

HANNIBAL

Carbide Tool, Inc

ISO 9001 Certified



CARBIDE TIPPED

& SOLID CARBIDE

CUTTING TOOLS

NOV 2023 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

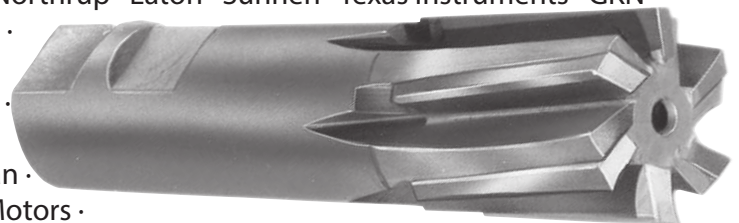
STABILITY — FOR TODAY & TOMORROW

- 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

CARBIDE TIPPED ADVANTAGE – pg. 5
 CHIP CLASSIFICATIONS – pg. 6
 CUTTING FEEDS & SPEEDS – pg. 8, 146, 160, 176
 COATINGS – pg. 10
 MODIFIED STANDARD TOOLS – pg. 12
 SPECIAL ORDER TOOLS – pg. 14-22

4

REAMERS

REAMER GUIDE – pg. 23
 REAMER SELECTOR – pg. 27
 REAMER INDEX
 CARBIDE TIPPED – pg. 30
 SOLID CARBIDE – pg. 101

23

DRILLS

DRILL TECH INFO – pg. 112
 DRILL POINT SELECTION – pg. 113
 DRILL INDEX – pg. 114
 CENTERS – pg. 139

112

COUNTERBORES

TECH INFO & INDEX – pg. 145
 COUNTERBORE PILOTS – pg. 158

145

MILLING CUTTERS

TECH INFO – pg. 160
 FEEDS & SPEEDS – pg. 160
 INDEX – pg. 159
 ARBOR HOLE TYPES – pg. 162-174
 SHANK TYPES – pg. 175-184

159

END MILLS

TECH INFO – pg. 188
 INDEX – pg. 189

188

SINGLE POINT TOOLS

193

CATALOG INDEX

ALPHABETICAL – pg. 196-197
 NUMERICAL BY TOOL TYPE – pg. 198
 GENERAL INFO – pg. 199

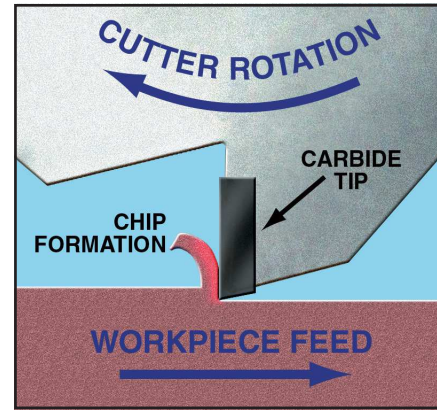


ALL ABOUT CARBIDE TECHNICAL INFORMATION

TECHNICAL

THE CUTTING PROCESS

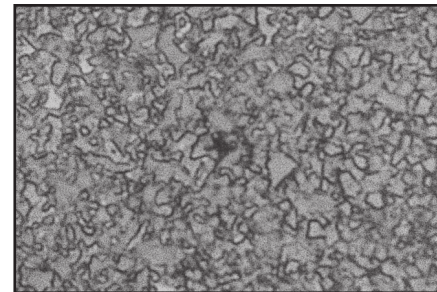
- Intense concentrated force at the cutting edge separates the metal's individual crystals
- Continuous flowing chip is separated from the workpiece
- Chip moves up cutting tool face until chip's internal stresses cause a chip fracture and chip breaks away as a segmented or discontinuous chip
- Large 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

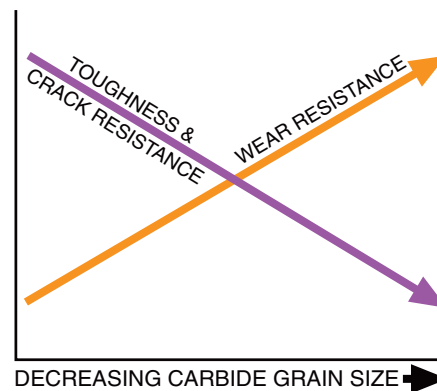
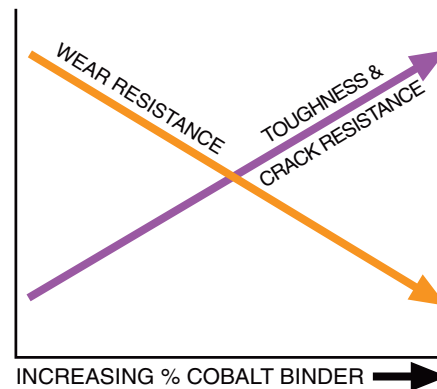
- Carbide powders are created by heating metal powders, usually tungsten, and carbon to a very high temperature – over 2800°F
- Resultant tungsten carbide powder grains are extremely hard and stable at elevated temperatures
- These carbide powders are sorted by grain size and recombined in appropriate 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)



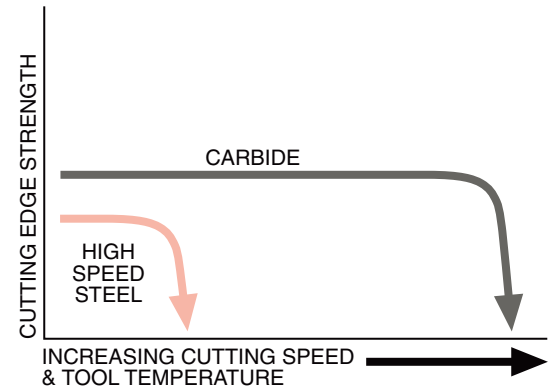
IMPORTANT NOTE: Some solid carbide tools now utilize a cobalt enriched cutting edge zone. HANNIBAL has utilized this same principle for many years — our hardened tough alloy steel bodies have always enabled us to select the carbide grade best suited for the cutting edge without the limitation of their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



THE HANNIBAL CARBIDE TIPPED END USER ADVANTAGE

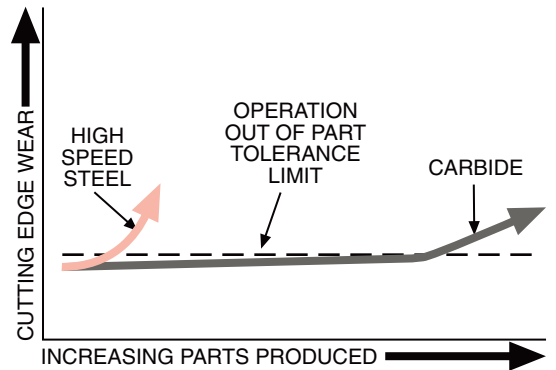
CARBIDE TIPPED VS. HIGH SPEED STEEL

- 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

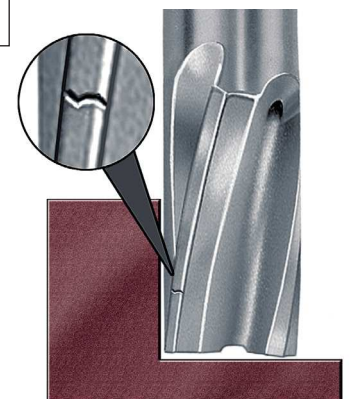


CRACKED SOLID CARBIDE TOOL SHATTERS



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

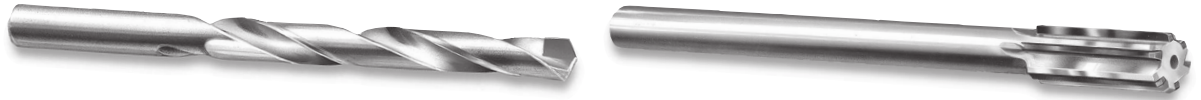
HANNIBAL'S CHIP CLASSIFICATIONS ARE BASED ON EACH MATERIAL'S MOST COMMON CONDITION. SPECIAL HEAT TREATMENTS OR PROCESSING MAY CHANGE THE MATERIAL'S MACHINING CHARACTERISTICS. THIS HANNIBAL GUIDE IS A SUGGESTED STARTING POINT FOR TOOL SELECTION.



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	- .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	- .020	- .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 .011	- .009	.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	.028 .028	.019 .025	.030 .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 .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

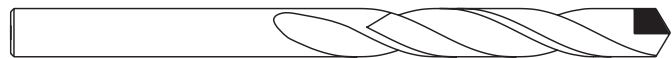
TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

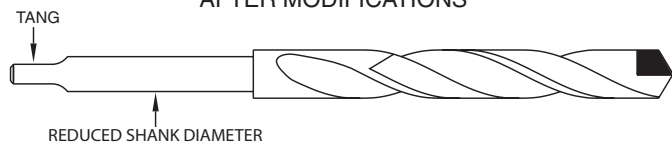
AL TITANIUM NITRIDE – AlTiN

- 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:

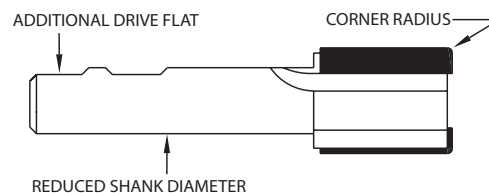
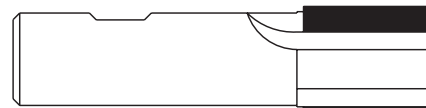
TITANIUM NITRIDE – TiN

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:

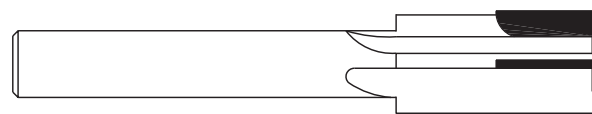
TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

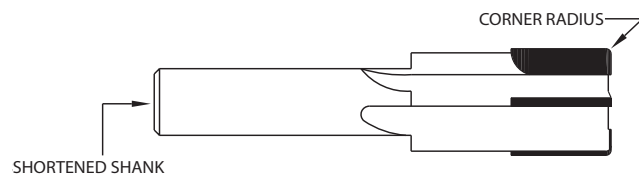
ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

BEFORE MODIFICATIONS



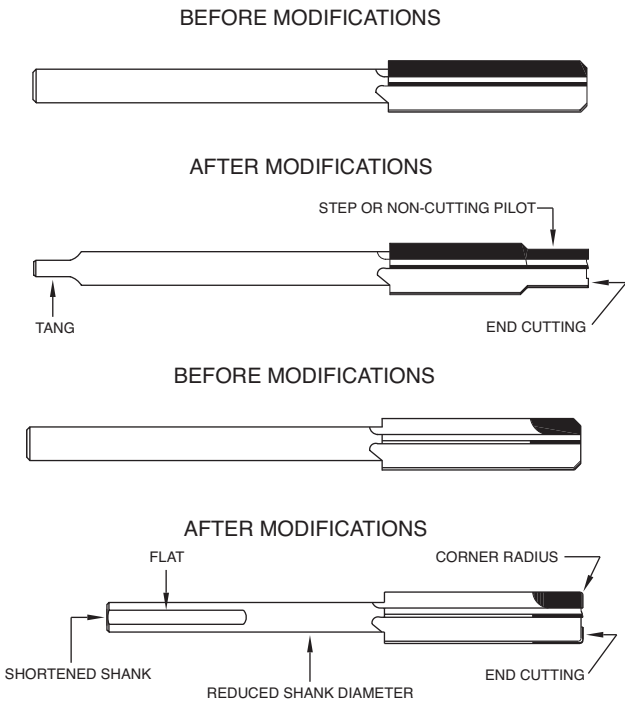
AFTER MODIFICATIONS



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:

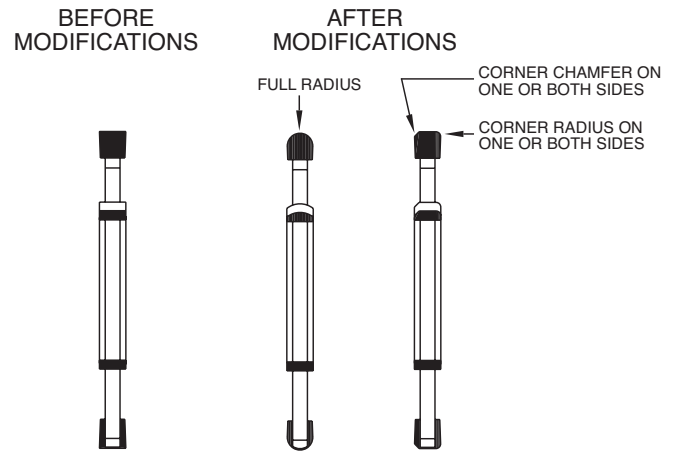
TITANIUM NITRIDE – TiN
TITANIUM CARBONITRIDE – TiCN
ZIRCONIUM NITRIDE – ZrN
AL TITANIUM NITRIDE – AlTiN



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:

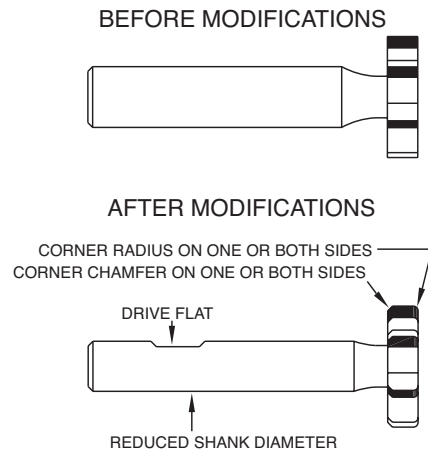
TITANIUM NITRIDE – TiN
TITANIUM CARBONITRIDE – TiCN
ZIRCONIUM NITRIDE – ZrN
AL TITANIUM NITRIDE – AlTiN



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

Agriculture



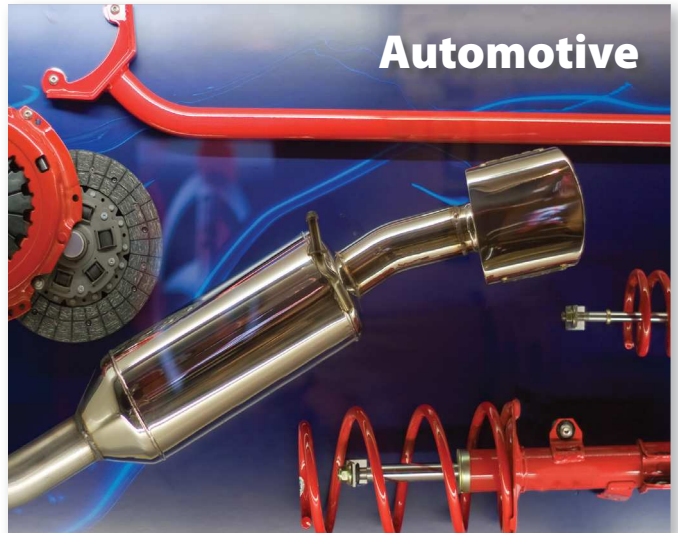
Aerospace



Heavy Equipment



Automotive



Manufacturing



Oil Industry





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

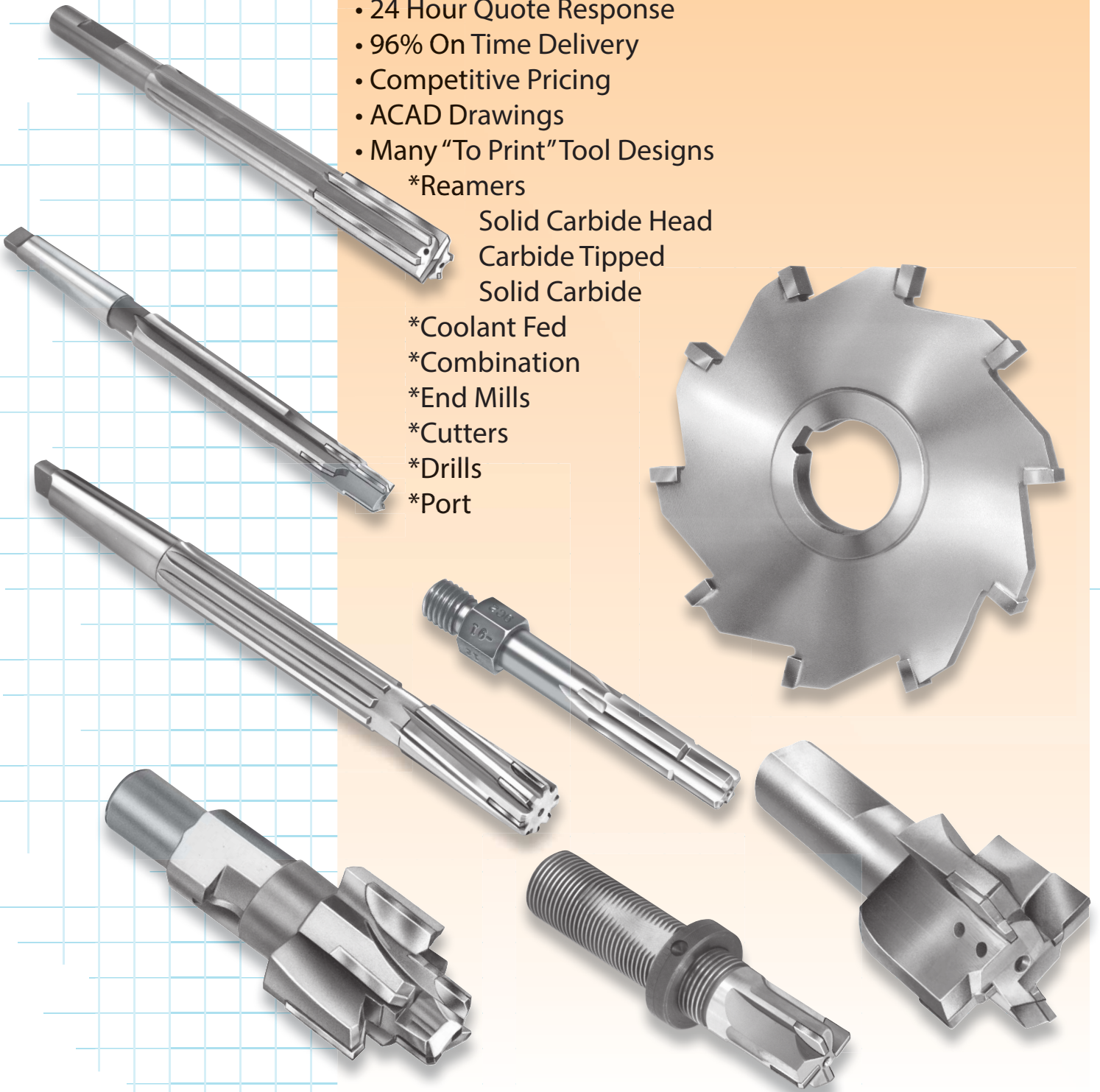
*Combination

*End Mills

*Cutters

*Drills

*Port





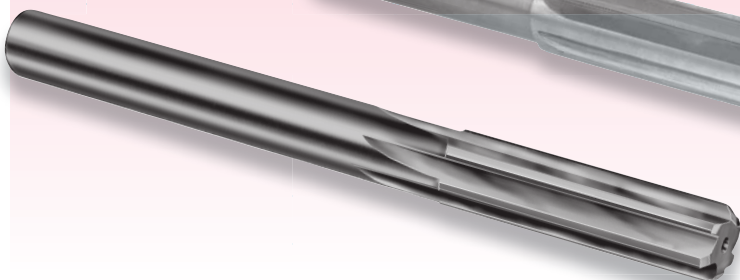
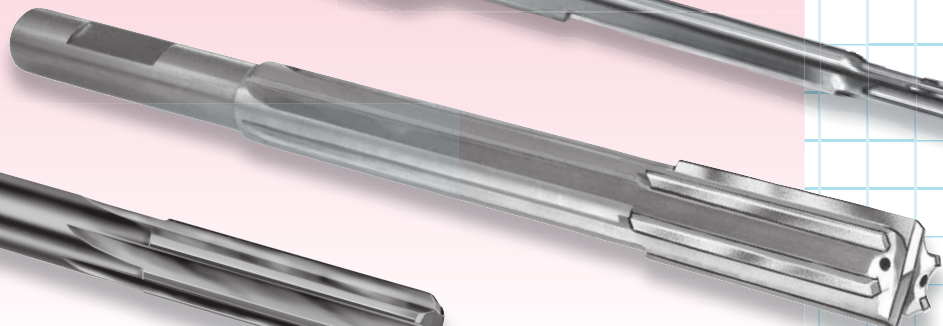
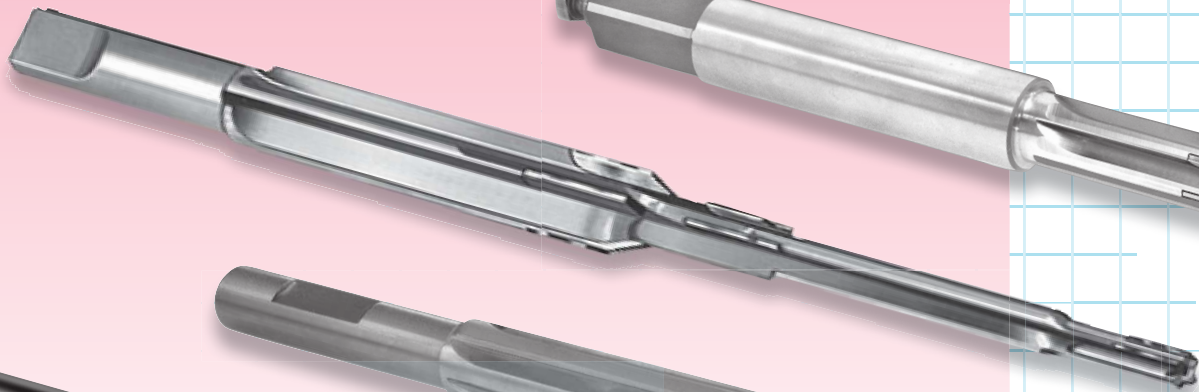
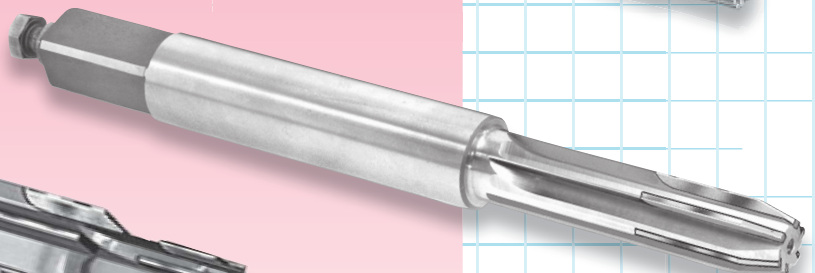
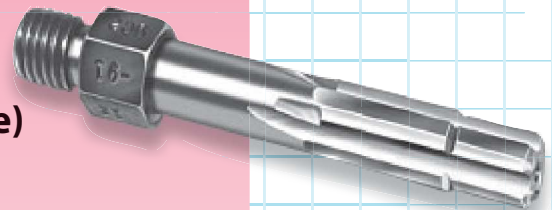
SPECIAL ENGINEERED TOOLS TO PRINT

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)





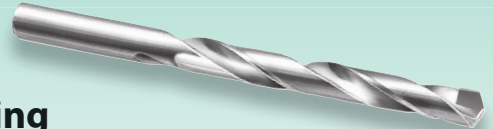
SPECIAL ENGINEERED TOOLS TO PRINT

ENGINEERED TOOLS TO YOUR SPECIFICATIONS



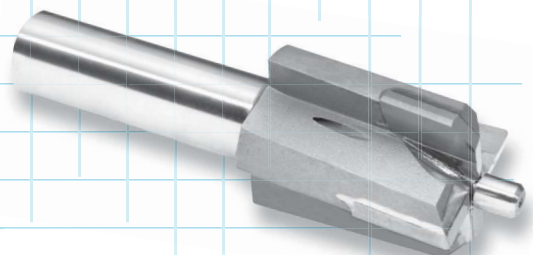
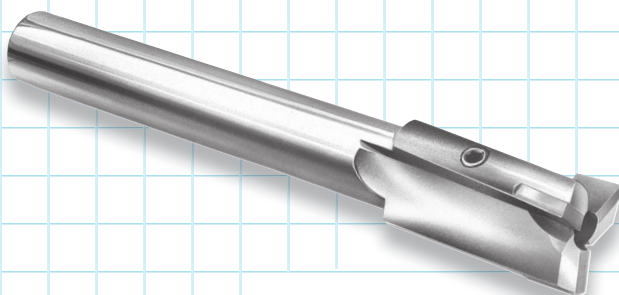
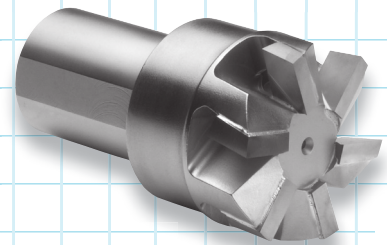
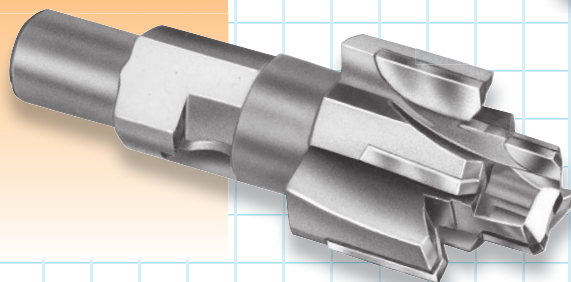
DRILLS

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



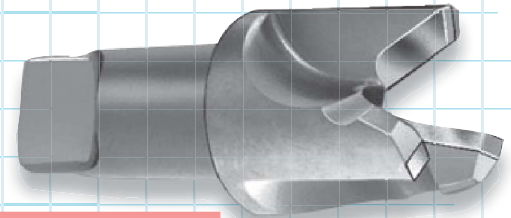
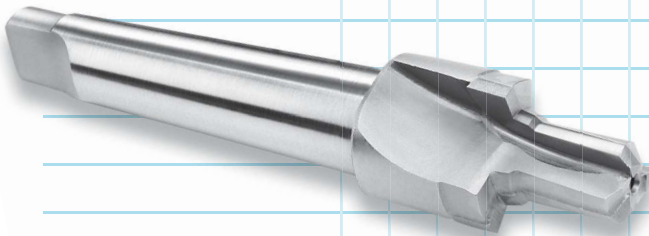
COUNTERBORES & SPOT FACE

- 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)



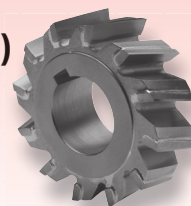
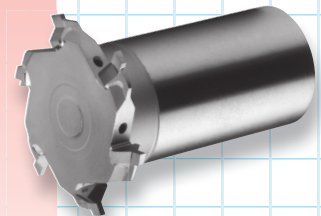
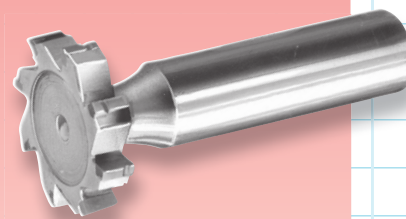
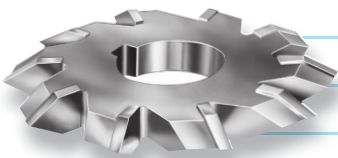
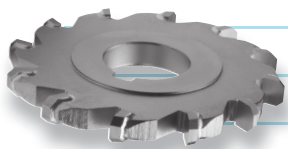
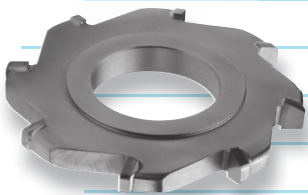
CUTTERS

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

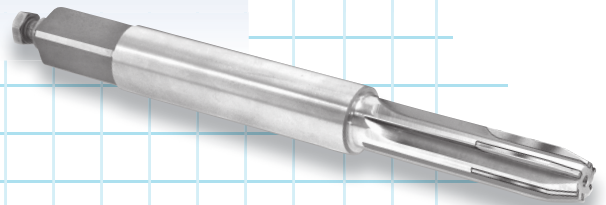
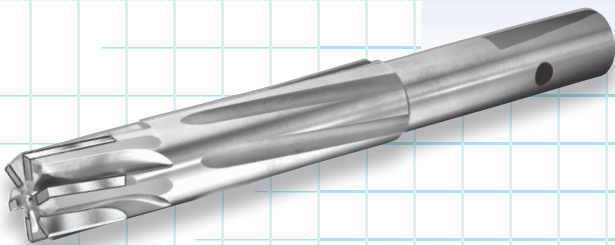
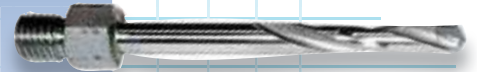
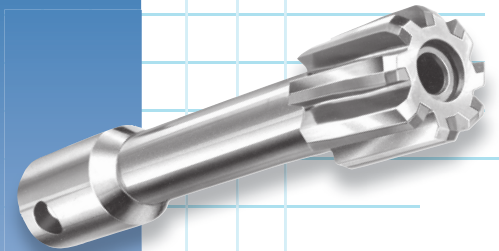
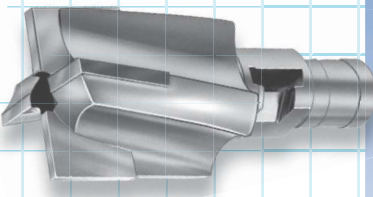
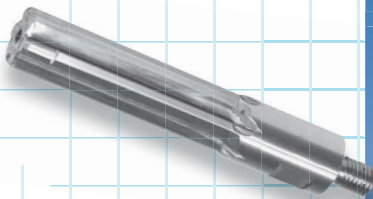
QUALITY "MADE TO PRINT" TOOLS FOR ALL MANUFACTURING SECTORS

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

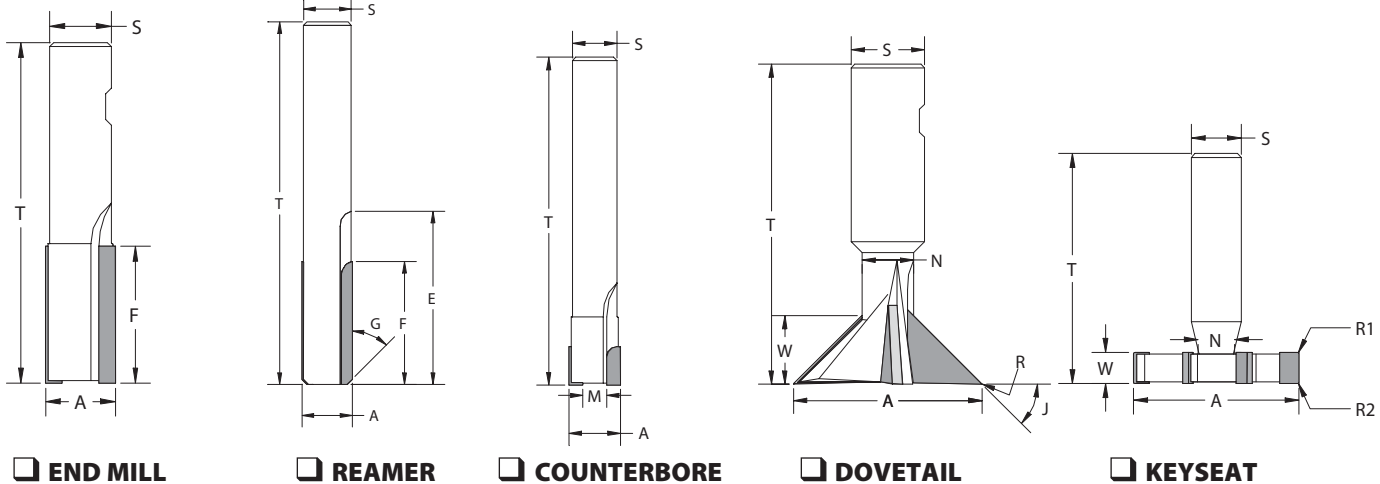




CARBIDE TIPPED SPECIALS QUOTE FORM

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
 Number of Flutes _____

Right Hand Cutting
 Right Hand Spiral _____ °

Left Hand Cutting
 Left Hand Spiral _____ °

IF PILOTED

Cutting Pilot Head Diam. _____
 Non-Cutting Pilot 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.



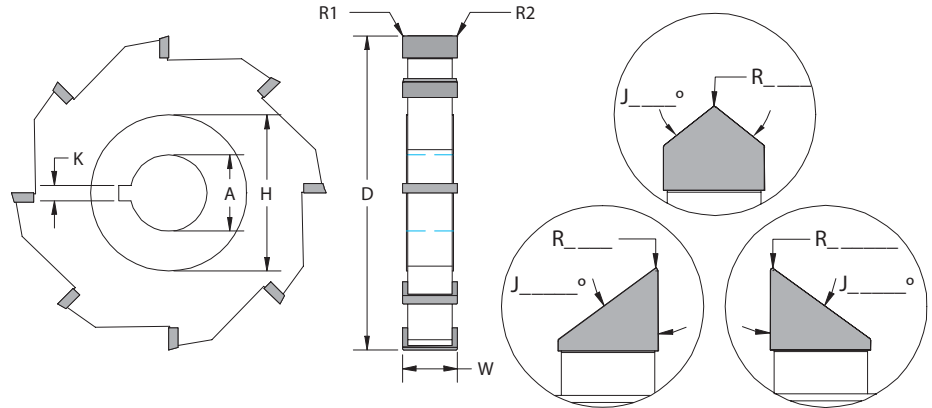
CARBIDE TIPPED SPECIALS QUOTE FORM

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

TECHNICAL

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.

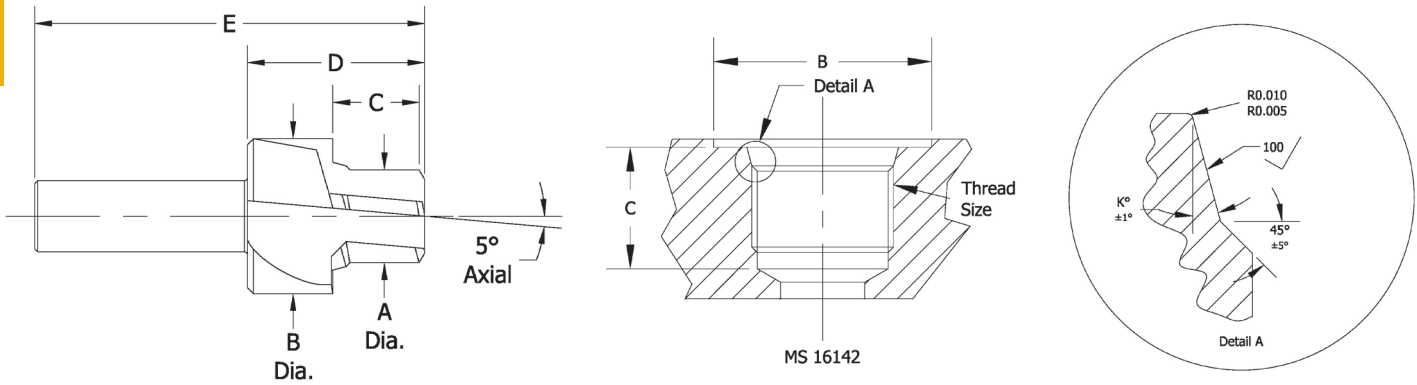
THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Hannibal Carbide Tool, Inc. shall have no liability or responsibility on any claim of any kind, whether in contract, tort or otherwise, for any 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-Rream 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	466 - 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:

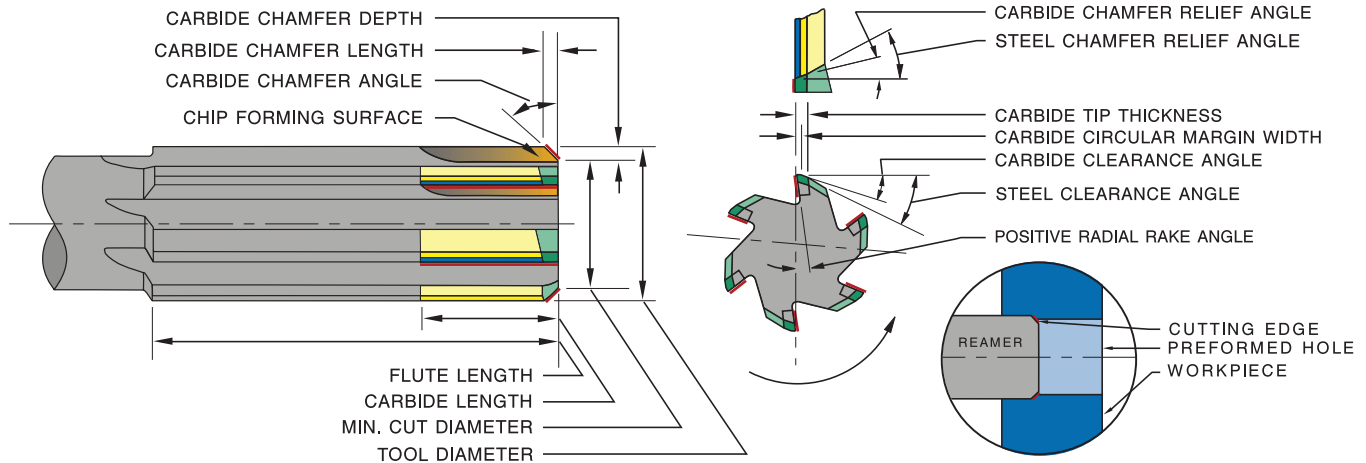
Reamer Expedite Fees: Order must be received by 2:00 PM CST

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

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	\$257.15	\$229.40	\$220.20	\$215.75	\$210.90	\$207.30
0.3781 - 0.4090	41413h6	42413h6	43413h6	.3125	4	1 3/4	5	257.70	230.15	220.90	216.45	211.75	207.85
0.4091 - 0.4410	41414h6	42414h6	43414h6	.3750	6	1 3/4	5	259.90	232.15	222.85	218.55	213.60	210.00
0.4411 - 0.4720	41415h6	42415h6	43415h6	.3750	6	1 3/4	5	261.65	233.95	224.65	220.25	215.45	211.80
0.4721 - 0.5030	41416h6	42416h6	43416h6	.4375	6	2	6	264.00	236.30	227.05	222.70	217.90	214.15
0.5031 - 0.5340	41417h6	42417h6	43417h6	.4375	6	2	6	268.55	240.85	231.65	227.30	222.60	218.80
0.5341 - 0.5660	41418h6	42418h6	43418h6	.4375	6	2	6	271.75	244.05	234.75	230.35	225.65	221.85
0.5661 - 0.5970	41419h6	42419h6	43419h6	.4375	6	2	6	276.20	248.45	239.15	234.85	230.15	226.40
0.5971 - 0.6280	41420h6	42420h6	43420h6	.5625	6	2 1/4	6	280.35	252.70	243.45	239.00	234.30	230.55
0.6281 - 0.6590	41421h6	42421h6	43421h6	.5625	6	2 1/4	6	304.45	276.80	267.45	263.20	258.40	254.65
0.6591 - 0.6910	41422h6	42422h6	43422h6	.5625	6	2 1/4	6	309.55	281.90	272.65	268.25	263.35	259.70
0.6911 - 0.7220	41423h6	42423h6	43423h6	.5625	6	2 1/4	6	320.45	292.90	283.60	279.15	274.45	270.65
0.7221 - 0.7530	41424h6	42424h6	43424h6	.6250	6	2 1/2	6	320.45	292.90	283.60	279.15	274.45	270.65
0.7531 - 0.7840	41425h6	42425h6	43425h6	.6250	6	2 1/2	6	328.35	300.75	291.40	287.00	282.30	278.50
0.7841 - 0.8160	41426h6	42426h6	43426h6	.6250	6	2 1/2	6	328.35	300.75	291.40	287.00	282.30	278.50
0.8161 - 0.8470	41427h6	42427h6	43427h6	.6250	6	2 1/2	6	337.70	309.95	300.80	296.30	291.50	287.70
0.8471 - 0.8780	41428h6	42428h6	43428h6	.7500	6	2 3/8	6	348.60	320.90	311.65	307.25	302.50	298.75
0.8781 - 0.9090	41429h6	42429h6	43429h6	.7500	6	2 3/8	6	381.00	353.40	344.10	339.70	334.95	331.20
0.9091 - 0.9410	41430h6	42430h6	43430h6	.7500	8	2 3/8	6	381.00	353.40	344.10	339.70	334.95	331.20
0.9411 - 0.9720	41431h6	42431h6	43431h6	.7500	8	2 3/8	6	382.25	354.50	345.35	340.90	336.10	332.35
0.9721 - 1.0030	41432h6	42432h6	43432h6	.8750	8	2 3/4	6	382.25	354.50	345.35	340.90	336.10	332.35

REAMERS



CENTER FED FOR BLIND HOLES STRAIGHT FLUTES & SHANK

MODIFICATIONS

- 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	\$261.80	\$234.15	\$224.85	\$220.30	\$215.75	\$211.85
9.602 - 10.389	414100h6	424100h6	434100h6	8	4	45	127	262.45	234.85	225.65	221.10	216.45	212.50
10.390 - 11.201	414110h6	424110h6	434110h6	10	6	45	127	264.40	236.95	227.65	223.20	218.55	214.65
11.202 - 12.000	414120h6	424120h6	434120h6	10	6	45	127	266.25	238.75	229.40	224.85	220.25	216.45
12.001 - 12.875	414125h6	424125h6	434125h6	10	6	51	153	268.55	241.20	231.70	227.30	222.70	218.80
12.876 - 13.565	414135h6	424135h6	434135h6	12	6	51	153	273.25	245.80	236.40	232.00	227.30	223.40
13.566 - 14.376	414140h6	424140h6	434140h6	12	6	51	153	276.30	248.70	239.50	234.90	230.35	226.50
14.377 - 15.164	414150h6	424150h6	434150h6	12	6	51	153	280.85	253.20	244.05	239.50	234.85	230.95
15.165 - 16.100	414160h6	424160h6	434160h6	14	6	57	153	285.00	257.55	248.20	243.60	239.00	235.15
16.101 - 16.740	414165h6	424165h6	434165h6	14	6	57	153	309.10	281.45	272.20	267.75	263.20	259.30
16.741 - 17.551	414175h6	424175h6	434175h6	14	6	57	153	314.15	286.70	277.45	272.85	268.25	264.35
17.552 - 18.340	414180h6	424180h6	434180h6	14	6	57	153	325.10	297.65	288.30	283.90	279.15	275.30
18.341 - 19.250	414190h6	424190h6	434190h6	16	6	64	153	325.10	297.65	288.30	283.90	279.15	275.30
19.251 - 20.126	414200h6	424200h6	434200h6	16	6	64	153	327.85	300.00	290.80	286.35	281.60	277.80
20.127 - 21.127	414210h6	424210h6	434210h6	16	6	64	153	337.05	309.35	300.10	295.65	290.90	287.15
21.128 - 22.127	414220h6	424220h6	434220h6	20	6	64	153	337.05	309.35	300.10	295.65	290.90	287.15
22.128 - 23.127	414230h6	424230h6	434230h6	20	6	67	153	380.25	352.50	343.35	338.80	334.15	330.35
23.128 - 24.127	414240h6	424240h6	434240h6	20	8	67	153	381.50	353.80	344.55	340.10	335.40	331.60
24.128 - 25.127	414250h6	424250h6	434250h6	20	8	70	153	381.50	353.80	344.55	340.10	335.40	331.60

*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	\$258.90	\$231.30	\$222.00	\$217.60	\$212.90	\$209.05
0.3781-0.4090	41613h6	42613h6	43513h6	.3125	4	1 3/4	5	264.00	236.30	227.05	222.70	217.90	214.15
0.4091-0.4410	41614h6	42614h6	43514h6	.3750	6	1 3/4	5	268.95	241.40	232.15	227.70	223.00	219.25
0.4411-0.4720	41615h6	42615h6	43515h6	.3750	6	1 3/4	5	268.95	241.40	232.15	227.70	223.00	219.25
0.4721-0.5030	41616h6	42616h6	43516h6	.4375	6	2	6	268.95	241.40	232.15	227.70	223.00	219.25
0.5031-0.5340	41617h6	42617h6	43517h6	.4375	6	2	6	281.35	253.75	244.50	240.15	235.35	231.60
0.5341-0.5660	41618h6	42618h6	43518h6	.4375	6	2	6	284.55	257.00	247.60	243.20	238.45	234.75
0.5661-0.5970	41619h6	42619h6	43519h6	.4375	6	2	6	286.75	259.00	249.75	245.25	240.50	236.95
0.5971-0.6280	41620h6	42620h6	43520h6	.5625	6	2 1/4	6	286.75	259.00	249.75	245.25	240.50	236.95
0.6281-0.6590	41621h6	42621h6	43521h6	.5625	6	2 1/4	6	311.85	284.20	274.75	270.50	265.70	261.95
0.6591-0.6910	41622h6	42622h6	43522h6	.5625	6	2 1/4	6	311.85	284.20	274.75	270.50	265.70	261.95
0.6911-0.7220	41623h6	42623h6	43523h6	.5625	6	2 1/4	6	329.45	301.70	292.45	288.15	283.25	279.60
0.7221-0.7530	41624h6	42624h6	43524h6	.6250	6	2 1/2	6	329.45	301.70	292.45	288.15	283.25	279.60
0.7531-0.7840	41625h6	42625h6	43525h6	.6250	6	2 1/2	6	330.60	302.80	293.65	289.15	284.40	280.70
0.7841-0.8160	41626h6	42626h6	43526h6	.6250	6	2 1/2	6	330.60	302.80	293.65	289.15	284.40	280.70
0.8161-0.8470	41627h6	42627h6	43527h6	.6250	6	2 1/2	6	338.75	311.15	301.85	297.50	292.70	288.90
0.8471-0.8780	41628h6	42628h6	43528h6	.7500	6	2 5/8	6	349.75	322.00	312.80	308.35	303.65	299.90
0.8781-0.9090	41629h6	42629h6	43529h6	.7500	6	2 5/8	6	386.05	358.35	349.05	344.65	339.90	336.10
0.9091-0.9410	41630h6	42630h6	43530h6	.7500	8	2 5/8	6	393.60	365.85	356.65	352.25	347.45	343.75
0.9411-0.9720	41631h6	42631h6	43531h6	.7500	8	2 5/8	6	393.60	365.85	356.65	352.25	347.45	343.75
0.9721-1.0030	41632h6	42632h6	43532h6	.8750	8	2 3/4	6	393.60	365.85	356.65	352.25	347.45	343.75



FLUTE FED FOR THRU HOLES STRAIGHT FLUTES & SHANK

MODIFICATIONS

- 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 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

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	\$263.50	\$236.00	\$226.65	\$222.15	\$217.60	\$213.60
9.602-10.389	416100h6	426100h6	435100h6	8	4	45	127	268.55	241.20	231.70	227.30	222.70	218.80
10.390-11.201	416110h6	426110h6	435110h6	10	6	45	127	273.65	246.15	236.95	232.30	227.70	223.90
11.202-12.000	416120h6	426120h6	435120h6	10	6	45	127	273.65	246.15	236.95	232.30	227.70	223.90
12.001-12.875	416125h6	426125h6	435125h6	10	6	51	153	273.65	246.15	236.95	232.30	227.70	223.90
12.876-13.565	416135h6	426135h6	435135h6	12	6	51	153	285.95	258.45	249.15	244.75	240.15	236.15
13.566-14.376	416140h6	426140h6	435140h6	12	6	51	153	289.15	261.65	252.45	247.90	243.20	239.45
14.377-15.164	416150h6	426150h6	435150h6	12	6	51	153	291.40	263.80	254.50	249.95	245.25	241.55
15.165-16.100	416160h6	426160h6	435160h6	14	6	57	153	291.40	263.80	254.50	249.95	245.25	241.55
16.101-16.740	416165h6	426165h6	435165h6	14	6	57	153	316.60	288.85	279.60	275.15	270.50	266.60
16.741-17.551	416175h6	426175h6	435175h6	14	6	57	153	316.60	288.85	279.60	275.15	270.50	266.60
17.552-18.340	416180h6	426180h6	435180h6	14	6	57	153	334.05	306.45	297.10	292.70	288.15	284.25
18.341-19.250	416190h6	426190h6	435190h6	16	6	64	153	334.05	306.45	297.10	292.70	288.15	284.25
19.251-20.126	416200h6	426200h6	435200h6	16	6	64	153	330.00	302.35	293.05	288.70	283.95	280.10
20.127-21.127	416210h6	426210h6	435210h6	16	6	64	153	338.20	310.45	301.20	296.85	292.05	288.30
21.128-22.127	416220h6	426220h6	435220h6	20	6	64	153	338.20	310.45	301.20	296.85	292.05	288.30
22.128-23.127	416230h6	426230h6	435230h6	20	6	67	153	385.35	357.65	348.35	344.00	339.25	335.40
23.128-24.127	416240h6	426240h6	435240h6	20	8	67	153	392.90	365.30	356.00	351.60	346.80	343.05
24.128-25.127	416250h6	426250h6	435250h6	20	8	70	153	392.90	365.30	356.00	351.60	346.80	343.05

*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	\$262.15	\$234.60	\$225.30	\$220.90	\$216.15	\$212.35
0.3781 - 0.4090	41113h6	41313h6	41513h6	.3125	4	1 3/4	5	262.80	235.05	225.90	221.45	216.65	213.00
0.4091 - 0.4410	41114h6	41314h6	41514h6	.3750	6	1 3/4	5	265.00	237.20	228.00	223.55	218.85	215.10
0.4411 - 0.4720	41115h6	41315h6	41515h6	.3750	6	1 3/4	5	266.90	239.15	229.95	225.55	220.80	217.05
0.4721 - 0.5030	41116h6	41316h6	41516h6	.4375	6	2	6	275.25	247.50	238.25	233.80	229.05	225.30
0.5031 - 0.5340	41117h6	41317h6	41517h6	.4375	6	2	6	283.25	255.60	246.25	241.85	237.10	233.35
0.5341 - 0.5660	41118h6	41318h6	41518h6	.4375	6	2	6	283.25	255.60	246.25	241.85	237.10	233.35
0.5661 - 0.5970	41119h6	41319h6	41519h6	.4375	6	2	6	292.30	264.50	255.30	250.85	246.10	242.35
0.5971 - 0.6280	41120h6	41320h6	41520h6	.5625	6	2 1/4	6	292.30	264.50	255.30	250.85	246.10	242.35
0.6281 - 0.6590	41121h6	41321h6	41521h6	.5625	6	2 1/4	6	323.05	295.40	286.10	281.70	276.90	273.15
0.6591 - 0.6910	41122h6	41322h6	41522h6	.5625	6	2 1/4	6	323.05	295.40	286.10	281.70	276.90	273.15
0.6911 - 0.7220	41123h6	41323h6	41523h6	.5625	6	2 1/4	6	334.65	306.90	297.65	293.20	288.50	284.70
0.7221 - 0.7530	41124h6	41324h6	41524h6	.6250	6	2 1/2	6	317.35	289.65	280.35	276.00	271.25	267.45
0.7531 - 0.7840	41125h6	41325h6	41525h6	.6250	6	2 1/2	6	356.30	328.60	319.35	315.00	310.20	306.45
0.7841 - 0.8160	41126h6	41326h6	41526h6	.6250	6	2 1/2	6	360.15	332.40	323.15	318.75	313.95	310.25
0.8161 - 0.8470	41127h6	41327h6	41527h6	.6250	6	2 1/2	6	365.80	338.15	328.80	324.45	319.70	315.95
0.8471 - 0.8780	41128h6	41328h6	41528h6	.7500	6	2 5/8	6	382.80	355.15	345.85	341.50	336.70	332.90
0.8781 - 0.9090	41129h6	41329h6	41529h6	.7500	6	2 5/8	6	402.30	374.60	365.35	360.95	356.20	352.35
0.9091 - 0.9410	41130h6	41330h6	41530h6	.7500	8	2 5/8	6	418.80	391.05	381.80	377.45	372.65	368.95
0.9411 - 0.9720	41131h6	41331h6	41531h6	.7500	8	2 5/8	6	419.90	392.20	382.90	378.55	373.75	370.05
0.9721 - 1.0030	41132h6	41332h6	41532h6	.8750	8	2 3/4	6	420.55	392.75	383.50	379.15	374.35	370.60

REAMERS



CENTER FED FOR BLIND HOLES RIGHT SPIRAL FLUTES STRAIGHT SHANK

MODIFICATIONS

- 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	\$262.15	\$234.60	\$225.30	\$220.90	\$216.15	\$212.35
9.602 - 10.389	411100h6	413100h6	415100h6	8	4	45	127	262.80	235.05	225.90	221.45	216.65	213.00
10.390 - 11.201	411110h6	413110h6	415110h6	10	6	45	127	265.00	237.20	228.00	223.55	218.85	215.10
11.202 - 12.000	411120h6	413120h6	415120h6	10	6	45	127	275.25	247.50	238.25	233.80	229.05	225.30
12.001 - 12.875	411125h6	413125h6	415125h6	10	6	51	153	283.25	255.60	246.25	241.85	237.10	233.35
12.876 - 13.565	411135h6	413135h6	415135h6	12	6	51	153	283.25	255.60	246.25	241.85	237.10	233.35
13.566 - 14.376	411140h6	413140h6	415140h6	12	6	51	153	283.25	255.60	246.25	241.85	237.10	233.35
14.377 - 15.164	411150h6	413150h6	415150h6	12	6	51	153	292.30	264.50	255.30	250.85	246.10	242.35
15.165 - 16.100	411160h6	413160h6	415160h6	14	6	57	153	323.05	295.40	286.10	281.70	276.90	273.15
16.101 - 16.740	411165h6	413165h6	415165h6	14	6	57	153	323.05	295.40	286.10	281.70	276.90	273.15
16.741 - 17.551	411175h6	413175h6	415175h6	14	6	57	153	323.05	295.40	286.10	281.70	276.90	273.15
17.552 - 18.340	411180h6	413180h6	415180h6	14	6	57	153	334.65	306.90	297.65	293.20	288.50	284.70
18.341 - 19.250	411190h6	413190h6	415190h6	16	6	64	153	356.30	328.60	319.35	315.00	310.20	306.45
19.251 - 20.126	411200h6	413200h6	415200h6	16	6	64	153	360.15	332.40	323.15	318.75	313.95	310.25
20.127 - 21.127	411210h6	413210h6	415210h6	16	6	64	153	365.80	338.15	328.80	324.45	319.70	315.95
21.128 - 22.127	411220h6	413220h6	415220h6	20	6	64	153	382.80	355.15	345.85	341.50	336.70	332.90
22.128 - 23.127	411230h6	413230h6	415230h6	20	6	67	153	418.80	391.05	381.80	377.45	372.65	368.95
23.128 - 24.127	411240h6	413240h6	415240h6	20	8	67	153	419.90	392.20	382.90	378.55	373.75	370.05
24.128 - 25.127	411250h6	413250h6	415250h6	20	8	70	153	420.55	392.75	383.50	379.15	374.35	370.60

*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	\$312.05	\$284.30	\$275.15	\$270.65	\$265.90	\$262.05
0.3781-0.4090	42713h6	42813h6	42913h6	.3125	4	1 3/4	5	313.05	285.45	276.15	271.75	267.00	263.20
0.4091-0.4410	42714h6	42814h6	42914h6	.3750	6	1 3/4	5	315.45	287.65	278.50	274.05	269.30	265.55
0.4411-0.4720	42715h6	42815h6	42915h6	.3750	6	1 3/4	5	317.85	290.05	280.85	276.35	271.60	267.85
0.4721-0.5030	42716h6	42816h6	42916h6	.4375	6	2	6	321.15	293.40	284.20	279.70	274.95	271.25
0.5031-0.5340	42717h6	42817h6	42917h6	.4375	6	2	6	326.70	298.90	289.75	285.30	280.55	276.80
0.5341-0.5660	42718h6	42818h6	42918h6	.4375	6	2	6	330.65	303.00	293.70	289.30	284.45	280.80
0.5661-0.5970	42719h6	42819h6	42919h6	.4375	6	2	6	336.35	308.70	299.45	295.10	290.25	286.50
0.5971-0.6280	42720h6	42820h6	42920h6	.5625	6	2 1/4	6	341.60	313.85	304.60	300.20	295.50	291.70
0.6281-0.6590	42721h6	42821h6	42921h6	.5625	6	2 1/4	6	372.30	344.55	335.35	330.95	326.15	322.45
0.6591-0.6910	42722h6	42822h6	42922h6	.5625	6	2 1/4	6	378.85	351.10	341.80	337.45	332.75	328.90
0.6911-0.7220	42723h6	42823h6	42923h6	.5625	6	2 1/4	6	385.65	357.90	348.70	344.25	339.50	335.85
0.7221-0.7530	42724h6	42824h6	42924h6	.6250	6	2 1/2	6	392.70	365.00	355.75	351.25	346.55	342.80
0.7531-0.7840	42725h6	42825h6	42925h6	.6250	6	2 1/2	6	398.40	370.75	361.50	357.10	352.30	348.55
0.7841-0.8160	42726h6	42826h6	42926h6	.6250	6	2 1/2	6	402.60	374.90	365.65	361.25	356.55	352.80
0.8161-0.8470	42727h6	42827h6	42927h6	.6250	6	2 1/2	6	408.90	381.20	372.00	367.60	362.75	359.05
0.8471-0.8780	42728h6	42828h6	42928h6	.7500	6	2 5/8	6	428.35	400.65	391.35	386.95	382.20	378.40
0.8781-0.9090	42729h6	42829h6	42929h6	.7500	6	2 5/8	6	450.35	422.60	413.35	409.00	404.15	400.45
0.9091-0.9410	42730h6	42830h6	42930h6	.7500	8	2 5/8	6	469.50	441.90	432.55	428.10	423.35	419.65
0.9411-0.9720	42731h6	42831h6	42931h6	.7500	8	2 5/8	6	470.50	442.90	433.55	429.20	424.45	420.65
0.9721-1.0030	42732h6	42832h6	42932h6	.8750	8	2 3/4	6	471.10	443.35	434.10	429.70	425.00	421.20

REAMERS



FLUTE FED FOR THRU HOLES LEFT SPIRAL FLUTES STRAIGHT SHANK

MODIFICATIONS

- 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	\$312.05	\$284.30	\$275.15	\$270.65	\$265.90	\$262.05
9.602-10.389	427100h6	428100h6	429100h6	8	4	45	127	313.05	285.45	276.15	271.75	267.00	263.20
10.390-11.201	427110h6	428110h6	429110h6	10	6	45	127	315.45	287.65	278.50	274.05	269.30	265.55
11.202-12.000	427120h6	428120h6	429120h6	10	6	45	127	321.15	293.40	284.20	279.70	274.95	271.25
12.001-12.875	427125h6	428125h6	429125h6	10	6	51	153	326.70	298.90	289.75	285.30	280.55	276.80
12.876-13.565	427135h6	428135h6	429135h6	12	6	51	153	330.65	303.00	293.70	289.30	284.45	280.80
13.566-14.376	427140h6	428140h6	429140h6	12	6	51	153	330.65	303.00	293.70	289.30	284.45	280.80
14.377-15.164	427150h6	428150h6	429150h6	12	6	51	153	336.35	308.70	299.45	295.10	290.25	286.50
15.165-16.100	427160h6	428160h6	429160h6	14	6	57	153	372.30	344.55	335.35	330.95	326.15	322.45
16.101-16.740	427165h6	428165h6	429165h6	14	6	57	153	378.85	351.10	341.80	337.45	332.75	328.90
16.741-17.551	427175h6	428175h6	429175h6	14	6	57	153	378.85	351.10	341.80	337.45	332.75	328.90
17.552-18.340	427180h6	428180h6	429180h6	14	6	57	153	385.65	357.90	348.70	344.25	339.50	335.85
18.341-19.250	427190h6	428190h6	429190h6	16	6	64	153	398.40	370.75	361.50	357.10	352.30	348.55
19.251-20.126	427200h6	428200h6	429200h6	16	6	64	153	402.60	374.90	365.65	361.25	356.55	352.80
20.127-21.127	427210h6	428210h6	429210h6	16	6	64	153	408.90	381.20	372.00	367.60	362.75	359.05
21.128-22.127	427220h6	428220h6	429220h6	20	6	64	153	428.35	400.65	391.35	386.95	382.20	378.40
22.128-23.127	427230h6	428230h6	429230h6	20	6	67	153	469.50	441.90	432.55	428.10	423.35	419.65
23.128-24.127	427240h6	428240h6	429240h6	20	8	67	153	470.50	442.90	433.55	429.20	424.45	420.65
24.128-25.127	427250h6	428250h6	429250h6	20	8	70	153	471.10	443.35	434.10	429.70	425.00	421.20

*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	\$297.05	\$260.15	\$247.75	\$241.90	\$235.65	\$230.60
* 0.1281-0.1435	457045EL	458045EL	459045EL	.1255	4	1 1/2	2 17/32 - 6 1/2	298.10	261.25	248.90	242.90	236.55	231.65
* 0.1436-0.1590	45705EL	45805EL	45905EL	.1411	4	1 1/2	2 17/32 - 7	303.05	266.10	253.75	247.80	241.55	236.50
* 0.1591-0.1750	457055EL	458055EL	459055EL	.1567	4	1 1/2	2 25/32 - 8	308.75	271.80	259.50	253.60	247.25	242.30
* 0.1751-0.1910	45706EL	45806EL	45906EL	.1724	4	1 1/2	4 17/32 - 9	316.95	280.05	267.60	261.85	255.40	250.45
* 0.1911-0.2210	45707EL	45807EL	45907EL	.1880	4	1 1/2	5 1/32 - 10	327.55	290.80	278.40	272.55	266.15	261.25
* 0.2211-0.2530	45708EL	45808EL	45908EL	.2193	4	1 1/2	6 1/32 - 12	348.80	311.85	299.60	293.70	287.40	282.40
* 0.2531-0.2840	45709EL	45809EL	45909EL	.2505	4	1 1/2	6 1/32 - 12	367.00	330.10	317.80	311.80	305.55	300.45
0.2841-0.3150	45710EL	45810EL	45910EL	.2792	4	1 1/2	6 1/32 - 12	260.40	223.50	211.20	205.25	198.95	194.00
0.3151-0.3470	45711EL	45811EL	45911EL	.2792	4	1 1/2	6 1/32 - 12	260.40	223.50	211.20	205.25	198.95	194.00
0.3471-0.3780	45712EL	45812EL	45912EL	.3105	4	1 3/4	7 1/32 - 14	268.90	232.10	219.75	213.75	207.45	202.45
0.3781-0.4090	45713EL	45813EL	45913EL	.3105	4	1 3/4	7 1/32 - 14	268.90	232.10	219.75	213.75	207.45	202.45
0.4091-0.4410	45714EL	45814EL	45914EL	.3730	6	1 3/4	7 1/32 - 14	277.50	240.50	228.25	222.25	216.00	211.00
0.4411-0.4720	45715EL	45815EL	45915EL	.3730	6	1 3/4	7 1/32 - 14	277.50	240.50	228.25	222.25	216.00	211.00
0.4721-0.5030	45716EL	45816EL	45916EL	.4355	6	2	8 1/32 - 16	283.25	246.25	233.95	228.05	221.80	216.75
0.5031-0.5340	45717EL	45817EL	45917EL	.4355	6	2	8 1/32 - 16	283.25	246.25	233.95	228.05	221.80	216.75
0.5341-0.5660	45718EL	45818EL	45918EL	.4355	6	2	8 1/32 - 16	288.50	251.55	239.20	233.35	227.00	222.05
0.5661-0.5970	45719EL	45819EL	45919EL	.4355	6	2	8 1/32 - 16	288.50	251.55	239.20	233.35	227.00	222.05
0.5971-0.6280	45720EL	45820EL	45920EL	.5615	6	2 1/4	9 1/32 - 18	294.55	257.65	245.25	239.45	233.15	228.15
0.6281-0.6590	45721EL	45821EL	45921EL	.5615	6	2 1/4	9 1/32 - 18	294.55	257.65	245.25	239.45	233.15	228.15
0.6591-0.6910	45722EL	45822EL	45922EL	.5615	6	2 1/4	9 1/32 - 18	295.45	258.50	246.10	240.25	233.95	228.95
0.6911-0.7220	45723EL	45823EL	45923EL	.5615	6	2 1/4	9 1/32 - 18	295.45	258.50	246.10	240.25	233.95	228.95
0.7221-0.7530	45724EL	45824EL	45924EL	.6245	6	2 1/2	9 17/32 - 18	317.10	280.15	267.75	261.95	255.70	250.65
0.7531-0.7840	45725EL	45825EL	45925EL	.6245	6	2 1/2	9 17/32 - 18	384.80	349.65	337.80	332.30	326.25	321.55
0.7841-0.8160	45726EL	45826EL	45926EL	.6245	6	2 1/2	9 17/32 - 18	397.05	361.85	350.10	344.55	338.55	333.75
0.8161-0.8470	45727EL	45827EL	45927EL	.6245	6	2 1/2	9 17/32 - 18	401.65	366.50	354.65	349.10	343.10	338.40
0.8471-0.8780	45728EL	45828EL	45928EL	.7495	6	2 5/8	10 1/32 - 18	410.20	374.90	363.15	357.65	351.60	346.80
0.8781-0.9090	45729EL	45829EL	45929EL	.7495	6	2 5/8	10 1/32 - 18	427.40	392.20	380.45	374.85	368.85	364.10
0.9091-0.9410	45730EL	45830EL	45930EL	.7495	8	2 5/8	10 1/32 - 18	431.75	396.45	384.70	379.15	373.10	368.45
0.9411-0.9720	45731EL	45831EL	45931EL	.7495	8	2 5/8	10 1/32 - 18	435.80	400.65	388.85	383.30	377.25	372.50
0.9721-1.0030	45732EL	45832EL	45932EL	.8745	8	2 3/4	10 17/32 - 18	445.95	410.80	399.00	393.45	387.35	382.65

*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 FLT	OVERALL RANGE	1	2	3	4	5-7	8-14**
* 0.1751-0.1910	41606EL	42606EL	43506EL	.1724	4	1 1/2	4 17/32 - 9	\$379.20	\$342.30	\$329.90	\$324.05	\$317.80	\$312.70
* 0.1911-0.2210	41607EL	42607EL	43507EL	.1880	4	1 1/2	5 1/2 - 10	393.80	356.85	344.45	338.65	332.35	327.35
* 0.2211-0.2530	41608EL	42608EL	43508EL	.2193	4	1 1/2	6 1/2 - 12	437.50	400.65	388.20	382.35	375.95	371.05
* 0.2531-0.2840	41609EL	42609EL	43509EL	.2505	4	1 1/2	6 1/2 - 12	458.75	421.80	409.45	403.55	397.15	392.20
0.2841-0.3150	41610EL	42610EL	43510EL	.2792	4	1 1/2	6 1/2 - 12	339.25	302.35	289.95	284.05	277.65	272.75
0.3151-0.3470	41611EL	42611EL	43511EL	.2792	4	1 1/2	6 1/2 - 12	339.25	302.35	289.95	284.05	277.65	272.75
0.3471-0.3780	41612EL	42612EL	43512EL	.3105	4	1 3/4	7 1/2 - 14	345.85	308.95	296.70	290.80	284.40	279.50
0.3781-0.4090	41613EL	42613EL	43513EL	.3105	4	1 3/4	7 1/2 - 14	345.85	308.95	296.70	290.80	284.40	279.50
0.4091-0.4410	41614EL	42614EL	43514EL	.3730	6	1 3/4	7 1/2 - 14	347.35	310.40	298.05	292.20	285.80	280.90
0.4411-0.4720	41615EL	42615EL	43515EL	.3730	6	1 3/4	7 1/2 - 14	347.35	310.40	298.05	292.20	285.80	280.90
0.4721-0.5030	41616EL	42616EL	43516EL	.4355	6	2	8 1/2 - 16	377.85	340.90	328.60	322.65	316.35	311.35
0.5031-0.5340	41617EL	42617EL	43517EL	.4355	6	2	8 1/2 - 16	377.85	340.90	328.60	322.65	316.35	311.35
0.5341-0.5660	41618EL	42618EL	43518EL	.4355	6	2	8 1/2 - 16	380.50	343.60	331.25	325.35	319.05	313.95
0.5661-0.5970	41619EL	42619EL	43519EL	.4355	6	2	8 1/2 - 16	380.50	343.60	331.25	325.35	319.05	313.95
0.5971-0.6280	41620EL	42620EL	43520EL	.5615	6	2 1/4	9 1/2 - 18	388.00	351.10	338.70	332.85	326.55	321.55
0.6281-0.6590	41621EL	42621EL	43521EL	.5615	6	2 1/4	9 1/2 - 18	388.00	351.10	338.70	332.85	326.55	321.55
0.6591-0.6910	41622EL	42622EL	43522EL	.5615	6	2 1/4	9 1/2 - 18	392.20	355.30	342.95	337.05	330.70	325.75
0.6911-0.7220	41623EL	42623EL	43523EL	.5615	6	2 1/4	9 1/2 - 18	392.20	355.30	342.95	337.05	330.70	325.75
0.7221-0.7530	41624EL	42624EL	43524EL	.6245	6	2 1/2	9 17/32 - 18	408.35	371.40	359.10	353.10	346.80	341.80
0.7531-0.7840	41625EL	42625EL	43525EL	.6245	6	2 1/2	9 17/32 - 18	465.45	430.20	418.45	412.85	406.90	402.10
0.7841-0.8160	41626EL	42626EL	43526EL	.6245	6	2 1/2	9 17/32 - 18	482.10	446.95	435.20	429.55	423.50	418.80
0.8161-0.8470	41627EL	42627EL	43527EL	.6245	6	2 1/2	9 17/32 - 18	486.60	451.45	439.65	434.05	428.00	423.25
0.8471-0.8780	41628EL	42628EL	43528EL	.7495	6	2 5/8	10 1/2 - 18	489.60	454.45	442.70	437.10	431.10	426.35
0.8781-0.9090	41629EL	42629EL	43529EL	.7495	6	2 5/8	10 1/2 - 18	508.65	473.55	461.70	456.10	450.10	445.40
0.9091-0.9410	41630EL	42630EL	43530EL	.7495	8	2 5/8	10 1/2 - 18	517.35	482.20	470.45	464.85	458.85	454.10
0.9411-0.9720	41631EL	42631EL	43531EL	.7495	8	2 5/8	10 1/2 - 18	520.25	485.10	473.30	467.70	461.65	456.90
0.9721-1.0030	41632EL	42632EL	43532EL	.8745	8	2 3/4	10 17/32 - 18	535.15	500.00	488.30	482.65	476.60	471.85

*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	\$418.50	\$374.25	\$359.50	\$352.45	\$344.90	\$338.80
* 0.2531 - 0.2840	44209EL	44309EL	44409EL	.2505	4	1 1/2	6 1/32 - 12	440.40	396.05	381.30	374.20	366.60	360.70
0.2841 - 0.3150	44210EL	44310EL	44410EL	.2792	4	1 1/2	6 1/32 - 12	312.55	268.25	253.50	246.35	238.80	232.80
0.3151 - 0.3470	44211EL	44311EL	44411EL	.2792	4	1 1/2	6 1/32 - 12	312.55	268.25	253.50	246.35	238.80	232.80
0.3471 - 0.3780	44212EL	44312EL	44412EL	.3105	4	1 3/4	7 1/32 - 14	322.75	278.50	263.65	256.50	249.00	243.00
0.3781 - 0.4090	44213EL	44313EL	44413EL	.3105	4	1 3/4	7 1/32 - 14	322.75	278.50	263.65	256.50	249.00	243.00
0.4091 - 0.4410	44214EL	44314EL	44414EL	.3730	6	1 3/4	7 1/32 - 14	332.95	288.75	273.90	266.75	259.15	253.20
0.4411 - 0.4720	44215EL	44315EL	44415EL	.3730	6	1 3/4	7 1/32 - 14	332.95	288.75	273.90	266.75	259.15	253.20
0.4721 - 0.5030	44216EL	44316EL	44416EL	.4355	6	2	8 1/32 - 16	339.90	295.55	280.80	273.65	266.10	260.10
0.5031 - 0.5340	44217EL	44317EL	44417EL	.4355	6	2	8 1/32 - 16	339.90	295.55	280.80	273.65	266.10	260.10
0.5341 - 0.5660	44218EL	44318EL	44418EL	.4355	6	2	8 1/32 - 16	346.25	301.85	287.05	280.00	272.45	266.40
0.5661 - 0.5970	44219EL	44319EL	44419EL	.4355	6	2	8 1/32 - 16	346.25	301.85	287.05	280.00	272.45	266.40
0.5971 - 0.6280	44220EL	44320EL	44420EL	.5615	6	2 1/4	9 1/32 - 18	353.55	309.20	294.35	287.40	279.70	273.85
0.6281 - 0.6590	44221EL	44321EL	44421EL	.5615	6	2 1/4	9 1/32 - 18	353.55	309.20	294.35	287.40	279.70	273.85
0.6591 - 0.6910	44222EL	44322EL	44422EL	.5615	6	2 1/4	9 1/32 - 18	354.40	310.20	295.40	288.35	280.80	274.75
0.6911 - 0.7220	44223EL	44323EL	44423EL	.5615	6	2 1/4	9 1/32 - 18	354.40	310.20	295.40	288.35	280.80	274.75
0.7221 - 0.7530	44224EL	44324EL	44424EL	.6245	6	2 1/2	9 17/32 - 18	380.55	336.25	321.40	314.35	306.75	300.85
0.7531 - 0.7840	44225EL	44325EL	44425EL	.6245	6	2 1/2	9 17/32 - 18	438.70	396.45	382.30	375.75	368.50	362.75
0.7841 - 0.8160	44226EL	44326EL	44426EL	.6245	6	2 1/2	9 17/32 - 18	451.30	409.15	395.00	388.30	381.10	375.40
0.8161 - 0.8470	44227EL	44327EL	44427EL	.6245	6	2 1/2	9 17/32 - 18	455.80	413.70	399.50	392.85	385.65	379.95
0.8471 - 0.8780	44228EL	44328EL	44428EL	.7495	6	2 5/8	10 1/32 - 18	457.60	415.35	401.35	394.65	387.35	381.65
0.8781 - 0.9090	44229EL	44329EL	44429EL	.7495	6	2 5/8	10 1/32 - 18	472.90	430.75	416.55	409.95	402.70	397.00
0.9091 - 0.9410	44230EL	44330EL	44430EL	.7495	8	2 5/8	10 1/32 - 18	488.75	446.70	432.50	425.80	418.60	412.90
0.9411 - 0.9720	44231EL	44331EL	44431EL	.7495	8	2 5/8	10 1/32 - 18	491.70	449.50	435.35	428.75	421.50	415.85
0.9721 - 1.0030	44232EL	44332EL	44432EL	.8745	8	2 3/4	10 17/32 - 18	509.65	467.50	453.35	446.75	439.50	433.75

