.65	76.35	67.30	62.75	58.20	54.45
7/8	.8750	-	-	-	50428	50528	50628	50728	50828	50928	49.10	103.65	76.35	67.30	62.75	58.20	54.45
15/16	.9375	-	-	-	50430	50530	50630	50730	50830	50930	51.80	106.30	79.05	70.00	65.45	60.90	57.15
1	1.0000	-	-	-	50432	50532	50632	50732	50832	50932	53.60	108.10	80.85	71.75	67.30	62.70	58.95
1 1/16	1.0625	-	-	-	-	-	50634	50734	50834	50934	55.55	110.05	82.80	73.70	69.15	64.65	60.90
1 1/8	1.1250	-	-	-	-	-	50636	50736	50836	50936	66.95	121.50	94.20	85.10	80.65	76.00	72.30
1 3/16	1.1875	-	-	-	-	-	50638	50738	50838	50938	69.00	123.50	96.25	87.15	82.70	78.10	74.35
1 1/4	1.2500	-	-	-	-	-	50640	50740	50840	50940	72.75	127.25	100.00	90.90	86.50	81.80	78.10
1 5/16	1.3125	-	-	-	-	-	-	50742	50842	50942	76.55	131.10	103.85	94.75	90.30	85.70	81.90
1 3/8	1.3750	-	-	-	-	-	50644	50744	50844	50944	83.60	138.25	111.00	101.90	97.35	92.80	89.00
1 7/16	1.4375	-	-	-	-	-	-	50746	50846	50946	84.60	139.15	111.85	102.75	98.30	93.65	89.95
1 1/2	1.5000	-	-	-	-	-	-	-	50848	50948	85.70	140.30	113.00	103.90	99.35	94.80	91.10
1 9/16	1.5625	-	-	-	-	-	-	-	50850	50950	86.70	141.35	114.10	105.00	100.45	95.90	92.15
1 5/8	1.6250	-	-	-	-	-	-	-	-	50952	87.65	142.15	114.90	105.80	101.30	96.70	93.00
1 11/16	1.6875	-	-	-	-	-	-	-	-	50954	88.80	143.30	116.05	106.95	102.45	97.85	94.15
1 3/4	1.7500	-	-	-	-	-	-	-	50856	50956	90.20	144.65	117.35	108.25	103.85	99.20	95.45
1 7/8	1.8750	-	-	-	-	-	-	-	-	50960	108.60	163.30	136.00	126.90	122.35	117.80	114.10
2	2.0000	-	-	-	-	-	-	-	-	50964	108.60	163.30	136.00	126.90	122.35	117.80	114.10

For larger pilot head diameters, contact us for price and availability.



MILLING CUTTERS INDEX AND COMPARISON CHART

DESCRIPTION	HANNIBAL		CLEVELAND	GAY-LEE	MORSE	NIAGARA	WHITNEY
	PAGE	TOOL TYPE					
ARBOR HOLE TYPES							
SHELL END MILLS							
For Non-Ferrous	174	530	-	-	5858	4920	-
For Cast Irons	174	531	-	-	5859	4900	-
For Steels	174	532	-	-	5860	4910	-
SIDE MILLING CUTTERS							
Staggered Tooth For General Purpose	162	547	-	-	-	-	-
Straight Tooth For Non-Ferrous	163	540	-	-	5861	1630	-
Straight Tooth For Cast Irons	163	541	-	-	5862	1590	-
Straight Tooth For Steels	163	542	-	-	5863	1550	-
Straight Tooth For High Temp Alloys	163	543	-	-	5849	-	-
Single Angle Cutters – For Non-Ferrous & Cast Irons							
45° Right	174	714	-	-	-	-	-
45° Left	174	716	-	-	-	-	-
60° Right	174	724	-	-	-	-	-
60° Left	174	726	-	-	-	-	-
Double Angle Cutters – For Non-Ferrous & Cast Irons							
45° Included	174	750	-	-	-	-	-
60° Included	174	752	-	-	-	-	DAA XXX 60
90° Included	174	754	-	-	-	-	DAA XXX 90
SLITTING SAWS – COARSE TOOTH							
For Non-Ferrous	164	550	-	CNF	5846	4690	-
For Cast Irons	164	552	-	CCI	5847	4240	-
For Steels	164	554	-	CST	5848	4220	-
For High Temp Alloys	164	558	-	GSS	5850	4260	-
SLITTING SAWS – STANDARD TOOTH							
For Non-Ferrous	165	551	1361	GPP	-	-	-
For Cast Irons	165	553	1361	GPP	-	-	-
For Steels	165, 166-169	556	1360	STL	-	-	-
For High Temp Alloys	165, 170-173	559	-	GSS	-	-	-
SHANK TYPES							
CHAMFER MILLING CUTTERS							
45° for Non-Ferrous & Cast Irons/Steels	183	730/731	-	-	-	-	CH XXXX 45C
60° for Non-Ferrous & Cast Irons/Steels	183	732/733	-	-	-	-	CH XXXX 60C
CORNER ROUNDING END MILLS							
For Non-Ferrous & Cast Irons/Steels	182	740/741	-	-	-	-	-
COUNTERSINKS							
Single Flute (60°/82°/90°/100°)	175	561/581/584/591	791	-	-	-	-
Three Flutes (60°/82°/90°/100°)	175	563/583/585/590	793	-	-	-	-
DOUBLE ANGLE CUTTERS							
60° for Non-Ferrous & Cast Irons/Steels	184	746/747	-	-	-	-	DA XXX 60C
90° for Non-Ferrous & Cast Irons/Steels	184	748/749	-	-	-	-	DA XXX 90C
DOVETAIL CUTTERS							
45° for Non-Ferrous & Cast Irons/Steels	183	734/735	-	-	-	-	C90 XXX 45
60° for Non-Ferrous & Cast Irons/Steels	183	736/737	-	-	-	-	C90 XXX 60
FACE MILLING CUTTERS – For Non-Ferrous/Cast Irons/Steels							
	175	536/537/538	-	-	-	1450/1460	-
KEYSEAT CUTTERS							
High Performance Straight Tooth for Aluminum	177	704	-	-	-	-	-
Straight Tooth for Non-Ferrous & Cast Irons	178	700	-	-	-	CB444	120
Staggered Tooth for Non-Ferrous & Cast Irons	179	701	-	-	-	-	121
Straight Tooth for Steels	180	702	-	-	-	-	-
Staggered Tooth for Steels	181	703	-	-	-	-	-
RADIUS CUTTERS – For Non-Ferrous/Cast Irons/Steels							
	184	718/719	-	-	-	-	R XXX C
T-SLOT CUTTERS – For Non-Ferrous/Cast Irons/Steels							
	182	720/721	-	-	-	-	C XXXX

CUTTERS

ARBOR DIAMETER: Select the **largest diameter** available to maximize rigidity and minimize deflection. For example, a 1¼" arbor is more than twice as rigid as a 1" arbor.

TOOL DIAMETER: For **slitting saws**, select the smallest diameter which permits the greatest number of teeth to be engaged in the cut at all times.

For **slot and side milling cutters**, select the diameter which permits no more than two teeth to be engaged in the cut at any time.

NUMBER OF TEETH: Select **fewer teeth** for low tensile materials and heavier chip loads. Select **more teeth** for high tensile materials and better finishes.

COATINGS are especially effective (see "Coating Selector" on page 10).

APPROPRIATE carbide grade, carbide finish, number of teeth, flute size, radial rake angle and cutting edge clearance are engineered by HANNIBAL for optimum performance when machining the materials indicated.

TYPES OF MILLING: In **conventional milling**, the direction of cutter rotation is opposite to the direction of workpiece feed. The initial portion of the chip generated is very thin and gradually increases through the cutting cycle. The maximum cutting force is upward at the end of the cutting cycle.

In **climb milling**, the direction of the cutter rotation and the direction of workpiece feed are the same. The initial portion of the chip generated is thick and gradually thins through the cutting cycle, producing a better finish. The maximum cutting force is the initial downward thrust at the beginning of the cutting cycle.

For **deep slotting**, HANNIBAL'S saws are appropriate due to adequate side & body clearance.



FEEDS & SPEEDS - MILLING CUTTERS OR SAWS CARBIDE TIPPED

RPM FORMULA: $\frac{SFM \times 3.82}{Diameter}$

IPM FORMULA: IPT X RPM X Number of teeth



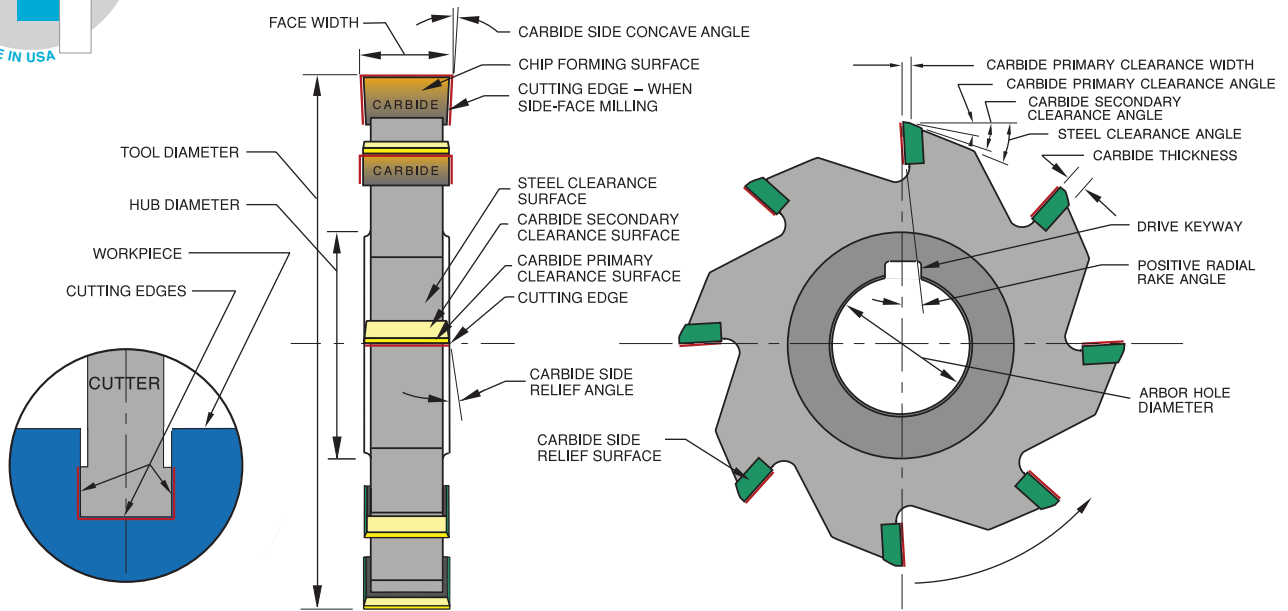
Feeds & speeds are starting recommendations only. Factors including fixturing, available horsepower, depth of cut, and coolant capabilities may significantly affect performance. Use this chart for half and full side mill & face mill cutters.

CHIP CLASS	MATERIAL BEING MACHINED	MATERIAL EXAMPLES	BRINELL HARDNESS	CHIP DESCRIPTION	SLITTING SAWS AND SIDE MILLING CUTTERS	
					SURFACE FEET PER MINUTE	INCHES PER TOOTH
					SFPM	IPT
20	ALUMINUM ALLOY CAST AND WROUGHT	308.0, 356.0, 360.0, 380.0, 383.0, 390.0, 2024, 3003, 4032, 5052, 6061, 7075	30 - 150 (500 kg)	DISCONTINUOUS FLAKY OR LONG STRINGY	1000 - 2000	.004-.008
	COPPER ALLOY TOUGH	101, 110, 115, 120, 130, 142, 155, 170, 172, 175, 195, 425, 610, 630, 655, 725, 805, 826, 910	40 - 200 (500 kg)	LONG CONTINUOUS	200 - 500	.004-.008
	LEAD ALLOY	Alloys 7, 8, 13, 15 15b, 45b, 65b, 85b, 95b	10 - 20 (500 kg)	DISCONTINUOUS TIGHTLY CURLED	300 - 1000	.004-.008
	PLASTIC	ABS, Acrylic, Allyl, Bakelite, Epoxy, Furan, Nylon, Polyethylene, Polystyrene, PVC	-	CONTINUOUS	1500 - 3000	.004-.008
	ZINC ALLOY	AC41 A, AG40A, AMS4803, 11 7RO 12, ZDC NO. 7 GRADES 903, 925	80 - 100	LONG TIGHTLY CURLED	750 - 1500	.005-.010
40	ALUMINUM BRONZE	614, 952-958	40 - 175	SHORT LOOSELY CURLED	200 - 600	.003-.006
	COPPER ALLOY/BRASS/BRONZE FREE MACHINING	268, 270, 314, 332, 335, 340, 342, 353, 356, 360, 370, 464-467, 485, 838, 945	10 - 100Rb	FLAT SMALL	400 - 800	.004-.008
	MAGNESIUM ALLOY	AM60A, AZ21A, AZ91B-C, HM31A, K1A, ZE41A, ZK40A	50 - 90 (500 kg)	FLAT SMALL	750 - 1500	.004-.008
	NICKEL SILVER	745, 752, 754, 757, 770, 973-978	10 - 100Rb	LOOSELY CURLED	200 - 400	.003-.006
60	CAST IRON - DUCTILE AUSTENITIC (NI-RESIST)	TYPES D-2, D-2B, D-2C, D-2M, D-3, D-3A, D-4, D-5, D-5B	120 - 275	DISCONTINUOUS TIGHTLY CURLED	75 - 150	.002-.004
	CAST IRON - DUCTILE FERRITIC & FERRITIC - PEARLITIC	GRADES 60-40-18, 65-45-12, 80-55-06, D4018, D4512, D5506	140 - 270	DISCONTINUOUS TIGHTLY CURLED	250 - 400	.003-.006
	CAST IRON - DUCTILE MARTENSITIC & PEARLITIC - MARTENSITIC	GRADES 100-70-03, 120-90-02, D7003, DQ&T	270 - 400	DISCONTINUOUS TIGHTLY CURLED	200 - 300	.003-.006
	CAST IRON - GRAY FERRITIC & FERRITIC - PEARLITIC	CLASSES 20, 25, 30, 35, 40 GRADES G1800, G2500, G3000	120 - 220	DISCONTINUOUS	250 - 425	.003-.006
	CAST IRON - GRAY PEARLITIC	CLASSES 45, 50, 55, 60 GRADES G3500, G4000	220 - 320	DISCONTINUOUS	120 - 300	.002-.004
	CAST IRON - MALLEABLE FERRITIC & PEARLITIC	GRADES 32510, 35018, 40010, 45008 GRADES M3210, M4504, M5003	110 - 240	DISCONTINUOUS	200 - 400	.003-.006
	CAST IRON - MALLEABLE TEMPERED MARTENSITE	GRADES 60004, 70003, 80002 GRADES M5003, M8501	200 - 320	DISCONTINUOUS	130 - 225	.002-.004
80	STEEL - LOW & MEDIUM STRENGTH FREE MACHINING	1108-1119, 1132-1151, 10L17, 10L18, 10L50, 11L44, 12L13, 12L14, 12L15	100 - 250	DISCONTINUOUS LOOSELY CURLED	250 - 500	.003-.006
	STEEL - LOW & MEDIUM STRENGTH WROUGHT	1005-1029, 1030-1050, 1513, 1518, 1524, 1552	100 - 375	CONTINUOUS STRINGY	200 - 400	.002-.004
100	ALLOY STEEL - LOW & MEDIUM STRENGTH FREE MACHINING	41L30, 41L40, 41L50, 86L20, 4142Se, 4145Te	100 - 275	DISCONTINUOUS TIGHTLY CURLED	200 - 400	.002-.004
	ALLOY STEEL - LOW & MEDIUM STRENGTH	1330, 1345, 1515, 4012, 4130, 4140, 4150, 4320, 4340, 4620, 5130, 8620, 8630, 8645, 9310	85 - 375	LOOSELY CURLED	150 - 300	.002-.005
	STAINLESS STEEL 400 SERIES	409, 410, 414, 420, 430, 436, 442, 446	135 - 325	DISCONTINUOUS TIGHTLY CURLED	200 - 400	.003-.006
	STAINLESS STEEL FREE MACHINING	203 EZ, 303, 303MA, 303Pb, 303 PLUS X, 303Se, 416, 416Se, 420F, 430F, 440F	135 - 275	SHORT TIGHTLY CURLED	250 - 500	.003-.006
120	ALLOY STEEL - HIGH STRENGTH, MARAGING STEEL, NITRIDING STEEL, TOOL STEEL	50100, 51100, 52100, GRADES 200-350, Nitrallloy, SERIES A2, D2, H13, M50, P20, S7, W1	175 - 400	CONTINUOUS WIRY	75 - 150	.002-.004
140	HIGH TEMP ALLOY NICKEL & IRON	A-286; Hastelloy C; Inconel 600, 625, 718, 825; Monel 400; Nimonic 75, 80; Rene 41; Waspaloy	140 - 300	CONTINUOUS WIRY	50 - 150	.002-.004
	STAINLESS STEEL 300 SERIES	301, 302, 304, 309, 314, 316, 321, 330, 347, 385, Nitronic 32, 33, 40, 50, 60	135 - 375	WIRY LOOSELY CURLED	75 - 150	.002-.004
	STAINLESS STEEL PH SERIES	13-8 Mo, 15-5PH, 16-6PH, 17-4PH, 17-7PH, AM-350, AM-335	150 - 440	WIRY LOOSELY CURLED	75 - 150	.002-.004
	TITANIUM ALLOY	98.9, 99.0, 99.2, 99.5, Ti-6Al-4V, Ti-6Al-6V2Sn, Ti-8Mn, Ti-10v-2Fe-3Al	110 - 380	CONTINUOUS WIRY	100 - 200	.002-.004

CUTTERS



CARBIDE TIPPED MILLING CUTTER TECHNICAL INFORMATION



MILLING CUTTER PROBLEM SOLVING GUIDE – CARBIDE TIPPED

AVOID PROBLEMS BY CAREFUL ORIGINAL SET-UP

- MACHINE CONDITION Tool holder in good condition and secure part holding fixture.
 TOOL CONDITION Use cutting tool recommended for material being machined. Avoid excessive tool overhang.
 FEEDS & SPEEDS Start with feeds and speeds recommended for material being machined.
 COOLANT Where used, coolant flow must be adequate to avoid intermittent quenching and to flush chips promptly, avoiding the recutting of hardened chips.

MILLING PROBLEMS	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. ROUGH FINISH	Dull cutting edge Wrong feeds & speeds	Resharpen to original tool geometry Increase speed – also try reduced feed
2. EXCESSIVE CUTTING EDGE WEAR	Wrong feeds & speeds Rough cutting edge Insufficient coolant	Increase feed (should always be over .001" per tooth) – especially when machining ductile or free machining materials. Also try reduced speed Lightly hone cutting edge with fine grit diamond hone Increase coolant flow – review type of coolant
3. CHIPPED CUTTING EDGE	Poor chip removal Recutting work hardened chips Vibration Incorrect carbide grade	Use tool with larger flute space – larger diameter or fewer flutes Increase coolant flow Increase rigidity of set-up, especially worn tool holders or arbors Change to tougher carbide grade
4. CHATTER MARKS	Insufficient machine horsepower Vibration	Use tool with fewer flutes as correct feeds & speeds must be maintained Consider climb milling Use larger diameter cutter Resharpen tool with more clearance
5. GLAZED FINISH	Feed too light Dull cutting edge Insufficient clearance	Increase feed Resharpen tool to original geometry Resharpen tool with more clearance
6. POOR TOOL LIFE	Excessive cratering Milling abrasive material Milling surface scale Milling hard material Insufficient chip room Delayed resharpening Thermal cracked carbide	Increase speed or decrease feed Change to harder grade of carbide Decrease speed and increase feed Increase coolant flow Climb milling better than conventional milling Conventional milling better than climb milling Reduce speed – rigidity very important Use larger diameter tool Prompt resharpening to original geometry will increase total tool life Maintain adequate coolant flow at all times Climb milling is cooler than conventional milling

CUTTERS



SIDE MILLING CUTTERS - STAGGERED TOOTH CARBIDE TIPPED TYPE 547 FRACTIONAL



SUITABLE FOR MOST MATERIALS

TYPE 547 – GENERAL PURPOSE

- Alternating right and left hand axial rake.
- Carbide extends across the entire length of each tooth.
- Tool geometry and carbide grade appropriate for machining most materials including steels, stainless steels, cast irons, composites, aluminums and titaniums.



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	547
	40	NON-FERROUS - SHORT CHIPS	547
	60	CAST IRONS	547
	80	LOW STRENGTH STEELS	547
	100	MEDIUM STRENGTH STEELS	547
	120	HIGH STRENGTH STEELS	547
	140	HIGH TEMPERATURE ALLOYS	547

MODIFICATIONS (Prompt delivery)

- Alternate chamfer every other tooth
- Corner chamfer or corner radius on one side
- Corner chamfer or corner radius on both sides
- Reduced face width
- Closer tool diameter tolerance
- Chip breakers
- Matched tool diameter set(s)
- Reduced hub width
- Additional keyway
- Coatings available:

TITANIUM NITRIDE – TiN
TITANIUM CARBONITRIDE – TiCN
ZIRCONIUM NITRIDE – ZrN
AL TITANIUM NITRIDE – AlTiN

Tool diameter tolerance: plus $\frac{1}{16}$ ", minus .000"
 Face width tolerance: plus .001", minus .000"
 Arbor hole tolerance: plus .001", minus .000"

TOOL DIAM.	FACE WIDTH		TYPE 547 FOR MOST MATERIALS			
	FRAC.	DEC.	NO. OF TEETH	1" ARBOR EDP NO.	1 1/4" ARBOR EDP NO.	PRICE
3	3/16	.1875	8	54710	-	\$600.85
	1/4	.2500	8	54712	-	615.15
	5/16	.3125	8	54714	-	620.65
	3/8	.3750	8	54716	-	623.10
	1/2	.5000	8	54718	-	642.45
	5/8	.6250	8	54720	-	687.80
4	3/16	.1875	10	54722	-	652.80
	1/4	.2500	10	54724	-	660.95
	5/16	.3125	10	54726	-	668.95
	3/8	.3750	10	54728	-	677.00
	1/2	.5000	10	54730	-	686.50
	5/8	.6250	10	54732	-	699.30
6	3/4	.7500	10	54734	-	707.20
	1/4	.2500	14	-	54750	848.65
	5/16	.3125	14	-	54752	855.05
	3/8	.3750	14	-	54754	856.30
	1/2	.5000	14	-	54756	867.45
	5/8	.6250	14	-	54758	872.40
	3/4	.7500	14	-	54760	900.85
1	1.0000	14	-	54762	964.55	



SIDE MILLING CUTTERS CARBIDE TIPPED TYPES 540, 541, 542, 543 FRACTIONAL



FOUR TYPES – FOR NON-FERROUS, CAST IRONS, STEELS, OR HIGH TEMPERATURE ALLOYS

TYPE 540 – FOR NON-FERROUS MATERIALS

- Very large flute capacity assures good chip flow and permits high feed rates

TYPE 541 – FOR CAST IRONS

- Large flute capacity but more teeth permits high metal removal at moderate feeds and speeds

TYPE 542 – FOR STEELS

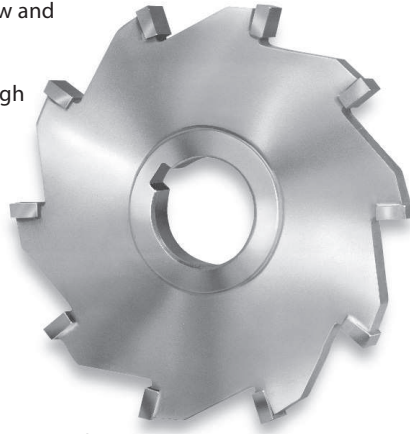
- Steel carbide grade permits longer production runs

TYPE 543 – FOR HIGH TEMP ALLOYS

- Larger number of teeth permits high metal removal at moderate feeds and speeds

ALL TYPES:

- For slotting, straddle milling, and face milling
- Tool diameter tolerance: plus $\frac{1}{16}$ ", minus .000"
- Face width tolerance: plus .001", minus .000"
- Arbor hole tolerance: plus .001", minus .000"
- Tool geometry & carbide grade appropriate for material being machined



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	540
	40	NON-FERROUS - SHORT CHIPS	540/541
	60	CAST IRONS	541
	80	LOW STRENGTH STEELS	542
	100	MEDIUM STRENGTH STEELS	542
	120	HIGH STRENGTH STEELS	542
	140	HIGH TEMPERATURE ALLOYS	543

MODIFICATIONS (Prompt delivery)

- Alternate chamfer every other tooth
- Corner chamfer or corner radius on one side
- Corner chamfer or corner radius on both sides
- Full radius
- Reduced face width
- Closer tool diameter tolerance
- Chip breakers
- Matched tool diameter set(s)
- Reduced hub width
- Additional keyway
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

TOOL DIAM.	FACE WIDTH		TYPE 540 FOR NON-FERROUS				TYPE 541 FOR CAST IRONS				TYPE 542 FOR STEELS				TYPE 543 FOR HIGH TEMP ALLOYS			
	FRACTIONAL	DECIMAL	NO. OF TEETH	1" ARBOR EDP NO.	1 1/4" ARBOR EDP NO.	PRICE	NO. OF TEETH	1" ARBOR EDP NO.	1 1/4" ARBOR EDP NO.	PRICE	NO. OF TEETH	1" ARBOR EDP NO.	1 1/4" ARBOR EDP NO.	PRICE	NO. OF TEETH	1" ARBOR EDP NO.	1 1/4" ARBOR EDP NO.	PRICE
3	1/4	.2500	4	54030	-	\$104.30	6	54130	-	\$130.50	6	54230	-	\$128.85	8	54330	-	\$160.75
	3/16	.3125	4	54031	-	109.55	6	54131	-	131.10	6	54231	-	130.60	8	54331	-	168.45
	3/8	.3750	4	54032	-	113.55	6	54132	-	133.70	6	54232	-	132.25	8	54332	-	170.75
	7/16	.4375	4	54033	-	118.20	6	54133	-	144.60	6	54233	-	147.50	-	-	-	-
	1/2	.5000	4	54034	-	123.90	6	54134	-	150.55	6	54234	-	149.50	8	54334	-	190.85
4	1/4	.2500	4	54040	-	136.00	8	54140	-	168.60	8	54240	-	169.70	10	54340	-	201.00
	3/16	.3125	4	54041	-	139.85	8	54141	-	174.25	8	54241	-	180.20	10	54341	-	211.15
	3/8	.3750	4	54042	54043	143.50	8	54142	54143	183.15	8	54242	54243	180.20	10	54342	54343	215.90
	7/16	.4375	4	54074	-	144.20	8	54174	-	186.80	8	54274	-	185.55	10	54374	-	234.40
	1/2	.5000	4	54044	54045	144.20	8	54144	54145	192.95	8	54244	54245	192.00	10	54344	54345	236.20
	5/16	.5625	4	54094	-	156.75	8	54194	-	198.30	8	54294	-	201.50	-	-	-	-
	3/8	.6250	4	54046	54047	168.20	8	54146	54147	214.95	8	54246	54247	235.55	10	54346	54347	248.75
	3/4	.7500	4	54048	54049	188.45	8	54148	54149	214.95	8	54248	54249	238.55	10	54348	54349	256.20
5	1/4	.2500	6	54050	-	190.00	10	54150	-	223.25	10	54250	-	223.40	-	-	-	-
	3/16	.3125	-	-	-	-	10	54151	-	223.25	10	54251	-	223.40	-	-	-	-
	3/8	.3750	-	-	-	-	10	-	54153	228.70	10	-	54253	234.55	-	-	-	-
	7/16	.4375	6	-	54075	197.65	10	-	54175	229.80	10	-	54275	242.10	-	-	-	-
	1/2	.5000	6	54054	54055	200.00	10	54154	54155	243.95	10	54254	54255	242.15	12	54354	54355	271.30
	5/16	.5625	6	-	54095	206.40	10	-	54195	248.15	10	-	54295	252.80	-	-	-	-
	3/8	.6250	6	-	54057	217.15	10	-	54157	264.10	10	-	54257	296.75	12	-	54357	296.30
	3/4	.7500	6	54058	54059	231.50	10	54158	54159	299.05	10	54258	54259	328.40	12	54358	54359	332.30
1	1.0000	6	-	54015	231.85	10	-	54115	325.40	10	-	54215	346.35	-	-	-	-	
6	3/8	.3750	6	54062	-	203.85	12	-	54163	280.95	12	-	54263	296.80	-	-	-	-
	1/2	.5000	6	54064	54065	223.25	12	54164	54165	298.35	12	54264	54265	305.70	14	54364	54365	349.05
	5/8	.6250	6	-	54067	244.70	12	-	54167	326.05	12	-	54267	332.55	14	-	54367	351.85
	3/4	.7500	6	54068	54069	281.40	12	54168	54169	365.80	12	54268	54269	378.80	14	54368	54369	379.70
	1	1.0000	6	-	54016	322.55	12	-	54116	369.70	12	-	54216	386.50	-	-	-	-
8	3/4	.7500	8	54088	54089	366.10	12	54188	54189	383.90	12	54288	54289	398.25	14	54388	-	407.10
	1	1.0000	8	54080	54081	397.25	12	54180	54181	400.15	12	54280	54281	414.50	-	-	-	-
				1 1/4" ARBOR	1 1/2" ARBOR			1 1/4" ARBOR	1 1/2" ARBOR			1 1/4" ARBOR	1 1/2" ARBOR			1 1/4" ARBOR	1 1/2" ARBOR	

CUTTERS



SLITTING SAWS - COARSE TOOTH CARBIDE TIPPED TYPES 550, 552, 554, 558 FRACTIONAL

MATERIAL SPECIFIC

FOUR TYPES – FOR NON-FERROUS, CAST IRONS, STEELS, OR HIGH TEMPERATURE ALLOYS

TYPE 550 – FOR NON-FERROUS MATERIALS

- Very large flute capacity assures good chip flow and permits high feed rates

TYPE 552 – FOR CAST IRONS

- Large flute capacity but more teeth permits high metal removal at moderate feeds and speeds

TYPE 554 – FOR STEELS

- Steel carbide grade permits longer production runs

TYPE 558 – FOR HIGH TEMPERATURE ALLOYS

- Larger number of teeth permits high metal removal at moderate feeds and speeds

ALL TYPES:

- For slitting, slotting, milling, and cut-off operations
- Tool diameter tolerance: plus 1/16", minus .000"
- Face width tolerance: plus .001", minus .000"
- Arbor hole tolerance: plus .001", minus .000"
- Tool geometry and carbide grade appropriate for material being machined

MODIFICATIONS (Prompt delivery)

- Alternate chamfer every other tooth
- Corner chamfer or corner radius on one side
- Corner chamfer or corner radius on both sides
- Full radius
- Reduced face width
- Closer tool diameter tolerance
- Chip breakers
- Matched tool diameter set(s)
- Reduced hub width
- Additional keyway
- Coatings available:

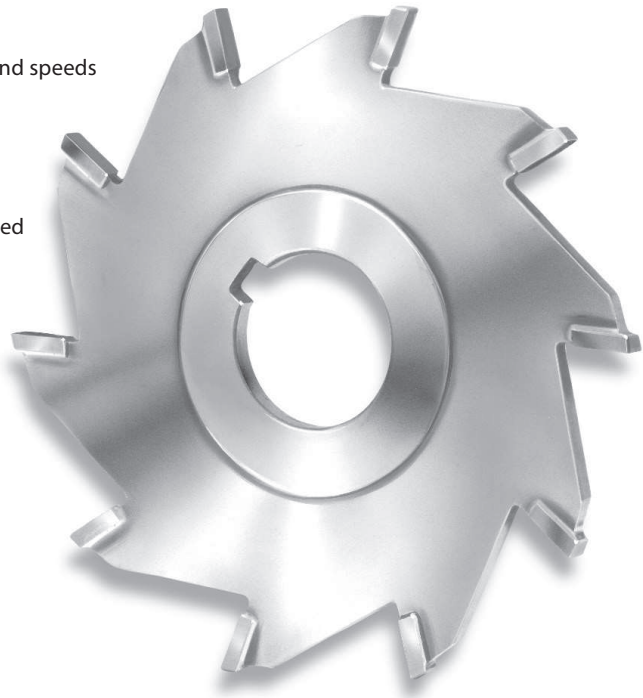
TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	550/551
	40	NON-FERROUS - SHORT CHIPS	550/551/552/553
	60	CAST IRONS	552/553
	80	LOW STRENGTH STEELS	554/556
	100	MEDIUM STRENGTH STEELS	554/556
	120	HIGH STRENGTH STEELS	554/556
140	HIGH TEMPERATURE ALLOYS	558/559	



TOOL DIAM.	FACE WIDTH		ARBOR HOLE	TYPE 550 FOR NON-FERROUS			TYPE 552 FOR CAST IRONS			TYPE 554 FOR STEELS			TYPE 558 FOR HIGH TEMP ALLOYS		
	FRACTIONAL	DECIMAL		NO. OF TEETH	EDP NO.	PRICE	NO. OF TEETH	EDP NO.	PRICE	NO. OF TEETH	EDP NO.	PRICE	NO. OF TEETH	EDP NO.	PRICE
3	3/32	.0938	1	6	55032	\$128.40	6	55232	\$147.80	8	55432	\$146.50	8	55832	\$137.25
	1/8	.1250	1	6	55034	132.25	6	55234	156.50	8	55434	163.95	8	55834	142.50
	3/16	.1875	1	6	55036	137.50	6	55236	165.50	8	55436	165.50	8	55836	148.00
	1/4	.2500	1	6	55037	93.50	6	55237	135.70	8	55437	135.70	8	55837	162.90
	5/16	.3125	1	6	55031	98.20	6	55231	135.70	8	55431	135.70	8	55831	162.90
	3/8	.3750	1	6	55038	100.15	6	55238	137.90	8	55438	137.90	8	55838	165.50
4	3/32	.0938	1	6	55042	157.65	8	55242	189.50	8	55442	189.50	10	55842	197.50
	1/8	.1250	1	6	55044	162.30	8	55244	192.00	8	55444	192.00	10	55844	200.00
	3/16	.1875	1	6	55046	164.75	8	55246	206.90	8	55446	206.90	10	55846	202.75
	1/4	.2500	1	6	55047	120.20	8	55247	175.70	8	55447	175.70	10	55847	210.95
	5/16	.3125	1	6	55041	123.55	8	55241	182.50	8	55441	182.50	10	55841	218.90
	3/8	.3750	1	6	55048	126.85	8	55248	189.15	8	55448	189.15	10	55848	226.95
5	3/8	.3750	1 1/4	6	55049	126.85	8	55249	189.15	8	55449	189.15	10	55849	226.95
	3/32	.0938	1	8	55052	170.55	10	55252	254.40	10	55452	254.40	12	55852	268.50
	1/8	.1250	1	8	55054	170.55	10	55254	273.60	10	55454	273.60	12	55854	274.05
6	3/16	.1875	1	-	-	-	10	55256	308.00	10	55456	308.00	12	55856	285.00
	1/8	.1250	1 1/4	8	55063	232.25	12	55263	333.90	12	55463	333.90	14	55863	320.60
	3/16	.1875	1 1/4	8	55065	306.10	12	55265	344.90	12	55465	344.90	14	55865	328.85
8	1/4	.2500	1 1/4	8	55067	317.05	12	55267	352.10	12	55467	352.10	14	55867	334.25
	1/8	.1250	1 1/4	10	55083	296.90	-	-	-	-	-	-	-	-	-
	3/16	.1875	1 1/4	-	-	-	16	55285	474.65	16	55485	474.65	-	-	-
8	1/4	.2500	1 1/4	-	-	-	16	55287	492.80	16	55487	492.80	-	-	-

CUTTERS



SLITTING SAWS - STANDARD TOOTH CARBIDE TIPPED TYPES 551, 553, 556, 559 FRACTIONAL

MATERIAL SPECIFIC

FOUR TYPES – FOR NON-FERROUS, CAST IRONS, STEELS, OR HIGH TEMPERATURE ALLOYS

TYPE 551 – FOR NON-FERROUS MATERIALS

TYPE 553 – FOR CAST IRONS

TYPE 556 – FOR STEELS

TYPE 559 – FOR HIGH TEMPERATURE ALLOYS

- Similar to slitting saws on page 164, except designed with more teeth for better finishes and higher feed rates
- For descriptions and tolerances, see page 164

Use the tool selector on page 164 to determine which tool is appropriate for the material you are cutting.

MODIFICATIONS

(See list on page 164)

TOOL DIAM.	FACE WIDTH		TYPE 551 FOR NON-FERROUS				TYPE 553 FOR CAST IRONS				TYPE 556 FOR STEELS				TYPE 559 FOR HIGH TEMP ALLOYS			
	FRACTIONAL	DECIMAL	NO. OF TEETH	1" ARBOR EDP NO.	1 1/4" ARBOR EDP NO.	PRICE	NO. OF TEETH	1" ARBOR EDP NO.	1 1/4" ARBOR EDP NO.	PRICE	NO. OF TEETH	1" ARBOR EDP NO.	1 1/4" ARBOR EDP NO.	PRICE	NO. OF TEETH	1" ARBOR EDP NO.	1 1/4" ARBOR EDP NO.	PRICE
3	1/16	.0625	12	55198	-	\$202.30	12	55398	-	\$202.30	16	55698	-	\$241.90	12	55998	-	\$227.55
	3/64	.0781	12	55100	-	239.25	12	55300	-	239.25	16	55600	-	292.50	12	55900	-	254.90
	3/32	.0938	12	55102	-	202.30	12	55302	-	202.30	16	55602	-	241.90	12	55902	-	227.55
	7/64	.1094	12	55104	-	201.55	12	55304	-	201.55	16	55604	-	223.20	12	55904	-	217.20
	1/8	.1250	12	55106	55107	162.65	12	55306	55307	162.65	16	55606	-	202.25	12	55906	55907	207.45
	5/32	.1562	12	55108	-	193.80	12	55308	-	193.80	16	55608	-	212.45	12	55908	-	212.45
	3/16	.1875	12	55109	-	173.35	12	55309	-	173.35	16	55609	-	222.70	12	55909	-	217.55
	7/32	.2188	12	55110	-	200.55	12	55310	-	200.55	16	55610	-	232.90	12	55910	-	224.45
	1/4	.2500	12	55111	-	210.85	12	55311	-	210.85	16	55611	-	243.20	12	55911	-	231.20
	5/16	.3125	12	55112	-	231.20	12	55312	-	231.20	16	55612	-	266.60	12	55912	-	253.25
	3/8	.3750	12	55113	-	251.60	12	55313	-	251.60	16	55613	-	290.15	12	55913	-	277.05
	7/16	.4375	-	-	-	-	-	-	-	-	16	55614	-	322.40	12	55914	-	301.05
1/2	.5000	-	-	-	-	-	-	-	-	16	55615	-	358.25	12	55915	-	324.90	
4	1/16	.0625	14	55116	55117	235.55	14	55316	-	235.55	20	55616	-	292.50	14	55916	55917	258.75
	3/64	.0781	14	55118	55119	278.25	14	55318	55319	278.25	20	55618	55619	320.05	14	55918	55919	296.50
	3/32	.0938	14	55120	55121	235.55	14	55320	55321	235.55	20	55620	55621	292.50	14	55920	55921	258.75
	7/64	.1094	14	55122	55123	240.55	14	55322	55323	240.55	20	55622	55623	276.60	14	55922	55923	306.85
	1/8	.1250	14	55124	55125	212.45	14	55324	55325	212.45	20	55624	55625	258.40	14	55924	55925	258.40
	5/32	.1562	14	55126	55127	241.30	14	55326	55327	241.30	20	55626	55627	277.60	14	55926	55927	265.20
	3/16	.1875	14	55128	55129	226.15	14	55328	55329	226.15	20	55628	55629	278.80	14	55928	55929	273.65
	7/32	.2188	14	55130	55131	256.70	14	55330	55331	256.70	20	55630	55631	295.20	14	55930	55931	282.25
	1/4	.2500	14	55132	55133	261.65	14	55332	55333	261.65	20	55632	55633	299.05	14	55932	55933	289.00
	5/16	.3125	14	55134	55135	282.25	14	55334	55335	282.25	20	55634	55635	324.50	14	55934	55935	309.40
	3/8	.3750	14	55136	55137	302.60	14	55336	55337	302.60	20	55636	55637	347.95	14	55936	55937	333.10
	7/16	.4375	-	-	-	-	-	-	-	-	20	55638	-	386.60	14	55938	-	357.10
1/2	.5000	-	-	-	-	-	-	-	-	20	55640	-	429.60	14	55940	-	381.10	
5	3/64	.0781	16	55142	55143	344.65	16	55342	55343	344.65	24	55642	55643	396.30	16	55942	55943	365.35
	3/32	.0938	16	55144	55145	284.40	16	55344	55345	284.40	24	55644	55645	399.10	16	55944	55945	313.35
	7/64	.1094	16	55146	55147	323.75	16	55346	55347	323.75	24	55646	55647	372.35	16	55946	55947	344.65
	1/8	.1250	16	55148	55149	262.70	16	55348	55349	262.70	24	55648	55649	322.90	16	55948	55949	304.30
	5/32	.1562	16	55150	55151	287.25	16	55350	55351	287.25	24	55650	55651	330.35	16	55950	55951	314.35
	3/16	.1875	16	55152	55153	294.20	16	55352	55353	294.20	24	55652	55653	353.55	16	55952	55953	331.45
	7/32	.2188	16	55154	55155	316.15	16	55354	55355	316.15	24	55654	55655	363.60	16	55954	55955	348.50
	1/4	.2500	16	55156	55157	329.80	16	55356	55357	329.80	24	55656	55657	379.25	16	55956	55957	365.40
	5/16	.3125	16	55158	55159	358.60	16	55358	55359	358.60	24	55658	55659	412.45	16	55958	55959	394.30
	3/8	.3750	16	55160	55161	387.55	16	55360	55361	387.55	24	55660	55661	445.60	16	55960	55961	424.95
	7/16	.4375	-	-	-	-	-	-	-	-	24	55662	-	495.20	16	55962	-	448.90
	1/2	.5000	-	-	-	-	-	-	-	-	24	55664	-	550.20	16	55964	-	472.85
6	3/64	.0781	18	55166	55167	387.50	18	55366	55367	387.50	28	55666	55667	445.55	18	55966	55967	410.85
	3/32	.0938	18	55168	55169	345.10	18	55368	55369	345.10	28	55668	55669	408.20	18	55968	55969	378.35
	7/64	.1094	18	55170	55171	388.80	18	55370	55371	388.80	28	55670	55671	447.10	18	55970	55971	412.25
	1/8	.1250	18	55172	55173	328.90	18	55372	55373	328.90	28	55672	55673	428.30	18	55972	55973	389.20
	5/32	.1562	18	55174	55175	372.15	18	55374	55375	372.15	28	55674	55675	428.10	18	55974	55975	406.20
	3/16	.1875	18	55176	55177	360.35	18	55376	55377	360.35	28	55676	55677	459.25	18	55976	55977	423.15
	7/32	.2188	18	55178	55179	406.20	18	55378	55379	406.20	28	55678	55679	467.15	18	55978	55979	440.20
	1/4	.2500	18	55180	55181	423.20	18	55380	55381	423.20	28	55680	55681	499.35	18	55980	55981	463.70
	5/16	.3125	18	55182	55183	440.30	18	55382	55383	440.30	28	55682	55683	506.30	18	55982	55983	484.40
	3/8	.3750	18	55184	55185	457.20	18	55384	55385	457.20	28	55684	55685	525.75	18	55984	55985	503.05
	7/16	.4375	-	-	-	-	-	-	-	-	28	55690	-	584.10	18	55990	-	527.00
	1/2	.5000	-	-	-	-	-	-	-	-	28	55692	-	649.05	18	55992	-	551.00
8	1/8	.1250	24	-	55186	546.10	24	-	55386	546.10	24	-	55686	577.25	24	-	55986	577.25
	5/32	.1562	24	-	55187	552.60	24	-	55387	552.60	24	-	55687	583.80	24	-	55987	583.80
	3/16	.1875	24	-	55188	559.10	24	-	55388	559.10	24	-	55688	590.30	24	-	55988	590.30
	1/4	.2500	24	-	55189	592.85	24	-	55389	592.85	24	-	55689	624.10	24	-	55989	624.10

CUTTERS



3" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

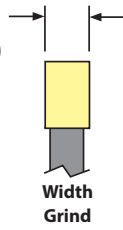
FOR STEEL

Modified width between .0600" and .5312"

TYPE 556

Cutter Notes (All cutters on page)

- 16 Teeth
- C-5 Carbide
- 1° - 3° Positive Radial Rake
- Width Tolerance: +.001"/-.000"
- OD tolerance: +.0313"/-.000"
- 1" Arbor hole +.001"/-.000"
- ANSI standard keyway dimensions
- Add 5% to grind down hub width
- Add 5% to match OD's on cutter sets within .001"
- Not designed to be used on heat treated materials greater than 475 Brinell (50RC)



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
3	.0555	55698D	0.0600 - 0.0703	\$294.70	\$274.80	\$271.10	\$269.25	\$268.10	\$241.90
3	.0711	55600D	0.0704 - 0.0859	345.25	325.35	321.70	319.90	318.75	292.50
3	.0867	55602D	0.0860 - 0.1015	294.70	274.80	271.10	269.25	268.10	241.90
3	.1024	55604D	0.1016 - 0.1171	275.95	256.00	252.35	250.55	249.40	223.20
3	.1180	55606D	0.1172 - 0.1406	255.00	235.10	231.45	229.65	228.45	202.25
3	.1562	55608D	0.1407 - 0.1718	265.25	245.35	241.70	239.85	238.65	212.45
3	.1875	55609D	0.1719 - 0.2031	275.45	255.55	251.95	250.10	248.90	222.70
3	.2188	55610D	0.2032 - 0.2343	285.65	265.75	262.15	260.30	259.15	232.90
3	.2500	55611D	0.2344 - 0.2812	295.95	276.05	272.40	270.60	269.40	243.20
3	.3125	55612D	0.2813 - 0.3437	319.40	299.45	295.85	294.00	292.85	266.65
3	.3750	55613D	0.3438 - 0.4062	342.95	323.05	319.40	317.55	316.35	290.15
3	.4375	55614D	0.4063 - 0.4687	375.15	355.25	351.65	349.80	348.65	322.40
3	.5000	55615D	0.4688 - 0.5312	411.00	391.10	387.50	385.65	384.50	358.25

Corner Radius or Chamfer on ONE Side

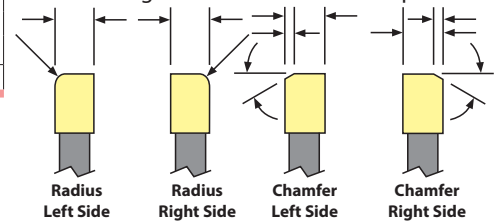
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH							
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED						
				1	2	3	4	5	6	
3	.0555	55698R1	0.0600 - 0.0703	\$308.00	\$278.85	\$274.80	\$272.70	\$271.40	\$270.75	
3	.0711	55600R1	0.0704 - 0.0859	358.65	329.45	325.40	323.30	322.05	321.35	
3	.0867	55602R1	0.0860 - 0.1015	308.00	278.85	274.80	272.70	271.40	270.75	
3	.1024	55604R1	0.1016 - 0.1171	289.30	260.10	256.05	253.95	252.70	252.00	
3	.1180	55606R1	0.1172 - 0.1406	268.35	239.20	235.15	233.05	231.75	231.05	
3	.1562	55608R1	0.1407 - 0.1718	278.55	249.45	245.40	243.30	241.95	241.30	
3	.1875	55609R1	0.1719 - 0.2031	288.80	259.65	255.60	253.50	252.20	251.55	
3	.2188	55610R1	0.2032 - 0.2343	299.05	269.85	265.80	263.70	262.45	261.75	
3	.2500	55611R1	0.2344 - 0.2812	309.30	280.15	276.10	274.00	272.70	272.00	
3	.3125	55612R1	0.2813 - 0.3437	332.75	303.55	299.50	297.40	296.15	295.45	
3	.3750	55613R1	0.3438 - 0.4062	356.25	327.15	323.10	321.00	319.65	319.00	
3	.4375	55614R1	0.4063 - 0.4687	388.55	359.35	355.30	353.20	351.95	351.30	
3	.5000	55615R1	0.4688 - 0.5312	424.40	395.25	391.20	389.10	387.75	387.15	

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is 1/2 the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of 1/3 the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- 1/2°
- Chamfers greater than 45° must be quoted

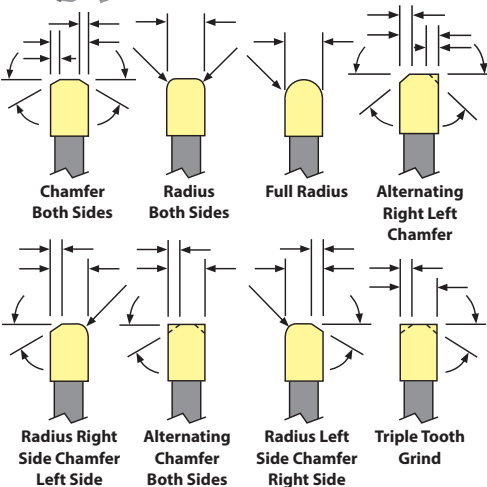


Specify right or left side for radius or chamfer



Corner Radius or Chamfer on BOTH Sides OR a Full Radius

• Price Increases 5% for Alternating Chamfers



TOOL DIAM.	HUB WIDTH	EDP NO.	RADI, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH							
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED						
				1	2	3	4	5	6	
3	.0555	55698R2	0.0600 - 0.0703	\$315.35	\$283.00	\$278.45	\$276.10	\$274.70	\$273.95	
3	.0711	55600R2	0.0704 - 0.0859	366.00	333.60	329.00	326.70	325.30	324.50	
3	.0867	55602R2	0.0860 - 0.1015	315.35	283.00	278.45	276.10	274.70	273.95	
3	.1024	55604R2	0.1016 - 0.1171	296.60	264.25	259.65	257.35	255.95	255.20	
3	.1180	55606R2	0.1172 - 0.1406	275.70	243.30	238.75	236.45	235.00	234.25	
3	.1562	55608R2	0.1407 - 0.1718	285.90	253.50	249.00	246.70	245.25	244.50	
3	.1875	55609R2	0.1719 - 0.2031	296.15	263.75	259.25	256.95	255.45	254.75	
3	.2188	55610R2	0.2032 - 0.2343	306.40	274.00	269.45	267.10	265.70	264.90	
3	.2500	55611R2	0.2344 - 0.2812	316.65	284.25	279.70	277.40	275.95	275.20	
3	.3125	55612R2	0.2813 - 0.3437	340.10	307.70	303.15	300.80	299.40	298.65	
3	.3750	55613R2	0.3438 - 0.4062	363.60	331.20	326.70	324.40	322.95	322.20	
3	.4375	55614R2	0.4063 - 0.4687	395.90	363.50	358.95	356.65	355.20	354.45	
3	.5000	55615R2	0.4688 - 0.5312	431.75	399.30	394.80	392.50	391.05	390.30	



4" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

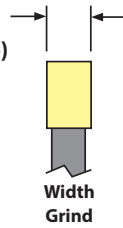
FOR STEEL

Modified width between .0600" and .5312"

TYPE 556

Cutter Notes (All cutters on page)

- 20 Teeth
- C-5 Carbide
- 1° - 3° Positive Radial Rake
- Width Tolerance: +.001"/-.000"
- OD tolerance: +.0313"/-.000"
- 1" Arbor hole +.001"/-.000"
- ANSI standard keyway dimensions
- Add 5% to grind down hub width
- Add 5% to match OD's on cutter sets within .001"
- Not designed to be used on heat treated materials greater than 475 Brinell (50RC)



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55616D	0.0600 - 0.0703	\$354.75	\$331.75	\$327.45	\$325.20	\$323.85	\$292.50
4	.0701	55618D	0.0704 - 0.0859	382.25	359.30	354.95	352.75	351.40	320.05
4	.0858	55620D	0.0860 - 0.1015	354.75	331.75	327.45	325.20	323.85	292.50
4	.1014	55622D	0.1016 - 0.1171	338.90	315.90	311.60	309.35	307.95	276.60
4	.1170	55624D	0.1172 - 0.1406	320.60	297.60	293.30	291.05	289.75	258.35
4	.1562	55626D	0.1407 - 0.1718	339.90	316.90	312.60	310.35	309.00	277.65
4	.1875	55628D	0.1719 - 0.2031	341.00	318.00	313.70	311.45	310.05	278.70
4	.2188	55630D	0.2032 - 0.2343	357.45	334.50	330.15	327.90	326.60	295.25
4	.2500	55632D	0.2344 - 0.2812	361.30	338.30	334.00	331.75	330.45	299.05
4	.3125	55634D	0.2813 - 0.3437	386.70	363.75	359.40	357.20	355.85	324.50
4	.3750	55636D	0.3438 - 0.4062	410.25	387.25	382.95	380.70	379.30	347.95
4	.4375	55638D	0.4063 - 0.4687	448.90	425.90	421.60	419.30	417.95	386.60
4	.5000	55640D	0.4688 - 0.5312	491.85	468.90	464.55	462.30	460.95	429.60

Corner Radius or Chamfer on ONE Side

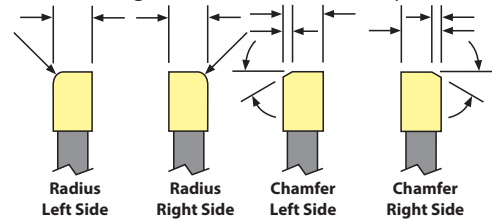
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55616R1	0.0600 - 0.0703	\$369.15	\$336.20	\$331.45	\$328.90	\$327.40	\$326.60
4	.0701	55618R1	0.0704 - 0.0859	396.70	363.75	358.95	356.40	354.95	354.10
4	.0858	55620R1	0.0860 - 0.1015	369.15	336.20	331.45	328.90	327.40	326.60
4	.1014	55622R1	0.1016 - 0.1171	353.25	320.35	315.60	313.05	311.55	310.75
4	.1170	55624R1	0.1172 - 0.1406	335.00	302.10	297.30	294.80	293.25	292.50
4	.1562	55626R1	0.1407 - 0.1718	354.30	321.35	316.60	314.05	312.60	311.75
4	.1875	55628R1	0.1719 - 0.2031	355.35	322.45	317.70	315.15	313.65	312.85
4	.2188	55630R1	0.2032 - 0.2343	371.90	338.95	334.15	331.65	330.15	329.35
4	.2500	55632R1	0.2344 - 0.2812	375.70	342.75	338.00	335.50	333.95	333.15
4	.3125	55634R1	0.2813 - 0.3437	401.15	368.25	363.40	360.90	359.40	358.60
4	.3750	55636R1	0.3438 - 0.4062	424.60	391.70	386.85	384.35	382.90	382.05
4	.4375	55638R1	0.4063 - 0.4687	463.25	430.35	425.55	423.05	421.50	420.75
4	.5000	55640R1	0.4688 - 0.5312	506.25	473.35	468.50	466.00	464.50	463.70

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is 1/2 the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of 1/3 the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- 1/2°
- Chamfers greater than 45° must be quoted

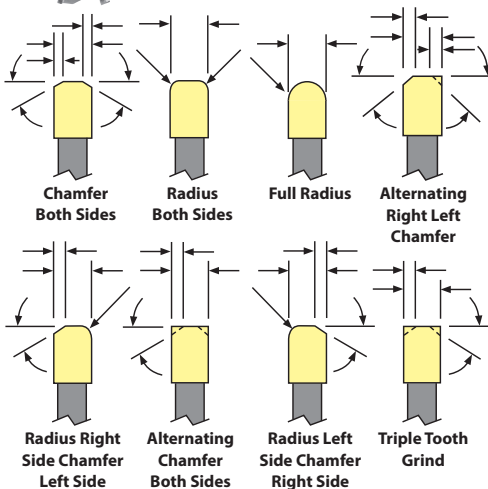


Specify right or left side for radius or chamfer



Corner Radius or Chamfer on BOTH Sides OR a Full Radius

• Price Increases 5% for Alternating Chamfers



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	RADI, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55616R2	0.0600 - 0.0703	\$377.00	\$340.65	\$335.40	\$332.65	\$330.95	\$330.05
4	.0701	55618R2	0.0704 - 0.0859	404.50	368.25	362.95	360.15	358.50	357.60
4	.0858	55620R2	0.0860 - 0.1015	377.00	340.65	335.40	332.65	330.95	330.05
4	.1014	55622R2	0.1016 - 0.1171	361.15	324.80	319.50	316.80	315.10	314.20
4	.1170	55624R2	0.1172 - 0.1406	342.90	306.55	301.30	298.50	296.85	295.95
4	.1562	55626R2	0.1407 - 0.1718	362.15	325.80	320.55	317.80	316.10	315.20
4	.1875	55628R2	0.1719 - 0.2031	363.25	326.90	321.60	318.90	317.20	316.30
4	.2188	55630R2	0.2032 - 0.2343	379.75	343.40	338.15	335.35	333.70	332.80
4	.2500	55632R2	0.2344 - 0.2812	383.55	347.25	342.00	339.20	337.50	336.65
4	.3125	55634R2	0.2813 - 0.3437	409.00	372.70	367.40	364.60	363.00	362.05
4	.3750	55636R2	0.3438 - 0.4062	432.45	396.15	390.85	388.10	386.45	385.55
4	.4375	55638R2	0.4063 - 0.4687	471.15	434.80	429.50	426.75	425.10	424.20
4	.5000	55640R2	0.4688 - 0.5312	514.10	477.80	472.50	469.70	468.10	467.20

CUTTERS



5" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556



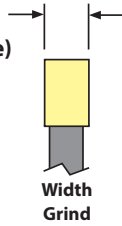
FOR STEEL

Modified width between .0704" and .5312"

TYPE 556

Cutter Notes (All cutters on page)

- 24 Teeth
- C-5 Carbide
- 1° - 3° Positive Radial Rake
- Width Tolerance: +.001"/-.000"
- OD tolerance: +.0313"/-.000"
- 1" Arbor hole +.001"/-.000"
- ANSI standard keyway dimensions
- Add 5% to grind down hub width
- Add 5% to match OD's on cutter sets within .001"
- Not designed to be used on heat treated materials greater than 475 Brinell (50RC)