*Solid Carbide

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



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



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	\$524.95	\$480.65	\$465.95	\$458.85	\$451.15	\$445.30
* 0.2531-0.2840	41109EL	41309EL	41509EL	.2505	4	1 1/2	6 1/2 - 12	550.40	506.15	491.25	484.25	476.60	470.65
0.2841-0.3150	41110EL	41310EL	41510EL	.2792	4	1 1/2	6 1/2 - 12	407.00	362.65	347.90	340.85	333.15	327.30
0.3151-0.3470	41111EL	41311EL	41511EL	.2792	4	1 1/2	6 1/2 - 12	407.00	362.65	347.90	340.85	333.15	327.30
0.3471-0.3780	41112EL	41312EL	41512EL	.3105	4	1 3/4	7 1/2 - 14	415.10	370.75	355.85	348.85	341.35	335.35
0.3781-0.4090	41113EL	41313EL	41513EL	.3105	4	1 3/4	7 1/2 - 14	415.10	370.75	355.85	348.85	341.35	335.35
0.4091-0.4410	41114EL	41314EL	41514EL	.3730	6	1 3/4	7 1/2 - 14	416.75	372.50	357.70	350.60	343.00	337.05
0.4411-0.4720	41115EL	41315EL	41515EL	.3730	6	1 3/4	7 1/2 - 14	416.75	372.50	357.70	350.60	343.00	337.05
0.4721-0.5030	41116EL	41316EL	41516EL	.4355	6	2	8 1/2 - 16	453.40	409.15	394.20	387.20	379.60	373.70
0.5031-0.5340	41117EL	41317EL	41517EL	.4355	6	2	8 1/2 - 16	453.40	409.15	394.20	387.20	379.60	373.70
0.5341-0.5660	41118EL	41318EL	41518EL	.4355	6	2	8 1/2 - 16	456.60	412.20	397.50	390.40	382.80	376.80
0.5661-0.5970	41119EL	41319EL	41519EL	.4355	6	2	8 1/2 - 16	456.60	412.20	397.50	390.40	382.80	376.80
0.5971-0.6280	41120EL	41320EL	41520EL	.5615	6	2 1/4	9 1/2 - 18	465.65	421.30	406.45	399.45	391.90	385.85
0.6281-0.6590	41121EL	41321EL	41521EL	.5615	6	2 1/4	9 1/2 - 18	465.65	421.30	406.45	399.45	391.90	385.85
0.6591-0.6910	41122EL	41322EL	41522EL	.5615	6	2 1/4	9 1/2 - 18	470.65	426.40	411.60	404.55	396.90	390.95
0.6911-0.7220	41123EL	41323EL	41523EL	.5615	6	2 1/4	9 1/2 - 18	470.65	426.40	411.60	404.55	396.90	390.95
0.7221-0.7530	41124EL	41324EL	41524EL	.6245	6	2 1/2	9 17/32 - 18	490.00	445.70	430.85	423.90	416.25	410.35
0.7531-0.7840	41125EL	41325EL	41525EL	.6245	6	2 1/2	9 17/32 - 18	494.70	452.50	438.45	431.75	424.45	418.80
0.7841-0.8160	41126EL	41326EL	41526EL	.6245	6	2 1/2	9 17/32 - 18	510.90	468.65	454.65	447.90	440.65	435.00
0.8161-0.8470	41127EL	41327EL	41527EL	.6245	6	2 1/2	9 17/32 - 18	515.50	473.30	459.20	452.45	445.25	439.60
0.8471-0.8780	41128EL	41328EL	41528EL	.7495	6	2 5/8	10 1/2 - 18	517.15	475.00	460.95	454.20	446.90	441.30
0.8781-0.9090	41129EL	41329EL	41529EL	.7495	6	2 5/8	10 1/2 - 18	535.70	493.45	479.40	472.60	465.45	459.80
0.9091-0.9410	41130EL	41330EL	41530EL	.7495	8	2 5/8	10 1/2 - 18	552.05	509.85	495.70	489.00	481.80	476.10
0.9411-0.9720	41131EL	41331EL	41531EL	.7495	8	2 5/8	10 1/2 - 18	554.95	512.80	498.70	491.90	484.70	479.10
0.9721-1.0030	41132EL	41332EL	41532EL	.8745	8	2 3/4	10 17/32 - 18	576.85	534.65	520.50	513.75	506.55	500.95

*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

REAMERS

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	\$418.50	\$374.25	\$359.50	\$352.45	\$344.90	\$338.80
* 0.2531 - 0.2840	48209EL	48309EL	48409EL	.2505	4	1 1/2	6 1/32 - 12	440.40	396.05	381.30	374.20	366.60	360.70
0.2841 - 0.3150	48210EL	48310EL	48410EL	.2792	4	1 1/2	6 1/32 - 12	312.55	268.25	253.50	246.35	238.80	232.80
0.3151 - 0.3470	48211EL	48311EL	48411EL	.2792	4	1 1/2	6 1/32 - 12	312.55	268.25	253.50	246.35	238.80	232.80
0.3471 - 0.3780	48212EL	48312EL	48412EL	.3105	4	1 3/4	7 1/32 - 14	322.75	278.50	263.65	256.50	249.00	243.00
0.3781 - 0.4090	48213EL	48313EL	48413EL	.3105	4	1 3/4	7 1/32 - 14	322.75	278.50	263.65	256.50	249.00	243.00
0.4091 - 0.4410	48214EL	48314EL	48414EL	.3730	6	1 3/4	7 1/32 - 14	332.95	288.75	273.90	266.75	259.15	253.20
0.4411 - 0.4720	48215EL	48315EL	48415EL	.3730	6	1 3/4	7 1/32 - 14	332.95	288.75	273.90	266.75	259.15	253.20
0.4721 - 0.5030	48216EL	48316EL	48416EL	.4355	6	2	8 1/32 - 16	339.90	295.55	280.80	273.65	266.10	260.10
0.5031 - 0.5340	48217EL	48317EL	48417EL	.4355	6	2	8 1/32 - 16	339.90	295.55	280.80	273.65	266.10	260.10
0.5341 - 0.5660	48218EL	48318EL	48418EL	.4355	6	2	8 1/32 - 16	346.25	301.85	287.05	280.00	272.45	266.40
0.5661 - 0.5970	48219EL	48319EL	48419EL	.4355	6	2	8 1/32 - 16	346.25	301.85	287.05	280.00	272.45	266.40
0.5971 - 0.6280	48220EL	48320EL	48420EL	.5615	6	2 1/4	9 1/32 - 18	353.55	309.20	294.35	287.40	279.70	273.85
0.6281 - 0.6590	48221EL	48321EL	48421EL	.5615	6	2 1/4	9 1/32 - 18	353.55	309.20	294.35	287.40	279.70	273.85
0.6591 - 0.6910	48222EL	48322EL	48422EL	.5615	6	2 1/4	9 1/32 - 18	354.40	310.20	295.40	288.35	280.80	274.75
0.6911 - 0.7220	48223EL	48323EL	48423EL	.5615	6	2 1/4	9 1/32 - 18	354.40	310.20	295.40	288.35	280.80	274.75
0.7221 - 0.7530	48224EL	48324EL	48424EL	.6245	6	2 1/2	9 17/32 - 18	380.55	336.25	321.40	314.35	306.75	300.85
0.7531 - 0.7840	48225EL	48325EL	48425EL	.6245	6	2 1/2	9 17/32 - 18	438.70	396.45	382.30	375.75	368.50	362.75
0.7841 - 0.8160	48226EL	48326EL	48426EL	.6245	6	2 1/2	9 17/32 - 18	451.30	409.15	395.00	388.30	381.10	375.40
0.8161 - 0.8470	48227EL	48327EL	48427EL	.6245	6	2 1/2	9 17/32 - 18	455.80	413.70	399.50	392.85	385.65	379.95
0.8471 - 0.8780	48228EL	48328EL	48428EL	.7495	6	2 5/8	10 1/32 - 18	457.60	415.35	401.35	394.65	387.35	381.65
0.8781 - 0.9090	48229EL	48329EL	48429EL	.7495	6	2 5/8	10 1/32 - 18	472.90	430.75	416.55	409.95	402.70	397.00
0.9091 - 0.9410	48230EL	48330EL	48430EL	.7495	8	2 5/8	10 1/32 - 18	488.75	446.70	432.50	425.80	418.60	412.90
0.9411 - 0.9720	48231EL	48331EL	48431EL	.7495	8	2 5/8	10 1/32 - 18	491.70	449.50	435.35	428.75	421.50	415.85
0.9721 - 1.0030	48232EL	48332EL	48432EL	.8745	8	2 3/4	10 17/32 - 18	509.65	467.50	453.35	446.75	439.50	433.75

*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	\$524.95	\$480.65	\$465.95	\$458.85	\$451.15	\$445.30
* 0.2531-0.2840	42709EL	42809EL	42909EL	.2505	4	1 1/2	6 1/2 -12	550.40	506.15	491.25	484.25	476.60	470.65
0.2841-0.3150	42710EL	42810EL	42910EL	.2792	4	1 1/2	6 1/2 -12	407.00	362.65	347.90	340.85	333.15	327.30
0.3151-0.3470	42711EL	42811EL	42911EL	.2792	4	1 1/2	6 1/2 -12	407.00	362.65	347.90	340.85	333.15	327.30
0.3471-0.3780	42712EL	42812EL	42912EL	.3105	4	1 3/4	7 1/2 -14	415.10	370.75	355.85	348.85	341.35	335.35
0.3781-0.4090	42713EL	42813EL	42913EL	.3105	4	1 3/4	7 1/2 -14	415.10	370.75	355.85	348.85	341.35	335.35
0.4091-0.4410	42714EL	42814EL	42914EL	.3730	6	1 3/4	7 1/2 -14	416.75	372.50	357.70	350.60	343.00	337.05
0.4411-0.4720	42715EL	42815EL	42915EL	.3730	6	1 3/4	7 1/2 -14	416.75	372.50	357.70	350.60	343.00	337.05
0.4721-0.5030	42716EL	42816EL	42916EL	.4355	6	2	8 1/2 -16	453.40	409.15	394.20	387.20	379.60	373.70
0.5031-0.5340	42717EL	42817EL	42917EL	.4355	6	2	8 1/2 -16	453.40	409.15	394.20	387.20	379.60	373.70
0.5341-0.5660	42718EL	42818EL	42918EL	.4355	6	2	8 1/2 -16	456.60	412.20	397.50	390.40	382.80	376.80
0.5661-0.5970	42719EL	42819EL	42919EL	.4355	6	2	8 1/2 -16	456.60	412.20	397.50	390.40	382.80	376.80
0.5971-0.6280	42720EL	42820EL	42920EL	.5615	6	2 1/4	9 1/2 -18	465.65	421.30	406.45	399.45	391.90	385.85
0.6281-0.6590	42721EL	42821EL	42921EL	.5615	6	2 1/4	9 1/2 -18	465.65	421.30	406.45	399.45	391.90	385.85
0.6591-0.6910	42722EL	42822EL	42922EL	.5615	6	2 1/4	9 1/2 -18	470.65	426.40	411.60	404.55	396.90	390.95
0.6911-0.7220	42723EL	42823EL	42923EL	.5615	6	2 1/4	9 1/2 -18	470.65	426.40	411.60	404.55	396.90	390.95
0.7221-0.7530	42724EL	42824EL	42924EL	.6245	6	2 1/2	9 1/2 -18	490.00	445.70	430.85	423.90	416.25	410.35
0.7531-0.7840	42725EL	42825EL	42925EL	.6245	6	2 1/2	9 1/2 -18	517.35	475.15	461.15	454.35	447.05	441.45
0.7841-0.8160	42726EL	42826EL	42926EL	.6245	6	2 1/2	9 1/2 -18	534.75	492.60	478.50	471.75	464.50	458.90
0.8161-0.8470	42727EL	42827EL	42927EL	.6245	6	2 1/2	9 1/2 -18	539.30	497.20	483.05	476.30	469.10	463.50
0.8471-0.8780	42728EL	42828EL	42928EL	.7495	6	2 5/8	10 1/2 -18	540.90	498.75	484.70	477.95	470.65	465.05
0.8781-0.9090	42729EL	42829EL	42929EL	.7495	6	2 5/8	10 1/2 -18	560.95	518.85	504.70	497.95	490.70	485.10
0.9091-0.9410	42730EL	42830EL	42930EL	.7495	8	2 5/8	10 1/2 -18	577.40	535.20	521.15	514.35	507.15	501.55
0.9411-0.9720	42731EL	42831EL	42931EL	.7495	8	2 5/8	10 1/2 -18	580.25	538.05	523.95	517.20	510.00	504.35
0.9721-1.0030	42732EL	42832EL	42932EL	.8745	8	2 3/4	10 1/2 -18	603.50	561.35	547.25	540.45	533.25	527.65

*Solid Carbide

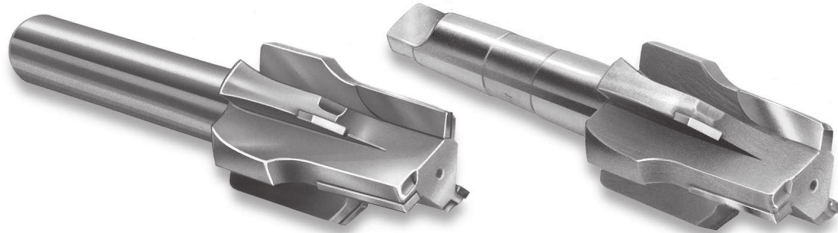
**Quantities of 15 or more — Contact Hannibal Specials Dept.



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 5/32	1/2	1 1/2	2 19/32	44601	\$173.75	2	4 1/32	44701	\$194.15
1/4 - 18	3/4	.450	.409	2 1/32	1/2	1 1/2	2 29/32	44602	179.35	2	4 29/32	44702	200.65
3/8 - 18	7/8	.586	.543	1 1/16	1/2	2	3 7/16	44603	205.65	2	4 1/16	44703	229.75
1/2 - 14	1	.725	.670	7/8	1/2	2	3 7/8	44604	218.45	2	5 1/8	44704	244.75
3/4 - 14	1 1/4	.937	.882	7/8	1	2 1/2	4 5/8	44606	295.05	3	6 1/8	44706	329.95
1 - 11 1/2	1 1/2	1.173	1.107	1 1/16	1	2 1/2	5 1/16	44608	343.05	3	6 1/16	44708	384.10
1 1/2 - 11 1/2	1 1/2	1.173	1.107	1 1/16	-	-	-	-	-	4	7 9/16	44709	394.10
1 3/4 - 11 1/2	1 7/8	1.518	1.448	1 1/8	1 1/2	3	5 5/8	44610	409.65	3	6 5/8	44710	457.55
1 1/4 - 11 1/2	1 7/8	1.518	1.448	1 1/8	-	-	-	-	-	4	7 5/8	44711	491.15
1 1/2 - 11 1/2	2 1/8	1.757	1.687	1 1/8	1 1/2	3	5 7/8	44612	563.80	3	6 7/8	44712	632.00
1 1/2 - 11 1/2	2 1/8	1.757	1.687	1 1/8	-	-	-	-	-	4	7 7/8	44713	649.25
2 - 11 1/2	2 5/8	2.230	2.154	1 7/32	1 1/2	3	6 7/32	44616	638.75	3	7 3/32	44716	715.30
2 - 11 1/2	2 5/8	2.230	2.154	1 7/32	-	-	-	-	-	4	8 7/32	44717	734.50
2 1/2 - 8	3 1/8	2.670	2.561	1 3/4	1 1/2	3	6 3/4	44620	859.10	3	7 3/4	44720	962.00
2 1/2 - 8	3 1/8	2.670	2.561	1 3/4	-	-	-	-	-	4	8 3/4	44721	987.90
3 - 8	3 3/4	3.296	3.180	1 7/8	1 1/2	3	6 7/8	44624	886.00	3	7 7/8	44724	992.35



JOBBER 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						
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*	
3/8	.3750	40312	\$163.20	1	4	2 1/2	5/8	5 13/16	0.3471 - 0.3780	\$204.50	\$183.70	\$176.90	\$173.55	\$170.05	\$167.30
7/16	.4375	40314	170.80	1	4	2 3/4	5/8	6 1/8	0.4091 - 0.4410	212.15	191.50	184.50	181.30	177.80	174.90
1/2	.5000	40316	178.65	1	6	3	5/8	6 7/16	0.4721 - 0.5030	219.95	199.25	192.25	189.10	185.45	182.65
5/8	.6250	40320	195.60	2	6	3 1/2	5/8	7 9/16	0.5971 - 0.6280	236.95	216.15	209.30	206.00	202.40	199.65
11/16	.6875	40322	204.35	2	6	3 3/8	5/8	8	0.6591 - 0.6910	245.65	224.85	217.95	214.65	211.05	208.40
3/4	.7500	40324	212.60	2	6	4 3/16	3/4	8 3/8	0.7221 - 0.7530	253.90	233.30	226.35	223.00	219.50	216.65
13/16	.8125	40326	220.70	2	6	4 9/16	3/4	8 13/16	0.7841 - 0.8160	261.90	241.25	234.40	231.10	227.55	224.75
7/8	.8750	40328	237.70	2	6	4 7/8	3/4	9 3/16	0.8471 - 0.8780	280.50	259.00	251.80	248.40	244.75	241.75
15/16	.9375	40330	250.05	3	8	5 1/8	3/4	10	0.9091 - 0.9410	284.85	271.40	264.15	260.70	257.10	254.10
1	1.0000	40332	255.20	3	8	5 7/16	3/4	10 3/8	0.9721 - 1.0030	297.95	276.55	269.45	265.90	262.10	259.35

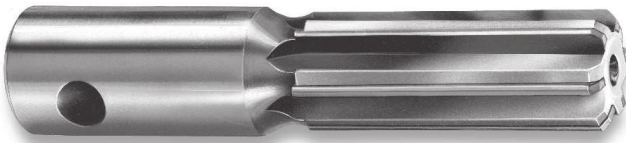
*Quantities of 15 or more - price of fractional size in same size range.



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 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	43006	44006	\$56.15	1/4	4	1	1/2	2 1/4	3/32	0.1770-0.2040	\$97.30	\$76.70	\$69.75	\$66.55	\$62.95	\$60.15
7/32	.2188	43007	44007	56.15	1/4	4	1	1/2	2 1/4	3/32	0.2041-0.2210	97.30	76.70	69.75	66.55	62.95	60.15
15/64	.2344	4302344	4402344	56.15	1/4	4	1	1/2	2 1/4	3/32	0.2211-0.2380	97.30	76.70	69.75	66.55	62.95	60.15
1/4	.2500	43008	44008	56.15	1/4	4	1	1/2	2 1/4	3/32	0.2381-0.2530	97.30	76.70	69.75	66.55	62.95	60.15
9/32	.2812	43009	44009	56.15	3/8	4	1	1/2	2 1/4	1/8	0.2531-0.2840	97.30	76.70	69.75	66.55	62.95	60.15
5/16	.3125	43010	44010	65.30	3/8	4	1	1	2 1/4	1/8	0.2841-0.3150	106.45	85.75	78.95	75.65	72.05	69.30
11/32	.3438	43011	44011	65.75	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3151-0.3470	107.05	86.45	79.50	76.30	72.65	69.90
3/8	.3750	43012	44012	71.40	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3471-0.3780	112.65	92.00	85.10	81.70	78.20	75.40
13/32	.4062	43013	44013	72.40	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.3781-0.4090	113.70	92.90	86.10	82.80	79.20	76.50
7/16	.4375	43014	44014	85.70	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4091-0.4410	127.00	106.35	99.35	96.10	92.60	89.85
15/32	.4688	43015	44015	85.70	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4411-0.4720	127.00	106.35	99.35	96.10	92.60	89.85
1/2	.5000	43016	44016	93.85	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4721-0.5030	136.25	115.00	107.90	104.55	100.80	98.05
17/32	.5312	43017	44017	93.85	5/8	6	1 1/2	1 1/2	3	1/4	0.5031-0.5340	136.25	115.00	107.90	104.55	100.80	98.05
9/16	.5625	43018	44018	98.95	5/8	6	1 1/2	1 1/2	3	1/4	0.5341-0.5660	141.15	120.00	112.80	109.50	105.85	102.90
19/32	.5938	43019	44019	98.95	5/8	6	1 1/2	1 1/2	3	1/4	0.5661-0.5970	141.15	120.00	112.80	109.50	105.85	102.90
5/8	.6250	43020	44020	101.50	5/8	6	1 1/2	1 1/2	3	1/4	0.5971-0.6280	143.90	122.70	115.55	112.10	108.50	105.70
21/32	.6562	43021	44021	101.50	5/8	6	1 1/2	1 1/2	3	1/4	0.6281-0.6590	143.90	122.70	115.55	112.10	108.50	105.70
11/16	.6875	43022	44022	106.25	5/8	6	1 1/2	1 1/2	3	1/4	0.6591-0.6910	148.55	127.40	120.30	116.85	113.25	110.40
23/32	.7188	43023	44023	106.25	3/4	6	1 1/2	1 1/2	3	5/16	0.6911-0.7220	148.55	127.40	120.30	116.85	113.25	110.40
3/4	.7500	43024	44024	109.05	3/4	6	1 1/2	1 1/2	3	5/16	0.7221-0.7530	151.20	130.10	122.95	119.55	115.95	113.15
25/32	.7812	43025	44025	109.05	3/4	6	1 1/2	1 1/2	3	5/16	0.7531-0.7840	151.20	130.10	122.95	119.55	115.95	113.15
13/16	.8125	43026	44026	118.30	3/4	6	1 1/2	1 1/2	3	5/16	0.7841-0.8160	160.65	139.55	132.35	129.00	125.35	122.60
27/32	.8438	43027	44027	118.30	3/4	6	1 1/2	1 1/2	3	5/16	0.8161-0.8470	160.65	139.55	132.35	129.00	125.35	122.60
7/8	.8750	43028	44028	129.35	3/4	6	1 1/2	1 1/2	3	5/16	0.8471-0.8780	173.30	151.15	143.80	140.30	136.55	133.60
29/32	.9062	43029	44029	129.35	3/4	6	1 1/2	1 1/2	3	5/16	0.8781-0.9090	173.30	151.15	143.80	140.30	136.55	133.60
15/16	.9375	43030	44030	142.40	3/4	6	1 1/2	1 1/2	3	5/16	0.9091-0.9410	186.30	164.40	157.00	153.45	149.75	146.75
31/32	.9688	43031	44031	142.40	3/4	8	1 1/2	1 1/2	3	5/16	0.9411-0.9720	186.30	164.40	157.00	153.45	149.75	146.75
1	1.0000	43032	44032	149.35	3/4	8	1 1/2	1 1/2	3	5/16	0.9721-1.0030	193.35	171.40	163.95	160.50	156.65	153.75
1 1/16	1.0625	43034	44034	149.35	3/4	8	1 1/2	1 1/2	3	5/16	1.0031-1.0660	193.35	171.40	163.95	160.50	156.65	153.75
1 1/8	1.1250	43036	44036	174.90	3/4	8	1 1/2	1 1/2	3	5/16	1.0661-1.1280	218.85	196.70	189.40	186.00	182.15	179.15
1 3/16	1.1875	43038	44038	182.30	3/4	8	1 1/2	1 1/2	3	5/16	1.1281-1.1905	226.35	204.30	196.85	193.35	189.65	186.60
1 1/4	1.2500	43040	44040	213.55	3/4	8	1 1/2	1 1/2	3	5/16	1.1906-1.2530	257.60	235.55	228.25	224.65	220.95	217.95
1 5/16	1.3125	43042	44042	213.55	3/4	8	1 1/2	1 1/2	3	5/16	1.2531-1.3155	257.60	235.55	228.25	224.65	220.95	217.95
1 3/8	1.3750	43044	44044	216.65	3/4	8	1 1/2	1 1/2	3	5/16	1.3156-1.3780	260.60	238.55	231.35	227.70	224.10	221.10
1 7/16	1.4375	43046	44046	252.55	3/4	8	1 1/2	1 1/2	3	5/16	1.3781-1.4405	296.60	274.50	267.20	263.65	259.90	257.00
1 1/2	1.5000	43048	44048	303.30	3/4	8	1 1/2	1 1/2	3	5/16	1.4406-1.5030	347.25	325.35	317.95	314.45	310.55	307.60

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



JOBBER'S 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	\$69.15	.151	4	1	1/2	3 1/8	0.1560-0.1769	\$110.45	\$89.85	\$82.85	\$79.60	\$76.05	\$73.30
11/64	.1719	4011719	69.15	.151	4	1	1/2	3 1/4	-	-	-	-	-	-	
3/16	.1875	40106	66.85	11/64	4	1 1/8	1/2	3 1/2	0.1770-0.2040	107.05	86.95	80.20	76.95	73.60	70.90
13/64	.2031	4012031	67.35	11/64	4	1 1/8	1/2	3 5/8	-	-	-	-	-	-	
7/32	.2188	40107	66.85	13/64	4	1 1/4	1/2	3 3/4	0.2041-0.2210	107.05	86.95	80.20	76.95	73.60	70.90
15/64	.2344	4012344	67.35	7/32	4	1 1/2	1/2	3 7/8	0.2211-0.2380	107.55	87.55	80.55	77.45	74.05	71.25
1/4	.2500	40108	66.85	15/64	4	1 1/2	1/2	4	0.2381-0.2530	107.05	86.95	80.20	76.95	73.60	70.90
17/64	.2656	4012656	68.20	15/64	4	1 1/2	1/2	4 1/8	-	-	-	-	-	-	
9/32	.2812	40109	67.80	15/64	4	1 1/2	1/2	4 1/4	0.2531-0.2840	107.95	87.85	81.15	77.90	74.45	71.75
19/64	.2969	4012969	68.20	9/32	4	1 1/2	1/2	4 3/8	-	-	-	-	-	-	
5/16	.3125	40110	67.80	9/32	4	1 1/2	1/2	4 1/2	0.2841-0.3150	107.95	87.85	81.15	77.90	74.45	71.75
21/64	.3281	4013281	70.25	9/32	4	1 1/2	5/8	4 5/8	-	-	-	-	-	-	
11/32	.3438	40111	69.50	9/32	4	1 1/2	5/8	4 3/4	0.3151-0.3470	109.55	89.50	82.80	79.60	76.10	73.40
23/64	.3594	4013594	70.25	5/16	4	1 3/4	5/8	4 7/8	-	-	-	-	-	-	
3/8	.3750	40112	63.85	5/16	4	1 3/4	5/8	5	0.3471-0.3780	100.60	82.15	75.85	72.95	69.90	67.35
25/64	.3906	4013906	72.90	5/16	4	1 3/4	5/8	5 1/8	-	-	-	-	-	-	
13/32	.4062	40113	71.70	5/16	4	1 3/4	5/8	5 1/4	0.3781-0.4090	111.90	91.75	85.00	81.90	78.30	75.65
27/64	.4219	4014219	72.90	3/8	4	1 3/4	5/8	5 3/8	-	-	-	-	-	-	
7/16	.4375	40114	74.85	3/8	4	1 3/4	5/8	5 1/2	0.4091-0.4410	115.00	94.90	88.15	84.90	81.45	78.80
29/64	.4531	4014531	77.75	3/8	4	1 3/4	5/8	5 5/8	-	-	-	-	-	-	
15/32	.4688	40115	78.20	3/8	4	1 3/4	5/8	5 3/4	0.4411-0.4720	118.30	98.25	91.50	88.30	84.85	82.15
31/64	.4844	4014844	82.85	7/16	6	2	5/8	5 7/8	-	-	-	-	-	-	
1/2	.5000	40116	87.80	7/16	6	2	5/8	6	0.4721-0.5030	132.00	109.80	102.50	99.00	95.10	92.10
33/64	.5156	4015156	93.30	7/16	6	2	5/8	6 5/8	-	-	-	-	-	-	
17/32	.5312	40117	93.30	7/16	6	2	5/8	6 5/8	0.5031-0.5340	137.50	115.30	107.95	104.45	100.65	97.70
35/64	.5469	4015469	93.30	7/16	6	2	5/8	6 5/8	-	-	-	-	-	-	
9/16	.5625	40118	93.30	7/16	6	2	5/8	6 5/8	0.5341-0.5660	137.50	115.30	107.95	104.45	100.65	97.70
37/64	.5781	4015781	95.85	7/16	6	2	5/8	6 5/8	-	-	-	-	-	-	
19/32	.5938	40119	95.85	7/16	6	2	5/8	7 1/8	0.5661-0.5970	140.20	118.05	110.65	107.05	103.20	100.35
39/64	.6094	4016094	95.85	9/16	6	2 1/4	5/8	7 1/8	-	-	-	-	-	-	
5/8	.6250	40120	95.85	9/16	6	2 1/4	5/8	7 1/8	0.5971-0.6280	140.20	118.05	110.65	107.05	103.20	100.35
41/64	.6406	4016406	97.10	9/16	6	2 1/4	5/8	7 1/8	-	-	-	-	-	-	
21/32	.6562	40121	97.10	9/16	6	2 1/4	5/8	7 1/8	0.6281-0.6590	141.30	119.25	111.80	108.20	104.45	101.40
43/64	.6719	4016719	97.10	9/16	6	2 1/4	5/8	7 7/8	-	-	-	-	-	-	
11/16	.6875	40122	97.10	9/16	6	2 1/4	5/8	7 7/8	0.6591-0.6910	141.30	119.25	111.80	108.20	104.45	101.40
45/64	.7031	4017031	100.45	9/16	6	2 1/4	5/8	7 7/8	-	-	-	-	-	-	
23/32	.7188	40123	100.45	9/16	6	2 1/4	5/8	7 5/8	0.6911-0.7220	144.60	122.60	115.15	111.55	107.80	104.75
47/64	.7344	4017344	100.45	5/8	6	2 1/2	3/4	7 5/8	-	-	-	-	-	-	
3/4	.7500	40124	100.45	5/8	6	2 1/2	3/4	8	0.7221-0.7530	144.60	122.60	115.15	111.55	107.80	104.75

*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	\$67.35	1 ¹ / ₆₄	4	1 1/8	1/2	3 1/2
.1885	47919	67.35	1 ¹ / ₆₄	4	1 1/8	1/2	3 1/2
.2490	47924	67.35	1 ⁵ / ₆₄	4	1 1/2	1/2	4
.2510	47925	67.35	1 ⁵ / ₆₄	4	1 1/2	1/2	4
.3115	47931	68.20	3/32	4	1 1/2	1/2	4 1/2
.3135	47932	68.20	3/32	4	1 1/2	1/2	4 1/2
.3740	47937	70.25	5/16	4	1 3/4	5/8	5
.3760	47938	70.25	5/16	4	1 3/4	5/8	5
.4365	47943	77.75	3/8	4	1 3/4	5/8	5 1/2
.4385	47944	77.75	3/8	4	1 3/4	5/8	5 1/2
.4990	47949	82.85	7/16	6	2	5/8	6
.5010	47950	82.85	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	\$67.35	1 ¹ / ₆₄	4	1 1/8	1/2	3 1/2
.1870	47718	67.35	1 ¹ / ₆₄	4	1 1/8	1/2	3 1/2
.2480	47723	67.35	1 ⁵ / ₆₄	4	1 1/2	1/2	4
.2495	47724	67.35	1 ⁵ / ₆₄	4	1 1/2	1/2	4
.3105	47730	68.20	3/32	4	1 1/2	1/2	4 1/2
.3120	47731	68.20	3/32	4	1 1/2	1/2	4 1/2
.3730	47736	70.25	5/16	4	1 3/4	5/8	5
.3745	47737	70.25	5/16	4	1 3/4	5/8	5
.4355	47742	77.75	3/8	4	1 3/4	5/8	5 1/2
.4370	47743	77.75	3/8	4	1 3/4	5/8	5 1/2
.4980	47748	82.85	7/16	6	2	5/8	6
.4995	47749	82.85	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	\$60.60	.151	4	1	1/2	4
21	.1590	4001590	60.60	.151	4	1	1/2	4
20	.1610	4001610	60.60	.151	4	1	1/2	4
19	.1660	4001660	60.60	.151	4	1	1/2	4
18	.1695	4001695	60.60	.151	4	1	1/2	4
17	.1730	4001730	60.60	.151	4	1	1/2	4
16	.1770	4001770	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
15	.1800	4001800	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
14	.1820	4001820	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
13	.1850	400047	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
12	.1890	400048	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
11	.1910	4001910	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
10	.1935	4001935	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
9	.1960	4001960	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
8	.1990	4001990	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
7	.2010	4002010	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
6	.2040	4002040	56.45	1 ¹ / ₆₄	4	1 1/8	1/2	4 1/2
5	.2055	4002055	56.45	1 ³ / ₆₄	4	1 1/4	1/2	5
4	.2090	4002090	56.45	1 ³ / ₆₄	4	1 1/4	1/2	5
3	.2130	4002130	56.45	1 ³ / ₆₄	4	1 1/4	1/2	5
2	.2210	4002210	56.45	1 ³ / ₆₄	4	1 1/4	1/2	5
1	.2280	4002280	59.00	7/32	4	1 1/2	1/2	6
A	.2340	4002340	59.00	7/32	4	1 1/2	1/2	6
B	.2380	4002380	59.00	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	\$56.45	1 ⁵ / ₆₄	4	1 1/2	1/2	6
D	.2460	4002460	56.45	1 ⁵ / ₆₄	4	1 1/2	1/2	6
E	.2500	40008	43.00	1 ⁵ / ₆₄	4	1 1/2	1/2	6
F	.2570	4002570	57.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
G	.2610	4002610	57.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
H	.2660	4002660	57.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
I	.2720	4002720	57.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
J	.2770	4002770	57.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
K	.2810	4002810	57.30	1 ⁵ / ₆₄	4	1 1/2	1/2	6
L	.2900	4002900	57.30	3/32	4	1 1/2	1/2	6
M	.2950	4002950	57.30	3/32	4	1 1/2	1/2	6
N	.3020	4003020	57.30	3/32	4	1 1/2	1/2	6
O	.3160	4003160	58.75	3/32	4	1 1/2	1/2	6
P	.3230	4003230	58.75	3/32	4	1 1/2	1/2	6
Q	.3320	4003320	58.75	3/32	4	1 1/2	1/2	6
R	.3390	4003390	58.75	3/32	4	1 1/2	1/2	6
S	.3480	4003480	58.75	5/16	4	1 3/4	5/8	7
T	.3580	4003580	58.75	5/16	4	1 3/4	5/8	7
U	.3680	4003680	58.75	5/16	4	1 3/4	5/8	7
V	.3770	4003770	58.75	5/16	4	1 3/4	5/8	7
W	.3860	4003860	61.00	5/16	4	1 3/4	5/8	7
X	.3970	4003970	61.00	5/16	4	1 3/4	5/8	7
Y	.4040	4004040	61.00	5/16	4	1 3/4	5/8	7
Z	.4130	4004130	64.15	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	\$46.85	.151	4	1	1/2	4	0.1560-0.1769	\$88.60	\$67.40	\$60.60	\$57.25	\$53.70	\$50.90
11/64	.1719	4001719	46.85	.151	4	1	1/2	4	-	-	-	-	-	-	-
3/16	.1875	40006	43.00	11/64	4	1 1/8	1/2	4 1/2	0.1770-0.2040	83.15	63.00	56.45	53.05	49.70	46.95
3/16	.1875	40086	45.50	11/64	4	1 1/4	1/2	5	0.1770-0.2040	85.70	65.55	59.00	55.60	52.20	49.50
13/64	.2031	4002031	45.50	11/64	4	1 1/8	1/2	4 1/2	-	-	-	-	-	-	-
7/32	.2188	40007	43.00	13/64	4	1 1/4	1/2	5	0.2041-0.2210	83.15	63.00	56.45	53.05	49.70	46.95
15/64	.2344	4002344	45.50	7/32	4	1 1/2	1/2	6	0.2211-0.2380	85.70	65.55	59.00	55.60	52.20	49.50
1/4	.2500	40008	43.00	15/64	4	1 1/2	1/2	6	0.2381-0.2530	83.15	63.00	56.45	53.05	49.70	46.95
17/64	.2656	4002656	46.55	15/64	4	1 1/2	1/2	6	-	-	-	-	-	-	-
9/32	.2812	40009	43.95	15/64	4	1 1/2	1/2	6	0.2531-0.2840	84.10	64.00	57.30	54.05	50.55	47.85
19/64	.2969	4002969	46.55	9/32	4	1 1/2	1/2	6	-	-	-	-	-	-	-
5/16	.3125	40010	43.95	9/32	4	1 1/2	1/2	6	0.2841-0.3150	84.10	64.00	57.30	54.05	50.55	47.85
21/64	.3281	4003281	48.30	9/32	4	1 1/2	5/8	6	-	-	-	-	-	-	-
11/32	.3438	40011	45.45	9/32	4	1 1/2	5/8	6	0.3151-0.3470	85.65	65.50	58.75	55.55	52.15	49.40
23/64	.3594	4003594	48.30	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-
3/8	.3750	40012	45.45	5/16	4	1 3/4	5/8	7	0.3471-0.3780	85.65	65.50	58.75	55.55	52.15	49.40
25/64	.3906	4003906	50.75	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-
13/32	.4062	40013	47.75	5/16	4	1 3/4	5/8	7	0.3781-0.4090	87.85	67.75	61.00	57.80	54.30	51.70
27/64	.4219	4004219	54.00	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-
7/16	.4375	40014	51.00	3/8	4	1 3/4	5/8	7	0.4091-0.4410	91.10	71.00	64.15	61.00	57.50	54.90
29/64	.4531	4004531	54.85	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-
15/32	.4688	40015	51.70	3/8	4	1 3/4	5/8	7	0.4411-0.4720	91.85	71.70	64.95	61.70	58.30	55.55
31/64	.4844	4004844	59.25	7/16	6	2	5/8	8	-	-	-	-	-	-	-
1/2	.5000	40016	61.45	7/16	6	2	5/8	8	0.4721-0.5030	105.70	83.60	76.10	72.65	68.75	65.75
33/64	.5156	4005156	66.85	7/16	6	2	5/8	8	-	-	-	-	-	-	-
17/32	.5312	40017	66.85	7/16	6	2	5/8	8	0.5031-0.5340	111.20	89.05	81.60	78.05	74.20	71.25
35/64	.5469	4005469	66.85	7/16	6	2	5/8	8	-	-	-	-	-	-	-
9/16	.5625	40018	66.85	7/16	6	2	5/8	8	0.5341-0.5660	111.20	89.05	81.60	78.05	74.20	71.25
37/64	.5781	4005781	69.60	7/16	6	2	5/8	8	-	-	-	-	-	-	-
19/32	.5938	40019	69.60	7/16	6	2	5/8	8	0.5661-0.5970	113.90	91.65	84.25	80.80	76.90	74.05
39/64	.6094	4006094	69.60	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
5/8	.6250	40020	69.60	9/16	6	2 1/4	5/8	9	0.5971-0.6280	113.90	91.65	84.25	80.80	76.90	74.05
41/64	.6406	4006406	70.85	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
21/32	.6562	40021	70.85	9/16	6	2 1/4	5/8	9	0.6281-0.6590	115.00	92.75	85.45	81.95	78.10	75.15
43/64	.6719	4006719	70.85	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
11/16	.6875	40022	70.85	9/16	6	2 1/4	5/8	9	0.6591-0.6910	115.00	92.75	85.45	81.95	78.10	75.15
45/64	.7031	4007031	74.15	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
23/32	.7188	40023	74.15	9/16	6	2 1/4	5/8	9	0.6911-0.7220	118.30	96.30	88.80	85.30	81.45	78.50
47/64	.7344	4007344	74.15	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
3/4	.7500	40024	74.15	5/8	6	2 1/2	3/4	9 1/2	0.7221-0.7530	118.30	96.30	88.80	85.30	81.45	78.50

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	\$76.55	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
29/32	.7812	40025	76.55	5/8	6	2 1/2	3/4	9 1/2	0.7531-0.7840	\$120.75	\$98.60	\$91.25	\$87.75	\$83.90	\$80.90
51/64	.7969	4007969	76.55	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
13/16	.8125	40026	76.55	5/8	6	2 1/2	3/4	9 1/2	0.7841-0.8160	120.75	98.60	91.25	87.75	83.90	80.90
53/64	.8281	4008281	79.65	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
27/32	.8438	40027	79.65	5/8	6	2 1/2	3/4	9 1/2	0.8161-0.8470	123.90	101.70	94.35	90.75	86.95	83.95
55/64	.8594	4008594	79.65	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-
7/8	.8750	40028	82.65	3/4	6	2 5/8	3/4	10	0.8471-0.8780	128.45	105.55	97.90	94.25	90.20	87.10
57/64	.8906	4008906	96.30	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-
29/32	.9062	40029	96.30	3/4	6	2 5/8	3/4	10	0.8781-0.9090	142.15	119.10	111.50	107.85	103.85	100.75
59/64	.9219	4009219	96.30	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-
15/16	.9375	40030	96.30	3/4	8	2 5/8	3/4	10	0.9091-0.9410	142.15	119.10	111.50	107.85	103.85	100.75
61/64	.9531	4009531	100.85	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-
31/32	.9688	40031	100.85	3/4	8	2 5/8	3/4	10	0.9411-0.9720	146.85	123.80	116.25	112.55	108.50	105.40
63/64	.9844	4009844	100.85	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-
1	1.0000	40032	100.85	7/8	8	2 3/4	3/4	10 1/2	0.9721-1.0030	146.85	123.80	116.25	112.55	108.50	105.40
1 1/16	1.0625	40034	104.35	7/8	8	2 3/4	3/4	10 1/2	1.0031-1.0660	148.40	126.35	118.90	115.50	111.65	108.65
1 1/8	1.1250	40036	112.75	7/8	8	2 7/8	7/8	11	1.0661-1.1280	156.80	134.80	127.50	123.95	120.05	117.15
1 3/16	1.1875	40038	118.65	1	8	2 7/8	7/8	11	1.1281-1.1905	162.55	140.55	133.15	129.60	125.95	122.85
1 1/4	1.2500	40040	125.35	1	8	3	7/8	11 1/2	1.1906-1.2530	169.40	147.45	139.95	136.50	132.70	129.65
1 5/16	1.3125	40042	131.90	1	8	3	7/8	11 1/2	1.2531-1.3155	175.90	153.85	146.40	143.00	139.15	136.25
1 3/8	1.3750	40044	139.95	1	8	3 1/4	7/8	12	1.3156-1.3780	183.85	161.95	154.60	151.05	147.35	144.40
1 7/16	1.4375	40046	155.95	1 1/4	8	3 1/4	7/8	12	1.3781-1.4405	200.00	178.00	170.60	167.10	163.30	160.35
1 1/2	1.5000	40048	164.90	1 1/4	8	3 1/2	7/8	12 1/2	1.4406-1.5030	208.85	186.85	179.40	176.00	172.20	169.20
1 9/16	1.5625	40050	244.90	1 1/4	8	3 1/2	7/8	12 1/2	1.5031-1.5660	288.85	266.85	259.50	255.95	252.25	249.20
1 5/8	1.6250	40052	253.30	1 1/4	8	3 3/4	7/8	13	1.5661-1.6280	297.15	275.25	267.85	264.35	260.55	257.60
1 11/16	1.6875	40054	284.85	1 1/4	8	3 3/4	7/8	13	1.6281-1.6910	328.90	306.90	299.50	296.05	292.30	289.30
1 3/4	1.7500	40056	284.85	1 1/4	10	4	7/8	13 1/2	1.6911-1.7530	328.90	306.90	299.50	296.05	292.30	289.30
1 13/16	1.8125	40058	284.85	1 1/2	10	4	7/8	13 1/2	1.7531-1.8160	328.90	306.90	299.50	296.05	292.30	289.30
1 7/8	1.8750	40060	298.55	1 1/2	10	4 1/4	7/8	14	1.8161-1.8780	342.45	320.45	313.00	309.55	305.75	302.70
1 15/16	1.9375	40062	298.55	1 1/2	10	4 1/4	7/8	14	1.8781-1.9410	342.45	320.45	313.00	309.55	305.75	302.70
2	2.0000	40064	298.55	1 1/2	12	4 1/4	7/8	14	1.9411-2.0030	342.45	320.45	313.00	309.55	305.75	302.70

*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	\$54.10	1/64	4	1 1/8	1/2	4 1/2
.1885	47819	54.10	1/64	4	1 1/8	1/2	4 1/2
.2490	47824	54.10	1/64	4	1 1/2	1/2	6
.2510	47825	54.10	1/64	4	1 1/2	1/2	6
.3115	47831	55.30	9/32	4	1 1/2	1/2	6
.3135	47832	55.30	9/32	4	1 1/2	1/2	6
.3740	47837	57.35	5/16	4	1 3/4	5/8	7
.3760	47838	57.35	5/16	4	1 3/4	5/8	7
.4365	47843	64.10	3/8	4	1 3/4	5/8	7
.4385	47844	64.10	3/8	4	1 3/4	5/8	7
.4990	47849	70.25	7/16	6	2	5/8	8
.5010	47850	70.25	7/16	6	2	5/8	8
.6240	47862	84.25	9/16	6	2 1/4	5/8	9
.6260	47863	84.25	9/16	6	2 1/4	5/8	9
.7490	47874	88.80	5/8	6	2 1/2	3/4	9 1/2
.7510	47875	88.80	5/8	6	2 1/2	3/4	9 1/2
.8740	47886	94.35	3/4	6	2 5/8	3/4	10
.8760	47887	97.90	3/4	6	2 5/8	3/4	10
.9990	47898	116.30	7/8	8	2 3/4	3/4	10 1/2
1.0010	47899	111.45	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	\$54.10	1/64	4	1 1/8	1/2	4 1/2
.1870	47618	54.10	1/64	4	1 1/8	1/2	4 1/2
.2480	47623	54.10	15/64	4	1 1/2	1/2	6
.2495	47624	54.10	15/64	4	1 1/2	1/2	6
.3105	47630	55.30	9/32	4	1 1/2	1/2	6
.3120	47631	55.30	9/32	4	1 1/2	1/2	6
.3730	47636	57.35	5/16	4	1 3/4	5/8	7
.3745	47637	57.35	5/16	4	1 3/4	5/8	7
.4355	47642	64.10	3/8	4	1 3/4	5/8	7
.4370	47643	64.10	3/8	4	1 3/4	5/8	7
.4980	47648	70.25	7/16	6	2	5/8	8
.4995	47649	70.25	7/16	6	2	5/8	8
	47600	\$675.05 - 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	\$60.60	.1860	4001860	\$56.45	.2160	4002160	\$56.45	.2460	4002460	\$56.45	.2760	4002760	\$57.30
.1565	4001565	60.60	.1865	47818	54.10	.2165	400055	56.45	.2465	4002465	56.45	.2765	4002765	57.30
.1570	4001570	60.60	.1870	4001870	56.45	.2170	4002170	56.45	.2470	4002470	56.45	.2770	4002770	57.30
.1575	400040	60.60	.1875	40006	43.00	.2175	4002175	56.45	.2475	4002475	56.45	.2775	4002775	57.30
.1580	4001580	60.60	.1880	4001880	56.45	.2180	4002180	56.45	.2480	400063	56.45	.2780	4002780	57.30
.1585	4001585	60.60	.1885	47819	54.10	.2185	4002185	56.45	.2485	4002485	56.45	.2785	4002785	57.30
.1590	4001590	60.60	.1890	400048	56.45	.2190	4002190	56.45	.2490	47824	54.10	.2790	4002790	57.30
.1595	4001595	60.60	.1895	4001895	56.45	.2195	4002195	56.45	.2495	4002495	56.45	.2795	400071	57.30
.1600	4001600	60.60	.1900	4001900	56.45	.2200	4002200	56.45	.2500	40008	43.00	.2800	4002800	57.30
.1605	4001605	60.60	.1905	4001905	56.45	.2205	400056	56.45	.2505	4002505	56.45	.2805	4002805	57.30
.1610	4001610	60.60	.1910	4001910	56.45	.2210	4002210	56.45	.2510	47825	54.10	.2810	4002810	57.30
.1615	4001615	60.60	.1915	4001915	56.45	.2215	4002215	59.00	.2515	4002515	56.45	.2815	4002815	57.30
.1620	4001620	60.60	.1920	4001920	56.45	.2220	4002220	59.00	.2520	400064	56.45	.2820	4002820	57.30
.1625	4001625	60.60	.1925	4001925	56.45	.2225	4002225	59.00	.2525	4002525	56.45	.2825	4002825	57.30
.1630	4001630	60.60	.1930	4001930	56.45	.2230	4002230	59.00	.2530	4002530	56.45	.2830	4002830	57.30
.1635	4001635	60.60	.1935	4001935	56.45	.2235	4002235	59.00	.2535	4002535	57.30	.2835	400072	57.30
.1640	4001640	60.60	.1940	4001940	56.45	.2240	4002240	59.00	.2540	4002540	57.30	.2840	4002840	57.30
.1645	4001645	60.60	.1945	4001945	56.45	.2245	4002245	59.00	.2545	4002545	57.30	.2845	4002845	57.30
.1650	4001650	60.60	.1950	4001950	56.45	.2250	4002250	59.00	.2550	4002550	57.30	.2850	4002850	57.30
.1655	4001655	60.60	.1955	4001955	56.45	.2255	4002255	59.00	.2555	4002555	57.30	.2855	4002855	57.30
.1660	4001660	60.60	.1960	4001960	56.45	.2260	4002260	59.00	.2560	4002560	57.30	.2860	4002860	57.30
.1665	4001665	60.60	.1965	4001965	56.45	.2265	4002265	59.00	.2565	4002565	57.30	.2865	4002865	57.30
.1670	4001670	60.60	.1970	4001970	56.45	.2270	4002270	59.00	.2570	4002570	57.30	.2870	4002870	57.30
.1675	4001675	60.60	.1975	4001975	56.45	.2275	4002275	59.00	.2575	4002575	57.30	.2875	4002875	57.30
.1680	4001680	60.60	.1980	4001980	56.45	.2280	4002280	59.00	.2580	4002580	57.30	.2880	4002880	57.30
.1685	4001685	60.60	.1985	4001985	56.45	.2285	4002285	59.00	.2585	4002585	57.30	.2885	4002885	57.30
.1690	4001690	60.60	.1990	4001990	56.45	.2290	4002290	59.00	.2590	4002590	57.30	.2890	4002890	57.30
.1695	4001695	60.60	.1995	4001995	56.45	.2295	4002295	59.00	.2595	4002595	57.30	.2895	4002895	57.30
.1700	4001700	60.60	.2000	4002000	56.45	.2300	4002300	59.00	.2600	4002600	57.30	.2900	4002900	57.30
.1705	4001705	60.60	.2005	4002005	56.45	.2305	4002305	59.00	.2605	4002605	57.30	.2905	4002905	57.30
.1710	4001710	60.60	.2010	4002010	56.45	.2310	4002310	59.00	.2610	4002610	57.30	.2910	4002910	57.30
.1715	4001715	60.60	.2015	4002015	56.45	.2315	4002315	59.00	.2615	4002615	57.30	.2915	4002915	57.30
.1720	4001720	60.60	.2020	4002020	56.45	.2320	4002320	59.00	.2620	4002620	57.30	.2920	4002920	57.30
.1725	4001725	60.60	.2025	4002025	56.45	.2325	4002325	59.00	.2625	4002625	57.30	.2925	4002925	57.30
.1730	4001730	60.60	.2030	4002030	56.45	.2330	4002330	59.00	.2630	4002630	57.30	.2930	4002930	57.30
.1735	4001735	60.60	.2035	4002035	56.45	.2335	4002335	59.00	.2635	4002635	57.30	.2935	4002935	57.30
.1740	4001740	60.60	.2040	4002040	56.45	.2340	4002340	59.00	.2640	4002640	57.30	.2940	4002940	57.30
.1745	4001745	60.60	.2045	4002045	56.45	.2345	4002345	59.00	.2645	4002645	57.30	.2945	4002945	57.30
.1750	4001750	60.60	.2050	4002050	56.45	.2350	4002350	59.00	.2650	4002650	57.30	.2950	4002950	57.30
.1755	4001755	60.60	.2055	4002055	56.45	.2355	4002355	59.00	.2655	4002655	57.30	.2955	4002955	57.30
.1760	4001760	60.60	.2060	4002060	56.45	.2360	4002360	59.00	.2660	4002660	57.30	.2960	4002960	57.30
.1765	4001765	60.60	.2065	4002065	56.45	.2365	4002365	59.00	.2665	4002665	57.30	.2965	4002965	57.30
.1770	4001770	56.45	.2070	4002070	56.45	.2370	4002370	59.00	.2670	4002670	57.30	.2970	4002970	57.30
.1775	4001775	56.45	.2075	4002075	56.45	.2375	4002375	59.00	.2675	4002675	57.30	.2975	4002975	57.30
.1780	4001780	56.45	.2080	4002080	56.45	.2380	4002380	59.00	.2680	4002680	57.30	.2980	4002980	57.30
.1785	4001785	56.45	.2085	4002085	56.45	.2385	4002385	56.45	.2685	4002685	57.30	.2985	4002985	57.30
.1790	4001790	56.45	.2090	4002090	56.45	.2390	4002390	56.45	.2690	4002690	57.30	.2990	4002990	57.30
.1795	4001795	56.45	.2095	4002095	56.45	.2395	4002395	56.45	.2695	4002695	57.30	.2995	4002995	57.30
.1800	4001800	56.45	.2100	4002100	56.45	.2400	4002400	56.45	.2700	4002700	57.30	.3000	4003000	57.30
.1805	4001805	56.45	.2105	4002105	56.45	.2405	4002405	56.45	.2705	4002705	57.30	.3005	4003005	57.30
.1810	4001810	56.45	.2110	4002110	56.45	.2410	4002410	56.45	.2710	4002710	57.30	.3010	4003010	57.30
.1815	4001815	56.45	.2115	4002115	56.45	.2415	4002415	56.45	.2715	4002715	57.30	.3015	4003015	57.30
.1820	4001820	56.45	.2120	4002120	56.45	.2420	4002420	56.45	.2720	4002720	57.30	.3020	4003020	57.30
.1825	4001825	56.45	.2125	4002125	56.45	.2425	4002425	56.45	.2725	4002725	57.30	.3025	4003025	57.30
.1830	4001830	56.45	.2130	4002130	56.45	.2430	4002430	56.45	.2730	4002730	57.30	.3030	4003030	57.30
.1835	4001835	56.45	.2135	4002135	56.45	.2435	4002435	56.45	.2735	4002735	57.30	.3035	4003035	57.30
.1840	4001840	56.45	.2140	4002140	56.45	.2440	4002440	56.45	.2740	4002740	57.30	.3040	4003040	57.30
.1845	4001845	56.45	.2145	4002145	56.45	.2445	4002445	56.45	.2745	4002745	57.30	.3045	4003045	57.30
.1850	400047	56.45	.2150	4002150	56.45	.2450	4002450	56.45	.2750	4002750	57.30	.3050	4003050	57.30
.1855	4001855	56.45	.2155	4002155	56.45	.2455	4002455	56.45	.2755	4002755	57.30	.3055	4003055	57.30

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	\$57.30	.3360	4003360	\$58.75	.3660	4003660	\$58.75	.3960	4003960	\$61.00	.4260	4004260	\$64.15
.3065	4003065	57.30	.3365	4003365	58.75	.3665	4003665	58.75	.3965	4003965	61.00	.4265	4004265	64.15
.3070	4003070	57.30	.3370	4003370	58.75	.3670	4003670	58.75	.3970	4003970	61.00	.4270	4004270	64.15
.3075	4003075	57.30	.3375	4003375	58.75	.3675	4003675	58.75	.3975	4003975	61.00	.4275	4004275	64.15
.3080	4003080	57.30	.3380	4003380	58.75	.3680	4003680	58.75	.3980	4003980	61.00	.4280	4004280	64.15
.3085	4003085	57.30	.3385	4003385	58.75	.3685	4003685	58.75	.3985	4003985	61.00	.4285	4004285	64.15
.3090	4003090	57.30	.3390	4003390	58.75	.3690	4003690	58.75	.3990	4003990	61.00	.4290	4004290	64.15
.3095	4003095	57.30	.3395	4003395	58.75	.3695	4003695	58.75	.3995	4003995	61.00	.4295	4004295	64.15
.3100	4003100	57.30	.3400	4003400	58.75	.3700	4003700	58.75	.4000	4004000	61.00	.4300	4004300	64.15
.3105	4003105	57.30	.3405	4003405	58.75	.3705	4003705	58.75	.4005	4004005	61.00	.4305	4004305	64.15
.3110	400079	57.30	.3410	4003410	58.75	.3710	4003710	58.75	.4010	4004010	61.00	.4310	4004310	64.15
.3115	47831	55.30	.3415	4003415	58.75	.3715	4003715	58.75	.4015	4004015	61.00	.4315	4004315	64.15
.3120	4003120	57.30	.3420	4003420	58.75	.3720	4003720	58.75	.4020	4004020	61.00	.4320	4004320	64.15
.3125	40010	43.95	.3425	400087	58.75	.3725	4003725	58.75	.4025	4004025	61.00	.4325	4004325	64.15
.3130	4003130	57.30	.3430	4003430	58.75	.3730	4003730	58.75	.4030	4004030	61.00	.4330	4004330	64.15
.3135	47832	55.30	.3435	4003435	58.75	.3735	4003735	58.75	.4035	4004035	61.00	.4335	4004335	64.15
.3140	4003140	57.30	.3440	4003440	58.75	.3740	47837	57.35	.4040	4004040	61.00	.4340	4004340	64.15
.3145	4003145	57.30	.3445	4003445	58.75	.3745	4003745	58.75	.4045	4004045	61.00	.4345	4004345	64.15
.3150	400080	57.30	.3450	4003450	58.75	.3750	40012	45.45	.4050	4004050	61.00	.4350	4004350	64.15
.3155	4003155	58.75	.3455	4003455	58.75	.3755	4003755	58.75	.4055	400103	61.00	.4355	4004355	64.15
.3160	4003160	58.75	.3460	4003460	58.75	.3760	47838	57.35	.4060	4004060	61.00	.4360	4004360	64.15
.3165	4003165	58.75	.3465	400088	58.75	.3765	4003765	58.75	.4065	4004065	61.00	.4365	47843	64.10
.3170	4003170	58.75	.3470	4003470	58.75	.3770	4003770	58.75	.4070	4004070	61.00	.4370	400111	64.15
.3175	4003175	58.75	.3475	4003475	58.75	.3775	4003775	58.75	.4075	4004075	61.00	.4375	40014	51.00
.3180	4003180	58.75	.3480	4003480	58.75	.3780	400096	58.75	.4080	4004080	61.00	.4380	4004380	64.15
.3185	4003185	58.75	.3485	4003485	58.75	.3785	4003785	61.00	.4085	4004085	61.00	.4385	47844	64.10
.3190	4003190	58.75	.3490	4003490	58.75	.3790	4003790	61.00	.4090	4004090	61.00	.4390	4004390	64.15
.3195	4003195	58.75	.3495	4003495	58.75	.3795	4003795	61.00	.4095	4004095	64.15	.4395	4004395	64.15
.3200	4003200	58.75	.3500	4003500	58.75	.3800	4003800	61.00	.4100	4004100	64.15	.4400	4004400	64.15
.3205	4003205	58.75	.3505	4003505	58.75	.3805	4003805	61.00	.4105	4004105	64.15	.4405	4004405	64.15
.3210	4003210	58.75	.3510	4003510	58.75	.3810	4003810	61.00	.4110	4004110	64.15	.4410	4004410	64.15
.3215	4003215	58.75	.3515	4003515	58.75	.3815	4003815	61.00	.4115	4004115	64.15	.4415	4004415	64.95
.3220	4003220	58.75	.3520	4003520	58.75	.3820	4003820	61.00	.4120	4004120	64.15	.4420	4004420	64.95
.3225	4003225	58.75	.3525	4003525	58.75	.3825	4003825	61.00	.4125	4004125	64.15	.4425	4004425	64.95
.3230	4003230	58.75	.3530	4003530	58.75	.3830	4003830	61.00	.4130	4004130	64.15	.4430	4004430	64.95
.3235	4003235	58.75	.3535	4003535	58.75	.3835	4003835	61.00	.4135	4004135	64.15	.4435	4004435	64.95
.3240	4003240	58.75	.3540	4003540	58.75	.3840	4003840	61.00	.4140	4004140	64.15	.4440	4004440	64.95
.3245	4003245	58.75	.3545	4003545	58.75	.3845	4003845	61.00	.4145	4004145	64.15	.4445	4004445	64.95
.3250	4003250	58.75	.3550	4003550	58.75	.3850	4003850	61.00	.4150	4004150	64.15	.4450	4004450	64.95
.3255	4003255	58.75	.3555	4003555	58.75	.3855	4003855	61.00	.4155	4004155	64.15	.4455	4004455	64.95
.3260	4003260	58.75	.3560	4003560	58.75	.3860	4003860	61.00	.4160	4004160	64.15	.4460	4004460	64.95
.3265	4003265	58.75	.3565	4003565	58.75	.3865	4003865	61.00	.4165	4004165	64.15	.4465	4004465	64.95
.3270	4003270	58.75	.3570	4003570	58.75	.3870	4003870	61.00	.4170	4004170	64.15	.4470	4004470	64.95
.3275	4003275	58.75	.3575	4003575	58.75	.3875	4003875	61.00	.4175	4004175	64.15	.4475	4004475	64.95
.3280	4003280	58.75	.3580	4003580	58.75	.3880	4003880	61.00	.4180	4004180	64.15	.4480	4004480	64.95
.3285	4003285	58.75	.3585	4003585	58.75	.3885	4003885	61.00	.4185	4004185	64.15	.4485	4004485	64.95
.3290	4003290	58.75	.3590	4003590	58.75	.3890	4003890	61.00	.4190	4004190	64.15	.4490	4004490	64.95
.3295	4003295	58.75	.3595	4003595	58.75	.3895	4003895	61.00	.4195	4004195	64.15	.4495	4004495	64.95
.3300	4003300	58.75	.3600	4003600	58.75	.3900	4003900	61.00	.4200	4004200	64.15	.4500	4004500	64.95
.3305	4003305	58.75	.3605	4003605	58.75	.3905	4003905	61.00	.4205	4004205	64.15	.4505	4004505	64.95
.3310	4003310	58.75	.3610	4003610	58.75	.3910	4003910	61.00	.4210	4004210	64.15	.4510	4004510	64.95
.3315	4003315	58.75	.3615	4003615	58.75	.3915	4003915	61.00	.4215	4004215	64.15	.4515	4004515	64.95
.3320	4003320	58.75	.3620	4003620	58.75	.3920	4003920	61.00	.4220	4004220	64.15	.4520	4004520	64.95
.3325	4003325	58.75	.3625	4003625	58.75	.3925	4003925	61.00	.4225	4004225	64.15	.4525	4004525	64.95
.3330	4003330	58.75	.3630	4003630	58.75	.3930	4003930	61.00	.4230	4004230	64.15	.4530	4004530	64.95
.3335	4003335	58.75	.3635	4003635	58.75	.3935	4003935	61.00	.4235	4004235	64.15	.4535	4004535	64.95
.3340	4003340	58.75	.3640	4003640	58.75	.3940	4003940	61.00	.4240	4004240	64.15	.4540	4004540	64.95
.3345	4003345	58.75	.3645	4003645	58.75	.3945	4003945	61.00	.4245	4004245	64.15	.4545	4004545	64.95
.3350	4003350	58.75	.3650	4003650	58.75	.3950	4003950	61.00	.4250	4004250	64.15	.4550	4004550	64.95
.3355	4003355	58.75	.3655	4003655	58.75	.3955	4003955	61.00	.4255	4004255	64.15	.4555	4004555	64.95

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	\$64.95	.4860	4004860	\$76.10	.5160	4005160	\$81.60	.5460	4005460	\$81.60	.5760	4005760	\$84.25
.4565	4004565	64.95	.4865	4004865	76.10	.5165	4005165	81.60	.5465	4005465	81.60	.5765	4005765	84.25
.4570	4004570	64.95	.4870	4004870	76.10	.5170	4005170	81.60	.5470	4005470	81.60	.5770	4005770	84.25
.4575	4004575	64.95	.4875	4004875	76.10	.5175	4005175	81.60	.5475	4005475	81.60	.5775	4005775	84.25
.4580	4004580	64.95	.4880	4004880	76.10	.5180	4005180	81.60	.5480	4005480	81.60	.5780	4005780	84.25
.4585	4004585	64.95	.4885	4004885	76.10	.5185	4005185	81.60	.5485	4005485	81.60	.5785	4005785	84.25
.4590	4004590	64.95	.4890	4004890	76.10	.5190	4005190	81.60	.5490	4005490	81.60	.5790	4005790	84.25
.4595	4004595	64.95	.4895	4004895	76.10	.5195	4005195	81.60	.5495	4005495	81.60	.5795	4005795	84.25
.4600	4004600	64.95	.4900	4004900	76.10	.5200	4005200	81.60	.5500	4005500	81.60	.5800	4005800	84.25
.4605	4004605	64.95	.4905	4004905	76.10	.5205	4005205	81.60	.5505	4005505	81.60	.5805	4005805	84.25
.4610	4004610	64.95	.4910	4004910	76.10	.5210	4005210	81.60	.5510	4005510	81.60	.5810	4005810	84.25
.4615	4004615	64.95	.4915	4004915	76.10	.5215	4005215	81.60	.5515	4005515	81.60	.5815	4005815	84.25
.4620	4004620	64.95	.4920	4004920	76.10	.5220	4005220	81.60	.5520	4005520	81.60	.5820	4005820	84.25
.4625	4004625	64.95	.4925	4004925	76.10	.5225	4005225	81.60	.5525	4005525	81.60	.5825	4005825	84.25
.4630	4004630	64.95	.4930	4004930	76.10	.5230	4005230	81.60	.5530	4005530	81.60	.5830	4005830	84.25
.4635	4004635	64.95	.4935	4004935	76.10	.5235	4005235	81.60	.5535	4005535	81.60	.5835	4005835	84.25
.4640	4004640	64.95	.4940	4004940	76.10	.5240	4005240	81.60	.5540	4005540	81.60	.5840	4005840	84.25
.4645	4004645	64.95	.4945	4004945	76.10	.5245	4005245	81.60	.5545	4005545	81.60	.5845	4005845	84.25
.4650	4004650	64.95	.4950	4004950	76.10	.5250	4005250	81.60	.5550	4005550	81.60	.5850	4005850	84.25
.4655	4004655	64.95	.4955	4004955	76.10	.5255	4005255	81.60	.5555	4005555	81.60	.5855	4005855	84.25
.4660	4004660	64.95	.4960	4004960	76.10	.5260	4005260	81.60	.5560	4005560	81.60	.5860	4005860	84.25
.4665	4004665	64.95	.4965	4004965	76.10	.5265	4005265	81.60	.5565	4005565	81.60	.5865	4005865	84.25
.4670	4004670	64.95	.4970	4004970	76.10	.5270	4005270	81.60	.5570	4005570	81.60	.5870	4005870	84.25
.4675	4004675	64.95	.4975	4004975	76.10	.5275	4005275	81.60	.5575	4005575	81.60	.5875	4005875	84.25
.4680	4004680	64.95	.4980	4004980	76.10	.5280	4005280	81.60	.5580	4005580	81.60	.5880	4005880	84.25
.4685	400119	64.95	.4985	4004985	76.10	.5285	4005285	81.60	.5585	4005585	81.60	.5885	4005885	84.25
.4690	4004690	64.95	.4990	47849	70.25	.5290	4005290	81.60	.5590	4005590	81.60	.5890	4005890	84.25
.4695	4004695	64.95	.4995	4004995	76.10	.5295	4005295	81.60	.5595	4005595	81.60	.5895	4005895	84.25
.4700	4004700	64.95	.5000	40016	61.45	.5300	4005300	81.60	.5600	4005600	81.60	.5900	4005900	84.25
.4705	4004705	64.95	.5005	4005005	76.10	.5305	4005305	81.60	.5605	4005605	81.60	.5905	4005905	84.25
.4710	4004710	64.95	.5010	47850	70.25	.5310	4005310	81.60	.5610	4005610	81.60	.5910	4005910	84.25
.4715	4004715	64.95	.5015	4005015	76.10	.5315	400135	81.60	.5615	4005615	81.60	.5915	4005915	84.25
.4720	4004720	64.95	.5020	4005020	76.10	.5320	4005320	81.60	.5620	4005620	81.60	.5920	4005920	84.25
.4725	4004725	76.10	.5025	4005025	76.10	.5325	4005325	81.60	.5625	40018	66.85	.5925	4005925	84.25
.4730	4004730	76.10	.5030	4005030	76.10	.5330	4005330	81.60	.5630	400143	81.60	.5930	4005930	84.25
.4735	4004735	76.10	.5035	4005035	81.60	.5335	4005335	81.60	.5635	4005635	81.60	.5935	4005935	84.25
.4740	4004740	76.10	.5040	4005040	81.60	.5340	4005340	81.60	.5640	4005640	81.60	.5940	4005940	84.25
.4745	4004745	76.10	.5045	4005045	81.60	.5345	4005345	81.60	.5645	4005645	81.60	.5945	400151	84.25
.4750	4004750	76.10	.5050	4005050	81.60	.5350	4005350	81.60	.5650	4005650	81.60	.5950	4005950	84.25
.4755	4004755	76.10	.5055	4005055	81.60	.5355	4005355	81.60	.5655	4005655	81.60	.5955	4005955	84.25
.4760	4004760	76.10	.5060	4005060	81.60	.5360	4005360	81.60	.5660	4005660	81.60	.5960	4005960	84.25
.4765	4004765	76.10	.5065	4005065	81.60	.5365	4005365	81.60	.5665	4005665	84.25	.5965	4005965	84.25
.4770	4004770	76.10	.5070	4005070	81.60	.5370	4005370	81.60	.5670	4005670	84.25	.5970	4005970	84.25
.4775	4004775	76.10	.5075	4005075	81.60	.5375	4005375	81.60	.5675	4005675	84.25	.5975	4005975	84.25
.4780	4004780	76.10	.5080	4005080	81.60	.5380	4005380	81.60	.5680	4005680	84.25	.5980	4005980	84.25
.4785	4004785	76.10	.5085	4005085	81.60	.5385	4005385	81.60	.5685	4005685	84.25	.5985	4005985	84.25
.4790	4004790	76.10	.5090	4005090	81.60	.5390	4005390	81.60	.5690	4005690	84.25	.5990	4005990	84.25
.4795	4004795	76.10	.5095	4005095	81.60	.5395	4005395	81.60	.5695	4005695	84.25	.5995	4005995	84.25
.4800	4004800	76.10	.5100	4005100	81.60	.5400	4005400	81.60	.5700	4005700	84.25	.6000	4006000	84.25
.4805	4004805	76.10	.5105	4005105	81.60	.5405	4005405	81.60	.5705	4005705	84.25	.6005	4006005	84.25
.4810	4004810	76.10	.5110	4005110	81.60	.5410	4005410	81.60	.5710	4005710	84.25	.6010	4006010	84.25
.4815	4004815	76.10	.5115	4005115	81.60	.5415	4005415	81.60	.5715	4005715	84.25	.6015	4006015	84.25
.4820	4004820	76.10	.5120	4005120	81.60	.5420	4005420	81.60	.5720	4005720	84.25	.6020	4006020	84.25
.4825	4004825	76.10	.5125	4005125	81.60	.5425	4005425	81.60	.5725	4005725	84.25	.6025	4006025	84.25
.4830	4004830	76.10	.5130	4005130	81.60	.5430	4005430	81.60	.5730	4005730	84.25	.6030	4006030	84.25
.4835	4004835	76.10	.5135	4005135	81.60	.5435	4005435	81.60	.5735	4005735	84.25	.6035	4006035	84.25
.4840	4004840	76.10	.5140	4005140	81.60	.5440	4005440	81.60	.5740	4005740	84.25	.6040	4006040	84.25
.4845	4004845	76.10	.5145	4005145	81.60	.5445	4005445	81.60	.5745	4005745	84.25	.6045	4006045	84.25
.4850	4004850	76.10	.5150	4005150	81.60	.5450	4005450	81.60	.5750	4005750	84.25	.6050	4006050	84.25
.4855	4004855	76.10	.5155	4005155	81.60	.5455	4005455	81.60	.5755	4005755	84.25	.6055	4006055	84.25

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	\$84.25	.6360	4006360	\$85.45	.6660	4006660	\$85.45	.6960	4006960	\$88.80	.7260	4007260	\$88.80
.6065	4006065	84.25	.6365	4006365	85.45	.6665	4006665	85.45	.6965	4006965	88.80	.7265	4007265	88.80
.6070	4006070	84.25	.6370	4006370	85.45	.6670	4006670	85.45	.6970	4006970	88.80	.7270	4007270	88.80
.6075	4006075	84.25	.6375	4006375	85.45	.6675	4006675	85.45	.6975	4006975	88.80	.7275	4007275	88.80
.6080	4006080	84.25	.6380	4006380	85.45	.6680	4006680	85.45	.6980	4006980	88.80	.7280	4007280	88.80
.6085	4006085	84.25	.6385	4006385	85.45	.6685	4006685	85.45	.6985	4006985	88.80	.7285	4007285	88.80
.6090	4006090	84.25	.6390	4006390	85.45	.6690	4006690	85.45	.6990	4006990	88.80	.7290	4007290	88.80
.6095	4006095	84.25	.6395	4006395	85.45	.6695	4006695	85.45	.6995	4006995	88.80	.7295	4007295	88.80
.6100	4006100	84.25	.6400	4006400	85.45	.6700	4006700	85.45	.7000	4007000	88.80	.7300	4007300	88.80
.6105	4006105	84.25	.6405	4006405	85.45	.6705	4006705	85.45	.7005	4007005	88.80	.7305	4007305	88.80
.6110	4006110	84.25	.6410	4006410	85.45	.6710	4006710	85.45	.7010	4007010	88.80	.7310	4007310	88.80
.6115	4006115	84.25	.6415	4006415	85.45	.6715	4006715	85.45	.7015	4007015	88.80	.7315	4007315	88.80
.6120	4006120	84.25	.6420	4006420	85.45	.6720	4006720	85.45	.7020	4007020	88.80	.7320	4007320	88.80
.6125	4006125	84.25	.6425	4006425	85.45	.6725	4006725	85.45	.7025	4007025	88.80	.7325	4007325	88.80
.6130	4006130	84.25	.6430	4006430	85.45	.6730	4006730	85.45	.7030	4007030	88.80	.7330	4007330	88.80
.6135	4006135	84.25	.6435	4006435	85.45	.6735	4006735	85.45	.7035	4007035	88.80	.7335	4007335	88.80
.6140	4006140	84.25	.6440	4006440	85.45	.6740	4006740	85.45	.7040	4007040	88.80	.7340	4007340	88.80
.6145	4006145	84.25	.6445	4006445	85.45	.6745	4006745	85.45	.7045	4007045	88.80	.7345	4007345	88.80
.6150	4006150	84.25	.6450	4006450	85.45	.6750	4006750	85.45	.7050	4007050	88.80	.7350	4007350	88.80
.6155	4006155	84.25	.6455	4006455	85.45	.6755	4006755	85.45	.7055	4007055	88.80	.7355	4007355	88.80
.6160	4006160	84.25	.6460	4006460	85.45	.6760	4006760	85.45	.7060	4007060	88.80	.7360	4007360	88.80
.6165	4006165	84.25	.6465	4006465	85.45	.6765	4006765	85.45	.7065	4007065	88.80	.7365	4007365	88.80
.6170	4006170	84.25	.6470	4006470	85.45	.6770	4006770	85.45	.7070	4007070	88.80	.7370	4007370	88.80
.6175	4006175	84.25	.6475	4006475	85.45	.6775	4006775	85.45	.7075	4007075	88.80	.7375	4007375	88.80
.6180	4006180	84.25	.6480	4006480	85.45	.6780	4006780	85.45	.7080	4007080	88.80	.7380	4007380	88.80
.6185	4006185	84.25	.6485	4006485	85.45	.6785	4006785	85.45	.7085	4007085	88.80	.7385	4007385	88.80
.6190	4006190	84.25	.6490	4006490	85.45	.6790	4006790	85.45	.7090	4007090	88.80	.7390	4007390	88.80
.6195	4006195	84.25	.6495	4006495	85.45	.6795	4006795	85.45	.7095	4007095	88.80	.7395	4007395	88.80
.6200	4006200	84.25	.6500	4006500	85.45	.6800	4006800	85.45	.7100	4007100	88.80	.7400	4007400	88.80
.6205	4006205	84.25	.6505	4006505	85.45	.6805	4006805	85.45	.7105	4007105	88.80	.7405	4007405	88.80
.6210	4006210	84.25	.6510	4006510	85.45	.6810	4006810	85.45	.7110	4007110	88.80	.7410	4007410	88.80
.6215	4006215	84.25	.6515	4006515	85.45	.6815	4006815	85.45	.7115	4007115	88.80	.7415	4007415	88.80
.6220	400158	84.25	.6520	4006520	85.45	.6820	4006820	85.45	.7120	4007120	88.80	.7420	4007420	88.80
.6225	4006225	84.25	.6525	4006525	85.45	.6825	4006825	85.45	.7125	4007125	88.80	.7425	4007425	88.80
.6230	4006230	84.25	.6530	4006530	85.45	.6830	4006830	85.45	.7130	4007130	88.80	.7430	4007430	88.80
.6235	4006235	84.25	.6535	400166	85.45	.6835	4006835	85.45	.7135	4007135	88.80	.7435	4007435	88.80
.6240	47862	84.25	.6540	4006540	85.45	.6840	4006840	85.45	.7140	4007140	88.80	.7440	4007440	88.80
.6245	4006245	84.25	.6545	4006545	85.45	.6845	4006845	85.45	.7145	4007145	88.80	.7445	4007445	88.80
.6250	40020	69.60	.6550	4006550	85.45	.6850	400174	85.45	.7150	4007150	88.80	.7450	4007450	88.80
.6255	4006255	84.25	.6555	4006555	85.45	.6855	4006855	85.45	.7155	4007155	88.80	.7455	4007455	88.80
.6260	47863	84.25	.6560	4006560	85.45	.6860	4006860	85.45	.7160	4007160	88.80	.7460	4007460	88.80
.6265	4006265	84.25	.6565	4006565	85.45	.6865	4006865	85.45	.7165	400182	88.80	.7465	4007465	88.80
.6270	4006270	84.25	.6570	4006570	85.45	.6870	4006870	85.45	.7170	4007170	88.80	.7470	4007470	88.80
.6275	4006275	84.25	.6575	400167	85.45	.6875	40022	70.85	.7175	4007175	88.80	.7475	4007475	88.80
.6280	4006280	84.25	.6580	4006580	85.45	.6880	4006880	85.45	.7180	4007180	88.80	.7480	400190	88.80
.6285	4006285	85.45	.6585	4006585	85.45	.6885	4006885	85.45	.7185	4007185	88.80	.7485	4007485	88.80
.6290	4006290	85.45	.6590	4006590	85.45	.6890	400175	85.45	.7190	4007190	88.80	.7490	47874	88.80
.6295	4006295	85.45	.6595	4006595	85.45	.6895	4006895	85.45	.7195	4007195	88.80	.7495	4007495	88.80
.6300	4006300	85.45	.6600	4006600	85.45	.6900	4006900	85.45	.7200	4007200	88.80	.7500	40024	74.15
.6305	4006305	85.45	.6605	4006605	85.45	.6905	4006905	85.45	.7205	400183	88.80	.7505	4007505	88.80
.6310	4006310	85.45	.6610	4006610	85.45	.6910	4006910	85.45	.7210	4007210	88.80	.7510	47875	88.80
.6315	4006315	85.45	.6615	4006615	85.45	.6915	4006915	88.80	.7215	4007215	88.80	.7515	4007515	88.80
.6320	4006320	85.45	.6620	4006620	85.45	.6920	4006920	88.80	.7220	4007220	88.80	.7520	400191	88.80
.6325	4006325	85.45	.6625	4006625	85.45	.6925	4006925	88.80	.7225	4007225	88.80	.7525	4007525	88.80
.6330	4006330	85.45	.6630	4006630	85.45	.6930	4006930	88.80	.7230	4007230	88.80	.7530	4007530	88.80
.6335	4006335	85.45	.6635	4006635	85.45	.6935	4006935	88.80	.7235	4007235	88.80	.7535	4007535	91.25
.6340	4006340	85.45	.6640	4006640	85.45	.6940	4006940	88.80	.7240	4007240	88.80	.7540	4007540	91.25
.6345	4006345	85.45	.6645	4006645	85.45	.6945	4006945	88.80	.7245	4007245	88.80	.7545	4007545	91.25
.6350	4006350	85.45	.6650	4006650	85.45	.6950	4006950	88.80	.7250	4007250	88.80	.7550	4007550	91.25
.6355	4006355	85.45	.6655	4006655	85.45	.6955	4006955	88.80	.7255	4007255	88.80	.7555	4007555	91.25

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	\$60.60	.151	4	1	½	4	3.962-4.493	\$91.55	\$71.00	\$64.05	\$60.65	\$57.25	\$54.25	\$50.40
4.5	.1772	400045	56.45	1/16	4	1 1/8	1/2	4 1/2	4.494-5.182	86.55	66.55	59.85	56.55	53.05	50.35	46.50
5.0	.1969	400050	56.45	1/16	4	1 1/8	1/2	4 1/2	-	-	-	-	-	-	-	-
5.5	.2165	400055	56.45	1/16	4	1 1/4	1/2	5	5.183-5.613	86.55	66.55	59.85	56.55	53.05	50.35	46.50
6.0	.2362	400060	59.00	7/32	4	1 1/2	1/2	6	5.614-6.045	89.15	69.10	62.30	59.10	55.60	52.85	49.00
6.3	.2480	400063	56.45	1/16	4	1 1/2	1/2	6	6.046-6.426	86.55	66.55	59.85	56.55	53.05	50.35	46.50
6.5	.2559	400065	57.30	1/16	4	1 1/2	1/2	6	6.427-7.214	87.60	67.40	60.75	57.40	54.05	51.20	47.35
7.0	.2756	400070	57.30	1/16	4	1 1/2	1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	400075	57.30	9/32	4	1 1/2	1/2	6	7.215-8.001	87.60	67.40	60.75	57.40	54.05	51.20	47.35
8.0	.3150	400080	57.30	9/32	4	1 1/2	1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	400085	58.75	9/32	4	1 1/2	5/8	6	8.002-8.814	89.10	69.00	62.25	59.00	55.55	52.80	48.90
9.0	.3543	400090	58.75	3/16	4	1 3/4	5/8	7	8.815-9.601	89.10	69.00	62.25	59.00	55.55	52.80	48.90
9.5	.3740	400095	58.75	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-	-
10.0	.3937	400100	61.00	5/16	4	1 3/4	5/8	7	9.602-10.389	91.25	71.15	64.50	61.20	57.80	55.05	51.15
10.5	.4134	400105	64.15	3/8	4	1 3/4	5/8	7	10.390-11.201	94.45	74.40	67.70	64.35	61.00	58.25	54.30
11.0	.4331	400110	64.15	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-	-
11.5	.4528	400115	64.95	3/8	4	1 3/4	5/8	7	11.202-11.989	95.15	75.15	68.40	65.20	61.70	59.00	55.15
12.0	.4724	400120	76.10	7/16	6	2	5/8	8	11.990-12.776	109.40	87.25	79.90	76.40	72.65	69.55	65.30
12.5	.4921	400125	76.10	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
13.0	.5118	400130	81.60	7/16	6	2	5/8	8	12.777-13.564	114.80	92.70	85.35	81.70	78.05	74.95	70.75
13.5	.5315	400135	81.60	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
14.0	.5512	400140	81.60	7/16	6	2	5/8	8	13.565-14.376	114.80	92.70	85.35	81.70	78.05	74.95	70.75
14.5	.5709	400145	84.25	7/16	6	2	5/8	8	14.377-15.164	117.55	95.45	88.00	84.45	80.80	77.70	73.40
15.0	.5906	400150	84.25	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
15.5	.6102	400155	84.25	9/16	6	2 1/4	5/8	9	15.165-15.951	117.55	95.45	88.00	84.45	80.80	77.70	73.40
16.0	.6299	400160	85.45	9/16	6	2 1/4	5/8	9	15.952-16.739	118.80	96.65	89.20	85.55	81.95	78.85	74.50
16.5	.6496	400165	85.45	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-	-
17.0	.6693	400170	85.45	9/16	6	2 1/4	5/8	9	16.740-17.551	118.80	96.65	89.20	85.55	81.95	78.85	74.50
17.5	.6890	400175	85.45	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-	-
18.0	.7087	400180	88.80	9/16	6	2 1/4	5/8	9	17.552-18.339	122.05	100.00	92.60	89.05	85.30	82.20	77.90
18.5	.7283	400185	88.80	5/8	6	2 1/2	3/4	9 1/2	18.340-19.126	122.05	100.00	92.60	89.05	85.30	82.20	77.90
19.0	.7480	400190	88.80	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	400195	91.25	5/8	6	2 1/2	3/4	9 1/2	19.127-19.914	124.45	102.50	95.05	91.35	87.75	84.60	80.40
20.0	.7874	400200	91.25	5/8	6	2 1/2	3/4	9 1/2	19.915-20.726	124.45	102.50	95.05	91.35	87.75	84.60	80.40
20.5	.8071	400205	91.25	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	400210	94.35	5/8	6	2 1/2	3/4	9 1/2	20.727-21.514	127.60	105.40	98.10	94.45	90.75	87.75	83.50
21.5	.8465	400215	94.35	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	400220	94.35	3/4	6	2 5/8	3/4	10	21.515-22.301	127.60	105.40	98.10	94.45	90.75	87.75	83.50
22.5	.8858	400225	111.50	3/4	6	2 5/8	3/4	10	22.302-23.089	146.00	123.05	115.40	111.65	107.85	104.65	100.20
23.0	.9055	400230	111.50	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-	-
23.5	.9252	400235	111.50	3/4	8	2 5/8	3/4	10	23.090-23.901	146.00	123.05	115.40	111.65	107.85	104.65	100.20
24.0	.9449	400240	116.25	3/4	8	2 5/8	3/4	10	23.902-24.689	150.70	127.70	120.05	116.35	112.55	109.35	104.90
24.5	.9646	400245	116.25	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-	-
25.0	.9843	400250	116.25	7/8	8	2 3/4	3/4	10 1/2	24.690-25.476	150.70	127.70	120.05	116.35	112.55	109.35	104.90
25.5	1.0039	400255	118.90	7/8	8	2 3/4	3/4	10 1/2	25.477-27.076	152.10	130.10	122.75	119.10	115.50	112.50	108.10
26.0	1.0236	400260	118.90	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	400270	118.90	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	400280	127.50	7/8	8	2 7/8	7/8	11	27.077-28.651	160.50	138.55	131.15	127.60	123.95	120.85	116.60
29.0	1.1417	400290	133.15	1	8	2 7/8	7/8	11	28.652-30.239	166.20	144.40	136.85	133.35	129.60	126.60	122.35
30.0	1.1811	400300	133.15	1	8	2 7/8	7/8	11	-	-	-	-	-	-	-	-
31.0	1.2205	400310	139.95	1	8	3	7/8	11 1/2	30.240-31.826	173.05	151.10	143.75	140.20	136.50	133.45	129.30
32.0	1.2598	400320	146.40	1	8	3	7/8	11 1/2	31.827-33.414	179.60	157.70	150.25	146.70	143.00	139.85	135.60
33.0	1.2992	400330	146.40	1	8	3	7/8	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	400340	154.60	1	8	3 1/4	7/8	12	33.415-35.001	187.60	165.75	158.25	154.75	151.05	147.95	143.75
35.0	1.3780	400350	154.60	1	8	3 1/4	7/8	12	-	-	-	-	-	-	-	-
36.0	1.4173	400360	170.60	1 1/4	8	3 1/4	7/8	12	35.002-36.589	203.70	181.70	174.35	170.70	167.10	163.95	159.80
37.0	1.4567	400370	179.40	1 1/4	8	3 1/2	7/8	12 1/2	36.590-38.176	212.60	190.60	183.20	179.65	176.00	172.90	168.70

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	\$36.60	-	-	41006SF	\$51.55	43006SF	44006SF	\$47.75	45006SF	\$43.80	-	-
0.2041-0.2210	40007SF	36.60	-	-	41007SF	51.55	43007SF	44007SF	47.75	45007SF	43.80	-	-
0.2211-0.2380	4002344SF	38.65	-	-	4102344SF	51.55	4302344SF	4402344SF	47.75	4502344SF	43.80	-	-
0.2381-0.2530	40008SF	36.60	40208SF	\$42.25	41008SF	51.55	43008SF	44008SF	47.75	45008SF	43.80	-	-
0.2531-0.2840	40009SF	37.30	40209SF	42.90	41009SF	51.70	43009SF	44009SF	47.75	45009SF	44.80	-	-
0.2841-0.3150	40010SF	37.30	40210SF	42.90	41010SF	51.70	43010SF	44010SF	55.40	45010SF	44.80	46510SF	\$67.60
0.3151-0.3470	40011SF	38.60	40211SF	44.45	41011SF	56.80	43011SF	44011SF	56.00	45011SF	46.35	46511SF	67.60
0.3471-0.3780	40012SF	35.40	40212SF	40.90	41012SF	57.35	43012SF	44012SF	60.65	45012SF	46.35	46512SF	63.25
0.3781-0.4090	40013SF	40.50	40213SF	46.60	41013SF	59.95	43013SF	44013SF	61.45	45013SF	48.60	46513SF	67.05
0.4091-0.4410	40014SF	43.15	40214SF	49.70	41014SF	62.30	43014SF	44014SF	72.90	45014SF	52.65	46514SF	67.05
0.4411-0.4720	40015SF	43.95	40215SF	51.10	41015SF	66.20	43015SF	44015SF	72.90	45015SF	56.80	46515SF	71.10
0.4721-0.5030	40016SF	52.35	40216SF	60.10	41016SF	68.70	43016SF	44016SF	79.70	45016SF	60.95	46516SF	71.10
0.5031-0.5340	40017SF	56.80	40217SF	64.95	41017SF	70.85	43017SF	44017SF	84.10	45017SF	62.50	46517SF	72.90
0.5341-0.5660	40018SF	56.80	40218SF	64.95	41018SF	70.85	43018SF	44018SF	84.10	45018SF	65.10	46518SF	76.10
0.5661-0.5970	40019SF	59.15	40219SF	67.95	41019SF	72.90	43019SF	44019SF	86.35	45019SF	65.10	46519SF	76.10
0.5971-0.6280	40020SF	59.15	40220SF	67.95	41020SF	72.90	43020SF	44020SF	86.35	45020SF	65.10	46520SF	76.10
0.6281-0.6590	40021SF	60.15	40221SF	69.25	41021SF	74.95	43021SF	44021SF	86.35	45021SF	66.20	46521SF	83.25
0.6591-0.6910	40022SF	60.15	40222SF	69.25	41022SF	79.85	43022SF	44022SF	90.30	45022SF	66.20	46522SF	83.25
0.6911-0.7220	40023SF	62.95	40223SF	72.40	41023SF	80.95	43023SF	44023SF	90.30	45023SF	69.25	46523SF	86.45
0.7221-0.7530	40024SF	62.95	40224SF	72.40	41024SF	82.25	43024SF	44024SF	92.60	45024SF	69.25	46524SF	86.45
0.7531-0.7840	40025SF	65.20	40225SF	74.55	41025SF	84.30	43025SF	44025SF	92.60	45025SF	71.55	46525SF	93.20
0.7841-0.8160	40026SF	65.20	40226SF	74.55	41026SF	84.30	43026SF	44026SF	100.60	45026SF	71.55	46526SF	93.20
0.8161-0.8470	40027SF	67.75	40227SF	77.85	41027SF	88.90	43027SF	44027SF	100.60	45027SF	74.45	46527SF	96.70
0.8471-0.8780	40028SF	70.25	40228SF	80.80	41028SF	92.30	43028SF	44028SF	109.95	45028SF	77.35	46528SF	100.40
0.8781-0.9090	40029SF	82.05	40229SF	94.75	41029SF	107.55	43029SF	44029SF	109.95	45029SF	90.00	46529SF	106.85
0.9091-0.9410	40030SF	82.05	40230SF	94.75	41030SF	107.55	43030SF	44030SF	121.00	45030SF	90.00	46530SF	106.85
0.9411-0.9720	40031SF	85.85	40231SF	98.60	41031SF	112.70	43031SF	44031SF	121.00	45031SF	94.35	46531SF	110.95
0.9721-1.0030	40032SF	85.85	40232SF	98.60	41032SF	112.70	43032SF	44032SF	127.05	45032SF	94.35	46532SF	110.95
1.0031-1.0660	40034SF	88.65	40234SF	135.60	41034SF	120.95	43034SF	44034SF	127.05	45034SF	97.65	46534SF	121.70
1.0661-1.1280	40036SF	95.95	40236SF	144.45	41036SF	124.70	43036SF	44036SF	148.65	45036SF	105.55	46536SF	121.70
1.1281-1.1905	40038SF	100.75	40238SF	153.10	41038SF	130.95	43038SF	44038SF	155.00	45038SF	110.40	46538SF	132.75
1.1906-1.2530	40040SF	106.50	40240SF	170.05	41040SF	138.75	43040SF	44040SF	181.65	45040SF	128.95	46540SF	132.75
1.2531-1.3155	40042SF	112.05	40242SF	183.45	41042SF	153.35	43042SF	44042SF	181.65	45042SF	128.95	46542SF	147.25
1.3156-1.3780	40044SF	118.90	40244SF	190.75	41044SF	168.15	43044SF	44044SF	184.15	45044SF	130.80	46544SF	154.10
1.3781-1.4405	40046SF	132.60	40246SF	194.80	41046SF	178.10	43046SF	44046SF	214.70	45046SF	144.50	46546SF	182.00
1.4406-1.5030	40048SF	140.20	40248SF	204.40	41048SF	188.15	43048SF	44048SF	257.85	45048SF	173.55	46548SF	187.45



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	\$49.55	1	4	1 1/2	1/2	6	0.2381-0.2530	\$89.65	\$69.60	\$62.90	\$59.70	\$56.40	\$53.60
3/32	.2812	40209	50.50	1	4	1 1/2	1/2	6	0.2531-0.2840	90.65	70.50	63.90	60.60	57.25	54.40
5/16	.3125	40210	50.50	1	4	1 1/2	1/2	6	0.2841-0.3150	90.65	70.50	63.90	60.60	57.25	54.40
11/32	.3438	40211	52.40	1	4	1 1/2	5/8	6	0.3151-0.3470	92.55	72.40	65.60	62.40	59.10	56.45
3/8	.3750	40212	48.05	1	4	1 3/4	5/8	7	0.3471-0.3780	84.90	66.45	60.20	57.35	54.15	51.70
13/32	.4062	40213	54.95	1	4	1 3/4	5/8	7	0.3781-0.4090	95.10	74.95	68.20	65.10	61.60	58.90
7/16	.4375	40214	58.50	1	4	1 3/4	5/8	7	0.4091-0.4410	98.60	78.50	71.75	68.60	65.20	62.35
15/32	.4688	40215	60.00	1	4	1 3/4	5/8	7	0.4411-0.4720	100.20	80.10	73.35	70.15	66.70	64.00
1/2	.5000	40216	70.75	1	6	2	5/8	8	0.4721-0.5030	114.90	92.70	85.35	81.90	78.05	75.10
17/32	.5312	40217	76.40	1	6	2	5/8	8	0.5031-0.5340	120.60	98.35	90.95	87.55	83.65	80.55
9/16	.5625	40218	76.40	1	6	2	5/8	8	0.5341-0.5660	120.60	98.35	90.95	87.55	83.65	80.55
19/32	.5938	40219	80.05	1	6	2	5/8	8	0.5661-0.5970	124.25	102.05	94.65	91.15	87.25	84.40
5/8	.6250	40220	80.05	2	6	2 1/4	5/8	9	0.5971-0.6280	124.25	102.05	94.65	91.15	87.25	84.40
21/32	.6562	40221	81.45	2	6	2 1/4	5/8	9	0.6281-0.6590	125.60	103.50	96.10	92.60	88.80	85.75
11/16	.6875	40222	81.45	2	6	2 1/4	5/8	9	0.6591-0.6910	125.60	103.50	96.10	92.60	88.80	85.75
23/32	.7188	40223	85.15	2	6	2 1/4	5/8	9	0.6911-0.7220	129.40	107.15	99.75	96.35	92.55	89.50
3/4	.7500	40224	85.15	2	6	2 1/2	3/4	9 1/2	0.7221-0.7530	129.40	107.15	99.75	96.35	92.55	89.50
25/32	.7812	40225	87.80	2	6	2 1/2	3/4	9 1/2	0.7531-0.7840	132.00	109.80	102.50	99.00	95.10	92.10
13/16	.8125	40226	87.80	2	6	2 1/2	3/4	9 1/2	0.7841-0.8160	132.00	109.80	102.50	99.00	95.10	92.10
27/32	.8438	40227	91.60	2	6	2 1/2	3/4	9 1/2	0.8161-0.8470	135.75	113.55	106.25	102.70	99.00	95.85
7/8	.8750	40228	95.10	2	6	2 5/8	3/4	10	0.8471-0.8780	140.85	118.00	110.25	106.50	102.65	99.50
29/32	.9062	40229	111.50	2	6	2 5/8	3/4	10	0.8781-0.9090	157.30	134.30	126.65	122.95	119.05	115.95
15/16	.9375	40230	111.50	3	8	2 5/8	3/4	10	0.9091-0.9410	157.30	134.30	126.65	122.95	119.05	115.95
31/32	.9688	40231	116.25	3	8	2 5/8	3/4	10	0.9411-0.9720	162.00	139.00	131.25	127.65	123.75	120.65
1	1.0000	40232	116.25	3	8	2 3/4	3/4	10 1/2	0.9721-1.0030	162.00	139.00	131.25	127.65	123.75	120.65
1 1/16	1.0625	40234	159.50	3	8	2 3/4	3/4	10 1/2	1.0031-1.0660	203.55	181.55	174.20	170.65	166.80	163.85
1 1/8	1.1250	40236	170.00	3	8	2 7/8	7/8	11	1.0661-1.1280	213.95	191.80	184.50	180.95	177.30	174.30
1 3/16	1.1875	40238	180.05	3	8	2 7/8	7/8	11	1.1281-1.1905	224.10	201.90	194.65	191.00	187.25	184.35
1 1/4	1.2500	40240	200.05	4	8	3	7/8	11 1/2	1.1906-1.2530	244.05	222.00	214.65	211.05	207.35	204.35
1 9/16	1.3125	40242	215.75	4	8	3	7/8	11 1/2	1.2531-1.3155	259.65	237.65	230.25	226.75	222.95	220.00
1 3/8	1.3750	40244	224.40	4	8	3 1/4	7/8	12	1.3156-1.3780	268.40	246.35	239.00	235.50	231.65	228.85
1 7/16	1.4375	40246	229.05	4	8	3 1/4	7/8	12	1.3781-1.4405	273.10	251.10	243.60	240.20	236.30	233.40
1 1/2	1.5000	40248	240.45	4	8	3 1/2	7/8	12 1/2	1.4406-1.5030	284.45	262.55	255.10	251.60	247.75	244.80
1 9/16	1.5625	40250	259.60	4	8	3 1/2	7/8	12 1/2	1.5031-1.5660	303.55	281.55	274.10	270.65	266.85	263.90
1 5/8	1.6250	40252	268.50	4	8	3 3/4	7/8	13	1.5661-1.6280	312.55	290.55	283.10	279.60	275.90	272.85
1 11/16	1.6875	40254	301.95	4	8	3 3/4	7/8	13	1.6281-1.6910	346.00	323.90	316.65	313.00	309.35	306.40
1 3/4	1.7500	40256	301.95	4	10	4	7/8	13 1/2	1.6911-1.7530	346.00	323.90	316.65	313.00	309.35	306.40
1 13/16	1.8125	40258	301.95	4	10	4	7/8	13 1/2	1.7531-1.8160	346.00	323.90	316.65	313.00	309.35	306.40
1 7/8	1.8750	40260	316.45	4	10	4 1/4	7/8	14	1.8161-1.8780	360.35	338.35	330.95	327.40	323.75	320.70
1 15/16	1.9375	40262	316.45	4	10	4 1/4	7/8	14	1.8781-1.9410	360.35	338.35	330.95	327.40	323.75	320.70
2	2.0000	40264	316.45	4	12	4 1/4	7/8	14	1.9411-2.0030	360.35	338.35	330.95	327.40	323.75	320.70

*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	\$62.90	1	4	1 1/2	1/2	6	6.000-6.426	\$93.20	\$73.05	\$66.40	\$63.00	\$59.70	\$56.80	\$52.95
6.5	.2559	402065	63.90	1	4	1 1/2	1/2	6	6.427-7.214	94.00	74.05	67.30	64.00	60.60	57.80	54.00
7.0	.2756	402070	63.90	1	4	1 1/2	1/2	6	-	-	-	-	-	-	-	
7.5	.2953	402075	63.90	1	4	1 1/2	1/2	6	7.215-8.001	94.00	74.05	67.30	64.00	60.60	57.80	54.00
8.0	.3150	402080	63.90	1	4	1 1/2	1/2	6	-	-	-	-	-	-	-	
8.5	.3346	402085	65.60	1	4	1 1/2	5/8	6	8.002-8.814	95.85	75.80	69.15	65.75	62.40	59.70	55.80
9.0	.3543	402090	60.20	1	4	1 3/4	5/8	7	8.815-9.601	87.95	69.60	63.50	60.45	57.35	54.85	51.20
9.5	.3740	402095	60.20	1	4	1 3/4	5/8	7	-	-	-	-	-	-	-	
10.0	.3937	402100	68.20	1	4	1 3/4	5/8	7	9.602-10.389	98.40	78.35	71.70	68.40	65.10	62.25	58.45
10.5	.4134	402105	71.75	1	4	1 3/4	5/8	7	10.390-11.201	102.00	82.05	75.20	72.00	68.60	65.70	62.00
11.0	.4331	402110	71.75	1	4	1 3/4	5/8	7	-	-	-	-	-	-	-	
11.5	.4528	402115	73.35	1	4	1 3/4	5/8	7	11.202-11.989	103.50	83.60	76.75	73.55	70.15	67.35	63.55
12.0	.4724	402120	85.35	1	6	2	5/8	8	11.990-12.776	118.50	96.60	89.15	85.50	81.90	78.80	74.45
12.5	.4921	402125	85.35	1	6	2	5/8	8	-	-	-	-	-	-	-	
13.0	.5118	402130	90.95	1	6	2	5/8	8	12.777-13.564	124.25	102.15	94.75	91.15	87.55	84.40	80.10
13.5	.5315	402135	90.95	1	6	2	5/8	8	-	-	-	-	-	-	-	
14.0	.5512	402140	90.95	1	6	2	5/8	8	13.565-14.376	124.25	102.15	94.75	91.15	87.55	84.40	80.10
14.5	.5709	402145	94.65	1	6	2	5/8	8	14.377-15.164	127.85	105.85	98.40	94.90	91.15	88.00	83.80
15.0	.5906	402150	94.65	1	6	2	5/8	8	-	-	-	-	-	-	-	
15.5	.6102	402155	94.65	2	6	2 1/4	5/8	9	15.165-15.951	127.85	105.85	98.40	94.90	91.15	88.00	83.80
16.0	.6299	402160	96.10	2	6	2 1/4	5/8	9	15.952-16.739	129.40	107.20	99.95	96.35	92.60	89.50	85.30
16.5	.6496	402165	96.10	2	6	2 1/4	5/8	9	-	-	-	-	-	-	-	
17.0	.6693	402170	96.10	2	6	2 1/4	5/8	9	16.740-17.551	129.40	107.20	99.95	96.35	92.60	89.50	85.30
17.5	.6890	402175	96.10	2	6	2 1/4	5/8	9	-	-	-	-	-	-	-	
18.0	.7087	402180	99.75	2	6	2 1/4	5/8	9	17.552-18.339	133.10	110.95	103.70	100.00	96.35	93.25	89.05
18.5	.7283	402185	99.75	2	6	2 1/2	3/4	9 1/2	18.340-19.126	133.10	110.95	103.70	100.00	96.35	93.25	89.05
19.0	.7480	402190	99.75	2	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	
19.5	.7677	402195	102.50	2	6	2 1/2	3/4	9 1/2	19.127-19.914	135.65	113.55	106.25	102.65	99.00	95.80	91.60
20.0	.7874	402200	102.50	2	6	2 1/2	3/4	9 1/2	19.915-20.726	135.65	113.55	106.25	102.65	99.00	95.80	91.60
20.5	.8071	402205	102.50	2	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	
21.0	.8268	402210	106.25	2	6	2 1/2	3/4	9 1/2	20.727-21.514	139.55	117.50	110.00	106.40	102.70	99.60	95.40
21.5	.8465	402215	106.25	2	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	
22.0	.8661	402220	106.25	2	6	2 5/8	3/4	10	21.515-22.301	139.55	117.50	110.00	106.40	102.70	99.60	95.40
22.5	.8858	402225	126.65	2	6	2 5/8	3/4	10	22.302-23.089	161.20	138.30	130.65	126.80	122.95	119.70	115.40
23.0	.9055	402230	126.65	2	6	2 5/8	3/4	10	-	-	-	-	-	-	-	
23.5	.9252	402235	126.65	3	8	2 5/8	3/4	10	23.090-23.901	161.20	138.30	130.65	126.80	122.95	119.70	115.40
24.0	.9449	402240	131.25	3	8	2 5/8	3/4	10	23.902-24.689	165.95	143.05	135.20	131.50	127.65	124.45	120.05
24.5	.9646	402245	131.25	3	8	2 5/8	3/4	10	-	-	-	-	-	-	-	
25.0	.9843	402250	131.25	3	8	2 3/4	3/4	10 1/2	24.690-25.476	165.95	143.05	135.20	131.50	127.65	124.45	120.05
25.5	1.0039	402255	174.20	3	8	2 3/4	3/4	10 1/2	25.477-27.076	207.30	185.25	178.00	174.35	170.65	167.60	163.45
26.0	1.0236	402260	174.20	3	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	
27.0	1.0630	402270	174.20	3	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	
28.0	1.1024	402280	184.50	3	8	2 7/8	7/8	11	27.077-28.651	217.60	195.60	188.25	184.70	180.95	178.00	173.70
29.0	1.1417	402290	194.65	3	8	2 7/8	7/8	11	28.652-30.239	227.65	205.75	198.45	194.80	191.00	188.10	183.75
30.0	1.1811	402300	194.65	3	8	2 7/8	7/8	11	-	-	-	-	-	-	-	
31.0	1.2205	402310	214.65	4	8	3	7/8	11 1/2	30.240-31.826	247.70	225.85	218.45	214.75	211.05	208.00	203.80
32.0	1.2598	402320	230.25	4	8	3	7/8	11 1/2	31.827-33.414	263.30	241.45	234.00	230.40	226.75	223.60	219.50
33.0	1.2992	402330	230.25	4	8	3	7/8	11 1/2	-	-	-	-	-	-	-	
34.0	1.3386	402340	239.00	4	8	3 1/4	7/8	12	33.415-35.001	272.05	250.15	242.80	239.15	235.50	232.40	228.25
35.0	1.3780	402350	239.00	4	8	3 1/4	7/8	12	-	-	-	-	-	-	-	
36.0	1.4173	402360	243.60	4	8	3 1/4	7/8	12	35.002-36.589	276.80	254.75	247.50	243.90	240.20	237.10	232.85
37.0	1.4567	402370	255.10	4	8	3 1/2	7/8	12 1/2	36.590-38.176	288.20	266.25	258.80	255.30	251.60	248.50	244.40
38.0	1.4961	402380	255.10	4	8	3 1/2	7/8	12 1/2	-	-	-	-	-	-	-	
39.0	1.5354	402390	274.10	4	8	3 1/2	7/8	12 1/2	38.177-39.776	307.25	285.30	277.90	274.35	270.65	267.50	263.30
40.0	1.5748	402400	283.10	4	8	3 3/4	7/8	13	39.777-41.351	316.20	294.30	286.90	283.30	279.60	276.55	272.25
41.0	1.6142	402410	283.10	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	\$51.45	1 1/64	4	1 1/2	6	0.1770-0.2040	\$92.70	\$72.05	\$65.30	\$61.90	\$58.30	\$55.50	
7/32	.2188	45007	51.45	1 3/64	4	1 1/2	6	0.2041-0.2210	92.70	72.05	65.30	61.90	58.30	55.50	
15/64	.2344	4502344	51.45	7/32	4	1 1/2	6	0.2211-0.2380	92.70	72.05	65.30	61.90	58.30	55.50	
1/4	.2500	45008	51.45	15/64	4	1 1/2	6	0.2381-0.2530	92.70	72.05	65.30	61.90	58.30	55.50	
9/32	.2812	45009	52.65	15/64	4	1 1/2	6	0.2531-0.2840	93.85	73.15	66.25	62.95	59.35	56.65	
5/16	.3125	45010	52.65	9/32	4	1 1/2	6	0.2841-0.3150	93.85	73.15	66.25	62.95	59.35	56.65	
11/32	.3438	45011	54.45	9/32	4	1 1/2	6	0.3151-0.3470	95.75	75.15	68.10	64.90	61.35	58.55	
3/8	.3750	45012	54.45	5/16	4	1 3/4	7	0.3471-0.3780	95.75	75.15	68.10	64.90	61.35	58.55	
13/32	.4062	45013	57.25	5/16	4	1 3/4	7	0.3781-0.4090	98.40	77.85	70.90	67.65	64.05	61.25	
7/16	.4375	45014	61.90	3/8	4	1 3/4	7	0.4091-0.4410	103.15	82.40	75.50	72.30	68.70	65.95	
15/32	.4688	45015	66.80	3/8	4	1 3/4	7	0.4411-0.4720	108.10	87.55	80.45	77.15	73.65	70.90	
1/2	.5000	45016	71.55	7/16	6	2	8	0.4721-0.5030	115.80	93.65	86.35	82.75	79.00	75.85	
17/32	.5312	45017	73.60	7/16	6	2	8	0.5031-0.5340	117.85	95.70	88.30	84.65	80.90	77.90	
9/16	.5625	45018	73.60	7/16	6	2	8	0.5341-0.5660	117.85	95.70	88.30	84.65	80.90	77.90	
19/32	.5938	45019	76.50	7/16	6	2	8	0.5661-0.5970	120.70	98.45	91.15	87.70	83.80	80.85	
5/8	.6250	45020	76.50	9/16	6	2	9	0.5971-0.6280	120.70	98.45	91.15	87.70	83.80	80.85	
21/32	.6562	45021	77.85	9/16	6	2	9	0.6281-0.6590	122.05	99.95	92.55	89.05	85.15	82.20	
11/16	.6875	45022	77.85	9/16	6	2	9	0.6591-0.6910	122.05	99.95	92.55	89.05	85.15	82.20	
23/32	.7188	45023	81.45	9/16	6	2	9	0.6911-0.7220	125.60	103.50	96.10	92.60	88.80	85.75	
3/4	.7500	45024	81.45	5/8	6	2	9 1/2	0.7221-0.7530	125.60	103.50	96.10	92.60	88.80	85.75	
25/32	.7812	45025	84.25	5/8	6	2	9 1/2	0.7531-0.7840	128.40	106.35	99.00	95.40	91.60	88.60	
13/16	.8125	45026	84.25	5/8	6	2	9 1/2	0.7841-0.8160	128.40	106.35	99.00	95.40	91.60	88.60	
27/32	.8438	45027	87.70	5/8	6	2	9 1/2	0.8161-0.8470	131.85	109.60	102.20	98.70	95.00	91.90	
7/8	.8750	45028	90.95	3/4	6	2 1/4	10	0.8471-0.8780	136.80	113.90	106.15	102.45	98.45	95.40	
29/32	.9062	45029	105.85	3/4	6	2 1/4	10	0.8781-0.9090	151.70	128.75	121.00	117.40	113.45	110.30	
15/16	.9375	45030	105.85	3/4	8	2 1/4	10	0.9091-0.9410	151.70	128.75	121.00	117.40	113.45	110.30	
31/32	.9688	45031	110.85	3/4	8	2 1/4	10	0.9411-0.9720	156.75	133.80	126.15	122.45	118.50	115.40	
1	1.0000	45032	110.85	7/8	8	2 1/4	10 1/2	0.9721-1.0030	156.75	133.80	126.15	122.45	118.50	115.40	
1 1/16	1.0625	45034	114.75	7/8	8	2 1/4	10 1/2	1.0031-1.0660	158.75	136.65	129.35	125.75	122.05	119.05	
1 1/8	1.1250	45036	124.20	7/8	8	2 1/4	11	1.0661-1.1280	168.10	146.20	138.75	135.20	131.40	128.40	
1 3/16	1.1875	45038	129.90	1	8	2 1/4	11	1.1281-1.1905	173.85	151.85	144.50	140.95	137.15	134.25	
1 1/4	1.2500	45040	151.70	1	8	2 1/2	11 1/2	1.1906-1.2530	195.60	173.65	166.20	162.70	158.90	155.95	
1 5/16	1.3125	45042	151.70	1	8	2 1/2	11 1/2	1.2531-1.3155	195.60	173.65	166.20	162.70	158.90	155.95	
1 3/8	1.3750	45044	153.90	1	8	2 1/2	12	1.3156-1.3780	197.85	175.90	168.45	164.95	161.20	158.15	
1 7/16	1.4375	45046	170.05	1 1/4	8	2 1/2	12	1.3781-1.4405	214.05	191.85	184.65	181.10	177.35	174.35	
1 1/2	1.5000	45048	204.10	1 1/4	8	2 1/2	12 1/2	1.4406-1.5030	248.10	226.00	218.70	215.20	211.40	208.50	
1 9/16	1.5625	45050	269.45	1 1/4	8	2 1/2	12 1/2	1.5031-1.5660	313.40	291.35	284.00	280.50	276.75	273.80	
1 5/8	1.6250	45052	278.65	1 1/4	8	2 3/4	13	1.5661-1.6280	322.60	300.45	293.15	289.75	285.90	282.95	
1 11/16	1.6875	45054	305.85	1 1/4	8	2 3/4	13	1.6281-1.6910	349.90	327.95	320.60	317.00	313.25	310.35	
1 3/4	1.7500	45056	305.85	1 1/4	10	3	13 1/2	1.6911-1.7530	349.90	327.95	320.60	317.00	313.25	310.35	
1 13/16	1.8125	45058	313.00	1 1/2	10	3	13 1/2	1.7531-1.8160	357.10	335.05	327.55	324.15	320.35	317.40	
1 7/8	1.8750	45060	328.25	1 1/2	10	3 1/4	14	1.8161-1.8780	372.20	350.20	342.90	339.35	335.50	332.60	
1 15/16	1.9375	45062	348.10	1 1/2	10	3 1/4	14	1.8781-1.9410	392.00	369.90	362.60	359.10	355.35	352.35	
2	2.0000	45064	348.10	1 1/2	12	3 1/4	14	1.9411-2.0030	392.00	369.90	362.60	359.10	355.35	352.35	

*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	\$65.30	1/64	4	1 1/2	6	4.494-5.182	\$96.30	\$75.65	\$68.70	\$65.35	\$61.90	\$59.00	\$55.05
5.0	.1969	450050	65.30	1/64	4	1 1/2	6	-	-	-	-	-	-	-	-
5.5	.2165	450055	65.30	13/64	4	1 1/2	6	5.183-5.613	96.30	75.65	68.70	65.35	61.90	59.00	55.05
6.0	.2362	450060	65.30	7/32	4	1 1/2	6	5.614-6.045	96.30	75.65	68.70	65.35	61.90	59.00	55.05
6.3	.2480	450063	65.30	15/64	4	1 1/2	6	6.046-6.426	96.30	75.65	68.70	65.35	61.90	59.00	55.05
6.5	.2559	450065	66.25	15/64	4	1 1/2	6	6.427-7.214	97.20	76.70	69.75	66.40	62.95	60.00	56.15
7.0	.2756	450070	66.25	15/64	4	1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	450075	66.25	9/32	4	1 1/2	6	7.215-8.001	97.20	76.70	69.75	66.40	62.95	60.00	56.15
8.0	.3150	450080	66.25	9/32	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	450085	68.10	9/32	4	1 1/2	6	8.002-8.814	99.20	78.70	71.70	68.35	64.90	62.05	58.05
9.0	.3543	450090	68.10	5/16	4	1 3/4	7	8.815-9.601	99.20	78.70	71.70	68.35	64.90	62.05	58.05
9.5	.3740	450095	68.10	5/16	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	450100	70.90	5/16	4	1 3/4	7	9.602-10.389	101.95	81.40	74.40	71.05	67.65	64.75	60.75
10.5	.4134	450105	75.50	3/8	4	1 3/4	7	10.390-11.201	106.65	85.90	79.05	75.70	72.30	69.35	65.40
11.0	.4331	450110	75.50	3/8	4	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	450115	80.45	3/8	4	1 3/4	7	11.202-11.989	111.55	90.95	84.10	80.75	77.15	74.30	70.35
12.0	.4724	450120	86.35	7/16	6	2	8	11.990-12.776	119.50	97.50	90.05	86.45	82.75	79.65	75.40
12.5	.4921	450125	86.35	7/16	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	450130	88.30	7/16	6	2	8	12.777-13.564	121.55	99.45	92.05	88.40	84.65	81.60	77.40
13.5	.5315	450135	88.30	7/16	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	450140	88.30	7/16	6	2	8	13.565-14.376	121.55	99.45	92.05	88.40	84.65	81.60	77.40
14.5	.5709	450145	91.15	7/16	6	2	8	14.377-15.164	124.40	102.30	95.00	91.30	87.70	84.50	80.30
15.0	.5906	450150	91.15	7/16	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	450155	91.15	9/16	6	2	9	15.165-15.951	124.40	102.30	95.00	91.30	87.70	84.50	80.30
16.0	.6299	450160	92.55	9/16	6	2	9	15.952-16.739	125.65	103.75	96.35	92.65	89.05	85.85	81.60
16.5	.6496	450165	92.55	9/16	6	2	9	-	-	-	-	-	-	-	-
17.0	.6693	450170	92.55	9/16	6	2	9	16.740-17.551	125.65	103.75	96.35	92.65	89.05	85.85	81.60
17.5	.6890	450175	92.55	9/16	6	2	9	-	-	-	-	-	-	-	-
18.0	.7087	450180	96.10	9/16	6	2	9	17.552-18.339	129.40	107.20	99.95	96.35	92.60	89.50	85.30
18.5	.7283	450185	96.10	5/8	6	2	9 1/2	18.340-19.126	129.40	107.20	99.95	96.35	92.60	89.50	85.30
19.0	.7480	450190	96.10	5/8	6	2	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	450195	99.00	5/8	6	2	9 1/2	19.127-19.914	132.15	110.20	102.70	99.10	95.40	92.30	88.00
20.0	.7874	450200	99.00	5/8	6	2	9 1/2	19.915-20.726	132.15	110.20	102.70	99.10	95.40	92.30	88.00
20.5	.8071	450205	99.00	5/8	6	2	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	450210	102.20	5/8	6	2	9 1/2	20.727-21.514	135.55	113.45	106.05	102.50	98.70	95.70	91.35
21.5	.8465	450215	102.20	5/8	6	2	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	450220	102.20	3/4	6	2 1/4	10	21.515-22.301	135.55	113.45	106.05	102.50	98.70	95.70	91.35
22.5	.8858	450225	121.00	3/4	6	2 1/4	10	22.302-23.089	155.55	132.70	125.00	121.20	117.40	114.10	109.65
23.0	.9055	450230	121.00	3/4	6	2 1/4	10	-	-	-	-	-	-	-	-
23.5	.9252	450235	121.00	3/4	8	2 1/4	10	23.090-23.901	155.55	132.70	125.00	121.20	117.40	114.10	109.65
24.0	.9449	450240	126.15	3/4	8	2 1/4	10	23.902-24.689	160.55	137.75	130.00	126.25	122.45	119.30	114.90
24.5	.9646	450245	126.15	3/4	8	2 1/4	10	-	-	-	-	-	-	-	-
25.0	.9843	450250	126.15	7/8	8	2 1/4	10 1/2	24.690-25.476	160.55	137.75	130.00	126.25	122.45	119.30	114.90
25.5	1.0039	450255	129.35	7/8	8	2 1/4	10 1/2	25.477-27.076	162.40	140.50	133.10	129.50	125.75	122.75	118.50
26.0	1.0236	450260	129.35	7/8	8	2 1/4	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	450270	129.35	7/8	8	2 1/4	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	450280	138.75	7/8	8	2 1/4	11	27.077-28.651	171.85	149.90	142.45	138.95	135.20	132.15	127.85
29.0	1.1417	450290	144.50	1	8	2 1/4	11	28.652-30.239	177.50	155.70	148.25	144.60	140.95	137.90	133.75
30.0	1.1811	450300	144.50	1	8	2 1/4	11	-	-	-	-	-	-	-	-
31.0	1.2205	450310	166.20	1	8	2 1/2	11 1/2	30.240-31.826	199.35	177.40	170.05	166.55	162.70	159.55	155.45
32.0	1.2598	450320	166.20	1	8	2 1/2	11 1/2	31.827-33.414	199.35	177.40	170.05	166.55	162.70	159.55	155.45
33.0	1.2992	450330	166.20	1	8	2 1/2	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	450340	168.45	1	8	2 1/2	12	33.415-35.001	201.65	179.65	172.25	168.70	164.95	161.95	157.75
35.0	1.3780	450350	168.45	1	8	2 1/2	12	-	-	-	-	-	-	-	-
36.0	1.4173	450360	184.65	1 1/4	8	2 1/2	12	35.002-36.589	217.65	195.80	188.35	184.75	181.10	178.05	173.75
37.0	1.4567	450370	218.70	1 1/4	8	2 1/2	12 1/2	36.590-38.176	251.70	229.80	222.45	218.85	215.20	212.10	207.85
38.0	1.4961	450380	218.70	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	\$27.55	.0580	8040580	\$28.35	.0880	8040880	\$28.55	.1180	8041180	\$32.25	.1480	8041480	\$35.50
.0285	8040285	29.10	.0585	8040585	28.35	.0885	8040885	28.55	.1185	8041185	32.35	.1485	8041485	35.50
.0290	8040290	29.10	.0590	8040590	24.70	.0890	8040890	27.65	.1190	8041190	32.35	.1490	8041490	35.50
.0295	8040295	27.55	.0595	8040595	26.05	.0895	8040895	29.25	.1195	8041195	32.35	.1495	8041495	33.75
.0300	8040300	29.10	.0600	8040600	28.20	.0900	8040900	29.25	.1200	8041200	30.75	.1500	8041500	35.50
.0305	8040305	29.10	.0605	8040605	28.20	.0905	8040905	29.25	.1205	8041205	32.35	.1505	8041505	35.50
.0310	8040310	27.55	.0610	8040610	26.70	.0910	8040910	29.40	.1210	8041210	32.35	.1510	8041510	35.50
.0315	804008	27.55	.0615	8040615	28.20	.0915	8040915	29.40	.1215	8041215	32.35	.1515	8041515	35.50
.0320	8040320	27.55	.0620	8040620	28.20	.0920	8040920	29.40	.1220	804031	30.75	.1520	8041520	33.75
.0325	8040325	29.10	.0625	80404	24.55	.0925	8040925	27.75	.1225	8041225	32.35	.1525	8041525	37.05
.0330	8040330	27.55	.0630	804016	26.70	.0930	8040930	29.40	.1230	8041230	32.35	.1530	8041530	37.05
.0335	8040335	27.55	.0635	8040635	26.70	.0935	8040935	27.75	.1235	8041235	32.35	.1535	804039	35.20
.0340	8040340	28.10	.0640	8040640	28.20	.0940	8040940	29.40	.1240	8041240	32.35	.1540	8041540	35.20
.0345	8040345	28.10	.0645	8040645	28.20	.0945	804024	27.75	.1245	8041245	32.35	.1545	8041545	37.05
.0350	8040350	26.75	.0650	8040650	28.35	.0950	8040950	29.70	.1250	80408	28.35	.1550	8041550	37.05
.0355	8040355	28.10	.0655	8040655	28.35	.0955	8040955	29.70	.1255	8041255	32.35	.1555	8041555	35.20
.0360	8040360	26.75	.0660	8040660	28.35	.0960	8040960	28.35	.1260	804032	30.75	.1560	8041560	37.05
.0365	8040365	28.10	.0665	8040665	28.35	.0965	8040965	28.35	.1265	8041265	32.45	.1565	8041565	38.35
.0370	8040370	26.75	.0670	8040670	27.00	.0970	8040970	29.70	.1270	8041270	32.45	.1570	8041570	36.40
.0375	8040375	28.10	.0675	8040675	28.35	.0975	8040975	29.70	.1275	8041275	32.45	.1575	804040	33.25
.0380	8040380	26.75	.0680	8040680	28.35	.0980	8040980	28.35	.1280	8041280	30.80	.1580	8041580	39.15
.0385	8040385	28.10	.0685	8040685	28.35	.0985	8040985	29.95	.1285	8041285	30.80	.1585	8041585	39.15
.0390	8040390	26.75	.0690	8040690	28.35	.0990	8040990	29.95	.1290	8041290	32.45	.1590	8041590	37.30
.0395	8040395	28.10	.0695	8040695	28.35	.0995	8040995	28.55	.1295	8041295	32.45	.1595	8041595	39.80
.0400	8040400	26.75	.0700	8040700	27.00	.1000	8041000	29.95	.1300	8041300	32.45	.1600	8041600	39.80
.0405	8040405	28.10	.0705	8040705	28.35	.1005	8041005	29.95	.1305	8041305	32.45	.1605	8041605	39.80
.0410	8040410	26.75	.0710	8040710	28.35	.1010	8041010	29.95	.1310	8041310	32.45	.1610	8041610	37.80
.0415	8040415	28.10	.0715	8040715	28.35	.1015	8041015	28.55	.1315	8041315	32.45	.1615	8041615	39.80
.0420	8040420	26.75	.0720	8040720	28.35	.1020	8041020	30.25	.1320	8041320	32.45	.1620	8041620	39.80
.0425	8040425	28.10	.0725	8040725	28.35	.1025	8041025	30.35	.1325	8041325	32.45	.1625	8041625	39.80
.0430	8040430	26.75	.0730	8040730	27.00	.1030	8041030	30.35	.1330	8041330	32.45	.1630	8041630	39.80
.0435	8040435	28.35	.0735	8040735	28.35	.1035	8041035	30.35	.1335	8041335	32.45	.1635	8041635	39.90
.0440	8040440	28.35	.0740	8040740	28.35	.1040	8041040	30.35	.1340	8041340	32.45	.1640	8041640	39.80
.0445	8040445	28.35	.0745	8040745	28.35	.1045	8041045	30.35	.1345	8041345	32.45	.1645	8041645	39.80
.0450	8040450	28.35	.0750	8040750	28.35	.1050	8041050	30.35	.1350	8041350	32.45	.1650	8041650	39.80
.0455	8040455	28.35	.0755	8040755	28.35	.1055	8041055	30.35	.1355	8041355	32.45	.1655	8041655	39.80
.0460	8040460	28.35	.0760	8040760	27.00	.1060	8041060	30.35	.1360	8041360	30.80	.1660	8041660	38.00
.0465	8040465	26.90	.0765	8040765	28.35	.1065	8041065	28.85	.1365	8041365	32.45	.1665	8041665	40.30
.0470	8040470	28.35	.0770	8040770	28.35	.1070	8041070	30.80	.1370	8041370	32.45	.1670	8041670	40.30
.0475	8040475	28.35	.0775	8040775	28.35	.1075	8041075	30.80	.1375	8041375	32.45	.1675	8041675	40.30
.0480	8040480	28.35	.0780	8040780	28.35	.1080	8041080	30.80	.1380	8041380	33.05	.1680	8041680	40.30
.0485	8040485	28.35	.0785	8040785	27.05	.1085	8041085	31.20	.1385	8041385	33.05	.1685	8041685	40.30
.0490	8040490	28.35	.0790	8040790	28.45	.1090	8041090	31.20	.1390	8041390	33.05	.1690	8041690	40.30
.0495	8040495	28.35	.0795	8040795	28.45	.1095	8041095	31.20	.1395	8041395	33.05	.1695	8041695	38.40
.0500	8040500	28.35	.0800	8040800	28.45	.1100	8041100	29.70	.1400	8041400	33.05	.1700	8041700	41.15
.0505	8040505	28.35	.0805	8040805	28.45	.1105	8041105	31.65	.1405	8041405	31.20	.1705	8041705	41.15
.0510	8040510	28.35	.0810	8040810	27.05	.1110	8041110	30.25	.1410	8041410	34.30	.1710	8041710	41.15
.0515	8040515	28.35	.0815	8040815	28.55	.1115	8041115	32.25	.1415	8041415	34.30	.1715	8041715	41.15
.0520	8040520	26.90	.0820	8040820	27.20	.1120	8041120	32.25	.1420	8041420	34.30	.1720	8041720	41.15
.0525	8040525	28.35	.0825	8040825	28.55	.1125	8041125	32.25	.1425	8041425	34.30	.1725	8041725	41.15
.0530	8040530	28.35	.0830	8040830	28.55	.1130	8041130	30.60	.1430	8041430	34.30	.1730	8041730	39.15
.0535	8040535	28.35	.0835	8040835	28.55	.1135	8041135	32.25	.1435	8041435	34.30	.1735	8041735	41.75
.0540	8040540	28.35	.0840	8040840	28.55	.1140	8041140	32.25	.1440	8041440	32.60	.1740	8041740	41.75
.0545	8040545	28.35	.0845	8040845	28.55	.1145	8041145	32.25	.1445	8041445	34.45	.1745	8041745	41.75
.0550	8040550	26.90	.0850	8040850	28.55	.1150	8041150	32.25	.1450	8041450	34.50	.1750	8041750	41.75
.0555	8040555	28.35	.0855	8040855	28.55	.1155	8041155	32.25	.1455	8041455	34.50	.1755	8041755	42.15
.0560	8040560	28.35	.0860	8040860	27.20	.1160	8041160	30.60	.1460	8041460	35.40	.1760	8041760	42.15
.0565	8040565	28.35	.0865	8040865	28.55	.1165	8041165	32.25	.1465	8041465	35.40	.1765	8041765	42.15
.0570	8040570	28.35	.0870	8040870	28.55	.1170	8041170	32.25	.1470	8041470	33.60	-	-	-
.0575	8040575	28.35	.0875	8040875	28.55	.1175	8041175	32.25	.1475	8041475	35.40	-	-	-

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	\$65.30	.2070	4502070	\$65.30	.2370	4502370	\$65.30	.2670	4502670	\$66.25	.2970	4502970	\$66.25
.1775	4501775	65.30	.2075	4502075	65.30	.2375	4502375	65.30	.2675	4502675	66.25	.2975	4502975	66.25
.1780	4501780	65.30	.2080	4502080	65.30	.2380	4502380	65.30	.2680	4502680	66.25	.2980	4502980	66.25
.1785	4501785	65.30	.2085	4502085	65.30	.2385	4502385	65.30	.2685	4502685	66.25	.2985	4502985	66.25
.1790	4501790	65.30	.2090	4502090	65.30	.2390	4502390	65.30	.2690	4502690	66.25	.2990	4502990	66.25
.1795	4501795	65.30	.2095	4502095	65.30	.2395	4502395	65.30	.2695	4502695	66.25	.2995	4502995	66.25
.1800	4501800	65.30	.2100	4502100	65.30	.2400	4502400	65.30	.2700	4502700	66.25	.3000	4503000	66.25
.1805	4501805	65.30	.2105	4502105	65.30	.2405	4502405	65.30	.2705	4502705	66.25	.3005	4503005	66.25
.1810	4501810	65.30	.2110	4502110	65.30	.2410	4502410	65.30	.2710	4502710	66.25	.3010	4503010	66.25
.1815	4501815	65.30	.2115	4502115	65.30	.2415	4502415	65.30	.2715	4502715	66.25	.3015	4503015	66.25
.1820	4501820	65.30	.2120	4502120	65.30	.2420	4502420	65.30	.2720	4502720	66.25	.3020	4503020	66.25
.1825	4501825	65.30	.2125	4502125	65.30	.2425	4502425	65.30	.2725	4502725	66.25	.3025	4503025	66.25
.1830	4501830	65.30	.2130	4502130	65.30	.2430	4502430	65.30	.2730	4502730	66.25	.3030	4503030	66.25
.1835	4501835	65.30	.2135	4502135	65.30	.2435	4502435	65.30	.2735	4502735	66.25	.3035	4503035	66.25
.1840	4501840	65.30	.2140	4502140	65.30	.2440	4502440	65.30	.2740	4502740	66.25	.3040	4503040	66.25
.1845	4501845	65.30	.2145	4502145	65.30	.2445	4502445	65.30	.2745	4502745	66.25	.3045	4503045	66.25
.1850	450047	65.30	.2150	4502150	65.30	.2450	4502450	65.30	.2750	4502750	66.25	.3050	4503050	66.25
.1855	4501855	65.30	.2155	4502155	65.30	.2455	4502455	65.30	.2755	4502755	66.25	.3055	4503055	66.25
.1860	4501860	65.30	.2160	4502160	65.30	.2460	4502460	65.30	.2760	4502760	66.25	.3060	4503060	66.25
.1865	4501865	65.30	.2165	450055	65.30	.2465	4502465	65.30	.2765	4502765	66.25	.3065	4503065	66.25
.1870	4501870	65.30	.2170	4502170	65.30	.2470	4502470	65.30	.2770	4502770	66.25	.3070	4503070	66.25
.1875	450006	51.45	.2175	4502175	65.30	.2475	4502475	65.30	.2775	4502775	66.25	.3075	4503075	66.25
.1880	4501880	65.30	.2180	4502180	65.30	.2480	450063	65.30	.2780	4502780	66.25	.3080	4503080	66.25
.1885	4501885	65.30	.2185	4502185	65.30	.2485	4502485	65.30	.2785	4502785	66.25	.3085	4503085	66.25
.1890	450048	65.30	.2190	4502190	65.30	.2490	4502490	65.30	.2790	4502790	66.25	.3090	4503090	66.25
.1895	4501895	65.30	.2195	4502195	65.30	.2495	4502495	65.30	.2795	450071	66.25	.3095	4503095	66.25
.1900	4501900	65.30	.2200	4502200	65.30	.2500	450008	51.45	.2800	4502800	66.25	.3100	4503100	66.25
.1905	4501905	65.30	.2205	450056	65.30	.2505	4502505	65.30	.2805	4502805	66.25	.3105	4503105	66.25
.1910	4501910	65.30	.2210	4502210	65.30	.2510	4502510	65.30	.2810	4502810	66.25	.3110	450079	66.25
.1915	4501915	65.30	.2215	4502215	65.30	.2515	4502515	65.30	.2815	4502815	66.25	.3115	4503115	66.25
.1920	4501920	65.30	.2220	4502220	65.30	.2520	450064	65.30	.2820	4502820	66.25	.3120	4503120	66.25
.1925	4501925	65.30	.2225	4502225	65.30	.2525	4502525	65.30	.2825	4502825	66.25	.3125	45010	52.65
.1930	4501930	65.30	.2230	4502230	65.30	.2530	4502530	65.30	.2830	4502830	66.25	.3130	4503130	66.25
.1935	4501935	65.30	.2235	4502235	65.30	.2535	4502535	66.25	.2835	450072	66.25	.3135	4503135	66.25
.1940	4501940	65.30	.2240	4502240	65.30	.2540	4502540	66.25	.2840	4502840	66.25	.3140	4503140	66.25
.1945	4501945	65.30	.2245	4502245	65.30	.2545	4502545	66.25	.2845	4502845	66.25	.3145	4503145	66.25
.1950	4501950	65.30	.2250	4502250	65.30	.2550	4502550	66.25	.2850	4502850	66.25	.3150	450080	66.25
.1955	4501955	65.30	.2255	4502255	65.30	.2555	4502555	66.25	.2855	4502855	66.25	.3155	4503155	68.10
.1960	4501960	65.30	.2260	4502260	65.30	.2560	4502560	66.25	.2860	4502860	66.25	.3160	4503160	68.10
.1965	4501965	65.30	.2265	4502265	65.30	.2565	4502565	66.25	.2865	4502865	66.25	.3165	4503165	68.10
.1970	4501970	65.30	.2270	4502270	65.30	.2570	4502570	66.25	.2870	4502870	66.25	.3170	4503170	68.10
.1975	4501975	65.30	.2275	4502275	65.30	.2575	4502575	66.25	.2875	4502875	66.25	.3175	4503175	68.10
.1980	4501980	65.30	.2280	4502280	65.30	.2580	4502580	66.25	.2880	4502880	66.25	.3180	4503180	68.10
.1985	4501985	65.30	.2285	4502285	65.30	.2585	4502585	66.25	.2885	4502885	66.25	.3185	4503185	68.10
.1990	4501990	65.30	.2290	4502290	65.30	.2590	4502590	66.25	.2890	4502890	66.25	.3190	4503190	68.10
.1995	4501995	65.30	.2295	4502295	65.30	.2595	4502595	66.25	.2895	4502895	66.25	.3195	4503195	68.10
.2000	4502000	65.30	.2300	4502300	65.30	.2600	4502600	66.25	.2900	4502900	66.25	.3200	4503200	68.10
.2005	4502005	65.30	.2305	4502305	65.30	.2605	4502605	66.25	.2905	4502905	66.25	.3205	4503205	68.10
.2010	4502010	65.30	.2310	4502310	65.30	.2610	4502610	66.25	.2910	4502910	66.25	.3210	4503210	68.10
.2015	4502015	65.30	.2315	4502315	65.30	.2615	4502615	66.25	.2915	4502915	66.25	.3215	4503215	68.10
.2020	4502020	65.30	.2320	4502320	65.30	.2620	4502620	66.25	.2920	4502920	66.25	.3220	4503220	68.10
.2025	4502025	65.30	.2325	4502325	65.30	.2625	4502625	66.25	.2925	4502925	66.25	.3225	4503225	68.10
.2030	4502030	65.30	.2330	4502330	65.30	.2630	4502630	66.25	.2930	4502930	66.25	.3230	4503230	68.10
.2035	4502035	65.30	.2335	4502335	65.30	.2635	4502635	66.25	.2935	4502935	66.25	.3235	4503235	68.10
.2040	4502040	65.30	.2340	4502340	65.30	.2640	4502640	66.25	.2940	4502940	66.25	.3240	4503240	68.10
.2045	4502045	65.30	.2345	4502345	65.30	.2645	4502645	66.25	.2945	4502945	66.25	.3245	4503245	68.10
.2050	4502050	65.30	.2350	4502350	65.30	.2650	4502650	66.25	.2950	4502950	66.25	.3250	4503250	68.10
.2055	4502055	65.30	.2355	4502355	65.30	.2655	4502655	66.25	.2955	4502955	66.25	.3255	4503255	68.10
.2060	4502060	65.30	.2360	4502360	65.30	.2660	4502660	66.25	.2960	4502960	66.25	.3260	4503260	68.10
.2065	4502065	65.30	.2365	4502365	65.30	.2665	4502665	66.25	.2965	4502965	66.25	.3265	4503265	68.10

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	\$68.10	.3570	4503570	\$68.10	.3870	4503870	\$70.90	.4170	4504170	\$75.50	.4470	4504470	\$80.55
.3275	4503275	68.10	.3575	4503575	68.10	.3875	4503875	70.90	.4175	4504175	75.50	.4475	4504475	80.55
.3280	4503280	68.10	.3580	4503580	68.10	.3880	4503880	70.90	.4180	4504180	75.50	.4480	4504480	80.55
.3285	4503285	68.10	.3585	4503585	68.10	.3885	4503885	70.90	.4185	4504185	75.50	.4485	4504485	80.55
.3290	4503290	68.10	.3590	4503590	68.10	.3890	4503890	70.90	.4190	4504190	75.50	.4490	4504490	80.55
.3295	4503295	68.10	.3595	4503595	68.10	.3895	4503895	70.90	.4195	4504195	75.50	.4495	4504495	80.55
.3300	4503300	68.10	.3600	4503600	68.10	.3900	4503900	70.90	.4200	4504200	75.50	.4500	4504500	80.55
.3305	4503305	68.10	.3605	4503605	68.10	.3905	4503905	70.90	.4205	4504205	75.50	.4505	4504505	80.55
.3310	4503310	68.10	.3610	4503610	68.10	.3910	4503910	70.90	.4210	4504210	75.50	.4510	4504510	80.55
.3315	4503315	68.10	.3615	4503615	68.10	.3915	4503915	70.90	.4215	4504215	75.50	.4515	4504515	80.55
.3320	4503320	68.10	.3620	4503620	68.10	.3920	4503920	70.90	.4220	4504220	75.50	.4520	4504520	80.55
.3325	4503325	68.10	.3625	4503625	68.10	.3925	4503925	70.90	.4225	4504225	75.50	.4525	4504525	80.55
.3330	4503330	68.10	.3630	4503630	68.10	.3930	4503930	70.90	.4230	4504230	75.50	.4530	4504530	80.55
.3335	4503335	68.10	.3635	4503635	68.10	.3935	4503935	70.90	.4235	4504235	75.50	.4535	4504535	80.55
.3340	4503340	68.10	.3640	4503640	68.10	.3940	4503940	70.90	.4240	4504240	75.50	.4540	4504540	80.55
.3345	4503345	68.10	.3645	4503645	68.10	.3945	4503945	70.90	.4245	4504245	75.50	.4545	4504545	80.55
.3350	4503350	68.10	.3650	4503650	68.10	.3950	4503950	70.90	.4250	4504250	75.50	.4550	4504550	80.55
.3355	4503355	68.10	.3655	4503655	68.10	.3955	4503955	70.90	.4255	4504255	75.50	.4555	4504555	80.55
.3360	4503360	68.10	.3660	4503660	68.10	.3960	4503960	70.90	.4260	4504260	75.50	.4560	4504560	80.55
.3365	4503365	68.10	.3665	4503665	68.10	.3965	4503965	70.90	.4265	4504265	75.50	.4565	4504565	80.55
.3370	4503370	68.10	.3670	4503670	68.10	.3970	4503970	70.90	.4270	4504270	75.50	.4570	4504570	80.55
.3375	4503375	68.10	.3675	4503675	68.10	.3975	4503975	70.90	.4275	4504275	75.50	.4575	4504575	80.55
.3380	4503380	68.10	.3680	4503680	68.10	.3980	4503980	70.90	.4280	4504280	75.50	.4580	4504580	80.55
.3385	4503385	68.10	.3685	4503685	68.10	.3985	4503985	70.90	.4285	4504285	75.50	.4585	4504585	80.55
.3390	4503390	68.10	.3690	4503690	68.10	.3990	4503990	70.90	.4290	4504290	75.50	.4590	4504590	80.55
.3395	4503395	68.10	.3695	4503695	68.10	.3995	4503995	70.90	.4295	4504295	75.50	.4595	4504595	80.55
.3400	4503400	68.10	.3700	4503700	68.10	.4000	4504000	70.90	.4300	4504300	75.50	.4600	4504600	80.55
.3405	4503405	68.10	.3705	4503705	68.10	.4005	4504005	70.90	.4305	4504305	75.50	.4605	4504605	80.55
.3410	4503410	68.10	.3710	4503710	68.10	.4010	4504010	70.90	.4310	4504310	75.50	.4610	4504610	80.55
.3415	4503415	68.10	.3715	4503715	68.10	.4015	4504015	70.90	.4315	4504315	75.50	.4615	4504615	80.55
.3420	4503420	68.10	.3720	4503720	68.10	.4020	4504020	70.90	.4320	4504320	75.50	.4620	4504620	80.55
.3425	450087	68.10	.3725	4503725	68.10	.4025	4504025	70.90	.4325	4504325	75.50	.4625	4504625	80.55
.3430	4503430	68.10	.3730	4503730	68.10	.4030	4504030	70.90	.4330	4504330	75.50	.4630	4504630	80.55
.3435	4503435	68.10	.3735	4503735	68.10	.4035	4504035	70.90	.4335	4504335	75.50	.4635	4504635	80.55
.3440	4503440	68.10	.3740	450095	68.10	.4040	4504040	70.90	.4340	4504340	75.50	.4640	4504640	80.55
.3445	4503445	68.10	.3745	4503745	68.10	.4045	4504045	70.90	.4345	4504345	75.50	.4645	4504645	80.55
.3450	4503450	68.10	.3750	45012	54.45	.4050	4504050	70.90	.4350	4504350	75.50	.4650	4504650	80.55
.3455	4503455	68.10	.3755	4503755	68.10	.4055	450103	70.90	.4355	4504355	75.50	.4655	4504655	80.55
.3460	4503460	68.10	.3760	4503760	68.10	.4060	4504060	70.90	.4360	4504360	75.50	.4660	4504660	80.55
.3465	450088	68.10	.3765	4503765	68.10	.4065	4504065	70.90	.4365	4504365	75.50	.4665	4504665	80.55
.3470	4503470	68.10	.3770	4503770	68.10	.4070	4504070	70.90	.4370	450111	75.50	.4670	4504670	80.55
.3475	4503475	68.10	.3775	4503775	68.10	.4075	4504075	70.90	.4375	45014	61.90	.4675	4504675	80.55
.3480	4503480	68.10	.3780	450096	68.10	.4080	4504080	70.90	.4380	4504380	75.50	.4680	4504680	80.55
.3485	4503485	68.10	.3785	4503785	70.90	.4085	4504085	70.90	.4385	4504385	75.50	.4685	450119	80.55
.3490	4503490	68.10	.3790	4503790	70.90	.4090	4504090	70.90	.4390	4504390	75.50	.4690	4504690	80.55
.3495	4503495	68.10	.3795	4503795	70.90	.4095	4504095	75.50	.4395	4504395	75.50	.4695	4504695	80.55
.3500	4503500	68.10	.3800	4503800	70.90	.4100	4504100	75.50	.4400	4504400	75.50	.4700	4504700	80.55
.3505	4503505	68.10	.3805	4503805	70.90	.4105	4504105	75.50	.4405	4504405	75.50	.4705	4504705	80.55
.3510	4503510	68.10	.3810	4503810	70.90	.4110	4504110	75.50	.4410	4504410	75.50	.4710	4504710	80.55
.3515	4503515	68.10	.3815	4503815	70.90	.4115	4504115	75.50	.4415	4504415	80.55	.4715	4504715	80.55
.3520	4503520	68.10	.3820	4503820	70.90	.4120	4504120	75.50	.4420	4504420	80.55	.4720	4504720	80.55
.3525	4503525	68.10	.3825	4503825	70.90	.4125	4504125	75.50	.4425	4504425	80.55	.4725	4504725	86.40
.3530	4503530	68.10	.3830	4503830	70.90	.4130	4504130	75.50	.4430	4504430	80.55	.4730	4504730	86.40
.3535	4503535	68.10	.3835	4503835	70.90	.4135	4504135	75.50	.4435	4504435	80.55	.4735	4504735	86.40
.3540	4503540	68.10	.3840	4503840	70.90	.4140	4504140	75.50	.4440	4504440	80.55	.4740	4504740	86.40
.3545	4503545	68.10	.3845	4503845	70.90	.4145	4504145	75.50	.4445	4504445	80.55	.4745	4504745	86.40
.3550	4503550	68.10	.3850	4503850	70.90	.4150	4504150	75.50	.4450	4504450	80.55	.4750	4504750	86.40
.3555	4503555	68.10	.3855	4503855	70.90	.4155	4504155	75.50	.4455	4504455	80.55	.4755	4504755	86.40
.3560	4503560	68.10	.3860	4503860	70.90	.4160	4504160	75.50	.4460	4504460	80.55	.4760	4504760	86.40
.3565	4503565	68.10	.3865	4503865	70.90	.4165	4504165	75.50	.4465	4504465	80.55	.4765	4504765	86.40