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55642D	0.0704 - 0.0859	\$459.95	\$436.50	\$432.10	\$429.75	\$428.40	\$396.30
5	.0848	55644D	0.0860 - 0.1015	462.75	439.25	434.85	432.55	431.20	399.10
5	.1004	55646D	0.1016 - 0.1171	435.95	412.50	408.10	405.75	404.40	372.35
5	.1160	55648D	0.1094 - 0.1406	386.50	363.05	358.65	356.30	354.95	322.90
5	.1562	55650D	0.1407 - 0.1718	393.95	370.50	366.10	363.75	362.40	330.35
5	.1875	55652D	0.1719 - 0.2031	417.15	393.70	389.30	387.00	385.60	353.55
5	.2188	55654D	0.2032 - 0.2343	427.25	403.80	399.30	397.05	395.65	363.60
5	.2500	55656D	0.2344 - 0.2812	442.90	419.40	414.95	412.70	411.30	379.25
5	.3125	55658D	0.2813 - 0.3437	476.05	452.60	448.15	445.90	444.45	412.45
5	.3750	55660D	0.3438 - 0.4062	509.30	485.85	481.35	479.10	477.70	445.65
5	.4375	55662D	0.4063 - 0.4687	558.80	535.35	530.95	528.60	527.25	495.20
5	.5000	55664D	0.4688 - 0.5312	613.85	590.35	585.95	583.65	582.30	550.20

Corner Radius or Chamfer on ONE Side

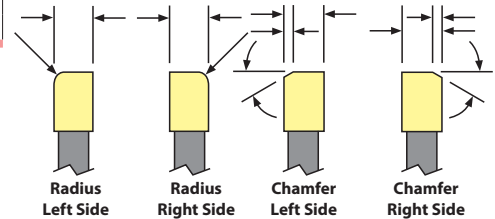
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55642R1	0.0704 - 0.0859	\$474.55	\$440.95	\$436.05	\$433.50	\$431.95	\$431.15
5	.0848	55644R1	0.0860 - 0.1015	477.35	443.75	438.85	436.30	434.75	433.90
5	.1004	55646R1	0.1016 - 0.1171	450.55	416.95	412.05	409.50	408.00	407.15
5	.1160	55648R1	0.1094 - 0.1406	401.10	367.50	362.55	360.05	358.50	357.70
5	.1562	55650R1	0.1407 - 0.1718	408.55	374.95	370.05	367.50	366.00	365.15
5	.1875	55652R1	0.1719 - 0.2031	431.75	398.15	393.30	390.70	389.20	388.35
5	.2188	55654R1	0.2032 - 0.2343	441.85	408.25	403.30	400.80	399.20	398.40
5	.2500	55656R1	0.2344 - 0.2812	457.50	423.90	418.95	416.40	414.85	414.00
5	.3125	55658R1	0.2813 - 0.3437	490.65	457.05	452.15	449.60	448.05	447.25
5	.3750	55660R1	0.3438 - 0.4062	523.90	490.30	485.35	482.80	481.25	480.45
5	.4375	55662R1	0.4063 - 0.4687	573.40	539.80	534.90	532.35	530.85	530.00
5	.5000	55664R1	0.4688 - 0.5312	628.40	594.80	589.90	587.35	585.85	585.00

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is 1/2 the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of 1/2 the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- 1/2°
- Chamfers greater than 45° must be quoted

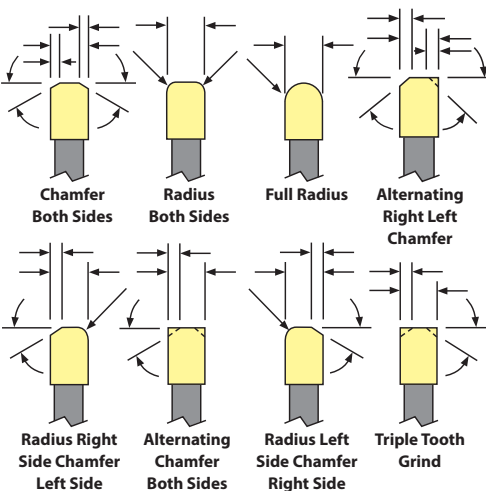


Specify right or left side for radius or chamfer



Corner Radius or Chamfer on BOTH Sides OR a Full Radius

• Price Increases 5% for Alternating Chamfers



TOOL DIAM.	HUB WIDTH	EDP NO.	RADI, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55642R2	0.0704 - 0.0859	\$490.20	\$449.85	\$444.00	\$440.95	\$439.10	\$438.10
5	.0848	55644R2	0.0860 - 0.1015	493.00	452.65	446.80	443.70	441.85	440.90
5	.1004	55646R2	0.1016 - 0.1171	466.20	425.90	420.00	416.90	415.05	414.10
5	.1160	55648R2	0.1094 - 0.1406	416.75	376.40	370.55	367.45	365.60	364.65
5	.1562	55650R2	0.1407 - 0.1718	424.20	383.90	378.00	374.90	373.05	372.10
5	.1875	55652R2	0.1719 - 0.2031	447.40	407.10	401.20	398.15	396.30	395.30
5	.2188	55654R2	0.2032 - 0.2343	457.50	417.15	411.30	408.20	406.35	405.35
5	.2500	55656R2	0.2344 - 0.2812	473.10	432.80	426.90	423.85	422.00	421.00
5	.3125	55658R2	0.2813 - 0.3437	506.30	466.00	460.10	457.00	455.20	454.20
5	.3750	55660R2	0.3438 - 0.4062	539.50	499.20	493.30	490.25	488.40	487.40
5	.4375	55662R2	0.4063 - 0.4687	589.05	548.75	542.85	539.75	537.90	536.95
5	.5000	55664R2	0.4688 - 0.5312	644.05	603.75	597.85	594.75	592.95	592.00



6" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

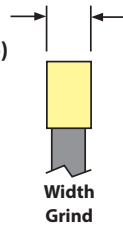
FOR STEEL

Modified width between .0704" and .5312"

TYPE 556

Cutter Notes (All cutters on page)

- 28 Teeth
- C-5 Carbide
- 1° - 3° Positive Radial Rake
- Width Tolerance: +.001"/-.000"
- OD tolerance: +.0313"/-.000"
- 1" Arbor hole +.001"/-.000"
- ANSI standard keyway dimensions
- Add 5% to grind down hub width
- Add 5% to match OD's on cutter sets within .001"
- Not designed to be used on heat treated materials greater than 475 Brinell (50RC)



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55666D	0.0704 - 0.0859	\$516.90	\$491.15	\$486.15	\$483.50	\$482.00	\$445.55
6	.0838	55668D	0.0860 - 0.1015	479.55	453.75	448.75	446.15	444.60	408.20
6	.0994	55670D	0.1016 - 0.1171	518.45	492.65	487.65	485.05	483.45	447.10
6	.1150	55672D	0.1094 - 0.1406	499.65	473.85	468.90	466.25	464.70	428.30
6	.1562	55674D	0.1407 - 0.1718	499.45	473.60	468.60	466.00	464.45	428.10
6	.1875	55676D	0.1719 - 0.2031	530.60	504.85	499.85	497.25	495.65	459.25
6	.2188	55678D	0.2032 - 0.2343	538.50	512.70	507.75	505.10	503.55	467.15
6	.2500	55680D	0.2344 - 0.2812	570.75	544.90	539.90	537.30	535.75	499.35
6	.3125	55682D	0.2813 - 0.3437	577.65	551.85	546.85	544.20	542.70	506.30
6	.3750	55684D	0.3438 - 0.4062	597.10	571.25	566.25	563.65	562.10	525.75
6	.4375	55690D	0.4063 - 0.4687	655.50	629.70	624.70	622.05	620.55	584.10
6	.5000	55692D	0.4688 - 0.5312	720.40	694.65	689.65	687.00	685.45	649.05

Corner Radius or Chamfer on ONE Side

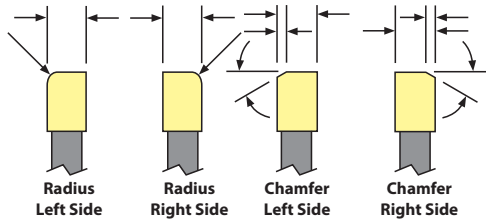
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55666R1	0.0704 - 0.0859	\$532.30	\$496.00	\$490.45	\$487.55	\$485.85	\$484.90
6	.0838	55668R1	0.0860 - 0.1015	494.90	458.65	453.10	450.20	448.45	447.50
6	.0994	55670R1	0.1016 - 0.1171	533.80	497.50	492.00	489.10	487.35	486.40
6	.1150	55672R1	0.1094 - 0.1406	515.00	478.75	473.20	470.30	468.55	467.60
6	.1562	55674R1	0.1407 - 0.1718	514.80	478.50	472.95	470.10	468.35	467.40
6	.1875	55676R1	0.1719 - 0.2031	546.00	509.70	504.15	501.25	499.55	498.60
6	.2188	55678R1	0.2032 - 0.2343	553.90	517.60	512.05	509.15	507.40	506.45
6	.2500	55680R1	0.2344 - 0.2812	586.10	549.80	544.20	541.35	539.65	538.70
6	.3125	55682R1	0.2813 - 0.3437	593.05	556.70	551.20	548.30	546.60	545.65
6	.3750	55684R1	0.3438 - 0.4062	612.45	576.15	570.60	567.75	566.00	565.05
6	.4375	55690R1	0.4063 - 0.4687	670.90	634.55	629.00	626.10	624.45	623.50
6	.5000	55692R1	0.4688 - 0.5312	735.80	699.50	693.95	691.05	689.30	688.40

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is 1/2 the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of 1/3 the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- 1/2°
- Chamfers greater than 45° must be quoted

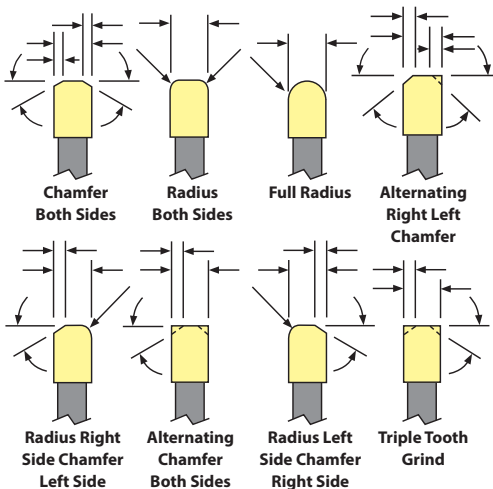


Specify right or left side for radius or chamfer



Corner Radius or Chamfer on BOTH Sides OR a Full Radius

• Price Increases 5% for Alternating Chamfers



TOOL DIAM.	HUB WIDTH	EDP NO.	RADI, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55666R2	0.0704 - 0.0859	\$549.00	\$505.70	\$499.05	\$495.65	\$493.60	\$492.50
6	.0838	55668R2	0.0860 - 0.1015	511.60	468.30	461.70	458.25	456.20	455.10
6	.0994	55670R2	0.1016 - 0.1171	550.50	507.20	500.60	497.10	495.15	493.95
6	.1150	55672R2	0.1094 - 0.1406	531.70	488.40	481.80	478.35	476.35	475.20
6	.1562	55674R2	0.1407 - 0.1718	531.50	488.20	481.60	478.10	476.10	474.95
6	.1875	55676R2	0.1719 - 0.2031	562.70	519.40	512.75	509.30	507.30	506.15
6	.2188	55678R2	0.2032 - 0.2343	570.55	527.25	520.65	517.20	515.20	514.05
6	.2500	55680R2	0.2344 - 0.2812	602.75	559.45	552.90	549.40	547.35	546.25
6	.3125	55682R2	0.2813 - 0.3437	609.75	566.40	559.80	556.35	554.35	553.20
6	.3750	55684R2	0.3438 - 0.4062	629.15	585.85	579.25	575.75	573.75	572.60
6	.4375	55690R2	0.4063 - 0.4687	687.55	644.25	637.65	634.20	632.15	631.05
6	.5000	55692R2	0.4688 - 0.5312	752.50	709.15	702.55	699.10	697.10	695.95

CUTTERS



3" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559



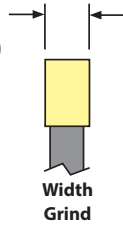
SUITABLE FOR MOST MATERIALS

Modified width between .0600" and .5312"

TYPE 559

Cutter Notes (All cutters on page)

- 12 Teeth
- C-2(m) Carbide
- 5° Positive Radial Rake
- Width Tolerance: +.001"/-.000"
- OD tolerance: +.0313"/-.000"
- 1" Arbor hole +.001"/-.000"
- ANSI standard keyway dimensions
- Add 5% to grind down hub width
- Add 5% to match OD's on cutter sets within .001"
- Not designed to be used on heat treated materials greater than 363 Brinell (39RC)



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
3	.0555	55998D	0.0600 - 0.0703	\$279.75	\$259.55	\$256.05	\$254.20	\$253.10	\$227.55
3	.0711	55900D	0.0704 - 0.0859	307.10	286.90	283.40	281.55	280.40	254.90
3	.0867	55902D	0.0860 - 0.1015	279.75	259.55	256.05	254.20	253.10	227.55
3	.1024	55904D	0.1016 - 0.1171	269.40	249.25	245.70	243.85	242.75	217.20
3	.1180	55906D	0.1172 - 0.1406	259.65	239.45	235.90	234.05	232.95	207.45
3	.1562	55908D	0.1407 - 0.1718	264.65	244.55	241.00	239.15	238.05	212.45
3	.1875	55909D	0.1719 - 0.2031	269.75	249.55	246.00	244.20	243.10	217.55
3	.2188	55910D	0.2032 - 0.2343	276.60	256.50	252.95	251.10	250.00	224.45
3	.2500	55911D	0.2344 - 0.2812	283.50	263.30	259.70	257.90	256.80	231.20
3	.3125	55912D	0.2813 - 0.3437	305.50	285.35	281.80	280.00	278.90	253.25
3	.3750	55913D	0.3438 - 0.4062	329.25	309.05	305.50	303.65	302.55	277.05
3	.4375	55914D	0.4063 - 0.4687	353.20	333.00	329.50	327.65	326.55	301.05
3	.5000	55915D	0.4688 - 0.5312	377.20	357.00	353.45	351.65	350.55	324.90

Corner Radius or Chamfer on ONE Side

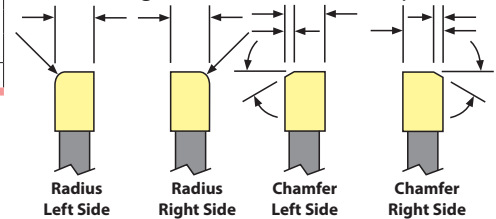
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
3	.0555	55998R1	0.0600 - 0.0703	\$293.40	\$263.55	\$259.55	\$257.55	\$256.30	\$255.70
3	.0711	55900R1	0.0704 - 0.0859	320.80	290.90	286.90	284.85	283.65	283.00
3	.0867	55902R1	0.0860 - 0.1015	293.40	263.55	259.55	257.55	256.30	255.70
3	.1024	55904R1	0.1016 - 0.1171	283.10	253.20	249.25	247.20	245.95	245.30
3	.1180	55906R1	0.1172 - 0.1406	273.30	243.40	239.45	237.40	236.20	235.50
3	.1562	55908R1	0.1407 - 0.1718	278.35	248.50	244.55	242.45	241.25	240.55
3	.1875	55909R1	0.1719 - 0.2031	283.45	253.50	249.55	247.55	246.35	245.65
3	.2188	55910R1	0.2032 - 0.2343	290.30	260.45	256.50	254.40	253.20	252.50
3	.2500	55911R1	0.2344 - 0.2812	297.10	267.20	263.30	261.25	260.00	259.35
3	.3125	55912R1	0.2813 - 0.3437	319.20	289.35	285.35	283.30	282.10	281.35
3	.3750	55913R1	0.3438 - 0.4062	342.95	313.00	309.05	307.00	305.80	305.15
3	.4375	55914R1	0.4063 - 0.4687	366.90	337.00	333.00	331.00	329.80	329.10
3	.5000	55915R1	0.4688 - 0.5312	390.85	360.95	357.00	355.00	353.70	353.05

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is 1/2 the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of 1/3 the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- 1/2°
- Chamfers greater than 45° must be quoted

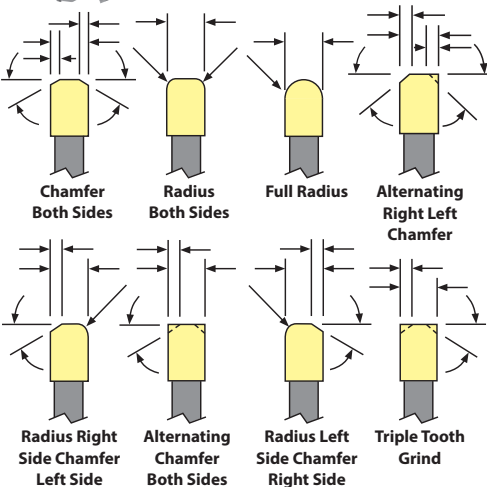


Specify right or left side for radius or chamfer



Corner Radius or Chamfer on BOTH Sides OR a Full Radius

• Price Increases 5% for Alternating Chamfers



TOOL DIAM.	HUB WIDTH	EDP NO.	RADI, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
3	.0555	55998R2	0.0600 - 0.0703	\$300.70	\$267.55	\$263.20	\$260.85	\$259.50	\$258.75
3	.0711	55900R2	0.0704 - 0.0859	328.10	294.90	290.50	288.20	286.80	286.05
3	.0867	55902R2	0.0860 - 0.1015	300.70	267.55	263.20	260.85	259.50	258.75
3	.1024	55904R2	0.1016 - 0.1171	290.45	257.20	252.85	250.55	249.15	248.45
3	.1180	55906R2	0.1172 - 0.1406	280.65	247.45	243.00	240.75	239.35	238.65
3	.1562	55908R2	0.1407 - 0.1718	285.70	252.45	248.05	245.80	244.45	243.70
3	.1875	55909R2	0.1719 - 0.2031	290.70	257.55	253.15	250.85	249.50	248.75
3	.2188	55910R2	0.2032 - 0.2343	297.70	264.45	260.05	257.80	256.35	255.70
3	.2500	55911R2	0.2344 - 0.2812	304.45	271.20	266.85	264.55	263.20	262.45
3	.3125	55912R2	0.2813 - 0.3437	326.50	293.30	288.85	286.65	285.30	284.55
3	.3750	55913R2	0.3438 - 0.4062	350.30	317.05	312.65	310.40	308.95	308.25
3	.4375	55914R2	0.4063 - 0.4687	374.15	341.05	336.65	334.30	332.95	332.20
3	.5000	55915R2	0.4688 - 0.5312	398.15	365.05	360.55	358.30	356.95	356.20



4" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559



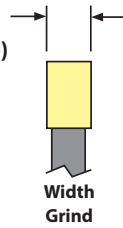
SUITABLE FOR MOST MATERIALS

Modified width between .0600" and .5312"

TYPE 559

Cutter Notes (All cutters on page)

- 14 Teeth
- C-2(m) Carbide
- 5° Positive Radial Rake
- Width Tolerance: +.001"/-.000"
- OD tolerance: +.0313"/-.000"
- 1" Arbor hole +.001"/-.000"
- ANSI standard keyway dimensions
- Add 5% to grind down hub width
- Add 5% to match OD's on cutter sets within .001"
- Not designed to be used on heat treated materials greater than 363 Brinell (39RC)



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55916D	0.0600 - 0.0703	\$320.30	\$297.10	\$292.90	\$290.70	\$289.40	\$258.80
4	.0701	55918D	0.0704 - 0.0859	358.05	334.80	330.55	328.40	327.10	296.50
4	.0858	55920D	0.0860 - 0.1015	320.30	297.10	292.90	290.70	289.40	258.80
4	.1014	55922D	0.1016 - 0.1171	368.40	345.20	340.95	338.80	337.45	306.85
4	.1170	55924D	0.1172 - 0.1406	319.95	296.70	292.40	290.25	288.95	258.40
4	.1562	55926D	0.1407 - 0.1718	326.70	303.50	299.25	297.10	295.75	265.20
4	.1875	55928D	0.1719 - 0.2031	335.15	311.95	307.70	305.55	304.20	273.65
4	.2188	55930D	0.2032 - 0.2343	343.75	320.55	316.30	314.15	312.80	282.20
4	.2500	55932D	0.2344 - 0.2812	350.55	327.30	323.05	320.90	319.55	289.00
4	.3125	55934D	0.2813 - 0.3437	370.85	347.65	343.40	341.25	339.90	309.40
4	.3750	55936D	0.3438 - 0.4062	394.70	371.50	367.25	365.10	363.70	333.10
4	.4375	55938D	0.4063 - 0.4687	418.65	395.45	391.20	389.00	387.65	357.10
4	.5000	55940D	0.4688 - 0.5312	442.65	419.35	415.15	412.95	411.65	381.10

Corner Radius or Chamfer on ONE Side

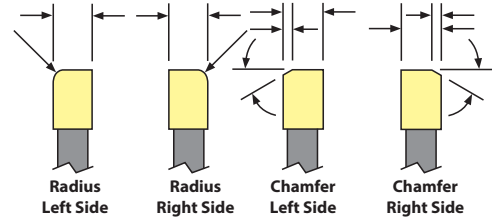
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55916R1	0.0600 - 0.0703	\$335.10	\$301.45	\$296.80	\$294.30	\$292.90	\$292.10
4	.0701	55918R1	0.0704 - 0.0859	372.80	339.15	334.50	332.00	330.55	329.80
4	.0858	55920R1	0.0860 - 0.1015	335.10	301.45	296.80	294.30	292.90	292.10
4	.1014	55922R1	0.1016 - 0.1171	383.20	349.55	344.80	342.40	340.95	340.15
4	.1170	55924R1	0.1172 - 0.1406	334.70	301.05	296.30	293.90	292.40	291.65
4	.1562	55926R1	0.1407 - 0.1718	341.45	307.80	303.15	300.70	299.25	298.45
4	.1875	55928R1	0.1719 - 0.2031	349.95	316.30	311.60	309.15	307.70	306.90
4	.2188	55930R1	0.2032 - 0.2343	358.60	324.85	320.20	317.80	316.30	315.45
4	.2500	55932R1	0.2344 - 0.2812	365.30	331.65	326.95	324.50	323.05	322.25
4	.3125	55934R1	0.2813 - 0.3437	385.65	351.95	347.30	344.85	343.40	342.55
4	.3750	55936R1	0.3438 - 0.4062	409.45	375.80	371.10	368.65	367.25	366.40
4	.4375	55938R1	0.4063 - 0.4687	433.45	399.80	395.05	392.65	391.20	390.40
4	.5000	55940R1	0.4688 - 0.5312	457.40	423.75	419.05	416.60	415.15	414.40

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is 1/2 the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of 1/3 the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- 1/2°
- Chamfers greater than 45° must be quoted

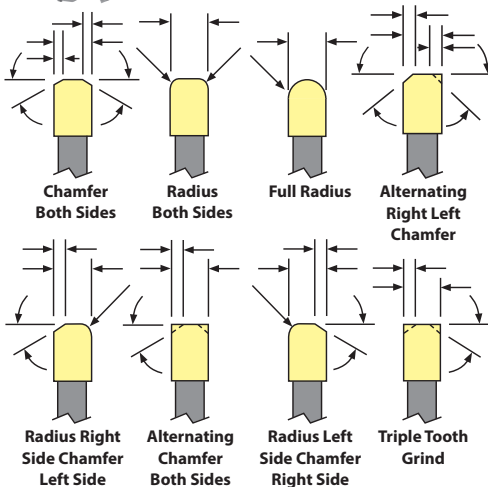


Specify right or left side for radius or chamfer



Corner Radius or Chamfer on BOTH Sides OR a Full Radius

• Price Increases 5% for Alternating Chamfers



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	RADI, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55916R2	0.0600 - 0.0703	\$342.95	\$305.85	\$300.60	\$297.95	\$296.30	\$295.45
4	.0701	55918R2	0.0704 - 0.0859	380.55	343.50	338.30	335.65	334.00	333.10
4	.0858	55920R2	0.0860 - 0.1015	342.95	305.85	300.60	297.95	296.30	295.45
4	.1014	55922R2	0.1016 - 0.1171	391.00	353.90	348.70	346.05	344.40	343.50
4	.1170	55924R2	0.1172 - 0.1406	342.45	305.40	300.20	297.50	295.90	295.00
4	.1562	55926R2	0.1407 - 0.1718	349.30	312.20	306.95	304.35	302.65	301.80
4	.1875	55928R2	0.1719 - 0.2031	357.80	320.65	315.45	312.80	311.10	310.35
4	.2188	55930R2	0.2032 - 0.2343	366.35	329.25	324.05	321.40	319.80	318.90
4	.2500	55932R2	0.2344 - 0.2812	373.05	336.00	330.80	328.10	326.50	325.60
4	.3125	55934R2	0.2813 - 0.3437	393.45	356.35	351.15	348.50	346.85	346.00
4	.3750	55936R2	0.3438 - 0.4062	417.25	380.15	374.95	372.30	370.70	369.80
4	.4375	55938R2	0.4063 - 0.4687	441.25	404.15	398.95	396.25	394.60	393.80
4	.5000	55940R2	0.4688 - 0.5312	465.20	428.15	422.90	420.20	418.60	417.70

CUTTERS



5" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559



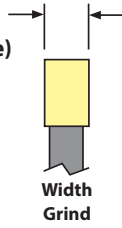
SUITABLE FOR MOST MATERIALS

Modified width between .0704" and .5312"

TYPE 559

Cutter Notes (All cutters on page)

- 16 Teeth
- C-2(m) Carbide
- 5° Positive Radial Rake
- Width Tolerance: +.001"/-.000"
- OD tolerance: +.0313"/-.000"
- 1" Arbor hole +.001"/-.000"
- ANSI standard keyway dimensions
- Add 5% to grind down hub width
- Add 5% to match OD's on cutter sets within .001"
- Not designed to be used on heat treated materials greater than 363 Brinell (39RC)



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55942D	0.0704 - 0.0859	\$428.30	\$404.50	\$400.15	\$397.95	\$396.65	\$365.35
5	.0848	55944D	0.0860 - 0.1015	376.30	352.55	348.25	346.05	344.70	313.35
5	.1004	55946D	0.1016 - 0.1171	407.55	383.80	379.45	377.25	375.90	344.65
5	.1160	55948D	0.1094 - 0.1406	367.25	343.40	339.15	336.90	335.60	304.30
5	.1562	55950D	0.1407 - 0.1718	377.30	353.55	349.30	347.00	345.65	314.35
5	.1875	55952D	0.1719 - 0.2031	394.40	370.65	366.35	364.15	362.80	331.45
5	.2188	55954D	0.2032 - 0.2343	411.45	387.65	383.35	381.15	379.75	348.50
5	.2500	55956D	0.2344 - 0.2812	428.35	404.55	400.30	398.05	396.75	365.40
5	.3125	55958D	0.2813 - 0.3437	457.20	433.45	429.15	426.90	425.55	394.30
5	.3750	55960D	0.3438 - 0.4062	487.85	464.05	459.80	457.55	456.20	424.95
5	.4375	55962D	0.4063 - 0.4687	511.80	488.05	483.80	481.55	480.20	448.90
5	.5000	55964D	0.4688 - 0.5312	535.80	512.05	507.75	505.50	504.15	472.85

Corner Radius or Chamfer on ONE Side

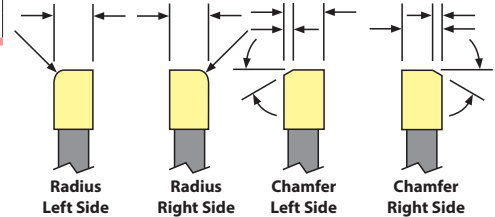
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55942R1	0.0704 - 0.0859	\$443.20	\$408.85	\$404.10	\$401.55	\$400.05	\$399.30
5	.0848	55944R1	0.0860 - 0.1015	391.30	356.95	352.10	349.65	348.15	347.30
5	.1004	55946R1	0.1016 - 0.1171	422.50	388.20	383.35	380.90	379.35	378.60
5	.1160	55948R1	0.1094 - 0.1406	382.15	347.80	343.05	340.50	339.05	338.25
5	.1562	55950R1	0.1407 - 0.1718	392.30	357.90	353.10	350.65	349.10	348.35
5	.1875	55952R1	0.1719 - 0.2031	409.35	375.00	370.20	367.70	366.25	365.40
5	.2188	55954R1	0.2032 - 0.2343	426.35	392.00	387.20	384.75	383.20	382.40
5	.2500	55956R1	0.2344 - 0.2812	443.30	409.00	404.15	401.70	400.15	399.35
5	.3125	55958R1	0.2813 - 0.3437	472.15	437.80	433.00	430.50	429.05	428.25
5	.3750	55960R1	0.3438 - 0.4062	502.80	468.45	463.65	461.15	459.70	458.90
5	.4375	55962R1	0.4063 - 0.4687	526.80	492.45	487.60	485.15	483.65	482.85
5	.5000	55964R1	0.4688 - 0.5312	550.70	516.40	511.60	509.15	507.55	506.80

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is 1/2 the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of 1/3 the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- 1/2°
- Chamfers greater than 45° must be quoted