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	\$86.40	.5070	4505070	\$88.30	.5370	4505370	\$88.30	.5670	4505670	\$91.15	.5970	4505970	\$91.15
.4775	4504775	86.40	.5075	4505075	88.30	.5375	4505375	88.30	.5675	4505675	91.15	.5975	4505975	91.15
.4780	4504780	86.40	.5080	4505080	88.30	.5380	4505380	88.30	.5680	4505680	91.15	.5980	4505980	91.15
.4785	4504785	86.40	.5085	4505085	88.30	.5385	4505385	88.30	.5685	4505685	91.15	.5985	4505985	91.15
.4790	4504790	86.40	.5090	4505090	88.30	.5390	4505390	88.30	.5690	4505690	91.15	.5990	4505990	91.15
.4795	4504795	86.40	.5095	4505095	88.30	.5395	4505395	88.30	.5695	4505695	91.15	.5995	4505995	91.15
.4800	4504800	86.40	.5100	4505100	88.30	.5400	4505400	88.30	.5700	4505700	91.15	.6000	4506000	91.15
.4805	4504805	86.40	.5105	4505105	88.30	.5405	4505405	88.30	.5705	4505705	91.15	.6005	4506005	91.15
.4810	4504810	86.40	.5110	4505110	88.30	.5410	4505410	88.30	.5710	4505710	91.15	.6010	4506010	91.15
.4815	4504815	86.40	.5115	4505115	88.30	.5415	4505415	88.30	.5715	4505715	91.15	.6015	4506015	91.15
.4820	4504820	86.40	.5120	4505120	88.30	.5420	4505420	88.30	.5720	4505720	91.15	.6020	4506020	91.15
.4825	4504825	86.40	.5125	4505125	88.30	.5425	4505425	88.30	.5725	4505725	91.15	.6025	4506025	91.15
.4830	4504830	86.40	.5130	4505130	88.30	.5430	4505430	88.30	.5730	4505730	91.15	.6030	4506030	91.15
.4835	4504835	86.40	.5135	4505135	88.30	.5435	4505435	88.30	.5735	4505735	91.15	.6035	4506035	91.15
.4840	4504840	86.40	.5140	4505140	88.30	.5440	4505440	88.30	.5740	4505740	91.15	.6040	4506040	91.15
.4845	4504845	86.40	.5145	4505145	88.30	.5445	4505445	88.30	.5745	4505745	91.15	.6045	4506045	91.15
.4850	4504850	86.40	.5150	4505150	88.30	.5450	4505450	88.30	.5750	4505750	91.15	.6050	4506050	91.15
.4855	4504855	86.40	.5155	4505155	88.30	.5455	4505455	88.30	.5755	4505755	91.15	.6055	4506055	91.15
.4860	4504860	86.40	.5160	4505160	88.30	.5460	4505460	88.30	.5760	4505760	91.15	.6060	4506060	91.15
.4865	4504865	86.40	.5165	4505165	88.30	.5465	4505465	88.30	.5765	4505765	91.15	.6065	4506065	91.15
.4870	4504870	86.40	.5170	4505170	88.30	.5470	4505470	88.30	.5770	4505770	91.15	.6070	4506070	91.15
.4875	4504875	86.40	.5175	4505175	88.30	.5475	4505475	88.30	.5775	4505775	91.15	.6075	4506075	91.15
.4880	4504880	86.40	.5180	4505180	88.30	.5480	4505480	88.30	.5780	4505780	91.15	.6080	4506080	91.15
.4885	4504885	86.40	.5185	4505185	88.30	.5485	4505485	88.30	.5785	4505785	91.15	.6085	4506085	91.15
.4890	4504890	86.40	.5190	4505190	88.30	.5490	4505490	88.30	.5790	4505790	91.15	.6090	4506090	91.15
.4895	4504895	86.40	.5195	4505195	88.30	.5495	4505495	88.30	.5795	4505795	91.15	.6095	4506095	91.15
.4900	4504900	86.40	.5200	4505200	88.30	.5500	4505500	88.30	.5800	4505800	91.15	.6100	4506100	91.15
.4905	4504905	86.40	.5205	4505205	88.30	.5505	4505505	88.30	.5805	4505805	91.15	.6105	4506105	91.15
.4910	4504910	86.40	.5210	4505210	88.30	.5510	4505510	88.30	.5810	4505810	91.15	.6110	4506110	91.15
.4915	4504915	86.40	.5215	4505215	88.30	.5515	4505515	88.30	.5815	4505815	91.15	.6115	4506115	91.15
.4920	4504920	86.40	.5220	4505220	88.30	.5520	4505520	88.30	.5820	4505820	91.15	.6120	4506120	91.15
.4925	4504925	86.40	.5225	4505225	88.30	.5525	4505525	88.30	.5825	4505825	91.15	.6125	4506125	91.15
.4930	4504930	86.40	.5230	4505230	88.30	.5530	4505530	88.30	.5830	4505830	91.15	.6130	4506130	91.15
.4935	4504935	86.40	.5235	4505235	88.30	.5535	4505535	88.30	.5835	4505835	91.15	.6135	4506135	91.15
.4940	4504940	86.40	.5240	4505240	88.30	.5540	4505540	88.30	.5840	4505840	91.15	.6140	4506140	91.15
.4945	4504945	86.40	.5245	4505245	88.30	.5545	4505545	88.30	.5845	4505845	91.15	.6145	4506145	91.15
.4950	4504950	86.40	.5250	4505250	88.30	.5550	4505550	88.30	.5850	4505850	91.15	.6150	4506150	91.15
.4955	4504955	86.40	.5255	4505255	88.30	.5555	4505555	88.30	.5855	4505855	91.15	.6155	4506155	91.15
.4960	4504960	86.40	.5260	4505260	88.30	.5560	4505560	88.30	.5860	4505860	91.15	.6160	4506160	91.15
.4965	4504965	86.40	.5265	4505265	88.30	.5565	4505565	88.30	.5865	4505865	91.15	.6165	4506165	91.15
.4970	4504970	86.40	.5270	4505270	88.30	.5570	4505570	88.30	.5870	4505870	91.15	.6170	4506170	91.15
.4975	4504975	86.40	.5275	4505275	88.30	.5575	4505575	88.30	.5875	4505875	91.15	.6175	4506175	91.15
.4980	4504980	86.40	.5280	4505280	88.30	.5580	4505580	88.30	.5880	4505880	91.15	.6180	4506180	91.15
.4985	4504985	86.40	.5285	4505285	88.30	.5585	4505585	88.30	.5885	4505885	91.15	.6185	4506185	91.15
.4990	4504990	86.40	.5290	4505290	88.30	.5590	4505590	88.30	.5890	4505890	91.15	.6190	4506190	91.15
.4995	4504995	86.40	.5295	4505295	88.30	.5595	4505595	88.30	.5895	4505895	91.15	.6195	4506195	91.15
.5000	45016	71.55	.5300	4505300	88.30	.5600	4505600	88.30	.5900	4505900	91.15	.6200	4506200	91.15
.5005	4505005	86.40	.5305	4505305	88.30	.5605	4505605	88.30	.5905	4505905	91.15	.6205	4506205	91.15
.5010	4505010	86.40	.5310	4505310	88.30	.5610	4505610	88.30	.5910	4505910	91.15	.6210	4506210	91.15
.5015	4505015	86.40	.5315	450135	88.30	.5615	4505615	88.30	.5915	4505915	91.15	.6215	4506215	91.15
.5020	4505020	86.40	.5320	4505320	88.30	.5620	4505620	88.30	.5920	4505920	91.15	.6220	450158	91.15
.5025	4505025	86.40	.5325	4505325	88.30	.5625	45018	73.60	.5925	4505925	91.15	.6225	4506225	91.15
.5030	4505030	86.40	.5330	4505330	88.30	.5630	450143	88.30	.5930	4505930	91.15	.6230	4506230	91.15
.5035	4505035	88.30	.5335	4505335	88.30	.5635	4505635	88.30	.5935	4505935	91.15	.6235	4506235	91.15
.5040	4505040	88.30	.5340	4505340	88.30	.5640	4505640	88.30	.5940	4505940	91.15	.6240	4506240	91.15
.5045	4505045	88.30	.5345	4505345	88.30	.5645	4505645	88.30	.5945	450151	91.15	.6245	4506245	91.15
.5050	4505050	88.30	.5350	4505350	88.30	.5650	4505650	88.30	.5950	4505950	91.15	.6250	45020	76.50
.5055	4505055	88.30	.5355	4505355	88.30	.5655	4505655	88.30	.5955	4505955	91.15	.6255	4506255	91.15
.5060	4505060	88.30	.5360	4505360	88.30	.5660	4505660	88.30	.5960	4505960	91.15	.6260	450159	91.15
.5065	4505065	88.30	.5365	4505365	88.30	.5665	4505665	91.15	.5965	4505965	91.15	.6265	4506265	91.15

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	FLUTE & CARBIDE	OVER-ALL		PRICE EACH - BASED ON QUANTITY ORDERED					
								1	2	3	4	5-7	8-14*	
1/4	.2500	45208	\$59.25	1	4	1 1/2	6	0.2381-0.2530	\$100.55	\$79.85	\$72.90	\$69.60	\$66.10	\$63.25
9/32	.2812	45209	60.00	1	4	1 1/2	6	0.2531-0.2840	101.35	80.75	73.70	70.40	66.85	64.10
5/16	.3125	45210	60.00	1	4	1 1/2	6	0.2841-0.3150	101.35	80.75	73.70	70.40	66.85	64.10
11/32	.3438	45211	61.40	1	4	1 1/2	6	0.3151-0.3470	102.70	82.10	75.15	71.75	68.20	65.45
3/8	.3750	45212	62.10	1	4	1 3/4	7	0.3471-0.3780	103.40	82.75	75.75	72.45	68.90	66.20
13/32	.4062	45213	65.40	1	4	1 3/4	7	0.3781-0.4090	106.70	85.90	79.05	75.75	72.30	69.50
7/16	.4375	45214	69.65	1	4	1 3/4	7	0.4091-0.4410	110.90	90.30	83.40	80.10	76.55	73.70
15/32	.4688	45215	71.10	1	4	1 3/4	7	0.4411-0.4720	112.50	91.65	84.85	81.50	78.00	75.20
1/2	.5000	45216	76.70	1	6	2	8	0.4721-0.5030	120.80	98.70	91.30	87.80	83.95	81.05
17/32	.5312	45217	83.95	1	6	2	8	0.5031-0.5340	128.25	106.05	98.60	95.10	91.30	88.30
9/16	.5625	45218	83.95	1	6	2	8	0.5341-0.5660	128.25	106.05	98.60	95.10	91.30	88.30
19/32	.5938	45219	87.85	1	6	2	8	0.5661-0.5970	132.05	109.95	102.55	99.05	95.20	92.25
5/8	.6250	45220	87.85	2	6	2	9	0.5971-0.6280	132.05	109.95	102.55	99.05	95.20	92.25
21/32	.6562	45221	89.50	2	6	2	9	0.6281-0.6590	133.80	111.55	104.05	100.65	96.80	93.90
11/16	.6875	45222	89.50	2	6	2	9	0.6591-0.6910	133.80	111.55	104.05	100.65	96.80	93.90
23/32	.7188	45223	90.75	2	6	2	9	0.6911-0.7220	135.05	112.80	105.35	101.90	98.10	95.10
3/4	.7500	45224	93.65	2	6	2	9 1/2	0.7221-0.7530	137.90	115.70	108.30	104.75	100.85	98.05
25/32	.7812	45225	94.40	2	6	2	9 1/2	0.7531-0.7840	138.65	116.50	109.10	105.40	101.70	98.70
13/16	.8125	45226	96.60	2	6	2	9 1/2	0.7841-0.8160	140.70	118.50	111.25	107.70	103.90	100.80
27/32	.8438	45227	100.75	2	6	2	9 1/2	0.8161-0.8470	145.05	122.85	115.40	111.95	108.10	105.20
7/8	.8750	45228	104.65	2	6	2 1/4	10	0.8471-0.8780	150.55	127.55	119.70	116.25	112.10	109.20
29/32	.9062	45229	117.85	2	6	2 1/4	10	0.8781-0.9090	163.65	140.70	133.10	129.40	125.35	122.35
15/16	.9375	45230	122.60	3	8	2 1/4	10	0.9091-0.9410	168.30	145.40	137.75	134.05	130.10	127.05
31/32	.9688	45231	127.60	3	8	2 1/4	10	0.9411-0.9720	173.50	150.55	142.80	139.15	135.15	132.15
1	1.0000	45232	127.60	3	8	2 1/4	10 1/2	0.9721-1.0030	173.50	150.55	142.80	139.15	135.15	132.15
1 1/16	1.0625	45234	174.90	3	8	2 1/4	10 1/2	1.0031-1.0660	218.85	196.70	189.40	186.00	182.15	179.15
1 1/8	1.1250	45236	188.35	3	8	2 1/4	11	1.0661-1.1280	232.30	210.30	203.00	199.40	195.60	192.65
1 3/16	1.1875	45238	202.40	3	8	2 1/4	11	1.1281-1.1905	246.35	224.30	216.95	213.40	209.75	206.65
1 1/4	1.2500	45240	215.10	4	8	2 1/2	11 1/2	1.1906-1.2530	259.00	237.00	229.70	226.05	222.25	219.35
1 5/16	1.3125	45242	242.85	4	8	2 1/2	11 1/2	1.2531-1.3155	286.80	264.85	257.30	253.95	250.15	247.15
1 3/8	1.3750	45244	277.50	4	8	2 1/2	12	1.3156-1.3780	321.40	299.45	292.00	288.50	284.70	281.75
1 7/16	1.4375	45246	289.60	4	8	2 1/2	12	1.3781-1.4405	333.60	311.60	304.20	300.80	296.90	293.90
1 1/2	1.5000	45248	301.70	4	8	2 1/2	12 1/2	1.4406-1.5030	345.65	323.75	316.35	312.80	309.00	306.00

*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	\$72.90	1	4	1 1/2	6	6.000-6.426	\$103.95	\$83.40	\$76.50	\$73.05	\$69.60	\$66.75	\$62.80		
6.5	.2559	452065	73.70	1	4	1 1/2	6	6.427-7.214	104.75	84.25	77.35	74.00	70.40	67.65	63.60		
7.0	.2756	452070	73.70	1	4	1 1/2	6	-	-	-	-	-	-	-	-		
7.5	.2953	452075	73.70	1	4	1 1/2	6	7.215-8.001	104.75	84.25	77.35	74.00	70.40	67.65	63.60		
8.0	.3150	452080	73.70	1	4	1 1/2	6	-	-	-	-	-	-	-	-		
8.5	.3346	452085	75.15	1	4	1 1/2	6	8.002-8.814	106.20	85.55	78.70	75.30	71.75	68.90	64.95		
9.0	.3543	452090	75.75	1	4	1 3/4	7	8.815-9.601	106.85	86.35	79.25	75.85	72.45	69.60	65.55		
9.5	.3740	452095	75.75	1	4	1 3/4	7	-	-	-	-	-	-	-	-		
10.0	.3937	452100	79.05	1	4	1 3/4	7	9.602-10.389	110.20	89.50	82.55	79.20	75.75	72.90	68.90		
10.5	.4134	452105	83.40	1	4	1 3/4	7	10.390-11.201	114.35	93.85	86.95	83.60	80.10	77.15	73.30		
11.0	.4331	452110	83.40	1	4	1 3/4	7	-	-	-	-	-	-	-	-		
11.5	.4528	452115	84.85	1	4	1 3/4	7	11.202-11.989	115.90	95.20	88.35	85.00	81.50	78.70	74.55		
12.0	.4724	452120	91.30	1	6	2	8	11.990-12.776	124.60	102.55	95.10	91.50	87.80	84.65	80.45		
12.5	.4921	452125	91.30	1	6	2	8	-	-	-	-	-	-	-	-		
13.0	.5118	452130	98.60	1	6	2	8	12.777-13.564	131.90	109.80	102.50	98.95	95.10	92.05	87.80		
13.5	.5315	452135	98.60	1	6	2	8	-	-	-	-	-	-	-	-		
14.0	.5512	452140	98.60	1	6	2	8	13.565-14.376	131.90	109.80	102.50	98.95	95.10	92.05	87.80		
14.5	.5709	452145	102.55	1	6	2	8	14.377-15.164	135.75	113.85	106.35	102.70	99.05	95.85	91.65		
15.0	.5906	452150	102.55	1	6	2	8	-	-	-	-	-	-	-	-		
15.5	.6102	452155	102.55	2	6	2	9	15.165-15.951	135.75	113.85	106.35	102.70	99.05	95.85	91.65		
16.0	.6299	452160	104.05	2	6	2	9	15.952-16.739	137.45	115.30	107.95	104.35	100.65	97.65	93.30		
16.5	.6496	452165	104.05	2	6	2	9	-	-	-	-	-	-	-	-		
17.0	.6693	452170	104.05	2	6	2	9	16.740-17.551	137.45	115.30	107.95	104.35	100.65	97.65	93.30		
17.5	.6890	452175	104.05	2	6	2	9	-	-	-	-	-	-	-	-		
18.0	.7087	452180	105.35	2	6	2	9	17.552-18.339	138.75	116.60	109.30	105.60	101.90	98.95	94.50		
18.5	.7283	452185	108.30	2	6	2	9 1/2	18.340-19.126	141.65	119.50	112.05	108.45	104.75	101.70	97.50		
19.0	.7480	452190	108.30	2	6	2	9 1/2	-	-	-	-	-	-	-	-		
19.5	.7677	452195	109.10	2	6	2	9 1/2	19.127-19.914	142.30	120.30	112.80	109.30	105.40	102.50	98.15		
20.0	.7874	452200	111.25	2	6	2	9 1/2	19.915-20.726	144.50	122.35	115.00	111.40	107.70	104.60	100.40		
20.5	.8071	452205	111.25	2	6	2	9 1/2	-	-	-	-	-	-	-	-		
21.0	.8268	452210	115.40	2	6	2	9 1/2	20.727-21.514	148.70	126.65	119.30	115.60	111.95	108.90	104.60		
21.5	.8465	452215	115.40	2	6	2	9 1/2	-	-	-	-	-	-	-	-		
22.0	.8661	452220	115.40	2	6	2 1/4	10	21.515-22.301	148.70	126.65	119.30	115.60	111.95	108.90	104.60		
22.5	.8858	452225	133.10	2	6	2 1/4	10	22.302-23.089	167.55	144.60	136.95	133.20	129.40	126.20	121.90		
23.0	.9055	452230	133.10	2	6	2 1/4	10	-	-	-	-	-	-	-	-		
23.5	.9252	452235	137.75	3	8	2 1/4	10	23.090-23.901	172.25	149.30	141.75	137.90	134.05	130.85	126.45		
24.0	.9449	452240	142.80	3	8	2 1/4	10	23.902-24.689	177.35	154.40	146.75	143.05	139.15	135.95	131.50		
24.5	.9646	452245	142.80	3	8	2 1/4	10	-	-	-	-	-	-	-	-		
25.0	.9843	452250	142.80	3	8	2 1/4	10 1/2	24.690-25.476	177.35	154.40	146.75	143.05	139.15	135.95	131.50		
25.5	1.0039	452255	189.40	3	8	2 1/4	10 1/2	25.477-27.076	222.60	200.60	193.15	189.65	186.00	182.90	178.70		
26.0	1.0236	452260	189.40	3	8	2 1/4	10 1/2	-	-	-	-	-	-	-	-		
27.0	1.0630	452270	189.40	3	8	2 1/4	10 1/2	-	-	-	-	-	-	-	-		
28.0	1.1024	452280	203.00	3	8	2 1/4	11	27.077-28.651	236.05	214.10	206.65	203.10	199.40	196.35	192.20		
29.0	1.1417	452290	216.95	3	8	2 1/4	11	28.652-30.239	250.05	228.15	220.70	217.15	213.40	210.40	206.15		
30.0	1.1811	452300	216.95	3	8	2 1/4	11	-	-	-	-	-	-	-	-		
31.0	1.2205	452310	229.70	4	8	2 1/2	11 1/2	30.240-31.826	262.70	240.80	233.40	229.80	226.05	223.00	218.85		
32.0	1.2598	452320	257.30	4	8	2 1/2	11 1/2	31.827-33.414	290.55	268.50	261.25	257.60	253.95	250.80	246.55		
33.0	1.2992	452330	257.30	4	8	2 1/2	11 1/2	-	-	-	-	-	-	-	-		
34.0	1.3386	452340	292.00	4	8	2 1/2	12	33.415-35.001	325.10	303.20	295.80	292.30	288.50	285.50	281.25		
35.0	1.3780	452350	292.00	4	8	2 1/2	12	-	-	-	-	-	-	-	-		
36.0	1.4173	452360	304.20	4	8	2 1/2	12	35.002-36.589	337.25	315.30	308.00	304.35	300.80	297.60	293.25		
37.0	1.4567	452370	316.35	4	8	2 1/2	12 1/2	36.590-38.176	349.45	327.40	320.05	316.60	312.80	309.80	305.60		
38.0	1.4961	452380	316.35	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
5/16	.3125	46510	\$79.35	5/32	4	1	6	0.2841-0.3150	\$120.70	\$100.00	\$92.95	\$89.85	\$86.35	\$83.50
1/32	.3438	46511	79.35	5/32	4	1	6	0.3151-0.3470	120.70	100.00	92.95	89.85	86.35	83.50
3/8	.3750	46512	74.40	5/16	4	1	7	0.3471-0.3780	113.20	93.75	87.15	84.15	80.85	78.20
13/32	.4062	46513	79.00	5/16	4	1	7	0.3781-0.4090	117.60	98.25	91.75	88.65	85.35	82.75
7/16	.4375	46514	79.00	3/8	4	1	7	0.4091-0.4410	117.60	98.25	91.75	88.65	85.35	82.75
15/32	.4688	46515	83.75	3/8	4	1	7	0.4411-0.4720	122.25	102.90	96.55	93.40	90.15	87.60
1/2	.5000	46516	83.75	7/16	6	1	8	0.4721-0.5030	122.25	102.90	96.55	93.40	90.15	87.60
17/32	.5312	46517	85.75	7/16	6	1	8	0.5031-0.5340	124.50	105.15	98.60	95.60	92.25	89.60
9/16	.5625	46518	85.75	7/16	6	1 1/8	8	0.5341-0.5660	124.50	105.15	98.60	95.60	92.25	89.60
19/32	.5938	46519	89.55	7/16	6	1 1/8	8	0.5661-0.5970	128.25	108.90	102.45	99.30	95.95	93.35
5/8	.6250	46520	89.55	9/16	6	1 1/4	9	0.5971-0.6280	128.25	108.90	102.45	99.30	95.95	93.35
21/32	.6562	46521	97.95	9/16	6	1 1/4	9	0.6281-0.6590	136.55	117.20	110.75	107.70	104.35	101.70
11/16	.6875	46522	97.95	9/16	6	1 1/4	9	0.6591-0.6910	136.55	117.20	110.75	107.70	104.35	101.70
23/32	.7188	46523	101.50	9/16	6	1 1/4	9	0.6911-0.7220	140.30	120.80	114.30	111.30	107.95	105.35
3/4	.7500	46524	101.50	5/8	6	1 3/8	9 1/2	0.7221-0.7530	140.30	120.80	114.30	111.30	107.95	105.35
25/32	.7812	46525	109.45	5/8	6	1 3/8	9 1/2	0.7531-0.7840	148.20	128.80	122.20	119.25	115.90	113.30
13/16	.8125	46526	109.45	5/8	6	1 3/8	9 1/2	0.7841-0.8160	148.20	128.80	122.20	119.25	115.90	113.30
27/32	.8438	46527	113.85	5/8	6	1 3/8	9 1/2	0.8161-0.8470	152.40	133.10	126.60	123.45	120.25	117.55
7/8	.8750	46528	118.10	3/4	6	1 1/2	10	0.8471-0.8780	158.10	138.10	131.25	128.20	124.70	122.00
29/32	.9062	46529	125.65	3/4	6	1 1/2	10	0.8781-0.9090	165.85	145.65	139.00	135.80	132.35	129.60
15/16	.9375	46530	125.65	3/4	8	1 1/2	10	0.9091-0.9410	165.85	145.65	139.00	135.80	132.35	129.60
31/32	.9688	46531	130.65	3/4	8	1 1/2	10	0.9411-0.9720	170.65	150.60	143.80	140.65	137.15	134.45
1	1.0000	46532	130.65	7/8	8	1 5/8	10 1/2	0.9721-1.0030	170.65	150.60	143.80	140.65	137.15	134.45
1 1/32	1.0312	46533	143.10	7/8	8	1 5/8	10 1/2	-	-	-	-	-	-	-
1 1/16	1.0625	46534	143.10	7/8	8	1 5/8	10 1/2	1.0031-1.0660	183.20	163.15	156.40	153.20	149.75	147.00
1 3/32	1.0938	46535	143.10	7/8	8	1 3/4	11	-	-	-	-	-	-	-
1 1/8	1.1250	46536	143.10	7/8	8	1 3/4	11	1.0661-1.1280	183.20	163.15	156.40	153.20	149.75	147.00
1 3/16	1.1875	46538	156.15	1	8	1 3/4	11	1.1281-1.1905	196.30	176.15	169.40	166.20	162.70	160.15
1 1/4	1.2500	46540	156.15	1	8	1 7/8	11 1/2	1.1906-1.2530	196.30	176.15	169.40	166.20	162.70	160.15
1 5/16	1.3125	46542	173.05	1	8	1 7/8	11 1/2	1.2531-1.3155	213.30	193.15	186.50	183.20	179.75	177.15
1 3/8	1.3750	46544	181.30	1	8	2	12	1.3156-1.3780	221.40	201.25	194.55	191.50	187.85	185.20
1 7/16	1.4375	46546	214.20	1 1/4	8	2	12	1.3781-1.4405	257.05	235.55	228.35	224.90	221.25	218.45
1 1/2	1.5000	46548	220.45	1 1/4	8	2 1/8	12 1/2	1.4406-1.5030	263.30	241.75	234.70	231.35	227.60	224.65
1 9/16	1.5625	46550	289.55	1 1/4	8	2 1/8	12 1/2	1.5031-1.5660	332.30	311.00	303.65	300.20	296.60	293.70
1 5/8	1.6250	46552	289.55	1 1/4	8	2 1/4	13	1.5661-1.6280	332.30	311.00	303.65	300.20	296.60	293.70
1 11/16	1.6875	46554	320.65	1 1/4	8	2 1/4	13	1.6281-1.6910	363.45	342.00	334.90	331.40	327.85	324.80
1 3/4	1.7500	46556	320.65	1 1/4	10	2 3/8	13 1/2	1.6911-1.7530	363.45	342.00	334.90	331.40	327.85	324.80
1 13/16	1.8125	46558	379.75	1 1/2	10	2 3/8	13 1/2	1.7531-1.8160	422.45	401.00	393.90	390.40	386.80	383.90
1 7/8	1.8750	46560	379.75	1 1/2	10	2 1/2	14	1.8161-1.8780	422.45	401.00	393.90	390.40	386.80	383.90
1 15/16	1.9375	46562	414.90	1 1/2	10	2 1/2	14	1.8781-1.9410	457.60	436.20	429.00	425.50	421.95	419.00
2	2.0000	46564	414.90	1 1/2	12	2 1/2	14	1.9411-2.0030	457.60	436.20	429.00	425.50	421.95	419.00
2 1/8	2.1250	46568	673.80	1 1/2	12	2 3/4	14 1/2	2.0031-2.1280	716.65	695.20	688.00	684.65	680.95	677.95
2 1/4	2.2500	46572	723.70	1 3/4	12	2 3/4	14 1/2	2.1281-2.2530	766.35	745.00	737.80	734.40	730.75	727.80
2 3/8	2.3750	46576	748.85	1 3/4	12	3	15	2.2531-2.3780	791.75	770.30	763.05	759.60	756.00	753.05
2 1/2	2.5000	46580	748.85	1 3/4	12	3	15	2.3781-2.5030	791.75	770.30	763.05	759.60	756.00	753.05

*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	\$92.95	5/32	4	1	6	7.215 - 8.001	\$124.20	\$103.50	\$96.60	\$93.30	\$89.85	\$86.95	\$82.90	
8.0	.3150	465080	92.95	5/32	4	1	6	-	-	-	-	-	-	-	-	
8.5	.3346	465085	92.95	5/32	4	1	6	8.002 - 8.814	124.20	103.50	96.60	93.30	89.85	86.95	82.90	
9.0	.3543	465090	87.15	3/16	4	1	7	8.815 - 9.601	116.40	97.05	90.50	87.55	84.15	81.50	77.75	
9.5	.3740	465095	87.15	5/16	4	1	7	-	-	-	-	-	-	-	-	
10.0	.3937	465100	91.75	5/16	4	1	7	9.602 - 10.389	120.80	101.50	95.10	91.90	88.65	85.90	82.30	
10.5	.4134	465105	91.75	3/8	4	1	7	10.390 - 11.201	120.80	101.50	95.10	91.90	88.65	85.90	82.30	
11.0	.4331	465110	91.75	3/8	4	1	7	-	-	-	-	-	-	-	-	
11.5	.4528	465115	96.55	3/8	4	1	7	11.202 - 11.989	125.55	106.35	99.75	96.65	93.40	90.70	87.00	
12.0	.4724	465120	96.55	7/16	6	1	8	11.990 - 12.776	125.55	106.35	99.75	96.65	93.40	90.70	87.00	
12.5	.4921	465125	96.55	7/16	6	1	8	-	-	-	-	-	-	-	-	
13.0	.5118	465130	98.60	7/16	6	1	8	12.777 - 13.564	127.75	108.45	101.95	98.85	95.60	92.85	89.15	
13.5	.5315	465135	98.60	7/16	6	1	8	-	-	-	-	-	-	-	-	
14.0	.5512	465140	98.60	7/16	6	1 1/8	8	13.565 - 14.376	127.75	108.45	101.95	98.85	95.60	92.85	89.15	
14.5	.5709	465145	102.45	7/16	6	1 1/8	8	14.377 - 15.164	131.50	112.10	105.70	102.55	99.30	96.60	92.85	
15.0	.5906	465150	102.45	7/16	6	1 1/8	8	-	-	-	-	-	-	-	-	
15.5	.6102	465155	102.45	9/16	6	1 1/4	9	15.165 - 15.951	131.50	112.10	105.70	102.55	99.30	96.60	92.85	
16.0	.6299	465160	110.75	9/16	6	1 1/4	9	15.952 - 16.739	139.80	120.60	114.05	110.85	107.70	105.05	101.30	
16.5	.6496	465165	110.75	9/16	6	1 1/4	9	-	-	-	-	-	-	-	-	
17.0	.6693	465170	110.75	9/16	6	1 1/4	9	16.740 - 17.551	139.80	120.60	114.05	110.85	107.70	105.05	101.30	
17.5	.6890	465175	110.75	9/16	6	1 1/4	9	-	-	-	-	-	-	-	-	
18.0	.7087	465180	114.30	9/16	6	1 1/4	9	17.552 - 18.339	143.55	124.20	117.65	114.60	111.30	108.65	104.90	
18.5	.7283	465185	114.30	5/8	6	1 3/8	9 1/2	18.340 - 19.126	143.55	124.20	117.65	114.60	111.30	108.65	104.90	
19.0	.7480	465190	114.30	5/8	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
19.5	.7677	465195	122.20	5/8	6	1 3/8	9 1/2	19.127 - 19.914	151.45	132.15	125.55	122.35	119.25	116.55	112.75	
20.0	.7874	465200	122.20	5/8	6	1 3/8	9 1/2	19.915 - 20.726	151.45	132.15	125.55	122.35	119.25	116.55	112.75	
20.5	.8071	465205	122.20	5/8	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
21.0	.8268	465210	126.60	5/8	6	1 3/8	9 1/2	20.727 - 21.514	155.70	136.40	129.85	126.75	123.45	120.75	117.05	
21.5	.8465	465215	126.60	5/8	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
22.0	.8661	465220	126.60	3/4	6	1 1/2	10	21.515 - 22.301	155.70	136.40	129.85	126.75	123.45	120.75	117.05	
22.5	.8858	465225	139.00	3/4	6	1 1/2	10	22.302 - 23.089	169.20	149.20	142.40	139.15	135.80	133.05	129.10	
23.0	.9055	465230	139.00	3/4	6	1 1/2	10	-	-	-	-	-	-	-	-	
23.5	.9252	465235	139.00	3/4	8	1 1/2	10	23.090 - 23.901	169.20	149.20	142.40	139.15	135.80	133.05	129.10	
24.0	.9449	465240	143.80	3/4	8	1 1/2	10	23.902 - 24.689	174.05	154.00	147.35	143.95	140.65	137.80	133.95	
24.5	.9646	465245	143.80	3/4	8	1 1/2	10	-	-	-	-	-	-	-	-	
25.0	.9843	465250	143.80	7/8	8	1 5/8	10 1/2	24.690 - 25.476	174.05	154.00	147.35	143.95	140.65	137.80	133.95	
25.5	1.0039	465255	156.40	7/8	8	1 5/8	10 1/2	25.477 - 27.076	186.60	166.60	159.80	156.50	153.20	150.40	146.50	
26.0	1.0236	465260	156.40	7/8	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-	
27.0	1.0630	465270	156.40	7/8	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-	
28.0	1.1024	465280	156.40	7/8	8	1 3/4	11	27.077 - 28.651	186.60	166.60	159.80	156.50	153.20	150.40	146.50	
29.0	1.1417	465290	169.40	1	8	1 3/4	11	28.652 - 30.239	199.65	179.60	172.90	169.50	166.20	163.50	159.50	
30.0	1.1811	465300	169.40	1	8	1 3/4	11	-	-	-	-	-	-	-	-	
31.0	1.2205	465310	169.40	1	8	1 7/8	11 1/2	30.240 - 31.826	199.65	179.60	172.90	169.50	166.20	163.50	159.50	
32.0	1.2598	465320	186.50	1	8	1 7/8	11 1/2	31.827 - 33.414	216.60	196.55	189.90	186.60	183.20	180.45	176.65	
33.0	1.2992	465330	186.50	1	8	1 7/8	11 1/2	-	-	-	-	-	-	-	-	
34.0	1.3386	465340	194.55	1	8	2	12	33.415 - 35.001	224.75	204.70	197.95	194.80	191.50	188.55	184.70	
35.0	1.3780	465350	194.55	1	8	2	12	-	-	-	-	-	-	-	-	
36.0	1.4173	465360	228.35	1 1/4	8	2	12	35.002 - 36.589	260.55	239.20	232.10	228.55	224.90	222.00	217.90	
37.0	1.4567	465370	234.70	1 1/4	8	2 1/8	12 1/2	36.590 - 38.176	266.90	245.60	238.40	234.80	231.35	228.30	224.20	
38.0	1.4961	465380	234.70	1 1/4	8	2 1/8	12 1/2	-	-	-	-	-	-	-	-	
39.0	1.5354	465390	303.65	1 1/4	8	2 1/8	12 1/2	38.177 - 39.776	335.95	314.50	307.30	303.85	300.20	297.15	293.15	
40.0	1.5748	465400	303.65	1 1/4	8	2 1/4	13	39.777 - 41.351	335.95	314.50	307.30	303.85	300.20	297.15	293.15	
41.0	1.6142	465410	303.65	1 1/4	8	2 1/4	13	-	-	-	-	-	-	-	-	
42.0	1.6535	465420	334.90	1 1/4	8	2 1/4	13	41.352 - 42.951	367.05	345.65	338.55	335.05	331.40	328.45	324.25	
43.0	1.6929	465430	334.90	1 1/4	10	2 3/8	13 1/2	42.952 - 44.526	367.05	345.65	338.55	335.05	331.40	328.45	324.25	
44.0	1.7323	465440	334.90	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	\$89.40	1	4	1	6	0.2841-0.3150	\$130.75	\$110.00	\$103.15	\$99.75	\$96.35	\$93.45	
11/32	.3438	46711	89.40	1	4	1	6	0.3151-0.3470	130.75	110.00	103.15	99.75	96.35	93.45	
3/8	.3750	46712	83.85	1	4	1	7	0.3471-0.3780	122.60	103.15	96.65	93.60	90.30	87.70	
13/32	.4062	46713	86.45	1	4	1	7	0.3781-0.4090	125.10	105.70	99.20	96.10	92.75	90.20	
7/16	.4375	46714	86.45	1	4	1	7	0.4091-0.4410	125.10	105.70	99.20	96.10	92.75	90.20	
15/32	.4688	46715	90.65	1	4	1	7	0.4411-0.4720	129.40	110.00	103.45	100.40	97.05	94.45	
1/2	.5000	46716	90.65	1	6	1	8	0.4721-0.5030	129.40	110.00	103.45	100.40	97.05	94.45	
17/32	.5312	46717	93.40	1	6	1	8	0.5031-0.5340	132.15	112.70	106.25	103.15	99.75	97.15	
9/16	.5625	46718	93.40	1	6	1 1/8	8	0.5341-0.5660	132.15	112.70	106.25	103.15	99.75	97.15	
19/32	.5938	46719	97.15	1	6	1 1/8	8	0.5661-0.5970	135.85	116.55	110.10	106.95	103.75	101.05	
5/8	.6250	46720	97.15	2	6	1 1/4	9	0.5971-0.6280	135.85	116.55	110.10	106.95	103.75	101.05	
21/32	.6562	46721	109.40	2	6	1 1/4	9	0.6281-0.6590	148.10	128.65	122.15	119.10	115.80	113.25	
11/16	.6875	46722	109.40	2	6	1 1/4	9	0.6591-0.6910	148.10	128.65	122.15	119.10	115.80	113.25	
23/32	.7188	46723	109.60	2	6	1 1/4	9	0.6911-0.7220	148.40	129.05	122.60	119.50	116.05	113.50	
3/4	.7500	46724	109.60	2	6	1 3/8	9 1/2	0.7221-0.7530	148.40	129.05	122.60	119.50	116.05	113.50	
25/32	.7812	46725	117.75	2	6	1 3/8	9 1/2	0.7531-0.7840	156.50	137.05	130.70	127.60	124.20	121.60	
13/16	.8125	46726	117.75	2	6	1 3/8	9 1/2	0.7841-0.8160	156.50	137.05	130.70	127.60	124.20	121.60	
27/32	.8438	46727	122.75	2	6	1 3/8	9 1/2	0.8161-0.8470	161.40	142.00	135.55	132.40	129.10	126.45	
7/8	.8750	46728	127.45	2	6	1 1/2	10	0.8471-0.8780	167.45	147.45	140.65	137.50	133.95	131.20	
29/32	.9062	46729	134.70	2	6	1 1/2	10	0.8781-0.9090	174.85	154.75	147.95	144.75	141.30	138.65	
15/16	.9375	46730	134.70	3	8	1 1/2	10	0.9091-0.9410	174.85	154.75	147.95	144.75	141.30	138.65	
31/32	.9688	46731	139.60	3	8	1 1/2	10	0.9411-0.9720	179.65	159.50	152.75	149.60	146.25	143.40	
1	1.0000	46732	139.60	3	8	1 5/8	10 1/2	0.9721-1.0030	179.65	159.50	152.75	149.60	146.25	143.40	
1 1/32	1.0312	46733	152.65	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-	
1 1/16	1.0625	46734	152.65	3	8	1 5/8	10 1/2	1.0031-1.0660	193.00	172.80	166.05	162.85	159.40	156.65	
1 3/32	1.0938	46735	152.65	3	8	1 3/4	11	-	-	-	-	-	-	-	
1 1/8	1.1250	46736	152.65	3	8	1 3/4	11	1.0661-1.1280	193.00	172.80	166.05	162.85	159.40	156.65	
1 3/16	1.1875	46738	171.75	3	8	1 3/4	11	1.1281-1.1905	211.85	191.75	185.05	181.85	178.45	175.70	
1 1/4	1.2500	46740	174.10	4	8	1 7/8	11 1/2	1.1906-1.2530	214.20	194.15	187.45	184.25	180.70	178.05	
1 5/16	1.3125	46742	190.30	4	8	1 7/8	11 1/2	1.2531-1.3155	230.40	210.30	203.55	200.40	197.05	194.20	
1 3/8	1.3750	46744	208.50	4	8	2	12	1.3156-1.3780	248.50	228.45	221.80	218.55	215.10	212.35	
1 7/16	1.4375	46746	234.00	4	8	2	12	1.3781-1.4405	276.80	255.35	248.20	244.75	241.05	238.20	
1 1/2	1.5000	46748	242.30	4	8	2 1/8	12 1/2	1.4406-1.5030	285.15	263.65	256.40	253.10	249.35	246.45	
1 9/16	1.5625	46750	332.90	4	8	2 1/8	12 1/2	1.5031-1.5660	375.80	354.30	347.15	343.75	340.00	337.10	
1 5/8	1.6250	46752	332.90	4	8	2 1/4	13	1.5661-1.6280	375.80	354.30	347.15	343.75	340.00	337.10	
1 11/16	1.6875	46754	368.70	4	8	2 1/4	13	1.6281-1.6910	411.60	390.15	382.90	379.45	375.85	372.90	
1 3/4	1.7500	46756	368.70	4	10	2 3/8	13 1/2	1.6911-1.7530	411.60	390.15	382.90	379.45	375.85	372.90	
1 13/16	1.8125	46758	436.55	4	10	2 3/8	13 1/2	1.7531-1.8160	479.40	458.05	450.85	447.40	443.65	440.80	
1 7/8	1.8750	46760	436.55	4	10	2 1/2	14	1.8161-1.8780	479.40	458.05	450.85	447.40	443.65	440.80	
1 15/16	1.9375	46762	477.15	4	10	2 1/2	14	1.8781-1.9410	519.85	498.40	491.20	487.85	484.10	481.35	
2	2.0000	46764	477.15	4	12	2 1/2	14	1.9411-2.0030	519.85	498.40	491.20	487.85	484.10	481.35	
2 1/8	2.1250	46768	714.30	5	12	2 3/4	14 1/2	2.0031-2.1280	757.10	735.70	728.45	725.05	721.45	718.45	
2 1/4	2.2500	46772	767.05	5	12	2 3/4	14 1/2	2.1281-2.2530	809.95	788.45	781.35	777.80	774.20	771.35	
2 3/8	2.3750	46776	793.75	5	12	3	15	2.2531-2.3780	836.50	815.20	807.90	804.60	800.85	798.00	
2 1/2	2.5000	46780	793.75	5	12	3	15	2.3781-2.5030	836.50	815.20	807.90	804.60	800.85	798.00	

*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	\$103.15	1	4	1	6	7.215-8.001	\$134.20	\$113.55	\$106.70	\$103.30	\$99.75	\$96.95	\$92.90	
8.0	.3150	467080	103.15	1	4	1	6	-	-	-	-	-	-	-	-	
8.5	.3346	467085	103.15	1	4	1	6	8.002-8.814	134.20	113.55	106.70	103.30	99.75	96.95	92.90	
9.0	.3543	467090	96.65	1	4	1	7	8.815-9.601	125.75	106.45	100.00	96.80	93.60	90.90	87.10	
9.5	.3740	467095	96.65	1	4	1	7	-	-	-	-	-	-	-	-	
10.0	.3937	467100	99.20	1	4	1	7	9.602-10.389	128.30	109.10	102.55	99.35	96.10	93.40	89.65	
10.5	.4134	467105	99.20	1	4	1	7	10.390-11.201	128.30	109.10	102.55	99.35	96.10	93.40	89.65	
11.0	.4331	467110	99.20	1	4	1	7	-	-	-	-	-	-	-	-	
11.5	.4528	467115	103.45	1	4	1	7	11.202-11.989	132.60	113.30	106.85	103.75	100.40	97.75	93.95	
12.0	.4724	467120	103.45	1	6	1	8	11.990-12.776	132.60	113.30	106.85	103.75	100.40	97.75	93.95	
12.5	.4921	467125	103.45	1	6	1	8	-	-	-	-	-	-	-	-	
13.0	.5118	467130	106.25	1	6	1	8	12.777-13.564	135.45	116.00	109.50	106.40	103.15	100.55	96.70	
13.5	.5315	467135	106.25	1	6	1	8	-	-	-	-	-	-	-	-	
14.0	.5512	467140	106.25	1	6	1 1/8	8	13.565-14.376	135.45	116.00	109.50	106.40	103.15	100.55	96.70	
14.5	.5709	467145	110.10	1	6	1 1/8	8	14.377-15.164	139.15	119.75	113.40	110.25	106.95	104.20	100.60	
15.0	.5906	467150	110.10	1	6	1 1/8	8	-	-	-	-	-	-	-	-	
15.5	.6102	467155	110.10	2	6	1 1/4	9	15.165-15.951	139.15	119.75	113.40	110.25	106.95	104.20	100.60	
16.0	.6299	467160	122.15	2	6	1 1/4	9	15.952-16.739	151.35	132.00	125.50	122.25	119.10	116.50	112.70	
16.5	.6496	467165	122.15	2	6	1 1/4	9	-	-	-	-	-	-	-	-	
17.0	.6693	467170	122.15	2	6	1 1/4	9	16.740-17.551	151.35	132.00	125.50	122.25	119.10	116.50	112.70	
17.5	.6890	467175	122.15	2	6	1 1/4	9	-	-	-	-	-	-	-	-	
18.0	.7087	467180	122.60	2	6	1 1/4	9	17.552-18.339	151.70	132.35	125.95	122.75	119.50	116.75	113.10	
18.5	.7283	467185	122.60	2	6	1 3/8	9 1/2	18.340-19.126	151.70	132.35	125.95	122.75	119.50	116.75	113.10	
19.0	.7480	467190	122.60	2	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
19.5	.7677	467195	130.70	2	6	1 3/8	9 1/2	19.127-19.914	159.75	140.50	133.95	130.80	127.60	124.85	121.10	
20.0	.7874	467200	130.70	2	6	1 3/8	9 1/2	19.915-20.726	159.75	140.50	133.95	130.80	127.60	124.85	121.10	
20.5	.8071	467205	130.70	2	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
21.0	.8268	467210	135.55	2	6	1 3/8	9 1/2	20.727-21.514	164.60	145.35	138.90	135.65	132.40	129.65	126.10	
21.5	.8465	467215	135.55	2	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-	
22.0	.8661	467220	135.55	2	6	1 1/2	10	21.515-22.301	164.60	145.35	138.90	135.65	132.40	129.65	126.10	
22.5	.8858	467225	147.95	2	6	1 1/2	10	22.302-23.089	178.20	158.10	151.45	148.10	144.75	142.00	138.15	
23.0	.9055	467230	147.95	2	6	1 1/2	10	-	-	-	-	-	-	-	-	
23.5	.9252	467235	147.95	3	8	1 1/2	10	23.090-23.901	178.20	158.10	151.45	148.10	144.75	142.00	138.15	
24.0	.9449	467240	152.75	3	8	1 1/2	10	23.902-24.689	183.05	163.10	156.35	153.10	149.60	146.85	143.05	
24.5	.9646	467245	152.75	3	8	1 1/2	10	-	-	-	-	-	-	-	-	
25.0	.9843	467250	152.75	3	8	1 5/8	10 1/2	24.690-25.476	183.05	163.10	156.35	153.10	149.60	146.85	143.05	
25.5	1.0039	467255	166.05	3	8	1 5/8	10 1/2	25.477-27.076	196.30	176.20	169.45	166.20	162.85	160.15	156.20	
26.0	1.0236	467260	166.05	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-	
27.0	1.0630	467270	166.05	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-	
28.0	1.1024	467280	166.05	3	8	1 3/4	11	27.077-28.651	196.30	176.20	169.45	166.20	162.85	160.15	156.20	
29.0	1.1417	467290	185.05	3	8	1 3/4	11	28.652-30.239	215.25	195.25	188.50	185.20	181.85	179.05	175.10	
30.0	1.1811	467300	185.05	3	8	1 3/4	11	-	-	-	-	-	-	-	-	
31.0	1.2205	467310	187.45	4	8	1 7/8	11 1/2	30.240-31.826	217.65	197.60	190.85	187.55	184.25	181.40	177.50	
32.0	1.2598	467320	203.55	4	8	1 7/8	11 1/2	31.827-33.414	233.75	213.70	207.10	203.75	200.40	197.60	193.75	
33.0	1.2992	467330	203.55	4	8	1 7/8	11 1/2	-	-	-	-	-	-	-	-	
34.0	1.3386	467340	221.80	4	8	2	12	33.415-35.001	251.90	232.00	225.20	221.95	218.55	215.75	211.85	
35.0	1.3780	467350	221.80	4	8	2	12	-	-	-	-	-	-	-	-	
36.0	1.4173	467360	248.20	4	8	2	12	35.002-36.589	280.35	259.00	251.80	248.35	244.75	241.70	237.70	
37.0	1.4567	467370	256.40	4	8	2 1/8	12 1/2	36.590-38.176	288.75	267.30	260.25	256.70	253.10	250.15	245.95	
38.0	1.4961	467380	256.40	4	8	2 1/8	12 1/2	-	-	-	-	-	-	-	-	
39.0	1.5354	467390	347.15	4	8	2 1/8	12 1/2	38.177-39.776	379.30	357.95	350.90	347.25	343.75	340.75	336.65	
40.0	1.5748	467400	347.15	4	8	2 1/4	13	39.777-41.351	379.30	357.95	350.90	347.25	343.75	340.75	336.65	
41.0	1.6142	467410	347.15	4	8	2 1/4	13	-	-	-	-	-	-	-	-	
42.0	1.6535	467420	382.90	4	8	2 1/4	13	41.352-42.951	415.15	393.80	386.65	383.20	379.45	376.60	372.35	
43.0	1.6929	467430	382.90	4	10	2 3/8	13 1/2	42.952-44.526	415.15	393.80	386.65	383.20	379.45	376.60	372.35	
44.0	1.7323	467440	382.90	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



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	CARBIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/16	.1875	41006	42006	\$60.60	1 1/64	4	1 1/8	1/2	4 1/2	0.1770-0.2040	\$99.95	\$80.20	\$73.60	\$70.40	\$67.05	\$64.50
7/32	.2188	41007	42007	60.60	1 3/64	4	1 1/4	1/2	5	0.2041-0.2210	99.95	80.20	73.60	70.40	67.05	64.50
15/64	.2344	4102344	4202344	60.60	7/32	4	1 1/2	1/2	6	0.2211-0.2380	99.95	80.20	73.60	70.40	67.05	64.50
1/4	.2500	41008	42008	60.60	1 5/64	4	1 1/2	1/2	6	0.2381-0.2530	99.95	80.20	73.60	70.40	67.05	64.50
9/32	.2812	41009	42009	60.80	1 5/64	4	1 1/2	1/2	6	0.2531-0.2840	100.05	80.35	73.70	70.60	67.25	64.60
5/16	.3125	41010	42010	60.80	9/32	4	1 1/2	1/2	6	0.2841-0.3150	100.05	80.35	73.70	70.60	67.25	64.60
11/32	.3438	41011	42011	66.85	9/32	4	1 1/2	5/8	6	0.3151-0.3470	106.20	86.45	79.85	76.75	73.40	70.80
3/8	.3750	41012	42012	67.50	5/16	4	1 3/4	5/8	7	0.3471-0.3780	106.80	87.10	80.45	77.45	74.10	71.40
13/32	.4062	41013	42013	70.50	5/16	4	1 3/4	5/8	7	0.3781-0.4090	109.90	90.20	83.60	80.40	77.00	74.40
7/16	.4375	41014	42014	73.40	3/8	4	1 3/4	5/8	7	0.4091-0.4410	112.65	92.95	86.40	83.25	79.85	77.20
15/32	.4688	41015	42015	77.85	3/8	4	1 3/4	5/8	7	0.4411-0.4720	117.20	97.50	90.95	87.75	84.45	81.65
1/2	.5000	41016	42016	80.85	7/16	6	2	5/8	8	0.4721-0.5030	121.10	100.80	94.10	90.95	87.55	84.75
17/32	.5312	41017	42017	83.25	7/16	6	2	5/8	8	0.5031-0.5340	123.65	103.40	96.65	93.40	90.00	87.20
9/16	.5625	41018	42018	83.25	7/16	6	2	5/8	8	0.5341-0.5660	123.65	103.40	96.65	93.40	90.00	87.20
19/32	.5938	41019	42019	85.75	7/16	6	2	5/8	8	0.5661-0.5970	126.10	105.90	99.10	95.85	92.40	89.65
5/8	.6250	41020	42020	85.75	9/16	6	2 1/4	5/8	9	0.5971-0.6280	126.10	105.90	99.10	95.85	92.40	89.65
21/32	.6562	41021	42021	88.20	9/16	6	2 1/4	5/8	9	0.6281-0.6590	128.65	108.40	101.55	98.35	94.80	92.25
11/16	.6875	41022	42022	93.95	9/16	6	2 1/4	5/8	9	0.6591-0.6910	134.25	114.00	107.25	104.00	100.60	97.90
23/32	.7188	41023	42023	95.20	9/16	6	2 1/4	5/8	9	0.6911-0.7220	135.55	115.30	108.55	105.35	101.90	99.15
3/4	.7500	41024	42024	96.70	5/8	6	2 1/2	3/4	9 1/2	0.7221-0.7530	137.05	116.85	110.10	106.85	103.40	100.65
25/32	.7812	41025	42025	99.15	5/8	6	2 1/2	3/4	9 1/2	0.7531-0.7840	139.60	119.40	112.60	109.35	105.90	103.15
13/16	.8125	41026	42026	99.15	5/8	6	2 1/2	3/4	9 1/2	0.7841-0.8160	139.60	119.40	112.60	109.35	105.90	103.15
27/32	.8438	41027	42027	104.60	5/8	6	2 1/2	3/4	9 1/2	0.8161-0.8470	145.05	124.75	118.05	114.80	111.30	108.55
7/8	.8750	41028	42028	108.55	3/4	6	2 5/8	3/4	10	0.8471-0.8780	150.45	129.50	122.35	119.10	115.50	112.65
29/32	.9062	41029	42029	126.45	3/4	6	2 5/8	3/4	10	0.8781-0.9090	168.30	147.40	140.40	137.00	133.40	130.65
15/16	.9375	41030	42030	126.45	3/4	8	2 5/8	3/4	10	0.9091-0.9410	168.30	147.40	140.40	137.00	133.40	130.65
31/32	.9688	41031	42031	132.60	3/4	8	2 5/8	3/4	10	0.9411-0.9720	174.55	153.50	146.60	143.15	139.55	136.80
1	1.0000	41032	42032	132.60	7/8	8	2 3/4	3/4	10 1/2	0.9721-1.0030	174.55	153.50	146.60	143.15	139.55	136.80
1 1/16	1.0625	41034	42034	142.30	7/8	8	2 3/4	3/4	10 1/2	1.0031-1.0660	184.20	163.20	156.20	152.75	149.20	146.40
1 1/8	1.1250	41036	42036	146.70	7/8	8	2 7/8	7/8	11	1.0661-1.1280	188.50	167.60	160.55	157.20	153.60	150.80
1 3/16	1.1875	41038	42038	154.15	1	8	2 7/8	7/8	11	1.1281-1.1905	196.00	175.00	168.00	164.60	161.10	158.20
1 1/4	1.2500	41040	42040	163.15	1	8	3	7/8	11 1/2	1.1906-1.2530	205.00	184.00	177.00	173.65	170.05	167.30
1 5/16	1.3125	41042	42042	180.45	1	8	3	7/8	11 1/2	1.2531-1.3155	222.45	201.45	194.30	191.05	187.45	184.65
1 3/8	1.3750	41044	42044	197.80	1	8	3 1/4	7/8	12	1.3156-1.3780	239.65	218.70	211.70	208.40	204.70	201.90
1 7/16	1.4375	41046	42046	209.50	1 1/4	8	3 1/4	7/8	12	1.3781-1.4405	251.40	230.40	223.40	220.15	216.50	213.60
1 1/2	1.5000	41048	42048	221.35	1 1/4	8	3 1/2	7/8	12 1/2	1.4406-1.5030	263.20	242.20	235.30	231.75	228.30	225.45

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



CHUCKING REAMERS CARBIDE TIPPED TYPE 410 & 420 METRIC



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	\$73.60	1 ¹ / ₆₄	4	1 1 ¹ / ₈	1/2	4 1/2	4.494-5.182	\$103.15	\$83.60	\$76.95	\$73.70	\$70.40	\$67.75	\$64.05
5.0	.1969	410050	420050	73.60	1 ¹ / ₆₄	4	1 1 ¹ / ₈	1/2	4 1/2	-	-	-	-	-	-	-	-
5.5	.2165	410055	420055	73.60	1 ³ / ₆₄	4	1 1/4	1/2	5	5.183-5.613	103.15	83.60	76.95	73.70	70.40	67.75	64.05
6.0	.2362	410060	420060	73.60	7/32	4	1 1/2	1/2	6	5.614-6.045	103.15	83.60	76.95	73.70	70.40	67.75	64.05
-	-	410063	420063	-	1 ⁵ / ₆₄	4	1 1/2	1/2	6	6.046-6.426	103.15	83.60	76.95	73.70	70.40	67.75	64.05
6.5	.2559	410065	420065	73.70	1 ⁵ / ₆₄	4	1 1/2	1/2	6	6.427-7.214	103.30	83.75	77.15	74.00	70.60	67.90	64.15
7.0	.2756	410070	420070	73.70	1 ⁵ / ₆₄	4	1 1/2	1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	410075	420075	73.70	9/32	4	1 1/2	1/2	6	7.215-8.001	103.30	83.75	77.15	74.00	70.60	67.90	64.15
8.0	.3150	410080	420080	73.70	9/32	4	1 1/2	1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	410085	420085	79.85	9/32	4	1 1/2	5/8	6	8.002-8.814	109.40	89.85	83.25	80.10	76.75	74.10	70.25
9.0	.3543	410090	420090	80.45	5/16	4	1 3/4	5/8	7	8.815-9.601	110.10	90.45	83.85	80.55	77.45	74.55	70.90
9.5	.3740	410095	420095	80.45	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-	-
10.0	.3937	410100	420100	83.60	3/8	4	1 3/4	5/8	7	9.602-10.389	113.20	93.55	87.00	83.75	80.40	77.70	74.00
10.5	.4134	410105	420105	86.40	3/8	4	1 3/4	5/8	7	10.390-11.201	115.95	96.40	89.75	86.50	83.25	80.45	76.75
11.0	.4331	410110	420110	86.40	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-	-
11.5	.4528	410115	420115	90.95	3/8	4	1 3/4	5/8	7	11.202-11.989	120.55	100.80	94.35	91.05	87.75	85.00	81.25
12.0	.4724	410120	420120	94.10	7/16	6	2	5/8	8	11.990-12.776	124.45	104.45	97.65	94.35	90.95	88.15	84.25
12.5	.4921	410125	420125	94.10	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
13.0	.5118	410130	420130	96.65	7/16	6	2	5/8	8	12.777-13.564	127.00	106.85	100.10	96.80	93.40	90.65	86.80
13.5	.5315	410135	420135	96.65	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
14.0	.5512	410140	420140	96.65	7/16	6	2	5/8	8	13.565-14.376	127.00	106.85	100.10	96.80	93.40	90.65	86.80
14.5	.5709	410145	420145	99.10	7/16	6	2	5/8	8	14.377-15.164	129.45	109.35	102.55	99.20	95.85	93.15	89.20
15.0	.5906	410150	420150	99.10	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
15.5	.6102	410155	420155	99.10	9/16	6	2 1/4	5/8	9	15.165-15.951	129.45	109.35	102.55	99.20	95.85	93.15	89.20
16.0	.6299	410160	420160	101.55	9/16	6	2 1/4	5/8	9	15.952-16.739	131.90	111.80	105.10	101.70	98.35	95.65	91.70
16.5	.6496	410165	420165	101.55	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-	-
17.0	.6693	410170	420170	107.25	9/16	6	2 1/4	5/8	9	16.740-17.551	137.60	117.50	110.75	107.45	104.00	101.30	97.30
17.5	.6890	410175	420175	107.25	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-	-
18.0	.7087	410180	420180	108.55	9/16	6	2 1/4	5/8	9	17.552-18.339	138.95	118.80	112.05	108.75	105.35	102.55	98.70
18.5	.7283	410185	420185	110.10	5/8	6	2 1/2	3/4	9 1/2	18.340-19.126	140.40	120.35	113.50	110.20	106.85	104.00	100.20
19.0	.7480	410190	420190	110.10	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	410195	420195	112.60	5/8	6	2 1/2	3/4	9 1/2	19.127-19.914	143.00	122.80	116.00	112.70	109.35	106.50	102.70
20.0	.7874	410200	420200	112.60	5/8	6	2 1/2	3/4	9 1/2	19.915-20.726	143.00	122.80	116.00	112.70	109.35	106.50	102.70
20.5	.8071	410205	420205	112.60	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	410210	420210	118.05	5/8	6	2 1/2	3/4	9 1/2	20.727-21.514	148.40	128.25	121.50	118.20	114.80	112.00	108.05
21.5	.8465	410215	420215	118.05	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	410220	420220	118.05	3/4	6	2 5/8	3/4	10	21.515-22.301	148.40	128.25	121.50	118.20	114.80	112.00	108.05
22.5	.8858	410225	420225	140.40	3/4	6	2 5/8	3/4	10	22.302-23.089	171.85	151.00	143.90	140.55	137.00	134.10	130.10
23.0	.9055	410230	420230	140.40	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-	-
23.5	.9252	410235	420235	140.40	3/4	8	2 5/8	3/4	10	23.090-23.901	171.85	151.00	143.90	140.55	137.00	134.10	130.10
24.0	.9449	410240	420240	146.60	3/4	8	2 5/8	3/4	10	23.902-24.689	178.05	157.10	150.10	146.70	143.15	140.25	136.30
24.5	.9646	410245	420245	146.60	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-	-
25.0	.9843	410250	420250	146.60	7/8	8	2 3/4	3/4	10 1/2	24.690-25.476	178.05	157.10	150.10	146.70	143.15	140.25	136.30
25.5	1.0039	410255	420255	156.20	7/8	8	2 3/4	3/4	10 1/2	25.477-27.076	187.70	166.80	159.85	156.40	152.75	149.95	145.90
26.0	1.0236	410260	420260	156.20	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	410270	420270	156.20	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	410280	420280	160.55	7/8	8	2 7/8	7/8	11	27.077-28.651	192.10	171.20	164.25	160.75	157.20	154.30	150.25
29.0	1.1417	410290	420290	168.00	1	8	2 7/8	7/8	11	28.652-30.239	199.60	178.65	171.65	168.20	164.60	161.75	157.75
30.0	1.1811	410300	420300	168.00	1	8	2 7/8	7/8	11	-	-	-	-	-	-	-	-
31.0	1.2205	410310	420310	177.00	1	8	3	7/8	11 1/2	30.240-31.826	208.50	187.60	180.60	177.15	173.65	170.70	166.75
32.0	1.2598	410320	420320	194.30	1	8	3	7/8	11 1/2	31.827-33.414	225.90	205.00	197.95	194.55	191.05	188.20	184.10
33.0	1.2992	410330	420330	194.30	1	8	3	7/8	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	410340	420340	211.70	1	8	3 1/4	7/8	12	33.415-35.001	243.25	222.25	215.30	211.85	208.40	205.40	201.45
35.0	1.3780	410350	420350	211.70	1	8	3 1/4	7/8	12	-	-	-	-	-	-	-	-
36.0	1.4173	410360	420360	223.40	1 1/4	8	3 1/4	7/8	12	35.002-36.589	254.95	234.00	227.00	223.55	220.15	217.15	213.10
37.0	1.4567	410370	420370	235.30	1 1/4	8	3 1/2	7/8	12 1/2	36.590-38.176	266.65	245.85	238.85	235.40	231.75	228.95	224.90
38.0	1.4961	410380	420380	235.30	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	\$63.55	1	4	1 1/2	1/2	6	0.2381 - 0.2530	\$102.20	\$82.80	\$76.40	\$73.30	\$69.95	\$67.35
9/32	.2812	41209	42209	63.55	1	4	1 1/2	1/2	6	0.2531 - 0.2840	102.20	82.80	76.40	73.30	69.95	67.35
5/16	.3125	41210	42210	64.95	1	4	1 1/2	1/2	6	0.2841 - 0.3150	103.75	84.25	77.75	74.55	71.35	68.70
11/32	.3438	41211	42211	66.10	1	4	1 1/2	5/8	6	0.3151 - 0.3470	104.70	85.35	78.95	75.75	72.45	69.90
3/8	.3750	41212	42212	67.00	1	4	1 3/4	5/8	7	0.3471 - 0.3780	105.75	86.45	79.85	76.80	73.50	70.90
13/32	.4062	41213	42213	70.25	1	4	1 3/4	5/8	7	0.3781 - 0.4090	109.10	89.60	83.15	80.10	76.70	74.15
7/16	.4375	41214	42214	73.35	1	4	1 3/4	5/8	7	0.4091 - 0.4410	112.00	92.65	86.15	83.00	79.70	77.10
15/32	.4688	41215	42215	76.30	1	4	1 3/4	5/8	7	0.4411 - 0.4720	114.90	95.45	89.05	85.85	82.55	80.05
1/2	.5000	41216	42216	87.80	1	6	2	5/8	8	0.4721 - 0.5030	129.00	108.30	101.40	98.15	94.65	91.85
17/32	.5312	41217	42217	90.15	1	6	2	5/8	8	0.5031 - 0.5340	131.40	110.70	103.85	100.55	96.95	94.10
9/16	.5625	41218	42218	90.15	1	6	2	5/8	8	0.5341 - 0.5660	131.40	110.70	103.85	100.55	96.95	94.10
19/32	.5938	41219	42219	93.65	1	6	2	5/8	8	0.5661 - 0.5970	134.95	114.15	107.30	104.00	100.55	97.75
5/8	.6250	41220	42220	93.65	2	6	2 1/4	5/8	9	0.5971 - 0.6280	134.95	114.15	107.30	104.00	100.55	97.75
11/16	.6875	41222	42222	102.75	2	6	2 1/4	5/8	9	0.6591 - 0.6910	144.00	123.30	116.50	113.20	109.55	106.85
3/4	.7500	41224	42224	108.70	2	6	2 1/2	3/4	9 1/2	0.7221 - 0.7530	149.90	129.35	122.25	119.05	115.50	112.70
13/16	.8125	41226	42226	113.25	2	6	2 1/2	3/4	9 1/2	0.7841 - 0.8160	154.55	133.85	126.85	123.65	120.05	117.25
7/8	.8750	41228	42228	121.95	2	6	2 5/8	3/4	10	0.8471 - 0.8780	164.75	143.20	136.10	132.70	129.00	126.15
15/16	.9375	41230	42230	141.80	3	8	2 5/8	3/4	10	0.9091 - 0.9410	184.65	163.20	155.95	152.50	148.80	146.00
1	1.0000	41232	42232	146.70	3	8	2 3/4	3/4	10 1/2	0.9721 - 1.0030	189.45	168.00	160.85	157.45	153.80	150.90

*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

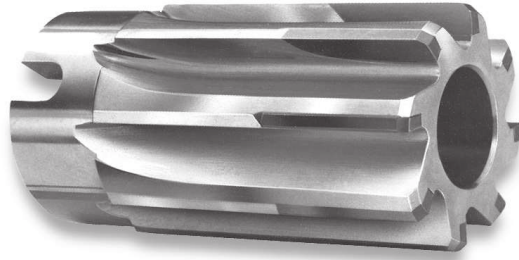
AL TITANIUM NITRIDE – AlTiN



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	\$204.60	3/8	4	6	1 3/4	1	2 1/4	0.7221 - 0.7530	\$289.45	\$247.00	\$232.75	\$225.95	\$218.70	\$213.05
25/32	.7812	43125	208.60	3/8	4	6	1 3/4	1	2 1/4	0.7531 - 0.7840	293.40	250.85	236.80	229.95	222.70	217.05
13/16	.8125	43126	208.60	1/2	5	6	1 15/16	1	2 1/2	0.7841 - 0.8160	293.40	250.85	236.80	229.95	222.70	217.05
7/8	.8750	43128	233.15	1/2	5	6	1 15/16	1	2 1/2	0.8161 - 0.8780	321.15	277.00	262.15	255.30	247.70	241.70
15/16	.9375	43130	233.15	1/2	5	8	1 15/16	1	2 1/2	0.8781 - 0.9410	321.15	277.00	262.15	255.30	247.70	241.70
1	1.0000	43132	237.35	1/2	5	8	1 15/16	1	2 1/2	0.9411 - 1.0030	325.35	281.25	266.55	259.50	251.90	245.95
1 1/16	1.0625	43134	245.70	5/8	6	8	2 1/8	1	2 3/4	1.0031 - 1.0660	333.60	289.55	274.65	267.75	260.25	254.20
1 1/8	1.1250	43136	249.75	5/8	6	8	2 1/8	1	2 3/4	1.0661 - 1.1280	337.70	293.70	278.85	271.95	264.35	258.45
1 1/16	1.1875	43138	254.00	5/8	6	8	2 1/8	1 1/8	2 3/4	1.1281 - 1.1905	341.80	297.90	283.10	276.15	268.50	262.65
1 1/4	1.2500	43140	270.65	5/8	6	8	2 1/8	1 1/8	2 3/4	1.1906 - 1.2530	358.55	314.50	299.80	292.70	285.25	279.25
1 1/8	1.3125	43142	274.65	3/4	7	8	2 1/4	1 1/8	3	1.2531 - 1.3155	362.65	318.65	303.90	296.90	289.45	283.40
1 3/8	1.3750	43144	283.05	3/4	7	8	2 1/4	1 1/8	3	1.3156 - 1.3780	371.05	326.90	312.25	305.10	297.60	291.70
1 7/16	1.4375	43146	291.40	3/4	7	8	2 1/4	1 1/8	3	1.3781 - 1.4405	379.30	335.30	320.60	313.60	305.85	300.10
1 1/2	1.5000	43148	303.90	3/4	7	8	2 1/4	1 1/8	3	1.4406 - 1.5030	391.90	347.80	333.00	326.00	318.45	312.55
1 5/8	1.5625	43150	351.85	3/4	7	10	2 1/4	1 1/8	3	1.5031 - 1.5660	443.60	397.70	382.25	374.85	367.00	360.85
1 3/4	1.6250	43152	369.15	3/4	7	10	2 1/4	1 1/8	3	1.5661 - 1.6280	461.05	415.05	399.60	392.25	384.45	378.20
1 11/16	1.6875	43154	399.65	1	8	10	2 3/4	1 1/8	3 1/2	1.6281 - 1.6910	491.55	445.50	430.10	422.75	414.95	408.75
1 3/4	1.7500	43156	399.65	1	8	10	2 3/4	1 1/8	3 1/2	1.6911 - 1.7530	491.55	445.50	430.10	422.75	414.95	408.75
1 13/16	1.8125	43158	430.00	1	8	10	2 3/4	1 1/8	3 1/2	1.7531 - 1.8160	521.70	475.80	460.40	453.10	445.20	438.95
1 7/8	1.8750	43160	430.00	1	8	10	2 3/4	1 1/8	3 1/2	1.8161 - 1.8780	521.70	475.80	460.40	453.10	445.20	438.95
1 15/16	1.9375	43162	460.50	1	8	10	2 3/4	1 1/8	3 1/2	1.8781 - 1.9410	552.15	506.20	490.85	483.60	475.70	469.50
2	2.0000	43164	460.50	1	8	10	2 3/4	1 1/8	3 1/2	1.9411 - 2.0030	552.15	506.20	490.85	483.60	475.70	469.50
2 1/16	2.0625	43166	495.20	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.0031 - 2.0660	586.95	541.05	525.55	518.30	510.35	504.25
2 1/8	2.1250	43168	495.20	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.0661 - 2.1280	586.95	541.05	525.55	518.30	510.35	504.25
2 3/16	2.1875	43170	538.60	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.1281 - 2.1905	630.40	584.40	569.00	561.65	553.90	547.55
2 1/4	2.2500	43172	538.60	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.1906 - 2.2530	630.40	584.40	569.00	561.65	553.90	547.55
2 5/16	2.3125	43174	569.00	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.2531 - 2.3155	660.85	614.80	599.45	592.05	584.25	578.00
2 3/8	2.3750	43176	569.00	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.3156 - 2.3780	660.85	614.80	599.45	592.05	584.25	578.00
2 7/16	2.4375	43178	599.50	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.3781 - 2.4405	691.30	645.30	629.90	622.55	614.70	608.45
2 1/2	2.5000	43180	599.50	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.4406 - 2.5030	691.30	645.30	629.90	622.55	614.70	608.45
2 9/16	2.5625	43182	658.05	1 1/2	10	14	3 1/8	1 1/8	4	2.5031 - 2.5660	749.80	703.85	688.45	681.10	673.25	667.05
2 5/8	2.6250	43184	682.45	1 1/2	10	14	3 1/8	1 1/8	4	2.5661 - 2.6280	774.20	728.15	712.90	705.45	697.65	691.40
2 11/16	2.6875	43186	708.95	1 1/2	10	14	3 1/8	1 1/8	4	2.6281 - 2.6910	800.70	754.80	739.35	732.10	724.15	717.95
2 3/4	2.7500	43188	733.60	1 1/2	10	14	3 1/8	1 1/8	4	2.6911 - 2.7530	825.40	779.35	763.95	756.70	748.80	742.55
2 13/16	2.8125	43190	759.35	1 1/2	10	14	3 1/8	1 1/8	4	2.7531 - 2.8160	851.10	805.20	789.80	782.45	774.60	768.45
2 7/8	2.8750	43192	789.80	1 1/2	10	14	3 1/8	1 1/8	4	2.8161 - 2.8780	881.45	835.65	820.15	812.90	805.00	798.80
2 15/16	2.9375	43194	820.30	1 1/2	10	14	3 1/8	1 1/8	4	2.8781 - 2.9410	912.05	866.05	850.65	843.45	835.55	829.30
3	3.0000	43196	850.75	1 1/2	10	14	3 1/8	1 1/8	4	2.9411 - 3.0030	942.45	896.55	881.15	873.95	866.00	859.80

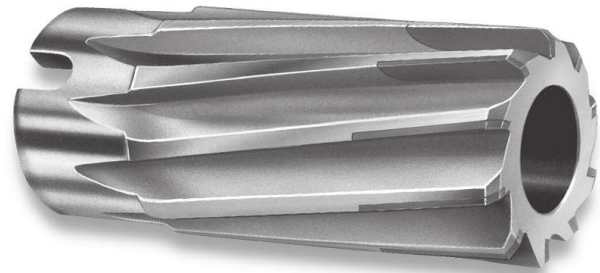
*Quantities of 15 or more - price of fractional size in same size range.