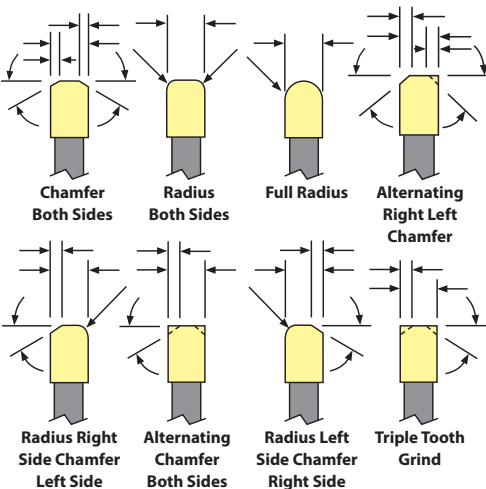


Specify right or left side for radius or chamfer



Corner Radius or Chamfer on BOTH Sides OR a Full Radius

• Price Increases 5% for Alternating Chamfers



TOOL DIAM.	HUB WIDTH	EDP NO.	RADI, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55942R2	0.0704 - 0.0859	\$458.80	\$417.60	\$411.80	\$408.80	\$407.05	\$406.10
5	.0848	55944R2	0.0860 - 0.1015	406.90	365.60	359.85	356.90	355.10	354.15
5	.1004	55946R2	0.1016 - 0.1171	438.05	396.85	391.10	388.10	386.35	385.35
5	.1160	55948R2	0.1094 - 0.1406	397.75	356.50	350.75	347.75	346.00	345.05
5	.1562	55950R2	0.1407 - 0.1718	407.85	366.60	360.85	357.90	356.10	355.10
5	.1875	55952R2	0.1719 - 0.2031	424.95	383.70	377.90	374.95	373.15	372.20
5	.2188	55954R2	0.2032 - 0.2343	441.90	400.75	394.95	392.00	390.20	389.25
5	.2500	55956R2	0.2344 - 0.2812	458.90	417.65	411.85	408.90	407.15	406.20
5	.3125	55958R2	0.2813 - 0.3437	487.70	446.50	440.75	437.75	435.95	435.00
5	.3750	55960R2	0.3438 - 0.4062	518.40	477.10	471.40	468.40	466.60	465.70
5	.4375	55962R2	0.4063 - 0.4687	542.40	501.10	495.35	492.40	490.60	489.65
5	.5000	55964R2	0.4688 - 0.5312	566.30	525.10	519.35	516.40	514.55	513.60



6" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559



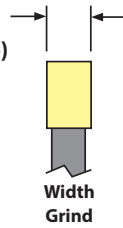
SUITABLE FOR MOST MATERIALS

Modified width between .0704" and .5312"

TYPE 559

Cutter Notes (All cutters on page)

- 18 Teeth
- C-2(m) Carbide
- 5° Positive Radial Rake
- Width Tolerance: +.001"/-.000"
- OD tolerance: +.0313"/-.000"
- 1" Arbor hole +.001"/-.000"
- ANSI standard keyway dimensions
- Add 5% to grind down hub width
- Add 5% to match OD's on cutter sets within .001"
- Not designed to be used on heat treated materials greater than 363 Brinell (39Rc)



TOOL DIAM.	HUB WIDTH	EDP NO.	MODIFIED FACE WIDTH RANGE	FINISHED TO MODIFIED FACE WIDTH					
				PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55966D	0.0704 - 0.0859	\$476.60	\$451.75	\$447.25	\$444.95	\$443.50	\$410.85
6	.0838	55968D	0.0860 - 0.1015	444.05	419.25	414.75	412.45	411.00	378.35
6	.0994	55970D	0.1016 - 0.1171	477.95	453.20	448.65	446.30	444.95	412.25
6	.1150	55972D	0.1094 - 0.1406	454.85	430.10	425.55	423.20	421.85	389.20
6	.1562	55974D	0.1407 - 0.1718	471.85	447.10	442.60	440.25	438.85	406.20
6	.1875	55976D	0.1719 - 0.2031	488.90	464.05	459.65	457.20	455.80	423.15
6	.2188	55978D	0.2032 - 0.2343	505.90	481.10	476.60	474.25	472.85	440.20
6	.2500	55980D	0.2344 - 0.2812	529.40	504.60	500.05	497.75	496.35	463.70
6	.3125	55982D	0.2813 - 0.3437	550.15	525.30	520.85	518.50	517.10	484.40
6	.3750	55984D	0.3438 - 0.4062	568.75	543.90	539.50	537.10	535.70	503.00
6	.4375	55992D	0.4063 - 0.4687	592.70	567.90	563.40	561.05	559.65	527.00
6	.5000	55990D	0.4688 - 0.5312	616.65	591.90	587.35	585.05	583.65	551.00

Corner Radius or Chamfer on ONE Side

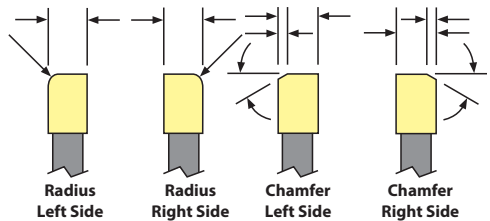
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55966R1	0.0704 - 0.0859	\$491.80	\$456.10	\$451.10	\$448.55	\$447.00	\$446.15
6	.0838	55968R1	0.0860 - 0.1015	459.30	423.60	418.60	416.05	414.50	413.65
6	.0994	55970R1	0.1016 - 0.1171	493.25	457.50	452.50	449.90	448.35	447.55
6	.1150	55972R1	0.1094 - 0.1406	470.15	434.40	429.40	426.80	425.30	424.45
6	.1562	55974R1	0.1407 - 0.1718	487.15	451.45	446.40	443.90	442.30	441.45
6	.1875	55976R1	0.1719 - 0.2031	504.15	468.45	463.45	460.85	459.30	458.50
6	.2188	55978R1	0.2032 - 0.2343	521.15	485.45	480.50	477.85	476.35	475.50
6	.2500	55980R1	0.2344 - 0.2812	544.65	509.00	503.95	501.40	499.80	498.95
6	.3125	55982R1	0.2813 - 0.3437	565.40	529.70	524.75	522.10	520.55	519.70
6	.3750	55984R1	0.3438 - 0.4062	584.00	548.30	543.30	540.70	539.20	538.35
6	.4375	55992R1	0.4063 - 0.4687	607.95	572.30	567.30	564.70	563.10	562.30
6	.5000	55990R1	0.4688 - 0.5312	631.95	596.25	591.20	588.70	587.10	586.25

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is 1/2 the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of 1/3 the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- 1/2°
- Chamfers greater than 45° must be quoted

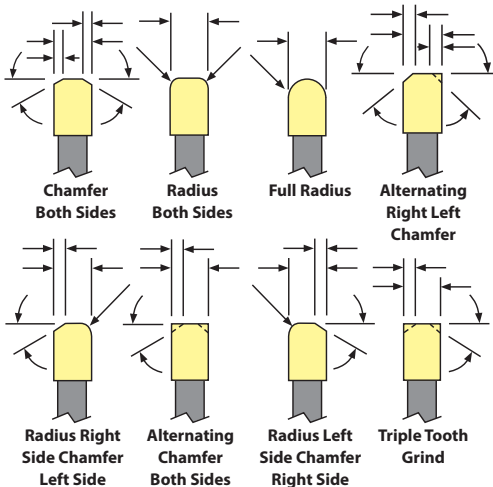


Specify right or left side for radius or chamfer



Corner Radius or Chamfer on BOTH Sides OR a Full Radius

• Price Increases 5% for Alternating Chamfers



TOOL DIAM.	HUB WIDTH	EDP NO.	RADI, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55966R2	0.0704 - 0.0859	\$507.40	\$464.85	\$458.90	\$455.80	\$453.90	\$452.90
6	.0838	55968R2	0.0860 - 0.1015	474.90	432.35	426.35	423.25	421.40	420.40
6	.0994	55970R2	0.1016 - 0.1171	508.85	466.25	460.25	457.20	455.35	454.35
6	.1150	55972R2	0.1094 - 0.1406	485.75	443.15	437.15	434.10	432.25	431.25
6	.1562	55974R2	0.1407 - 0.1718	502.75	460.15	454.20	451.10	449.25	448.25
6	.1875	55976R2	0.1719 - 0.2031	519.70	477.10	471.20	468.15	466.30	465.30
6	.2188	55978R2	0.2032 - 0.2343	536.75	494.20	488.20	485.15	483.25	482.25
6	.2500	55980R2	0.2344 - 0.2812	560.25	517.65	511.70	508.60	506.75	505.80
6	.3125	55982R2	0.2813 - 0.3437	580.95	538.45	532.45	529.40	527.50	526.50
6	.3750	55984R2	0.3438 - 0.4062	599.55	557.00	551.05	548.00	546.15	545.15
6	.4375	55992R2	0.4063 - 0.4687	623.55	580.95	575.05	572.00	570.10	569.10
6	.5000	55990R2	0.4688 - 0.5312	647.55	604.95	599.00	596.00	594.10	593.05

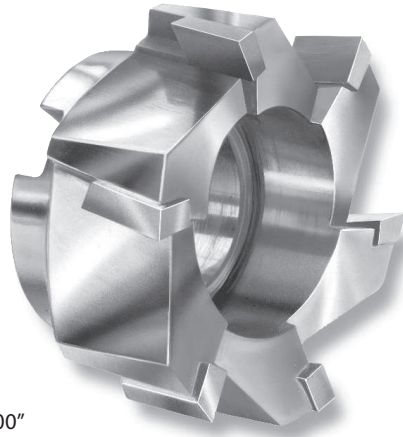
CUTTERS



SHELL END MILLS CARBIDE TIPPED TYPES 530, 531, 532 FRACTIONAL

MATERIAL SPECIFIC

THREE TYPES – FOR NON-FERROUS, CAST IRONS, OR STEELS



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	530
	40	NON-FERROUS - SHORT CHIPS	530/531
	60	CAST IRONS	531
	80	LOW STRENGTH STEELS	532
	100	MEDIUM STRENGTH STEELS	532
	120	HIGH STRENGTH STEELS	532
	140	HIGH TEMPERATURE ALLOYS	531

TYPE 530 – FOR NON-FERROUS

- Right spiral flutes

TYPE 531 – FOR CAST IRONS

- Right spiral flutes

TYPE 532 – FOR STEELS

- Left spiral flutes absorb the impact shock on entering steel

ALL TYPES:

- Large open flutes for easy chip flow
- Tool diameter tolerance: plus $\frac{1}{16}$ ", minus .000"
- Arbor hole tolerance: plus .001", minus .000"
- Tool geometry & carbide grade appropriate for material being machined

MODIFICATIONS (Prompt delivery)

- Corner chamfer or corner radius
- Cutting diameter reduced for step
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

TOOL DIAM.	DIMENSIONS					TYPE 530 FOR NON-FERROUS			TYPE 531 FOR CAST IRONS			TYPE 532 FOR STEELS		
	ARBOR HOLE	LENGTH		DRIVE SLOTS		NO. OF TEETH	EDP NO.	PRICE	NO. OF TEETH	EDP NO.	PRICE	NO. OF TEETH	EDP NO.	PRICE
		CAR-BIDE	OVER-ALL	WIDTH	DEPTH									
1 ¼	½	½	1	¼	5/32	4	53024	\$161.90	4	53124	\$161.90	4	53224	\$168.40
1 ½	½	½	1 ½	¼	5/32	4	53026	168.60	4	53126	168.60	4	53226	175.35
1 ¾	¾	½	1 ¼	5/16	3/16	4	53028	210.10	4	53128	210.10	4	53228	218.45
2	¾	5/8	1 ¾	5/16	3/16	4	53032	220.60	4	53132	234.70	4	53232	244.05
2 ¼	1	5/8	1 ½	3/8	7/32	6	53036	233.05	6	53136	254.10	6	53236	264.30
2 ½	1	5/8	1 5/8	3/8	7/32	6	53040	245.40	6	53140	277.00	6	53240	277.00
2 ¾	1	5/8	1 5/8	3/8	7/32	6	53044	258.95	6	53144	290.55	6	53244	290.55
3	1 ¼	¾	1 ¾	½	9/32	6	53048	283.85	6	53148	316.05	6	53248	316.05
3 ½	1 ¼	¾	1 7/8	½	9/32	6	53056	347.45	8	53156	371.70	6	53256	392.90
4	1 ½	¾	2 ¼	5/8	3/8	6	53064	436.60	8	53164	459.80	6	53264	488.00

CUTTERS



ANGLE CUTTERS CARBIDE TIPPED TYPES 714, 716, 724, 726, 750, 752, 754 FRACTIONAL

FOR NON-FERROUS OR CAST IRONS

CHIP CLASS 20, 40, 60



TOOL DIAMETER	WIDTH	ARBOR HOLES	NO. OF TEETH	RIGHT 45° TYPE 714 EDP NO.	LEFT 45° TYPE 716 EDP NO.	RIGHT 60° TYPE 724 EDP NO.	LEFT 60° TYPE 726 EDP NO.	ALL TYPES PRICE
3	½	1	8	71408	71608	72408	72608	\$317.45
4	½	1 ¼	10	71416	71616	72416	72616	392.90
4	¾	1 ¼	10	71424	71624	72424	72624	426.25

SINGLE ANGLE CUTTERS

TYPE 714 - 45° RIGHT

TYPE 716 - 45° LEFT

TYPE 724 - 60° RIGHT

TYPE 726 - 60° LEFT

DOUBLE ANGLE CUTTERS

TYPE 750 - 45° INCLUDED • TYPE 752 - 60° INCLUDED • TYPE 754 - 90° INCLUDED

TOOL DIAMETER	WIDTH	ARBOR HOLES	NO. OF TEETH	45° TYPE 750 EDP NO.	60° TYPE 752 EDP NO.	90° TYPE 754 EDP NO.	ALL TYPES PRICE
2 ¾	½	1	8	-	75207	75407	\$267.25
3	½	1	8	75008	75208	75408	333.30
4	½	1 ¼	10	75016	75216	75416	412.50
4	¾	1 ¼	10	75024	75224	75424	447.45
4	1	1 ¼	10	-	75232	75432	523.70

ALL TYPES:

- Carbide tips brazed to alloy steel body
- General purpose cutters for cutting non-ferrous materials and cast irons
- Arbor hole tolerance: plus .001", minus .000"
- Tool geometry & carbide grade appropriate for material being machined



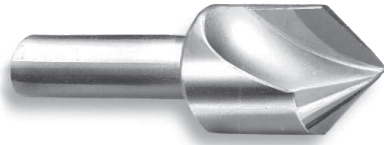


SPIRAL FLUTE COUNTERSINKS CARBIDE TIPPED

TYPES 561, 563, 581, 583, 584, 585, 590, 591 FRACTIONAL



SINGLE OR THREE FLUTES: 60°, 82°, 90°, 100° ANGLES



- TYPE 561 – 60° SINGLE FLUTE
- TYPE 581 – 82° SINGLE FLUTE
- TYPE 591 – 90° SINGLE FLUTE
- TYPE 584 – 100° SINGLE FLUTE

- Right spiral flute minimizes chatter
- Carbide tip brazed to tough hardened alloy steel body
- Not recommended for portable tool use (use “three flutes” type)

- TYPE 563 – 60° THREE FLUTES
- TYPE 583 – 82° THREE FLUTES
- TYPE 590 – 90° THREE FLUTES
- TYPE 585 – 100° THREE FLUTES

- Right spiral flutes minimizes chatter
- Carbide tips brazed to tough hardened alloy steel body
- Three flute design tends to center the tool in portable use and results in longer tool life

MODIFICATIONS (Prompt delivery)

- Modified included angle
- Shank drive flat(s)
- Reduced shank diameter
- 4 coatings available (listed on page 174)

TOOL DIAM.	SHANK DIAM.	MIN. CUT DIAM.	TYPE 561 60° ANGLE EDP NO.	TYPE 581 82° ANGLE EDP NO.	TYPE 591 90° ANGLE EDP NO.	TYPE 584 100° ANGLE EDP NO.	PRICE ALL TYPES
1/4	3/16	1/16	56108	58108	59108	58408	\$46.15
3/8	1/4	5/64	56112	58112	59112	58412	46.15
1/2	3/8	3/32	56116	58116	59116	58416	54.75
3/4	1/2	1/8	56124	58124	59124	58424	68.50
1	1/2	1/8	56132	58132	59132	58432	89.45
1 1/4	1/2	5/32	56140	58140	59140	58440	113.80
1 1/2	1/2	3/16	56148	58148	59148	58448	127.65

TOOL DIAM.	SHANK DIAM.	MIN. CUT DIAM.	TYPE 563 60° ANGLE EDP NO.	TYPE 583 82° ANGLE EDP NO.	TYPE 590 90° ANGLE EDP NO.	TYPE 585 100° ANGLE EDP NO.	PRICE ALL TYPES
1/4	3/16	5/64	56308	58308	59008	58508	\$50.70
3/8	1/4	7/64	56312	58312	59012	58512	50.70
1/2	3/8	9/64	56316	58316	59016	58516	60.25
3/8	3/8	9/64	56320	58320	59020	58520	63.35
3/4	1/2	3/16	56324	58324	59024	58524	76.20
7/8	1/2	3/16	56328	58328	59028	58528	87.30
1	1/2	1/4	56332	58332	59032	58532	95.25
1 1/4	1/2	5/16	56340	58340	59040	58540	118.50
1 1/2	1/2	3/8	56348	58348	59048	58548	138.20



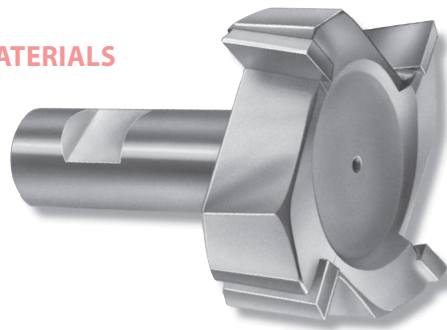
FACE MILLING CUTTERS - SHANK TYPE CARBIDE TIPPED

TYPES 536, 537, 538 FRACTIONAL



- TYPE 536 – FOR NON-FERROUS MATERIALS
- TYPE 537 – FOR CAST IRONS
- TYPE 538 – FOR STEELS

- Carbide tips brazed to tough alloy steel body
- Straight shank with Weldon flats
- Tool geometry and carbide grade appropriate for material being machined



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS		536
40	NON-FERROUS - SHORT CHIPS		536/537
60	CAST IRONS		537
80	LOW STRENGTH STEELS		538
100	MEDIUM STRENGTH STEELS		538
120	HIGH STRENGTH STEELS		538
140	HIGH TEMPERATURE ALLOYS		537

MODIFICATIONS (Prompt delivery)

- Corner chamfer or corner radius
- Additional shank drive flat(s)
- 4 coatings available (listed on page 174)

TOOL DIAM.	DIMENSIONS						NO. OF TEETH	TYPE 536 FOR NON-FERROUS		NO. OF TEETH	TYPE 537 FOR CAST IRONS		NO. OF TEETH	TYPE 538 FOR STEELS	
	SHANK DIAM.	TOOL WIDTH	CARBIDE DEPTH	LENGTH		EDP NO.		PRICE	EDP NO.		PRICE	EDP NO.		PRICE	
				CAR-BIDE	OVER-ALL										
1 1/2	3/4	3/4	1/4	1/2	2 7/8	4	53624	\$150.90	4	53724	150.90	4	53824	\$155.30	
2	3/4	3/4	1/4	1/2	2 7/8	4	53632	184.50	4	53732	184.50	4	53832	188.80	
2 1/2	3/4	3/4	1/4	1/2	2 7/8	6	53640	207.75	6	53740	207.75	6	53840	213.30	
3 1/2	1 1/4	1 1/8	5/16	3/8	4	6	53656	358.50	6	53756	358.50	8	53856	370.80	
3 1/2	1 1/2	1 1/8	5/16	3/8	4	6	53657	376.45	6	53757	376.45	8	53857	389.30	
4	1 1/2	1 1/2	3/8	3/4	5	8	53664	402.85	8	53764	402.85	8	53864	403.30	

CUTTERS



FEEDS & SPEEDS - KEYSEAT CUTTERS CARBIDE TIPPED

Speeds & feeds are starting recommendations only. Factors such as machine, fixture and tooling rigidity, horsepower available, coolant application and others will affect the performance significantly. Please read machine operators instructions and use all safety shields and glasses before performing these operations. **Use this chart for carbide tipped keyseat cutters types 700, 701, 702, and 703.**

IPM is based on catalog standards only using the mid SFPM and a 0.002 IPT chip load as a starting point. For all other conditions use the following formulas to calculate RPM and IPM from the ranges listed in the material group and brinell hardness section as a starting point.

IPM = Inches Per Minute

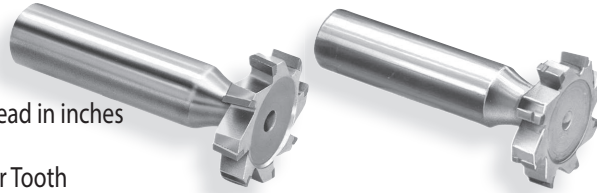
RPM = Rotations Per Minute

SFPM = Surface Feet Per Minute

Cutter Diameter = Diameter of the head in inches

$RPM = (SFPM * 3.82) / \text{Cutter Diameter}$

$IPM = IPT * RPM * \#Teeth$ IPT = Inches Per Tooth



SPEEDS AND FEEDS FOR TYPE 704 ONLY:

Starting point for Aluminum slotting:
1K - 4K SFPM, .002 - .008 IPT. Reduce SFPM and IPT by 25% for widths under .0938.

CHIP CLASS	MATERIAL	BRINELL	SFPM	IPT	KEYSEAT CUTTER DIAMETER									
					1/2	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8	1 1/2	
					IPM	IPM	IPM	IPM	IPM	IPM	IPM	IPM	IPM	
20	ALUMINUM ALLOY - WROUGHT	30-150 (500kg)	1200+	.002-.010	110	88	73	63	73	65	59	53	49	
	MAGNESIUM ALLOY	50-90	1000+	.002-.010	92	73	61	52	61	54	49	44	41	
	NON-METAL AND PLASTIC	-	1500+	.002-.006	138	110	92	79	92	81	73	67	61	
	ZINC ALLOY - DIE CAST	80-100	750-1000	.002-.006	80	64	53	46	53	48	43	39	36	
40	ALUMINUM BRONZE	40-175	200-600	.002-.006	37	29	24	21	24	22	20	18	16	
	BRASS ALLOY - LEADED AND FREE CUTTING	10-100Rb	400-550	.002-.006	44	35	29	25	29	26	23	21	19	
	NICKEL SILVER	10-100Rb	200-400	.002-.006	28	22	18	16	18	16	15	13	12	
	COPPER ALLOY - TOUGH	40-200	200-500	.002-.006	32	26	21	18	21	19	17	16	14	
60	DUCTILE CAST IRON - AUSTENITIC	120-275	75-150	.002-.004	10	8	7	6	7	6	6	5	5	
	DUCTILE CAST IRON - FERRITIC	140-270	200-400	.002-.007	28	22	18	16	18	16	15	13	12	
	DUCTILE CAST IRON - MARTENSITIC	270-440	150-350	.002-.007	23	18	15	13	15	14	12	11	10	
	GRAY - PEARLITIC	220-320	150-300	.002-.007	21	17	14	12	14	12	11	10	9	
	GRAY - FERRITIC	110-240	220-410	.002-.006	29	23	19	17	19	17	15	14	13	
	MALLEABLE CAST IRON - MARTENSITIC	200-320	130-300	.002-.004	20	16	13	11	13	12	11	10	9	
80	LOW AND MEDIUM CARBON STEEL - FREE MACHINING	100-250	200-500	.001-.005	32	26	21	18	21	19	17	16	14	
	LOW AND MEDIUM CARBON STEEL - WROUGHT	100-375	200-400	.001-.005	28	22	18	16	18	16	15	13	12	
100	LOW AND MEDIUM CARBON ALLOY STEEL - FREE MACHINING	100-275	200-400	.001-.005	28	22	18	16	18	16	15	13	12	
	LOW AND MEDIUM CARBON ALLOY STEEL	85-375	130-330	.001-.005	21	17	14	12	14	12	11	10	9	
	STAINLESS STEEL - 400 SERIES	135-325	135-375	.002-.005	24	19	16	14	16	14	13	12	11	
120	STAINLESS STEEL - 400 SERIES FREE MACHINING	135-275	250-500	.002-.005	34	28	23	20	23	20	18	17	15	
	HIGH STRENGTH STEEL - WROUGHT & TOOL STEEL	175-400	75-200	.001-.004	13	28	23	20	23	20	18	17	15	
140	HIGH TEMP ALLOYS NICKEL & IRON BASE ALLOY	140-300	50-150	.001-.004	9	7	6	5	6	5	5	4	4	
	STAINLESS STEEL - 300 SERIES	135-375	75-175	.001-.004	11	9	8	7	8	7	6	6	5	
	STAINLESS STEEL - PH SERIES	150-440	75-175	.001-.004	11	9	8	7	8	7	6	6	5	
	TITANIUM ALLOY	110-380	75-200	.002-.006	13	10	8	7	8	7	7	6	6	

CUTTERS



KEYSEAT CUTTERS

CHIP CLASS 20, 40 - CARBIDE TIPPED TYPE 704 FRACTIONAL



HIGH PERFORMANCE

MODIFICATIONS (Prompt delivery)
• See page 178



See box on page 176 for speeds and feeds

TYPE 704 - HIGH PERFORMANCE - FOR ALUMINUM

- Carbide tips brazed to tough hardened alloy steel body
- Face width tolerance: plus .0005", minus .0005"
- Tool diameter tolerance: plus .015", plus .020"

USE:

- Specifically designed for use in aluminum and non-ferrous materials
- High volume flute capacity for milling, slotting, grooving, snap & O-rings

*TOOL DIAM.	SHANK DIAM.
Up to 1 1/2"	1/2"
1 3/4" to 2 1/2"	3/4"

AMERICAN STANDARD NO.	TOOL DIAM.	DIMENSIONS				TYPE 704 EDP NO.	PRICE EACH	MODIFIED FACE WIDTH RANGE	AMERICAN STANDARD NO.	TOOL DIAM.	DIMENSIONS				TYPE 704 EDP NO.	PRICE EACH	MODIFIED FACE WIDTH RANGE
		FACE WIDTH	NECK DIAM.	OVER-ALL LEN.	NO. OF TEETH						FACE WIDTH	NECK DIAM.	OVER-ALL LEN.	NO. OF TEETH			
-	5/8	1/16	.160	2 1/16	2	7042002	\$106.10	.0575 - .0787	-	1 3/8	3/32	.312	2 3/32	3	7044403	\$145.85	.0788 - .1088
305	5/8	3/32	.191	2 3/32	2	7040305	106.10	.0788 - .1099	-	1 3/8	1/8	.342	2 1/8	3	7044404	145.85	.1089 - .1400
405	5/8	1/8	.223	2 1/8	2	7040405	106.10	.1100 - .1400	-	1 3/8	9/32	.374	2 3/32	3	7044405	145.85	.1401 - .1713
505	5/8	5/32	.252	2 5/32	2	7040505	106.10	.1401 - .1713	-	1 3/8	3/16	.401	2 3/16	3	7044406	145.85	.1714 - .2025
605	5/8	3/16	.279	2 3/16	2	7040605	106.10	.1714 - .2025	-	1 3/8	7/32	.401	2 7/32	3	7044407	145.85	.2026 - .2339
-	5/8	7/32	.342	2 7/32	2	7042007	106.10	.2026 - .2339	811	1 3/8	1/4	.401	2 1/4	3	7040811	145.85	.2340 - .2650
-	5/8	1/4	.342	2 1/4	2	7042008	106.10	.2340 - .2650	-	1 3/8	9/32	.467	2 9/32	3	7044409	145.85	.2651 - .2968
-	3/4	1/16	.160	2 1/16	2	7042402	111.40	.0575 - .0787	1011	1 3/8	5/16	.467	2 5/16	3	7041011	145.85	.2969 - .3281
-	3/4	3/32	.191	2 3/32	2	7042403	111.40	.0788 - .1099	-	1 3/8	11/32	.467	2 11/32	3	7044411	145.85	.3282 - .3593
406	3/4	1/8	.217	2 1/8	2	7040406	111.40	.1100 - .1400	1211	1 3/8	3/8	.467	2 3/8	3	7041211	145.85	.3594 - .3900
506	3/4	5/32	.246	2 5/32	2	7040506	111.40	.1401 - .1713	-	1 1/2	3/32	.435	2 3/32	3	7044803	165.80	.0788 - .1088
606	3/4	3/16	.279	2 3/16	2	7040606	111.40	.1714 - .2025	-	1 1/2	1/8	.435	2 1/8	3	7044804	165.80	.1089 - .1400
-	3/4	7/32	.342	2 7/32	2	7042407	111.40	.2026 - .2339	-	1 1/2	5/32	.435	2 5/32	3	7044805	165.80	.1401 - .1713
806	3/4	1/4	.342	2 1/4	2	7040806	111.40	.2340 - .2650	-	1 1/2	3/16	.435	2 3/16	3	7044806	165.80	.1714 - .2025
-	7/8	1/16	.160	2 1/16	2	7042802	119.40	.0575 - .0787	-	1 1/2	7/32	.435	2 7/32	3	7044807	165.80	.2026 - .2339
-	7/8	3/32	.191	2 3/32	2	7042803	119.40	.0788 - .1099	812	1 1/2	1/4	.435	2 1/4	3	7040812	165.80	.2340 - .2650
-	7/8	1/8	.217	2 1/8	2	7042804	119.40	.1100 - .1400	-	1 1/2	9/32	.467	2 9/32	3	7044809	165.80	.2651 - .2968
507	7/8	5/32	.246	2 5/32	2	7040507	119.40	.1401 - .1713	1012	1 1/2	1/16	.467	2 3/16	3	7041012	165.80	.2969 - .3281
607	7/8	3/16	.279	2 3/16	2	7040607	119.40	.1714 - .2025	-	1 1/2	11/32	.467	2 11/32	3	7044811	165.80	.3282 - .3593
707	7/8	7/32	.312	2 7/32	2	7040707	119.40	.2026 - .2339	1212	1 1/2	3/8	.467	2 3/8	3	7041212	198.90	.3594 - .3900
807	7/8	1/4	.342	2 1/4	2	7040807	119.40	.2340 - .2650	-	1 1/2	13/32	.467	2 13/32	3	7044813	198.90	.3901 - .4219
-	1	3/32	.191	2 3/32	2	7043203	126.00	.0788 - .1088	-	1 1/2	7/16	.467	2 7/16	3	7044814	198.90	.4220 - .4531
-	1	1/8	.217	2 1/8	2	7043204	126.00	.1089 - .1400	-	1 1/2	15/32	.467	2 15/32	3	7044815	198.90	.4532 - .4843
-	1	5/32	.246	2 5/32	2	7043205	126.00	.1401 - .1713	-	1 1/2	1/2	.467	2 1/2	3	7044816	198.90	.4844 - .5150
608	1	3/16	.279	2 3/16	2	7040608	126.00	.1714 - .2025	-	1 3/4	1/8	.718	3 1/8	4	7045604	183.00	.1089 - .1400
708	1	7/32	.312	2 7/32	2	7040708	126.00	.2026 - .2339	-	1 3/4	5/32	.718	3 5/32	4	7045605	183.00	.1401 - .1713
808	1	1/4	.342	2 1/4	2	7040808	126.00	.2340 - .2650	-	1 3/4	3/16	.718	3 3/16	4	7045606	183.00	.1714 - .2025
-	1	9/32	.401	2 9/32	2	7043209	126.00	.2651 - .2968	-	1 3/4	7/32	.718	3 7/32	4	7045607	183.00	.2026 - .2339
1008	1	5/16	.401	2 5/16	2	7041008	126.00	.2969 - .3281	-	1 3/4	1/4	.718	3 1/4	4	7045608	183.00	.2340 - .2650
-	1	11/32	.467	2 11/32	2	7043211	126.00	.3282 - .3593	-	1 3/4	9/32	.718	3 9/32	4	7045609	183.00	.2651 - .2968
1208	1	3/8	.467	2 3/8	2	7041208	126.00	.3594 - .3900	-	1 3/4	5/16	.718	3 5/16	4	7045610	183.00	.2969 - .3281
-	1 1/8	3/32	.217	2 3/32	2	7043603	126.00	.0788 - .1088	-	1 3/4	11/32	.718	3 11/32	4	7045611	183.00	.3282 - .3593
-	1 1/8	1/8	.246	2 1/8	2	7043604	126.00	.1089 - .1400	-	1 3/4	3/8	.718	3 3/8	4	7045612	214.90	.3594 - .3900
-	1 1/8	5/32	.279	2 5/32	2	7043605	126.00	.1401 - .1713	-	1 3/4	13/32	.718	3 13/32	4	7045613	214.90	.3901 - .4219
609	1 1/8	3/16	.312	2 3/16	2	7040609	126.00	.1714 - .2025	-	1 3/4	7/16	.718	3 7/16	4	7045614	214.90	.4220 - .4531
709	1 1/8	7/32	.342	2 7/32	2	7040709	126.00	.2026 - .2339	-	1 3/4	15/32	.718	3 15/32	4	7045615	214.90	.4532 - .4843
809	1 1/8	1/4	.374	2 1/4	2	7040809	126.00	.2340 - .2650	-	1 3/4	1/2	.718	3 1/2	4	7045616	214.90	.4844 - .5150
-	1 1/8	9/32	.435	2 9/32	2	7043609	126.00	.2651 - .2968	-	2	1/8	.718	3 1/8	4	7046404	212.15	.1089 - .1400
1009	1 1/8	5/16	.435	2 5/16	2	7041009	126.00	.2969 - .3281	-	2	5/32	.718	3 5/32	4	7046405	212.15	.1401 - .1713
-	1 1/8	11/32	.467	2 11/32	2	7043611	126.00	.3282 - .3593	-	2	3/16	.718	3 3/16	4	7046406	212.15	.1714 - .2025
-	1 1/8	3/8	.467	2 3/8	2	7043612	126.00	.3594 - .3900	-	2	7/32	.718	3 7/32	4	7046407	212.15	.2026 - .2339
-	1 1/4	3/32	.217	2 3/32	3	7044003	132.60	.0788 - .1088	-	2	1/4	.718	3 1/4	4	7046408	212.15	.2340 - .2650
-	1 1/4	1/8	.246	2 1/8	3	7044004	132.60	.1089 - .1400	-	2	9/32	.718	3 9/32	4	7046409	212.15	.2651 - .2968
-	1 1/4	5/32	.279	2 5/32	3	7044005	132.60	.1401 - .1713	-	2	3/16	.718	3 3/16	4	7046410	212.15	.2969 - .3281
610	1 1/4	3/16	.312	2 3/16	3	7040610	132.60	.1714 - .2025	-	2	11/32	.718	3 11/32	4	7046411	212.15	.3282 - .3593
710	1 1/4	7/32	.342	2 7/32	3	7040710	132.60	.2026 - .2339	-	2	3/8	.718	3 3/8	4	7046412	245.40	.3594 - .3900
810	1 1/4	1/4	.374	2 1/4	3	7040810	132.60	.2340 - .2650	-	2	13/32	.718	3 13/32	4	7046413	245.40	.3901 - .4219
-	1 1/4	9/32	.435	2 9/32	3	7044009	132.60	.2651 - .2968	-	2	7/16	.718	3 7/16	4	7046414	245.40	.4220 - .4531
1010	1 1/4	5/16	.435	2 5/16	3	7041010	132.60	.2969 - .3281	-	2	15/32	.718	3 15/32	4	7046415	245.40	.4532 - .4843
-	1 1/4	11/32	.467	2 11/32	3	7044011	132.60	.3282 - .3593	-	2	1/2	.718	3 1/2	4	7046416	245.40	.4844 - .5150
1210	1 1/4	3/8	.467	2 3/8	3	7041210	132.60	.3594 - .3900	-	-	-	-	-	-	-	-	-

*Contact Hannibal for price and availability on tool diameters greater than 2"

CUTTERS



KEYSEAT CUTTERS

CHIP CLASS 20, 40, 60, 140 - CARBIDE TIPPED TYPE 700



STRAIGHT TOOTH FOR NON-FERROUS & CAST IRONS

TYPE 700 - FOR NON-FERROUS MATERIALS AND CAST IRONS

- Woodruff type
- Carbide tips brazed to tough hardened alloy steel body
- Straight shank: 1/2" diameter, 2" long
- Tool diameter tolerance: plus .020", plus .015"
- Face width tolerance: plus .0000", minus .0005"
- Chip breakers on all straight tooth cutters 5/32" and greater in face width
- Tool geometry and carbide grade appropriate for material being machined
- Decimal size cutters DO NOT have chip breakers



MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified face width
- Metric face width
- Reduced neck diameter
- Shank drive flat(s)
- Coatings available:
- Corner chamfer or corner radius on one or both sides
- Shortened shank or reduced shank diameter

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

AMERICAN STANDARD NO.	TOOL DIAM.	DIMENSIONS				TYPE 700 FOR N-F/CI EDP NO.	PRICE EACH	FINISHED TO MODIFIED FACE WIDTH						
		FACE WIDTH	NECK DIAM.	OVERALL LENGTH	NO. OF TEETH			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
									1	2	3	4	5-7	8-14*
204	1/2	1/16	.130	2 1/16	6	7000204	\$86.55	.0575 - .0787	\$116.55	\$103.60	\$99.30	\$97.20	\$95.00	\$93.20
304	1/2	3/32	.160	2 3/32	6	7000304	86.55	.0788 - .1088	116.55	103.60	99.30	97.20	95.00	93.20
404	1/2	1/8	.191	2 1/8	6	7000404	86.55	.1089 - .1400	116.55	103.60	99.30	97.20	95.00	93.20
305	5/8	3/32	.191	2 3/32	6	7000305	89.65	.0788 - .1088	119.80	106.85	102.50	100.40	98.20	96.45
405	5/8	1/8	.223	2 1/8	6	7000405	89.65	.1089 - .1400	119.80	106.85	102.50	100.40	98.20	96.45
505	5/8	5/32	.252	2 5/32	6	7000505	89.65	.1401 - .1713	119.80	106.85	102.50	100.40	98.20	96.45
605	5/8	3/16	.279	2 3/16	6	7000605	89.65	.1714 - .2025	119.80	106.85	102.50	100.40	98.20	96.45
406	3/4	1/8	.217	2 1/8	6	7000406	93.60	.1100 - .1400	123.90	111.00	106.60	104.55	102.35	100.55
506	3/4	5/32	.246	2 5/32	6	7000506	93.60	.1401 - .1713	123.90	111.00	106.60	104.55	102.35	100.55
606	3/4	3/16	.279	2 3/16	6	7000606	93.60	.1714 - .2025	123.90	111.00	106.60	104.55	102.35	100.55
-	3/4	7/32	.342	2 7/32	6	7002407	102.50	.2026 - .2339	123.90	111.00	106.60	104.55	102.35	100.55
806	3/4	1/4	.342	2 1/4	6	7000806	93.60	.2340 - .2650	123.90	111.00	106.60	104.55	102.35	100.55
507	7/8	5/32	.246	2 5/32	6	7000507	98.00	.1401 - .1713	128.55	115.60	111.25	109.20	107.00	105.20
607	7/8	3/16	.279	2 3/16	6	7000607	98.00	.1714 - .2025	128.55	115.60	111.25	109.20	107.00	105.20
707	7/8	7/32	.312	2 7/32	6	7000707	98.00	.2026 - .2339	128.55	115.60	111.25	109.20	107.00	105.20
807	7/8	1/4	.342	2 1/4	6	7000807	98.00	.2340 - .2650	128.55	115.60	111.25	109.20	107.00	105.20
608	1	3/16	.279	2 3/16	8	7000608	110.55	.1714 - .2025	141.70	128.75	124.40	122.30	120.10	118.35
708	1	7/32	.312	2 7/32	8	7000708	110.55	.2026 - .2339	141.70	128.75	124.40	122.30	120.10	118.35
808	1	1/4	.342	2 1/4	8	7000808	110.55	.2340 - .2650	141.70	128.75	124.40	122.30	120.10	118.35
-	1	9/32	.401	2 9/32	8	7003209	121.10	.2651 - .2968	141.70	128.75	124.40	122.30	120.10	118.35
1008	1	5/16	.401	2 5/16	8	7001008	110.55	.2969 - .3281	141.70	128.75	124.40	122.30	120.10	118.35
-	1	11/32	.467	2 11/32	8	7003211	121.10	.3282 - .3593	141.70	128.75	124.40	122.30	120.10	118.35
1208	1	3/8	.467	2 3/8	8	7001208	110.55	.3594 - .3900	141.70	128.75	124.40	122.30	120.10	118.35
609	1 1/8	3/16	.312	2 3/16	8	7000609	116.15	.1714 - .2025	147.50	134.60	130.25	128.15	125.95	124.20
709	1 1/8	7/32	.342	2 7/32	8	7000709	116.15	.2026 - .2339	147.50	134.60	130.25	128.15	125.95	124.20
809	1 1/8	1/4	.374	2 1/4	8	7000809	116.15	.2340 - .2650	147.50	134.60	130.25	128.15	125.95	124.20
-	1 1/8	9/32	.435	2 9/32	8	7003609	127.20	.2651 - .2968	147.50	134.60	130.25	128.15	125.95	124.20
1009	1 1/8	5/16	.435	2 5/16	8	7001009	116.15	.2969 - .3281	147.50	134.60	130.25	128.15	125.95	124.20
610	1 1/4	3/16	.312	2 3/16	8	7000610	121.95	.1714 - .2025	153.60	140.70	136.30	134.25	132.05	130.25
710	1 1/4	7/32	.342	2 7/32	8	7000710	121.95	.2026 - .2339	153.60	140.70	136.30	134.25	132.05	130.25
810	1 1/4	1/4	.374	2 1/4	8	7000810	121.95	.2340 - .2650	153.60	140.70	136.30	134.25	132.05	130.25
-	1 1/4	9/32	.435	2 9/32	8	7004009	133.55	.2651 - .2968	153.60	140.70	136.30	134.25	132.05	130.25
1010	1 1/4	5/16	.435	2 5/16	8	7001010	121.95	.2969 - .3281	153.60	140.70	136.30	134.25	132.05	130.25
-	1 1/4	11/32	.467	2 11/32	8	7004011	133.55	.3282 - .3593	153.60	140.70	136.30	134.25	132.05	130.25
1210	1 1/4	3/8	.467	2 3/8	8	7001210	121.95	.3594 - .3900	153.60	140.70	136.30	134.25	132.05	130.25
811	1 3/8	1/4	.401	2 1/4	8	7000811	128.10	.2340 - .2650	160.05	147.10	142.80	140.70	138.50	136.75
-	1 3/8	9/32	.467	2 9/32	8	7004409	140.30	.2651 - .2968	160.05	147.10	142.80	140.70	138.50	136.75
1011	1 3/8	5/16	.467	2 5/16	8	7001011	128.10	.2969 - .3281	160.05	147.10	142.80	140.70	138.50	136.75
-	1 3/8	11/32	.467	2 11/32	8	7004411	140.30	.3282 - .3593	160.05	147.10	142.80	140.70	138.50	136.75
1211	1 3/8	3/8	.467	2 3/8	8	7001211	128.10	.3594 - .3900	160.05	147.10	142.80	140.70	138.50	136.75
812	1 1/2	1/4	.435	2 1/4	8	7000812	134.50	.2340 - .2650	166.75	153.85	149.50	147.40	145.20	143.45
-	1 1/2	9/32	.467	2 9/32	8	7004809	147.30	.2651 - .2968	166.75	153.85	149.50	147.40	145.20	143.45
1012	1 1/2	5/16	.467	2 5/16	8	7001012	134.50	.2969 - .3281	166.75	153.85	149.50	147.40	145.20	143.45
-	1 1/2	11/32	.467	2 11/32	8	7004811	147.30	.3282 - .3593	166.75	153.85	149.50	147.40	145.20	143.45
1212	1 1/2	3/8	.467	2 3/8	8	7001212	134.50	.3594 - .3900	166.75	153.85	149.50	147.40	145.20	143.45
-	1 1/2	13/32	.467	2 13/32	8	7004813	147.30	.3901 - .4219	166.75	153.85	149.50	147.40	145.20	143.45
-	1 1/2	7/16	.467	2 7/16	8	7004814	147.30	.4220 - .4531	166.75	153.85	149.50	147.40	145.20	143.45
-	1 1/2	15/32	.467	2 15/32	8	7004815	147.30	.4532 - .4843	166.75	153.85	149.50	147.40	145.20	143.45
-	1 1/2	1/2	.467	2 1/2	8	7004816	147.30	.4844 - .5150	166.75	153.85	149.50	147.40	145.20	143.45

*Quantities of 15 or more - price of fractional size in same size range



KEYSEAT CUTTERS

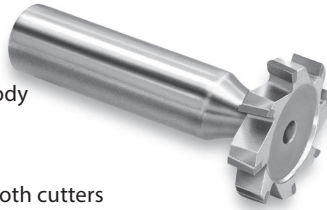
CHIP CLASS 20, 40, 60, 140 - CARBIDE TIPPED TYPE 701

MATERIAL SPECIFIC

STAGGERED TOOTH FOR NON-FERROUS & CAST IRONS

TYPE 701 - FOR NON-FERROUS MATERIALS AND CAST IRONS

- Woodruff type
- Carbide tips brazed to tough hardened alloy steel body
- Straight shank: 1/2" diameter, 2" long
- Tool diameter tolerance: plus .020", plus .015"
- Face width tolerance: plus .0000", minus .0005"
- Alternate right and left axial rake on all staggered tooth cutters
- Tool geometry and carbide grade appropriate for material being machined



MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified face width
- Metric face width
- Reduced neck diameter
- Shank drive flat(s)
- Coatings available:
- Corner chamfer or corner radius on one or both sides
- Shortened shank or reduced shank diameter

- TITANIUM NITRIDE - TiN
- TITANIUM CARBONITRIDE - TiCN
- ZIRCONIUM NITRIDE - ZrN
- AL TITANIUM NITRIDE - AlTiN

AMERICAN STANDARD NO.	TOOL DIAM.	DIMENSIONS				TYPE 701 FOR N-F/CI EDP NO.	PRICE EACH	FINISHED TO MODIFIED FACE WIDTH							
		FACE WIDTH	NECK DIAM.	OVERALL LENGTH	NO. OF TEETH			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED						
									1	2	3	4	5-7	8-14*	
204	1/2	1/16	.130	2 1/16	6	7010204	\$101.85	.0575 - .0787	\$132.55	\$119.60	\$115.25	\$113.20	\$111.00	\$109.20	
304	1/2	3/32	.160	2 3/32	6	7010304	101.85	.0788 - .1088	132.55	119.60	115.25	113.20	111.00	109.20	
404	1/2	1/8	.191	2 1/8	6	7010404	101.85	.1089 - .1400	132.55	119.60	115.25	113.20	111.00	109.20	
305	5/8	3/32	.191	2 3/32	6	7010305	105.45	.0788 - .1088	136.35	123.45	119.10	117.00	114.80	113.00	
405	5/8	1/8	.223	2 1/8	6	7010405	105.45	.1089 - .1400	136.35	123.45	119.10	117.00	114.80	113.00	
505	5/8	5/32	.252	2 5/32	6	7010505	105.45	.1401 - .1713	136.35	123.45	119.10	117.00	114.80	113.00	
605	5/8	3/16	.279	2 3/16	6	7010605	105.45	.1714 - .2025	136.35	123.45	119.10	117.00	114.80	113.00	
406	3/4	1/8	.217	2 1/8	6	7010406	110.20	.1100 - .1400	141.30	128.40	124.00	121.95	119.75	118.00	
506	3/4	5/32	.246	2 5/32	6	7010506	110.20	.1401 - .1713	141.30	128.40	124.00	121.95	119.75	118.00	
606	3/4	3/16	.279	2 3/16	6	7010606	110.20	.1714 - .2025	141.30	128.40	124.00	121.95	119.75	118.00	
-	3/4	7/32	.342	2 7/32	6	7012407	120.70	.2026 - .2339	141.30	128.40	124.00	121.95	119.75	118.00	
806	3/4	1/4	.342	2 1/4	6	7010806	110.20	.2340 - .2650	141.30	128.40	124.00	121.95	119.75	118.00	
507	7/8	5/32	.246	2 5/32	6	7010507	115.25	.1401 - .1713	146.60	133.65	129.30	127.20	125.00	123.25	
607	7/8	3/16	.279	2 3/16	6	7010607	115.25	.1714 - .2025	146.60	133.65	129.30	127.20	125.00	123.25	
707	7/8	7/32	.312	2 7/32	6	7010707	115.25	.2026 - .2339	146.60	133.65	129.30	127.20	125.00	123.25	
807	7/8	1/4	.342	2 1/4	6	7010807	115.25	.2340 - .2650	146.60	133.65	129.30	127.20	125.00	123.25	
608	1	3/16	.279	2 3/16	8	7010608	130.05	.1714 - .2025	162.10	149.15	144.80	142.70	140.50	138.75	
708	1	7/32	.312	2 7/32	8	7010708	130.05	.2026 - .2339	162.10	149.15	144.80	142.70	140.50	138.75	
808	1	1/4	.342	2 1/4	8	7010808	130.05	.2340 - .2650	162.10	149.15	144.80	142.70	140.50	138.75	
-	1	9/32	.401	2 9/32	8	7013209	142.45	.2651 - .2968	162.10	149.15	144.80	142.70	140.50	138.75	
1008	1	5/16	.401	2 5/16	8	7011008	130.05	.2969 - .3281	162.10	149.15	144.80	142.70	140.50	138.75	
-	1	11/32	.467	2 11/32	8	7013211	142.45	.3282 - .3593	162.10	149.15	144.80	142.70	140.50	138.75	
1208	1	3/8	.467	2 3/8	8	7011208	130.05	.3594 - .3900	162.10	149.15	144.80	142.70	140.50	138.75	
609	1 1/8	3/16	.312	2 3/16	8	7010609	136.50	.1714 - .2025	168.85	155.90	151.55	149.50	147.30	145.50	
709	1 1/8	7/32	.342	2 7/32	8	7010709	136.50	.2026 - .2339	168.85	155.90	151.55	149.50	147.30	145.50	
809	1 1/8	1/4	.374	2 1/4	8	7010809	136.50	.2340 - .2650	168.85	155.90	151.55	149.50	147.30	145.50	
-	1 1/8	9/32	.435	2 9/32	8	7013609	149.50	.2651 - .2968	168.85	155.90	151.55	149.50	147.30	145.50	
1009	1 1/8	5/16	.435	2 5/16	8	7011009	136.50	.2969 - .3281	168.85	155.90	151.55	149.50	147.30	145.50	
610	1 1/4	3/16	.312	2 3/16	8	7010610	143.40	.1714 - .2025	176.05	163.10	158.75	156.65	154.45	152.70	
710	1 1/4	7/32	.342	2 7/32	8	7010710	143.40	.2026 - .2339	176.05	163.10	158.75	156.65	154.45	152.70	
810	1 1/4	1/4	.374	2 1/4	8	7010810	143.40	.2340 - .2650	176.05	163.10	158.75	156.65	154.45	152.70	
-	1 1/4	9/32	.435	2 9/32	8	7014009	157.05	.2651 - .2968	176.05	163.10	158.75	156.65	154.45	152.70	
1010	1 1/4	5/16	.435	2 5/16	8	7011010	143.40	.2969 - .3281	176.05	163.10	158.75	156.65	154.45	152.70	
-	1 1/4	11/32	.467	2 11/32	8	7014011	157.05	.3282 - .3593	176.05	163.10	158.75	156.65	154.45	152.70	
1210	1 1/4	3/8	.467	2 3/8	8	7011210	143.40	.3594 - .3900	176.05	163.10	158.75	156.65	154.45	152.70	
811	1 3/8	1/4	.401	2 1/4	8	7010811	150.60	.2340 - .2650	183.65	170.75	166.40	164.30	162.10	160.30	
-	1 3/8	9/32	.467	2 9/32	8	7014409	164.95	.2651 - .2968	183.65	170.75	166.40	164.30	162.10	160.30	
1011	1 3/8	5/16	.467	2 5/16	8	7011011	150.60	.2969 - .3281	183.65	170.75	166.40	164.30	162.10	160.30	
-	1 3/8	11/32	.467	2 11/32	8	7014411	164.95	.3282 - .3593	183.65	170.75	166.40	164.30	162.10	160.30	
1211	1 3/8	3/8	.467	2 3/8	8	7011211	150.60	.3594 - .3900	183.65	170.75	166.40	164.30	162.10	160.30	
812	1 1/2	1/4	.435	2 1/4	8	7010812	158.20	.2340 - .2650	191.55	178.65	174.25	172.20	170.00	168.20	
-	1 1/2	9/32	.467	2 9/32	8	7014809	173.25	.2651 - .2968	191.55	178.65	174.25	172.20	170.00	168.20	
1012	1 1/2	5/16	.467	2 5/16	8	7011012	158.20	.2969 - .3281	191.55	178.65	174.25	172.20	170.00	168.20	
-	1 1/2	11/32	.467	2 11/32	8	7014811	173.25	.3282 - .3593	191.55	178.65	174.25	172.20	170.00	168.20	
1212	1 1/2	3/8	.467	2 3/8	8	7011212	158.20	.3594 - .3900	191.55	178.65	174.25	172.20	170.00	168.20	
-	1 1/2	13/32	.467	2 13/32	8	7014813	173.25	.3901 - .4219	191.55	178.65	174.25	172.20	170.00	168.20	
-	1 1/2	7/16	.467	2 7/16	8	7014814	173.25	.4220 - .4531	191.55	178.65	174.25	172.20	170.00	168.20	
-	1 1/2	15/32	.467	2 15/32	8	7014815	173.25	.4532 - .4843	191.55	178.65	174.25	172.20	170.00	168.20	
-	1 1/2	1/2	.467	2 1/2	8	7014816	173.25	.4844 - .5150	191.55	178.65	174.25	172.20	170.00	168.20	

*Quantities of 15 or more - price of fractional size in same size range



KEYSEAT CUTTERS

CHIP CLASS 80, 100, 120 - CARBIDE TIPPED TYPE 702



STRAIGHT TOOTH FOR STEEL



TYPE 702 - FOR STEELS

- Woodruff type
- Carbide tips brazed to tough hardened alloy steel body
- Straight shank: 1/2" diameter, 2" long
- Tool diameter tolerance: plus .020", plus .015"
- Face width tolerance: plus .0000", minus .0005"
- Chip breakers on all straight tooth cutters 5/32" and greater in face width
- Tool geometry and carbide grade appropriate for material being machined
- Decimal size cutters DO NOT have chip breakers

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified face width
- Metric face width
- Reduced neck diameter
- Shank drive flat(s)
- Coatings available:
- Corner chamfer or corner radius on one or both sides
- Shortened shank or reduced shank diameter

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

AMERICAN STANDARD NO.	TOOL DIAM.	DIMENSIONS				TYPE 702 FOR STEEL EDP NO.	PRICE EACH	FINISHED TO MODIFIED FACE WIDTH						
		FACE WIDTH	NECK DIAM.	OVERALL LENGTH	NO. OF TEETH			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
									1	2	3	4	5-7	8-14*
204	1/2	1/16	.130	2 1/16	6	7020204	\$100.00	.0575 - .0787	\$131.95	\$118.35	\$113.75	\$111.55	\$109.25	\$107.40
304	1/2	3/32	.160	2 3/32	6	7020304	100.00	.0788 - .1088	131.95	118.35	113.75	111.55	109.25	107.40
404	1/2	1/8	.191	2 1/8	6	7020404	100.00	.1089 - .1400	131.95	118.35	113.75	111.55	109.25	107.40
305	5/8	3/32	.191	2 3/32	6	7020305	103.60	.0788 - .1088	135.60	122.05	117.50	115.30	113.00	111.15
405	5/8	1/8	.223	2 1/8	6	7020405	103.60	.1089 - .1400	135.60	122.05	117.50	115.30	113.00	111.15
505	5/8	5/32	.252	2 5/32	6	7020505	103.60	.1401 - .1713	135.60	122.05	117.50	115.30	113.00	111.15
605	5/8	3/16	.279	2 3/16	6	7020605	103.60	.1714 - .2025	135.60	122.05	117.50	115.30	113.00	111.15
406	3/4	1/8	.217	2 1/8	6	7020406	108.10	.1100 - .1400	140.45	126.85	122.25	120.05	117.75	115.90
506	3/4	5/32	.246	2 5/32	6	7020506	108.10	.1401 - .1713	140.45	126.85	122.25	120.05	117.75	115.90
606	3/4	3/16	.279	2 3/16	6	7020606	108.10	.1714 - .2025	140.45	126.85	122.25	120.05	117.75	115.90
-	3/4	7/32	.342	2 7/32	6	7022407	118.40	.2026 - .2339	140.45	126.85	122.25	120.05	117.75	115.90
806	3/4	1/4	.342	2 1/4	6	7020806	108.10	.2340 - .2650	140.45	126.85	122.25	120.05	117.75	115.90
507	7/8	5/32	.246	2 5/32	6	7020507	113.25	.1401 - .1713	145.75	132.15	127.60	125.40	123.10	121.20
607	7/8	3/16	.279	2 3/16	6	7020607	113.25	.1714 - .2025	145.75	132.15	127.60	125.40	123.10	121.20
707	7/8	5/32	.312	2 5/32	6	7020707	113.25	.2026 - .2339	145.75	132.15	127.60	125.40	123.10	121.20
807	7/8	1/4	.342	2 1/4	6	7020807	113.25	.2340 - .2650	145.75	132.15	127.60	125.40	123.10	121.20
608	1	3/16	.279	2 3/16	8	7020608	127.75	.1714 - .2025	160.90	147.35	142.75	140.60	138.30	136.40
708	1	7/32	.312	2 7/32	8	7020708	127.75	.2026 - .2339	160.90	147.35	142.75	140.60	138.30	136.40
808	1	1/4	.342	2 1/4	8	7020808	127.75	.2340 - .2650	160.90	147.35	142.75	140.60	138.30	136.40
-	1	5/32	.401	2 5/32	8	7023209	139.90	.2651 - .2968	160.90	147.35	142.75	140.60	138.30	136.40
1008	1	5/16	.401	2 5/16	8	7021008	127.75	.2969 - .3281	160.90	147.35	142.75	140.60	138.30	136.40
-	1	11/32	.467	2 11/32	8	7023211	139.90	.3282 - .3593	160.90	147.35	142.75	140.60	138.30	136.40
1208	1	3/8	.467	2 3/8	8	7021208	127.75	.3594 - .3900	160.90	147.35	142.75	140.60	138.30	136.40
609	1 1/8	3/16	.312	2 3/16	8	7020609	134.15	.1714 - .2025	167.70	154.10	149.50	147.35	145.05	143.15
709	1 1/8	7/32	.342	2 7/32	8	7020709	134.15	.2026 - .2339	167.70	154.10	149.50	147.35	145.05	143.15
809	1 1/8	1/4	.374	2 1/4	8	7020809	134.15	.2340 - .2650	167.70	154.10	149.50	147.35	145.05	143.15
-	1 1/8	5/32	.435	2 5/32	8	7023609	146.90	.2651 - .2968	167.70	154.10	149.50	147.35	145.05	143.15
1009	1 1/8	5/16	.435	2 5/16	8	7021009	134.15	.2969 - .3281	167.70	154.10	149.50	147.35	145.05	143.15
610	1 1/4	3/16	.312	2 3/16	8	7020610	140.85	.1714 - .2025	174.70	161.10	156.55	154.35	152.05	150.20
710	1 1/4	7/32	.342	2 7/32	8	7020710	140.85	.2026 - .2339	174.70	161.10	156.55	154.35	152.05	150.20
810	1 1/4	1/4	.374	2 1/4	8	7020810	140.85	.2340 - .2650	174.70	161.10	156.55	154.35	152.05	150.20
-	1 1/4	5/32	.435	2 5/32	8	7024009	154.25	.2651 - .2968	174.70	161.10	156.55	154.35	152.05	150.20
1010	1 1/4	5/16	.435	2 5/16	8	7021010	140.85	.2969 - .3281	174.70	161.10	156.55	154.35	152.05	150.20
-	1 1/4	11/32	.467	2 11/32	8	7024011	154.25	.3282 - .3593	174.70	161.10	156.55	154.35	152.05	150.20
1210	1 1/4	3/8	.467	2 3/8	8	7021210	140.85	.3594 - .3900	174.70	161.10	156.55	154.35	152.05	150.20
811	1 3/8	1/4	.401	2 1/4	8	7020811	147.95	.2340 - .2650	182.20	168.60	164.00	161.80	159.50	157.65
-	1 3/8	5/32	.467	2 5/32	8	7024409	162.05	.2651 - .2968	182.20	168.60	164.00	161.80	159.50	157.65
1011	1 3/8	5/16	.467	2 5/16	8	7021011	147.95	.2969 - .3281	182.20	168.60	164.00	161.80	159.50	157.65
-	1 3/8	11/32	.467	2 11/32	8	7024411	162.05	.3282 - .3593	182.20	168.60	164.00	161.80	159.50	157.65
1211	1 3/8	3/8	.467	2 3/8	8	7021211	147.95	.3594 - .3900	182.20	168.60	164.00	161.80	159.50	157.65
812	1 1/2	1/4	.435	2 1/4	8	7020812	155.35	.2340 - .2650	189.90	176.35	171.80	169.60	167.25	165.45
-	1 1/2	5/32	.467	2 5/32	8	7024809	170.15	.2651 - .2968	189.90	176.35	171.80	169.60	167.25	165.45
1012	1 1/2	5/16	.467	2 5/16	8	7021012	155.35	.2969 - .3281	189.90	176.35	171.80	169.60	167.25	165.45
-	1 1/2	11/32	.467	2 11/32	8	7024811	170.15	.3282 - .3593	189.90	176.35	171.80	169.60	167.25	165.45
1212	1 1/2	3/8	.467	2 3/8	8	7021212	155.35	.3594 - .3900	189.90	176.35	171.80	169.60	167.25	165.45
-	1 1/2	13/32	.467	2 13/32	8	7024813	170.15	.3901 - .4219	189.90	176.35	171.80	169.60	167.25	165.45
-	1 1/2	7/16	.467	2 7/16	8	7024814	170.15	.4220 - .4531	189.90	176.35	171.80	169.60	167.25	165.45
-	1 1/2	15/32	.467	2 15/32	8	7024815	170.15	.4532 - .4843	189.90	176.35	171.80	169.60	167.25	165.45
-	1 1/2	1/2	.467	2 1/2	8	7024816	170.15	.4844 - .5150	189.90	176.35	171.80	169.60	167.25	165.45