SHELL REAMERS AND ARBORS CARBIDE TIPPED TYPES 441 FRACTIONAL & 481



LEFT SPIRAL FLUTES



TYPE 441

- Left spiral polished flutes
- Arbor hole tapered 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*
3/4	.7500	44124	\$265.95	3/8	4	6	1 3/4	1	2 1/4	0.7221-0.7530	\$350.70	\$308.30	\$294.05	\$287.35	\$280.05	\$274.30
25/32	.7812	44125	271.15	3/8	4	6	1 3/4	1	2 1/4	0.7531-0.7840	355.80	313.45	299.15	292.40	285.15	279.50
13/16	.8125	44126	271.15	1/2	5	6	1 15/16	1	2 1/2	0.7841-0.8160	355.80	313.45	299.15	292.40	285.15	279.50
7/8	.8750	44128	303.15	1/2	5	6	1 15/16	1	2 1/2	0.8161-0.8780	391.00	347.05	332.20	325.20	317.65	311.70
15/16	.9375	44130	303.15	1/2	5	8	1 15/16	1	2 1/2	0.8781-0.9410	391.00	347.05	332.20	325.20	317.65	311.70
1	1.0000	44132	308.50	1/2	5	8	1 15/16	1	2 1/2	0.9411-1.0030	396.40	352.35	337.60	330.65	323.05	317.10
1 1/16	1.0625	44134	318.15	5/8	6	8	2 1/8	1	2 3/4	1.0031-1.0660	406.05	362.05	347.20	340.25	332.65	326.75
1 1/8	1.1250	44136	324.75	5/8	6	8	2 1/8	1	2 3/4	1.0661-1.1280	412.65	368.60	353.90	346.90	339.35	333.35
1 3/16	1.1875	44138	330.15	5/8	6	8	2 1/8	1 1/8	2 3/4	1.1281-1.1905	418.20	373.95	359.20	352.30	344.75	338.70
1 1/4	1.2500	44140	351.75	5/8	6	8	2 1/8	1 1/8	2 3/4	1.1906-1.2530	439.65	395.65	380.85	373.85	366.40	360.35
1 1/2	1.3125	44142	357.25	3/4	7	8	2 1/4	1 1/8	3	1.2531-1.3155	445.20	401.00	386.35	379.30	371.80	365.80
1 5/8	1.3750	44144	368.00	3/4	7	8	2 1/4	1 1/8	3	1.3156-1.3780	456.00	411.90	397.15	390.15	382.55	376.65
1 7/16	1.4375	44146	378.85	3/4	7	8	2 1/4	1 1/8	3	1.3781-1.4405	466.80	422.70	408.00	400.90	393.40	387.30
1 1/2	1.5000	44148	395.05	3/4	7	8	2 1/4	1 1/8	3	1.4406-1.5030	483.05	438.90	424.20	417.25	409.60	403.75
1 5/16	1.5625	44150	457.45	3/4	7	10	2 1/4	1 1/8	3	1.5031-1.5660	549.25	503.30	487.85	480.55	472.75	466.40
1 5/8	1.6250	44152	479.95	3/4	7	10	2 1/4	1 1/8	3	1.5661-1.6280	571.75	525.85	510.35	503.00	495.20	488.85
1 11/16	1.6875	44154	519.35	1	8	10	2 3/4	1 1/8	3 1/2	1.6281-1.6910	611.30	565.25	549.85	542.65	534.70	528.50
1 3/4	1.7500	44156	519.35	1	8	10	2 3/4	1 1/8	3 1/2	1.6911-1.7530	611.30	565.25	549.85	542.65	534.70	528.50
1 13/16	1.8125	44158	558.70	1	8	10	2 3/4	1 1/8	3 1/2	1.7531-1.8160	650.40	604.35	589.00	581.75	573.85	567.60
1 7/8	1.8750	44160	558.70	1	8	10	2 3/4	1 1/8	3 1/2	1.8161-1.8780	650.40	604.35	589.00	581.75	573.85	567.60
1 15/16	1.9375	44162	598.65	1	8	10	2 3/4	1 1/8	3 1/2	1.8781-1.9410	690.40	644.35	629.05	621.65	613.75	607.55
2	2.0000	44164	598.65	1	8	10	2 3/4	1 1/8	3 1/2	1.9411-2.0030	690.40	644.35	629.05	621.65	613.75	607.55
2 1/16	2.0625	44166	643.70	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.0031-2.0660	735.50	689.55	674.05	666.75	659.00	652.75
2 1/8	2.1250	44168	643.70	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.0661-2.1280	735.50	689.55	674.05	666.75	659.00	652.75
2 3/16	2.1875	44170	700.25	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.1281-2.1905	791.90	745.90	730.55	723.30	715.35	709.20
2 1/4	2.2500	44172	700.25	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.1906-2.2530	791.90	745.90	730.55	723.30	715.35	709.20
2 5/16	2.3125	44174	739.80	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.2531-2.3155	831.60	785.60	770.20	762.90	754.95	748.80
2 3/8	2.3750	44176	739.80	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.3156-2.3780	831.60	785.60	770.20	762.90	754.95	748.80
2 7/16	2.4375	44178	779.25	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.3781-2.4405	871.00	825.05	809.75	802.30	794.45	788.20
2 1/2	2.5000	44180	779.25	1 1/4	9	12	2 7/8	1 1/8	3 3/4	2.4406-2.5030	871.00	825.05	809.75	802.30	794.45	788.20
2 5/16	2.5625	44182	855.45	1 1/2	10	14	3 1/8	1 1/8	4	2.5031-2.5660	947.20	901.25	885.80	878.65	870.70	864.50
2 5/8	2.6250	44184	887.15	1 1/2	10	14	3 1/8	1 1/8	4	2.5661-2.6280	979.00	933.00	917.70	910.35	902.50	896.25

*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	\$129.90	2	48114	\$154.95
5	0.7841-1.0030	9 1/2	.625	48105	144.95	2	48115	184.95
6	1.0031-1.2530	10	.750	48106	160.00	3	48116	199.90
7	1.2531-1.6280	11	.875	48107	174.95	3	48117	220.00
8	1.6281-2.0030	12	1.125	48108	194.95	4	48118	245.00
9	2.0031-2.5030	13	1.375	48109	234.90	4	48119	274.95
10	2.5031-3.0030	14	1.625	48110	305.50	5	48120	348.80

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	\$75.40	.1704	4	1 1/8	4 1/2	4.494 - 4.696	\$106.45	\$85.85	\$79.00	\$75.65	\$72.15	\$69.30	\$65.35
5.0	.1969	480050	75.40	.1805	4	1 1/8	4 1/2	4.697 - 5.182	106.45	85.85	79.00	75.65	72.15	69.30	65.35
5.5	.2165	480055	75.40	.2075	4	1 1/4	5	5.183 - 5.613	106.45	85.85	79.00	75.65	72.15	69.30	65.35
6.0	.2362	480060	75.40	.2265	4	1 1/2	6	5.614 - 6.045	106.45	85.85	79.00	75.65	72.15	69.30	65.35
-	-	480063	-	.2405	4	1 1/2	6	6.046 - 6.426	106.45	85.85	79.00	75.65	72.15	69.30	65.35
6.5	.2559	480065	76.75	.2485	4	1 1/2	6	6.427 - 7.214	107.85	87.15	80.30	76.90	73.55	70.60	66.70
7.0	.2756	480070	76.75	.2485	4	1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	480075	76.75	.2792	4	1 1/2	6	7.215 - 8.001	107.85	87.15	80.30	76.90	73.55	70.60	66.70
8.0	.3150	480080	76.75	.2792	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	480085	79.05	.2792	4	1 1/2	6	8.002 - 8.814	110.20	89.50	82.55	79.20	75.75	72.90	68.90
9.0	.3543	480090	79.05	.3105	4	1 3/4	7	8.815 - 9.601	110.20	89.50	82.55	79.20	75.75	72.90	68.90
9.5	.3740	480095	79.05	.3105	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	480100	82.30	.3105	4	1 3/4	7	9.602 - 10.389	113.30	92.70	85.75	82.40	79.00	76.10	72.15
10.5	.4134	480105	93.20	.3730	6	1 3/4	7	10.390 - 11.201	124.25	103.70	96.70	93.35	89.90	87.00	83.00
11.0	.4331	480110	93.20	.3730	6	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	480115	93.95	.3730	6	1 3/4	7	11.202 - 11.989	125.05	104.35	97.50	94.05	90.65	87.80	83.80
12.0	.4724	480120	100.65	.4355	6	2	8	11.990 - 12.776	133.90	111.85	104.45	100.75	97.10	94.00	89.85
12.5	.4921	480125	100.65	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	480130	103.00	.4355	6	2	8	12.777 - 13.564	136.40	114.25	106.85	103.20	99.50	96.45	92.25
13.5	.5315	480135	103.00	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	480140	103.00	.4355	6	2	8	13.565 - 14.376	136.40	114.25	106.85	103.20	99.50	96.45	92.25
14.5	.5709	480145	106.40	.4355	6	2	8	14.377 - 15.164	139.65	117.60	110.25	106.65	102.85	99.75	95.60
15.0	.5906	480150	106.40	.4355	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	480155	106.40	.5615	6	2 1/4	9	15.165 - 15.951	139.65	117.60	110.25	106.65	102.85	99.75	95.60
16.0	.6299	480160	108.10	.5615	6	2 1/4	9	15.952 - 16.739	141.45	119.40	111.95	108.30	104.60	101.50	97.20
16.5	.6496	480165	108.10	.5615	6	2 1/4	9	-	-	-	-	-	-	-	-
17.0	.6693	480170	108.10	.5615	6	2 1/4	9	16.740 - 17.551	141.45	119.40	111.95	108.30	104.60	101.50	97.20
17.5	.6890	480175	108.10	.5615	6	2 1/4	9	-	-	-	-	-	-	-	-
18.0	.7087	480180	112.50	.5615	6	2 1/2	9	17.552 - 18.339	145.60	123.50	116.25	112.60	108.90	105.75	101.50
18.5	.7283	480185	112.50	.6245	6	2 1/2	9 1/2	18.340 - 19.126	145.60	123.50	116.25	112.60	108.90	105.75	101.50
19.0	.7480	480190	112.50	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	480195	115.70	.6245	6	2 1/2	9 1/2	19.127 - 19.914	149.05	126.95	119.50	115.90	112.10	109.15	104.90
20.0	.7874	480200	115.70	.6245	6	2 1/2	9 1/2	19.915 - 20.726	149.05	126.95	119.50	115.90	112.10	109.15	104.90
20.5	.8071	480205	115.70	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	480210	119.70	.6245	6	2 1/2	9 1/2	20.727 - 21.514	153.15	130.95	123.50	119.95	116.30	113.20	109.05
21.5	.8465	480215	119.70	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	480220	119.70	.7495	6	2 5/8	10	21.515 - 22.301	153.15	130.95	123.50	119.95	116.30	113.20	109.05
22.5	.8858	480225	142.20	.7495	6	2 5/8	10	22.302 - 23.089	176.75	153.85	146.25	142.40	138.55	135.45	130.90
23.0	.9055	480230	142.20	.7495	6	2 5/8	10	-	-	-	-	-	-	-	-
23.5	.9252	480235	142.20	.7495	8	2 5/8	10	23.090 - 23.901	176.75	153.85	146.25	142.40	138.55	135.45	130.90
24.0	.9449	480240	148.30	.7495	8	2 5/8	10	23.902 - 24.689	182.90	160.00	152.35	148.55	144.60	141.50	137.00
24.5	.9646	480245	148.30	.7495	8	2 5/8	10	-	-	-	-	-	-	-	-
25.0	.9843	480250	148.30	.8745	8	2 3/4	10 1/2	24.690 - 25.476	182.90	160.00	152.35	148.55	144.60	141.50	137.00
25.5	1.0039	480255	152.30	.8745	8	2 3/4	10 1/2	25.477 - 27.076	185.25	163.45	155.95	152.40	148.70	145.60	141.45
26.0	1.0236	480260	152.30	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	480270	152.30	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	480280	163.60	.8745	8	2 7/8	11	27.077 - 28.651	196.65	174.85	167.40	163.75	160.15	157.05	152.75
29.0	1.1417	480290	177.90	.9995	8	2 7/8	11	28.652 - 30.239	210.90	189.05	181.65	178.05	174.35	171.30	167.10
30.0	1.1811	480300	177.90	.9995	8	2 7/8	11	-	-	-	-	-	-	-	-
31.0	1.2205	480310	196.50	.9995	8	3	11 1/2	30.240 - 31.826	229.70	207.70	200.35	196.65	193.05	189.95	185.85
32.0	1.2598	480320	196.50	.9995	8	3	11 1/2	31.827 - 33.414	229.70	207.70	200.35	196.65	193.05	189.95	185.85
33.0	1.2992	480330	196.50	.9995	8	3	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	480340	199.25	.9995	8	3 1/4	12	33.415 - 35.001	232.30	210.40	203.05	199.40	195.80	192.65	188.45
35.0	1.3780	480350	199.25	.9995	8	3 1/4	12	-	-	-	-	-	-	-	-
36.0	1.4173	480360	218.65	.9995	8	3 1/4	12	35.002 - 36.589	251.65	229.75	222.25	218.80	215.10	212.05	207.80
37.0	1.4567	480370	259.60	1.2495	8	3 1/2	12 1/2	36.590 - 38.176	292.65	270.70	263.30	259.70	256.00	253.05	248.85
38.0	1.4961	480380	259.60	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
3/16	.1875	48006	\$61.70	.1805	4	1 1/8	4 1/2	0.1770 - 0.2040	\$103.00	\$82.35	\$75.40	\$72.15	\$68.65	\$65.75
13/64	.2031	4802031	61.70	.1805	4	1 1/8	4 1/2	-	-	-	-	-	-	-
7/32	.2188	48007	61.70	.2075	4	1 1/4	5	0.2041 - 0.2210	103.00	82.35	75.40	72.15	68.65	65.75
15/64	.2344	4802344	61.70	.2265	4	1 1/2	6	0.2211 - 0.2380	103.00	82.35	75.40	72.15	68.65	65.75
1/4	.2500	48008	61.70	.2405	4	1 1/2	6	0.2381 - 0.2530	103.00	82.35	75.40	72.15	68.65	65.75
17/64	.2656	4802656	63.05	.2485	4	1 1/2	6	-	-	-	-	-	-	-
9/32	.2812	48009	63.05	.2485	4	1 1/2	6	0.2531 - 0.2840	104.35	83.75	76.75	73.55	69.95	67.25
19/64	.2969	4802969	63.05	.2792	4	1 1/2	6	-	-	-	-	-	-	-
5/16	.3125	48010	63.05	.2792	4	1 1/2	6	0.2841 - 0.3150	104.35	83.75	76.75	73.55	69.95	67.25
21/64	.3281	4803281	65.40	.2792	4	1 1/2	6	-	-	-	-	-	-	-
11/32	.3438	48011	65.40	.2792	4	1 1/2	6	0.3151 - 0.3470	106.70	85.90	79.05	75.75	72.30	69.50
23/64	.3594	4803594	65.40	.3105	4	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	48012	65.40	.3105	4	1 3/4	7	0.3471 - 0.3780	106.70	85.90	79.05	75.75	72.30	69.50
25/64	.3906	4803906	68.65	.3105	4	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	48013	68.65	.3105	4	1 3/4	7	0.3781 - 0.4090	109.80	89.20	82.30	79.00	75.40	72.65
27/64	.4219	4804219	79.50	.3730	6	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	48014	79.50	.3730	6	1 3/4	7	0.4091 - 0.4410	120.75	100.05	93.20	89.90	86.40	83.60
29/64	.4531	4804531	80.20	.3730	6	1 3/4	7	-	-	-	-	-	-	-
15/32	.4688	48015	80.20	.3730	6	1 3/4	7	0.4411 - 0.4720	121.55	100.75	93.95	90.65	87.05	84.30
31/64	.4844	4804844	85.90	.4355	6	2	8	-	-	-	-	-	-	-
1/2	.5000	48016	85.90	.4355	6	2	8	0.4721 - 0.5030	130.20	108.05	100.65	97.10	93.30	90.35
33/64	.5156	4805156	88.40	.4355	6	2	8	-	-	-	-	-	-	-
17/32	.5312	48017	88.40	.4355	6	2	8	0.5031 - 0.5340	132.60	110.45	103.00	99.50	95.75	92.70
35/64	.5469	4805469	88.40	.4355	6	2	8	-	-	-	-	-	-	-
9/16	.5625	48018	88.40	.4355	6	2	8	0.5341 - 0.5660	132.60	110.45	103.00	99.50	95.75	92.70
37/64	.5781	4805781	91.75	.4355	6	2	8	-	-	-	-	-	-	-
19/32	.5938	48019	91.75	.4355	6	2	8	0.5661 - 0.5970	135.95	113.90	106.40	102.85	99.10	96.10
39/64	.6094	4806094	91.75	.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	\$91.75	.5615	6	2 1/4	9	0.5971 - 0.6280	\$135.95	\$113.90	\$106.40	\$102.85	\$99.10	\$96.10
41/64	.6406	4806406	93.45	.5615	6	2 1/4	9	-	-	-	-	-	-	
21/32	.6562	48021	93.45	.5615	6	2 1/4	9	0.6281 - 0.6590	137.75	115.55	108.10	104.60	100.75	97.85
43/64	.6719	4806719	93.45	.5615	6	2 1/4	9	-	-	-	-	-	-	
11/16	.6875	48022	93.45	.5615	6	2 1/4	9	0.6591 - 0.6910	137.75	115.55	108.10	104.60	100.75	97.85
45/64	.7031	4807031	97.75	.5615	6	2 1/4	9	-	-	-	-	-	-	
23/32	.7188	48023	97.75	.5615	6	2 1/4	9	0.6911 - 0.7220	141.95	119.70	112.50	108.90	105.10	102.05
47/64	.7344	4807344	97.75	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	
3/4	.7500	48024	97.75	.6245	6	2 1/2	9 1/2	0.7221 - 0.7530	141.95	119.70	112.50	108.90	105.10	102.05
49/64	.7656	4807656	101.20	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	
25/32	.7812	48025	101.20	.6245	6	2 1/2	9 1/2	0.7531 - 0.7840	145.25	123.10	115.70	112.10	108.40	105.35
51/64	.7969	4807969	101.20	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	
13/16	.8125	48026	101.20	.6245	6	2 1/2	9 1/2	0.7841 - 0.8160	145.25	123.10	115.70	112.10	108.40	105.35
53/64	.8281	4808281	105.20	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	
27/32	.8438	48027	105.20	.6245	6	2 1/2	9 1/2	0.8161 - 0.8470	149.30	127.10	119.70	116.30	112.55	109.45
55/64	.8594	4808594	105.20	.7495	6	2 3/8	10	-	-	-	-	-	-	
7/8	.8750	48028	109.20	.7495	6	2 3/8	10	0.8471 - 0.8780	154.95	132.00	124.30	120.65	116.65	113.55
57/64	.8906	4808906	127.05	.7495	6	2 3/8	10	-	-	-	-	-	-	
29/32	.9062	48029	127.05	.7495	6	2 3/8	10	0.8781 - 0.9090	172.95	150.00	142.20	138.55	134.60	131.50
59/64	.9219	4809219	127.05	.7495	8	2 3/8	10	-	-	-	-	-	-	
15/16	.9375	48030	127.05	.7495	8	2 3/8	10	0.9091 - 0.9410	172.95	150.00	142.20	138.55	134.60	131.50
61/64	.9531	4809531	133.15	.7495	8	2 3/8	10	-	-	-	-	-	-	
31/32	.9688	48031	133.15	.7495	8	2 3/8	10	0.9411 - 0.9720	179.05	156.10	148.30	144.60	140.70	137.60
63/64	.9844	4809844	133.15	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	
1	1.0000	48032	133.15	.8745	8	2 3/4	10 1/2	0.9721 - 1.0030	179.05	156.10	148.30	144.60	140.70	137.60
1 1/16	1.0625	48034	137.65	.8745	8	2 3/4	10 1/2	1.0031 - 1.0660	181.65	159.50	152.30	148.70	144.95	142.00
1 1/8	1.1250	48036	149.15	.8745	8	2 7/8	11	1.0661 - 1.1280	193.05	171.00	163.60	160.15	156.40	153.35
1 3/16	1.1875	48038	163.30	.9995	8	2 7/8	11	1.1281 - 1.1905	207.30	185.20	177.90	174.35	170.60	167.60
1 1/4	1.2500	48040	182.00	.9995	8	3	11 1/2	1.1906 - 1.2530	225.95	203.90	196.50	193.05	189.25	186.25
1 5/16	1.3125	48042	182.00	.9995	8	3	11 1/2	1.2531 - 1.3155	225.95	203.90	196.50	193.05	189.25	186.25
1 3/8	1.3750	48044	184.70	.9995	8	3 1/4	12	1.3156 - 1.3780	228.60	206.60	199.25	195.80	191.85	189.05
1 7/16	1.4375	48046	204.05	.9995	8	3 1/4	12	1.3781 - 1.4405	247.95	225.95	218.65	215.10	211.25	208.45
1 1/2	1.5000	48048	245.00	1.2495	8	3 1/2	12 1/2	1.4406 - 1.5030	288.95	266.90	259.60	256.00	252.35	249.30

*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	\$77.15	.1805	4	1 1/8	4 1/2
.1885	48819	77.15	.1805	4	1 1/8	4 1/2
.2490	48824	77.15	.2405	4	1 1/2	6
.2510	48825	77.15	.2405	4	1 1/2	6
.3115	48831	78.55	.2792	4	1 1/2	6
.3135	48832	78.55	.2792	4	1 1/2	6
.3740	48837	80.85	.3105	4	1 3/4	7
.3760	48838	80.85	.3105	4	1 3/4	7
.4365	48843	95.00	.3730	6	1 3/4	7
.4385	48844	95.00	.3730	6	1 3/4	7
.4990	48849	102.55	.4355	6	2	8
.5010	48850	102.55	.4355	6	2	8
	48800	\$971.50 - 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	\$77.15	.1805	4	1 1/8	4 1/2
.1870	48618	77.15	.1805	4	1 1/8	4 1/2
.2480	48623	77.15	.2405	4	1 1/2	6
.2495	48624	77.15	.2405	4	1 1/2	6
.3105	48630	78.55	.2792	4	1 1/2	6
.3120	48631	78.55	.2792	4	1 1/2	6
.3730	48636	80.85	.3105	4	1 3/4	7
.3745	48637	80.85	.3105	4	1 3/4	7
.4355	48642	95.00	.3730	6	1 3/4	7
.4370	48643	95.00	.3730	6	1 3/4	7
.4980	48648	102.55	.4355	6	2	8
.4995	48649	102.55	.4355	6	2	8
	48600	\$971.50 - 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
5/32	.1562	40705	40805	40905	\$56.40	.1510	4	1	1/2	4	0.1560-0.1769	\$97.65	\$76.80	\$69.95	\$66.70	\$63.05	\$60.30
3/16	.1875	40706	40806	40906	51.70	.1805	4	1 1/8	1/2	4 1/2	0.1770-0.2040	91.85	71.70	64.95	61.70	58.30	55.55
7/32	.2188	40707	40807	40907	51.70	.2075	4	1 1/4	1/2	5	0.2041-0.2210	91.85	71.70	64.95	61.70	58.30	55.55
15/64	.2344	4072344	4082344	4092344	54.85	.2265	4	1 1/2	1/2	6	0.2211-0.2380	95.00	74.85	68.05	64.90	61.40	58.70
1/4	.2500	40708	40808	40908	52.00	.2405	4	1 1/2	1/2	6	0.2381-0.2530	92.10	72.05	65.35	62.10	58.60	55.95
9/32	.2812	40709	40809	40909	52.95	.2485	4	1 1/2	1/2	6	0.2531-0.2840	93.25	73.05	66.40	63.05	59.70	56.85
5/16	.3125	40710	40810	40910	52.95	.2792	4	1 1/2	1/2	6	0.2841-0.3150	93.25	73.05	66.40	63.05	59.70	56.85
3/8	.3750	40712	40812	40912	50.50	.3105	4	1 3/4	5/8	7	0.3151-0.3470	95.15	75.10	68.35	65.20	61.65	59.00
11/32	.3438	40711	40811	40911	55.05	.2792	4	1 1/2	5/8	6	0.3151-0.3470	100.60	80.45	73.70	70.50	67.05	64.35
3/8	.3750	40712	40812	40912	50.50	.3105	4	1 3/4	5/8	7	0.3471-0.3780	87.25	68.85	62.75	59.80	56.60	54.10
7/16	.4375	40714	40814	40914	61.45	.3730	6	1 3/4	5/8	7	0.3471-0.3780	92.30	73.80	67.70	64.75	61.55	59.10
13/32	.4062	40713	40813	40913	57.65	.3105	4	1 3/4	5/8	7	0.3781-0.4090	97.85	77.70	71.00	67.75	64.20	61.60
13/32	.4062	40793	40893	40993	61.45	.3105	6	1 3/4	5/8	7	0.3781-0.4090	101.65	81.50	74.85	71.55	68.10	65.45
7/16	.4375	40714	40814	40914	61.45	.3730	6	1 3/4	5/8	7	0.4091-0.4410	101.65	81.50	74.85	71.55	68.10	65.45
15/32	.4688	40715	40815	40915	62.35	.3730	6	1 3/4	5/8	7	0.4411-0.4720	102.55	82.40	75.70	72.45	69.10	66.40
1/2	.5000	40716	40816	40916	73.70	.4355	6	2	5/8	8	0.4721-0.5030	118.05	95.80	88.40	84.90	81.10	78.10
17/32	.5312	40717	40817	40917	80.30	.4355	6	2	5/8	8	0.5031-0.5340	124.45	102.30	95.00	91.35	87.70	84.60
9/16	.5625	40718	40818	40918	80.30	.4355	6	2	5/8	8	0.5341-0.5660	124.45	102.30	95.00	91.35	87.70	84.60
19/32	.5938	40719	40819	40919	83.60	.4355	6	2	5/8	8	0.5661-0.5970	127.75	105.60	98.15	94.65	90.90	87.85
5/8	.6250	40720	40820	40920	83.60	.5615	6	2 1/4	5/8	9	0.5971-0.6280	127.75	105.60	98.15	94.65	90.90	87.85
21/32	.6562	40721	40821	40921	85.00	.5615	6	2 1/4	5/8	9	0.6281-0.6590	129.30	107.05	99.60	96.10	92.30	89.35
11/16	.6875	40722	40822	40922	85.00	.5615	6	2 1/4	5/8	9	0.6591-0.6910	129.30	107.05	99.60	96.10	92.30	89.35
23/32	.7188	40723	40823	40923	89.05	.5615	6	2 1/4	5/8	9	0.6911-0.7220	133.20	110.95	103.70	100.05	96.35	93.30
3/4	.7500	40724	40824	40924	89.05	.6245	6	2 1/2	3/4	9 1/2	0.7221-0.7530	133.20	110.95	103.70	100.05	96.35	93.30
25/32	.7812	40725	40825	40925	91.85	.6245	6	2 1/2	3/4	9 1/2	0.7531-0.7840	136.10	113.95	106.50	102.90	99.15	96.30
13/16	.8125	40726	40826	40926	91.85	.6245	6	2 1/2	3/4	9 1/2	0.7841-0.8160	136.10	113.95	106.50	102.90	99.15	96.30
27/32	.8438	40727	40827	40927	95.60	.6245	6	2 1/2	3/4	9 1/2	0.8161-0.8470	139.70	117.60	110.25	106.70	102.85	99.95
7/8	.8750	40728	40828	40928	99.15	.7495	6	2 5/8	3/4	10	0.8471-0.8780	145.05	122.05	114.30	110.75	106.85	103.75
29/32	.9062	40729	40829	40929	115.50	.7495	6	2 5/8	3/4	10	0.8781-0.9090	161.35	138.35	130.75	127.05	123.05	119.95
15/16	.9375	40730	40830	40930	115.50	.7495	8	2 5/8	3/4	10	0.9091-0.9410	161.35	138.35	130.75	127.05	123.05	119.95
31/32	.9688	40731	40831	40931	120.95	.7495	8	2 5/8	3/4	10	0.9411-0.9720	166.80	143.80	136.20	132.40	128.45	125.35
1	1.0000	40732	40832	40932	120.95	.8745	8	2 3/4	3/4	10 1/2	0.9721-1.0030	166.80	143.80	136.20	132.40	128.45	125.35
1 1/16	1.0625	40734	40834	40934	125.25	.8745	8	2 3/4	3/4	10 1/2	1.0031-1.0660	169.20	147.25	139.80	136.30	132.45	129.55
1 1/8	1.1250	40736	40836	40936	135.45	.8745	8	2 7/8	7/8	11	1.0661-1.1280	179.35	157.30	150.00	146.40	142.65	139.70
1 3/16	1.1875	40738	40838	40938	142.30	.9995	8	2 7/8	7/8	11	1.1281-1.1905	186.25	164.30	156.90	153.35	149.60	146.70
1 1/4	1.2500	40740	40840	40940	150.40	.9995	8	3	7/8	11 1/2	1.1906-1.2530	194.40	172.40	164.95	161.45	157.75	154.75
1 5/16	1.3125	40742	40842	40942	158.25	.9995	8	3	7/8	11 1/2	1.2531-1.3155	202.30	180.35	172.90	169.40	165.55	162.60
1 3/8	1.3750	40744	40844	40944	167.95	.9995	8	3 1/4	7/8	12	1.3156-1.3780	212.00	189.90	182.45	179.05	175.10	172.25
1 7/16	1.4375	40746	40846	40946	187.15	.9995	8	3 1/4	7/8	12	1.3781-1.4405	231.30	209.10	201.80	198.35	194.45	191.60
1 1/2	1.5000	40748	40848	40948	197.85	1.2495	8	3 1/2	7/8	12 1/2	1.4406-1.5030	241.85	219.85	212.40	209.00	205.15	202.20

*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 METRIC EDP NO.	TYPE 408 NAS/ CAST IRON METRIC EDP NO.	TYPE 409 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	CAR- BIDE	OVER- ALL	1			2	3	4		5-7	8-14	OVER 14				
4.0	.1575	407040	408040	409040	\$69.95	.1510	4	1	½	4	3.962-4.493	\$101.05	\$80.40	\$73.55	\$70.15	\$66.70	\$63.90	\$59.85
4.5	.1772	407045	408045	409045	64.95	.1704	4	1 ⅛	½	4 ½	4.494-4.696	95.15	75.15	68.40	65.20	61.70	59.00	55.15
5.0	.1969	407050	408050	409050	64.95	.1805	4	1 ⅛	½	4 ½	4.697-5.182	95.15	75.15	68.40	65.20	61.70	59.00	55.15
5.5	.2165	407055	408055	409055	64.95	.2075	4	1 ¼	½	5	5.183-5.613	95.15	75.15	68.40	65.20	61.70	59.00	55.15
6.0	.2362	407060	408060	409060	68.05	.2265	4	1 ½	½	6	5.614-6.045	98.30	78.25	71.50	68.20	64.90	62.10	58.25
-	-	407063	408063	409063	-	.2405	4	1 ½	½	6	6.046-6.426	95.60	75.50	68.70	65.45	62.10	59.30	55.40
6.5	.2559	407065	408065	409065	66.40	.2485	4	1 ½	½	6	6.427-7.214	96.60	76.55	69.75	66.55	63.05	60.30	56.55
7.0	.2756	407070	408070	409070	66.40	.2485	4	1 ½	½	6	-	-	-	-	-	-	-	-
7.5	.2953	407075	408075	409075	66.40	.2792	4	1 ½	½	6	7.215-8.001	96.60	76.55	69.75	66.55	63.05	60.30	56.55
7.5	.2953	407078	408078	409078	71.55	.2792	6	1 ½	½	6	7.215-8.001	101.90	81.90	75.10	71.75	68.40	65.55	61.70
8.0	.3150	407080	408080	409080	66.40	.2792	4	1 ½	½	6	-	-	-	-	-	-	-	-
8.0	.3150	407083	408083	409083	71.55	.2792	6	1 ½	½	6	-	-	-	-	-	-	-	-
8.5	.3346	407085	408085	409085	68.35	.2792	4	1 ½	⅝	6	8.002-8.814	98.45	78.50	71.75	68.55	65.20	62.30	58.50
8.5	.3346	407088	408088	409088	73.70	.2792	6	1 ½	⅝	6	8.002-8.814	103.95	83.90	77.15	74.00	70.50	67.75	63.95
9.0	.3543	407090	408090	409090	62.75	.3105	4	1 ¾	⅝	7	8.815-9.601	90.40	72.05	65.75	62.85	59.80	57.25	53.70
9.0	.3543	407093	408093	409093	67.70	.3105	6	1 ¾	⅝	7	8.815-9.601	95.40	76.95	70.85	67.80	64.75	62.15	58.60
9.5	.3740	407095	408095	409095	62.75	.3105	4	1 ¾	⅝	7	-	-	-	-	-	-	-	-
9.5	.3740	407098	408098	409098	67.70	.3105	6	1 ¾	⅝	7	-	-	-	-	-	-	-	-
10.0	.3937	407100	408100	409100	71.00	.3105	4	1 ¾	⅝	7	9.602-10.389	101.25	81.15	74.40	71.10	67.75	64.95	61.15
10.0	.3937	407103	408103	409103	74.85	.3105	6	1 ¾	⅝	7	9.602-10.389	105.10	85.00	78.25	74.95	71.55	68.75	64.95
10.5	.4134	407105	408105	409105	74.85	.3730	6	1 ¾	⅝	7	10.390-11.201	105.10	85.00	78.25	74.95	71.55	68.75	64.95
11.0	.4331	407110	408110	409110	74.85	.3730	6	1 ¾	⅝	7	-	-	-	-	-	-	-	-
11.5	.4528	407115	408115	409115	75.70	.3730	6	1 ¾	⅝	7	11.202-11.989	105.90	85.85	79.15	75.80	72.45	69.65	65.75
12.0	.4724	407120	408120	409120	88.40	.4355	6	2	⅝	8	11.990-12.776	121.70	99.60	92.25	88.60	84.90	81.90	77.65
12.5	.4921	407125	408125	409125	88.40	.4355	6	2	⅝	8	-	-	-	-	-	-	-	-
13.0	.5118	407130	408130	409130	95.00	.4355	6	2	⅝	8	12.777-13.564	128.25	106.20	98.70	95.10	91.35	88.30	84.10
13.5	.5315	407135	408135	409135	95.00	.4355	6	2	⅝	8	-	-	-	-	-	-	-	-
14.0	.5512	407140	408140	409140	95.00	.4355	6	2	⅝	8	13.565-14.376	128.25	106.20	98.70	95.10	91.35	88.30	84.10
14.5	.5709	407145	408145	409145	98.15	.4355	6	2	⅝	8	14.377-15.164	131.50	109.40	102.00	98.35	94.65	91.60	87.25
15.0	.5906	407150	408150	409150	98.15	.4355	6	2	⅝	8	-	-	-	-	-	-	-	-
15.5	.6102	407155	408155	409155	98.15	.5615	6	2 ¼	⅝	9	15.165-15.951	131.50	109.40	102.00	98.35	94.65	91.60	87.25
16.0	.6299	407160	408160	409160	99.60	.5615	6	2 ¼	⅝	9	15.952-16.739	133.00	110.80	103.45	99.75	96.10	92.95	88.80
16.5	.6496	407165	408165	409165	99.60	.5615	6	2 ¼	⅝	9	-	-	-	-	-	-	-	-
17.0	.6693	407170	408170	409170	99.60	.5615	6	2 ¼	⅝	9	16.740-17.551	133.00	110.80	103.45	99.75	96.10	92.95	88.80
17.5	.6890	407175	408175	409175	99.60	.5615	6	2 ¼	⅝	9	-	-	-	-	-	-	-	-
18.0	.7087	407180	408180	409180	103.70	.5615	6	2 ¼	⅝	9	17.552-18.339	136.85	114.80	107.50	103.85	100.05	97.05	92.70
19.0	.7480	407190	408190	409190	103.70	.6245	6	2 ½	¾	9 ½	18.340-19.126	136.85	114.80	107.50	103.85	100.05	97.05	92.70
19.5	.7677	407195	408195	409195	106.50	.6245	6	2 ½	¾	9 ½	19.127-19.914	139.70	117.65	110.30	106.70	102.90	99.95	95.70
20.0	.7874	407200	408200	409200	106.50	.6245	6	2 ½	¾	9 ½	19.915-20.726	139.70	117.65	110.30	106.70	102.90	99.95	95.70
21.0	.8268	407210	408210	409210	110.25	.6245	6	2 ½	¾	9 ½	20.727-21.514	143.40	121.45	114.00	110.40	106.70	103.70	99.35
22.0	.8661	407220	408220	409220	110.25	.7495	6	2 ⅝	¾	10	21.515-22.301	143.40	121.45	114.00	110.40	106.70	103.70	99.35
23.0	.9055	407230	408230	409230	130.75	.7495	6	2 ⅝	¾	10	22.302-23.089	165.15	142.30	134.60	130.85	127.05	123.80	119.50
23.5	.9252	407235	408235	409235	130.75	.7495	8	2 ⅝	¾	10	23.090-23.901	165.15	142.30	134.60	130.85	127.05	123.80	119.50
24.0	.9449	407240	408240	409240	136.20	.7495	8	2 ⅝	¾	10	23.902-24.689	170.65	147.75	140.15	136.35	132.40	129.35	124.90
25.0	.9843	407250	408250	409250	136.20	.8745	8	2 ¾	¾	10 ½	24.690-25.476	170.65	147.75	140.15	136.35	132.40	129.35	124.90
26.0	1.0236	407260	408260	409260	139.80	.8745	8	2 ¾	¾	10 ½	25.477-27.076	172.90	151.00	143.65	139.95	136.30	133.20	129.00
27.0	1.0630	407270	408270	409270	139.80	.8745	8	2 ¾	¾	10 ½	-	-	-	-	-	-	-	-
28.0	1.1024	407280	408280	409280	150.00	.8745	8	2 ⅞	⅞	11	27.077-28.651	183.00	161.15	153.75	150.10	146.40	143.35	139.15
29.0	1.1417	407290	408290	409290	156.90	.9995	8	2 ⅞	⅞	11	28.652-30.239	189.95	168.00	160.60	157.05	153.35	150.30	146.20
30.0	1.1811	407300	408300	409300	156.90	.9995	8	2 ⅞	⅞	11	-	-	-	-	-	-	-	-
31.0	1.2205	407310	408310	409310	164.95	.9995	8	3	⅞	11 ½	30.240-31.826	197.95	176.15	168.85	165.15	161.45	158.35	154.15
32.0	1.2598	407320	408320	409320	172.90	.9995	8	3	⅞	11 ½	31.827-33.414	206.00	184.00	176.70	173.05	169.40	166.30	162.05
33.0	1.2992	407330	408330	409330	172.90	.9995	8	3	⅞	11 ½	-	-	-	-	-	-	-	-
34.0	1.3386	407340	408340	409340	182.45	.9995	8	3 ¼	⅞	12	33.415-35.001	215.60	193.70	186.25	182.80	179.05	176.00	171.70
35.0	1.3780	407350	408350	409350	182.45	.9995	8	3 ¼	⅞	12	-	-	-	-	-	-	-	-
36.0	1.4173	407360	408360	409360	201.80	.9995	8	3 ¼	⅞	12	35.002-36.589	234.80	212.90	205.60	201.90	198.35	195.25	190.95
37.0	1.4567	407370	408370	409370	212.40	1.2495	8	3 ½	⅞	12 ½	36.590-38.176	245.65	223.55	216.30	212.70	209.00	205.95	201.70

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 FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
								FLUTE & CARBIDE	OVER-ALL			1	2	3	4	5-7
3/16	.1875	45706	45806	45906	\$61.70	.1805	4	1 1/8	4 1/2	0.1770-0.2040	\$103.00	\$82.35	\$75.40	\$72.15	\$68.65	\$65.75
7/32	.2188	45707	45807	45907	61.70	.2075	4	1 1/4	5	0.2041-0.2210	103.00	82.35	75.40	72.15	68.65	65.75
15/64	.2344	4572344	4582344	4592344	61.70	.2265	4	1 1/2	6	0.2211-0.2380	103.00	82.35	75.40	72.15	68.65	65.75
1/4	.2500	45708	45808	45908	61.70	.2405	4	1 1/2	6	0.2381-0.2530	103.00	82.35	75.40	72.15	68.65	65.75
9/32	.2812	45709	45809	45909	63.05	.2485	4	1 1/2	6	0.2531-0.2840	104.35	83.75	76.75	73.55	69.95	67.25
5/16	.3125	45710	45810	45910	63.05	.2792	4	1 1/2	6	0.2841-0.3150	104.35	83.75	76.75	73.55	69.95	67.25
11/32	.3438	45711	45811	45911	65.40	.2792	4	1 1/2	6	0.3151-0.3470	106.70	85.90	79.05	75.75	72.30	69.50
3/8	.3750	45712	45812	45912	65.40	.3105	4	1 3/4	7	0.3471-0.3780	106.70	85.90	79.05	75.75	72.30	69.50
13/32	.4062	45713	45813	45913	68.65	.3105	4	1 3/4	7	0.3781-0.4090	109.80	89.20	82.30	79.00	75.40	72.65
7/16	.4375	45714	45814	45914	74.25	.3730	6	1 3/4	7	0.4091-0.4410	115.50	94.90	87.90	84.60	81.10	78.25
15/32	.4688	45715	45815	45915	80.20	.3730	6	1 3/4	7	0.4411-0.4720	121.55	100.75	93.95	90.65	87.05	84.30
1/2	.5000	45716	45816	45916	85.90	.4355	6	2	8	0.4721-0.5030	130.20	108.05	100.65	97.10	93.30	90.35
17/32	.5312	45717	45817	45917	88.40	.4355	6	2	8	0.5031-0.5340	132.60	110.45	103.00	99.50	95.75	92.70
9/16	.5625	45718	45818	45918	88.40	.4355	6	2	8	0.5341-0.5660	132.60	110.45	103.00	99.50	95.75	92.70
19/32	.5938	45719	45819	45919	91.75	.4355	6	2	8	0.5661-0.5970	135.95	113.90	106.40	102.85	99.10	96.10
5/8	.6250	45720	45820	45920	91.75	.5615	6	2 1/4	9	0.5971-0.6280	135.95	113.90	106.40	102.85	99.10	96.10
21/32	.6562	45721	45821	45921	93.45	.5615	6	2 1/4	9	0.6281-0.6590	137.75	115.55	108.10	104.60	100.75	97.85
11/16	.6875	45722	45822	45922	93.45	.5615	6	2 1/4	9	0.6591-0.6910	137.75	115.55	108.10	104.60	100.75	97.85
23/32	.7188	45723	45823	45923	97.75	.5615	6	2 1/4	9	0.6911-0.7220	141.95	119.70	112.50	108.90	105.10	102.05
3/4	.7500	45724	45824	45924	97.75	.6245	6	2 1/2	9 1/2	0.7221-0.7530	141.95	119.70	112.50	108.90	105.10	102.05
25/32	.7812	45725	45825	45925	101.20	.6245	6	2 1/2	9 1/2	0.7531-0.7840	145.25	123.10	115.70	112.10	108.40	105.35
13/16	.8125	45726	45826	45926	101.20	.6245	6	2 1/2	9 1/2	0.7841-0.8160	145.25	123.10	115.70	112.10	108.40	105.35
27/32	.8438	45727	45827	45927	105.20	.6245	6	2 1/2	9 1/2	0.8161-0.8470	149.30	127.10	119.70	116.30	112.55	109.45
7/8	.8750	45728	45828	45928	109.20	.7495	6	2 3/8	10	0.8471-0.8780	154.95	132.00	124.30	120.65	116.65	113.55
29/32	.9062	45729	45829	45929	127.05	.7495	6	2 3/8	10	0.8781-0.9090	172.95	150.00	142.20	138.55	134.60	131.50
15/16	.9375	45730	45830	45930	127.05	.7495	8	2 3/8	10	0.9091-0.9410	172.95	150.00	142.20	138.55	134.60	131.50
31/32	.9688	45731	45831	45931	133.15	.7495	8	2 3/8	10	0.9411-0.9720	179.05	156.10	148.30	144.60	140.70	137.60
1	1.0000	45732	45832	45932	133.15	.8745	8	2 3/4	10 1/2	0.9721-1.0030	179.05	156.10	148.30	144.60	140.70	137.60
1 1/16	1.0625	45734	45834	45934	137.65	.8745	8	2 3/4	10 1/2	1.0031-1.0660	181.65	159.50	152.30	148.70	144.95	142.00
1 1/8	1.1250	45736	45836	45936	149.15	.8745	8	2 7/8	11	1.0661-1.1280	193.05	171.00	163.60	160.15	156.40	153.35
1 3/16	1.1875	45738	45838	45938	155.85	.9995	8	2 7/8	11	1.1281-1.1905	199.85	177.90	170.50	167.00	163.20	160.20
1 1/4	1.2500	45740	45840	45940	168.45	.9995	8	3	11 1/2	1.1906-1.2530	212.40	190.50	183.00	179.60	175.75	172.80
1 5/16	1.3125	45742	45842	45942	173.10	.9995	8	3	11 1/2	1.2531-1.3155	217.15	195.15	187.70	184.25	180.45	177.45
1 3/8	1.3750	45744	45844	45944	184.70	.9995	8	3 1/4	12	1.3156-1.3780	228.60	206.60	199.25	195.80	191.85	189.05
1 7/16	1.4375	45746	45846	45946	200.00	.9995	8	3 1/4	12	1.3781-1.4405	243.95	221.95	214.55	211.00	207.30	204.30
1 1/2	1.5000	45748	45848	45948	205.80	1.2495	8	3 1/2	12 1/2	1.4406-1.5030	249.75	227.70	220.35	216.85	213.15	210.15
1 9/16	1.5625	45750	45850	45950	323.25	1.2495	8	3 1/2	12 1/2	1.5031-1.5660	367.30	345.35	337.95	334.35	330.60	327.55
1 5/8	1.6250	45752	45852	45952	334.30	1.2495	8	3 1/2	13	1.5661-1.6280	378.40	356.40	349.00	345.50	341.65	338.70
1 11/16	1.6875	45754	45854	45954	367.10	1.2495	8	3 1/2	13	1.6281-1.6910	411.15	389.20	381.75	378.25	374.45	371.45
1 3/4	1.7500	45756	45856	45956	367.10	1.2495	10	3 1/2	13 1/2	1.6911-1.7530	411.15	389.20	381.75	378.25	374.45	371.45
1 13/16	1.8125	45758	45858	45958	375.70	1.4995	10	3 1/2	13 1/2	1.7531-1.8160	419.70	397.70	390.30	386.80	382.90	380.05
1 7/8	1.8750	45760	45860	45960	394.00	1.4995	10	3 1/2	14	1.8161-1.8780	438.05	416.00	408.55	405.15	401.35	398.35
1 15/16	1.9375	45762	45862	45962	417.65	1.4995	10	3 1/2	14	1.8781-1.9410	461.70	439.65	432.30	428.80	425.00	422.05
2	2.0000	45764	45864	45964	417.05	1.4995	12	3 1/2	14	1.9411-2.0030	461.15	439.05	431.80	428.20	424.45	421.45
2 1/8	2.1250	45768	45868	45968	774.90	1.4995	12	3 1/2	14 1/2	2.0031-2.1280	818.95	796.90	789.50	786.10	782.20	779.25
2 1/4	2.2500	45772	45872	45972	832.25	1.7495	12	3 1/2	14 1/2	2.1281-2.2530	876.30	854.25	846.95	843.45	839.60	836.70
2 3/8	2.3750	45776	45876	45976	861.20	1.7495	12	3 1/2	15	2.2531-2.3780	905.20	883.15	875.75	872.35	868.50	865.55
2 1/2	2.5000	45780	45880	45980	861.20	1.7495	12	3 1/2	15	2.3781-2.5030	905.20	883.15	875.75	872.35	868.50	865.55

*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	\$75.40	.1704	4	1 1/8	4 1/2	4.494-4.696	\$106.45	\$85.85	\$79.00	\$75.65	\$72.15	\$69.30	\$65.35
5.0	.1969	457050	458050	459050	75.40	.1805	4	1 1/8	4 1/2	4.697-5.182	106.45	85.85	79.00	75.65	72.15	69.30	65.35
5.5	.2165	457055	458055	459055	75.40	.2075	4	1 1/4	5	5.183-5.613	106.45	85.85	79.00	75.65	72.15	69.30	65.35
6.0	.2362	457060	458060	459060	75.40	.2265	4	1 1/2	6	5.614-6.045	106.45	85.85	79.00	75.65	72.15	69.30	65.35
-	-	457063	458063	459063	-	.2405	4	1 1/2	6	6.046-6.426	106.45	85.85	79.00	75.65	72.15	69.30	65.35
6.5	.2559	457065	458065	459065	76.75	.2485	4	1 1/2	6	6.427-7.214	107.85	87.15	80.30	76.90	73.55	70.60	66.70
7.0	.2756	457070	458070	459070	76.75	.2485	4	1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	457075	458075	459075	76.75	.2792	4	1 1/2	6	7.215-8.001	107.85	87.15	80.30	76.90	73.55	70.60	66.70
8.0	.3150	457080	458080	459080	76.75	.2792	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	457085	458085	459085	79.05	.2792	4	1 1/2	6	8.002-8.814	110.20	89.50	82.55	79.20	75.75	72.90	68.90
9.0	.3543	457090	458090	459090	79.05	.3105	4	1 3/4	7	8.815-9.601	110.20	89.50	82.55	79.20	75.75	72.90	68.90
9.5	.3740	457095	458095	459095	79.05	.3105	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	457100	458100	459100	82.30	.3105	4	1 3/4	7	9.602-10.389	113.30	92.70	85.75	82.40	79.00	76.10	72.15
10.5	.4134	457105	458105	459105	87.90	.3730	6	1 3/4	7	10.390-11.201	118.95	98.35	91.50	88.00	84.60	81.70	77.85
11.0	.4331	457110	458110	459110	87.90	.3730	6	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	457115	458115	459115	93.95	.3730	6	1 3/4	7	11.202-11.989	125.05	104.35	97.50	94.05	90.65	87.80	83.80
12.0	.4724	457120	458120	459120	100.65	.4355	6	2	8	11.990-12.776	133.90	111.85	104.45	100.75	97.10	94.00	89.85
12.5	.4921	457125	458125	459125	100.65	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	457130	458130	459130	103.00	.4355	6	2	8	12.777-13.564	136.40	114.25	106.85	103.20	99.50	96.45	92.25
13.5	.5315	457135	458135	459135	103.00	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	457140	458140	459140	103.00	.4355	6	2	8	13.565-14.376	136.40	114.25	106.85	103.20	99.50	96.45	92.25
14.5	.5709	457145	458145	459145	106.40	.4355	6	2	8	14.377-15.164	139.65	117.60	110.25	106.65	102.85	99.75	95.60
15.0	.5906	457150	458150	459150	106.40	.4355	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	457155	458155	459155	106.40	.5615	6	2 1/4	9	15.165-15.951	139.65	117.60	110.25	106.65	102.85	99.75	95.60
16.0	.6299	457160	458160	459160	108.10	.5615	6	2 1/4	9	15.952-16.739	141.45	119.40	111.95	108.30	104.60	101.50	97.20
16.5	.6496	457165	458165	459165	108.10	.5615	6	2 1/4	9	-	-	-	-	-	-	-	-
17.0	.6693	457170	458170	459170	108.10	.5615	6	2 1/4	9	16.740-17.551	141.45	119.40	111.95	108.30	104.60	101.50	97.20
17.5	.6890	457175	458175	459175	108.10	.5615	6	2 1/4	9	-	-	-	-	-	-	-	-
18.0	.7087	457180	458180	459180	112.50	.6245	6	2 1/2	9 1/2	17.552-18.339	145.60	123.50	116.25	112.60	108.90	105.75	101.50
18.5	.7283	457185	458185	459185	112.50	.6245	6	2 1/2	9 1/2	18.340-19.126	145.60	123.50	116.25	112.60	108.90	105.75	101.50
19.0	.7480	457190	458190	459190	112.50	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	457195	458195	459195	115.70	.6245	6	2 1/2	9 1/2	19.127-19.914	149.05	126.95	119.50	115.90	112.10	109.15	104.90
20.0	.7874	457200	458200	459200	115.70	.6245	6	2 1/2	9 1/2	19.915-20.726	149.05	126.95	119.50	115.90	112.10	109.15	104.90
20.5	.8071	457205	458205	459205	115.70	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	457210	458210	459210	119.70	.6245	6	2 1/2	9 1/2	20.727-21.514	153.15	130.95	123.50	119.95	116.30	113.20	109.05
21.5	.8465	457215	458215	459215	119.70	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	457220	458220	459220	119.70	.7495	6	2 5/8	10	21.515-22.301	153.15	130.95	123.50	119.95	116.30	113.20	109.05
22.5	.8858	457225	458225	459225	142.20	.7495	6	2 5/8	10	22.302-23.089	176.75	153.85	146.25	142.40	138.55	135.45	130.90
23.0	.9055	457230	458230	459230	142.20	.7495	6	2 5/8	10	-	-	-	-	-	-	-	-
23.5	.9252	457235	458235	459235	142.20	.7495	8	2 5/8	10	23.090-23.901	176.75	153.85	146.25	142.40	138.55	135.45	130.90
24.0	.9449	457240	458240	459240	148.30	.7495	8	2 5/8	10	23.902-24.689	182.90	160.00	152.35	148.55	144.60	141.50	137.00
24.5	.9646	457245	458245	459245	148.30	.7495	8	2 5/8	10	-	-	-	-	-	-	-	-
25.0	.9843	457250	458250	459250	148.30	.8745	8	2 3/4	10 1/2	24.690-25.476	182.90	160.00	152.35	148.55	144.60	141.50	137.00
25.5	1.0039	457255	458255	459255	152.30	.8745	8	2 3/4	10 1/2	25.477-27.076	185.25	163.45	155.95	152.40	148.70	145.60	141.45
26.0	1.0236	457260	458260	459260	152.30	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	457270	458270	459270	152.30	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	457280	458280	459280	163.60	.8745	8	2 3/4	11	27.077-28.651	196.65	174.85	167.40	163.75	160.15	157.05	152.75
29.0	1.1417	457290	458290	459290	170.50	.9995	8	2 7/8	11	28.652-30.239	203.55	181.65	174.30	170.65	167.00	163.85	159.55
30.0	1.1811	457300	458300	459300	170.50	.9995	8	2 7/8	11	-	-	-	-	-	-	-	-
31.0	1.2205	457310	458310	459310	183.00	.9995	8	3	11 1/2	30.240-31.826	216.20	194.20	186.85	183.20	179.60	176.40	172.25
32.0	1.2598	457320	458320	459320	187.70	.9995	8	3	11 1/2	31.827-33.414	220.80	198.85	191.60	187.90	184.25	181.15	176.90
33.0	1.2992	457330	458330	459330	187.70	.9995	8	3	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	457340	458340	459340	199.25	.9995	8	3 1/4	12	33.415-35.001	232.30	210.40	203.05	199.40	195.80	192.65	188.45
35.0	1.3780	457350	458350	459350	199.25	.9995	8	3 1/4	12	-	-	-	-	-	-	-	-
36.0	1.4173	457360	458360	459360	214.55	.9995	8	3 1/4	12	35.002-36.589	247.60	225.70	218.25	214.70	211.00	207.90	203.75
37.0	1.4567	457370	458370	459370	220.35	1.2495	8	3 1/2	12 1/2	36.590-38.176	253.50	231.50	224.20	220.50	216.85	213.75	209.65
38.0	1.4961	457380	458380	459380	220.35	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	\$59.55	1	4	1 1/2	1/2	6	0.2381-0.2530	\$99.65	\$79.60	\$72.85	\$69.60	\$66.25	\$63.55
9/32	.2812	47209	47309	47409	60.55	1	4	1 1/2	1/2	6	0.2531-0.2840	100.65	80.50	73.80	70.60	67.25	64.50
5/16	.3125	47210	47310	47410	60.55	1	4	1 1/2	1/2	6	0.2841-0.3150	100.65	80.50	73.80	70.60	67.25	64.50
11/32	.3438	47211	47311	47411	62.35	1	4	1 1/2	5/8	6	0.3151-0.3470	102.55	82.40	75.70	72.45	69.10	66.40
3/8	.3750	47212	47312	47412	57.65	1	4	1 3/4	5/8	7	0.3471-0.3780	94.45	76.05	69.90	66.85	63.85	61.25
13/32	.4062	47213	47313	47413	65.95	1	4	1 3/4	5/8	7	0.3781-0.4090	106.05	85.90	79.20	76.05	72.65	69.95
7/16	.4375	47214	47314	47414	70.20	1	6	1 3/4	5/8	7	0.4091-0.4410	110.40	90.30	83.60	80.30	76.80	74.15
15/32	.4688	47215	47315	47415	72.10	1	6	1 3/4	5/8	7	0.4411-0.4720	112.20	92.10	85.45	82.20	78.80	76.05
1/2	.5000	47216	47316	47416	82.55	1	6	2	5/8	8	0.4721-0.5030	126.75	104.60	97.15	93.65	89.90	86.90
17/32	.5312	47217	47317	47417	87.75	1	6	2	5/8	8	0.5031-0.5340	131.90	109.65	102.30	98.95	95.05	92.05
9/16	.5625	47218	47318	47418	87.75	1	6	2	5/8	8	0.5341-0.5660	131.90	109.65	102.30	98.95	95.05	92.05
19/32	.5938	47219	47319	47419	93.30	1	6	2	5/8	8	0.5661-0.5970	137.50	115.30	107.95	104.45	100.65	97.70
5/8	.6250	47220	47320	47420	93.30	2	6	2 1/4	5/8	9	0.5971-0.6280	137.50	115.30	107.95	104.45	100.65	97.70
21/32	.6562	47221	47321	47421	94.90	2	6	2 1/4	5/8	9	0.6281-0.6590	139.05	116.90	109.45	105.90	102.15	99.15
11/16	.6875	47222	47322	47422	94.90	2	6	2 1/4	5/8	9	0.6591-0.6910	139.05	116.90	109.45	105.90	102.15	99.15
23/32	.7188	47223	47323	47423	98.60	2	6	2 1/4	5/8	9	0.6911-0.7220	142.90	120.70	113.30	109.65	105.90	102.90
3/4	.7500	47224	47324	47424	98.60	2	6	2 1/2	3/4	9 1/2	0.7221-0.7530	142.90	120.70	113.30	109.65	105.90	102.90
25/32	.7812	47225	47325	47425	100.85	2	6	2 1/2	3/4	9 1/2	0.7531-0.7840	145.20	123.05	115.60	112.05	108.30	105.30
13/16	.8125	47226	47326	47426	100.85	2	6	2 1/2	3/4	9 1/2	0.7841-0.8160	145.20	123.05	115.60	112.05	108.30	105.30
27/32	.8438	47227	47327	47427	105.85	2	6	2 1/2	3/4	9 1/2	0.8161-0.8470	150.10	127.85	120.60	117.00	113.20	110.25
7/8	.8750	47228	47328	47428	109.90	2	6	2 5/8	3/4	10	0.8471-0.8780	155.75	132.75	125.10	121.40	117.45	114.30
29/32	.9062	47229	47329	47429	133.75	2	6	2 5/8	3/4	10	0.8781-0.9090	179.60	156.60	148.80	145.25	141.25	138.25
15/16	.9375	47230	47330	47430	133.75	3	8	2 5/8	3/4	10	0.9091-0.9410	179.60	156.60	148.80	145.25	141.25	138.25
31/32	.9688	47231	47331	47431	137.60	3	8	2 5/8	3/4	10	0.9411-0.9720	183.55	160.50	152.75	149.20	145.25	142.15
1	1.0000	47232	47332	47432	137.60	3	8	2 3/4	3/4	10 1/2	0.9721-1.0030	183.55	160.50	152.75	149.20	145.25	142.15
1 1/16	1.0625	47234	47334	47434	170.00	3	8	2 3/4	3/4	10 1/2	1.0031-1.0660	213.95	191.80	184.50	180.95	177.30	174.30
1 1/8	1.1250	47236	47336	47436	180.45	3	8	2 7/8	7/8	11	1.0661-1.1280	224.40	202.40	194.95	191.60	187.70	184.75
1 1/16	1.1875	47238	47338	47438	197.25	3	8	2 7/8	7/8	11	1.1281-1.1905	241.25	219.20	211.80	208.45	204.55	201.65
1 1/4	1.2500	47240	47340	47440	214.20	4	8	3	7/8	11 1/2	1.1906-1.2530	258.30	236.15	228.90	225.30	221.55	218.65
1 5/16	1.3125	47242	47342	47442	226.35	4	8	3	7/8	11 1/2	1.2531-1.3155	270.30	248.25	240.85	237.35	233.60	230.60
1 3/8	1.3750	47244	47344	47444	238.40	4	8	3 1/4	7/8	12	1.3156-1.3780	282.35	260.30	252.90	249.35	245.70	242.70
1 7/16	1.4375	47246	47346	47446	251.95	4	8	3 1/4	7/8	12	1.3781-1.4405	296.05	273.95	266.60	263.15	259.35	256.35
1 1/2	1.5000	47248	47348	47448	265.55	4	8	3 1/2	7/8	12 1/2	1.4406-1.5030	309.45	287.50	280.05	276.55	272.80	269.80
1 9/16	1.5625	47250	47350	47450	311.40	4	8	3 1/2	7/8	12 1/2	1.5031-1.5660	355.45	333.35	326.00	322.55	318.75	315.80
1 5/8	1.6250	47252	47352	47452	322.35	4	8	3 3/4	7/8	13	1.5661-1.6280	366.25	344.15	336.85	333.20	329.50	326.60
1 11/16	1.6875	47254	47354	47454	362.45	4	8	3 3/4	7/8	13	1.6281-1.6910	406.40	384.45	376.95	373.50	369.75	366.70
1 3/4	1.7500	47256	47356	47456	362.45	4	10	4	7/8	13 1/2	1.6911-1.7530	406.40	384.45	376.95	373.50	369.75	366.70
1 13/16	1.8125	47258	47358	47458	362.45	4	10	4	7/8	13 1/2	1.7531-1.8160	406.40	384.45	376.95	373.50	369.75	366.70
1 7/8	1.8750	47260	47360	47460	379.75	4	10	4 1/4	7/8	14	1.8161-1.8780	423.75	401.65	394.20	390.80	387.00	384.00
1 15/16	1.9375	47262	47362	47462	379.75	4	10	4 1/4	7/8	14	1.8781-1.9410	423.75	401.65	394.20	390.80	387.00	384.00
2	2.0000	47264	47364	47464	379.75	4	12	4 1/4	7/8	14	1.9411-2.0030	423.75	401.65	394.20	390.80	387.00	384.00

*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	\$71.05	1	4	1 1/2	6	0.2381-0.2530	\$112.30	\$91.60	\$84.65	\$81.45	\$77.90	\$75.15
9/32	.2812	45309	45409	45509	72.15	1	4	1 1/2	6	0.2531-0.2840	113.40	92.70	85.75	82.50	79.00	76.30
5/16	.3125	45310	45410	45510	72.15	1	4	1 1/2	6	0.2841-0.3150	113.40	92.70	85.75	82.50	79.00	76.30
11/32	.3438	45311	45411	45511	73.70	1	4	1 1/2	6	0.3151-0.3470	115.05	94.35	87.55	84.15	80.55	77.85
3/8	.3750	45312	45412	45512	74.50	1	4	1 3/4	7	0.3471-0.3780	115.90	95.15	88.30	85.00	81.45	78.70
13/32	.4062	45313	45413	45513	78.50	1	4	1 3/4	7	0.3781-0.4090	119.65	99.10	92.10	88.85	85.30	82.50
7/16	.4375	45314	45414	45514	83.65	1	6	1 3/4	7	0.4091-0.4410	124.90	104.10	97.20	94.00	90.45	87.75
15/32	.4688	45315	45415	45515	85.35	1	6	1 3/4	7	0.4411-0.4720	126.65	106.00	99.10	95.75	92.25	89.40
1/2	.5000	45316	45416	45516	91.90	1	6	2	8	0.4721-0.5030	136.20	114.00	106.65	103.00	99.30	96.35
17/32	.5312	45317	45417	45517	100.75	1	6	2	8	0.5031-0.5340	145.05	122.85	115.40	111.95	108.10	105.20
9/16	.5625	45318	45418	45518	100.75	1	6	2	8	0.5341-0.5660	145.05	122.85	115.40	111.95	108.10	105.20
19/32	.5938	45319	45419	45519	105.40	1	6	2	8	0.5661-0.5970	149.75	127.60	120.25	116.60	112.80	109.80
5/8	.6250	45320	45420	45520	105.40	2	6	2 1/4	9	0.5971-0.6280	149.75	127.60	120.25	116.60	112.80	109.80
21/32	.6562	45321	45421	45521	107.50	2	6	2 1/4	9	0.6281-0.6590	151.65	129.45	122.05	118.40	114.75	111.80
11/16	.6875	45322	45422	45522	107.50	2	6	2 1/4	9	0.6591-0.6910	151.65	129.45	122.05	118.40	114.75	111.80
23/32	.7188	45323	45423	45523	108.90	2	6	2 1/4	9	0.6911-0.7220	153.15	130.90	123.45	119.95	116.25	113.20
3/4	.7500	45324	45424	45524	112.50	2	6	2 1/2	9 1/2	0.7221-0.7530	156.60	134.40	127.00	123.45	119.65	116.65
25/32	.7812	45325	45425	45525	113.30	2	6	2 1/2	9 1/2	0.7531-0.7840	157.45	135.30	127.85	124.40	120.65	117.60
13/16	.8125	45326	45426	45526	115.80	2	6	2 1/2	9 1/2	0.7841-0.8160	160.00	137.90	130.55	126.95	123.10	120.25
27/32	.8438	45327	45427	45527	120.80	2	6	2 1/2	9 1/2	0.8161-0.8470	165.00	143.00	135.55	132.00	128.25	125.25
7/8	.8750	45328	45428	45528	125.35	2	6	2 5/8	10	0.8471-0.8780	171.30	148.30	140.65	136.95	133.10	129.90
29/32	.9062	45329	45429	45529	147.35	2	6	2 5/8	10	0.8781-0.9090	193.15	170.25	162.50	158.85	154.85	151.85
15/16	.9375	45330	45430	45530	147.35	3	8	2 5/8	10	0.9091-0.9410	193.15	170.25	162.50	158.85	154.85	151.85
31/32	.9688	45331	45431	45531	153.25	3	8	2 5/8	10	0.9411-0.9720	199.05	176.10	168.30	164.75	160.85	157.75
1	1.0000	45332	45432	45532	153.25	3	8	2 3/4	10 1/2	0.9721-1.0030	199.05	176.10	168.30	164.75	160.85	157.75
1 1/16	1.0625	45334	45434	45534	195.35	3	8	2 3/4	10 1/2	1.0031-1.0660	239.25	217.35	209.95	206.45	202.70	199.65
1 1/8	1.1250	45336	45436	45536	207.50	3	8	2 7/8	11	1.0661-1.1280	251.60	229.65	222.15	218.70	214.80	212.00
1 3/16	1.1875	45338	45438	45538	226.95	3	8	2 7/8	11	1.1281-1.1905	270.90	248.90	241.55	237.90	234.30	231.35
1 1/4	1.2500	45340	45440	45540	246.25	4	8	3	11 1/2	1.1906-1.2530	290.20	268.20	260.85	257.25	253.55	250.60
1 5/16	1.3125	45342	45442	45542	260.25	4	8	3	11 1/2	1.2531-1.3155	304.20	282.10	274.65	271.30	267.45	264.45
1 3/8	1.3750	45344	45444	45544	275.25	4	8	3 1/4	12	1.3156-1.3780	319.15	297.10	289.80	286.30	282.45	279.50
1 7/16	1.4375	45346	45446	45546	289.75	4	8	3 1/4	12	1.3781-1.4405	333.70	311.65	304.30	300.85	296.95	294.00
1 1/2	1.5000	45348	45448	45548	305.40	4	8	3 1/2	12 1/2	1.4406-1.5030	349.40	327.30	319.95	316.45	312.65	309.75

*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					
											1	2	3	4	5-7	8-14*
5/16	.3125	46410	46610	46810	\$95.20	.2792	4	1	6	0.2841 - 0.3150	\$136.50	\$115.90	\$109.05	\$105.60	\$102.05	\$99.30
11/32	.3438	46411	46611	46811	95.20	.2792	4	1	6	0.3151 - 0.3470	136.50	115.90	109.05	105.60	102.05	99.30
3/8	.3750	46412	46612	46812	90.00	.3105	4	1	7	0.3471 - 0.3780	128.55	109.30	102.75	99.65	96.40	93.75
13/32	.4062	46413	46613	46813	94.75	.3105	4	1	7	0.3781 - 0.4090	133.40	114.05	107.60	104.55	101.25	98.45
7/16	.4375	46414	46614	46814	94.75	.3730	6	1	7	0.4091 - 0.4410	133.40	114.05	107.60	104.55	101.25	98.45
15/32	.4688	46415	46615	46815	100.40	.3730	6	1	7	0.4411 - 0.4720	139.05	119.65	113.25	110.20	106.85	104.10
1/2	.5000	46416	46616	46816	100.40	.4355	6	1	8	0.4721 - 0.5030	139.05	119.65	113.25	110.20	106.85	104.10
17/32	.5312	46417	46617	46817	102.90	.4355	6	1	8	0.5031 - 0.5340	141.80	122.20	115.80	112.70	109.40	106.85
9/16	.5625	46418	46618	46818	102.90	.4355	6	1 1/8	8	0.5341 - 0.5660	141.80	122.20	115.80	112.70	109.40	106.85
19/32	.5938	46419	46619	46819	107.50	.4355	6	1 1/8	8	0.5661 - 0.5970	146.05	126.75	120.30	117.15	113.90	111.25
5/8	.6250	46420	46620	46820	107.50	.5615	6	1 1/4	9	0.5971 - 0.6280	146.05	126.75	120.30	117.15	113.90	111.25
21/32	.6562	46421	46621	46821	117.50	.5615	6	1 1/4	9	0.6281 - 0.6590	156.15	136.75	130.25	127.10	123.90	121.35
11/16	.6875	46422	46622	46822	117.50	.5615	6	1 1/4	9	0.6591 - 0.6910	156.15	136.75	130.25	127.10	123.90	121.35
23/32	.7188	46423	46623	46823	121.95	.5615	6	1 1/4	9	0.6911 - 0.7220	160.60	141.15	134.70	131.70	128.30	125.60
3/4	.7500	46424	46624	46824	121.95	.6245	6	1 3/8	9 1/2	0.7221 - 0.7530	160.60	141.15	134.70	131.70	128.30	125.60
25/32	.7812	46425	46625	46825	131.40	.6245	6	1 3/8	9 1/2	0.7531 - 0.7840	170.10	150.70	144.25	141.10	137.80	135.15
13/16	.8125	46426	46626	46826	131.40	.6245	6	1 3/8	9 1/2	0.7841 - 0.8160	170.10	150.70	144.25	141.10	137.80	135.15
27/32	.8438	46427	46627	46827	136.50	.6245	6	1 3/8	9 1/2	0.8161 - 0.8470	175.30	155.80	149.30	146.25	143.00	140.40
7/8	.8750	46428	46628	46828	141.75	.7495	6	1 1/2	10	0.8471 - 0.8780	181.85	161.75	154.95	151.80	148.30	145.60
29/32	.9062	46429	46629	46829	150.80	.7495	6	1 1/2	10	0.8781 - 0.9090	190.90	170.80	164.10	160.95	157.45	154.75
15/16	.9375	46430	46630	46830	150.80	.7495	8	1 1/2	10	0.9091 - 0.9410	190.90	170.80	164.10	160.95	157.45	154.75
31/32	.9688	46431	46631	46831	156.60	.7495	8	1 1/2	10	0.9411 - 0.9720	196.70	176.70	170.00	166.75	163.30	160.55
1	1.0000	46432	46632	46832	156.60	.8745	8	1 5/8	10 1/2	0.9721 - 1.0030	196.70	176.70	170.00	166.75	163.30	160.55
1 1/32	1.0312	46433	46633	46833	171.70	.8745	8	1 5/8	10 1/2	-	-	-	-	-	-	-
1 1/16	1.0625	46434	46634	46834	171.70	.8745	8	1 5/8	10 1/2	1.0031 - 1.0660	211.80	191.70	185.00	181.80	178.25	175.65
1 3/32	1.0938	46435	46635	46835	171.70	.8745	8	1 3/4	11	-	-	-	-	-	-	-
1 1/8	1.1250	46436	46636	46836	171.70	.8745	8	1 3/4	11	1.0661 - 1.1280	211.80	191.70	185.00	181.80	178.25	175.65
1 3/16	1.1875	46438	46638	46838	187.45	.9995	8	1 3/4	11	1.1281 - 1.1905	227.60	207.40	200.65	197.50	194.00	191.50
1 1/4	1.2500	46440	46640	46840	187.45	.9995	8	1 7/8	11 1/2	1.1906 - 1.2530	227.60	207.40	200.65	197.50	194.00	191.50
1 5/16	1.3125	46442	46642	46842	206.95	.9995	8	1 7/8	11 1/2	1.2531 - 1.3155	247.10	226.95	220.25	217.10	213.55	210.85
1 3/8	1.3750	46444	46644	46844	217.45	.9995	8	2	12	1.3156 - 1.3780	257.70	237.65	230.85	227.65	224.25	221.45
1 7/16	1.4375	46446	46646	46846	256.30	.9995	8	2	12	1.3781 - 1.4405	299.15	277.65	270.55	267.15	263.35	260.45
1 1/2	1.5000	46448	46648	46848	263.50	1.2495	8	2 1/8	12 1/2	1.4406 - 1.5030	306.45	284.85	277.70	274.35	270.65	267.75
1 9/16	1.5625	46450	46650	46850	346.25	1.2495	8	2 1/8	12 1/2	1.5031 - 1.5660	389.05	367.70	360.45	357.00	353.40	350.40
1 5/8	1.6250	46452	46652	46852	346.25	1.2495	8	2 1/4	13	1.5661 - 1.6280	389.05	367.70	360.45	357.00	353.40	350.40
1 11/16	1.6875	46454	46654	46854	383.40	1.2495	8	2 1/4	13	1.6281 - 1.6910	426.30	404.85	397.70	394.15	390.45	387.70
1 3/4	1.7500	46456	46656	46856	383.40	1.2495	10	2 3/8	13 1/2	1.6911 - 1.7530	426.30	404.85	397.70	394.15	390.45	387.70
1 13/16	1.8125	46458	46658	46858	454.00	1.4995	10	2 3/8	13 1/2	1.7531 - 1.8160	496.80	475.30	468.25	464.85	461.15	458.20
1 7/8	1.8750	46460	46660	46860	454.00	1.4995	10	2 1/2	14	1.8161 - 1.8780	496.80	475.30	468.25	464.85	461.15	458.20
1 15/16	1.9375	46462	46662	46862	496.15	1.4995	10	2 1/2	14	1.8781 - 1.9410	538.85	517.45	510.25	506.85	503.15	500.30
2	2.0000	46464	46664	46864	496.15	1.4995	12	2 1/2	14	1.9411 - 2.0030	538.85	517.45	510.25	506.85	503.15	500.30