*Quantities of 15 or more - price of fractional size in same size range

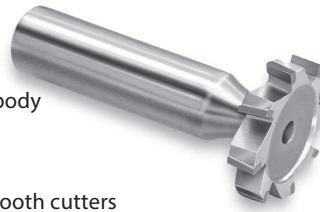


KEYSEAT CUTTERS

CHIP CLASS 80, 100, 120 - CARBIDE TIPPED TYPE 703

MATERIAL SPECIFIC

STAGGERED TOOTH FOR STEEL



TYPE 703 - FOR STEELS

- Woodruff type
- Carbide tips brazed to tough hardened alloy steel body
- Straight shank: 1/2" diameter, 2" long
- Tool diameter tolerance: plus .020", plus .015"
- Face width tolerance: plus .0000", minus .0005"
- Alternate right and left axial rake on all staggered tooth cutters
- Tool geometry and carbide grade appropriate for material being machined

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Modified face width
- Metric face width
- Reduced neck diameter
- Shank drive flat(s)
- Coatings available:
- Corner chamfer or corner radius on one or both sides
- Shortened shank or reduced shank diameter

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

AMERICAN STANDARD NO.	TOOL DIAM.	DIMENSIONS				TYPE 703 FOR STEEL EDP NO.	PRICE EACH	FINISHED TO MODIFIED FACE WIDTH						
		FACE WIDTH	NECK DIAM.	OVERALL LENGTH	NO. OF TEETH			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
									1	2	3	4	5-7	8-14*
204	1/2	1/16	.130	2 1/16	6	7030204	\$117.65	.0575 - .0787	\$150.40	\$136.80	\$132.25	\$130.05	\$127.75	\$125.90
304	1/2	3/32	.160	2 3/32	6	7030304	117.65	.0788 - .1088	150.40	136.80	132.25	130.05	127.75	125.90
404	1/2	1/8	.191	2 1/8	6	7030404	117.65	.1089 - .1400	150.40	136.80	132.25	130.05	127.75	125.90
305	5/8	3/32	.191	2 3/32	6	7030305	121.80	.0788 - .1088	154.75	141.20	136.65	134.45	132.15	130.30
405	5/8	1/8	.223	2 1/8	6	7030405	121.80	.1089 - .1400	154.75	141.20	136.65	134.45	132.15	130.30
505	5/8	5/32	.252	2 5/32	6	7030505	121.80	.1401 - .1713	154.75	141.20	136.65	134.45	132.15	130.30
605	5/8	3/16	.279	2 3/16	6	7030605	121.80	.1714 - .2025	154.75	141.20	136.65	134.45	132.15	130.30
406	3/4	1/8	.217	2 1/8	6	7030406	127.25	.1100 - .1400	160.50	146.95	142.40	140.20	137.85	136.00
506	3/4	5/32	.246	2 5/32	6	7030506	127.25	.1401 - .1713	160.50	146.95	142.40	140.20	137.85	136.00
606	3/4	3/16	.279	2 3/16	6	7030606	127.25	.1714 - .2025	160.50	146.95	142.40	140.20	137.85	136.00
-	3/4	7/32	.342	2 7/32	6	7032407	139.40	.2026 - .2339	160.50	146.95	142.40	140.20	137.85	136.00
806	3/4	1/4	.342	2 1/4	6	7030806	127.25	.2340 - .2650	160.50	146.95	142.40	140.20	137.85	136.00
507	7/8	5/32	.246	2 5/32	6	7030507	133.15	.1401 - .1713	166.60	153.00	148.45	146.20	143.90	142.10
607	7/8	3/16	.279	2 3/16	6	7030607	133.15	.1714 - .2025	166.60	153.00	148.45	146.20	143.90	142.10
707	7/8	7/32	.312	2 7/32	6	7030707	133.15	.2026 - .2339	166.60	153.00	148.45	146.20	143.90	142.10
807	7/8	1/4	.342	2 1/4	6	7030807	133.15	.2340 - .2650	166.60	153.00	148.45	146.20	143.90	142.10
608	1	3/16	.279	2 3/16	8	7030608	150.20	.1714 - .2025	184.50	170.95	166.35	164.15	161.85	160.00
708	1	7/32	.312	2 7/32	8	7030708	150.20	.2026 - .2339	184.50	170.95	166.35	164.15	161.85	160.00
808	1	1/4	.342	2 1/4	8	7030808	150.20	.2340 - .2650	184.50	170.95	166.35	164.15	161.85	160.00
-	1	9/32	.401	2 9/32	8	7033209	164.55	.2651 - .2968	184.50	170.95	166.35	164.15	161.85	160.00
1008	1	5/16	.401	2 5/16	8	7031008	150.20	.2969 - .3281	184.50	170.95	166.35	164.15	161.85	160.00
-	1	11/32	.467	2 11/32	8	7033211	164.55	.3282 - .3593	184.50	170.95	166.35	164.15	161.85	160.00
1208	1	3/8	.467	2 3/8	8	7031208	150.20	.3594 - .3900	184.50	170.95	166.35	164.15	161.85	160.00
609	1 1/8	3/16	.312	2 3/16	8	7030609	157.65	.1714 - .2025	192.30	178.70	174.15	172.00	169.70	167.80
709	1 1/8	7/32	.342	2 7/32	8	7030709	157.65	.2026 - .2339	192.30	178.70	174.15	172.00	169.70	167.80
809	1 1/8	1/4	.374	2 1/4	8	7030809	157.65	.2340 - .2650	192.30	178.70	174.15	172.00	169.70	167.80
-	1 1/8	9/32	.435	2 9/32	8	7033609	172.65	.2651 - .2968	192.30	178.70	174.15	172.00	169.70	167.80
1009	1 1/8	5/16	.435	2 5/16	8	7031009	157.65	.2969 - .3281	192.30	178.70	174.15	172.00	169.70	167.80
610	1 1/4	3/16	.312	2 3/16	8	7030610	165.60	.1714 - .2025	200.60	187.00	182.50	180.30	178.00	176.15
710	1 1/4	7/32	.342	2 7/32	8	7030710	165.60	.2026 - .2339	200.60	187.00	182.50	180.30	178.00	176.15
810	1 1/4	1/4	.374	2 1/4	8	7030810	165.60	.2340 - .2650	200.60	187.00	182.50	180.30	178.00	176.15
-	1 1/4	9/32	.435	2 9/32	8	7034009	181.40	.2651 - .2968	200.60	187.00	182.50	180.30	178.00	176.15
1010	1 1/4	5/16	.435	2 5/16	8	7031010	165.60	.2969 - .3281	200.60	187.00	182.50	180.30	178.00	176.15
-	1 1/4	11/32	.467	2 11/32	8	7034011	181.40	.3282 - .3593	200.60	187.00	182.50	180.30	178.00	176.15
1210	1 1/4	3/8	.467	2 3/8	8	7031210	165.60	.3594 - .3900	200.60	187.00	182.50	180.30	178.00	176.15
811	1 3/8	1/4	.401	2 1/4	8	7030811	174.00	.2340 - .2650	209.40	195.90	191.25	189.10	186.80	184.90
-	1 3/8	9/32	.467	2 9/32	8	7034409	190.50	.2651 - .2968	209.40	195.90	191.25	189.10	186.80	184.90
1011	1 3/8	5/16	.467	2 5/16	8	7031011	174.00	.2969 - .3281	209.40	195.90	191.25	189.10	186.80	184.90
-	1 3/8	11/32	.467	2 11/32	8	7034411	190.50	.3282 - .3593	209.40	195.90	191.25	189.10	186.80	184.90
1211	1 3/8	3/8	.467	2 3/8	8	7031211	174.00	.3594 - .3900	209.40	195.90	191.25	189.10	186.80	184.90
812	1 1/2	1/4	.435	2 1/4	8	7030812	182.70	.2340 - .2650	218.55	204.95	200.40	198.20	195.90	194.05
-	1 1/2	9/32	.467	2 9/32	8	7034809	200.10	.2651 - .2968	218.55	204.95	200.40	198.20	195.90	194.05
1012	1 1/2	5/16	.467	2 5/16	8	7031012	182.70	.2969 - .3281	218.55	204.95	200.40	198.20	195.90	194.05
-	1 1/2	11/32	.467	2 11/32	8	7034811	200.10	.3282 - .3593	218.55	204.95	200.40	198.20	195.90	194.05
1212	1 1/2	3/8	.467	2 3/8	8	7031212	182.70	.3594 - .3900	218.55	204.95	200.40	198.20	195.90	194.05
-	1 1/2	13/32	.467	2 13/32	8	7034813	200.10	.3901 - .4219	218.55	204.95	200.40	198.20	195.90	194.05
-	1 1/2	7/16	.467	2 7/16	8	7034814	200.10	.4220 - .4531	218.55	204.95	200.40	198.20	195.90	194.05
-	1 1/2	15/32	.467	2 15/32	8	7034815	200.10	.4532 - .4843	218.55	204.95	200.40	198.20	195.90	194.05
-	1 1/2	1/2	.467	2 1/2	8	7034816	200.10	.4844 - .5150	218.55	204.95	200.40	198.20	195.90	194.05

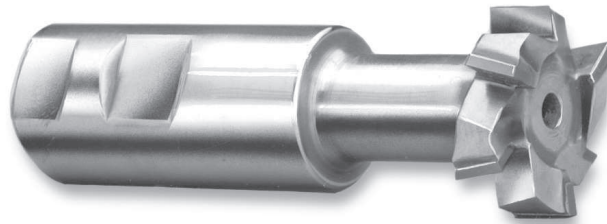
*Quantities of 15 or more - price of fractional size in same size range

CUTTERS



T-SLOT CUTTERS CARBIDE TIPPED TYPES 720 & 721 FRACTIONAL

MATERIAL SPECIFIC



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	720
	40	NON-FERROUS - SHORT CHIPS	720
	60	CAST IRONS	720
	80	LOW STRENGTH STEELS	721
	100	MEDIUM STRENGTH STEELS	721
	120	HIGH STRENGTH STEELS	721
140	HIGH TEMPERATURE ALLOYS	720	

TYPE 720 – FOR NON-FERROUS & CAST IRONS TYPE 721 – FOR STEELS

- Alternate right and left axial rake
- Straight shank with Weldon flats
- Tool diameter tolerance: plus .000", minus .010"
- Tool geometry & carbide grade appropriate for material being machined

MODIFICATIONS (Prompt delivery)

- Modified tool width
- Metric tool width
- Reduced neck diameter
- Shortened shank or reduced shank diameter
- Additional shank drive flat(s)
- Coolant outlets
- 4 coatings available (see bottom of page)

BOLT DIAM.	TOOL DIAM.	DIMENSIONS						TYPE 720 FOR NON-FERROUS/CAST IRONS		TYPE 721 FOR STEELS	
		TOOL WIDTH	SHANK DIAM.	NECK DIAM.	LENGTH		NO. OF TEETH	EDP NO.	PRICE	EDP NO.	PRICE
					UNDERCUT	OVERALL					
1/4	9/16	15/64	1/2	17/64	35/64	2 19/32	6	72008	\$114.65	72108	\$123.80
5/16	21/32	17/64	1/2	21/64	39/64	2 11/16	6	72010	113.25	72110	122.30
3/8	25/32	21/64	3/4	13/32	59/64	3 1/4	6	72012	142.50	72112	153.95
1/2	31/32	25/64	3/4	17/32	63/64	3 7/16	6	72016	154.95	72116	167.30
5/8	1 1/4	31/64	1	21/32	1 9/64	3 15/16	6	72020	205.65	72120	222.15
3/4	1 15/32	5/8	1	25/32	1 1/2	4 7/16	6	72024	229.80	72124	248.15
1	1 27/32	53/64	1 1/4	1 1/32	1 43/64	4 13/16	8	72032	328.10	72132	354.40
1 1/4	2 7/32	1 3/32	1 1/4	1 7/32	1 31/32	5 3/8	8	72040	414.05	72140	447.20
1 1/2	2 21/32	1 11/32	1 1/4	1 17/32	2 1/8	5 29/32	8	72048	479.50	72148	517.90



CORNER ROUNDING END MILLS CARBIDE TIPPED TYPES 740 & 741 FRACTIONAL

MATERIAL SPECIFIC



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	740
	40	NON-FERROUS - SHORT CHIPS	740
	60	CAST IRONS	740
	80	LOW STRENGTH STEELS	741
	100	MEDIUM STRENGTH STEELS	741
	120	HIGH STRENGTH STEELS	741
140	HIGH TEMPERATURE ALLOYS	740	

TYPE 740 – FOR NON-FERROUS & CAST IRONS TYPE 741 – FOR STEELS

- All sizes have 3 flutes.
- Straight shank with Weldon flats
- Tool geometry & carbide grade appropriate for material being machined

USE:

- For milling round corners on square edges

MODIFICATIONS (Prompt delivery)

- Shortened shank or reduced shank diameter
- Additional shank drive flat(s)
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

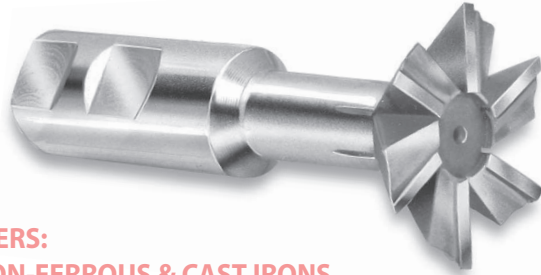
AL TITANIUM NITRIDE – AlTiN

CIRCLE RADIUS	TOOL DIAMETER	DIMENSIONS				TYPE 740 FOR N-F/CI		TYPE 741 FOR STEELS	
		SHANK DIAM.	END DIAM.	CAR-BIDE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
1/16	7/16	3/8	17/64	13/32	2 3/4	74002	\$105.20	74102	\$113.70
3/32	1/2	3/8	17/64	13/32	2 3/4	74003	105.20	74103	113.70
1/8	5/8	1/2	19/64	13/32	3	74004	108.90	74104	117.55
5/32	3/4	1/2	23/64	13/32	3	74005	115.50	74105	124.70
3/16	7/8	3/4	13/32	13/32	3 1/4	74006	122.20	74106	131.95
1/4	1	3/4	13/32	15/32	3 1/2	74008	139.30	74108	150.40
5/16	1 1/8	7/8	13/32	19/32	3 1/2	74010	143.05	74110	154.55
3/8	1 1/4	7/8	13/32	25/32	3 3/4	74012	148.65	74112	160.55
7/16	1 3/8	1	13/32	7/8	4	74014	165.50	74114	178.75
1/2	1 1/2	1	13/32	1	4	74016	184.20	74116	199.00
5/8	2	1 1/4	21/32	1 7/32	4 1/4	74020	226.70	74120	244.85



DOVETAIL CUTTERS CARBIDE TIPPED TYPES 734, 735, 736, & 737 FRACTIONAL

MATERIAL SPECIFIC



45° DOVETAIL CUTTERS:

- TYPE 734 – FOR NON-FERROUS & CAST IRONS
- TYPE 735 – FOR STEELS

60° DOVETAIL CUTTERS:

- TYPE 736 – FOR NON-FERROUS & CAST IRONS
- TYPE 737 – FOR STEELS
- Right hand cut
- Straight shank with Weldon flats
- .015" - .020" corner radius
- Tool diameter tolerance: plus .015", minus .000"
- Tool geometry & carbide grade appropriate for material being machined

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	734 or 736
	40	NON-FERROUS - SHORT CHIPS	734 or 736
	60	CAST IRONS	734 or 736
	80	LOW STRENGTH STEELS	735 or 737
	100	MEDIUM STRENGTH STEELS	735 or 737
	120	HIGH STRENGTH STEELS	735 or 737
	140	HIGH TEMPERATURE ALLOYS	734 or 736

MODIFICATIONS (Prompt delivery)

- Reduced neck diameter
- Shortened shank or reduced shank diameter
- Additional shank drive flat(s)
- Coatings available:

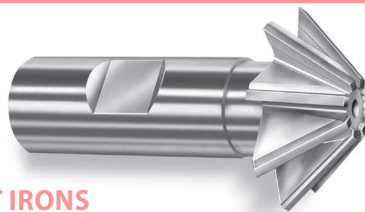
TITANIUM NITRIDE - TiN
TITANIUM CARBONITRIDE - TiCN
ZIRCONIUM NITRIDE - ZrN
AL TITANIUM NITRIDE - AlTiN

TOOL DIAM.	DIMENSIONS				45° ANGLE						60° ANGLE			
	SHANK DIAM.	NECK DIAM.	OVER-ALL LENGTH	NO. OF TEETH	TOOL WIDTH	TYPE 734 FOR N-F/CI		TYPE 735 FOR STEELS		TOOL WIDTH	TYPE 736 FOR N-F/CI		TYPE 737 FOR STEELS	
						EDP NO.	PRICE	EDP NO.	PRICE		EDP NO.	PRICE	EDP NO.	PRICE
1/2	3/8	3/16	2 1/8	3	5/32	73416	\$107.80	73516	\$116.50	7/32	73616	\$107.80	73716	\$116.50
3/4	3/8	1/4	2 1/4	3	1/4	73424	116.30	73524	125.55	1/4	73624	116.30	73724	125.55
1	1/2	3/8	2 1/2	4	5/16	73432	124.40	73532	134.40	3/8	73632	124.40	73732	134.40
1 1/4	5/8	1/2	2 3/4	4	3/8	73440	141.40	73540	152.80	1/2	73640	141.40	73740	152.80
1 1/2	3/4	1/2	3 1/4	4	1/2	73448	165.25	73548	178.50	5/8	73648	165.25	73748	178.50
2	1	3/4	4 1/4	6	5/8	73464	265.50	73564	286.75	3/4	73664	265.50	73764	286.75
2 1/2	1 1/4	1	4 3/8	6	3/4	73480	359.05	73580	387.70	7/8	73680	359.05	73780	387.70
3	1 1/4	1	4 1/2	6	1	73496	423.40	73596	457.30	1 1/8	73696	423.40	73796	457.30



CHAMFER MILLING CUTTERS CARBIDE TIPPED TYPES 730, 731, 732, & 733 FRACTIONAL

MATERIAL SPECIFIC



45° CHAMFER MILLING CUTTERS:

- TYPE 730 – FOR NON-FERROUS & CAST IRONS
- TYPE 731 – FOR STEELS

60° CHAMFER MILLING CUTTERS:

- TYPE 732 – FOR NON-FERROUS & CAST IRONS
- TYPE 733 – FOR STEELS

- Right hand cut
- Straight shank with Weldon flats
- Tool diameter tolerance: plus .015", minus .000"
- Tool geometry & carbide grade appropriate for material being machined

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	730 or 732
	40	NON-FERROUS - SHORT CHIPS	730 or 732
	60	CAST IRONS	730 or 732
	80	LOW STRENGTH STEELS	731 or 733
	100	MEDIUM STRENGTH STEELS	731 or 733
	120	HIGH STRENGTH STEELS	731 or 733
	140	HIGH TEMPERATURE ALLOYS	730 or 732

MODIFICATIONS (Prompt delivery)

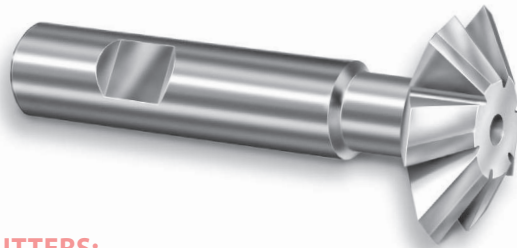
- Reduced neck diameter
- Shortened shank or reduced shank diameter
- Additional shank drive flat(s)
- 4 coatings available (see top of page)

TOOL DIAM.	DIMENSIONS			45° ANGLE						60° ANGLE			
	SHANK DIAM.	OVER-ALL LENGTH	NO. OF TEETH	TOOL WIDTH	TYPE 730 FOR N-F/CI		TYPE 731 FOR STEELS		TOOL WIDTH	TYPE 732 FOR N-F/CI		TYPE 733 FOR STEELS	
					EDP NO.	PRICE	EDP NO.	PRICE		EDP NO.	PRICE	EDP NO.	PRICE
1/2	3/8	2 1/8	4	1/8	73016	\$140.25	73116	\$154.20	7/32	73216	\$140.25	73316	\$154.20
3/4	3/8	2 1/8	6	3/16	73024	151.20	73124	166.25	5/16	73224	151.20	73324	166.25
1	1/2	2 1/2	6	5/16	73032	177.35	73132	195.05	7/16	73232	177.35	73332	195.05
1 1/2	3/4	2 3/4	8	1/2	73048	224.75	73148	247.35	5/8	73248	224.75	73348	247.35

CUTTERS



DOUBLE ANGLE CUTTERS CARBIDE TIPPED TYPES 746, 747, 748, & 749 FRACTIONAL



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	746 or 748
	40	NON-FERROUS - SHORT CHIPS	746 or 748
	60	CAST IRONS	746 or 748
	80	LOW STRENGTH STEELS	747 or 749
	100	MEDIUM STRENGTH STEELS	747 or 749
	120	HIGH STRENGTH STEELS	747 or 749
140	HIGH TEMPERATURE ALLOYS	746 or 748	

60° DOUBLE ANGLE CUTTERS:

TYPE 746 – FOR NON-FERROUS & CAST IRONS

TYPE 747 – FOR STEELS

90° DOUBLE ANGLE CUTTERS:

TYPE 748 – FOR NON-FERROUS & CAST IRONS

TYPE 749 – FOR STEELS

- Right hand cut
- Straight shank with Weldon flats
- .010" - .020" corner radius
- Tool diameter tolerance: plus .015", minus .000"
- Tool geometry & carbide grade appropriate for material being machined

MODIFICATIONS (Prompt delivery)

- Reduced neck diameter
- Shortened shank or reduced shank diameter
- Additional shank drive flat(s)
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

TOOL DIAMETER	DIMENSIONS		60° ANGLE						90° ANGLE					
	SHANK DIAM.	NO. OF TEETH	TOOL WIDTH	OVER-ALL LENGTH	TYPE 746 FOR N-F/CI		TYPE 747 FOR STEELS		TOOL WIDTH	OVER-ALL LENGTH	TYPE 748 FOR N-F/CI		TYPE 749 FOR STEELS	
					EDP NO.	PRICE	EDP NO.	PRICE			EDP NO.	PRICE	EDP NO.	PRICE
3/4	3/8	6	3/16	2 3/8	74624	\$125.00	74724	\$137.55	1/4	2 3/8	74824	\$125.00	74924	\$137.55
1	1/2	6	5/16	2 27/32	74632	147.65	74732	162.45	3/8	2 29/32	74832	147.65	74932	162.45
1 3/8	5/8	6	7/16	3 7/32	74644	171.05	74744	188.20	1/2	3 3/32	74844	171.05	74944	188.20
1 1/2	5/8	6	1/2	3 3/8	74648	179.65	74748	197.60	9/16	3 7/16	74848	179.65	74948	197.60
1 7/8	3/4	6	5/8	3 25/32	74660	272.80	74760	300.10	5/8	3 25/32	74860	272.80	74960	300.10
2 1/4	7/8	6	3/4	4 5/32	74672	369.25	74772	406.15	3/4	4 5/32	74872	369.25	74972	406.15



RADIUS CUTTERS CARBIDE TIPPED TYPES 718 & 719 FRACTIONAL



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	718
	40	NON-FERROUS - SHORT CHIPS	718
	60	CAST IRONS	718
	80	LOW STRENGTH STEELS	719
	100	MEDIUM STRENGTH STEELS	719
	120	HIGH STRENGTH STEELS	719
140	HIGH TEMPERATURE ALLOYS	718	

RADIUS CUTTERS:

TYPE 718 – FOR NON-FERROUS & CAST IRONS

TYPE 719 – FOR STEELS

- Right hand cut; Convex radius
- Straight shank with Weldon flats
- Tool geometry & carbide grade appropriate for material being machined
- Tool diameter tolerance: plus .005", minus .000"
- Tool radius tolerance thru 1/8" radius: plus .001", minus .001"
- Tool radius tolerance over 1/8" radius: plus .002", minus .002"

MODIFICATIONS (Prompt delivery)

- Reduced neck diameter
- Shortened shank or reduced shank diameter
- Additional shank drive flat(s)
- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

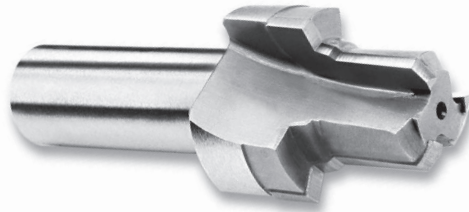
AL TITANIUM NITRIDE – AlTiN

TOOL RADIUS	TOOL DIAMETER	DIMENSIONS				TYPE 718 FOR N-F/CI		TYPE 719 FOR STEELS	
		TOOL WIDTH	SHANK DIAM.	OVER-ALL LENGTH	NO. OF TEETH	EDP NO.	PRICE	EDP NO.	PRICE
1/32	3/4	1/16	1/2	3	6	71801	\$166.10	71901	\$182.75
1/16	3/4	1/8	1/2	3	6	71802	166.10	71902	182.75
3/32	7/8	3/16	1/2	3	6	71803	181.60	71903	199.65
1/8	1 1/4	1/4	3/4	3 1/2	6	71804	197.60	71904	217.40
5/32	1 5/16	5/16	3/4	3 1/2	6	71805	227.40	71905	250.15
3/16	1 3/8	3/8	3/4	3 1/2	6	71806	240.65	71906	264.70
1/4	1 1/2	1/2	3/4	4	6	71808	249.10	71908	274.05



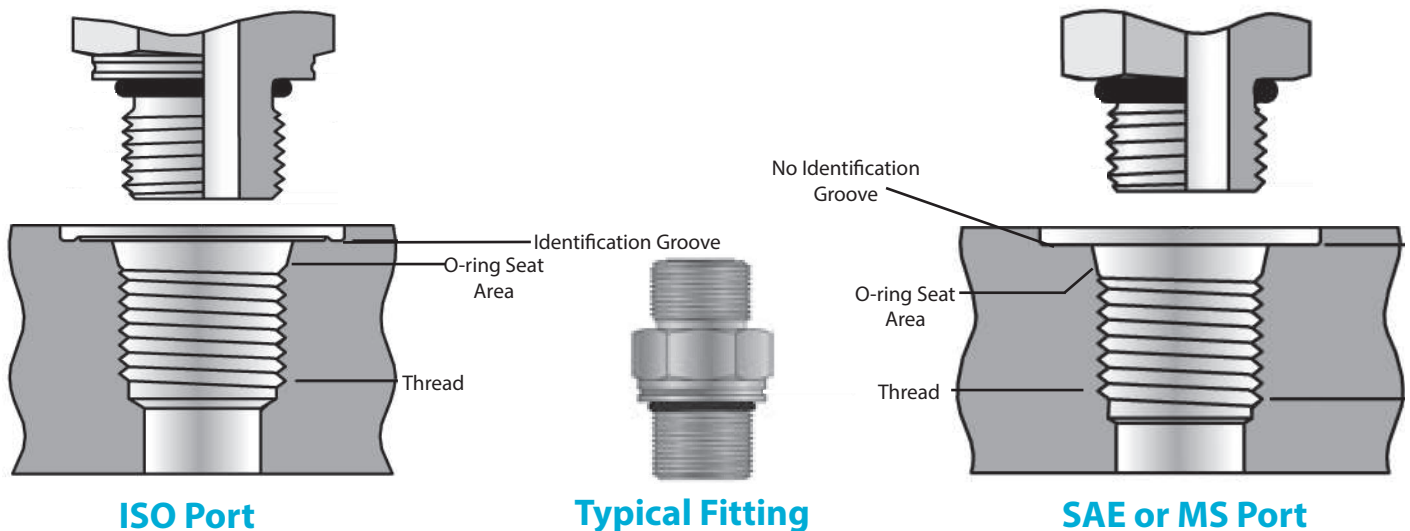
PORT CONTOUR TOOLS CARBIDE TIPPED

PORTING TOOLS GUIDE



Port Contour Cutter

Porting tools are used to cut a contour per required specification. The reamer portion sizes the thread diameter prior to threading, while the o-ring seat and spotface are machined in one pass. Hannibal is stocking Port Cutters made to SAE, ISO and MS specifications. The ISO spec calls for an identification groove. This groove identifies the port as metric.