*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 FLTS	LENGTH 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	\$100.65	1	4	1	7	0.3471 - 0.3780	\$139.25	\$119.95	\$113.45	\$110.40	\$107.05	\$104.45
13/32	.4062	46113	46213	46313	102.15	1	4	1	7	0.3781 - 0.4090	140.80	121.45	115.00	111.90	108.50	105.90
7/16	.4375	46114	46214	46314	103.75	1	6	1	7	0.4091 - 0.4410	142.30	122.95	116.50	113.40	110.10	107.50
15/32	.4688	46115	46215	46315	108.10	1	6	1	7	0.4411 - 0.4720	146.85	127.55	120.85	117.85	114.60	111.95
1/2	.5000	46116	46216	46316	108.80	1	6	1	8	0.4721 - 0.5030	147.45	128.10	121.60	118.40	115.20	112.60
17/32	.5312	46117	46217	46317	112.10	1	6	1	8	0.5031 - 0.5340	150.80	131.50	125.05	121.95	118.50	115.95
9/16	.5625	46118	46218	46318	112.10	1	6	1 1/8	8	0.5341 - 0.5660	150.80	131.50	125.05	121.95	118.50	115.95
19/32	.5938	46119	46219	46319	116.40	1	6	1 1/8	8	0.5661 - 0.5970	155.00	135.65	129.30	126.15	122.80	120.25
5/8	.6250	46120	46220	46320	116.65	2	6	1 1/4	9	0.5971 - 0.6280	155.40	135.95	129.50	126.40	123.10	120.55
21/32	.6562	46121	46221	46321	126.75	2	6	1 1/4	9	0.6281 - 0.6590	165.45	146.00	139.55	136.45	133.15	130.55
11/16	.6875	46122	46222	46322	127.05	2	6	1 1/4	9	0.6591 - 0.6910	165.85	146.50	139.85	136.80	133.45	130.90
23/32	.7188	46123	46223	46323	131.75	2	6	1 1/4	9	0.6911 - 0.7220	170.50	151.00	144.50	141.45	138.10	135.55
3/4	.7500	46124	46224	46324	131.75	2	6	1 3/8	9 1/2	0.7221 - 0.7530	170.50	151.00	144.50	141.45	138.10	135.55
25/32	.7812	46125	46225	46325	141.30	2	6	1 3/8	9 1/2	0.7531 - 0.7840	180.10	160.65	154.15	151.10	147.75	145.20
13/16	.8125	46126	46226	46326	141.30	2	6	1 3/8	9 1/2	0.7841 - 0.8160	180.10	160.65	154.15	151.10	147.75	145.20
27/32	.8438	46127	46227	46327	147.25	2	6	1 3/8	9 1/2	0.8161 - 0.8470	186.00	166.60	160.00	156.90	153.60	151.00
7/8	.8750	46128	46228	46328	152.65	2	6	1 1/2	10	0.8471 - 0.8780	193.00	172.80	166.05	162.85	159.40	156.65
29/32	.9062	46129	46229	46329	160.95	2	6	1 1/2	10	0.8781 - 0.9090	201.00	180.90	174.20	171.00	167.55	164.80
15/16	.9375	46130	46230	46330	161.75	3	8	1 1/2	10	0.9091 - 0.9410	201.85	181.80	175.00	171.85	168.30	165.75
31/32	.9688	46131	46231	46331	167.45	3	8	1 1/2	10	0.9411 - 0.9720	207.50	187.50	180.70	177.50	174.10	171.40
1	1.0000	46132	46232	46332	167.45	3	8	1 5/8	10 1/2	0.9721 - 1.0030	207.50	187.50	180.70	177.50	174.10	171.40
1 1/32	1.0312	46133	46233	46333	178.10	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-
1 1/16	1.0625	46134	46234	46334	178.10	3	8	1 5/8	10 1/2	1.0031 - 1.0660	218.25	198.15	191.55	188.25	184.85	182.10
1 3/32	1.0938	46135	46235	46335	183.45	3	8	1 3/4	11	-	-	-	-	-	-	-
1 1/8	1.1250	46136	46236	46336	183.45	3	8	1 3/4	11	1.0661 - 1.1280	223.45	203.35	196.55	193.35	189.95	187.25
1 3/16	1.1875	46138	46238	46338	195.60	3	8	1 3/4	11	1.1281 - 1.1905	235.80	215.60	208.95	205.75	202.25	199.60
1 1/4	1.2500	46140	46240	46340	208.95	4	8	1 7/8	11 1/2	1.1906 - 1.2530	249.10	228.95	222.15	218.95	215.55	212.90
1 5/16	1.3125	46142	46242	46342	216.75	4	8	1 7/8	11 1/2	1.2531 - 1.3155	257.00	236.90	230.10	226.90	223.45	220.70
1 3/8	1.3750	46144	46244	46344	240.35	4	8	2	12	1.3156 - 1.3780	280.65	260.45	253.85	250.60	247.10	244.45
1 7/16	1.4375	46146	46246	46346	266.45	4	8	2	12	1.3781 - 1.4405	309.35	287.70	280.70	277.25	273.50	270.65
1 1/2	1.5000	46148	46248	46348	274.50	4	8	2 1/8	12 1/2	1.4406 - 1.5030	317.35	295.80	288.75	285.30	281.60	278.75
1 5/8	1.5625	46150	46250	46350	384.65	4	8	2 1/8	12 1/2	1.5031 - 1.5660	427.50	405.95	398.65	395.35	391.70	388.85
1 3/4	1.6250	46152	46252	46352	384.65	4	8	2 1/4	13	1.5661 - 1.6280	427.50	405.95	398.65	395.35	391.70	388.85
1 11/16	1.6875	46154	46254	46354	426.15	4	8	2 1/4	13	1.6281 - 1.6910	469.05	447.50	440.25	436.85	433.25	430.25
1 3/4	1.7500	46156	46256	46356	426.15	4	10	2 3/8	13 1/2	1.6911 - 1.7530	469.05	447.50	440.25	436.85	433.25	430.25
1 13/16	1.8125	46158	46258	46358	504.50	4	10	2 3/8	13 1/2	1.7531 - 1.8160	547.35	525.95	518.70	515.30	511.60	508.75
1 7/8	1.8750	46160	46260	46360	504.50	4	10	2 1/2	14	1.8161 - 1.8780	547.35	525.95	518.70	515.30	511.60	508.75
1 15/16	1.9375	46162	46262	46362	550.95	4	10	2 1/2	14	1.8781 - 1.9410	593.80	572.35	565.15	561.80	558.15	555.25
2	2.0000	46164	46264	46364	550.95	4	12	2 1/2	14	1.9411 - 2.0030	593.80	572.35	565.15	561.80	558.15	555.25

*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
3/16	.1875	43206	43606	43806	\$65.35	.1805	4	1 1/8	1/2	4 1/2	0.1770-0.2040	\$104.00	\$84.65	\$78.10	\$75.10	\$71.70	\$69.15
7/32	.2188	43207	43607	43807	65.35	.2075	4	1 1/4	1/2	5	0.2041-0.2210	104.00	84.65	78.10	75.10	71.70	69.15
15/64	.2344	4322344	4362344	4382344	65.35	.2265	4	1 1/2	1/2	6	0.2211-0.2380	104.00	84.65	78.10	75.10	71.70	69.15
1/4	.2500	43208	43608	43808	65.35	.2405	4	1 1/2	1/2	6	0.2381-0.2530	104.00	84.65	78.10	75.10	71.70	69.15
9/32	.2812	43209	43609	43809	65.45	.2485	4	1 1/2	1/2	6	0.2531-0.2840	104.10	84.85	78.30	75.30	71.95	69.30
5/16	.3125	43210	43610	43810	65.45	.2792	4	1 1/2	1/2	6	0.2841-0.3150	104.10	84.85	78.30	75.30	71.95	69.30
11/32	.3438	43211	43611	43811	72.15	.2792	4	1 1/2	5/8	6	0.3151-0.3470	110.80	91.50	85.00	81.95	78.55	75.85
3/8	.3750	43212	43612	43812	72.80	.3105	4	1 3/4	5/8	7	0.3471-0.3780	111.45	92.05	85.55	82.50	79.15	76.55
13/32	.4062	43213	43613	43813	76.05	.3105	4	1 3/4	5/8	7	0.3781-0.4090	114.70	95.25	88.85	85.70	82.40	79.80
7/16	.4375	43214	43614	43814	79.00	.3730	6	1 3/4	5/8	7	0.4091-0.4410	117.60	98.25	91.75	88.65	85.35	82.75
15/32	.4688	43215	43615	43815	83.95	.3730	6	1 3/4	5/8	7	0.4411-0.4720	122.75	103.30	96.80	93.75	90.40	87.85
1/2	.5000	43216	43616	43816	90.45	.4355	6	2	5/8	8	0.4721-0.5030	131.75	110.95	104.05	100.75	97.20	94.45
17/32	.5312	43217	43617	43817	93.20	.4355	6	2	5/8	8	0.5031-0.5340	134.40	113.85	106.85	103.50	100.00	97.15
9/16	.5625	43218	43618	43818	93.20	.4355	6	2	5/8	8	0.5341-0.5660	134.40	113.85	106.85	103.50	100.00	97.15
19/32	.5938	43219	43619	43819	96.05	.4355	6	2	5/8	8	0.5661-0.5970	137.30	116.60	109.60	106.40	102.80	100.05
5/8	.6250	43220	43620	43820	96.05	.5615	6	2 1/4	5/8	9	0.5971-0.6280	137.30	116.60	109.60	106.40	102.80	100.05
21/32	.6562	43221	43621	43821	99.00	.5615	6	2 1/4	5/8	9	0.6281-0.6590	140.20	119.50	112.60	109.30	105.70	102.85
11/16	.6875	43222	43622	43822	105.20	.5615	6	2 1/4	5/8	9	0.6591-0.6910	146.40	125.65	118.85	115.50	111.95	109.20
23/32	.7188	43223	43623	43823	106.80	.5615	6	2 1/4	5/8	9	0.6911-0.7220	147.95	127.40	120.45	117.15	113.55	110.80
3/4	.7500	43224	43624	43824	108.25	.6245	6	2 1/2	3/4	9 1/2	0.7221-0.7530	149.55	128.85	121.95	118.75	115.15	112.30
25/32	.7812	43225	43625	43825	111.25	.6245	6	2 1/2	3/4	9 1/2	0.7531-0.7840	152.45	131.80	124.90	121.60	118.10	115.25
13/16	.8125	43226	43626	43826	111.25	.6245	6	2 1/2	3/4	9 1/2	0.7841-0.8160	152.45	131.80	124.90	121.60	118.10	115.25
27/32	.8438	43227	43627	43827	117.15	.6245	6	2 1/2	3/4	9 1/2	0.8161-0.8470	158.25	137.75	130.80	127.55	123.95	121.10
7/8	.8750	43228	43628	43828	121.55	.7495	6	2 5/8	3/4	10	0.8471-0.8780	164.40	143.00	135.75	132.30	128.65	125.65
29/32	.9062	43229	43629	43829	141.65	.7495	6	2 5/8	3/4	10	0.8781-0.9090	184.40	162.90	155.75	152.40	148.70	145.85
15/16	.9375	43230	43630	43830	141.65	.7495	8	2 5/8	3/4	10	0.9091-0.9410	184.40	162.90	155.75	152.40	148.70	145.85
31/32	.9688	43231	43631	43831	148.55	.7495	8	2 5/8	3/4	10	0.9411-0.9720	191.45	169.95	162.65	159.30	155.55	152.60
1	1.0000	43232	43632	43832	148.55	.8745	8	2 3/4	3/4	10 1/2	0.9721-1.0030	191.45	169.95	162.65	159.30	155.55	152.60
1 1/16	1.0625	43234	43634	43834	159.35	.8745	8	2 3/4	3/4	10 1/2	1.0031-1.0660	202.20	180.70	173.55	170.15	166.55	163.55
1 1/8	1.1250	43236	43636	43836	164.30	.8745	8	2 7/8	7/8	11	1.0661-1.1280	207.20	185.65	178.50	175.00	171.40	168.45
1 3/16	1.1875	43238	43638	43838	172.60	.9995	8	2 7/8	7/8	11	1.1281-1.1905	215.40	193.95	186.80	183.45	179.65	176.75
1 1/4	1.2500	43240	43640	43840	182.80	.9995	8	3	7/8	11 1/2	1.1906-1.2530	225.65	204.15	197.05	193.45	189.85	186.95
1 5/16	1.3125	43242	43642	43842	202.20	.9995	8	3	7/8	11 1/2	1.2531-1.3155	245.00	223.50	216.45	213.00	209.30	206.45
1 3/8	1.3750	43244	43644	43844	221.40	.9995	8	3 1/4	7/8	12	1.3156-1.3780	264.30	242.85	235.65	232.20	228.55	225.70
1 7/16	1.4375	43246	43646	43846	234.70	.9995	8	3 1/4	7/8	12	1.3781-1.4405	277.50	256.00	248.90	245.50	241.70	238.85
1 1/2	1.5000	43248	43648	43848	247.90	1.2495	8	3 1/2	7/8	12 1/2	1.4406-1.5030	290.70	269.25	262.00	258.65	254.95	252.00

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



MATERIAL SPECIFIC REAMERS CARBIDE TIPPED TYPES 442, 443, 444 FRACTIONAL

MATERIAL SPECIFIC

**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

REAMERS

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 FLTS	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	\$78.55	.2792	4	1 1/2	6	0.2841 - 0.3150	\$117.20	\$97.90	\$91.35	\$88.30	\$85.00	\$82.35
1/32	.3438	44211	44311	44411	86.55	.2792	4	1 1/2	6	0.3151 - 0.3470	125.25	105.85	99.35	96.35	92.90	90.35
3/8	.3750	44212	44312	44412	87.25	.3105	4	1 3/4	7	0.3471 - 0.3780	126.10	106.65	100.10	97.05	93.75	91.15
13/32	.4062	44213	44313	44413	91.25	.3105	4	1 3/4	7	0.3781 - 0.4090	129.85	110.55	104.00	100.85	97.70	95.05
7/16	.4375	44214	44314	44414	94.75	.3730	6	1 3/4	7	0.4091 - 0.4410	133.40	114.05	107.60	104.55	101.25	98.45
15/32	.4688	44215	44315	44415	100.75	.3730	6	1 3/4	7	0.4411 - 0.4720	139.50	120.05	113.55	110.55	107.15	104.60
1/2	.5000	44216	44316	44416	108.70	.4355	6	2	8	0.4721 - 0.5030	149.90	129.35	122.25	119.05	115.50	112.70
17/32	.5312	44217	44317	44417	111.85	.4355	6	2	8	0.5031 - 0.5340	153.15	132.35	125.40	122.15	118.75	115.90
9/16	.5625	44218	44318	44418	111.85	.4355	6	2	8	0.5341 - 0.5660	153.15	132.35	125.40	122.15	118.75	115.90
19/32	.5938	44219	44319	44419	115.15	.4355	6	2	8	0.5661 - 0.5970	156.40	135.65	128.80	125.40	121.95	119.10
5/8	.6250	44220	44320	44420	115.15	.5615	6	2 1/4	9	0.5971 - 0.6280	156.40	135.65	128.80	125.40	121.95	119.10
21/32	.6562	44221	44321	44421	118.80	.5615	6	2 1/4	9	0.6281 - 0.6590	160.00	139.25	132.35	129.10	125.55	122.80
11/16	.6875	44222	44322	44422	126.10	.5615	6	2 1/4	9	0.6591 - 0.6910	167.35	146.70	139.70	136.45	133.00	130.15
23/32	.7188	44223	44323	44423	128.00	.5615	6	2 1/4	9	0.6911 - 0.7220	169.30	148.55	141.75	138.35	134.90	132.05
3/4	.7500	44224	44324	44424	129.90	.6245	6	2 1/2	9 1/2	0.7221 - 0.7530	171.15	150.55	143.60	140.40	136.80	134.05
25/32	.7812	44225	44325	44425	133.40	.6245	6	2 1/2	9 1/2	0.7531 - 0.7840	174.70	154.00	147.00	143.70	140.25	137.45
13/16	.8125	44226	44326	44426	133.40	.6245	6	2 1/2	9 1/2	0.7841 - 0.8160	174.70	154.00	147.00	143.70	140.25	137.45
27/32	.8438	44227	44327	44427	140.60	.6245	6	2 1/2	9 1/2	0.8161 - 0.8470	181.85	161.15	154.20	151.00	147.45	144.60
7/8	.8750	44228	44328	44428	145.90	.7495	6	2 5/8	10	0.8471 - 0.8780	188.70	167.30	160.10	156.65	153.10	150.10
29/32	.9062	44229	44329	44429	170.00	.7495	6	2 5/8	10	0.8781 - 0.9090	212.85	191.45	184.15	180.70	177.15	174.20
15/16	.9375	44230	44330	44430	170.00	.7495	8	2 5/8	10	0.9091 - 0.9410	212.85	191.45	184.15	180.70	177.15	174.20
31/32	.9688	44231	44331	44431	178.20	.7495	8	2 5/8	10	0.9411 - 0.9720	221.15	199.65	192.45	189.10	185.35	182.45
1	1.0000	44232	44332	44432	178.20	.8745	8	2 3/4	10 1/2	0.9721 - 1.0030	221.15	199.65	192.45	189.10	185.35	182.45
1 1/16	1.0625	44234	44334	44434	209.50	.8745	8	2 3/4	10 1/2	1.0031 - 1.0660	252.45	230.85	223.65	220.30	216.60	213.70
1 1/8	1.1250	44236	44336	44436	216.00	.8745	8	2 7/8	11	1.0661 - 1.1280	258.80	237.35	230.15	226.80	223.20	220.25
1 3/16	1.1875	44238	44338	44438	227.00	.9995	8	2 7/8	11	1.1281 - 1.1905	269.90	248.40	241.35	237.80	234.15	231.35
1 1/4	1.2500	44240	44340	44440	240.25	.9995	8	3	11 1/2	1.1906 - 1.2530	283.10	261.70	254.50	251.10	247.30	244.50
1 5/16	1.3125	44242	44342	44442	265.85	.9995	8	3	11 1/2	1.2531 - 1.3155	308.70	287.30	280.05	276.70	272.95	270.00
1 3/8	1.3750	44244	44344	44444	291.30	.9995	8	3 1/4	12	1.3156 - 1.3780	334.05	312.60	305.55	301.95	298.35	295.50
1 7/16	1.4375	44246	44346	44446	308.65	.9995	8	3 1/4	12	1.3781 - 1.4405	351.30	329.90	322.75	319.40	315.75	312.80
1 1/2	1.5000	44248	44348	44448	326.00	1.2495	8	3 1/2	12 1/2	1.4406 - 1.5030	368.80	347.35	340.10	336.85	333.00	330.25

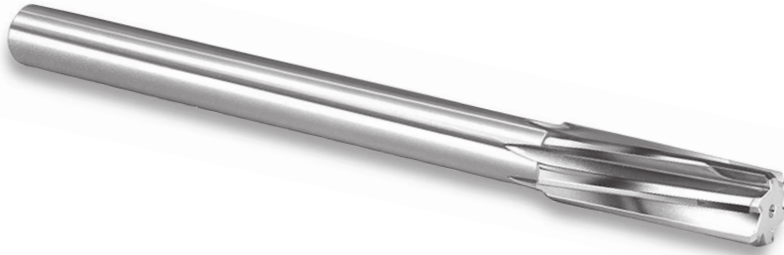
*Quantities of 15 or more - price of fractional size in same size range.



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
3/16	.1875	43306	43706	43906	\$69.65	.1805	4	1 1/8	1/2	4 1/2	0.1770 - 0.2040	\$110.90	\$90.30	\$83.40	\$80.10	\$76.55	\$73.70
7/32	.2188	43307	43707	43907	69.65	.2075	4	1 1/4	1/2	5	0.2041 - 0.2210	110.90	90.30	83.40	80.10	76.55	73.70
15/64	.2344	4332344	4372344	4392344	69.65	.2265	4	1 1/2	1/2	6	0.2211 - 0.2380	110.90	90.30	83.40	80.10	76.55	73.70
1/4	.2500	43308	43708	43908	69.65	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	110.90	90.30	83.40	80.10	76.55	73.70
9/32	.2812	43309	43709	43909	69.90	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	111.20	90.45	83.60	80.20	76.70	74.00
5/16	.3125	43310	43710	43910	69.90	.2792	4	1 1/2	1/2	6	0.2841 - 0.3150	111.20	90.45	83.60	80.20	76.70	74.00
11/32	.3438	43311	43711	43911	76.90	.2792	4	1 1/2	5/8	6	0.3151 - 0.3470	118.20	97.65	90.65	87.25	83.80	81.05
3/8	.3750	43312	43712	43912	77.65	.3105	4	1 3/4	5/8	7	0.3471 - 0.3780	118.90	98.25	91.30	87.95	84.45	81.60
13/32	.4062	43313	43713	43913	81.10	.3105	4	1 3/4	5/8	7	0.3781 - 0.4090	122.25	101.70	94.75	91.50	87.90	85.15
7/16	.4375	43314	43714	43914	84.25	.3730	6	1 3/4	5/8	7	0.4091 - 0.4410	125.40	104.75	97.90	94.65	91.00	88.30
15/32	.4688	43315	43715	43915	89.55	.3730	6	1 3/4	5/8	7	0.4411 - 0.4720	130.85	110.25	103.30	100.00	96.45	93.65
1/2	.5000	43316	43716	43916	92.85	.4355	6	2	5/8	8	0.4721 - 0.5030	135.20	114.00	106.90	103.50	99.95	97.05
17/32	.5312	43317	43717	43917	95.70	.4355	6	2	5/8	8	0.5031 - 0.5340	138.00	116.75	109.60	106.35	102.70	99.75
9/16	.5625	43318	43718	43918	95.70	.4355	6	2	5/8	8	0.5341 - 0.5660	138.00	116.75	109.60	106.35	102.70	99.75
19/32	.5938	43319	43719	43919	98.60	.4355	6	2	5/8	8	0.5661 - 0.5970	140.95	119.65	112.65	109.30	105.60	102.75
5/8	.6250	43320	43720	43920	98.60	.5615	6	2 1/4	5/8	9	0.5971 - 0.6280	140.95	119.65	112.65	109.30	105.60	102.75
21/32	.6562	43321	43721	43921	101.50	.5615	6	2 1/4	5/8	9	0.6281 - 0.6590	143.90	122.70	115.55	112.10	108.50	105.70
11/16	.6875	43322	43722	43922	107.95	.5615	6	2 1/4	5/8	9	0.6591 - 0.6910	150.30	129.10	122.00	118.50	115.00	112.05
23/32	.7188	43323	43723	43923	109.55	.5615	6	2 1/4	5/8	9	0.6911 - 0.7220	151.95	130.75	123.65	120.30	116.60	113.85
3/4	.7500	43324	43724	43924	111.20	.6245	6	2 1/2	3/4	9 1/2	0.7221 - 0.7530	153.50	132.30	125.25	121.90	118.20	115.30
25/32	.7812	43325	43725	43925	114.15	.6245	6	2 1/2	3/4	9 1/2	0.7531 - 0.7840	156.60	135.30	128.25	124.85	121.25	118.30
13/16	.8125	43326	43726	43926	114.15	.6245	6	2 1/2	3/4	9 1/2	0.7841 - 0.8160	156.60	135.30	128.25	124.85	121.25	118.30
27/32	.8438	43327	43727	43927	120.30	.6245	6	2 1/2	3/4	9 1/2	0.8161 - 0.8470	162.65	141.45	134.25	130.90	127.20	124.40
7/8	.8750	43328	43728	43928	124.85	.7495	6	2 5/8	3/4	10	0.8471 - 0.8780	168.85	146.75	139.25	135.85	132.05	129.05
29/32	.9062	43329	43729	43929	145.40	.7495	6	2 5/8	3/4	10	0.8781 - 0.9090	189.30	167.35	160.00	156.45	152.60	149.75
15/16	.9375	43330	43730	43930	145.40	.7495	8	2 5/8	3/4	10	0.9091 - 0.9410	189.30	167.35	160.00	156.45	152.60	149.75
31/32	.9688	43331	43731	43931	152.45	.7495	8	2 5/8	3/4	10	0.9411 - 0.9720	196.45	174.45	167.10	163.55	159.80	156.80
1	1.0000	43332	43732	43932	152.45	.8745	8	2 3/4	3/4	10 1/2	0.9721 - 1.0030	196.45	174.45	167.10	163.55	159.80	156.80
1 1/16	1.0625	43334	43734	43934	163.60	.8745	8	2 3/4	3/4	10 1/2	1.0031 - 1.0660	207.50	185.65	178.15	174.70	170.90	167.95
1 1/8	1.1250	43336	43736	43936	168.70	.8745	8	2 7/8	7/8	11	1.0661 - 1.1280	212.70	190.60	183.20	179.70	176.00	173.00
1 3/16	1.1875	43338	43738	43938	177.30	.9995	8	2 7/8	7/8	11	1.1281 - 1.1905	221.20	199.20	191.75	188.25	184.50	181.55
1 1/4	1.2500	43340	43740	43940	187.60	.9995	8	3	7/8	11 1/2	1.1906 - 1.2530	231.55	209.65	202.20	198.70	194.90	191.85
1 5/16	1.3125	43342	43742	43942	207.50	.9995	8	3	7/8	11 1/2	1.2531 - 1.3155	251.60	229.65	222.15	218.70	214.80	212.00
1 3/8	1.3750	43344	43744	43944	227.40	.9995	8	3 1/4	7/8	12	1.3156 - 1.3780	271.40	249.30	241.90	238.45	234.70	231.65
1 7/16	1.4375	43346	43746	43946	241.00	.9995	8	3 1/4	7/8	12	1.3781 - 1.4405	284.85	262.85	255.60	251.95	248.25	245.25
1 1/2	1.5000	43348	43748	43948	254.60	1.2495	8	3 1/2	7/8	12 1/2	1.4406 - 1.5030	298.55	276.45	269.10	265.65	261.85	258.80

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



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

MATERIAL SPECIFIC

**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
5/16	.3125	48210	48310	48410	\$83.80	.2792	4	1 1/2	6	0.2841-0.3150	\$125.10	\$104.35	\$97.50	\$94.10	\$90.65	\$87.85
1/32	.3438	48211	48311	48411	92.30	.2792	4	1 1/2	6	0.3151-0.3470	133.55	112.85	106.00	102.70	99.15	96.40
3/8	.3750	48212	48312	48412	93.20	.3105	4	1 3/4	7	0.3471-0.3780	134.40	113.85	106.85	103.50	100.00	97.15
13/32	.4062	48213	48313	48413	97.20	.3105	4	1 3/4	7	0.3781-0.4090	138.55	118.00	110.90	107.70	104.05	101.35
7/16	.4375	48214	48314	48414	101.20	.3730	6	1 3/4	7	0.4091-0.4410	142.30	121.70	114.75	111.50	107.90	105.20
15/32	.4688	48215	48315	48415	107.55	.3730	6	1 3/4	7	0.4411-0.4720	148.80	128.10	121.10	118.00	114.30	111.55
1/2	.5000	48216	48316	48416	111.55	.4355	6	2	8	0.4721-0.5030	154.00	132.75	125.60	122.20	118.50	115.70
17/32	.5312	48217	48317	48417	114.80	.4355	6	2	8	0.5031-0.5340	157.20	135.85	128.85	125.40	121.90	118.95
9/16	.5625	48218	48318	48418	114.80	.4355	6	2	8	0.5341-0.5660	157.20	135.85	128.85	125.40	121.90	118.95
19/32	.5938	48219	48319	48419	118.20	.4355	6	2	8	0.5661-0.5970	160.55	139.25	132.20	128.85	125.25	122.25
5/8	.6250	48220	48320	48420	118.20	.5615	6	2 1/4	9	0.5971-0.6280	160.55	139.25	132.20	128.85	125.25	122.25
21/32	.6562	48221	48321	48421	121.95	.5615	6	2 1/4	9	0.6281-0.6590	164.30	143.10	135.85	132.60	128.95	126.10
11/16	.6875	48222	48322	48422	129.45	.5615	6	2 1/4	9	0.6591-0.6910	171.75	150.60	143.40	140.20	136.45	133.55
23/32	.7188	48223	48323	48423	131.50	.5615	6	2 1/4	9	0.6911-0.7220	173.75	152.50	145.50	142.05	138.40	135.60
3/4	.7500	48224	48324	48424	133.40	.6245	6	2 1/2	9 1/2	0.7221-0.7530	175.75	154.60	147.45	144.00	140.50	137.60
25/32	.7812	48225	48325	48425	136.95	.6245	6	2 1/2	9 1/2	0.7531-0.7840	179.35	158.10	151.00	147.70	143.95	141.10
13/16	.8125	48226	48326	48426	136.95	.6245	6	2 1/2	9 1/2	0.7841-0.8160	179.35	158.10	151.00	147.70	143.95	141.10
27/32	.8438	48227	48327	48427	144.40	.6245	6	2 1/2	9 1/2	0.8161-0.8470	186.70	165.45	158.25	154.95	151.35	148.50
7/8	.8750	48228	48328	48428	149.85	.7495	6	2 5/8	10	0.8471-0.8780	193.75	171.70	164.40	160.85	157.05	154.10
29/32	.9062	48229	48329	48429	174.55	.7495	6	2 5/8	10	0.8781-0.9090	218.50	196.45	189.10	185.65	181.80	178.85
15/16	.9375	48230	48330	48430	174.55	.7495	8	2 5/8	10	0.9091-0.9410	218.50	196.45	189.10	185.65	181.80	178.85
31/32	.9688	48231	48331	48431	183.00	.7495	8	2 5/8	10	0.9411-0.9720	227.00	205.00	197.70	194.15	190.35	187.45
1	1.0000	48232	48332	48432	183.00	.8745	8	2 3/4	10 1/2	0.9721-1.0030	227.00	205.00	197.70	194.15	190.35	187.45
1 1/16	1.0625	48234	48334	48434	215.20	.8745	8	2 3/4	10 1/2	1.0031-1.0660	259.10	237.10	229.75	226.10	222.45	219.50
1 1/8	1.1250	48236	48336	48436	221.85	.8745	8	2 7/8	11	1.0661-1.1280	265.80	243.80	236.30	232.85	229.05	226.05
1 3/16	1.1875	48238	48338	48438	233.15	.9995	8	2 7/8	11	1.1281-1.1905	277.05	255.10	247.70	244.15	240.35	237.40
1 1/4	1.2500	48240	48340	48440	246.85	.9995	8	3	11 1/2	1.1906-1.2530	290.70	268.70	261.30	257.75	254.00	251.10
1 5/16	1.3125	48242	48342	48442	272.95	.9995	8	3	11 1/2	1.2531-1.3155	316.95	294.85	287.55	284.05	280.25	277.35
1 3/8	1.3750	48244	48344	48444	299.10	.9995	8	3 1/4	12	1.3156-1.3780	343.00	321.10	313.65	310.05	306.40	303.30
1 7/16	1.4375	48246	48346	48446	316.85	.9995	8	3 1/4	12	1.3781-1.4405	360.85	338.70	331.40	327.95	324.15	321.20
1 1/2	1.5000	48248	48348	48448	334.70	1.2495	8	3 1/2	12 1/2	1.4406-1.5030	378.65	356.65	349.40	345.70	342.00	339.15

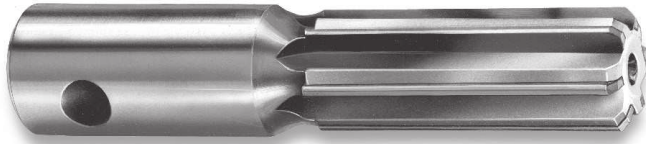
*Quantities of 15 or more - price of fractional size in same size range.



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

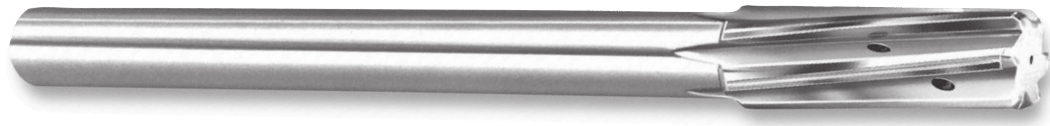
TOOL DIAMETER		TYPE 470 NON-FERROUS EDP NO.	TYPE 471 NAS/ CAST IRON EDP NO.	TYPE 475 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICES	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
FRACTIONAL	DECIMAL					SHANK DIAM.	NO. OF FLTS	LENGTH			PIN HOLE DIAM.	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
		FLT	CAR- BIDE	OVER- ALL	1			2	3	4			5-7	8-14*				
3/16	.1875	47006	47106	47506	\$67.35	1/4	4	1	1/2	2 1/4	3/32	0.1770-0.2040	\$108.50	\$87.90	\$81.05	\$77.75	\$74.15	\$71.40
7/32	.2188	47007	47107	47507	67.35	1/4	4	1	1/2	2 1/4	3/32	0.2041-0.2210	108.50	87.90	81.05	77.75	74.15	71.40
15/64	.2344	4702344	4712344	4752344	67.35	1/4	4	1	1/2	2 1/4	3/32	0.2211-0.2380	108.50	87.90	81.05	77.75	74.15	71.40
1/4	.2500	47008	47108	47508	67.35	1/4	4	1	1/2	2 1/4	3/32	0.2381-0.2530	108.50	87.90	81.05	77.75	74.15	71.40
9/32	.2812	47009	47109	47509	67.35	3/8	4	1	1/2	2 1/4	1/8	0.2531-0.2840	108.50	87.90	81.05	77.75	74.15	71.40
5/16	.3125	47010	47110	47510	78.25	3/8	4	1	1	2 1/4	1/8	0.2841-0.3150	119.55	99.00	92.00	88.65	85.15	82.35
11/32	.3438	47011	47111	47511	79.00	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3151-0.3470	120.30	99.60	92.65	89.35	85.75	83.00
3/8	.3750	47012	47112	47512	85.65	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3471-0.3780	126.85	106.25	99.30	96.05	92.55	89.65
13/32	.4062	47013	47113	47513	86.95	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.3781-0.4090	128.20	107.55	100.60	97.20	93.75	90.95
7/16	.4375	47014	47114	47514	102.80	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4091-0.4410	144.20	123.45	116.55	113.25	109.60	106.90
15/32	.4688	47015	47115	47515	102.80	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4411-0.4720	144.20	123.45	116.55	113.25	109.60	106.90
1/2	.5000	47016	47116	47516	117.50	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4721-0.5030	161.75	139.55	132.05	128.45	124.75	121.80
17/32	.5312	47017	47117	47517	117.50	5/8	6	1 1/2	1 1/2	3	1/4	0.5031-0.5340	161.75	139.55	132.05	128.45	124.75	121.80
9/16	.5625	47018	47118	47518	123.80	5/8	6	1 1/2	1 1/2	3	1/4	0.5341-0.5660	168.00	145.85	138.35	134.90	131.05	128.10
19/32	.5938	47019	47119	47519	123.80	5/8	6	1 1/2	1 1/2	3	1/4	0.5661-0.5970	168.00	145.85	138.35	134.90	131.05	128.10
5/8	.6250	47020	47120	47520	127.05	5/8	6	1 1/2	1 1/2	3	1/4	0.5971-0.6280	171.30	149.20	141.85	138.25	134.40	131.50
21/32	.6562	47021	47121	47521	127.05	5/8	6	1 1/2	1 1/2	3	1/4	0.6281-0.6590	171.30	149.20	141.85	138.25	134.40	131.50
11/16	.6875	47022	47122	47522	133.10	5/8	6	1 1/2	1 1/2	3	1/4	0.6591-0.6910	177.30	155.15	147.75	144.25	140.50	137.45
23/32	.7188	47023	47123	47523	133.10	3/4	6	1 1/2	1 1/2	3	5/16	0.6911-0.7220	177.30	155.15	147.75	144.25	140.50	137.45
3/4	.7500	47024	47124	47524	136.45	3/4	6	1 1/2	1 1/2	3	5/16	0.7221-0.7530	180.65	158.60	151.05	147.55	143.70	140.70
25/32	.7812	47025	47125	47525	136.45	3/4	6	1 1/2	1 1/2	3	5/16	0.7531-0.7840	180.65	158.60	151.05	147.55	143.70	140.70
13/16	.8125	47026	47126	47526	148.20	3/4	6	1 1/2	1 1/2	3	5/16	0.7841-0.8160	192.40	170.30	162.85	159.30	155.50	152.45
27/32	.8438	47027	47127	47527	148.20	3/4	6	1 1/2	1 1/2	3	5/16	0.8161-0.8470	192.40	170.30	162.85	159.30	155.50	152.45
7/8	.8750	47028	47128	47528	161.95	3/4	6	1 1/2	1 1/2	3	5/16	0.8471-0.8780	207.80	184.85	177.25	173.50	169.45	166.55
29/32	.9062	47029	47129	47529	161.95	3/4	6	1 1/2	1 1/2	3	5/16	0.8781-0.9090	207.80	184.85	177.25	173.50	169.45	166.55
15/16	.9375	47030	47130	47530	178.25	3/4	6	1 1/2	1 1/2	3	5/16	0.9091-0.9410	224.25	201.20	193.65	189.90	186.00	182.90
31/32	.9688	47031	47131	47531	178.25	3/4	8	1 1/2	1 1/2	3	5/16	0.9411-0.9720	224.25	201.20	193.65	189.90	186.00	182.90
1	1.0000	47032	47132	47532	187.15	3/4	8	1 1/2	1 1/2	3	5/16	0.9721-1.0030	233.05	210.10	202.30	198.70	194.80	191.70
1 1/16	1.0625	47034	47134	47534	179.35	3/4	8	1 1/2	1 1/2	3	5/16	1.0031-1.0660	223.40	201.25	193.95	190.50	186.60	183.65
1 1/8	1.1250	47036	47136	47536	209.85	3/4	8	1 1/2	1 1/2	3	5/16	1.0661-1.1280	253.85	231.75	224.40	220.95	217.15	214.15
1 3/16	1.1875	47038	47138	47538	218.85	3/4	8	1 1/2	1 1/2	3	5/16	1.1281-1.1905	262.75	240.80	233.40	229.95	226.05	223.20
1 1/4	1.2500	47040	47140	47540	256.40	3/4	8	1 1/2	1 1/2	3	5/16	1.1906-1.2530	300.35	278.35	271.05	267.45	263.75	260.70
1 5/16	1.3125	47042	47142	47542	256.40	3/4	8	1 1/2	1 1/2	3	5/16	1.2531-1.3155	300.35	278.35	271.05	267.45	263.75	260.70
1 3/8	1.3750	47044	47144	47544	260.00	3/4	8	1 1/2	1 1/2	3	5/16	1.3156-1.3780	303.90	281.90	274.50	271.05	267.25	264.30
1 7/16	1.4375	47046	47146	47546	303.15	3/4	8	1 1/2	1 1/2	3	5/16	1.3781-1.4405	347.10	325.05	317.65	314.15	310.40	307.35
1 1/2	1.5000	47048	47148	47548	364.05	3/4	8	1 1/2	1 1/2	3	5/16	1.4406-1.5030	408.10	386.05	378.60	375.20	371.35	368.45

*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

REAMERS



STEP REAMERS CUTTING OR NON-CUTTING PILOT

MATERIAL SPECIFIC

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	\$141.50	.1805	4	1 1/4	1/2	5	0.1770 - 0.2040	\$185.75	\$163.55	\$156.10	\$152.60	\$148.80	\$145.85
13/64	.2031	4142031	4242031	4342031	141.50	.1805	4	1 1/4	1/2	5	-	-	-	-	-	-	-
7/32	.2188	41407	42407	43407	141.50	.2075	4	1 1/4	1/2	5	0.2041 - 0.2210	185.75	163.55	156.10	152.60	148.80	145.85
15/64	.2344	4142344	4242344	4342344	141.50	.2265	4	1 1/2	1/2	6	0.2211 - 0.2380	185.75	163.55	156.10	152.60	148.80	145.85
1/4	.2500	41408	42408	43408	141.50	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	185.75	163.55	156.10	152.60	148.80	145.85
17/64	.2656	4142656	4242656	4342656	150.15	.2485	4	1 1/2	1/2	6	-	-	-	-	-	-	-
9/32	.2812	41409	42409	43409	150.15	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	194.40	172.25	164.80	161.25	157.45	154.55
19/64	.2969	4142969	4242969	4342969	158.65	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
5/16	.3125	41410	42410	43410	158.65	.2792	4	1 1/2	1 1/2	6	0.2841 - 0.3150	202.90	180.65	173.25	169.55	165.95	162.90
21/64	.3281	4143281	4243281	4343281	159.85	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
11/32	.3438	41411	42411	43411	159.85	.2792	4	1 1/2	1 1/2	6	0.3151 - 0.3470	204.05	181.85	174.55	170.90	167.20	164.25
23/64	.3594	4143594	4243594	4343594	161.45	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	41412	42412	43412	161.45	.3105	4	1 3/4	1 3/4	7	0.3471 - 0.3780	205.75	183.55	176.15	172.55	168.75	165.85
25/64	.3906	4143906	4243906	4343906	162.00	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	41413	42413	43413	162.00	.3105	4	1 3/4	1 3/4	7	0.3781 - 0.4090	206.15	184.15	176.70	173.10	169.35	166.25
27/64	.4219	4144219	4244219	4344219	163.60	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	41414	42414	43414	163.60	.3730	6	1 3/4	1 3/4	7	0.4091 - 0.4410	207.85	185.75	178.20	174.80	170.90	168.00
29/64	.4531	4144531	4244531	4344531	165.00	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
15/32	.4688	41415	42415	43415	165.00	.3730	6	1 3/4	1 3/4	7	0.4411 - 0.4720	209.30	187.15	179.70	176.20	172.35	169.40
31/64	.4844	4144844	4244844	4344844	166.90	.4355	6	2	2	8	-	-	-	-	-	-	-
1/2	.5000	41416	42416	43416	166.90	.4355	6	2	2	8	0.4721 - 0.5030	211.20	189.10	181.70	178.10	174.35	171.30
33/64	.5156	4145156	4245156	4345156	170.70	.4355	6	2	2	8	-	-	-	-	-	-	-
17/32	.5312	41417	42417	43417	170.70	.4355	6	2	2	8	0.5031 - 0.5340	214.80	192.75	185.35	181.80	178.05	174.95
9/16	.5625	41418	42418	43418	173.10	.4355	6	2	2	8	0.5341 - 0.5660	217.35	195.15	187.75	184.30	180.45	177.45
19/32	.5938	41419	42419	43419	176.75	.4355	6	2	2	8	0.5661 - 0.5970	220.95	198.75	191.45	187.90	184.15	181.10
5/8	.6250	41420	42420	43420	180.10	.5615	6	2 1/4	2 1/4	9	0.5971 - 0.6280	224.30	202.10	194.80	191.10	187.45	184.40
21/32	.6562	41421	42421	43421	199.35	.5615	6	2 1/4	2 1/4	9	0.6281 - 0.6590	243.55	221.40	213.95	210.55	206.65	203.70
11/16	.6875	41422	42422	43422	203.40	.5615	6	2 1/4	2 1/4	9	0.6591 - 0.6910	247.60	225.55	218.00	214.60	210.75	207.75
23/32	.7188	41423	42423	43423	212.15	.5615	6	2 1/4	2 1/4	9	0.6911 - 0.7220	256.35	234.30	226.90	223.35	219.55	216.50
3/4	.7500	41424	42424	43424	212.15	.6245	6	2 1/2	2 1/2	9 1/2	0.7221 - 0.7530	256.35	234.30	226.90	223.35	219.55	216.50
25/32	.7812	41425	42425	43425	218.50	.6245	6	2 1/2	2 1/2	9 1/2	0.7531 - 0.7840	262.65	240.45	233.15	229.65	225.75	222.75
13/16	.8125	41426	42426	43426	218.50	.6245	6	2 1/2	2 1/2	9 1/2	0.7841 - 0.8160	262.65	240.45	233.15	229.65	225.75	222.75
27/32	.8438	41427	42427	43427	225.95	.6245	6	2 1/2	2 1/2	9 1/2	0.8161 - 0.8470	270.10	248.10	240.50	237.05	233.30	230.20
7/8	.8750	41428	42428	43428	234.50	.7495	6	2 5/8	2 5/8	10	0.8471 - 0.8780	280.35	257.30	249.65	245.95	242.10	238.95
29/32	.9062	41429	42429	43429	260.35	.7495	6	2 5/8	2 5/8	10	0.8781 - 0.9090	306.25	283.25	275.50	271.95	267.90	264.90
15/16	.9375	41430	42430	43430	260.35	.7495	8	2 5/8	2 5/8	10	0.9091 - 0.9410	306.25	283.25	275.50	271.95	267.90	264.90
31/32	.9688	41431	42431	43431	261.35	.7495	8	2 5/8	2 5/8	10	0.9411 - 0.9720	307.25	284.30	276.70	272.95	268.90	265.90
1	1.0000	41432	42432	43432	261.35	.8745	8	2 3/4	2 3/4	10 1/2	0.9721 - 1.0030	307.25	284.30	276.70	272.95	268.90	265.90
1 1/16	1.0625	41434	42434	43434	268.80	.8745	8	2 3/4	2 3/4	10 1/2	1.0031 - 1.0660	314.70	291.70	284.00	280.35	276.30	273.30
1 1/8	1.1250	41436	42436	43436	278.15	.8745	8	2 7/8	2 7/8	11	1.0661 - 1.1280	324.00	301.05	293.20	289.60	285.65	282.55
1 3/16	1.1875	41438	42438	43438	297.90	.9995	8	2 7/8	2 7/8	11	1.1281 - 1.1905	343.80	320.75	313.00	309.45	305.55	302.45
1 1/4	1.2500	41440	42440	43440	301.75	.9995	8	3	3	11 1/2	1.1906 - 1.2530	347.75	324.70	317.00	313.40	309.45	306.40
1 5/16	1.3125	41442	42442	43442	310.45	.9995	8	3	3	11 1/2	1.2531 - 1.3155	356.40	333.35	325.65	321.90	318.05	315.00
1 3/8	1.3750	41444	42444	43444	323.05	.9995	8	3 1/4	3 1/4	12	1.3156 - 1.3780	368.95	345.85	338.25	334.60	330.65	327.45
1 7/16	1.4375	41446	42446	43446	333.05	.9995	8	3 1/4	3 1/4	12	1.3781 - 1.4405	379.10	356.00	348.40	344.75	340.75	337.70
1 1/2	1.5000	41448	42448	43448	344.25	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406 - 1.5030	390.20	367.20	359.55	355.85	351.90	348.80

*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	\$366.55	1.2495	8	3 1/2	3 1/2	12 1/2	1.5031 - 1.5660	\$410.30	\$388.40	\$381.10	\$377.60	\$373.75	\$370.95
1 5/8	1.6250	41452	42452	43452	401.35	1.2495	8	3 1/2	3 1/2	13	1.5661 - 1.6280	444.95	423.15	415.85	412.25	408.50	405.65
1 11/16	1.6875	41454	42454	43454	409.75	1.2495	8	3 1/2	3 1/2	13	1.6281 - 1.6910	453.55	431.75	424.40	420.80	417.05	414.15
1 3/4	1.7500	41456	42456	43456	448.80	1.2495	10	3 1/2	3 1/2	13 1/2	1.6911 - 1.7530	492.55	470.65	463.30	459.85	456.05	453.15
1 13/16	1.8125	41458	42458	43458	467.10	1.4995	10	3 1/2	3 1/2	13 1/2	1.7531 - 1.8160	510.90	489.00	481.70	478.15	474.35	471.55
1 7/8	1.8750	41460	42460	43460	493.15	1.4995	10	3 1/2	3 1/2	14	1.8161 - 1.8780	536.90	514.95	507.70	504.20	500.40	497.45
1 15/16	1.9375	41462	42462	43462	522.85	1.4995	10	3 1/2	3 1/2	14	1.8781 - 1.9410	566.55	544.70	537.35	533.90	530.10	527.15
2	2.0000	41464	42464	43464	542.90	1.4995	12	3 1/2	3 1/2	14	1.9411 - 2.0030	586.70	564.90	557.50	554.00	550.20	547.30



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 METRIC EDP NO.	TYPE 434 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	414045	424045	434045	\$156.10	.1704	4	*1 1/4	5	4.494-4.696	\$189.40	\$167.35	\$159.90	\$156.40	\$152.60	\$149.55	\$145.25
5.0	.1969	414050	424050	434050	156.10	.1805	4	*1 1/4	5	4.697-5.182	189.40	167.35	159.90	156.40	152.60	149.55	145.25
5.5	.2165	414055	424055	434055	156.10	.2075	4	*1 1/4	5	5.183-5.613	189.40	167.35	159.90	156.40	152.60	149.55	145.25
6.0	.2362	414060	424060	434060	156.10	.2265	4	*1 1/2	6	5.614-6.045	189.40	167.35	159.90	156.40	152.60	149.55	145.25
-	-	414063	424063	434063	-	.2405	4	*1 1/2	6	6.046-6.426	189.40	167.35	159.90	156.40	152.60	149.55	145.25
6.5	.2559	414065	424065	434065	164.80	.2485	4	*1 1/2	6	6.427-7.214	198.05	176.00	168.60	164.95	161.25	158.15	154.00
7.0	.2756	414070	424070	434070	164.80	.2485	4	*1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	414075	424075	434075	173.25	.2792	4	1 1/2	6	7.215-8.001	206.50	184.40	177.10	173.45	169.55	166.70	162.30
8.0	.3150	414080	424080	434080	173.25	.2792	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	414085	424085	434085	174.55	.2792	4	1 1/2	6	8.002-8.814	207.75	185.75	178.20	174.70	170.90	167.90	163.60
9.0	.3543	414090	424090	434090	176.15	.3105	4	1 3/4	7	8.815-9.601	209.35	187.35	179.85	176.25	172.55	169.45	165.35
9.5	.3740	414095	424095	434095	176.15	.3105	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	414100	424100	434100	176.70	.3105	4	1 3/4	7	9.602-10.389	209.90	187.90	180.45	176.85	173.10	170.05	165.85
10.5	.4134	414105	424105	434105	178.20	.3730	6	1 3/4	7	10.390-11.201	211.50	189.45	182.10	178.50	174.80	171.70	167.40
11.0	.4331	414110	424110	434110	178.20	.3730	6	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	414115	424115	434115	179.70	.3730	6	1 3/4	7	11.202-11.989	213.05	190.90	183.55	179.85	176.20	173.10	169.00
12.0	.4724	414120	424120	434120	181.70	.4355	6	2	8	11.990-12.776	214.80	192.95	185.40	181.80	178.10	174.95	170.75
12.5	.4921	414125	424125	434125	181.70	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	414130	424130	434130	185.35	.4355	6	2	8	12.777-13.564	218.65	196.55	189.15	185.45	181.80	178.70	174.55
13.5	.5315	414135	424135	434135	185.35	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	414140	424140	434140	187.75	.4355	6	2	8	13.565-14.376	221.10	198.95	191.65	188.05	184.30	181.15	176.90
14.5	.5709	414145	424145	434145	191.45	.4355	6	2	8	14.377-15.164	224.65	202.55	195.15	191.65	187.90	184.85	180.50
15.5	.6102	414155	424155	434155	194.80	.5615	6	2 1/4	9	15.165-15.951	228.00	206.00	198.55	194.90	191.10	188.15	183.80
16.0	.6299	414160	424160	434160	213.95	.5615	6	2 1/4	9	15.952-16.739	247.25	225.20	217.80	214.20	210.55	207.40	203.10
17.0	.6693	414170	424170	434170	218.00	.5615	6	2 1/4	9	16.740-17.551	251.35	229.25	221.95	218.25	214.60	211.45	207.25
18.0	.7087	414180	424180	434180	226.90	.5615	6	2 1/4	9	17.552-18.339	260.10	238.15	230.60	227.00	223.35	220.20	216.00
18.5	.7283	414185	424185	434185	226.90	.6245	6	2 1/2	9 1/2	18.340-19.126	260.10	238.15	230.60	227.00	223.35	220.20	216.00
19.5	.7677	414195	424195	434195	233.15	.6245	6	2 1/2	9 1/2	19.127-19.914	266.35	244.35	236.95	233.30	229.65	226.50	222.20
20.0	.7874	414200	424200	434200	233.15	.6245	6	2 1/2	9 1/2	19.915-20.726	266.35	244.35	236.95	233.30	229.65	226.50	222.20
21.0	.8268	414210	424210	434210	240.50	.6245	6	2 1/2	9 1/2	20.727-21.514	273.90	251.80	244.45	240.80	237.05	234.00	229.75
22.0	.8661	414220	424220	434220	240.50	.7495	6	2 5/8	10	21.515-22.301	273.90	251.80	244.45	240.80	237.05	234.00	229.75
22.5	.8858	414225	424225	434225	275.50	.7495	6	2 5/8	10	22.302-23.089	310.05	287.15	279.50	275.70	271.95	268.75	264.30
23.5	.9252	414235	424235	434235	275.50	.7495	8	2 5/8	10	23.090-23.901	310.05	287.15	279.50	275.70	271.95	268.75	264.30
24.0	.9449	414240	424240	434240	276.70	.7495	8	2 5/8	10	23.902-24.689	311.15	288.20	280.55	276.80	272.95	269.75	265.30
25.0	.9843	414250	424250	434250	276.70	.8745	8	2 3/4	10 1/2	24.690-25.476	311.15	288.20	280.55	276.80	272.95	269.75	265.30
25.5	1.0039	414255	424255	434255	284.00	.8745	8	2 3/4	10 1/2	25.477-27.076	318.50	295.60	288.00	284.20	280.35	277.20	272.75
28.0	1.1024	414280	424280	434280	293.20	.8745	8	2 7/8	11	27.077-28.651	327.90	304.90	297.15	293.45	289.60	286.45	282.00
29.0	1.1417	414290	424290	434290	313.00	.9995	8	2 7/8	11	28.652-30.239	347.70	324.70	317.00	313.25	309.45	306.25	301.75
31.0	1.2205	414310	424310	434310	317.00	.9995	8	3	11 1/2	30.240-31.826	351.55	328.65	321.05	317.20	313.40	310.20	305.75
32.0	1.2598	414320	424320	434320	325.65	.9995	8	3	11 1/2	31.827-33.414	360.20	337.25	329.65	325.90	321.90	318.80	314.40
34.0	1.3386	414340	424340	434340	338.25	.9995	8	3 1/4	12	33.415-35.001	372.75	349.80	342.20	338.40	334.60	331.35	326.95
36.0	1.4173	414360	424360	434360	348.40	.9995	8	3 1/4	12	35.002-36.589	382.85	359.90	352.30	348.55	344.75	341.55	337.10
37.0	1.4567	414370	424370	434370	359.55	1.2495	8	3 1/2	12 1/2	36.590-38.176	394.05	371.15	363.45	359.75	355.85	352.75	348.20

*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							
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*
3/16	.1875	41606	42606	43506	\$146.85	.1805	4	1 1/4	1/2	5	0.1770 - 0.2040	\$191.00	\$169.00	\$161.45	\$157.95	\$154.15	\$151.10
13/64	.2031	4162031	4262031	4352031	146.85	.1805	4	1 1/4	1/2	5	-	-	-	-	-	-	-
7/32	.2188	41607	42607	43507	146.85	.2075	4	1 1/4	1/2	5	0.2041 - 0.2210	191.00	169.00	161.45	157.95	154.15	151.10
15/64	.2344	4162344	4262344	4352344	146.85	.2265	4	1 1/2	1/2	6	0.2211 - 0.2380	191.00	169.00	161.45	157.95	154.15	151.10
1/4	.2500	41608	42608	43508	146.85	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	191.00	169.00	161.45	157.95	154.15	151.10
17/64	.2656	4162656	4262656	4352656	150.15	.2485	4	1 1/2	1/2	6	-	-	-	-	-	-	-
9/32	.2812	41609	42609	43509	150.15	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	194.40	172.25	164.80	161.25	157.45	154.55
19/64	.2969	4162969	4262969	4352969	162.90	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
5/16	.3125	41610	42610	43510	162.90	.2792	4	1 1/2	1 1/2	6	0.2841 - 0.3150	207.20	184.95	177.50	174.05	170.30	167.30
21/64	.3281	4163281	4263281	4353281	162.90	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
11/32	.3438	41611	42611	43511	162.90	.2792	4	1 1/2	1 1/2	6	0.3151 - 0.3470	207.20	184.95	177.50	174.05	170.30	167.30
23/64	.3594	4163594	4263594	4353594	162.90	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	41612	42612	43512	162.90	.3105	4	1 3/4	1 3/4	7	0.3471 - 0.3780	207.20	184.95	177.50	174.05	170.30	167.30
25/64	.3906	4163906	4263906	4353906	166.90	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	41613	42613	43513	166.90	.3105	4	1 3/4	1 3/4	7	0.3781 - 0.4090	211.20	189.10	181.70	178.10	174.35	171.30
27/64	.4219	4164219	4264219	4354219	171.00	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	41614	42614	43514	171.00	.3730	6	1 3/4	1 3/4	7	0.4091 - 0.4410	215.25	193.10	185.75	182.15	178.45	175.40
29/64	.4531	4164531	4264531	4354531	171.00	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
15/32	.4688	41615	42615	43515	171.00	.3730	6	1 3/4	1 3/4	7	0.4411 - 0.4720	215.25	193.10	185.75	182.15	178.45	175.40
31/64	.4844	4164844	4264844	4354844	171.00	.4355	6	2	2	8	-	-	-	-	-	-	-
1/2	.5000	41616	42616	43516	171.00	.4355	6	2	2	8	0.4721 - 0.5030	215.25	193.10	185.75	182.15	178.45	175.40
33/64	.5156	4165156	4265156	4355156	180.90	.4355	6	2	2	8	-	-	-	-	-	-	-
17/32	.5312	41617	42617	43517	180.90	.4355	6	2	2	8	0.5031 - 0.5340	225.05	203.00	195.60	192.10	188.20	185.25
9/16	.5625	41618	42618	43518	183.50	.4355	6	2	2	8	0.5341 - 0.5660	227.65	205.60	198.05	194.55	190.75	187.75
19/32	.5938	41619	42619	43519	185.10	.4355	6	2	2	8	0.5661 - 0.5970	229.30	207.25	199.80	196.25	192.45	189.45
5/8	.6250	41620	42620	43520	185.10	.5615	6	2 1/4	2 1/4	9	0.5971 - 0.6280	229.30	207.25	199.80	196.25	192.45	189.45
21/32	.6562	41621	42621	43521	205.20	.5615	6	2 1/4	2 1/4	9	0.6281 - 0.6590	249.55	227.30	219.85	216.40	212.50	209.65
11/16	.6875	41622	42622	43522	205.20	.5615	6	2 1/4	2 1/4	9	0.6591 - 0.6910	249.55	227.30	219.85	216.40	212.50	209.65
23/32	.7188	41623	42623	43523	219.30	.5615	6	2 1/2	2 1/2	9	0.6911 - 0.7220	263.50	241.40	234.00	230.45	226.60	223.60
3/4	.7500	41624	42624	43524	219.30	.6245	6	2 1/2	2 1/2	9 1/2	0.7221 - 0.7530	263.50	241.40	234.00	230.45	226.60	223.60
25/32	.7812	41625	42625	43525	219.30	.6245	6	2 1/2	2 1/2	9 1/2	0.7531 - 0.7840	263.50	241.40	234.00	230.45	226.60	223.60
13/16	.8125	41626	42626	43526	219.30	.6245	6	2 1/2	2 1/2	9 1/2	0.7841 - 0.8160	263.50	241.40	234.00	230.45	226.60	223.60
27/32	.8438	41627	42627	43527	225.95	.6245	6	2 1/2	2 1/2	9 1/2	0.8161 - 0.8470	270.10	248.10	240.50	237.05	233.30	230.20
7/8	.8750	41628	42628	43528	234.50	.7495	6	2 3/8	2 3/8	10	0.8471 - 0.8780	280.35	257.30	249.65	245.95	242.10	238.95
29/32	.9062	41629	42629	43529	263.25	.7495	6	2 3/8	2 3/8	10	0.8781 - 0.9090	309.10	286.15	278.50	274.75	270.75	267.75
15/16	.9375	41630	42630	43530	269.45	.7495	8	2 3/8	2 3/8	10	0.9091 - 0.9410	315.20	292.30	284.55	280.90	276.90	273.90
31/32	.9688	41631	42631	43531	269.45	.7495	8	2 3/8	2 3/8	10	0.9411 - 0.9720	315.20	292.30	284.55	280.90	276.90	273.90
1	1.0000	41632	42632	43532	269.45	.8745	8	2 3/4	2 3/4	10 1/2	0.9721 - 1.0030	315.20	292.30	284.55	280.90	276.90	273.90
1 1/16	1.0625	41634	42634	43534	284.85	.8745	8	2 3/4	2 3/4	10 1/2	1.0031 - 1.0660	330.75	307.90	300.15	296.45	292.50	289.50
1 1/8	1.1250	41636	42636	43536	286.10	.8745	8	2 3/4	2 3/4	11	1.0661 - 1.1280	332.00	308.95	301.20	297.60	293.70	290.55
1 3/16	1.1875	41638	42638	43538	297.90	.9995	8	2 7/8	2 7/8	11	1.1281 - 1.1905	343.80	320.75	313.00	309.45	305.55	302.45
1 1/4	1.2500	41640	42640	43540	301.75	.9995	8	3	3	11 1/2	1.1906 - 1.2530	347.75	324.70	317.00	313.40	309.45	306.40
1 5/16	1.3125	41642	42642	43542	310.45	.9995	8	3	3	11 1/2	1.2531 - 1.3155	356.40	333.35	325.65	321.90	318.05	315.00
1 3/8	1.3750	41644	42644	43544	323.05	.9995	8	3 1/4	3 1/4	12	1.3156 - 1.3780	368.95	345.85	338.25	334.60	330.65	327.45
1 7/16	1.4375	41646	42646	43546	333.05	.9995	8	3 1/4	3 1/4	12	1.3781 - 1.4405	379.10	356.00	348.40	344.75	340.75	337.70
1 1/2	1.5000	41648	42648	43548	344.25	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406 - 1.5030	390.20	367.20	359.55	355.85	351.90	348.80

*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	\$387.05	1.2495	8	3 1/2	3 1/2	12 1/2	1.5031 - 1.5660	\$430.80	\$408.90	\$401.55	\$398.15	\$394.25	\$391.40
1 5/8	1.6250	41652	42652	43552	425.55	1.2495	8	3 1/2	3 1/2	13	1.5661 - 1.6280	469.30	447.50	440.05	436.60	432.80	429.95
1 11/16	1.6875	41654	42654	43554	432.95	1.2495	8	3 1/2	3 1/2	13	1.6281 - 1.6910	476.70	454.85	447.50	444.00	440.15	437.35
1 3/4	1.7500	41656	42656	43556	473.15	1.2495	10	3 1/2	3 1/2	13 1/2	1.6911 - 1.7530	516.90	495.00	487.60	484.20	480.45	477.45
1 13/16	1.8125	41658	42658	43558	492.70	1.4995	10	3 1/2	3 1/2	13 1/2	1.7531 - 1.8160	536.40	514.55	507.15	503.65	499.90	497.05
1 7/8	1.8750	41660	42660	43560	518.70	1.4995	10	3 1/2	3 1/2	14	1.8161 - 1.8780	562.50	540.55	533.25	529.80	525.95	523.05
1 15/16	1.9375	41662	42662	43562	551.85	1.4995	10	3 1/2	3 1/2	14	1.8781 - 1.9410	595.55	573.75	566.30	562.85	559.05	556.20
2	2.0000	41664	42664	43564	571.85	1.4995	12	3 1/2	3 1/2	14	1.9411 - 2.0030	615.60	593.75	586.40	582.95	579.05	576.25



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	\$161.45	.1704	4	*1 1/4	5	4.494-4.696	\$194.80	\$172.70	\$165.35	\$161.75	\$157.95	\$154.85	\$150.60
5.0	.1969	416050	426050	435050	161.45	.1805	4	*1 1/4	5	4.697-5.182	194.80	172.70	165.35	161.75	157.95	154.85	150.60
5.5	.2165	416055	426055	435055	161.45	.2075	4	*1 1/4	5	5.183-5.613	194.80	172.70	165.35	161.75	157.95	154.85	150.60
6.0	.2362	416060	426060	435060	161.45	.2265	4	*1 1/2	6	5.614-6.045	194.80	172.70	165.35	161.75	157.95	154.85	150.60
-	-	416063	426063	435063	-	.2405	4	*1 1/2	6	6.046-6.426	194.80	172.70	165.35	161.75	157.95	154.85	150.60
6.5	.2559	416065	426065	435065	164.80	.2485	4	*1 1/2	6	6.427-7.214	198.05	176.00	168.60	164.95	161.25	158.15	154.00
7.0	.2756	416070	426070	435070	164.80	.2485	4	*1 1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	416075	426075	435075	177.50	.2792	4	1 1/2	6	7.215-8.001	210.80	188.75	181.35	177.80	174.05	170.90	166.75
8.0	.3150	416080	426080	435080	177.50	.2792	4	1 1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	416085	426085	435085	177.50	.2792	4	1 1/2	6	8.002-8.814	210.80	188.75	181.35	177.80	174.05	170.90	166.75
9.0	.3543	416090	426090	435090	177.50	.3105	4	1 3/4	7	8.815-9.601	210.80	188.75	181.35	177.80	174.05	170.90	166.75
9.5	.3740	416095	426095	435095	177.50	.3105	4	1 3/4	7	-	-	-	-	-	-	-	-
10.0	.3937	416100	426100	435100	181.70	.3105	4	1 3/4	7	9.602-10.389	214.80	192.95	185.40	181.80	178.10	174.95	170.75
10.5	.4134	416105	426105	435105	185.75	.3730	6	1 3/4	7	10.390-11.201	218.90	197.05	189.45	185.90	182.15	179.10	174.85
11.0	.4331	416110	426110	435110	185.75	.3730	6	1 3/4	7	-	-	-	-	-	-	-	-
11.5	.4528	416115	426115	435115	185.75	.3730	6	1 3/4	7	11.202-11.989	218.90	197.05	189.45	185.90	182.15	179.10	174.85
12.0	.4724	416120	426120	435120	185.75	.4355	6	2	8	11.990-12.776	218.90	197.05	189.45	185.90	182.15	179.10	174.85
12.5	.4921	416125	426125	435125	185.75	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	416130	426130	435130	195.60	.4355	6	2	8	12.777-13.564	228.85	206.70	199.35	195.80	192.10	188.95	184.75
13.5	.5315	416135	426135	435135	195.60	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	416140	426140	435140	198.05	.4355	6	2	8	13.565-14.376	231.40	209.30	201.90	198.35	194.55	191.60	187.25
14.5	.5709	416145	426145	435145	199.80	.4355	6	2	8	14.377-15.164	233.15	211.00	203.55	199.90	196.25	193.15	188.95
15.5	.6102	416155	426155	435155	199.80	.5615	6	2 1/4	9	15.165-15.951	233.15	211.00	203.55	199.90	196.25	193.15	188.95
16.0	.6299	416160	426160	435160	219.85	.5615	6	2 1/4	9	15.952-16.739	253.15	231.10	223.60	220.10	216.40	213.30	209.00
17.0	.6693	416170	426170	435170	219.85	.5615	6	2 1/4	9	16.740-17.551	253.15	231.10	223.60	220.10	216.40	213.30	209.00
18.0	.7087	416180	426180	435180	234.00	.6245	6	2 1/2	9 1/2	17.552-18.339	267.25	245.10	237.75	234.15	230.45	227.40	223.25
18.5	.7283	416185	426185	435185	234.00	.6245	6	2 1/2	9 1/2	18.340-19.126	267.25	245.10	237.75	234.15	230.45	227.40	223.25
19.5	.7677	416195	426195	435195	234.00	.6245	6	2 1/2	9 1/2	19.127-19.914	267.25	245.10	237.75	234.15	230.45	227.40	223.25
20.0	.7874	416200	426200	435200	234.00	.6245	6	2 1/2	9 1/2	19.915-20.726	267.25	245.10	237.75	234.15	230.45	227.40	223.25
21.0	.8268	416210	426210	435210	240.50	.6245	6	2 1/2	9 1/2	20.727-21.514	273.90	251.80	244.45	240.80	237.05	234.00	229.75
22.0	.8661	416220	426220	435220	240.50	.7495	6	2 5/8	10	21.515-22.301	273.90	251.80	244.45	240.80	237.05	234.00	229.75
22.5	.8858	416225	426225	435225	278.50	.7495	6	2 5/8	10	22.302-23.089	312.95	290.05	282.40	278.65	274.75	271.55	267.25
23.5	.9252	416235	426235	435235	284.55	.7495	8	2 5/8	10	23.090-23.901	319.10	296.20	288.50	284.70	280.90	277.65	273.30
24.0	.9449	416240	426240	435240	284.55	.7495	8	2 5/8	10	23.902-24.689	319.10	296.20	288.50	284.70	280.90	277.65	273.30
25.0	.9843	416250	426250	435250	284.55	.8745	8	2 3/4	10 1/2	24.690-25.476	319.10	296.20	288.50	284.70	280.90	277.65	273.30
25.5	1.0039	416255	426255	435255	300.15	.8745	8	2 3/4	10 1/2	25.477-27.076	334.65	311.80	304.15	300.25	296.45	293.20	288.85
28.0	1.1024	416280	426280	435280	301.25	.8745	8	2 7/8	11	27.077-28.651	335.85	312.90	305.20	301.50	297.60	294.45	290.00
29.0	1.1417	416290	426290	435290	313.00	.9995	8	2 7/8	11	28.652-30.239	347.70	324.70	317.00	313.25	309.45	306.25	301.75
31.0	1.2205	416310	426310	435310	317.00	.9995	8	3	11 1/2	30.240-31.826	351.55	328.65	321.05	317.20	313.40	310.20	305.75
32.0	1.2598	416320	426320	435320	325.65	.9995	8	3	11 1/2	31.827-33.414	360.20	337.25	329.65	325.90	321.90	318.80	314.40
34.0	1.3386	416340	426340	435340	338.25	.9995	8	3 1/4	12	33.415-35.001	372.75	349.80	342.20	338.40	334.60	331.35	326.95
36.0	1.4173	416360	426360	435360	348.40	.9995	8	3 1/4	12	35.002-36.589	382.85	359.90	352.30	348.55	344.75	341.55	337.10
37.0	1.4567	416370	426370	435370	359.55	1.2495	8	3 1/2	12 1/2	36.590-38.176	394.05	371.15	363.45	359.75	355.85	352.75	348.20