When ordering you must know the required specification and either the tube size or thread size.

Ordering Examples:

Order by Tube Size: SAE - # 4 TUBE SIZE

OR

Order by Thread Size: ISO - M 14 X 1.5 THREADS

PORT CONTOUR TECHNICAL INFO:

- Appropriate carbide grade for material being machined
- 3 flute design allows for smooth chip flow
- Positive axial rake allows for improved shearing action and better chip evacuation
- Negative radial rake reduces chatter and provides cutting edge strength



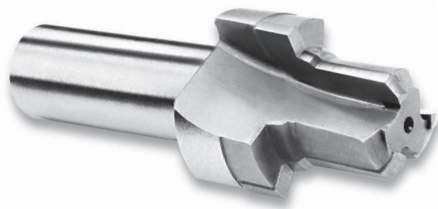
PORT CONTOUR CUTTERS CARBIDE TIPPED TYPES 780 & 781 FRACTIONAL

MATERIAL SPECIFIC

INDEX

DESCRIPTION	HANNIBAL		Scientific Tool	METCUT	Form Relief
	PAGE	TOOL TYPE			
PORT CONTOUR CUTTERS					
SAE PORTS - MS16142 - J514F - J1926					
Straight Shank - For Non-Ferrous & Cast Irons	186	780	MS16142-R	263	SAE-T
Straight Shank - For Steels	186	781			
ISO 6149-1 Metric Port without I.D. Groove Straight Shank					
For Non-Ferrous & Cast Irons	187	786	ISO-6149	269-1	M1-T
For Steels	187	787			
MS33649 Integral Reamer Pilot Series Straight Shank					
For Non-Ferrous & Cast Irons	187	792	MS33649-R	264	MS49R-T
For Steels	187	793			

S.A.E. PORTS - MS16142 • J514F • J1926 STRAIGHT SHANK - TWO TYPES: FOR NON-FERROUS & CAST IRONS OR FOR STEELS



TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	780
	40	NON-FERROUS - SHORT CHIPS	780
	60	CAST IRONS	780
	80	LOW STRENGTH STEELS	781
	100	MEDIUM STRENGTH STEELS	781
	120	HIGH STRENGTH STEELS	781
	140	HIGH TEMPERATURE ALLOYS	780

MODIFICATIONS (Prompt delivery)

- Reamer diameter
- Spotface diameter
- Reamer length
- Shank style
- Port ID groove
- Coatings available:
- Weldon flats
- Whistle notch
- Tang
- Shank length
- Metric tool diameter

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN

S.A.E. PORTS - MS16142 • J514F • J1926 TYPE 780 - FOR NON-FERROUS MATERIALS AND CAST IRONS TYPE 781 - FOR STEELS

- 5° axial rake
- Negative radial rake
- Heat treated bodies
- All tolerances within military specs

USE:

- In a single operation, a port contour cutter can produce the form and finish required on internal straight thread o-ring ports

TUBE		DIMENSIONS									TYPE 780 N-F/CI EDP NO.	TYPE 781 STEEL EDP NO.	BOTH TYPES PRICE
NO.	SIZE	THREAD SIZE	DIAMETER			SEALING SEAT ANGLE	LENGTH						
			REAMER	SPOTFACE	SHANK		SHANK	REAMER	HEAD	OVERALL			
2	1/8	3/16-24	.2720	.6820	.5000	12°	2	.4730	1 1/8	3 1/8	78002	78102	\$265.45
3	3/16	3/8-24	.3350	.7600	.5000	12°	2	.4730	1 1/4	3 1/4	78003	78103	265.45
4	1/4	7/16-20	.3890	.8380	.5000	12°	2	.5520	1 1/4	3 1/4	78004	78104	265.45
5	5/16	1/2-20	.4520	.9160	.5000	12°	2	.5520	1 1/4	3 1/4	78005	78105	273.80
6	3/8	9/16-18	.5090	.9790	.5000	12°	2	.6140	1 1/4	3 1/4	78006	78106	273.80
8	1/2	3/4-16	.6890	1.1980	.7500	15°	2	.6930	1 3/8	3 3/8	78008	78108	299.65
10	5/8	7/8-14	.8060	1.3540	.7500	15°	2	.7860	1 5/8	3 5/8	78010	78110	338.90
12	3/4	1 1/16-12	.9810	1.6350	.7500	15°	2 1/4	.9110	1 7/8	4 1/8	78012	78112	365.60
14	7/8	1 3/16-12	1.1060	1.7750	.7500	15°	2 1/4	.9110	1 7/8	4 1/8	78014	78114	371.50
16	1	1 5/16-12	1.2310	1.9200	.7500	15°	2 1/4	.9110	1 7/8	4 1/8	78016	78116	399.85
20	1 1/4	1 5/8-12	1.5440	2.2800	1.0000	15°	2 1/4	.9110	2	4 1/4	78020	78120	440.50
24	1 1/2	1 7/8-12	1.7940	2.5700	1.0000	15°	2 1/4	.9110	2	4 1/4	78024	78124	541.75
32	2	2 1/2-12	2.4190	3.4900	1.0000	15°	2 1/4	.9110	2 1/4	4 1/2	78032	78132	707.50



PORT CONTOUR CUTTERS CARBIDE TIPPED TYPES 786, 787, 792, & 793

MATERIAL SPECIFIC

**ISO 6149-1 METRIC PORT
WITHOUT I.D. GROOVE
STRAIGHT SHANK - TWO TYPES:
FOR NON-FERROUS & CAST IRONS OR
FOR STEELS**

**ISO 6149-1 METRIC PORT WITHOUT I.D. GROOVE
TYPE 786 - FOR NON-FERROUS MATERIALS AND CAST IRONS
TYPE 787 - FOR STEELS**

NOTE: For general information, use, modifications and coatings, see page 186

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	786
	40	NON-FERROUS - SHORT CHIPS	786
	60	CAST IRONS	786
	80	LOW STRENGTH STEELS	787
	100	MEDIUM STRENGTH STEELS	787
	120	HIGH STRENGTH STEELS	787
	140	HIGH TEMPERATURE ALLOYS	786

THREAD SIZE	DIMENSIONS									TYPE 786 N-F/CI EDP NO.	TYPE 787 STEEL EDP NO.	BOTH TYPES PRICE
	DIAMETER			NO. OF FLTS	SEALING SEAT ANGLE	LENGTH						
	REAMER	SPOTFACE	SHANK			SHANK	REAMER	HEAD	OVERALL			
M 8X1	.2770	.6690	.5000	3	12°	2	.4530	1 1/8	3 3/8	786080	787080	\$285.40
M 10X1	.3560	.7870	.5000	3	12°	2	.4530	1 1/4	3 1/4	786100	787100	285.40
M 12X1.5	.4150	.9060	.5000	3	15°	2	.5510	1 1/4	3 1/4	786120	787120	298.90
M 14X1.5	.4930	.9840	.5000	3	15°	2	.5510	1 1/4	3 1/4	786140	787140	298.90
M 16X1.5	.5720	1.1020	.5000	3	15°	2	.6100	1 1/4	3 1/4	786160	787160	329.15
M 18X1.5	.6510	1.1810	.7500	3	15°	2	.6690	1 3/8	3 3/8	786180	787180	329.15
M 20X1.5	.7300	1.2600	.7500	3	15°	2	.6890	1 3/8	3 3/8	786200	787200	341.85
M 22X1.5	.8080	1.3390	.7500	3	15°	2	.7090	1 3/8	3 3/8	786220	787220	354.55
M 27X2	.9850	1.5750	.7500	3	15°	2 1/4	.8660	1 7/8	4 1/8	786270	787270	383.20
M 33X2	1.2210	1.9290	.7500	3	15°	2 1/4	.8660	1 7/8	4 1/8	786330	787330	440.75
M 42X2	1.5760	2.3620	1.0000	3	15°	2 1/4	.8860	1 7/8	4 1/8	786420	787420	481.65
M 48X2	1.8120	2.5890	1.0000	4	15°	2 1/4	.9840	2	4 1/4	786480	787480	509.20
M 60X2	2.2840	2.9920	1.0000	4	15°	2 1/4	1.0830	2	4 1/4	786600	787600	576.00



**MS 33649 INTEGRAL REAMER PILOT
STRAIGHT SHANK - TWO TYPES:
FOR NON-FERROUS & CAST IRONS OR
FOR STEELS**

**MS 33649 INTEGRAL REAMER PILOT
TYPE 792 - FOR NON-FERROUS MATERIALS AND CAST IRONS
TYPE 793 - FOR STEELS**

NOTE: For general information, use, modifications and coatings, see page 186

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	792
	40	NON-FERROUS - SHORT CHIPS	792
	60	CAST IRONS	792
	80	LOW STRENGTH STEELS	793
	100	MEDIUM STRENGTH STEELS	793
	120	HIGH STRENGTH STEELS	793
	140	HIGH TEMPERATURE ALLOYS	792

TUBE		DIMENSIONS								TYPE 792 N-F/CI EDP NO.	TYPE 793 STEEL EDP NO.	BOTH TYPES PRICE
NO.	SIZE	THREAD SIZE	DIAMETER			LENGTH						
			REAMER	SPOTFACE	SHANK	SHANK	REAMER	HEAD	OVERALL			
1	1/16	1/4-28	.2150	.6500	.5000	2	.4070	1	3	79201	79301	\$310.05
2	1/8	3/16-24	.2750	.7420	.5000	2	.5820	1 1/8	3 1/8	79202	79302	310.05
3	3/16	3/8-24	.3390	.8050	.5000	2	.5880	1 1/4	3 1/4	79203	79303	294.15
4	1/4	7/16-20	.3930	.8880	.5000	2	.6610	1 1/4	3 1/4	79204	79304	302.10
5	5/16	1/2-20	.4550	.9500	.5000	2	.6610	1 1/4	3 1/4	79205	79305	310.05
6	3/8	5/16-18	.5120	1.0120	.5000	2	.7140	1 1/2	3 1/2	79206	79306	325.95
7	7/16	3/8-18	.5750	1.1050	.5000	2	.7300	1 1/2	3 1/2	79207	79307	333.90
8	1/2	3/4-16	.6930	1.2400	.7500	2	.8390	1 5/8	3 5/8	79208	79308	341.85
9	5/8	13/16-16	.7560	1.3020	.7500	2	.8550	1 5/8	3 5/8	79209	79309	349.80
10	3/4	7/8-14	.8100	1.4150	.7500	2 1/4	.9350	1 7/8	4 1/8	79210	79310	357.75
11	7/8	1-12	.9250	1.6020	.7500	2 1/4	1.0690	2 1/8	4 3/8	79211	79311	389.55
12	1	1 1/16-12	.9870	1.6650	.7500	2 1/4	1.0690	2 1/8	4 3/8	79212	79312	413.40
14	1 1/8	1 3/16-12	1.1120	1.7900	.7500	2 1/4	1.0690	2 1/8	4 3/8	79214	79314	472.25
16	1 1/4	1 1/2-12	1.2370	1.9650	.7500	2 1/4	1.0690	2 1/8	4 3/8	79216	79316	530.25
18	1 3/8	1 5/8-12	1.4250	2.0900	.7500	2 1/4	1.1210	2 1/4	4 1/2	79218	79318	571.45
20	1 1/2	1 7/8-12	1.5500	2.3100	1.0000	2 1/4	1.1210	2 1/4	4 1/2	79220	79320	665.80
24	1 3/4	2-12	1.8000	2.6000	1.0000	2 1/4	1.1320	2 1/4	4 1/2	79224	79324	806.15
32	2	2 1/2-12	2.4250	3.5200	1.0000	2 1/2	1.3730	2 1/2	5	79232	79332	1146.40

CUTTERS



CARBIDE TIPPED END MILLS TECHNICAL INFORMATION

END MILL BASICS

END MILLS have cutting edges on both the end and sides, permitting end cutting and peripheral cutting. Center cutting types permit plunge and traverse milling.

CUTTING EDGE: Select **sharp edged** for faster speeds. Select radial edged for longer tool life.

SHANK DIAMETER: Select **largest diameter** available to maximize rigidity and minimize axial deflection and chatter.

NUMBER OF FLUTES: Select **fewer flutes** for milling softer materials at higher feeds and speeds where more chip space is required or when machine horsepower is limited.

Select **more flutes** for milling tougher materials at reduced feeds and speeds or for increased table feeds using the same cutting speeds.

TOOL DIAMETER: Select **largest practical diameter** to maximize rigidity, minimize chatter and improve tool life. If machine spindle speed is limited, the largest practical diameter permits higher cutting speeds

COATINGS are especially effective (see "Coating Selector" on page 10).

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	PAGE #
	20	NON-FERROUS - LONG CHIPS	189-191
	40	NON-FERROUS - SHORT CHIPS	189-191
	60	CAST IRONS	189-191
	80	LOW STRENGTH STEELS	189,192
	100	MEDIUM STRENGTH STEELS	189,192
	120	HIGH STRENGTH STEELS	189,192
	140	HIGH TEMPERATURE ALLOYS	189,191

FLUTE AXIAL RELATIONSHIP:

Select **straight flutes** for a wide variety of applications.

Select **right spiral flutes** for improved cutting action and easier chip removal.

Select **left spiral flutes** for use in absorbing impact shock when entering steel workpiece – maintains constant hold down pressure and minimizes chatter. Useful in profiling applications where recutting chips causes premature cutter dulling.

Select **high spiral** (15° or more) to **dramatically** improve cutting action, finish, chip removal, and tool life. High spirals distribute impact load more evenly throughout the tool's entire revolution.

END MILL SPECIFICATIONS AND TOLERANCES

- Geometry, carbide grade, O.D. relief and end clearance appropriate for material being machined
- Flute long carbide tips brazed to tough hardened alloy steel body
- Spiral flute carbide tips formed to true helix angles
- Straight shanks have standard Weldon drive flats
- Non-center cutting end mills have the ends cleared to depth of carbide

- Precision ground cutting edges
- USCTI
- Tool diameter tolerance:
Radial edged: plus .002", minus .000"
Sharp edged: plus .005", minus .000"
- Shank diameter tolerance:
minus .0001", minus .0005"

END MILL PROBLEM SOLVING GUIDE — CARBIDE TIPPED

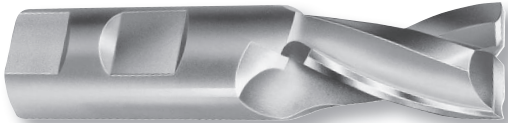
MILLING PROBLEMS	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. ROUGH FINISH	Dull cutting edge Wrong feeds & speeds	Resharpener to original tool geometry Increase speed—also try reduced feed
2. EXCESSIVE CUTTING EDGE WATER	Wrong feeds & speeds Rough cutting edge Insufficient coolant	Increase feed (should always be over .001" per tooth) — especially when machining ductile or free machining materials. Also try reduced speed Lightly hone cutting edge with fine grit diamond hone Increase coolant flow — review type of coolant
3. CHIPPED CUTTING EDGE	Poor chip removal Recutting work hardened chips Vibration Incorrect carbide grade	Use tool with larger flute space — larger diameter or fewer flutes Increase coolant flow Increase rigidity of set-up, especially worn tool holders Change to appropriate carbide grade
4. CHATTER MARKS	Insufficient machine horsepower Vibration	Use tool with fewer flutes as correct feeds & speeds must be maintained Consider climb milling Use larger diameter cutter Resharpener tool with more clearance
5. GLAZED FINISH	Feed too light Dull cutting edge Insufficient clearance	Increase feed Resharpener tool to original geometry Resharpener tool with more clearance
6. POOR TOOL LIFE	Excessive cratering Milling abrasive material Milling surface scale Milling hard material Insufficient chip room Delayed resharpening Thermal cracked carbide	Increase speed or decrease feed Change to harder grade of carbide Decrease speed and increase feed Increase coolant flow Climb milling better than conventional milling Conventional milling better than climb milling Reduce speed — rigidity very important Use larger diameter tool Prompt resharpening to original geometry will increase total tool life Maintain adequate coolant flow at all times Climb milling is cooler than conventional milling



END MILLS INDEX AND COMPARISON CHART

DESCRIPTION	HANNIBAL		FULLERTON	PUTNAM	MORSE	NIAGARA
	PAGE	TOOL TYPE				
CENTER CUTTING END MILLS						
Straight Flutes						
For Non-Ferrous & Cast Irons	189	314	60SK	SKM	5935	4800
For Steels	189	312	60SKS	-	5936	4780
25° Right Spiral Flutes						
For Non-Ferrous & Cast Irons	189	318	60CS	-	5966	-
HIGH SPIRAL SHEAR CUTTING END MILLS						
15° Right Spiral Flutes						
For Non-Ferrous & Cast Irons	191	375	-	HLS	5962	4840
For Cast Irons & High Temp Alloys	191	320	-	-	-	-
For Steels	192	350	60GSS	HES	5960	4820
25° Right Spiral Flutes						
For Non-Ferrous (Sharp Edged)	191	327	-	-	-	-
For Non-Ferrous	191	325	60FS	HNS	5958	4860
SLOW SPIRAL END MILLS						
6° Right Spiral Flutes						
For Non-Ferrous (Sharp Edged)	190	307	-	-	-	-
For Non-Ferrous & Cast Irons	190	306	60RS	RSEM	5921	-
For Steels	192	308	60RSS	-	-	-
6° Left Spiral Flutes for Steels	192	310	60LSS	LSEM	5964	-
STRAIGHT FLUTES END MILLS						
Sharp Edged						
For Non-Ferrous (4 Flutes)	190	305	-	-	-	-
Radial Edged						
For Non-Ferrous & Cast Irons (2 Flutes)	190	302	60TF	TFEM	5923	4700
For Non-Ferrous & Cast Irons (4 or 6 Flts.)	190	304	60EM	EM	5925	4750
For Steels (2 Flutes)	192	300	60TFS	-	5927	-

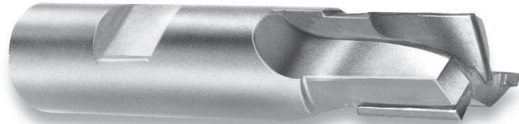
CENTER CUTTING TYPE TYPES 318, 312, 314 FRACTIONAL



25° RIGHT SPIRAL FLUTES TYPE 318 - FOR NON-FERROUS & CAST IRONS

- Larger flute capacity for heavy milling
- Center cutting design for plunge, slot, profile and peripheral milling including splines, keyways, and spotfacing
- Radial edged for longer tool life
- Detailed specifications on page 188

TOOL DIAMETER		DIMENSIONS				TYPE 318 FOR NON-FERR.	
FRAC.	DECIMAL	SHANK DIAM.	LENGTH		NO. OF FLUTES	EDP NO.	PRICE
			CARBIDE	OVERALL			
1/2	.5000	1/2	1	3	2	31816	\$131.40
5/8	.6250	5/8	1 1/4	3 3/8	2	31820	146.90
3/4	.7500	3/4	1 1/4	3 3/8	2	31824	155.65
7/8	.8750	7/8	1 1/2	3 3/4	2	31828	171.20
1	1.0000	1	1 1/2	4	2	31832	196.75
1 1/4	1.2500	1 1/4	1 3/4	4 1/4	2	31840	267.40
1 1/2	1.5000	1 1/2	2	4 3/4	2	31848	312.05



THREE STRAIGHT FLUTES TYPE 312 - FOR STEELS TYPE 314 - FOR NON-FERROUS & CAST IRONS

- Three straight flutes provide generous capacity for chips
- Center cutting design for plunge, slot, profile, and peripheral milling including splines, keyways, and spotfacing
- Radial edged for longer tool life
- Detailed specifications on page 188

TOOL DIAMETER		DIMENSIONS				TYPE 314 FOR NON-FERR. & C.I.		TYPE 312 FOR STEELS	
FRAC.	DECIMAL	SHANK DIAM.	LENGTH		NO. OF FLTS	EDP NO.	PRICE	EDP NO.	PRICE
			CARBIDE	OVERALL					
3/8	.3750	3/8	1/2	2 1/2	3	31412	\$78.60	31212	\$81.70
7/16	.4375	3/8	3/4	2 1/2	3	31414	80.35	31214	83.50
1/2	.5000	1/2	3/4	3	3	31416	82.45	31216	85.50
9/16	.5625	1/2	3/4	3	3	31418	85.60	31218	88.95
5/8	.6250	5/8	3/4	3 1/4	3	31420	100.25	31220	104.00
3/4	.7500	5/8	3/4	3 3/8	3	31424	104.85	31224	108.90
7/8	.8750	7/8	3/4	3 3/4	3	31428	122.40	31228	127.15
1	1.0000	7/8	3/4	3 3/4	3	31432	134.50	31232	139.65
1 1/8	1.1250	1	3/4	4	3	31436	144.05	31236	149.55
1 1/4	1.2500	1	3/4	4	3	31440	166.90	31240	173.40
1 1/2	1.5000	1 1/4	3/4	4	3	31448	198.45	31248	206.10

MODIFICATIONS (See list on page 190)

END MILLS



END MILLS FOR NON-FERROUS & CAST IRONS CARBIDE TIPPED TYPES 302, 304, 305, 306, 307, FRACTIONAL

MATERIAL SPECIFIC

BASIC TYPES

MODIFICATIONS (Prompt delivery)

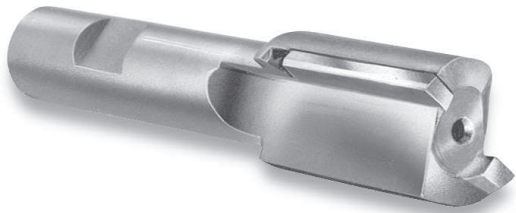
- Modified tool diameter
- Metric tool diameter
- Cutting diameter reduced for step or pilot
- Corner chamfer or corner radius
- Shortened shank or reduced shank diam.
- Additional shank drive flat(s)
- Coolant outlets (except on Type 318)
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

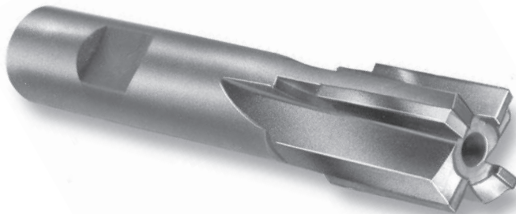
ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN



RADIAL EDGED WITH TWO STRAIGHT FLUTES TYPE 302 - FOR NON-FERROUS MATERIALS & CAST IRONS

- Two large flutes for easy chip removal
- Use when machine horsepower is too low for high chip capacity end mills



RADIAL EDGED WITH FOUR OR SIX STRAIGHT FLUTES TYPE 304 - FOR NON-FERROUS MATERIALS & CAST IRONS

- More flutes for improved finish
- Use when machine horsepower allows for a higher chip capacity end mill



RADIAL EDGED WITH 6° RIGHT SPIRAL FLUTES TYPE 306 - FOR NON-FERROUS MATERIALS & CAST IRONS

- Spiral flutes aid in chip removal, permitting heavier feeds and faster speeds
- Radial edged for tough aluminum alloys and castings

SHARP EDGED WITH FOUR STRAIGHT FLUTES TYPE 305 - FOR NON-FERROUS MATERIALS

- Four flutes for improved finish
- Use when machine horsepower allows for a higher capacity end mill

SHARP EDGED WITH 6° RIGHT SPIRAL FLUTES TYPE 307 - FOR NON-FERROUS MATERIALS

- Same as Type 306 above, but sharp edged for improved finish

ALL TYPES:

- Detailed specifications on page 188

TOOL DIAMETER		DIMENSIONS			TYPE 302 2 STRAIGHT FLUTES			TYPE 304 4 OR 6 STRAIGHT FLUTES			TYPE 305 SHARP EDGED 4 STRAIGHT FLTS			TYPE 306 RADIAL EDGED 6° RIGHT SPIRAL			TYPE 307 SHARP EDGED 6° RIGHT SPIRAL		
FRAC.	DEC.	SHANK DIAM.	LENGTH		NO. OF FLTS	EDP NO.	PRICE	NO. OF FLTS	EDP NO.	PRICE	NO. OF FLTS	EDP NO.	PRICE	NO. OF FLTS	EDP NO.	PRICE	NO. OF FLTS	EDP NO.	PRICE
			CAR- BIDE	OVER- ALL															
1/4	.2500	3/8	1/2	2 1/2	2	30208	\$42.95	4	30408	\$43.35	4	30508	\$43.35	2	30608	\$43.90	2	30708	\$46.55
5/16	.3125	3/8	5/8	2 1/2	2	30210	44.60	4	30410	46.30	-	-	-	2	30610	45.50	-	-	-
3/8	.3750	3/8	5/8	2 1/2	2	30212	47.80	4	30412	48.80	-	-	-	2	30612	48.70	-	-	-
7/16	.4375	3/8	1	2 1/16	2	30214	47.80	4	30414	48.80	4	30514	46.95	2	30614	48.70	2	30714	51.65
1/2	.5000	1/2	1	3 1/4	2	30216	49.00	4	30416	49.95	4	30516	49.85	2	30616	50.00	2	30716	52.90
9/16	.5625	1/2	1	3 3/8	2	30218	54.20	4	30418	56.10	4	30518	55.95	2	30618	55.35	2	30718	58.55
5/8	.6250	1/2	1	3 3/8	2	30220	54.20	4	30420	58.75	4	30520	58.65	4	30620	57.50	4	30720	60.85
11/16	.6875	5/8	1	3 3/8	2	30222	58.65	4	30422	64.70	4	30522	64.50	-	-	-	-	-	-
3/4	.7500	5/8	1	3 5/8	2	30224	60.85	4	30424	60.45	4	30524	67.00	4	30624	65.70	4	30724	69.50
13/16	.8125	5/8	1	3 5/8	2	30226	73.55	4	30426	71.40	4	30526	76.70	-	-	-	-	-	-
7/8	.8750	5/8	1 1/4	4	2	30228	74.05	4	30428	71.40	4	30528	79.25	4	30628	87.80	4	30728	93.05
15/16	.9375	7/8	1 1/4	4	2	30230	79.25	4	30430	79.30	4	30530	84.35	-	-	-	-	-	-
1	1.0000	7/8	1 1/4	4	2	30232	79.50	4	30432	82.55	4	30532	91.50	4	30632	101.45	4	30732	107.45
1 1/8	1.1250	1	1 1/4	4 1/4	2	30236	81.60	4	30436	93.60	4	30536	103.70	4	30636	115.05	-	-	-
1 1/4	1.2500	1	1 1/4	4 1/4	2	30240	98.35	4	30440	105.25	4	30540	116.60	4	30640	129.30	4	30740	136.75
1 1/2	1.5000	1 1/4	1 1/2	4 1/2	2	30248	121.80	4	30448	135.70	4	30548	144.40	4	30648	160.10	4	30748	163.25
1 3/4	1.7500	1 1/4	1 1/2	4 1/2	2	30256	144.40	6	30456	174.90	-	-	-	6	30656	206.65	-	-	-
2	2.0000	1 1/4	1 1/2	4 1/2	2	30264	161.10	6	30464	201.50	-	-	-	6	30664	237.95	6	30764	242.50

END MILLS



END MILLS FOR NON-FERROUS & CAST IRONS CARBIDE TIPPED TYPES 325, 327, 375, 320 FRACTIONAL

MATERIAL SPECIFIC

HIGH SPIRAL SHEAR CUTTING TYPES

MODIFICATIONS (Prompt delivery)

- Modified tool diameter
- Metric tool diameter
- Cutting diameter reduced for step or pilot
- Corner chamfer or corner radius
- Shortened shank or reduced shank diam.
- Additional shank drive flat(s)
- Coolant outlets
- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN



SHARP EDGED WITH 25° RIGHT SPIRAL FLUTES TYPE 327 - FOR NON-FERROUS MATERIALS

- Higher spiral permits faster chip removal
- Spiral flutes distribute the milling impact load evenly, improving finish and increasing tool life

RADIAL EDGED WITH 25° RIGHT SPIRAL FLUTES TYPE 325 - FOR NON-FERROUS MATERIALS

- Same as Type 327 above, but radial edged for tough aluminum alloys and castings

RADIAL EDGED WITH 15° RIGHT SPIRAL FLUTES TYPE 375 - FOR NON-FERROUS MATERIALS & CAST IRONS

- 15° spiral flutes for improved chip removal
- Radial edged for tough aluminum alloys and castings
- Spiral flutes distribute the milling impact load evenly, improving finish and increasing tool life