*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
1/4	.2500	41108	41308	41508	\$145.35	.2405	4	1 1/2	1/2	6	0.2381-0.2530	\$186.55	\$165.95	\$159.00	\$155.70	\$152.10	\$149.30
9/32	.2812	41109	41309	41509	148.65	.2485	4	1 1/2	1/2	6	0.2531-0.2840	188.45	168.55	161.85	158.70	155.35	152.50
5/16	.3125	41110	41310	41510	162.90	.2792	4	1 1/2	1 1/2	6	0.2841-0.3150	204.15	183.50	176.55	173.25	169.55	166.85
11/32	.3438	41111	41311	41511	164.10	.2792	4	1 1/2	1 1/2	6	0.3151-0.3470	205.35	184.75	177.90	174.55	170.90	168.15
3/8	.3750	41112	41312	41512	165.85	.3105	4	1 3/4	1 3/4	7	0.3471-0.3780	207.10	186.30	179.45	176.20	172.70	169.95
13/32	.4062	41113	41313	41513	166.25	.3105	4	1 3/4	1 3/4	7	0.3781-0.4090	207.50	186.95	180.05	176.70	173.10	170.35
7/16	.4375	41114	41314	41514	168.00	.3730	6	1 3/4	1 3/4	7	0.4091-0.4410	209.30	188.55	181.70	178.45	174.85	172.15
15/32	.4688	41115	41315	41515	169.45	.3730	6	1 3/4	1 3/4	7	0.4411-0.4720	210.80	190.05	183.20	179.85	176.30	173.55
1/2	.5000	41116	41316	41516	176.10	.4355	6	2	2	8	0.4721-0.5030	218.50	197.20	190.05	186.70	183.05	180.30
17/32	.5312	41117	41317	41517	182.45	.4355	6	2	2	8	0.5031-0.5340	224.80	203.55	196.45	193.10	189.45	186.60
9/16	.5625	41118	41318	41518	182.45	.4355	6	2	2	8	0.5341-0.5660	224.80	203.55	196.45	193.10	189.45	186.60
19/32	.5938	41119	41319	41519	189.70	.4355	6	2	2	8	0.5661-0.5970	232.15	210.85	203.75	200.45	196.70	193.90
5/8	.6250	41120	41320	41520	189.70	.5615	6	2 1/4	2 1/4	9	0.5971-0.6280	232.15	210.85	203.75	200.45	196.70	193.90
21/32	.6562	41121	41321	41521	214.40	.5615	6	2 1/4	2 1/4	9	0.6281-0.6590	256.70	235.55	228.35	224.95	221.35	218.55
11/16	.6875	41122	41322	41522	214.40	.5615	6	2 1/4	2 1/4	9	0.6591-0.6910	256.70	235.55	228.35	224.95	221.35	218.55
23/32	.7188	41123	41323	41523	223.60	.5615	6	2 1/4	2 1/4	9	0.6911-0.7220	266.10	244.85	237.75	234.45	230.70	227.75
3/4	.7500	41124	41324	41524	210.10	.6245	6	2 1/2	2 1/2	9 1/2	0.7221-0.7530	249.95	229.95	223.35	220.10	216.65	213.95
25/32	.7812	41125	41325	41525	241.05	.6245	6	2 1/2	2 1/2	9 1/2	0.7531-0.7840	283.40	269.10	255.10	251.65	248.10	245.10
13/16	.8125	41126	41326	41526	243.95	.6245	6	2 1/2	2 1/2	9 1/2	0.7841-0.8160	286.35	265.10	258.05	254.65	251.10	248.25
27/32	.8438	41127	41327	41527	248.50	.6245	6	2 1/2	2 1/2	9 1/2	0.8161-0.8470	291.05	269.75	262.65	259.20	255.65	252.75
7/8	.8750	41128	41328	41528	261.95	.7495	6	2 3/8	2 3/8	10	0.8471-0.8780	305.85	284.00	276.55	273.10	269.25	266.35
29/32	.9062	41129	41329	41529	277.55	.7495	6	2 3/8	2 3/8	10	0.8781-0.9090	321.50	299.50	292.15	288.70	284.80	281.90
15/16	.9375	41130	41330	41530	290.85	.7495	8	2 3/8	2 3/8	10	0.9091-0.9410	334.90	312.80	305.55	301.90	298.10	295.15
31/32	.9688	41131	41331	41531	291.70	.7495	8	2 3/8	2 3/8	10	0.9411-0.9720	335.55	313.65	306.25	302.65	298.90	296.05
1	1.0000	41132	41332	41532	292.15	.8745	8	2 3/4	2 3/4	10 1/2	0.9721-1.0030	336.10	314.05	306.70	303.20	299.45	296.45
1 1/16	1.0625	41134	41334	41534	300.25	.8745	8	2 3/4	2 3/4	10 1/2	1.0031-1.0660	344.20	322.35	314.85	311.30	307.55	304.60
1 1/8	1.1250	41136	41336	41536	310.65	.8745	8	2 7/8	2 7/8	11	1.0661-1.1280	354.75	332.65	325.35	321.80	318.05	315.10
1 3/16	1.1875	41138	41338	41538	332.85	.9995	8	2 7/8	2 7/8	11	1.1281-1.1905	376.80	354.90	347.40	344.00	340.05	337.10
1 1/4	1.2500	41140	41340	41540	337.10	.9995	8	3	3	11 1/2	1.1906-1.2530	381.10	359.10	351.75	348.20	344.45	341.55
1 5/16	1.3125	41142	41342	41542	346.90	.9995	8	3	3	11 1/2	1.2531-1.3155	390.85	368.80	361.40	357.90	354.20	351.15
1 3/8	1.3750	41144	41344	41544	361.00	.9995	8	3 1/4	3 1/4	12	1.3156-1.3780	405.00	382.90	375.50	372.10	368.25	365.30
1 7/16	1.4375	41146	41346	41546	372.20	.9995	8	3 1/4	3 1/4	12	1.3781-1.4405	416.20	394.15	386.80	383.30	379.45	376.60
1 1/2	1.5000	41148	41348	41548	384.80	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406-1.5030	428.75	406.85	399.40	395.80	392.10	389.20

*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	\$155.70	.2405	4	1 1/2	1/2	6	0.2381-0.2530	\$199.85	\$177.80	\$170.35	\$166.80	\$163.10	\$160.00
9/32	.2812	41709	41809	41909	165.15	.2485	4	1 1/2	1/2	6	0.2531-0.2840	209.35	187.25	179.75	176.25	172.50	169.45
5/16	.3125	41710	41810	41910	174.55	.2792	4	1 1/2	1 1/2	6	0.2841-0.3150	218.70	196.55	189.15	185.70	181.80	178.85
11/32	.3438	41711	41811	41911	175.90	.2792	4	1 1/2	1 1/2	6	0.3151-0.3470	220.10	197.90	190.50	187.00	183.10	180.30
3/8	.3750	41712	41812	41912	177.55	.3105	4	1 3/4	1 3/4	7	0.3471-0.3780	221.95	199.70	192.25	188.75	184.95	182.00
13/32	.4062	41713	41813	41913	178.15	.3105	4	1 3/4	1 3/4	7	0.3781-0.4090	222.35	200.25	192.95	189.30	185.45	182.50
7/16	.4375	41714	41814	41914	180.05	.3730	6	1 3/4	1 3/4	7	0.4091-0.4410	224.25	202.05	194.70	191.05	187.35	184.35
15/32	.4688	41715	41815	41915	181.70	.3730	6	1 3/4	1 3/4	7	0.4411-0.4720	225.90	203.70	196.25	192.75	188.95	186.00
1/2	.5000	41716	41816	41916	183.65	.4355	6	2	2	8	0.4721-0.5030	227.85	205.80	198.45	194.85	191.00	188.10
17/32	.5312	41717	41817	41917	190.45	.4355	6	2	2	8	0.5031-0.5340	234.65	212.40	205.05	201.65	197.70	194.80
9/16	.5625	41718	41818	41918	190.45	.4355	6	2	2	8	0.5341-0.5660	234.65	212.40	205.05	201.65	197.70	194.80
19/32	.5938	41719	41819	41919	197.95	.4355	6	2	2	8	0.5661-0.5970	242.20	220.10	212.60	209.15	205.25	202.30
5/8	.6250	41720	41820	41920	197.95	.5615	6	2 1/4	2 1/4	9	0.5971-0.6280	242.20	220.10	212.60	209.15	205.25	202.30
21/32	.6562	41721	41821	41921	223.60	.5615	6	2 1/4	2 1/4	9	0.6281-0.6590	267.85	245.80	238.35	234.75	230.95	228.00
11/16	.6875	41722	41822	41922	223.60	.5615	6	2 1/4	2 1/4	9	0.6591-0.6910	267.85	245.80	238.35	234.75	230.95	228.00
23/32	.7188	41723	41823	41923	233.40	.5615	6	2 1/4	2 1/4	9	0.6911-0.7220	277.60	255.40	248.20	244.55	240.80	237.75
3/4	.7500	41724	41824	41924	233.40	.6245	6	2 1/2	2 1/2	9 1/2	0.7221-0.7530	277.60	255.40	248.20	244.55	240.80	237.75
25/32	.7812	41725	41825	41925	251.50	.6245	6	2 1/2	2 1/2	9 1/2	0.7531-0.7840	295.65	273.50	266.15	262.65	258.80	255.90
13/16	.8125	41726	41826	41926	254.60	.6245	6	2 1/2	2 1/2	9 1/2	0.7841-0.8160	298.80	276.70	269.25	265.80	261.90	258.90
27/32	.8438	41727	41827	41927	259.40	.6245	6	2 1/2	2 1/2	9 1/2	0.8161-0.8470	303.65	281.45	274.00	270.50	266.65	263.75
7/8	.8750	41728	41828	41928	273.35	.7495	6	2 5/8	2 5/8	10	0.8471-0.8780	319.30	296.30	288.65	284.85	280.95	277.80
29/32	.9062	41729	41829	41929	289.60	.7495	6	2 5/8	2 5/8	10	0.8781-0.9090	335.45	312.55	304.85	301.15	297.15	294.15
15/16	.9375	41730	41830	41930	303.55	.7495	8	2 5/8	2 5/8	10	0.9091-0.9410	349.45	326.40	318.65	315.10	311.15	308.05
31/32	.9688	41731	41831	41931	304.35	.7495	8	2 5/8	2 5/8	10	0.9411-0.9720	350.25	327.30	319.50	315.85	311.90	308.85
1	1.0000	41732	41832	41932	304.85	.8745	8	2 3/4	2 3/4	10 1/2	0.9721-1.0030	350.80	327.85	320.00	316.35	312.45	309.35
1 1/16	1.0625	41734	41834	41934	351.55	.8745	8	2 3/4	2 3/4	10 1/2	1.0031-1.0660	397.40	374.45	366.70	363.05	359.15	356.00
1 1/8	1.1250	41736	41836	41936	353.05	.8745	8	2 7/8	2 7/8	11	1.0661-1.1280	398.95	375.90	368.25	364.55	360.70	357.55
1 3/16	1.1875	41738	41838	41938	367.70	.9995	8	2 7/8	2 7/8	11	1.1281-1.1905	413.40	390.40	382.80	379.15	375.25	372.10
1 1/4	1.2500	41740	41840	41940	372.45	.9995	8	3	3	11 1/2	1.1906-1.2530	418.35	395.35	387.70	384.00	380.05	376.95
1 5/16	1.3125	41742	41842	41942	383.25	.9995	8	3	3	11 1/2	1.2531-1.3155	429.10	406.10	398.30	394.70	390.80	387.70
1 3/8	1.3750	41744	41844	41944	398.55	.9995	8	3 1/4	3 1/4	12	1.3156-1.3780	444.60	421.60	413.80	410.25	406.30	403.15
1 7/16	1.4375	41746	41846	41946	411.05	.9995	8	3 1/4	3 1/4	12	1.3781-1.4405	457.05	434.00	426.35	422.70	418.80	415.65
1 1/2	1.5000	41748	41848	41948	424.95	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406-1.5030	470.75	447.90	440.10	436.45	432.50	429.40

*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	CAR- BIDE	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	\$180.05	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	\$224.25	\$202.05	\$194.70	\$191.05	\$187.35	\$184.35
9/32	.2812	42709	42809	42909	190.90	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	235.05	213.05	205.65	202.05	198.35	195.30
5/16	.3125	42710	42810	42910	201.75	.2792	4	1 1/2	1 1/2	6	0.2841 - 0.3150	245.90	223.65	216.40	212.85	209.00	206.05
11/32	.3438	42711	42811	42911	203.30	.2792	4	1 1/2	1 1/2	6	0.3151 - 0.3470	247.35	225.25	217.90	214.40	210.60	207.50
3/8	.3750	42712	42812	42912	205.25	.3105	4	1 3/4	1 3/4	7	0.3471 - 0.3780	249.60	227.40	220.00	216.45	212.60	209.75
13/32	.4062	42713	42813	42913	206.10	.3105	4	1 3/4	1 3/4	7	0.3781 - 0.4090	250.35	228.25	220.80	217.30	213.40	210.55
7/16	.4375	42714	42814	42914	208.05	.3730	6	1 3/4	1 3/4	7	0.4091 - 0.4410	252.35	230.15	222.75	219.25	215.50	212.40
15/32	.4688	42715	42815	42915	209.90	.3730	6	1 3/4	1 3/4	7	0.4411 - 0.4720	254.05	232.05	224.60	221.10	217.30	214.25
1/2	.5000	42716	42816	42916	212.60	.4355	6	2	2	8	0.4721 - 0.5030	256.95	234.70	227.30	223.65	220.00	217.05
17/32	.5312	42717	42817	42917	217.10	.4355	6	2	2	8	0.5031 - 0.5340	261.30	239.10	231.70	228.25	224.40	221.40
9/16	.5625	42718	42818	42918	220.20	.4355	6	2	2	8	0.5341 - 0.5660	264.45	242.30	234.85	231.40	227.55	224.60
19/32	.5938	42719	42819	42919	224.80	.4355	6	2	2	8	0.5661 - 0.5970	268.95	246.95	239.50	236.00	232.20	229.20
5/8	.6250	42720	42820	42920	229.00	.5615	6	2 1/4	2 1/4	9	0.5971 - 0.6280	273.20	251.10	243.60	240.15	236.30	233.35
21/32	.6562	42721	42821	42921	253.60	.5615	6	2 1/4	2 1/4	9	0.6281 - 0.6590	297.85	275.65	268.25	264.75	260.95	257.90
11/16	.6875	42722	42822	42922	258.70	.5615	6	2 1/4	2 1/4	9	0.6591 - 0.6910	303.00	280.85	273.35	269.90	266.10	263.15
23/32	.7188	42723	42823	42923	264.30	.5615	6	2 1/4	2 1/4	9	0.6911 - 0.7220	308.45	286.30	278.85	275.35	271.55	268.55
3/4	.7500	42724	42824	42924	269.90	.6245	6	2 1/2	2 1/2	9 1/2	0.7221 - 0.7530	314.05	292.00	284.45	281.05	277.20	274.25
25/32	.7812	42725	42825	42925	274.50	.6245	6	2 1/2	2 1/2	9 1/2	0.7531 - 0.7840	318.65	296.60	289.05	285.60	281.75	278.80
13/16	.8125	42726	42826	42926	277.80	.6245	6	2 1/2	2 1/2	9 1/2	0.7841 - 0.8160	321.90	299.90	292.45	288.90	285.15	282.10
27/32	.8438	42727	42827	42927	282.85	.6245	6	2 1/2	2 1/2	9 1/2	0.8161 - 0.8470	327.20	305.00	297.55	294.00	290.20	287.30
7/8	.8750	42728	42828	42928	298.25	.7495	6	2 5/8	2 5/8	10	0.8471 - 0.8780	344.15	321.20	313.45	309.80	305.80	302.65
29/32	.9062	42729	42829	42929	315.80	.7495	6	2 5/8	2 5/8	10	0.8781 - 0.9090	361.70	338.65	331.00	327.35	323.45	320.35
15/16	.9375	42730	42830	42930	331.25	.7495	8	2 5/8	2 5/8	10	0.9091 - 0.9410	377.05	354.15	346.40	342.75	338.70	335.70
31/32	.9688	42731	42831	42931	332.10	.7495	8	2 5/8	2 5/8	10	0.9411 - 0.9720	377.90	355.00	347.20	343.55	339.60	336.55
1	1.0000	42732	42832	42932	332.55	.8745	8	2 3/4	2 3/4	10 1/2	0.9721 - 1.0030	378.40	355.45	347.75	344.05	340.05	336.95
1 1/16	1.0625	42734	42834	42934	351.55	.8745	8	2 3/4	2 3/4	10 1/2	1.0031 - 1.0660	397.40	374.45	366.70	363.05	359.15	356.00
1 1/8	1.1250	42736	42836	42936	353.05	.8745	8	2 7/8	2 7/8	11	1.0661 - 1.1280	398.95	375.90	368.25	364.55	360.70	357.55
1 1/16	1.1875	42738	42838	42938	367.70	.9995	8	2 7/8	2 7/8	11	1.1281 - 1.1905	413.40	390.40	382.80	379.15	375.25	372.10
1 1/4	1.2500	42740	42840	42940	372.45	.9995	8	3	3	11 1/2	1.1906 - 1.2530	418.35	395.35	387.70	384.00	380.05	376.95
1 5/16	1.3125	42742	42842	42942	383.25	.9995	8	3	3	11 1/2	1.2531 - 1.3155	429.10	406.10	398.30	394.70	390.80	387.70
1 3/8	1.3750	42744	42844	42944	398.55	.9995	8	3 1/4	3 1/4	12	1.3156 - 1.3780	444.60	421.60	413.80	410.25	406.30	403.15
1 7/16	1.4375	42746	42846	42946	411.05	.9995	8	3 1/4	3 1/4	12	1.3781 - 1.4405	457.05	434.00	426.35	422.70	418.80	415.65
1 1/2	1.5000	42748	42848	42948	424.95	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406 - 1.5030	470.75	447.90	440.10	436.45	432.50	429.40

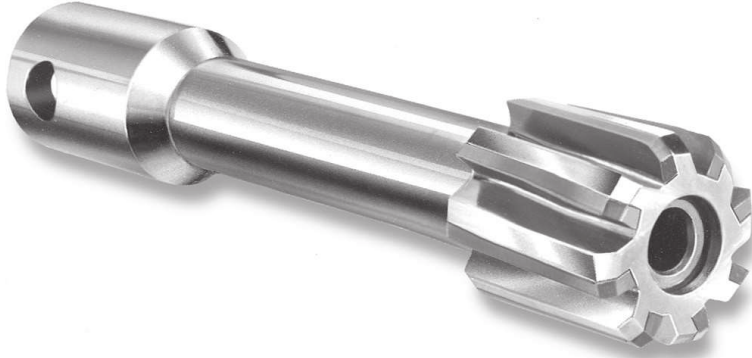
*Quantities of 15 or more - price of fractional size in same size range.



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	\$137.50	3/8	3/4	6	1/2	2 1/2	0.3181 - 0.3800	\$222.20	\$179.70	\$165.55	\$158.80	\$151.50	\$145.80	
13/32	.4062	49013	139.55	3/8	3/4	6	1/2	2 5/8	0.3801 - 0.4090	224.25	181.80	167.55	160.75	153.50	147.85	
7/16	.4375	49014	139.55	3/8	3/4	6	1/2	2 5/8	0.4091 - 0.4410	224.25	181.80	167.55	160.75	153.50	147.85	
15/32	.4688	49015	143.30	5/8	1	6	5/8	3 1/2	0.4411 - 0.4720	228.05	185.65	171.50	164.60	157.30	151.65	
1/2	.5000	49016	143.30	5/8	1	6	5/8	3 1/2	0.4721 - 0.5050	228.05	185.65	171.50	164.60	157.30	151.65	
9/16	.5625	49018	156.65	5/8	1	6	3/4	3 3/4	0.5051 - 0.5660	241.40	198.85	184.75	178.00	170.70	164.95	
5/8	.6250	49020	156.65	5/8	1	6	3/4	3 3/4	0.5661 - 0.6300	241.40	198.85	184.75	178.00	170.70	164.95	
11/16	.6875	49022	173.75	5/8	1	6	3/4	4 1/4	0.6301 - 0.6910	258.55	216.10	201.90	195.05	187.85	182.10	
3/4	.7500	49024	173.75	5/8	1	6	3/4	4 1/4	0.6911 - 0.7550	258.55	216.10	201.90	195.05	187.85	182.10	
13/16	.8125	49026	183.30	5/8	1	6	7/8	4 3/4	0.7551 - 0.8160	268.10	225.70	211.40	204.60	197.35	191.70	
7/8	.8750	49028	190.25	5/8	1	6	7/8	4 3/4	0.8161 - 0.8800	278.25	234.15	219.35	212.35	204.90	198.85	
15/16	.9375	49030	228.00	1	1 1/2	8	1	5 1/2	0.8801 - 0.9410	315.95	271.95	257.15	250.15	242.60	236.65	
1	1.0000	49032	228.00	1	1 1/2	8	1	5 1/2	0.9411 - 1.0050	315.95	271.95	257.15	250.15	242.60	236.65	
1 1/16	1.0625	49034	252.35	1	1 1/2	8	1 1/4	6	1.0051 - 1.0660	344.05	298.05	282.75	275.35	267.45	261.30	
1 1/8	1.1250	49036	252.35	1	1 1/2	8	1 1/4	6	1.0661 - 1.1300	344.05	298.05	282.75	275.35	267.45	261.30	
1 3/16	1.1875	49038	258.55	1	1 1/2	8	1 1/4	6	1.1301 - 1.1900	350.35	304.35	288.95	281.60	273.85	267.50	
1 1/4	1.2500	49040	258.55	1	1 1/2	8	1 1/4	6	1.1901 - 1.2550	350.35	304.35	288.95	281.60	273.85	267.50	
1 5/16	1.3125	49042	277.25	1	1 1/2	8	1 1/4	6	1.2551 - 1.3155	369.05	323.05	307.60	300.25	292.40	286.25	
1 3/8	1.3750	49044	277.25	1	1 1/2	8	1 1/4	6	1.3156 - 1.3800	369.05	323.05	307.60	300.25	292.40	286.25	
1 7/16	1.4375	49046	295.80	1	1 1/2	8	1 1/4	6	1.3801 - 1.4405	387.65	341.60	326.15	318.90	311.10	304.85	
1 1/2	1.5000	49048	295.80	1	1 1/2	8	1 1/4	6	1.4406 - 1.5050	387.65	341.60	326.15	318.90	311.10	304.85	
1 9/16	1.5625	49050	310.25	1	1 1/2	10	1 1/4	6	1.5051 - 1.5660	402.05	356.00	340.70	333.35	325.45	319.30	
1 5/8	1.6250	49052	310.25	1	1 1/2	10	1 1/4	6	1.5661 - 1.6300	402.05	356.00	340.70	333.35	325.45	319.30	
1 11/16	1.6875	49054	328.90	1	1 1/2	10	1 1/4	6	1.6301 - 1.6910	420.70	374.70	359.35	352.05	344.15	337.95	
1 3/4	1.7500	49056	328.90	1	1 1/2	10	1 1/4	6	1.6911 - 1.7550	420.70	374.70	359.35	352.05	344.15	337.95	
1 13/16	1.8125	49058	345.45	1	1 1/2	10	1 1/4	6	1.7551 - 1.8160	437.30	391.25	375.85	368.55	360.70	354.40	
1 7/8	1.8750	49060	345.45	1	1 1/2	10	1 1/4	6	1.8161 - 1.8800	437.30	391.25	375.85	368.55	360.70	354.40	
1 15/16	1.9375	49062	362.05	1	1 1/2	10	1 1/4	6	1.8801 - 1.9410	453.65	407.70	392.35	385.05	377.10	371.05	
2	2.0000	49064	362.05	1	1 1/2	10	1 1/4	6	1.9411 - 2.0150	453.65	407.70	392.35	385.05	377.10	371.05	

*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

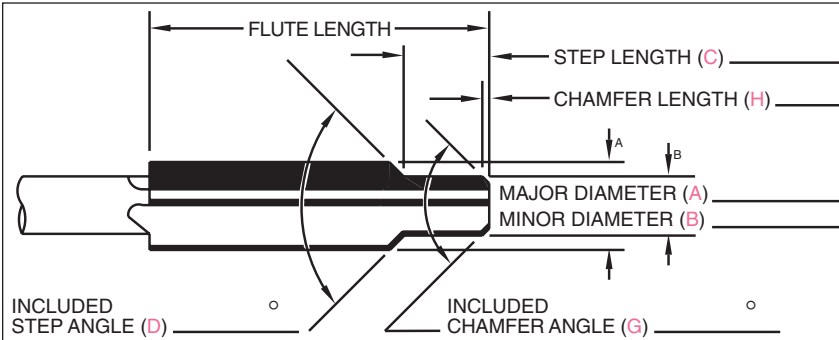
TYPE 458ST - FOR CAST IRONS

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	\$165.95	\$124.50	\$110.70	\$104.05	\$97.05	\$91.50	\$83.40
0.2041-0.2210	.1920	.2075	4	1 1/4	5	45707ST	45807ST	45907ST	165.95	124.50	110.70	104.05	97.05	91.50	83.40
0.2211-0.2380	.2080	.2265	4	1 1/2	6	4572344ST	4582344ST	4592344ST	165.95	124.50	110.70	104.05	97.05	91.50	83.40
0.2381-0.2530	.2240	.2405	4	1 1/2	6	45708ST	45808ST	45908ST	165.95	124.50	110.70	104.05	97.05	91.50	83.40
0.2531-0.2840	.2380	.2485	4	1 1/2	6	45709ST	45809ST	45909ST	167.85	126.40	112.60	106.00	99.00	93.35	85.25
0.2841-0.3150	.2670	.2792	4	1 1/2	6	45710ST	45810ST	45910ST	167.85	126.40	112.60	106.00	99.00	93.35	85.25
0.3151-0.3470	.2960	.2792	4	1 1/2	6	45711ST	45811ST	45911ST	170.75	129.45	115.55	109.10	101.95	96.40	88.30
0.3471-0.3780	.3260	.3105	4	1 3/4	7	45712ST	45812ST	45912ST	170.75	129.45	115.55	109.10	101.95	96.40	88.30
0.3781-0.4090	.3550	.3105	4	1 3/4	7	45713ST	45813ST	45913ST	175.05	133.85	120.00	113.40	106.35	100.70	92.65
0.4091-0.4410	.3850	.3730	6	1 3/4	7	45714ST	45814ST	45914ST	182.85	141.45	127.60	120.95	113.95	108.30	100.35
0.4411-0.4720	.4150	.3730	6	1 3/4	7	45715ST	45815ST	45915ST	190.75	149.40	135.60	129.00	121.95	116.35	108.25
0.4721-0.5030	.4440	.4355	6	2	8	45716ST	45816ST	45916ST	204.40	160.10	145.25	138.25	130.70	124.70	116.00
0.5031-0.5340	.4730	.4355	6	2	8	45717ST	45817ST	45917ST	207.75	163.50	148.65	141.65	133.95	128.00	119.40
0.5341-0.5660	.5020	.4355	6	2	8	45718ST	45818ST	45918ST	207.75	163.50	148.65	141.65	133.95	128.00	119.40
0.5661-0.5970	.5320	.4355	6	2	8	45719ST	45819ST	45919ST	212.35	168.10	153.25	146.20	138.65	132.60	123.95
0.5971-0.6280	.5610	.5615	6	2 1/4	9	45720ST	45820ST	45920ST	212.35	168.10	153.25	146.20	138.65	132.60	123.95
0.6281-0.6590	.5900	.5615	6	2 1/4	9	45721ST	45821ST	45921ST	214.65	170.35	155.50	148.40	140.85	134.90	126.25
0.6591-0.6910	.6200	.5615	6	2 1/4	9	45722ST	45822ST	45922ST	214.65	170.35	155.50	148.40	140.85	134.90	126.25
0.6911-0.7220	.6500	.5615	6	2 1/4	9	45723ST	45823ST	45923ST	220.25	176.00	161.20	154.15	146.60	140.60	131.90
0.7221-0.7530	.6790	.6245	6	2 1/2	9 1/2	45724ST	45824ST	45924ST	220.25	176.00	161.20	154.15	146.60	140.60	131.90
0.7531-0.7840	.7080	.6245	6	2 1/2	9 1/2	45725ST	45825ST	45925ST	224.80	180.50	165.80	158.70	151.05	145.15	136.45
0.7841-0.8160	.7370	.6245	6	2 1/2	9 1/2	45726ST	45826ST	45926ST	224.80	180.50	165.80	158.70	151.05	145.15	136.45
0.8161-0.8470	.7670	.6245	6	2 1/2	9 1/2	45727ST	45827ST	45927ST	230.20	186.00	171.15	164.10	156.50	150.55	141.90
0.8471-0.8780	.7970	.7495	6	2 3/8	10	45728ST	45828ST	45928ST	238.95	193.00	177.55	170.30	162.40	156.20	147.25
0.8781-0.9090	.8260	.7495	6	2 3/8	10	45729ST	45829ST	45929ST	263.25	217.30	201.85	194.65	186.70	180.50	171.55
0.9091-0.9410	.8550	.7495	8	2 3/8	10	45730ST	45830ST	45930ST	263.25	217.30	201.85	194.65	186.70	180.50	171.55
0.9411-0.9720	.8850	.7495	8	2 3/8	10	45731ST	45831ST	45931ST	271.45	225.45	210.10	202.75	194.85	188.60	179.65
0.9721-1.0030	.9140	.8745	8	2 3/4	10 1/2	45732ST	45832ST	45932ST	271.45	225.45	210.10	202.75	194.85	188.60	179.65
1.0031-1.0660	.9430	.8745	8	2 3/4	10 1/2	45734ST	45834ST	45934ST	273.80	229.70	214.80	207.85	200.35	194.40	185.85
1.0661-1.1280	1.0020	.8745	8	2 3/4	11	45736ST	45836ST	45936ST	289.05	245.05	230.35	223.40	215.80	209.85	201.20
1.1281-1.1905	1.0610	.9995	8	2 3/4	11	45738ST	45838ST	45938ST	298.35	254.20	239.50	232.50	224.90	218.95	210.40
1.1906-1.2530	1.1200	.9995	8	3	11 1/2	45740ST	45840ST	45940ST	315.40	271.40	256.50	249.60	242.10	236.10	227.55
1.2531-1.3155	1.1780	.9995	8	3	11 1/2	45742ST	45842ST	45942ST	321.70	277.60	262.85	255.90	248.35	242.35	233.75
1.3156-1.3780	1.2370	.9995	8	3 1/4	12	45744ST	45844ST	45944ST	337.25	293.15	278.50	271.45	263.90	257.90	249.30
1.3781-1.4405	1.2960	.9995	8	3 1/4	12	45746ST	45846ST	45946ST	357.80	313.70	298.90	291.90	284.35	278.50	269.80
1.4406-1.5030	1.3550	1.2495	8	3 1/2	12 1/2	45748ST	45848ST	45948ST	365.75	321.70	307.00	299.95	292.40	286.45	277.80



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

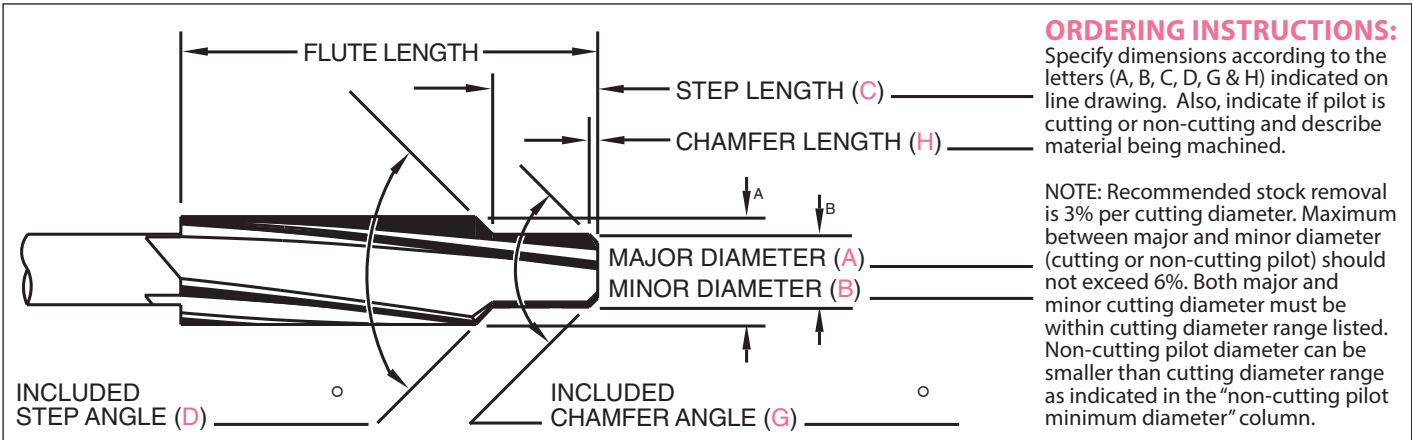
TYPE 443ST - FOR CAST IRONS

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	\$183.50	\$144.60	\$131.75	\$125.50	\$118.90	\$113.70	\$106.05
0.3151 - 0.3470	.2960	.2792	4	1 1/2	6	44211ST	44311ST	44411ST	194.25	155.45	142.40	136.35	129.60	124.45	116.85
0.3471 - 0.3780	.3260	.3105	4	1 3/4	7	44212ST	44312ST	44412ST	195.30	156.60	143.60	137.45	130.80	125.50	118.05
0.3781 - 0.4090	.3550	.3105	4	1 3/4	7	44213ST	44313ST	44413ST	200.55	161.80	148.80	142.60	135.95	130.80	123.15
0.4091 - 0.4410	.3850	.3730	6	1 3/4	7	44214ST	44314ST	44414ST	205.25	166.60	153.50	147.40	140.70	135.55	127.85
0.4411 - 0.4720	.4150	.3730	6	1 3/4	7	44215ST	44315ST	44415ST	213.40	174.70	161.75	155.50	148.95	143.65	136.10
0.4721 - 0.5030	.4440	.4355	6	2	8	44216ST	44316ST	44416ST	229.20	187.85	173.95	167.40	160.40	154.75	146.70
0.5031 - 0.5340	.4730	.4355	6	2	8	44217ST	44317ST	44417ST	233.45	192.15	178.25	171.70	164.60	159.10	151.00
0.5341 - 0.5660	.5020	.4355	6	2	8	44218ST	44318ST	44418ST	233.45	192.15	178.25	171.70	164.60	159.10	151.00
0.5661 - 0.5970	.5320	.4355	6	2	8	44219ST	44319ST	44419ST	237.85	196.60	182.85	176.20	169.15	163.55	155.45
0.5971 - 0.6280	.5610	.5615	6	2 1/4	9	44220ST	44320ST	44420ST	237.85	196.60	182.85	176.20	169.15	163.55	155.45
0.6281 - 0.6590	.5900	.5615	6	2 1/4	9	44221ST	44321ST	44421ST	242.80	201.65	187.60	181.10	173.95	168.45	160.40
0.6591 - 0.6910	.6200	.5615	6	2 1/4	9	44222ST	44322ST	44422ST	252.85	211.45	197.60	191.00	184.00	178.45	170.30
0.6911 - 0.7220	.6500	.5615	6	2 1/4	9	44223ST	44323ST	44423ST	255.35	214.05	200.25	193.65	186.55	180.95	172.95
0.7221 - 0.7530	.6790	.6245	6	2 1/2	9 1/2	44224ST	44324ST	44424ST	257.90	216.60	202.75	196.20	189.15	183.55	175.40
0.7531 - 0.7840	.7080	.6245	6	2 1/2	9 1/2	44225ST	44325ST	44425ST	262.60	221.25	207.40	200.90	193.75	188.20	180.10
0.7841 - 0.8160	.7370	.6245	6	2 1/2	9 1/2	44226ST	44326ST	44426ST	262.60	221.25	207.40	200.90	193.75	188.20	180.10
0.8161 - 0.8470	.7670	.6245	6	2 1/2	9 1/2	44227ST	44327ST	44427ST	272.40	231.10	217.25	210.65	203.45	197.95	189.85
0.8471 - 0.8780	.7970	.7495	6	2 5/8	10	44228ST	44328ST	44428ST	282.65	239.80	225.40	218.65	211.20	205.45	197.10
0.8781 - 0.9090	.8260	.7495	6	2 5/8	10	44229ST	44329ST	44429ST	315.10	272.10	257.75	250.95	243.60	237.80	229.30
0.9091 - 0.9410	.8550	.7495	8	2 5/8	10	44230ST	44330ST	44430ST	315.10	272.10	257.75	250.95	243.60	237.80	229.30
0.9411 - 0.9720	.8850	.7495	8	2 5/8	10	44231ST	44331ST	44431ST	326.30	283.40	269.10	262.10	254.85	249.10	240.75
0.9721 - 1.0030	.9140	.8745	8	2 3/4	10 1/2	44232ST	44332ST	44432ST	326.30	283.40	269.10	262.10	254.85	249.10	240.75
1.0031 - 1.0660	.9430	.8745	8	2 3/4	10 1/2	44234ST	44334ST	44434ST	368.50	325.55	311.20	304.35	297.00	291.30	282.85
1.0661 - 1.1280	1.0020	.8745	8	2 7/8	11	44236ST	44336ST	44436ST	377.25	334.30	319.95	313.15	305.75	300.00	291.55
1.1281 - 1.1905	1.0610	.9995	8	2 7/8	11	44238ST	44338ST	44438ST	392.20	349.40	334.95	328.15	320.75	315.05	306.60
1.1906 - 1.2530	1.1200	.9995	8	3	11 1/2	44240ST	44340ST	44440ST	409.80	367.00	352.65	345.70	338.45	332.65	324.20
1.2531 - 1.3155	1.1780	.9995	8	3	11 1/2	44242ST	44342ST	44442ST	444.60	401.65	387.25	380.50	373.05	367.30	358.95
1.3156 - 1.3780	1.2370	.9995	8	3 1/4	12	44244ST	44344ST	44444ST	478.75	435.85	421.60	414.70	407.30	401.55	393.30
1.3781 - 1.4405	1.2960	.9995	8	3 1/4	12	44246ST	44346ST	44446ST	502.15	459.20	444.90	438.05	430.75	424.95	416.55
1.4406 - 1.5030	1.3550	1.2495	8	3 1/2	12 1/2	44248ST	44348ST	44448ST	525.75	482.90	468.50	461.70	454.35	448.65	440.10

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

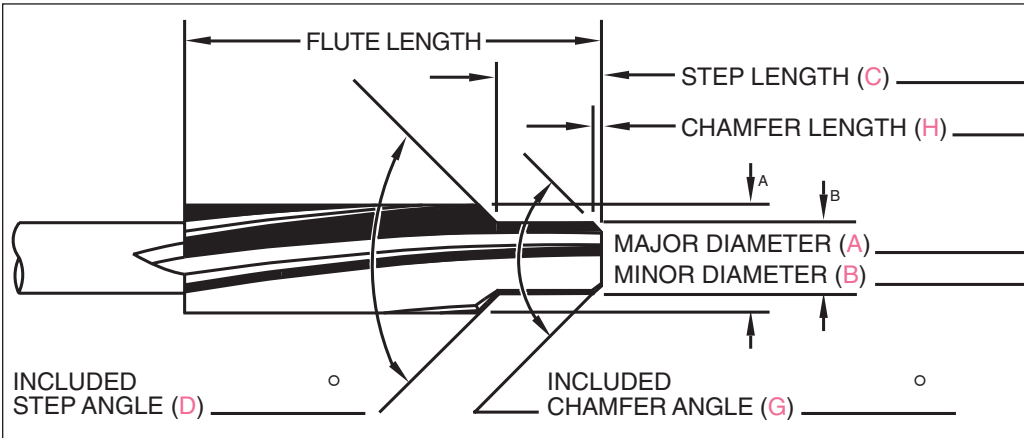
TYPE 483ST - FOR CAST IRONS

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	\$195.65	\$154.35	\$140.55	\$133.90	\$126.80	\$121.25	\$113.20
0.3151 - 0.3470	.2960	.2792	4	1 1/2	6	48211ST	48311ST	48411ST	207.25	165.85	151.95	145.40	138.30	132.75	124.60
0.3471 - 0.3780	.3260	.3105	4	1 3/4	7	48212ST	48312ST	48412ST	208.40	166.90	153.20	146.60	139.50	133.90	125.75
0.3781 - 0.4090	.3550	.3105	4	1 3/4	7	48213ST	48313ST	48413ST	213.90	172.50	158.75	152.10	145.05	139.50	131.40
0.4091 - 0.4410	.3850	.3730	6	1 3/4	7	48214ST	48314ST	48414ST	218.90	177.55	163.75	157.25	150.10	144.55	136.45
0.4411 - 0.4720	.4150	.3730	6	1 3/4	7	48215ST	48315ST	48415ST	227.65	186.25	172.40	165.95	158.80	153.25	145.15
0.4721 - 0.5030	.4440	.4355	6	2	8	48216ST	48316ST	48416ST	235.35	192.95	178.65	171.90	164.60	158.90	150.60
0.5031 - 0.5340	.4730	.4355	6	2	8	48217ST	48317ST	48417ST	239.75	197.30	183.05	176.25	169.15	163.35	154.95
0.5341 - 0.5660	.5020	.4355	6	2	8	48218ST	48318ST	48418ST	239.75	197.30	183.05	176.25	169.15	163.35	154.95
0.5661 - 0.5970	.5320	.4355	6	2	8	48219ST	48319ST	48419ST	244.40	201.90	187.60	180.90	173.65	167.95	159.50
0.5971 - 0.6280	.5610	.5615	6	2 1/4	9	48220ST	48320ST	48420ST	244.40	201.90	187.60	180.90	173.65	167.95	159.50
0.6281 - 0.6590	.5900	.5615	6	2 1/4	9	48221ST	48321ST	48421ST	249.35	206.85	192.75	186.00	178.65	172.95	164.60
0.6591 - 0.6910	.6200	.5615	6	2 1/4	9	48222ST	48322ST	48422ST	259.60	217.15	202.95	196.20	188.85	183.10	174.85
0.6911 - 0.7220	.6500	.5615	6	2 1/4	9	48223ST	48323ST	48423ST	262.15	219.85	205.65	198.75	191.65	185.90	177.45
0.7221 - 0.7530	.6790	.6245	6	2 1/2	9 1/2	48224ST	48324ST	48424ST	264.90	222.35	208.15	201.45	194.20	188.45	180.15
0.7531 - 0.7840	.7080	.6245	6	2 1/2	9 1/2	48225ST	48325ST	48425ST	269.70	227.20	213.05	206.15	198.85	193.15	184.90
0.7841 - 0.8160	.7370	.6245	6	2 1/2	9 1/2	48226ST	48326ST	48426ST	269.70	227.20	213.05	206.15	198.85	193.15	184.90
0.8161 - 0.8470	.7670	.6245	6	2 1/2	9 1/2	48227ST	48327ST	48427ST	279.65	237.20	223.00	216.20	209.00	203.30	194.95
0.8471 - 0.8780	.7970	.7495	6	2 5/8	10	48228ST	48328ST	48428ST	290.20	246.15	231.45	224.40	216.85	210.90	202.30
0.8781 - 0.9090	.8260	.7495	6	2 5/8	10	48229ST	48329ST	48429ST	323.55	279.45	264.75	257.70	250.15	244.15	235.55
0.9091 - 0.9410	.8550	.7495	8	2 5/8	10	48230ST	48330ST	48430ST	323.55	279.45	264.75	257.70	250.15	244.15	235.55
0.9411 - 0.9720	.8850	.7495	8	2 5/8	10	48231ST	48331ST	48431ST	335.10	291.10	276.25	269.25	261.80	255.80	247.15
0.9721 - 1.0030	.9140	.8745	8	2 3/4	10 1/2	48232ST	48332ST	48432ST	335.10	291.10	276.25	269.25	261.80	255.80	247.15
1.0031 - 1.0660	.9430	.8745	8	2 3/4	10 1/2	48234ST	48334ST	48434ST	378.30	334.30	319.50	312.55	305.00	299.10	290.30
1.0661 - 1.1280	1.0020	.8745	8	2 7/8	11	48236ST	48336ST	48436ST	387.25	343.35	328.55	321.50	313.95	308.05	299.45
1.1281 - 1.1905	1.0610	.9995	8	2 7/8	11	48238ST	48338ST	48438ST	402.70	358.60	344.00	336.90	329.35	323.50	314.75
1.1906 - 1.2530	1.1200	.9995	8	3	11 1/2	48240ST	48340ST	48440ST	420.80	376.80	362.10	355.05	347.50	341.60	332.90
1.2531 - 1.3155	1.1780	.9995	8	3	11 1/2	48242ST	48342ST	48442ST	456.50	412.45	397.70	390.70	383.20	377.10	368.55
1.3156 - 1.3780	1.2370	.9995	8	3 1/4	12	48244ST	48344ST	48444ST	491.65	447.65	432.80	425.80	418.30	412.25	403.75
1.3781 - 1.4405	1.2960	.9995	8	3 1/4	12	48246ST	48346ST	48446ST	515.60	471.65	456.80	449.75	442.30	436.35	427.75
1.4406 - 1.5030	1.3550	1.2495	8	3 1/2	12 1/2	48248ST	48348ST	48448ST	539.90	495.70	480.90	474.00	466.40	460.50	451.95



SOLID CARBIDE REAMERS



INDEX

SOLID CARBIDE: GENERAL PURPOSE CHUCKING REAMERS - SHORT SERIES - STRAIGHT SHANK & FLUTES

- TYPE 804** - FRACTIONAL - 1/32 - 1/2" diameterpg 105
- LETTER - Size A-Zpg 105
- DECIMAL - .0280 - .5150 diameter (.0005 increments)pg 106-109
- WIRE - Size 1 - 51pg 105
- METRIC - 1.0 - 13.0mmpg 105

SOLID CARBIDE: MATERIAL SPECIFIC REAMERS - SHORT SERIES - STRAIGHT SHANK - pg 104

- TYPE 802** - STRAIGHT FLUTES FOR CAST IRONS & STEELS
- TYPE 812** - RIGHT SPIRAL FLUTES FOR CAST IRONS & STEELS
- TYPE 822** - LEFT SPIRAL FLUTES FOR CAST IRONS & STEELS
- TYPE 803** - STRAIGHT FLUTES FOR NON-FERROUS MATERIALS
- TYPE 813** - RIGHT SPIRAL FLUTES FOR NON-FERROUS MATERIALS
- TYPE 823** - LEFT SPIRAL FLUTES FOR NON-FERROUS MATERIALS

SOLID CARBIDE: COOLANT FED MATERIAL SPECIFIC REAMERS - SHORT SERIES - STRAIGHT SHANK - pg 102-103

CENTER FED COOLANT

- TYPE 806** - STRAIGHT FLUTES FOR CAST IRONS & STEELS
- TYPE 816** - RIGHT SPIRAL FLUTES FOR CAST IRONS & STEELS
- TYPE 807** - STRAIGHT FLUTES FOR NON-FERROUS MATERIALS
- TYPE 817** - RIGHT SPIRAL FLUTES FOR NON-FERROUS MATERIALS

FLUTE FED COOLANT

- TYPE 808** - STRAIGHT FLUTES FOR CAST IRONS & STEELS
- TYPE 828** - LEFT SPIRAL FLUTES FOR CAST IRONS & STEELS
- TYPE 809** - STRAIGHT FLUTES FOR NON-FERROUS MATERIALS
- TYPE 829** - LEFT SPIRAL FLUTES FOR NON-FERROUS MATERIALS

SOLID CARBIDE HEAD: MATERIAL SPECIFIC REAMERS - STEEL SHANK WITH SOLID CARBIDE HEAD - pg 110-111

- TYPE 800** - STRAIGHT FLUTES FOR CAST IRONS & STEELS
- TYPE 810** - RIGHT SPIRAL FLUTES FOR CAST IRONS & STEELS
- TYPE 820** - LEFT SPIRAL FLUTES FOR CAST IRONS & STEELS
- TYPE 801** - STRAIGHT FLUTES FOR NON-FERROUS MATERIALS
- TYPE 811** - RIGHT SPIRAL FLUTES FOR NON-FERROUS MATERIALS
- TYPE 821** - LEFT SPIRAL FLUTES FOR NON-FERROUS MATERIALS

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	\$156.35	\$135.45	\$128.40	\$125.10	\$121.40	\$118.65	\$114.50
.1281-.1435	.1255	4	3/4	2 1/2	80709	80609	157.45	136.40	129.60	126.15	122.60	119.70	115.60
.1436-.1590	.1411	4	3/4	2 1/2	80710	80610	158.05	137.15	130.20	126.85	123.15	120.35	116.30
.1591-.1750	.1567	4	7/8	2 3/4	80711	80611	159.55	138.75	131.75	128.35	124.70	121.95	117.85
.1751-.1910	.1724	4	7/8	2 3/4	80712	80612	166.05	145.00	138.15	134.70	131.15	128.30	124.25
.1911-.2210	.1880	6	1	3	80714	80614	168.50	147.55	140.55	137.15	133.60	130.75	126.75
.2211-.2530	.2193	6	1	3	80716	80616	171.50	150.55	143.60	140.20	136.45	133.80	129.65
.2531-.2840	.2505	6	1 1/8	3 1/4	80718	80618	176.35	155.40	148.50	145.00	141.45	138.65	134.45
.2841-.3150	.2817	6	1 1/8	3 1/4	80720	80620	180.40	159.45	152.50	149.15	145.55	142.80	138.65
.3151-.3470	.3130	6	1 1/4	3 1/2	80722	80622	185.45	164.45	157.50	154.00	150.55	147.70	143.60
.3471-.3780	.3443	6	1 1/4	3 1/2	80724	80624	191.05	170.05	163.15	159.80	156.15	153.30	149.25
.3781-.4090	.3755	6	1 3/8	3 3/4	80726	80626	199.85	178.90	172.05	168.60	165.00	162.20	158.05

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	\$221.20	\$200.30	\$193.30	\$189.95	\$186.25	\$183.55	\$179.45
.1281-.1435	.1255	4	3/4	2 1/2	80909	80809	210.15	189.15	182.25	178.75	175.30	172.40	168.30
.1436-.1590	.1411	4	3/4	2 1/2	80910	80810	223.40	202.40	195.55	192.10	188.50	185.65	181.55
.1591-.1750	.1567	4	7/8	2 3/4	80911	80811	225.30	204.35	197.40	194.10	190.45	187.60	183.55
.1751-.1910	.1724	4	7/8	2 3/4	80912	80812	226.70	205.80	198.75	195.45	191.75	189.00	184.90
.1911-.2210	.1880	6	1	3	80914	80814	272.45	251.50	244.50	241.10	237.55	234.80	230.60
.2211-.2530	.2193	6	1	3	80916	80816	275.85	254.75	247.95	244.45	240.90	238.05	233.95
.2531-.2840	.2505	6	1 1/8	3 1/4	80918	80818	281.70	260.70	253.85	250.40	246.85	243.95	239.80
.2841-.3150	.2817	6	1 1/8	3 1/4	80920	80820	286.35	265.50	258.50	255.10	251.50	248.55	244.50
.3151-.3470	.3130	6	1 1/4	3 1/2	80922	80822	304.60	283.65	276.75	273.25	269.70	266.90	262.75
.3471-.3780	.3443	6	1 1/4	3 1/2	80924	80824	311.10	290.10	283.25	279.70	276.20	273.30	269.25
.3781-.4090	.3755	6	1 3/8	3 3/4	80926	80826	321.75	300.80	293.80	290.40	286.80	284.00	279.90



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	\$160.35	\$139.25	\$132.40	\$128.95	\$125.35	\$122.60	\$118.35
.1281-.1435	.1255	4	3/4	2 1/2	81709	81609	161.35	140.45	133.45	130.10	126.35	123.70	119.60
.1436-.1590	.1411	4	3/4	2 1/2	81710	81610	162.05	141.05	134.25	130.75	127.10	124.35	120.20
.1591-.1750	.1567	4	7/8	2 3/4	81711	81611	163.60	142.65	135.75	132.30	128.70	125.85	121.70
.1751-.1910	.1724	4	7/8	2 3/4	81712	81612	169.95	149.00	142.00	138.65	135.00	132.20	128.20
.1911-.2210	.1880	6	1	3	81714	81614	172.35	151.40	144.45	140.95	137.45	134.60	130.45
.2211-.2530	.2193	6	1	3	81716	81616	175.35	154.40	147.45	143.90	140.45	137.60	133.45
.2531-.2840	.2505	6	1 1/8	3 1/4	81718	81618	180.15	159.30	152.35	148.95	145.25	142.40	138.35
.2841-.3150	.2817	6	1 1/8	3 1/4	81720	81620	184.25	163.35	156.40	153.05	149.35	146.50	142.40
.3151-.3470	.3130	6	1 1/4	3 1/2	81722	81622	189.30	168.45	161.40	158.00	154.50	151.65	147.55
.3471-.3780	.3443	6	1 1/4	3 1/2	81724	81624	196.15	175.05	168.15	164.80	161.15	158.35	154.35
.3781-.4090	.3755	6	1 3/8	3 3/4	81726	81626	205.05	184.15	177.15	173.75	170.10	167.35	163.30

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	\$253.05	\$232.10	\$225.20	\$221.80	\$218.10	\$215.30	\$211.20
.1281-.1435	.1255	4	3/4	2 1/2	82909	82809	254.45	233.45	226.55	223.25	219.50	216.65	212.60
.1436-.1590	.1411	4	3/4	2 1/2	82910	82810	255.20	234.20	227.35	223.85	220.30	217.45	213.35
.1591-.1750	.1567	4	7/8	2 3/4	82911	82811	257.00	236.00	229.05	225.70	222.05	219.30	215.20
.1751-.1910	.1724	4	7/8	2 3/4	82912	82812	258.15	237.20	230.35	226.80	223.35	220.45	216.40
.1911-.2210	.1880	6	1	3	82914	82814	333.85	312.95	305.95	302.50	298.85	296.20	292.10
.2211-.2530	.2193	6	1	3	82916	82816	333.55	312.65	305.70	302.35	298.65	295.80	291.80
.2531-.2840	.2505	6	1 1/8	3 1/4	82918	82818	339.40	318.50	311.45	308.10	304.45	301.70	297.65
.2841-.3150	.2817	6	1 1/8	3 1/4	82920	82820	344.15	323.25	316.30	312.95	309.35	306.45	302.40
.3151-.3470	.3130	6	1 1/4	3 1/2	82922	82822	362.30	341.45	334.40	331.00	327.40	324.65	320.45
.3471-.3780	.3443	6	1 1/4	3 1/2	82924	82824	368.85	348.00	341.00	337.55	334.00	331.20	327.15
.3781-.4090	.3755	6	1 3/8	3 3/4	82926	82826	379.75	358.65	351.80	348.35	344.80	341.95	337.90



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

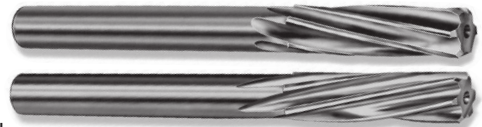
- Solid carbide head and straight shank
- Tool diameter tolerance thru .2500": plus .0002", minus .0000"
over .2500": plus .0003", minus .0000"
- Shank diameter tolerance: plus .0000", minus .0010"
- Tool geometry appropriate for material being machined

MODIFICATIONS (See list on page 101)

REAMERS

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	\$82.35	\$51.30	\$40.90	\$36.00	\$30.65	\$26.45	\$20.35
*0.0661 - 0.0740	.0650	4	1/2	1 3/4	-	80245	82.65	51.50	41.15	36.20	30.90	26.70	20.65
*0.0741 - 0.0810	.0730	4	1/2	1 3/4	-	80205	82.80	51.60	41.20	36.40	30.95	26.90	20.70
*0.0811 - 0.0890	.0800	4	1/2	2	-	80255	83.20	52.20	41.80	36.90	31.60	27.40	21.30
*0.0891 - 0.0970	.0880	4	1/2	2	-	80206	83.80	52.65	42.30	37.35	32.15	27.75	21.80
*0.0971 - 0.1120	.0943	4	5/8	2 1/4	80307	80207	84.10	52.90	42.60	37.65	32.35	28.20	22.10
0.1121 - 0.1280	.1099	4	5/8	2 1/4	80308	80208	85.60	54.45	44.05	39.15	33.75	29.60	23.55
0.1281 - 0.1435	.1255	4	3/4	2 1/2	80309	80209	86.15	55.10	44.65	39.80	34.45	30.30	24.15
0.1436 - 0.1590	.1411	4	3/4	2 1/2	80310	80210	87.65	56.50	46.10	41.20	35.95	31.65	25.60
0.1591 - 0.1750	.1567	4	7/8	2 3/4	80311	80211	90.95	59.80	49.40	44.55	39.20	35.05	28.90
0.1751 - 0.1910	.1724	4	7/8	2 3/4	80312	80212	93.15	62.00	51.60	46.75	41.30	37.25	31.10
0.1911 - 0.2210	.1880	6	1	3	80314	80214	97.00	65.90	55.50	50.60	45.35	41.10	35.05
0.2211 - 0.2530	.2193	6	1	3	80316	80216	103.55	72.50	62.10	57.25	51.90	47.70	41.65
0.2531 - 0.2840	.2505	6	1 1/8	3 1/4	80318	80218	111.30	80.15	69.75	64.85	59.55	55.35	49.30
0.2841 - 0.3150	.2817	6	1 1/8	3 1/4	80320	80220	119.75	88.65	78.15	73.40	68.05	63.85	57.80
0.3151 - 0.3470	.3130	6	1 1/4	3 1/2	80322	80222	132.30	101.25	90.90	85.95	80.70	76.30	70.40
0.3471 - 0.3780	.3443	6	1 1/4	3 1/2	80324	80224	133.90	102.90	92.60	87.65	82.30	78.05	72.00
0.3781 - 0.4090	.3755	6	1 3/8	3 3/4	80326	80226	145.05	113.95	103.55	98.55	93.30	89.10	83.00
0.4091 - 0.4410	.4067	6	1 3/8	3 3/4	80328	80228	146.30	115.20	104.80	99.90	94.60	90.35	84.25
0.4411 - 0.4720	.4380	6	1 1/2	4	80330	80230	155.20	124.10	113.65	108.80	103.45	99.30	93.20
0.4721 - 0.5150	.4693	6	1 1/2	4	80332	80232	163.85	132.75	122.25	117.45	112.15	107.95	101.85

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	\$87.25	\$55.90	\$45.35	\$40.40	\$34.95	\$30.65	\$24.50
0.1121 - 0.1280	.1099	4	5/8	2 1/4	81308	81208	82308	82208	88.95	57.45	46.95	42.05	36.55	32.30	26.20
0.1281 - 0.1435	.1255	4	3/4	2 1/2	81309	81209	82309	82209	94.10	61.20	50.15	44.85	39.25	34.80	28.25
0.1436 - 0.1590	.1411	4	3/4	2 1/2	81310	81210	82310	82210	95.90	62.85	51.80	46.60	40.95	36.45	30.10
0.1591 - 0.1750	.1567	4	7/8	2 3/4	81311	81211	82311	82211	99.75	66.75	55.65	50.40	44.80	40.30	33.80
0.1751 - 0.1910	.1724	4	7/8	2 3/4	81312	81212	82312	82212	102.20	69.30	58.15	52.90	47.25	42.80	36.35
0.1911 - 0.2210	.1880	6	1	3	81314	81214	82314	82214	111.85	77.25	65.70	60.20	54.25	49.55	42.80
0.2211 - 0.2530	.2193	6	1	3	81316	81216	82316	82216	120.05	85.30	73.70	68.35	62.35	57.80	51.05
0.2531 - 0.2840	.2505	6	1 1/8	3 1/4	81318	81218	82318	82218	129.45	94.80	83.25	77.85	71.80	67.25	60.45
0.2841 - 0.3150	.2817	6	1 1/8	3 1/4	81320	81220	82320	82220	139.65	105.10	93.45	88.00	82.15	77.40	70.60
0.3151 - 0.3470	.3130	6	1 1/4	3 1/2	81322	81222	82322	82222	155.10	120.55	108.90	103.45	97.50	92.75	86.00
0.3471 - 0.3780	.3443	6	1 1/4	3 1/2	81324	81224	82324	82224	157.20	122.60	111.00	105.45	99.65	94.90	88.15
0.3781 - 0.4090	.3755	6	1 3/8	3 3/4	81326	81226	82326	82226	161.55	126.90	115.30	109.80	103.90	99.20	92.50
0.4091 - 0.4410	.4067	6	1 3/8	3 3/4	81328	81228	82328	82228	162.90	128.20	116.60	111.20	105.25	100.55	93.85
0.4411 - 0.4720	.4380	6	1 1/2	4	81330	81230	82330	82230	172.80	138.15	126.60	121.20	115.25	110.55	103.75
0.4721 - 0.5150	.4693	6	1 1/2	4	81332	81232	82332	82232	182.35	147.75	136.20	130.80	124.75	120.10	113.35

*Designed with male centers



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	\$27.55	.0520	8040520	\$26.90	.0760	8040760	\$27.00	.1000	8041000	\$29.95	.1240	8041240	\$32.35
.0285	8040285	29.10	.0525	8040525	28.35	.0765	8040765	28.35	.1005	8041005	29.95	.1245	8041245	32.35
.0290	8040290	29.10	.0530	8040530	28.35	.0770	8040770	28.35	.1010	8041010	29.95	.1250	80408	28.35
.0295	8040295	27.55	.0535	8040535	28.35	.0775	8040775	28.35	.1015	8041015	28.55	.1255	8041255	32.35
.0300	8040300	29.10	.0540	8040540	28.35	.0780	8040780	28.35	.1020	8041020	30.25	.1260	804032	30.75
.0305	8040305	29.10	.0545	8040545	28.35	.0785	8040785	27.05	.1025	8041025	30.35	.1265	8041265	32.45
.0310	8040310	27.55	.0550	8040550	26.90	.0790	8040790	28.45	.1030	8041030	30.35	.1270	8041270	32.45
.0315	804008	27.55	.0555	8040555	28.35	.0795	8040795	28.45	.1035	8041035	30.35	.1275	8041275	32.45
.0320	8040320	27.55	.0560	8040560	28.35	.0800	8040800	28.45	.1040	8041040	30.35	.1280	8041280	30.80
.0325	8040325	29.10	.0565	8040565	28.35	.0805	8040805	28.45	.1045	8041045	30.35	.1285	8041285	30.80
.0330	8040330	27.55	.0570	8040570	28.35	.0810	8040810	27.05	.1050	8041050	30.35	.1290	8041290	32.45
.0335	8040335	27.55	.0575	8040575	28.35	.0815	8040815	28.55	.1055	8041055	30.35	.1295	8041295	32.45
.0340	8040340	28.10	.0580	8040580	28.35	.0820	8040820	27.20	.1060	8041060	30.35	.1300	8041300	32.45
.0345	8040345	28.10	.0585	8040585	28.35	.0825	8040825	28.55	.1065	8041065	28.85	.1305	8041305	32.45
.0350	8040350	26.75	.0590	8040590	24.70	.0830	8040830	28.55	.1070	8041070	30.80	.1310	8041310	32.45
.0355	8040355	28.10	.0595	8040595	26.05	.0835	8040835	28.55	.1075	8041075	30.80	.1315	8041315	32.45
.0360	8040360	26.75	.0600	8040600	28.20	.0840	8040840	28.55	.1080	8041080	30.80	.1320	8041320	32.45
.0365	8040365	28.10	.0605	8040605	28.20	.0845	8040845	28.55	.1085	8041085	31.20	.1325	8041325	32.45
.0370	8040370	26.75	.0610	8040610	26.70	.0850	8040850	28.55	.1090	8041090	31.20	.1330	8041330	32.45
.0375	8040375	28.10	.0615	8040615	28.20	.0855	8040855	28.55	.1095	8041095	31.20	.1335	8041335	32.45
.0380	8040380	26.75	.0620	8040620	28.20	.0860	8040860	27.20	.1100	8041100	29.70	.1340	8041340	32.45
.0385	8040385	28.10	.0625	80404	24.55	.0865	8040865	28.55	.1105	8041105	31.65	.1345	8041345	32.45
.0390	8040390	26.75	.0630	804016	26.70	.0870	8040870	28.55	.1110	8041110	30.25	.1350	8041350	32.45
.0395	8040395	28.10	.0635	8040635	26.70	.0875	8040875	28.55	.1115	8041115	32.25	.1355	8041355	32.45
.0400	8040400	26.75	.0640	8040640	28.20	.0880	8040880	28.55	.1120	8041120	32.25	.1360	8041360	30.80
.0405	8040405	28.10	.0645	8040645	28.20	.0885	8040885	28.55	.1125	8041125	32.25	.1365	8041365	32.45
.0410	8040410	26.75	.0650	8040650	28.35	.0890	8040890	27.65	.1130	8041130	30.60	.1370	8041370	32.45
.0415	8040415	28.10	.0655	8040655	28.35	.0895	8040895	29.25	.1135	8041135	32.25	.1375	8041375	32.45
.0420	8040420	26.75	.0660	8040660	28.35	.0900	8040900	29.25	.1140	8041140	32.25	.1380	8041380	33.05
.0425	8040425	28.10	.0665	8040665	28.35	.0905	8040905	29.25	.1145	8041145	32.25	.1385	8041385	33.05
.0430	8040430	26.75	.0670	8040670	27.00	.0910	8040910	29.40	.1150	8041150	32.25	.1390	8041390	33.05
.0435	8040435	28.35	.0675	8040675	28.35	.0915	8040915	29.40	.1155	8041155	32.25	.1395	8041395	33.05
.0440	8040440	28.35	.0680	8040680	28.35	.0920	8040920	29.40	.1160	8041160	30.60	.1400	8041400	33.05
.0445	8040445	28.35	.0685	8040685	28.35	.0925	8040925	27.75	.1165	8041165	32.25	.1405	8041405	31.20
.0450	8040450	28.35	.0690	8040690	28.35	.0930	8040930	29.40	.1170	8041170	32.25	.1410	8041410	34.30
.0455	8040455	28.35	.0695	8040695	28.35	.0935	8040935	27.75	.1175	8041175	32.25	.1415	8041415	34.30
.0460	8040460	28.35	.0700	8040700	27.00	.0940	8040940	29.40	.1180	8041180	32.25	.1420	8041420	34.30
.0465	8040465	26.90	.0705	8040705	28.35	.0945	804024	27.75	.1185	8041185	32.35	.1425	8041425	34.30
.0470	8040470	28.35	.0710	8040710	28.35	.0950	8040950	29.70	.1190	8041190	32.35	.1430	8041430	34.30
.0475	8040475	28.35	.0715	8040715	28.35	.0955	8040955	29.70	.1195	8041195	32.35	.1435	8041435	34.30
.0480	8040480	28.35	.0720	8040720	28.35	.0960	8040960	28.35	.1200	8041200	30.75	.1440	8041440	32.60
.0485	8040485	28.35	.0725	8040725	28.35	.0965	8040965	28.35	.1205	8041205	32.35	.1445	8041445	34.45
.0490	8040490	28.35	.0730	8040730	27.00	.0970	8040970	29.70	.1210	8041210	32.35	.1450	8041450	34.50
.0495	8040495	28.35	.0735	8040735	28.35	.0975	8040975	29.70	.1215	8041215	32.35	.1455	8041455	34.50
.0500	8040500	28.35	.0740	8040740	28.35	.0980	8040980	28.35	.1220	804031	30.75	.1460	8041460	35.40
.0505	8040505	28.35	.0745	8040745	28.35	.0985	8040985	29.95	.1225	8041225	32.35	.1465	8041465	35.40
.0510	8040510	28.35	.0750	8040750	28.35	.0990	8040990	29.95	.1230	8041230	32.35	.1470	8041470	33.60
.0515	8040515	28.35	.0755	8040755	28.35	.0995	8040995	28.55	.1235	8041235	32.35	.1475	8041475	35.40



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	\$35.50	.1720	8041720	\$41.15	.1960	8041960	\$45.75	.2200	8042200	\$55.75	.2440	8042440	\$59.50
.1485	8041485	35.50	.1725	8041725	41.15	.1965	8041965	47.90	.2205	804056	52.85	.2445	8042445	59.50
.1490	8041490	35.50	.1730	8041730	39.15	.1970	8041970	48.45	.2210	8042210	52.85	.2450	8042450	59.50
.1495	8041495	33.75	.1735	8041735	41.75	.1975	8041975	48.45	.2215	8042215	57.95	.2455	8042455	59.50
.1500	8041500	35.50	.1740	8041740	41.75	.1980	8041980	48.45	.2220	8042220	57.95	.2460	8042460	56.65
.1505	8041505	35.50	.1745	8041745	41.75	.1985	8041985	48.45	.2225	8042225	57.95	.2465	8042465	59.50
.1510	8041510	35.50	.1750	8041750	41.75	.1990	8041990	45.95	.2230	8042230	57.95	.2470	8042470	59.50
.1515	8041515	35.50	.1755	8041755	42.15	.1995	8041995	49.85	.2235	8042235	57.95	.2475	8042475	59.50
.1520	8041520	33.75	.1760	8041760	42.15	.2000	8042000	49.85	.2240	8042240	57.95	.2480	804063	56.65
.1525	8041525	37.05	.1765	8041765	42.15	.2005	8042005	49.85	.2245	8042245	57.95	.2485	8042485	59.50
.1530	8041530	37.05	.1770	8041770	40.10	.2010	8042010	47.45	.2250	8042250	57.95	.2490	8042490	59.50
.1535	804039	35.20	.1775	8041775	42.30	.2015	8042015	49.85	.2255	8042255	57.95	.2495	8042495	59.50
.1540	8041540	35.20	.1780	8041780	42.30	.2020	8042020	49.85	.2260	8042260	57.95	.2500	80416	51.50
.1545	8041545	37.05	.1785	8041785	42.30	.2025	8042025	49.85	.2265	8042265	58.55	.2505	8042505	59.50
.1550	8041550	37.05	.1790	8041790	42.30	.2030	8042030	49.85	.2270	8042270	58.55	.2510	8042510	59.50
.1555	8041555	35.20	.1795	8041795	42.30	.2035	8042035	49.85	.2275	8042275	58.55	.2515	8042515	59.50
.1560	8041560	37.05	.1800	8041800	40.30	.2040	8042040	47.45	.2280	8042280	55.55	.2520	804064	62.40
.1565	8041565	38.35	.1805	8041805	42.60	.2045	8042045	49.85	.2285	8042285	58.55	.2525	8042525	62.40
.1570	8041570	36.40	.1810	8041810	42.65	.2050	8042050	49.85	.2290	8042290	58.55	.2530	8042530	59.50
.1575	804040	33.25	.1815	8041815	42.90	.2055	8042055	47.45	.2295	8042295	58.55	.2535	8042535	65.70
.1580	8041580	39.15	.1820	8041820	40.90	.2060	8042060	49.85	.2300	8042300	58.55	.2540	8042540	65.70
.1585	8041585	39.15	.1825	8041825	43.15	.2065	8042065	49.85	.2305	8042305	58.55	.2545	8042545	65.70
.1590	8041590	37.30	.1830	8041830	43.15	.2070	8042070	49.85	.2310	8042310	58.55	.2550	8042550	65.70
.1595	8041595	39.80	.1835	8041835	43.25	.2075	8042075	49.85	.2315	8042315	58.55	.2555	8042555	65.70
.1600	8041600	39.80	.1840	8041840	43.25	.2080	8042080	49.85	.2320	8042320	58.55	.2560	8042560	65.70
.1605	8041605	39.80	.1845	8041845	43.25	.2085	8042085	49.85	.2325	8042325	58.55	.2565	8042565	65.70
.1610	8041610	37.80	.1850	804047	41.15	.2090	8042090	49.85	.2330	8042330	58.55	.2570	8042570	62.35
.1615	8041615	39.80	.1855	8041855	45.50	.2095	8042095	49.85	.2335	8042335	58.55	.2575	8042575	65.70
.1620	8041620	39.80	.1860	8041860	45.50	.2100	8042100	49.85	.2340	8042340	55.55	.2580	8042580	65.70
.1625	8041625	39.80	.1865	8041865	45.50	.2105	8042105	49.85	.2345	8042345	58.55	.2585	8042585	65.70
.1630	8041630	39.80	.1870	8041870	43.35	.2110	8042110	49.85	.2350	8042350	58.55	.2590	8042590	65.70
.1635	8041635	39.90	.1875	80412	39.45	.2115	8042115	49.85	.2355	8042355	58.55	.2595	8042595	65.70
.1640	8041640	39.80	.1880	8041880	45.65	.2120	8042120	49.85	.2360	8042360	58.55	.2600	8042600	65.70
.1645	8041645	39.80	.1885	8041885	45.65	.2125	8042125	49.85	.2365	8042365	59.50	.2605	8042605	65.70
.1650	8041650	39.80	.1890	804048	43.35	.2130	8042130	47.45	.2370	8042370	59.50	.2610	8042610	62.35
.1655	8041655	39.80	.1895	8041895	46.10	.2135	8042135	49.85	.2375	8042375	59.50	.2615	8042615	65.70
.1660	8041660	38.00	.1900	8041900	46.10	.2140	8042140	49.85	.2380	8042380	56.65	.2620	8042620	65.70
.1665	8041665	40.30	.1905	8041905	46.10	.2145	8042145	49.85	.2385	8042385	59.50	.2625	8042625	65.70
.1670	8041670	40.30	.1910	8041910	43.90	.2150	8042150	49.85	.2390	8042390	59.50	.2630	8042630	65.70
.1675	8041675	40.30	.1915	8041915	46.20	.2155	8042155	49.85	.2395	8042395	59.50	.2635	8042635	65.70
.1680	8041680	40.30	.1920	8041920	46.20	.2160	8042160	49.85	.2400	8042400	59.50	.2640	8042640	65.70
.1685	8041685	40.30	.1925	8041925	46.20	.2165	804055	43.35	.2405	8042405	59.50	.2645	8042645	65.70
.1690	8041690	40.30	.1930	8041930	46.70	.2170	8042170	49.85	.2410	8042410	59.50	.2650	8042650	65.70
.1695	8041695	38.40	.1935	8041935	44.15	.2175	8042175	49.85	.2415	8042415	59.50	.2655	8042655	65.70
.1700	8041700	41.15	.1940	8041940	46.70	.2180	8042180	49.85	.2420	8042420	56.65	.2660	8042660	62.35
.1705	8041705	41.15	.1945	8041945	46.70	.2185	8042185	47.45	.2425	8042425	59.50	.2665	8042665	65.70
.1710	8041710	41.15	.1950	8041950	47.90	.2190	8042190	55.75	.2430	8042430	59.50	.2670	8042670	65.70
.1715	8041715	41.15	.1955	8041955	47.90	.2195	8042195	55.75	.2435	8042435	59.50	.2675	8042675	65.70