RADIAL EDGED WITH 15° RIGHT SPIRAL FLUTES TYPE 320 - FOR CAST IRONS & HIGH TEMP ALLOYS

- 15° spiral flutes for improved chip removal
- More flutes than Type 375 for use where less feed per tooth is required, but table feed is maintained for same productivity

ALL TYPES:

- Detailed specifications on page 188

TOOL DIAMETER		DIMENSIONS			TYPE 327 OR 325 - 25° RIGHT SPIRAL FOR NON-FERROUS				TYPE 375 - 15° RIGHT SPIRAL FOR NON-FERROUS & CAST IRON			TYPE 320 - 15° RIGHT SPIRAL FOR CAST IRON & HIGH TEMP ALLOYS		
		SHANK DIAM.	LENGTH		NO. OF FLTS	TYPE 327 SHARP EDP NO.	TYPE 325 RADIAL EDP NO.	PRICE	NO. OF FLTS	TYPE 375 RADIAL EDP NO.	PRICE	NO. OF FLTS	TYPE 320 RADIAL EDP NO.	PRICE
FRACTIONAL	DECIMAL		CARBIDE	OVERALL										
1/2	.5000	3/8	1	3	2	-	32516	\$78.55	2	37516	\$72.35	-	-	-
1/2	.5000	1/2	1	3	2	-	32517	78.55	2	37517	72.35	4	32017	\$78.55
9/16	.5625	1/2	1	3	2	-	32518	84.35	2	37518	77.80	-	-	-
5/8	.6250	1/2	1 1/4	3 1/4	2	-	32520	90.80	2	37520	83.65	-	-	-
3/8	.6250	5/8	1 1/4	3 3/8	2	32721	32521	90.80	2	37521	83.65	4	32021	90.80
11/16	.6875	1/2	1 1/4	3 1/4	2	-	32522	94.65	2	37522	87.20	-	-	-
11/16	.6875	5/8	1 1/4	3 3/8	2	-	32523	94.65	2	37523	87.20	4	32023	94.65
3/4	.7500	1/2	1 1/4	3 1/4	2	32724	32524	101.05	2	37524	93.10	-	-	-
3/4	.7500	5/8	1 1/4	3 3/8	2	32725	32525	101.05	2	37525	93.10	4	32025	101.05
13/16	.8125	5/8	1 1/2	3 5/8	2	32726	32526	109.00	2	37526	100.45	4	32026	109.00
7/8	.8750	5/8	1 1/2	3 5/8	2	-	32528	115.70	2	37528	106.70	-	-	-
7/8	.8750	7/8	1 1/2	3 3/4	2	-	32529	115.70	2	37529	106.70	4	32029	115.70
15/16	.9375	5/8	1 1/2	3 3/4	2	-	32530	130.85	3	37530	157.90	-	-	-
15/16	.9375	7/8	1 1/2	3 3/4	2	-	32531	130.85	3	37531	157.90	-	-	-
1	1.0000	7/8	1 1/2	3 3/4	2	32732	32532	133.60	3	37532	149.50	-	-	-
1	1.0000	1	1 1/2	4	2	32733	32533	133.60	3	37533	149.50	6	32033	162.25
1 1/8	1.1250	1	1 3/4	4 1/4	2	-	32536	146.25	3	37536	176.05	6	32036	191.00
1 1/4	1.2500	1	1 3/4	4 1/4	3	32740	32540	194.05	4	37540	201.75	6	32040	218.90
1 3/8	1.3750	1	1 3/4	4 1/4	3	32744	32544	210.35	4	37544	235.60	6	32044	255.75
1 1/2	1.5000	1 1/4	2	4 1/2	3	32748	32548	234.95	4	37548	232.15	6	32048	251.90
1 5/8	1.6250	1 1/4	2	4 1/2	3	-	32552	278.10	4	37552	283.90	-	-	-
1 3/4	1.7500	1 1/4	2	4 1/2	3	-	32556	298.35	4	37556	302.75	8	32056	316.75
1 7/8	1.8750	1 1/4	2	4 1/2	3	-	32560	321.20	4	37560	323.80	-	-	-
2	2.0000	1 1/4	2	4 1/2	3	32764	32564	343.35	4	37564	342.05	8	32064	357.85

END MILLS



END MILLS FOR STEELS CARBIDE TIPPED TYPES 300, 308, 350, FRACTIONAL

MATERIAL SPECIFIC

BASIC TYPES

MODIFICATIONS (See list on page 191)

TYPE 300 - TWO STRAIGHT FLUTES

- Two large flutes for easy chip removal
- Use when machine horsepower is too low for high chip capacity end mills



TYPE 308 - 6° RIGHT SPIRAL FLUTES

- Spiral flutes aid in chip removal, permitting heavier feeds and faster speeds

TYPE 310 - 6° LEFT SPIRAL FLUTES

- Left spiral flutes maintain a constant pressure on the workpiece and absorb the impact shock on entering steel
- Left hand helix best when milling tough steel alloys
- For peripheral milling

ALL TYPES:

- Radial edged for longer tool life
- Detailed specifications on page 188

TOOL DIAMETER		DIMENSIONS			TYPE 300 - 2 STRAIGHT FLUTES			TYPE 308 OR TYPE 310 - 6° SPIRAL FLUTES			
FRAC.	DECIMAL	SHANK DIAM.	LENGTH		NO. OF FLTS	EDP NO.	PRICE	NO. OF FLTS	TYPE 308 RIGHT EDP NO.	TYPE 310 LEFT EDP NO.	PRICE
			CARBIDE	OVERALL							
1/4	.2500	3/8	1/2	2 1/2	2	30008	\$49.35	2	30808	31008	\$50.80
5/16	.3125	3/8	5/8	2 1/2	2	30010	51.40	2	30810	31010	54.80
3/8	.3750	3/8	5/8	2 1/2	2	30012	54.90	2	30812	31012	58.10
7/16	.4375	3/8	1	2 11/16	2	30014	54.90	2	30814	31014	58.10
1/2	.5000	1/2	1	3 1/4	2	30016	56.20	4	30816	31016	62.60
9/16	.5625	1/2	1	3 3/8	2	30018	62.25	4	30818	31018	67.25
5/8	.6250	1/2	1	3 3/8	2	30020	62.25	4	30820	31020	83.00
3/4	.7500	5/8	1	3 3/8	2	30024	69.90	4	30824	31024	92.50
7/8	.8750	5/8	1 1/4	4	2	30028	82.60	4	30828	31028	111.40
1	1.0000	7/8	1 1/4	4	2	30032	91.30	6	30832	31032	128.10
1 1/8	1.1250	1	1 1/4	4 1/4	2	30036	93.50	6	30836	31036	135.85
1 1/4	1.2500	1	1 1/4	4 1/4	2	30040	104.25	6	30840	31040	164.20
1 1/2	1.5000	1 1/4	1 1/2	4 1/2	2	30048	134.30	6	30848	31048	199.70
1 3/4	1.7500	1 1/4	1 1/2	4 1/2	2	30056	150.65	8	30856	31056	240.45
2	2.0000	1 1/4	1 1/2	4 1/2	2	30064	179.85	8	30864	31064	268.45

HIGH SPIRAL SHEAR CUTTING TYPES



TYPE 350 - 15° RIGHT SPIRAL FLUTES

- 15° right spiral flutes for improved chip removal
- Spiral flutes distribute the milling impact load evenly, improving finish and increasing tool life
- Radial edged for longer tool life
- Detailed specifications on page 188

TOOL DIAMETER		DIMENSIONS			TYPE 350 - 15° RIGHT SPIRAL 4 TO 8 FLUTES		
FRAC.	DECIMAL	SHANK DIAM.	LENGTH		NO. OF FLTS	EDP NO.	PRICE
			CARBIDE	OVERALL			
1/2	.5000	3/8	1	3	4	35016	\$78.55
1/2	.5000	1/2	1	3	4	35017	78.55
9/16	.5625	1/2	1	3	4	35018	84.35
5/8	.6250	1/2	1 1/4	3 1/4	4	35020	90.80
5/8	.6250	5/8	1 1/4	3 3/8	4	35021	90.80
11/16	.6875	1/2	1 1/4	3 1/4	4	35022	94.65
11/16	.6875	5/8	1 1/4	3 3/8	4	35023	94.65
3/4	.7500	1/2	1 1/4	3 1/4	4	35024	101.05
3/4	.7500	5/8	1 1/4	3 3/8	4	35025	101.05
13/16	.8125	5/8	1 1/2	3 5/8	4	35026	109.00
7/8	.8750	5/8	1 1/2	3 5/8	4	35028	115.70
7/8	.8750	7/8	1 1/2	3 3/4	4	35029	115.70
15/16	.9375	5/8	1 1/2	3 3/4	4	35030	171.35
15/16	.9375	7/8	1 1/2	3 3/4	4	35031	171.35
1	1.0000	7/8	1 1/2	3 3/4	6	35032	162.25
1	1.0000	1	1 1/2	4	6	35033	162.25
1 1/8	1.1250	1	1 3/4	4 1/4	6	35036	191.00
1 1/4	1.2500	1	1 3/4	4 1/4	6	35040	218.90
1 3/8	1.3750	1	1 3/4	4 1/4	6	35044	255.75
1 1/2	1.5000	1 1/4	2	4 1/2	6	35048	251.90
1 5/8	1.6250	1 1/4	2	4 1/2	8	35052	335.80
1 3/4	1.7500	1 1/4	2	4 1/2	8	35056	358.15
1 7/8	1.8750	1 1/4	2	4 1/2	8	35060	383.00
2	2.0000	1 1/4	2	4 1/2	8	35064	404.50

END MILLS



BRAZED SINGLE POINT TOOLS CARBIDE TIPPED

MATERIAL
SPECIFIC

FINISH GROUND
READY FOR USE

883/PREMIUM C2 FOR NON-FERROUS & CAST IRONS
370/PREMIUM C5-C6 FOR STEELS



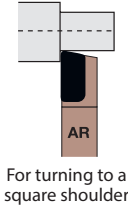
AR

0° SIDE CUTTING EDGE ANGLE

For machining to a square shoulder

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
AR-4	11104	\$9.60	11204	\$7.05	¼	¼	2	12
AR-5	11105	8.50	11205	7.45	⅝	⅝	2 ¼	12
AR-6	11106	8.65	11206	7.60	⅜	⅜	2 ½	12
AR-7	11107	9.30	11207	8.25	⅞	⅞	3	12
AR-8	11108	7.95	11208	7.95	½	½	3 ½	12
AR-10	11110	11.85	11210	10.95	⅝	⅝	4	12
AR-12	11112	15.20	11212	13.65	¾	¾	4 ½	12
AR-16	11116	27.90	11216	27.15	1	1	7	6
AR-20	11120	CALL US	11220	CALL US	1 ¼	1 ¼	8	1
AR-44	11144	CALL US	11244	CALL US	½	1	7	12

*Some sizes not available in premium grade carbide. Prices subject to change.



For turning to a square shoulder



AL

0° SIDE CUTTING EDGE ANGLE

For machining to a square shoulder

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
AL-4	11404	\$9.60	11504	\$7.05	¼	¼	2	12
AL-5	11405	8.50	11505	7.45	⅝	⅝	2 ¼	12
AL-6	11406	8.65	11506	7.60	⅜	⅜	2 ½	12
AL-7	11407	9.30	11507	8.25	⅞	⅞	3	12
AL-8	11408	7.95	11508	7.95	½	½	3 ½	12
AL-10	11410	11.25	11510	10.95	⅝	⅝	4	12
AL-12	11412	14.50	11512	14.40	¾	¾	4 ½	12
AL-16	11416	28.25	11516	28.25	1	1	7	6
AL-20	-	-	11520	CALL US	1 ¼	1 ¼	8	1
AL-44	11444	CALL US	11544	CALL US	½	1	7	12

*Some sizes not available in premium grade carbide. Prices subject to change.



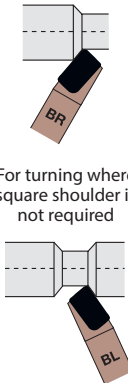
BR

15° SIDE CUTTING EDGE ANGLE

For interrupted or irregular cuts

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
BR-4	12104	\$9.60	12204	\$7.05	¼	¼	2	12
BR-5	12105	8.50	12205	7.45	⅝	⅝	2 ¼	12
BR-6	12106	8.65	12206	7.60	⅜	⅜	2 ½	12
BR-7	12107	9.30	12207	8.25	⅞	⅞	3	12
BR-8	12108	7.95	12208	7.95	½	½	3 ½	12
BR-10	12110	11.85	12210	10.95	⅝	⅝	4	12
BR-12	12112	15.20	12212	13.65	¾	¾	4 ½	12
BR-16	12116	27.90	12216	27.15	1	1	7	6
BR-20	12120	CALL US	12220	CALL US	1 ¼	1 ¼	8	1
BR-44	12144	CALL US	12244	CALL US	½	1	7	12

*Some sizes not available in premium grade carbide. Prices subject to change.



For turning where square shoulder is not required



BL

15° SIDE CUTTING EDGE ANGLE

For interrupted or irregular cuts

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
BL-4	12404	\$9.60	12504	\$7.05	¼	¼	2	12
BL-5	12405	8.50	12505	7.45	⅝	⅝	2 ¼	12
BL-6	12406	8.65	12506	7.60	⅜	⅜	2 ½	12
BL-7	12407	9.30	12507	8.25	⅞	⅞	3	12
BL-8	12408	7.95	12508	7.95	½	½	3 ½	12
BL-10	12410	11.25	12510	10.95	⅝	⅝	4	12
BL-12	12412	14.50	12512	14.40	¾	¾	4 ½	12
BL-16	12416	28.25	12516	28.25	1	1	7	6
BL-20	12420	CALL US	12520	CALL US	1 ¼	1 ¼	8	1
BL-44	12444	CALL US	12544	CALL US	½	1	7	12

*Some sizes not available in premium grade carbide. Prices subject to change.



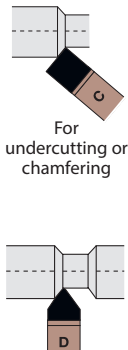
C

0° SQUARE NOSE

No nose radius

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
C-4	13704	\$6.30	13804	\$6.30	¼	¼	2	12
C-5	13705	7.00	13805	6.75	⅝	⅝	2 ¼	12
C-6	13706	9.05	13806	7.45	⅜	⅜	2 ½	12
C-7	13707	6.90	13807	9.55	⅞	⅞	3	12
C-8	13708	11.10	13808	10.30	½	½	3 ½	12
C-10	13710	12.50	13810	13.65	⅝	⅝	4	12
C-12	13712	17.20	13812	19.55	¾	¾	4 ½	12
C-16	13716	35.70	13816	34.35	1	1	7	6
C-20	13720	CALL US	13820	CALL US	1 ¼	1 ¼	8	1
C-44	13744	CALL US	13844	CALL US	½	1	7	12

*Some sizes not available in premium grade carbide. Prices subject to change.



For undercutting or chamfering



D

40° SIDE CUTTING EDGE ANGLE

80° pointed nose

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
D-4	14704	\$5.90	14804	\$5.90	¼	¼	2	12
D-5	14705	6.80	14805	7.05	⅝	⅝	2 ¼	12
D-6	14706	7.00	14806	7.50	⅜	⅜	2 ½	12
D-7	14707	9.55	14807	11.55	⅞	⅞	3	12
D-8	14708	9.15	14808	9.70	½	½	3 ½	12
D-10	14710	12.80	14810	14.20	⅝	⅝	4	12
D-12	14712	18.30	14812	16.10	¾	¾	4 ½	12
D-16	14716	27.20	14816	28.05	1	1	7	6

*Some sizes not available in premium grade carbide. Prices subject to change.

SINGLE POINTS



BRAZED SINGLE POINT TOOLS CARBIDE TIPPED

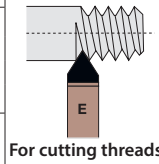
MATERIAL
SPECIFIC

FINISH GROUND
READY FOR USE

883/PREMIUM C2 FOR NON-FERROUS & CAST IRONS
370/PREMIUM C5-C6 FOR STEELS

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
E-4	15704	\$5.90	15804	\$5.90	1/4	1/4	2	12
E-5	15705	6.40	15805	6.40	5/16	5/16	2 1/4	12
E-6	15706	6.70	15806	6.50	3/8	3/8	2 1/2	12
E-7	15707	10.35	15807	12.40	7/16	7/16	3	12
E-8	15708	15.35	15808	8.20	1/2	1/2	3 1/2	12
E-10	15710	12.70	15810	11.50	5/8	5/8	4	12
E-12	15712	15.80	15812	16.00	3/4	3/4	4 1/2	12
E-16	15716	27.70	15816	26.65	1	1	7	6

*Some sizes not available in premium grade carbide. Prices subject to change.



For cutting threads



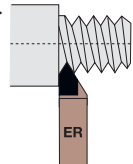
60° INCLUDED ANGLE;
30° SIDE CUTTING EDGE ANGLE

For threading, chamfering,
notching, or undercutting



30° SIDE CUTTING EDGE ANGLE

Offset for threading or boring



For cutting threads

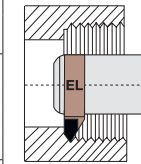


30° SIDE CUTTING EDGE ANGLE

Offset for threading or boring

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
ER-4	15104	\$7.30	15204	\$5.90	1/4	1/4	2	12
ER-5	15105	7.30	15205	6.55	5/16	5/16	2 1/4	12
ER-6	15106	7.40	15206	6.75	3/8	3/8	2 1/2	12
ER-8	15108	13.10	15208	13.10	1/2	1/2	3 1/2	12
ER-10	15110	14.30	15210	14.30	5/8	5/8	4	12
ER-12	15112	15.45	15212	16.80	3/4	3/4	4 1/2	12

*Some sizes not available in premium grade carbide. Prices subject to change.



For bore threading
in a 90° bar

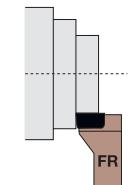
TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
EL-4	15404	\$8.40	15504	\$5.90	1/4	1/4	2	12
EL-5	15405	8.40	15505	8.05	5/16	5/16	2 1/4	12
EL-6	15406	8.40	15506	8.15	3/8	3/8	2 1/2	12
EL-8	15408	13.10	15508	14.45	1/2	1/2	3 1/2	12
EL-10	15410	14.30	15510	15.75	5/8	5/8	4	12
EL-12	15412	15.45	15512	16.80	3/4	3/4	4 1/2	12

*Some sizes not available in premium grade carbide. Prices subject to change.



0° END CUTTING EDGE ANGLE

Offset for facing to a square shoulder or close to chuck jaws



For facing to a
square shoulder



0° END CUTTING EDGE ANGLE

Offset for facing to a square shoulder or close to chuck jaws

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
FR-8	16108	\$11.00	16208	\$10.85	1/2	1/2	3 1/2	12
FR-10	16110	15.95	16210	15.15	5/8	5/8	4	12
FR-12	16112	20.60	16212	20.35	3/4	3/4	4 1/2	6
FR-16	16116	43.10	16216	45.35	1	1	7	4
FR-44	16144	CALL US	16244	CALL US	1/2	1	6	6

*Some sizes not available in premium grade carbide. Prices subject to change.

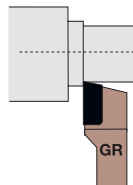
TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
FL-8	16408	\$11.10	16508	\$10.50	1/2	1/2	3 1/2	12
FL-10	16410	16.65	16510	15.15	5/8	5/8	4	12
FL-12	16412	21.35	16512	18.90	3/4	3/4	4 1/2	6
FL-16	16416	40.20	16516	45.35	1	1	7	4
FL-44	16444	CALL US	16544	CALL US	1/2	1	6	6

*Some sizes not available in premium grade carbide. Prices subject to change.



0° SIDE CUTTING EDGE ANGLE

Offset for facing or turning to a square shoulder
or close to chuck jaws



For turning to a
square shoulder



0° SIDE CUTTING EDGE ANGLE

Offset for facing or turning to a square shoulder
or close to chuck jaws

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
GR-8	17108	\$11.10	17208	\$10.50	1/2	1/2	3 1/2	12
GR-10	17110	16.65	17210	15.15	5/8	5/8	4	12
GR-12	17112	21.35	17212	18.90	3/4	3/4	4 1/2	6
GR-16	17116	45.05	17216	45.35	1	1	7	4
GR-20	17120	CALL US	17220	CALL US	1 1/4	1 1/4	8	1
GR-44	17144	CALL US	17244	CALL US	1/2	1	6	6

*Some sizes not available in premium grade carbide. Prices subject to change.

TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
GL-8	17408	\$11.00	17508	\$10.85	1/2	1/2	3 1/2	12
GL-10	17410	15.95	17510	15.15	5/8	5/8	4	12
GL-12	17412	20.60	17512	20.35	3/4	3/4	4 1/2	6
GL-16	17416	43.70	17516	45.35	1	1	7	4
GL-20	17420	CALL US	17520	CALL US	1 1/4	1 1/4	8	1
GL-44	17444	CALL US	17544	CALL US	1/2	1	6	6

*Some sizes not available in premium grade carbide. Prices subject to change.

SINGLE POINTS



BRAZED CUT-OFF TOOLS CARBIDE TIPPED



883/PREMIUM C2 FOR NON-FERROUS & CAST IRONS
370/PREMIUM C5-C6 FOR STEELS



STANDARD CUT-OFF TOOL

For stock cut-off of solid bars
Finish ground - ready for use

TOOL STYLE	CUT-OFF WIDTH	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS		
		EDP NO.	PRICE	EDP NO.	PRICE	W	H	L
CT-111	1/8	10111	\$14.25	10211	\$14.80	1/2	1	5
CT-122	3/16	10122	14.65	10222	15.10	1/2	1	5
CT-121	1/4	10133	15.15	10233	15.65	1/2	1	5
CT-120	5/16	10144	15.10	10244	15.65	1/2	1	5
CT-130	3/8	10155	18.30	10255	19.50	5/8	1 1/4	5
CT-140	3/8	10166	20.30	10266	21.00	3/4	1 1/2	6

*Some sizes not available in premium grade carbide. Prices subject to change.

Standard packaging quantity is 6

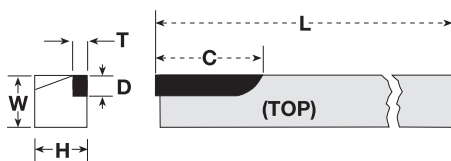
STANDARD CUT-OFF TOOL

For stock cut-off of solid bars
Finish ground - ready for use

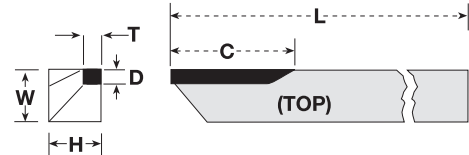
TOOL STYLE	CUT-OFF WIDTH	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS		
		EDP NO.	PRICE	EDP NO.	PRICE	W	H	L
CTL-111	1/8	10411	\$14.25	10511	\$14.80	1/2	1	5
CTL-122	3/16	10422	14.65	10522	15.10	1/2	1	5
CTL-121	1/4	10433	15.15	10533	15.65	1/2	1	5
CTL-120	5/16	10444	15.10	10544	15.65	1/2	1	5
CTL-130	3/8	10455	18.30	10555	19.50	5/8	1 1/4	5
CTL-140	3/8	10466	20.30	10566	21.00	3/4	1 1/2	6

*Some sizes not available in premium grade carbide. Prices subject to change.

Standard packaging quantity is 6



H = Tool Height
W = Tool Width
L = Overall Tool Length
T = Carbide Thickness
D = Cut-off Width
C = Carbide Length



S.A. SERIES SWISS AUTOMATIC TOOL

Requires finish grind for cut-off, forming or turning

TOOL STYLE	C2 CARBIDE*		SHANK DIMENSIONS			CARBIDE DIMENSIONS		
	EDP NO.	PRICE	"W"	"H"	"L"	"T"	"D"	"C"
SA6T	19901	\$12.90	1/4	1/4	6	3/32	1/8	1 1/4
SA7T	19902	13.80	5/32	5/32	6	3/32	1/8	1 1/4
SA8T	19903	15.05	3/16	3/16	6	3/32	3/16	1 1/4
SA9T	19904	16.00	3/8	3/8	6	3/32	3/16	1 1/4
SA10T	19905	17.30	13/32	13/32	6	3/32	3/16	1 1/4
SA11T	19906	17.95	7/16	7/16	6	1/8	1/4	1
SA11.5T	19907	18.00	15/32	15/32	6	1/8	1/4	1
SA12T	19908	19.15	1/2	1/2	6	1/8	1/4	1

*Prices subject to change

Standard packaging quantity is 10

S.A. SERIES SWISS AUTOMATIC TOOL

Requires finish grind for cut-off, forming or turning

TOOL STYLE	C2 CARBIDE*		SHANK DIMENSIONS			CARBIDE DIMENSIONS		
	EDP NO.	PRICE	"W"	"H"	"L"	"T"	"D"	"C"
SA6C	19921	\$12.90	1/4	1/4	6	1/8	3/32	1 1/4
SA7C	19922	13.80	5/32	5/32	6	1/8	3/32	1 1/4
SA8C	19923	15.05	3/16	3/16	6	1/8	3/32	1 1/4
SA9C	19924	16.00	3/8	3/8	6	1/8	3/32	1 1/4
SA10C	19925	17.30	13/32	13/32	6	1/8	3/32	1 1/4
SA11C	19926	17.95	7/16	7/16	6	3/32	1/8	1 1/4
SA11.5C	19927	18.00	15/32	15/32	6	3/32	1/8	1 1/4
SA12C	19928	19.15	1/2	1/2	6	3/32	1/8	1 1/4

*Prices subject to change

Standard packaging quantity is 10

SINGLE POINTS



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GENERAL INFORMATION

SELECTED DISTRIBUTION

To ensure exceptional service & technical application support, Hannibal only sells through selected distributors, your communications link with us. If you require direct technical assistance, contact our Engineering and Technical Service Team.

Phone: 800-451-9436

Fax: 800-633-7302

E-mail: sales@hannibalcarbide.com

STOCK STATUS

Because of our exceptionally broad product listing of over 20,000 line items, our distributors seldom stock our tools unless they have a consistent demand for particular tools requiring same day delivery. HANNIBAL maintains a 99% line item order fill rate. We have a huge inventory of finished tools ready to meet your needs.

SHIPPING

Normal procedure is to ship all distributor orders by UPS, unless requested otherwise. Our lost shipment insurance does not cover shipments sent "freight collect."

ORDERING

The only description required to order a standard tool is the EDP number. However, as a cross-check, orders should include a brief description of the tool.

MODIFICATIONS

Many standard tools ordered include requests for one or more modifications. On each page of this catalog is a list of the modifications most commonly requested. Just phone, fax, or e-mail us for an immediate quote. Modified tools are delivered promptly and are competitively priced.

APPLICATIONS ENGINEERING

HANNIBAL prides itself on the ability to solve end user tooling problems. We will suggest solutions including tool designs that have been used successfully to solve similar problems. Our proven applications engineering capability is reflected in the fact that some of the largest machine tool builders select HANNIBAL to design and produce the original cutting tools used in producing engines and transmissions.

FREE TECHNICAL REAMING GUIDE AVAILABLE

For technical reaming information see pages 23-29 or contact us to request your free hard copy, or PDF version of "HANNIBAL'S Guide to Cost Effective Reaming." It is continuously updated to include the latest reamer technical developments, including:

Reamer Stock Removal Chart • Titanium Coatings • Flute Geometry • Reamer Nomenclature & Definitions • Avoiding Reaming Problems • Runout Concerns • Developing Optimum Feeds & Speeds

QUALITY TOOLS

20% of HANNIBAL'S sales are special order tools made to end user's specifications and prints for the very demanding automotive, diesel engine, aircraft engine, aerospace, and construction equipment industries. To meet these stringent requirements, our engineers and tool makers work daily with exacting tolerances and procedures.

QUALITY APPROVED

Our plants have consistently passed quality system inspections by key engineering, production, and purchasing executives of our major tool users. HANNIBAL was Ford Q101 certified in 1989 and was originally ISO Certified on August 18, 1999 and continues to maintain ISO 9001 certifications.

TOLERANCES AND SPECIFICATIONS

All our tools are manufactured to one or more of the following specifications:

USCTI - United States Cutting Tool Institute

NAS - National Aerospace Standards

ISO - International Organization for Standardization

ASME/ANSI - American National Standards Institute, and affiliate of American Society of Mechanical Engineers

TOOL PERFORMANCE

While price is always a consideration, the real measure of the tool's value is its in-plant performance. HANNIBAL'S tool performance is proven wherever accurate records are kept, such as the aerospace and automotive industries. Here our tools earn "excellent" ratings... and that is why we are one of the fastest growing tool companies in the world.

PEOPLE

HANNIBAL'S engineers, technicians, tool makers, and sales & support staff are continually focused on the goal of producing the world's best carbide tipped tools. Our experienced tool makers sincerely want to do their very best every day making every effort to manufacture tools that will meet your exacting needs.

HANNIBAL

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SERVICING THE GLOBE

- Phone Coverage 7 a.m. - 5 p.m. CDT
- Design & Manufacture Special Tools
- Comprehensive Tooling Solutions
- Experienced Technical Support
- Exceptional Customer Services
- Same Day Shipment Available
- No Charge for Drop Shipments
- 24-Hour Quote Turn Around
- Digital Catalog Available
- No Minimum Order Size
- Reliable Deliveries
- Consistent Quality
- ISO 9001 Certified
- Made in USA



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