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	\$65.70	.2920	8042920	\$77.00	.3160	8043160	\$80.10	.3400	8043400	\$97.70	.3640	8043640	\$100.15
.2685	8042685	65.70	.2925	8042925	77.00	.3165	8043165	85.25	.3405	8043405	97.70	.3645	8043645	100.15
.2690	8042690	65.70	.2930	8042930	77.00	.3170	8043170	85.25	.3410	8043410	97.70	.3650	8043650	100.15
.2695	8042695	65.70	.2935	8042935	77.00	.3175	8043175	85.25	.3415	8043415	97.70	.3655	8043655	100.15
.2700	8042700	65.70	.2940	8042940	77.00	.3180	8043180	85.25	.3420	8043420	97.70	.3660	8043660	100.15
.2705	8042705	65.70	.2945	8042945	77.00	.3185	8043185	85.25	.3425	804087	97.45	.3665	8043665	100.15
.2710	8042710	65.70	.2950	8042950	73.20	.3190	8043190	85.25	.3430	8043430	97.70	.3670	8043670	100.15
.2715	8042715	65.70	.2955	8042955	77.00	.3195	8043195	85.25	.3435	8043435	97.70	.3675	8043675	100.15
.2720	8042720	62.35	.2960	8042960	77.00	.3200	8043200	85.25	.3440	8043440	97.90	.3680	8043680	95.25
.2725	8042725	65.70	.2965	8042965	77.00	.3205	8043205	85.25	.3445	8043445	97.90	.3685	8043685	101.15
.2730	8042730	65.70	.2970	8042970	80.10	.3210	8043210	85.25	.3450	8043450	97.90	.3690	8043690	101.35
.2735	8042735	65.70	.2975	8042975	80.10	.3215	8043215	85.25	.3455	8043455	97.90	.3695	8043695	101.15
.2740	8042740	65.70	.2980	8042980	80.10	.3220	8043220	85.25	.3460	8043460	97.90	.3700	8043700	101.15
.2745	8042745	65.70	.2985	8042985	80.10	.3225	8043225	85.25	.3465	804088	97.90	.3705	8043705	101.15
.2750	8042750	65.70	.2990	8042990	80.10	.3230	8043230	81.05	.3470	8043470	97.90	.3710	8043710	101.15
.2755	8042755	65.70	.2995	8042995	80.10	.3235	8043235	85.25	.3475	8043475	97.90	.3715	8043715	101.15
.2760	8042760	65.70	.3000	8043000	80.10	.3240	8043240	97.70	.3480	8043480	93.20	.3720	8043720	101.15
.2765	8042765	65.70	.3005	8043005	80.10	.3245	8043245	97.70	.3485	8043485	97.90	.3725	8043725	101.15
.2770	8042770	62.35	.3010	8043010	80.10	.3250	8043250	97.70	.3490	8043490	97.90	.3730	8043730	101.15
.2775	8042775	65.70	.3015	8043015	80.10	.3255	8043255	97.70	.3495	8043495	97.90	.3735	8043735	101.15
.2780	8042780	71.10	.3020	8043020	76.25	.3260	8043260	97.70	.3500	8043500	97.90	.3740	804095	95.80
.2785	8042785	71.10	.3025	8043025	80.10	.3265	8043265	97.70	.3505	8043505	97.90	.3745	8043745	101.15
.2790	8042790	71.10	.3030	8043030	80.10	.3270	8043270	97.70	.3510	8043510	97.90	.3750	80424	87.70
.2795	804071	71.00	.3035	8043035	80.10	.3275	8043275	97.70	.3515	8043515	97.90	.3755	8043755	119.90
.2800	8042800	71.10	.3040	8043040	80.10	.3280	8043280	97.70	.3520	8043520	97.90	.3760	8043760	120.00
.2805	8042805	71.10	.3045	8043045	80.10	.3285	8043285	97.70	.3525	8043525	97.90	.3765	8043765	119.90
.2810	8042810	67.60	.3050	8043050	80.10	.3290	8043290	97.70	.3530	8043530	97.90	.3770	8043770	113.80
.2815	8042815	71.10	.3055	8043055	80.10	.3295	8043295	97.70	.3535	8043535	97.90	.3775	8043775	119.90
.2820	8042820	77.00	.3060	8043060	80.10	.3300	8043300	97.70	.3540	8043540	97.90	.3780	804096	119.60
.2825	8042825	77.00	.3065	8043065	80.10	.3305	8043305	97.70	.3545	8043545	97.90	.3785	8043785	119.90
.2830	8042830	77.00	.3070	8043070	80.10	.3310	8043310	94.30	.3550	8043550	98.35	.3790	8043790	119.90
.2835	804072	76.75	.3075	8043075	80.10	.3315	8043315	97.70	.3555	8043555	98.35	.3795	8043795	119.90
.2840	8042840	77.00	.3080	8043080	80.10	.3320	8043320	92.75	.3560	8043560	98.35	.3800	8043800	119.90
.2845	8042845	77.00	.3085	8043085	80.10	.3325	8043325	97.70	.3565	8043565	98.35	.3805	8043805	119.90
.2850	8042850	77.00	.3090	8043090	80.10	.3330	8043330	97.70	.3570	8043570	98.35	.3810	8043810	119.90
.2855	8042855	77.00	.3095	8043095	80.10	.3335	8043335	97.70	.3575	8043575	98.35	.3815	8043815	119.90
.2860	8042860	77.00	.3100	8043100	80.10	.3340	8043340	97.70	.3580	8043580	93.60	.3820	8043820	119.90
.2865	8042865	77.00	.3105	8043105	80.10	.3345	8043345	97.70	.3585	8043585	98.35	.3825	8043825	119.90
.2870	8042870	77.00	.3110	804079	80.10	.3350	8043350	97.70	.3590	8043590	99.10	.3830	8043830	119.90
.2875	8042875	77.00	.3115	8043115	80.10	.3355	8043355	97.70	.3595	8043595	100.15	.3835	8043835	119.90
.2880	8042880	77.00	.3120	8043120	80.10	.3360	8043360	97.70	.3600	8043600	100.15	.3840	8043840	119.90
.2885	8042885	77.00	.3125	80420	69.70	.3365	8043365	97.70	.3605	8043605	100.15	.3845	8043845	119.90
.2890	8042890	77.00	.3130	8043130	80.10	.3370	8043370	97.70	.3610	8043610	100.15	.3850	8043850	119.90
.2895	8042895	77.00	.3135	8043135	80.10	.3375	8043375	97.70	.3615	8043615	100.15	.3855	8043855	119.90
.2900	8042900	73.20	.3140	8043140	80.10	.3380	8043380	97.70	.3620	8043620	100.15	.3860	8043860	114.10
.2905	8042905	77.00	.3145	8043145	80.10	.3385	8043385	97.70	.3625	8043625	100.15	.3865	8043865	126.00
.2910	8042910	77.00	.3150	804080	69.70	.3390	8043390	92.75	.3630	8043630	100.15	.3870	8043870	126.00
.2915	8042915	77.00	.3155	8043155	80.10	.3395	8043395	97.70	.3635	8043635	100.15	.3875	8043875	126.00



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	\$126.00	.4135	8044135	\$129.40	.4390	8044390	\$141.70	.4645	8044645	\$141.70	.4900	8044900	\$154.15
.3885	8043885	126.00	.4140	8044140	129.40	.4395	8044395	141.70	.4650	8044650	141.70	.4905	8044905	154.15
.3890	8043890	126.00	.4145	8044145	129.40	.4400	8044400	141.70	.4655	8044655	141.70	.4910	8044910	154.15
.3895	8043895	126.00	.4150	8044150	129.40	.4405	8044405	141.70	.4660	8044660	141.70	.4915	8044915	154.15
.3900	8043900	126.00	.4155	8044155	129.40	.4410	8044410	141.70	.4665	8044665	141.70	.4920	8044920	154.15
.3905	8043905	126.00	.4160	8044160	129.40	.4415	8044415	141.70	.4670	8044670	141.70	.4925	8044925	154.15
.3910	8043910	126.00	.4165	8044165	129.40	.4420	8044420	141.70	.4675	8044675	141.70	.4930	8044930	154.15
.3915	8043915	126.00	.4170	8044170	129.40	.4425	8044425	141.70	.4680	8044680	141.70	.4935	8044935	154.15
.3920	8043920	126.00	.4175	8044175	129.40	.4430	8044430	141.70	.4685	804119	141.70	.4940	8044940	154.15
.3925	8043925	126.00	.4180	8044180	129.40	.4435	8044435	141.70	.4690	8044690	141.70	.4945	8044945	154.15
.3930	8043930	126.00	.4185	8044185	129.40	.4440	8044440	141.70	.4695	8044695	141.70	.4950	8044950	154.15
.3935	8043935	126.00	.4190	8044190	129.40	.4445	8044445	141.70	.4700	8044700	141.70	.4955	8044955	154.15
.3940	8043940	126.00	.4195	8044195	129.40	.4450	8044450	141.70	.4705	8044705	141.70	.4960	8044960	154.15
.3945	8043945	126.00	.4200	8044200	129.40	.4455	8044455	141.70	.4710	8044710	141.70	.4965	8044965	154.15
.3950	8043950	126.00	.4205	8044205	129.40	.4460	8044460	141.70	.4715	8044715	141.70	.4970	8044970	154.15
.3955	8043955	126.00	.4210	8044210	129.40	.4465	8044465	141.70	.4720	8044720	141.70	.4975	8044975	154.15
.3960	8043960	126.00	.4215	8044215	129.40	.4470	8044470	141.70	.4725	8044725	154.15	.4980	8044980	154.15
.3965	8043965	126.00	.4220	8044220	129.40	.4475	8044475	141.70	.4730	8044730	154.15	.4985	8044985	154.15
.3970	8043970	120.00	.4225	8044225	129.40	.4480	8044480	141.70	.4735	8044735	154.15	.4990	8044990	154.15
.3975	8043975	126.00	.4230	8044230	129.40	.4485	8044485	141.70	.4740	8044740	154.15	.4995	8044995	145.80
.3980	8043980	126.00	.4235	8044235	129.40	.4490	8044490	141.70	.4745	8044745	154.15	.5000	80432	145.80
.3985	8043985	126.00	.4240	8044240	129.40	.4495	8044495	141.70	.4750	8044750	154.15	.5005	8045005	183.00
.3990	8043990	126.00	.4245	8044245	129.40	.4500	8044500	141.70	.4755	8044755	154.15	.5010	8045010	183.00
.3995	8043995	126.00	.4250	8044250	129.40	.4505	8044505	141.70	.4760	8044760	154.15	.5015	8045015	183.00
.4000	8044000	126.00	.4255	8044255	129.40	.4510	8044510	141.70	.4765	8044765	154.15	.5020	8045020	183.00
.4005	8044005	126.00	.4260	8044260	129.40	.4515	8044515	141.70	.4770	8044770	154.15	.5025	8045025	183.00
.4010	8044010	126.00	.4265	8044265	129.40	.4520	8044520	141.70	.4775	8044775	154.15	.5030	8045030	183.00
.4015	8044015	126.00	.4270	8044270	129.40	.4525	8044525	141.70	.4780	8044780	154.15	.5035	8045035	183.00
.4020	8044020	126.00	.4275	8044275	129.40	.4530	8044530	141.70	.4785	8044785	154.15	.5040	8045040	183.00
.4025	8044025	126.00	.4280	8044280	129.40	.4535	8044535	141.70	.4790	8044790	154.15	.5045	8045045	183.00
.4030	8044030	126.00	.4285	8044285	129.40	.4540	8044540	141.70	.4795	8044795	154.15	.5050	8045050	183.00
.4035	8044035	126.00	.4290	8044290	129.40	.4545	8044545	141.70	.4800	8044800	154.15	.5055	8045055	183.00
.4040	8044040	120.00	.4295	8044295	129.40	.4550	8044550	141.70	.4805	8044805	154.15	.5060	8045060	183.00
.4045	8044045	126.00	.4300	8044300	129.40	.4555	8044555	141.70	.4810	8044810	154.15	.5065	8045065	183.00
.4050	8044050	126.00	.4305	8044305	129.40	.4560	8044560	141.70	.4815	8044815	154.15	.5070	8045070	183.00
.4055	804103	126.00	.4310	8044310	129.40	.4565	8044565	141.70	.4820	8044820	154.15	.5075	8045075	183.00
.4060	8044060	126.00	.4315	8044315	129.40	.4570	8044570	141.70	.4825	8044825	154.15	.5080	8045080	183.00
.4065	8044065	126.00	.4320	8044320	129.40	.4575	8044575	141.70	.4830	8044830	154.15	.5085	8045085	183.00
.4070	8044070	126.00	.4325	8044325	129.40	.4580	8044580	141.70	.4835	8044835	154.15	.5090	8045090	183.00
.4075	8044075	126.00	.4330	8044330	129.40	.4585	8044585	141.70	.4840	8044840	154.15	.5095	8045095	183.00
.4080	8044080	126.00	.4335	8044335	129.40	.4590	8044590	141.70	.4845	8044845	154.15	.5100	8045100	183.00
.4085	8044085	126.00	.4340	8044340	129.40	.4595	8044595	141.70	.4850	8044850	154.15	.5105	8045105	183.00
.4090	8044090	126.00	.4345	8044345	129.40	.4600	8044600	141.70	.4855	8044855	154.15	.5110	8045110	183.00
.4095	8044095	126.00	.4350	8044350	129.40	.4605	8044605	141.70	.4860	8044860	154.15	.5115	8045115	183.00
.4100	8044100	126.00	.4355	8044355	129.40	.4610	8044610	141.70	.4865	8044865	154.15	.5120	8045120	183.00
.4105	8044105	126.00	.4360	8044360	129.40	.4615	8044615	141.70	.4870	8044870	154.15	.5125	8045125	183.00
.4110	8044110	126.00	.4365	8044365	129.40	.4620	8044620	141.70	.4875	8044875	154.15	.5130	8045130	183.00
.4115	8044115	126.00	.4370	804111	129.40	.4625	8044625	141.70	.4880	8044880	154.15	.5135	8045135	183.00
.4120	8044120	126.00	.4375	80428	123.15	.4630	8044630	141.70	.4885	8044885	154.15	.5140	8045140	183.00
.4125	8044125	126.00	.4380	8044380	141.70	.4635	8044635	141.70	.4890	8044890	154.15	.5145	8045145	183.00
.4130	8044130	120.00	.4385	8044385	141.70	.4640	8044640	141.70	.4895	8044895	154.15	.5150	8045150	183.00

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	\$87.60	\$64.75	\$56.85	\$53.35	\$49.30	\$46.35
* 3/32	.0938	-	80006	\$41.85	.0880	4	3/4	3	0.0891 - 0.0970	87.60	64.75	56.85	53.35	49.30	46.35
* 7/64	.1094	-	80007	41.85	.0943	4	7/8	3 1/2	0.0971 - 0.1120	87.60	64.75	56.85	53.35	49.30	46.35
* 1/8	.1250	80108	80008	41.85	.1099	4	7/8	3 1/2	0.1121 - 0.1280	87.60	64.75	56.85	53.35	49.30	46.35
* 9/64	.1406	80109	80009	47.85	.1255	4	7/8	3 1/2	0.1281 - 0.1435	93.60	70.65	62.90	59.30	55.40	52.25
* 5/32	.1562	80110	80010	49.20	.1411	4	1	4	0.1436 - 0.1590	94.90	72.05	64.25	60.70	56.70	53.80
* 11/64	.1719	80111	80011	55.45	.1567	4	1	4	0.1591 - 0.1750	101.10	78.35	70.65	66.95	63.05	60.00
* 3/16	.1875	80112	80012	56.65	.1724	4	1 1/8	4 1/2	0.1751 - 0.1910	102.40	79.50	71.70	68.15	64.20	61.25
13/64	.2031	80113	80013	60.35	.1880	6	1 1/4	5	-	-	-	-	-	-	-
7/32	.2188	80114	80014	60.35	.1880	6	1 1/4	5	0.1911 - 0.2210	106.10	83.25	75.60	71.85	67.95	64.95
15/64	.2344	80115	80015	64.20	.2193	6	1 1/2	6	-	-	-	-	-	-	-
1/4	.2500	80116	80016	64.20	.2193	6	1 1/2	6	0.2211 - 0.2530	109.95	87.00	79.40	75.80	71.70	68.75
17/64	.2656	80117	80017	69.05	.2505	6	1 1/2	6	-	-	-	-	-	-	-
9/32	.2812	80118	80018	69.05	.2505	6	1 1/2	6	0.2531 - 0.2840	114.70	91.90	84.20	80.60	76.70	73.60
19/64	.2969	80119	80019	71.85	.2817	6	1 5/8	6	-	-	-	-	-	-	-
5/16	.3125	80120	80020	71.85	.2817	6	1 5/8	6	0.2841 - 0.3150	117.55	94.70	87.00	83.40	79.50	76.35
21/64	.3281	80121	80021	76.95	.3130	6	1 5/8	6	-	-	-	-	-	-	-
11/32	.3438	80122	80022	76.95	.3130	6	1 5/8	6	0.3151 - 0.3470	122.60	99.70	91.95	88.30	84.45	81.45
23/64	.3594	80123	80023	82.75	.3443	6	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	80124	80024	82.75	.3443	6	1 3/4	7	0.3471 - 0.3780	128.35	105.45	97.80	94.25	90.30	87.25
25/64	.3906	80125	80025	94.50	.3755	6	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	80126	80026	94.50	.3755	6	1 3/4	7	0.3781 - 0.4090	140.20	117.30	109.75	106.05	102.10	99.00
27/64	.4219	80127	80027	100.45	.4067	6	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	80128	80028	100.45	.4067	6	1 3/4	7	0.4091 - 0.4410	146.05	123.10	115.55	111.95	107.95	104.80
29/64	.4531	80129	80029	106.45	.4380	6	1 3/4	8	-	-	-	-	-	-	-
15/32	.4688	80130	80030	106.45	.4380	6	1 3/4	8	0.4411 - 0.4720	152.15	129.20	121.60	118.00	114.10	110.90
31/64	.4844	80131	80031	114.25	.4693	6	1 3/4	8	-	-	-	-	-	-	-
1/2	.5000	80132	80032	114.25	.4693	6	1 3/4	8	0.4721 - 0.5030	160.05	137.10	129.35	125.75	121.80	118.80
33/64	.5156	80133	80033	147.40	.5005	6	1 7/8	9	-	-	-	-	-	-	-
17/32	.5312	80134	80034	147.40	.5005	6	1 7/8	9	0.5031 - 0.5340	193.05	170.15	162.60	158.90	154.95	151.85
35/64	.5469	80135	80035	174.00	.5005	6	1 7/8	9	-	-	-	-	-	-	-
9/16	.5625	80136	80036	170.85	.5005	6	1 7/8	9	0.5341 - 0.5660	215.70	193.10	185.60	182.10	178.20	175.25
37/64	.5781	80137	80037	193.85	.5630	6	1 7/8	9	-	-	-	-	-	-	-
19/32	.5938	80138	80038	193.85	.5630	6	1 7/8	9	0.5661 - 0.5970	238.75	216.25	208.70	205.10	201.30	198.25
39/64	.6094	80139	80039	196.05	.5630	6	1 7/8	9	-	-	-	-	-	-	-
5/8	.6250	80140	80040	196.05	.5630	6	1 7/8	9	0.5971 - 0.6280	240.85	218.30	211.00	207.35	203.55	200.40
21/32	.6562	80142	80042	283.60	.6255	6	2	9 1/2	0.6281 - 0.6590	326.25	304.90	297.75	294.35	291.10	287.75
11/16	.6875	80144	80044	283.60	.6255	6	2	9 1/2	0.6591 - 0.6910	326.25	304.90	297.75	294.35	291.10	287.75
23/32	.7188	80146	80046	319.15	.6880	6	2	9 1/2	0.6911 - 0.7220	361.80	340.35	333.30	329.85	326.65	323.30
3/4	.7500	80148	80048	319.15	.6880	6	2	9 1/2	0.7221 - 0.7530	361.80	340.35	333.30	329.85	326.65	323.30
25/32	.7812	80150	80050	354.30	.7505	8	2	10	0.7531 - 0.7840	396.90	375.50	368.40	365.00	361.70	358.35
13/16	.8125	80152	80052	386.55	.7817	8	2	10	0.7841 - 0.8160	429.20	407.75	400.70	397.30	394.05	390.70
27/32	.8438	80154	80054	407.65	.8130	8	2	10	0.8161 - 0.8470	450.30	428.90	421.80	418.40	415.10	411.80
7/8	.8750	80156	80056	399.10	.8440	8	2	10	0.8471 - 0.8780	441.75	420.35	413.25	409.85	406.55	403.20
29/32	.9062	80158	80058	467.00	.8755	8	2	10	0.8781 - 0.9090	509.65	488.20	481.15	477.75	474.45	471.15
15/16	.9375	80160	80060	490.90	.9067	8	2	10	0.9091 - 0.9410	533.50	512.15	505.00	501.60	498.35	495.00
31/32	.9688	80162	80062	514.20	.9380	8	2	10	0.9411 - 0.9720	556.85	535.45	528.35	524.95	521.65	518.30
1	1.0000	80164	80064	533.55	.9693	8	2	10	0.9721 - 1.0030	576.25	554.85	547.70	544.30	541.10	537.75

*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	\$42.70	.1099	4	7/8	3 1/2	0.1121-0.1280	\$81.05	\$61.90	\$55.35	\$52.35	\$49.00	\$46.50
* 9/64	.1406	81109	81009	82109	82009	48.75	.1255	4	7/8	3 1/2	0.1281-0.1435	87.10	67.90	61.45	58.45	55.20	52.60
* 5/32	.1562	81110	81010	82110	82010	50.40	.1411	4	1	4	0.1436-0.1590	88.65	69.40	62.95	59.95	56.60	54.05
* 11/64	.1719	81111	81011	82111	82011	62.30	.1567	4	1	4	0.1591-0.1750	104.60	83.45	76.30	73.00	69.40	66.65
* 3/16	.1875	81112	81012	82112	82012	63.65	.1724	4	1 1/8	4 1/2	0.1751-0.1910	105.75	84.75	77.60	74.30	70.70	67.80
13/64	.2031	81113	81013	82113	82013	67.80	.1880	6	1 1/4	5	-	-	-	-	-	-	-
7/32	.2188	81114	81014	82114	82014	73.60	.1880	6	1 1/4	5	0.1911-0.2210	119.30	96.40	88.80	85.20	81.10	78.10
15/64	.2344	81115	81015	82115	82015	78.40	.2193	6	1 1/2	6	-	-	-	-	-	-	-
1/4	.2500	81116	81016	82116	82016	78.40	.2193	6	1 1/2	6	0.2211-0.2530	124.10	101.10	93.60	89.80	85.85	82.80
17/64	.2656	81117	81017	82117	82017	84.20	.2505	6	1 1/2	6	-	-	-	-	-	-	-
9/32	.2812	81118	81018	82118	82018	84.20	.2505	6	1 1/2	6	0.2531-0.2840	129.90	107.10	99.30	95.70	91.75	88.80
19/64	.2969	81119	81019	82119	82019	87.80	.2817	6	1 5/8	6	-	-	-	-	-	-	-
5/16	.3125	81120	81020	82120	82020	87.80	.2817	6	1 5/8	6	0.2841-0.3150	133.40	110.55	102.90	99.20	95.25	92.20
21/64	.3281	81121	81021	82121	82021	93.70	.3130	6	1 5/8	6	-	-	-	-	-	-	-
11/32	.3438	81122	81022	82122	82022	93.70	.3130	6	1 5/8	6	0.3151-0.3470	139.35	116.60	108.80	105.15	101.20	98.25
23/64	.3594	81123	81023	82123	82023	100.95	.3443	6	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	81124	81024	82124	82024	100.95	.3443	6	1 3/4	7	0.3471-0.3780	146.45	123.55	116.00	112.45	108.45	105.25
25/64	.3906	81125	81025	82125	82025	115.35	.3755	6	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	81126	81026	82126	82026	115.35	.3755	6	1 3/4	7	0.3781-0.4090	160.95	138.00	130.40	126.70	122.90	119.70
27/64	.4219	81127	81027	82127	82027	122.35	.4067	6	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	81128	81028	82128	82028	122.35	.4067	6	1 3/4	7	0.4091-0.4410	168.00	145.05	137.50	133.85	129.90	126.80
29/64	.4531	81129	81029	82129	82029	129.85	.4380	6	1 3/4	8	-	-	-	-	-	-	-
15/32	.4688	81130	81030	82130	82030	129.85	.4380	6	1 3/4	8	0.4411-0.4720	175.45	152.60	144.95	141.30	137.45	134.30
31/64	.4844	81131	81031	82131	82031	139.25	.4693	6	1 3/4	8	-	-	-	-	-	-	-
1/2	.5000	81132	81032	82132	82032	139.25	.4693	6	1 3/4	8	0.4721-0.5030	184.95	162.10	154.45	150.75	146.95	143.80
33/64	.5156	81133	81033	82133	82033	165.55	.5005	6	1 7/8	9	-	-	-	-	-	-	-
17/32	.5312	81134	81034	82134	82034	162.50	.5005	6	1 7/8	9	0.5031-0.5340	203.95	183.15	176.20	172.90	169.40	166.70
35/64	.5469	81135	81035	82135	82035	191.95	.5005	6	1 7/8	9	-	-	-	-	-	-	-
9/16	.5625	81136	81036	82136	82036	191.95	.5005	6	1 7/8	9	0.5341-0.5660	233.40	212.60	205.65	202.35	198.75	195.95
37/64	.5781	81137	81037	82137	82037	217.80	.5630	6	1 7/8	9	-	-	-	-	-	-	-
19/32	.5938	81138	81038	82138	82038	217.80	.5630	6	1 7/8	9	0.5661-0.5970	259.10	238.45	231.55	228.20	224.65	221.90
39/64	.6094	81139	81039	82139	82039	220.30	.5630	6	1 7/8	9	-	-	-	-	-	-	-
5/8	.6250	81140	81040	82140	82040	220.30	.5630	6	1 7/8	9	0.5971-0.6280	261.75	241.05	234.00	230.75	227.20	224.35
21/32	.6562	81142	81042	82142	82042	319.00	.6255	6	2	9 1/2	0.6281-0.6590	367.00	342.90	334.90	331.00	327.40	323.60
11/16	.6875	81144	81044	82144	82044	319.00	.6255	6	2	9 1/2	0.6591-0.6910	367.00	342.90	334.90	331.00	327.40	323.60
23/32	.7188	81146	81046	82146	82046	358.90	.6880	6	2	9 1/2	0.6911-0.7220	406.95	382.70	374.75	371.00	367.25	363.45
3/4	.7500	81148	81048	82148	82048	358.90	.6880	6	2	9 1/2	0.7221-0.7530	406.95	382.70	374.75	371.00	367.25	363.45
25/32	.7812	81150	81050	82150	82050	398.40	.7505	8	2	10	0.7531-0.7840	446.35	422.30	414.25	410.40	406.65	403.00
13/16	.8125	81152	81052	82152	82052	434.65	.7817	8	2	10	0.7841-0.8160	482.65	458.55	450.60	446.70	443.00	439.25
27/32	.8438	81154	81054	82154	82054	458.35	.8130	8	2	10	0.8161-0.8470	506.35	482.35	474.30	470.50	466.80	463.00
7/8	.8750	81156	81056	82156	82056	448.80	.8440	8	2	10	0.8471-0.8780	496.80	472.75	464.70	460.85	457.20	453.45
29/32	.9062	81158	81058	82158	82058	525.20	.8755	8	2	10	0.8781-0.9090	573.15	549.15	541.05	537.20	533.50	529.80
15/16	.9375	81160	81060	82160	82060	552.00	.9067	8	2	10	0.9091-0.9410	599.95	575.90	567.90	564.05	560.35	556.65
31/32	.9688	81162	81062	82162	82062	578.20	.9380	8	2	10	0.9411-0.9720	626.15	602.10	594.15	590.25	586.60	582.90
1	1.0000	81164	81064	82164	82064	600.00	.9693	8	2	10	0.9721-1.0030	648.00	623.90	616.00	612.20	608.40	604.75

*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

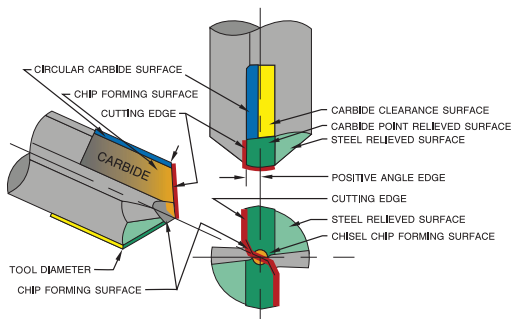


DRILL POINT SELECTION GUIDE TWIST DRILLS, DIE DRILLS & COOLANT FED DRILLS

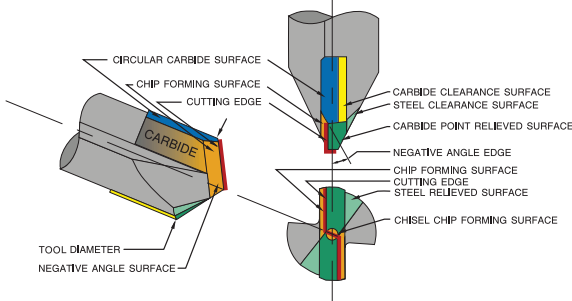
**FOR HIGHER PENETRATION RATES, LONGER TOOL LIFE
& MORE ACCURATE HOLES**

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.

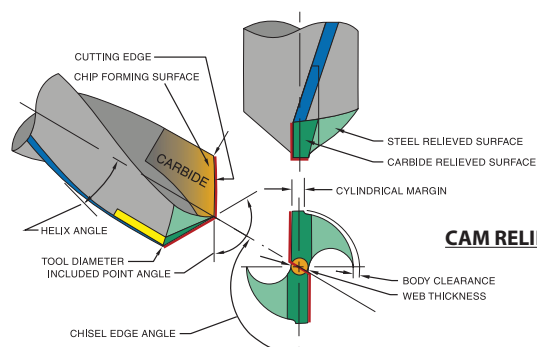
DRILLS



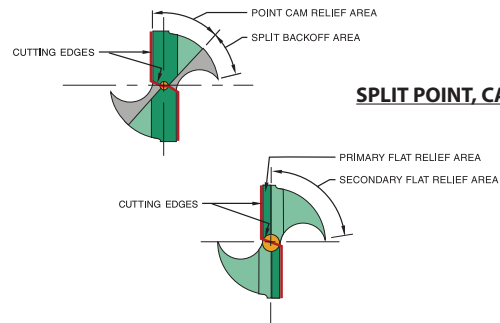
POSITIVE ANGLE CUTTING EDGE DIE DRILL (PG. 134)



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



DRILLS

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

DISCONTINUED - WHILE SUPPLIES LAST

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	\$299.25	0.3100-0.3160
1/32	.3438	8	10	65822	299.25	0.3281-0.3460
3/16	.3750	9	11	65824	316.30	0.3594-0.3770
1/2	.4062	9	11	65826	360.00	0.3906-0.4080
7/16	.4375	9	11	65828	360.00	0.4200-0.4390
15/32	.4688	9 3/4	12	65830	380.15	0.4531-0.4710
1/2	.5000	9 3/4	12	65832	380.15	0.4800-0.5030
1 1/2	.5312	9 3/4	12	65834	408.00	0.5118-0.5330
9/16	.5625	10 3/4	13	65836	439.45	0.5430-0.5650
5/8	.6250	10 3/4	13	65840	464.00	0.6070-0.6270
11/16	.6875	11 3/4	14	65844	483.20	0.6693-0.6900
23/32	.7188	11 3/4	14	65846	505.40	0.7031-0.7220
3/4	.7500	11 3/4	14	65848	511.50	0.7320-0.7530
13/16	.8125	12 3/4	15	65852	543.15	0.7953-0.8160
7/8	.8750	12 3/4	15	65856	585.25	0.8570-0.8780
15/16	.9375	13 3/4	16	65860	625.30	0.9180-0.9390
1	1.0000	13 3/4	16	65864	677.20	0.9820-1.0030

*Contact us for decimal diameter range prices

DISCONTINUED - WHILE SUPPLIES LAST

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	\$398.85	-
8.5	.3346	203	8	254	10	658085	398.85	8.280 - 8.788
9.0	.3543	229	9	279	11	658090	421.40	8.992 - 9.576
9.5	.3740	229	9	279	11	658095	421.40	-
10.0	.3937	229	9	279	11	658100	463.05	9.779 - 10.363
10.5	.4134	229	9	279	11	658105	463.05	10.414 - 11.151
11.0	.4331	229	9	279	11	658110	463.05	-
11.5	.4528	248	9 3/4	305	12	658115	489.20	11.153 - 12.000
12.0	.4724	248	9 3/4	305	12	658120	489.20	-
12.5	.4921	248	9 3/4	305	12	658125	489.20	12.002 - 12.776

**Contact us for metric 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)



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



125° FOUR FACET POINT

DISCONTINUED - WHILE SUPPLIES LAST



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	\$189.30	.2490-.2530
17/64	.2656	2 3/4	5 5/32	65217	189.30	-
9/32	.2812	2 3/4	5 5/32	65218	189.30	.2640-.2840
19/64	.2969	3 3/16	5 19/32	65219	189.30	-
5/16	.3125	3 3/16	5 19/32	65220	189.30	.2950-.3160
21/64	.3281	3 7/16	5 27/32	65221	189.30	-
11/32	.3438	3 7/16	5 27/32	65222	189.30	.3260-.3460
23/64	.3594	3 5/8	6 1/32	65223	191.40	-
3/8	.3750	3 5/8	6 1/32	65224	191.40	.3540-.3770
25/64	.3906	3 7/8	6 9/32	65225	196.15	-
13/32	.4062	3 7/8	6 9/32	65226	196.15	.3850-.4080
27/64	.4219	4 1/16	6 15/32	65227	202.75	-
7/16	.4375	4 1/16	6 15/32	65228	202.75	.4100-.4390
29/64	.4531	4 3/16	6 23/32	65229	215.90	-
15/32	.4688	4 3/16	6 23/32	65230	215.90	.4391-.4724
31/64	.4844	4 1/2	6 29/32	65231	222.20	-
1/2	.5000	4 1/2	6 29/32	65232	222.20	.4725-.5030
33/64	.5156	4 13/16	7 7/32	65233	231.55	-
17/32	.5312	4 13/16	7 7/32	65234	235.45	.5031-.5330
35/64	.5469	4 13/16	7 7/32	65235	244.25	-
9/16	.5625	4 13/16	7 7/32	65236	248.50	.5331-.5650
37/64	.5781	5 3/16	7 19/32	65237	292.80	-
19/32	.5938	5 3/16	7 19/32	65238	297.65	.5651-.5950
39/64	.6094	5 3/16	7 19/32	65239	292.80	-
5/8	.6250	5 3/16	7 19/32	65240	297.65	.5951-.6270
41/64	.6406	5 3/16	7 19/32	65241	313.85	-
21/32	.6562	5 3/16	7 19/32	65242	313.85	.6271-.6570
43/64	.6719	5 5/8	8 1/32	65243	339.55	-
11/16	.6875	5 5/8	8 1/32	65244	340.00	.6571-.6900
45/64	.7031	5 5/8	8 1/32	65245	349.65	-
23/32	.7188	5 5/8	8 1/32	65246	349.65	.6901-.7220
47/64	.7344	6 1/16	8 15/32	65247	353.15	-
3/4	.7500	6 1/16	8 15/32	65248	353.15	.7221-.7530
49/64	.7656	6 1/16	8 9/16	65249	369.70	-
25/32	.7812	6 1/16	8 9/16	65250	376.05	.7531-.7840
13/16	.8125	6 1/16	8 9/16	65252	382.30	.7841-.8160
27/32	.8438	6 1/2	9	65254	405.40	.8161-.8470
7/8	.8750	6 1/2	9	65256	415.15	.8471-.8780
29/32	.9062	6 15/16	9 7/16	65258	444.25	.8781-.9090
15/16	.9375	6 15/16	9 7/16	65260	477.25	.9091-.9390
31/32	.9688	6 15/16	9 7/16	65262	496.80	.9391-.9700
1	1.0000	7 3/8	9 7/8	65264	509.85	.9701-1.0030

TOOL DIAMETER		LENGTH				TYPE 652 METRIC EDP NO.	METRIC PRICE	METRIC DIAMETER RANGE*
mm	INCH	FLUTE		OVERALL				
mm	INCH	mm	INCH	mm	INCH			
**6.5	.2559	64	2 1/2	125	4 29/32	652065	\$244.60	-
7.0	.2756	70	2 3/4	131	5 5/32	652070	244.60	6.706 - 7.214
7.5	.2953	81	3 3/16	142	5 19/32	652075	244.60	7.493 - 8.026
8.0	.3150	81	3 3/16	142	5 19/32	652080	244.60	-
8.5	.3346	87	3 7/16	148	5 27/32	652085	236.20	8.280 - 8.788
9.0	.3543	92	3 5/8	153	6 1/32	652090	236.20	8.992 - 9.576
9.5	.3740	92	3 5/8	153	6 1/32	652095	236.20	-
10.0	.3937	98	3 7/8	159	6 9/32	652100	236.20	9.779 - 10.363
10.5	.4134	103	4 1/16	164	6 15/32	652105	244.60	10.414 - 11.151
11.0	.4331	103	4 1/16	164	6 15/32	652110	244.60	-
11.5	.4528	109	4 3/16	171	6 23/32	652115	264.40	11.153 - 12.000
12.0	.4724	109	4 3/16	171	6 23/32	652120	264.40	-
12.5	.4921	114	4 1/2	175	6 29/32	652125	270.00	12.002 - 12.776
13.0	.5118	122	4 13/16	183	7 7/32	652130	286.80	12.779 - 13.538
13.5	.5315	122	4 13/16	183	7 7/32	652135	286.80	-
14.0	.5512	122	4 13/16	183	7 7/32	652140	300.90	13.541 - 14.351
14.5	.5709	131	5 3/16	193	7 19/32	652145	365.55	14.354 - 15.113
15.0	.5906	131	5 3/16	193	7 19/32	652150	365.55	-
15.5	.6102	131	5 3/16	193	7 19/32	652155	365.55	15.116 - 15.926
16.0	.6299	131	5 3/16	193	7 19/32	652160	373.90	15.928 - 16.688
16.5	.6496	131	5 3/16	193	7 19/32	652165	373.90	-
17.0	.6693	143	5 5/8	204	8 1/32	652170	399.20	16.690 - 17.526
17.5	.6890	143	5 5/8	204	8 1/32	652175	399.20	-
18.0	.7087	143	5 5/8	204	8 1/32	652180	419.05	17.529 - 18.339
18.5	.7283	154	6 1/16	215	8 15/32	652185	421.75	18.341 - 19.126
19.0	.7480	154	6 1/16	215	8 15/32	652190	421.75	-
19.5	.7677	154	6 1/16	217	8 9/16	652195	447.15	19.129 - 19.914
20.0	.7874	154	6 1/16	217	8 9/16	652200	452.85	19.916 - 20.726
20.5	.8071	154	6 1/16	217	8 9/16	652205	452.85	-
21.0	.8268	165	6 1/2	229	9	652210	478.00	20.729 - 21.514
21.5	.8465	165	6 1/2	229	9	652215	478.00	-
22.0	.8661	165	6 1/2	229	9	652220	489.30	21.516 - 22.301
22.5	.8858	176	6 15/16	240	9 7/16	652225	539.90	22.304 - 23.089
23.0	.9055	176	6 15/16	240	9 7/16	652230	539.90	-
23.5	.9252	176	6 15/16	240	9 7/16	652235	559.60	23.091 - 23.851
24.0	.9449	176	6 15/16	240	9 7/16	652240	582.00	23.853 - 24.638
24.5	.9646	176	6 15/16	240	9 7/16	652245	577.15	-
25.0	.9843	187	7 3/8	251	9 7/8	652250	582.00	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

DISCONTINUED - WHILE SUPPLIES LAST



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	\$207.35	0.2490 - 0.2530
17/64	.2656	4 3/4	6 1/4	65017	207.35	-
9/32	.2812	4 3/4	6 1/4	65018	207.35	0.2640 - 0.2840
19/64	.2969	4 7/8	6 3/8	65019	207.35	-
5/16	.3125	4 7/8	6 3/8	65020	207.35	0.2950 - 0.3160
21/64	.3281	5	6 1/2	65021	199.60	-
11/32	.3438	5	6 1/2	65022	199.60	0.3260 - 0.3460
23/64	.3594	5 1/4	6 3/4	65023	194.45	-
3/8	.3750	5 1/4	6 3/4	65024	201.95	0.3540 - 0.3770
25/64	.3906	5 1/2	7	65025	199.60	-
13/32	.4062	5 1/2	7	65026	199.60	0.3850 - 0.4080
27/64	.4219	5 3/4	7 1/4	65027	206.05	-
7/16	.4375	5 3/4	7 1/4	65028	206.05	0.4100 - 0.4390
29/64	.4531	5 3/4	7 1/2	65029	219.00	-
15/32	.4688	5 3/4	7 1/2	65030	219.00	0.4391 - 0.4724
31/64	.4844	5 3/4	7 3/4	65031	225.55	-
1/2	.5000	5 3/4	7 3/4	65032	225.55	0.4725 - 0.5030
33/64	.5156	6	8	65033	242.05	-
17/32	.5312	6	8	65034	242.05	0.5031 - 0.5330
35/64	.5469	6 1/4	8 1/4	65035	250.70	-
9/16	.5625	6 1/4	8 1/4	65036	254.95	0.5331 - 0.5650
37/64	.5781	6 3/4	8 3/4	65037	301.85	-
19/32	.5938	6 3/4	8 3/4	65038	306.95	0.5651 - 0.5950
39/64	.6094	6 3/4	8 3/4	65039	301.85	-
5/8	.6250	6 3/4	8 3/4	65040	306.95	0.5951 - 0.6270
41/64	.6406	7	9	65041	318.10	-
21/32	.6562	7	9	65042	323.60	0.6271 - 0.6570
43/64	.6719	7 1/4	9 1/4	65043	340.50	-
11/16	.6875	7 1/4	9 1/4	65044	346.55	0.6571 - 0.6900
45/64	.7031	7 1/2	9 1/2	65045	353.55	-
23/32	.7188	7 1/2	9 1/2	65046	359.55	0.6901 - 0.7220
47/64	.7344	7 3/4	9 3/4	65047	356.50	-
3/4	.7500	7 3/4	9 3/4	65048	362.75	0.7221 - 0.7530
49/64	.7656	7 7/8	9 7/8	65049	385.65	-
25/32	.7812	7 7/8	9 7/8	65050	385.65	0.7531 - 0.7840
13/16	.8125	8	10	65052	392.15	0.7841 - 0.8160
27/32	.8438	8	10	65054	415.15	0.8161 - 0.8470
7/8	.8750	8	10	65056	425.00	0.8471 - 0.8780
29/32	.9062	8	10	65058	470.75	0.8781 - 0.9090
15/16	.9375	8 3/4	10 3/4	65060	490.25	0.9091 - 0.9390
31/32	.9688	9	11	65062	495.00	0.9391 - 0.9700
1	1.0000	9	11	65064	495.00	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	\$216.10	-
7.0	.2756	121	4 3/4	159	6 1/4	650070	216.10	6.706 - 7.214
7.5	.2953	124	4 7/8	162	6 3/8	650075	216.10	7.493 - 8.026
8.0	.3150	124	4 7/8	162	6 3/8	650080	216.10	-
8.5	.3346	127	5	165	6 1/2	650085	208.70	8.280 - 8.788
9.0	.3543	133	5 1/4	171	6 3/4	650090	208.70	8.992 - 9.576
9.5	.3740	133	5 1/4	171	6 3/4	650095	208.70	-
10.0	.3937	140	5 1/2	178	7	650100	208.70	9.779 - 10.363
10.5	.4134	146	5 3/4	184	7 1/4	650105	216.10	10.414 - 11.151
11.0	.4331	146	5 3/4	184	7 1/4	650110	216.10	-
11.5	.4528	146	5 3/4	191	7 1/2	650115	233.55	11.153 - 12.000
12.0	.4724	146	5 3/4	191	7 1/2	650120	233.55	-
12.5	.4921	146	5 3/4	197	7 3/4	650125	238.50	12.002 - 12.776
13.0	.5118	152	6	203	8	650130	253.35	12.779 - 13.538
13.5	.5315	152	6	203	8	650135	253.35	-
14.0	.5512	159	6 1/4	210	8 1/4	650140	265.80	13.541 - 14.351
14.5	.5709	171	6 3/4	222	8 3/4	650145	322.80	14.354 - 15.113
15.0	.5906	171	6 3/4	222	8 3/4	650150	322.80	-
15.5	.6102	171	6 3/4	222	8 3/4	650155	322.80	15.116 - 15.926
16.0	.6299	178	7	229	9	650160	330.35	15.928 - 16.688
16.5	.6496	178	7	229	9	650165	330.35	-
17.0	.6693	184	7 1/4	235	9 1/4	650170	352.60	16.690 - 17.526
17.5	.6890	184	7 1/4	235	9 1/4	650175	352.60	-
18.0	.7087	191	7 1/2	241	9 1/2	650180	370.10	17.529 - 18.339
18.5	.7283	197	7 3/4	248	9 3/4	650185	372.55	18.341 - 19.126
19.0	.7480	197	7 3/4	248	9 3/4	650190	372.55	-
19.5	.7677	200	7 7/8	251	9 7/8	650195	395.00	19.129 - 19.914
20.0	.7874	203	8	254	10	650200	400.05	19.916 - 20.726
20.5	.8071	203	8	254	10	650205	400.05	-
21.0	.8268	203	8	254	10	650210	422.30	20.729 - 21.514
21.5	.8465	203	8	254	10	650215	422.30	-
22.0	.8661	203	8	254	10	650220	432.20	21.516 - 22.301
22.5	.8858	203	8	254	10	650225	476.95	22.304 - 23.089
23.0	.9055	203	8	254	10	650230	476.95	-
23.5	.9252	222	8 3/4	273	10 3/4	650235	494.30	23.091 - 23.851
24.0	.9449	229	9	279	11	650240	514.20	23.853 - 24.638
24.5	.9646	229	9	279	11	650245	514.20	-
25.0	.9843	229	9	279	11	650250	514.20	24.641 - 25.476

**6.5mm tool diameter has 6.35mm shank diameter



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



DISCONTINUED - WHILE SUPPLIES LAST

TOOL DIAMETER		LENGTH		TYPE 656 - 125° PT.		TYPE 657 - 135° PT.	
FRAC.	DEC.	FLUTE	OVERALL	EDP NO.	PRICE	EDP NO.	PRICE
1/4	.2500	3 3/4	6 1/8	65616	\$208.00	65716	\$260.40
9/32	.2812	3 7/8	6 1/4	65618	208.00	65718	256.25
5/16	.3125	4	6 3/8	65620	N/A	65720	N/A
11/32	.3438	4 1/8	6 1/2	65622	208.00	65722	256.25
3/8	.3750	4 1/4	6 3/4	65624	208.00	65724	256.25
13/32	.4062	4 3/8	7	65626	208.00	65726	274.95
7/16	.4375	4 5/8	7 1/4	65628	208.00	65728	274.95
15/32	.4688	4 7/8	7 1/2	65630	N/A	65730	N/A
1/2	.5000	5	7 3/4	65632	N/A	65732	N/A
17/32	.5312	5 1/4	8	65634	N/A	65734	N/A
9/16	.5625	5 3/8	8 1/4	65636	N/A	65736	N/A
19/32	.5938	5 5/8	8 1/2	65638	307.05	65738	366.15
5/8	.6250	5 3/4	8 3/4	65640	307.05	65740	366.15
21/32	.6562	5 7/8	9	65642	326.60	65742	389.45
11/16	.6875	6	9 1/4	65644	349.90	65744	417.10
23/32	.7188	6 3/16	9 1/2	65646	364.55	65746	427.90
3/4	.7500	6 3/8	9 3/4	65648	366.45	65748	430.20

*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	\$26.25	64332	\$29.15
	31	.1200	7/8	1 7/8	64231	26.25	64331	29.15
		.1250	7/8	1 7/8	64008	19.70	64108	21.30
	30	.1285	15/16	1 15/16	64230	27.80	64330	30.65
3/64	29	.1360	15/16	1 15/16	64229	27.80	64329	30.65
	28	.1405	15/16	1 15/16	64228	27.80	64328	30.65
		.1406	15/16	1 15/16	64009	23.85	64109	28.10
	27	.1440	1	2 1/16	64227	27.80	64327	30.65
1/2	26	.1470	1	2 1/16	64226	27.80	64326	30.65
	25	.1495	1	2 1/16	64225	27.80	64325	30.65
	24	.1520	1	2 1/16	64224	27.80	64324	30.65
	23	.1540	1	2 1/16	64223	27.80	64323	30.65
5/32		.1562	1	2 1/16	64010	20.85	64110	22.70
	22	.1570	1 1/16	2 1/8	64222	27.80	64322	30.65
	21	.1590	1 1/16	2 1/8	64221	27.80	64321	30.65
	20	.1610	1 1/16	2 1/8	64220	32.30	64320	35.95
11/64	19	.1660	1 1/16	2 1/8	64219	32.30	64319	35.95
	18	.1695	1 1/16	2 1/8	64218	32.30	64318	35.95
		.1719	1 1/16	2 1/8	64011	28.40	64111	30.50
	17	.1730	1 1/8	2 3/16	64217	32.95	64317	36.55
3/8	16	.1770	1 1/8	2 3/16	64216	32.95	64316	36.55
	15	.1800	1 1/8	2 3/16	64215	32.95	64315	36.55
	14	.1820	1 1/8	2 3/16	64214	32.95	64314	36.55
	13	.1850	1 1/8	2 3/16	64213	32.95	64313	36.55
7/16		.1875	1 1/8	2 3/16	64012	21.90	64112	24.05
	12	.1890	1 3/16	2 1/4	64212	32.70	64312	36.30
	11	.1910	1 3/16	2 1/4	64211	32.70	64311	36.30
	10	.1935	1 3/16	2 1/4	64210	32.70	64310	36.30
13/64	9	.1960	1 3/16	2 1/4	64209	32.70	64309	36.30
	8	.1990	1 3/16	2 1/4	64208	32.70	64308	36.30
		.2010	1 3/16	2 1/4	64207	28.75	64307	34.45
	7	.2031	1 3/16	2 1/4	64013	28.40	64113	30.50
1/2	6	.2040	1 1/4	2 3/8	64206	32.95	64306	36.55
	5	.2055	1 1/4	2 3/8	64205	32.95	64305	36.55
	4	.2090	1 1/4	2 3/8	64204	32.95	64304	36.55
	3	.2130	1 1/4	2 3/8	64203	28.75	64303	34.45
7/32		.2188	1 1/4	2 3/8	64014	23.60	64114	26.15
	2	.2210	1 1/2	2 7/8	64202	32.70	64302	36.30
	1	.2280	1 1/2	2 7/8	64201	28.75	64301	36.30
	A	.2340	1 1/2	2 7/8	64401	32.70	64501	36.30
15/64		.2344	1 1/2	2 7/8	64015	26.15	64115	31.20
	B	.2380	1 5/8	2 1/2	64402	32.70	64502	36.30
	C	.2420	1 3/8	2 1/2	64403	32.70	64503	36.30
	D	.2460	1 3/8	2 1/2	64404	28.75	64504	34.45
1/4	E	.2500	1 3/8	2 1/2	64016	24.00	64116	27.65
	F	.2570	1 7/16	2 5/8	64406	33.45	64506	40.20
	G	.2610	1 7/16	2 5/8	64407	33.45	64507	40.20
17/64		.2656	1 7/16	2 5/8	64017	29.15	64117	34.60
	H	.2660	1 1/2	2 11/16	64408	32.35	64508	42.00
	I	.2720	1 1/2	2 11/16	64409	33.45	64509	42.00
	J	.2770	1 1/2	2 11/16	64410	37.80	64510	42.00
	K	.2810	1 1/2	2 11/16	64411	37.80	64511	42.00

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	\$27.60	64118	\$32.15
		.2900	1 1/2	2 3/4	64412	39.00	64512	43.20
	M	.2950	1 1/2	2 3/4	64413	39.00	64513	43.20
		.2969	1 1/2	2 3/4	64019	33.45	64119	39.60
5/16	N	.3020	1 5/8	2 13/16	64414	44.70	64514	49.80
		.3125	1 5/8	2 13/16	64020	29.40	64120	34.25
	O	.3160	1 11/16	2 15/16	64415	41.15	64515	49.65
		.3230	1 11/16	2 15/16	64416	46.75	64516	51.95
21/64	Q	.3281	1 11/16	2 15/16	64021	36.30	64121	42.10
		.3320	1 11/16	3	64417	41.15	64517	49.65
	R	.3390	1 11/16	3	64418	41.15	64518	49.65
		.3438	1 11/16	3	64022	34.30	64122	39.60
11/32	S	.3480	1 3/4	3 1/16	64419	47.25	64519	52.55
		.3580	1 3/4	3 1/16	64420	47.25	64520	52.55
	T	.3594	1 3/4	3 1/16	64023	37.35	64123	43.45
		.3680	1 13/16	3 1/8	64421	42.35	64521	50.85
3/8	U	.3750	1 13/16	3 1/8	64024	35.10	64124	40.60
		.3770	1 7/8	3 1/4	64422	54.50	64522	60.50
	V	.3860	1 7/8	3 1/4	64423	48.05	64523	57.80
		.3906	1 7/8	3 1/4	64025	41.60	64125	48.35
25/64	W	.3970	1 15/16	3 5/16	64424	48.05	64524	60.50
		.4040	1 15/16	3 5/16	64425	54.50	64525	60.50
	X	.4062	1 15/16	3 5/16	64026	41.60	64126	48.35
		.4130	2	3 3/8	64426	61.95	64526	68.90
13/32	Y	.4219	2	3 3/8	64027	46.10	64127	52.55
		.4375	2 1/16	3 7/16	64028	44.50	64128	49.35
	Z	.4531	2 1/8	3 9/16	64029	59.30	64129	76.20
		.4688	2 1/8	3 9/16	64030	63.30	64130	73.60
27/64		.4844	2 3/16	3 11/16	64031	56.75	64131	72.95
		.5000	2 1/4	3 3/4	64032	60.60	64132	70.40
		.5156	2 3/8	3 7/8	64033	90.40	64133	100.65
		.5312	2 3/8	3 7/8	64034	75.50	64134	85.20
7/16		.5469	2 1/2	4	64035	90.40	64135	100.65
		.5625	2 1/2	4	64036	75.50	64136	85.20
		.5781	2 5/8	4 1/8	64037	105.55	64137	117.40
		.5938	2 5/8	4 1/8	64038	86.55	64138	97.65
3/4		.6094	2 3/4	4 1/4	64039	105.55	64139	117.40
		.6250	2 3/4	4 1/4	64040	86.55	64140	97.65
		.6406	2 7/8	4 1/2	64041	126.05	64141	140.25
		.6562	2 7/8	4 1/2	64042	104.05	64142	117.50
15/32		.6719	2 7/8	4 5/8	64043	129.20	64143	143.65
		.6875	2 7/8	4 5/8	64044	106.90	64144	120.55
		.7031	3	4 3/4	64045	146.05	64145	162.25
		.7188	3	4 3/4	64046	121.05	64146	140.60
1/2		.7344	3 1/8	5	64047	146.25	64147	162.70
		.7500	3 1/8	5	64048	121.50	64148	136.80
		.7656	3 1/4	5 1/8	64049	156.45	64149	174.10
		.7812	3 1/4	5 1/8	64050	150.05	64150	174.20
23/64		.7969	3 3/8	5 1/4	64051	175.05	64151	194.80
		.8125	3 3/8	5 1/4	64052	150.25	64152	169.40
		.8281	3 1/2	5 3/8	64053	171.60	64153	190.75
		.8438	3 1/2	5 3/8	64054	164.40	64154	190.95

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.	
Frac.	Dec. Equiv.	Flute	Overall	EDP No.	Price	EDP No.	Price
5/64	.8594	3 1/2	5 1/2	64055	\$192.15	64155	\$213.75
7/8	.8750	3 1/2	5 1/2	64056	164.80	64156	185.70
5/64	.8906	3 3/8	5 5/8	64057	184.30	64157	204.90
29/32	.9062	3 3/8	5 5/8	64058	176.70	64158	205.00
59/64	.9219	3 3/4	5 3/4	64059	206.15	64159	229.45
15/16	.9375	3 3/4	5 3/4	64060	176.90	64160	199.50
61/64	.9531	3 7/8	5 7/8	64061	206.15	64161	229.45
31/32	.9688	3 7/8	5 7/8	64062	186.60	64162	216.70
63/64	.9844	4	6	64063	218.00	64163	242.55
1	1.0000	4	6	64064	186.90	64164	210.85
*1 1/32	1.0312	4	6 1/4	64066	273.15	64166	303.70
*1 1/16	1.0625	4	6 1/4	64068	234.05	64168	264.10
*1 3/32	1.0938	4	6 3/8	64070	303.05	64170	337.20
*1 1/8	1.1250	4	6 3/8	64072	259.90	64172	292.95
*1 5/32	1.1562	4 1/4	6 5/8	64074	369.90	64174	411.60
*1 3/16	1.1875	4 1/4	6 5/8	64076	317.25	64176	355.55
*1 7/32	1.2188	4 3/8	6 3/4	64078	369.90	64178	411.60
*1 1/4	1.2500	4 3/8	6 3/4	64080	317.25	64180	355.55

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

METRIC TOOL DIAMETERS

DISCONTINUED - WHILE SUPPLIES LAST

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
		mm	INCH	mm	INCH				
3.0	.1181	22	7/8	48	1 7/8	640030	\$26.15	641030	\$28.80
3.1	.1220	22	7/8	48	1 7/8	640031	26.15	641031	28.80
3.2	.1260	24	15/16	49	1 15/16	640032	26.15	641032	28.80
3.3	.1299	24	15/16	49	1 15/16	640033	26.15	641033	28.80
3.4	.1339	24	15/16	49	1 15/16	640034	26.15	641034	28.80
3.5	.1378	24	15/16	49	1 15/16	640035	22.35	641035	25.60
3.6	.1417	25	1	52	2 1/16	640036	26.15	641036	28.80
3.7	.1457	25	1	52	2 1/16	640037	26.15	641037	28.80
3.8	.1496	25	1	52	2 1/16	640038	26.15	641038	28.80
3.9	.1535	25	1	52	2 1/16	640039	26.15	641039	28.80
4.0	.1575	27	1 1/16	54	2 1/8	640040	22.35	641040	25.65
4.1	.1614	27	1 1/16	54	2 1/8	640041	31.15	641041	34.30
4.2	.1654	27	1 1/16	54	2 1/8	640042	31.15	641042	34.30
4.3	.1693	27	1 1/16	54	2 1/8	640043	31.15	641043	34.30
4.4	.1732	29	1 1/8	56	2 3/16	640044	31.15	641044	34.30
4.5	.1772	29	1 1/8	56	2 3/16	640045	26.60	641045	30.55
4.6	.1811	29	1 1/8	56	2 3/16	640046	31.15	641046	34.30
4.7	.1850	29	1 1/8	56	2 3/16	64213	32.95	64313	36.55
4.8	.1890	30	1 3/16	57	2 1/4	64212	32.70	64312	36.30
4.9	.1929	30	1 3/16	57	2 1/4	640049	31.15	641049	34.30
5.0	.1969	30	1 3/16	57	2 1/4	640050	26.60	641050	30.55
5.1	.2008	30	1 3/16	57	2 1/4	640051	31.15	641051	34.30
5.2	.2047	32	1 1/4	60	2 3/8	640052	31.15	641052	34.30
5.3	.2087	32	1 1/4	60	2 3/8	640053	31.15	641053	34.30
5.4	.2126	32	1 1/4	60	2 3/8	640054	31.15	641054	34.30
5.5	.2165	32	1 1/4	60	2 3/8	640055	26.60	641055	30.55
5.6	.2205	33	1 5/16	62	2 7/16	640056	31.15	641056	34.30
5.7	.2244	33	1 5/16	62	2 7/16	640057	31.15	641057	34.30
5.8	.2283	33	1 5/16	62	2 7/16	640058	31.15	641058	34.30
5.9	.2323	33	1 5/16	62	2 7/16	640059	31.15	641059	34.30
6.0	.2362	35	1 3/8	64	2 1/2	640060	24.90	641060	28.50
6.1	.2402	35	1 3/8	64	2 1/2	640061	32.15	641061	35.65
6.2	.2441	35	1 3/8	64	2 1/2	640062	32.15	641062	35.65
6.3	.2480	35	1 3/8	64	2 1/2	640063	32.15	641063	35.65
6.4	.2520	37	1 7/16	67	2 5/8	640064	32.15	641064	35.65
6.5	.2559	37	1 7/16	67	2 5/8	640065	27.60	641065	31.65

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
		mm	INCH	mm	INCH				
6.6	.2598	37	1 7/16	67	2 5/8	640066	\$32.15	641066	\$35.65
6.7	.2638	37	1 7/16	67	2 5/8	640067	32.15	641067	35.65
6.8	.2677	38	1 1/2	68	2 11/16	640068	32.15	641068	35.65
6.9	.2717	38	1 1/2	68	2 11/16	640069	32.15	641069	35.65
7.0	.2756	38	1 1/2	68	2 11/16	640070	27.60	641070	31.65
7.1	.2795	38	1 1/2	68	2 11/16	640071	32.15	641071	35.65
7.2	.2835	40	1 9/16	70	2 3/4	640072	36.95	641072	40.75
7.3	.2874	40	1 9/16	70	2 3/4	640073	36.95	641073	40.75
7.4	.2913	40	1 9/16	70	2 3/4	640074	36.95	641074	40.75
7.5	.2953	40	1 9/16	70	2 3/4	640075	31.70	641075	36.20
7.6	.2992	41	1 5/8	71	2 13/16	640076	36.95	641076	40.75
7.7	.3031	41	1 5/8	71	2 13/16	640077	36.95	641077	40.75
7.8	.3071	41	1 5/8	71	2 13/16	640078	36.95	641078	40.75
7.9	.3110	41	1 5/8	71	2 13/16	640079	36.95	641079	40.75
8.0	.3150	43	1 11/16	75	2 15/16	640080	31.70	641080	36.20
8.1	.3189	43	1 11/16	75	2 15/16	640081	39.75	641081	43.50
8.2	.3228	43	1 11/16	75	2 15/16	640082	39.75	641082	43.50
8.3	.3268	43	1 11/16	75	2 15/16	640083	39.75	641083	43.50
8.4	.3307	43	1 11/16	76	3	640084	39.75	641084	43.50
8.5	.3346	43	1 11/16	76	3	640085	34.05	641085	38.50
8.6	.3386	43	1 11/16	76	3	640086	39.75	641086	43.50
8.7	.3425	43	1 11/16	76	3	640087	40.40	641087	44.50
8.8	.3465	44	1 3/4	78	3 1/16	640088	40.40	641088	44.50
8.9	.3504	44	1 3/4	78	3 1/16	640089	40.40	641089	44.50
9.0	.3543	44	1 3/4	78	3 1/16	640090	34.65	641090	39.75
9.1	.3583	44	1 3/4	78	3 1/16	640091	40.40	641091	44.50
9.2	.3622	46	1 13/16	79	3 1/8	640092	40.40	641092	44.50
9.3	.3661	46	1 13/16	79	3 1/8	640093	40.40	641093	44.50
9.4	.3701	46	1 13/16	79	3 1/8	640094	40.40	641094	44.50
9.5	.3740	46	1 13/16	79	3 1/8	640095	34.65	641095	39.75
9.6	.3780	48	1 7/8	83	3 1/4	640096	44.95	641096	49.55
9.7	.3819	48	1 7/8	83	3 1/4	640097	44.95	641097	49.55
9.8	.3858	48	1 7/8	83	3 1/4	640098	44.95	641098	49.55
9.9	.3898	48	1 7/8	83	3 1/4	640099	44.95	641099	49.55
10.0	.3937	49	1 15/16	84	3 5/8	640100	38.55	641100	44.10
10.5	.4134	51	2	86	3 3/8	640105	43.10	641105	48.00
11.0	.4331	52	2 1/16	87	3 7/16	640110	43.10	641110	48.00
11.5	.4528	54	2 1/8	90	3 9/16	640115	60.65	641115	67.20
12.0	.4724	56	2 3/16	94	3 11/16	640120	58.00	641120	64.35
12.5	.4921	57	2 1/4	95	3 3/4	640125	58.00	641125	64.35
13.0	.5118	60	2 3/8	98	3 7/8	640130	71.65	641130	77.80
13.5	.5315	60	2 3/8	98	3 7/8	640135	70.30	641135	77.80
14.0	.5512	64	2 1/2	102	4	640140	70.30	641140	77.80
14.5	.5709	67	2 5/8	105	4 1/8	640145	99.05	641145	109.15
15.0	.5906	67	2 5/8	105	4 1/8	640150	99.05	641150	109.15
15.5	.6102	70	2 3/4	108	4 1/4	640155	111.65	641155	123.10
16.0	.6299	73	2 7/8	114	4 1/2	640160	125.80	641160	138.75
16.5	.6496	73	2 7/8	114	4 1/2	640165	125.80	641165	138.75
17.0	.6693	73	2 7/8	117	4 5/8	640170	125.80	641170	138.75
17.5	.6890	76	3	121	4 3/4	640175	138.80	641175	152.95
18.0	.7087	76	3	121	4 3/4	640180	138.80	641180	152.95
18.5	.7283	79	3 1/8	127	5	640185	151.65	641185	167.15
19.0	.7480	79	3 1/8	127	5	640190	151.65	641190	167.15
19.5	.7677	83	3 1/4	130	5 1/8	640195	167.70	641195	184.90
20.0	.7874	86	3 3/8	133	5 1/4	640200	187.55	641200	206.50
20.5	.8071	86	3 3/8	133	5 1/4	640205	187.55	641205	206.50
21.0	.8268	89	3 1/2	137	5 3/8	640210	205.85	641210	226.75
21.5	.8465	89	3 1/2	140	5 1/2	640215	205.85	641215	226.75
22.0	.8661	89	3 1/2	140	5 1/2	640220	205.85	641220	226.75
22.5	.8858	92	3 3/8	143	5 3/8	640225	211.85	641225	233.35
23.0	.9055	92	3 3/8	143	5 3/8	640230	211.85	641230	233.35
23.5	.9252	95							



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	\$23.35	-	-
	*39	.0995	1 ¼	2 ¼	60239	23.35	-	-
	*38	.1015	1 ¼	2 ¼	60238	23.35	-	-
	*37	.1040	1 ¼	2 ¼	60237	23.35	-	-
	*36	.1065	1 ¼	2 ¼	60236	23.35	-	-
*7/64		.1094	1 ¼	2 ¼	60007	23.35	-	-
	*35	.1100	1 ¼	2 ¼	60235	23.35	-	-
	*34	.1110	1 ¼	2 ¼	60234	23.35	-	-
1/8	*33	.1130	1 ¼	2 ¼	60233	23.35	-	-
	32	.1160	1 ½	2 ¾	60232	18.85	60332	\$22.10
	31	.1200	1 ½	2 ¾	60231	17.05	60331	19.85
		.1250	1 ½	2 ¾	60008	17.45	60108	20.35
9/64	30	.1285	1 ½	2 ¾	60230	17.80	60330	20.70
	29	.1360	1 ¾	2 ¾	60229	18.45	60329	21.30
	28	.1405	1 ¾	2 ¾	60228	18.60	60328	21.70
		.1406	1 ¾	2 ¾	60009	18.85	60109	22.00
1/4	27	.1440	1 ¾	3	60227	19.10	60327	22.15
	26	.1470	1 ¾	3	60226	17.70	60326	20.70
	25	.1495	1 ¾	3	60225	17.70	60325	20.70
	24	.1520	2	3 ½	60224	19.10	60324	22.15
5/32	23	.1540	2	3 ½	60223	18.60	60323	21.70
		.1562	2	3 ½	60010	18.50	60110	21.70
	22	.1570	2	3 ½	60222	20.45	60322	24.00
3/8	21	.1590	2 ½	3 ¼	60221	19.70	60321	22.95
	20	.1610	2 ½	3 ¼	60220	20.20	60320	23.35
	19	.1660	2 ½	3 ¼	60219	20.20	60319	23.35
	18	.1695	2 ½	3 ¼	60218	20.20	60318	23.35
1/2		.1719	2 ½	3 ¼	60011	20.20	60111	23.35
	17	.1730	2 ¾	3 ¾	60217	20.20	60317	23.35
	16	.1770	2 ¾	3 ¾	60216	19.70	60316	22.95
	15	.1800	2 ¾	3 ¾	60215	20.45	60315	24.00
5/8	14	.1820	2 ¾	3 ¾	60214	19.70	60314	22.95
	13	.1850	2 ¾	3 ½	60213	21.70	60313	22.95
		.1875	2 ¾	3 ½	60012	19.70	60112	22.95
	12	.1890	2 ¾	3 ½	60212	22.70	60312	24.00
3/4	11	.1910	2 ¾	3 ½	60211	20.95	60311	24.20
	10	.1935	2 ¾	3 ½	60210	20.45	60310	24.00
	9	.1960	2 ¾	3 ½	60209	20.95	60309	24.20
	8	.1990	2 ¾	3 ½	60208	20.95	60308	24.20
7/8	7	.2010	2 ¾	3 ½	60207	20.95	60307	24.20
	6	.2031	2 ¾	3 ½	60013	21.65	60113	24.90
		.2040	2 ½	3 ¾	60206	21.40	60306	24.85
	5	.2055	2 ½	3 ¾	60205	21.65	60305	24.20
1 1/8	4	.2090	2 ½	3 ¾	60204	21.40	60304	24.85
	3	.2130	2 ½	3 ¾	60203	21.65	60303	24.20
		.2188	2 ½	3 ¾	60014	21.65	60114	24.90
	2	.2210	2 ½	3 ¾	60202	22.55	60302	26.05
1 1/4	1	.2280	2 ½	3 ¾	60201	22.10	60301	25.65
	A	.2340	2 ½	3 ¾	60401	24.50	60501	28.40
		.2344	2 ½	3 ¾	60015	23.20	60115	27.00
	B	.2380	2 ¾	4	60402	24.50	60502	28.40
1 1/2		.2420	2 ¾	4	60403	24.50	60503	28.40
	D	.2460	2 ¾	4	60404	23.90	60504	27.80
	E	.2500	2 ¾	4	60016	23.20	60116	27.00

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 ¾	4 ½	60406	\$27.50	60506	\$31.85
	G	.2610	2 ¾	4 ½	60407	28.20	60507	32.60
		.2656	2 ¾	4 ½	60017	25.85	60117	29.60
	H	.2660	2 ¾	4 ½	60408	28.75	60508	33.35
9/32	I	.2720	2 ¾	4 ½	60409	28.20	60509	32.60
	J	.2770	2 ¾	4 ½	60410	28.75	60510	33.35
	K	.2810	2 ¾	4 ¼	60411	28.75	60511	33.35
19/64		.2812	2 ¾	4 ¼	60018	27.45	60118	31.70
	L	.2900	2 ¾	4 ¼	60412	28.75	60512	33.35
	M	.2950	3 ¼	4 ¾	60413	31.65	60513	36.85
		.2969	3 ¼	4 ¾	60019	30.35	60119	35.10
5/16		.3020	3 ¼	4 ¾	60414	30.90	60514	36.00
	O	.3125	3 ¾	4 ½	60020	29.70	60120	34.40
		.3160	3 ¾	4 ½	60415	30.50	60515	35.25
	P	.3230	3 ¾	4 ½	60416	32.50	60516	37.60
21/64		.3281	3 ¾	4 ½	60021	31.45	60121	36.55
	Q	.3320	3 ¾	4 ¾	60417	33.10	60517	38.60
	R	.3390	3 ¾	4 ¾	60418	32.50	60518	37.60
		.3438	3 ¾	4 ¾	60022	31.45	60122	36.55
11/32	S	.3480	3 ½	4 ¾	60419	34.95	60519	40.55
	T	.3580	3 ½	4 ¾	60420	35.65	60520	41.55
		.3594	3 ½	4 ¾	60023	33.50	60123	38.95
	U	.3680	3 ½	5	60421	34.30	60521	39.80
3/8		.3750	3 ½	5	60024	33.50	60124	38.95
	V	.3770	3 ½	5	60422	34.95	60522	40.55
	W	.3860	3 ¾	5 ½	60423	38.35	60523	44.40
		.3906	3 ¾	5 ½	60025	36.40	60125	42.40
25/64		.3970	3 ¾	5 ½	60424	36.70	60524	42.55
	Y	.4040	3 ¾	5 ½	60425	38.35	60525	44.40
		.4062	3 ¾	5 ½	60026	36.40	60126	42.40
	Z	.4130	3 ¾	5 ½	60426	42.45	60526	49.15
27/64		.4219	3 ¾	5 ¾	60027	39.60	60127	46.00
	7/16	.4375	4 ¼	5 ½	60028	39.60	60128	46.00
	29/64	.4531	4 ¾	5 ½	60029	45.60	60129	52.75
	15/32	.4688	4 ¾	5 ¾	60030	44.50	60130	51.55
31/64		.4844	4 ¾	5 ¾	60031	49.85	60131	57.75
	1/2	.5000	4 ½	6	60032	54.70	60132	57.75
	33/64	.5156	4 ¾	6 ½	60033	71.30	60133	82.85
	17/32	.5312	4 ¾	6 ½	60034	71.30	60134	82.85
35/64		.5469	4 ¾	6 ½	60035	71.95	60135	83.55
	9/16	.5625	4 ¾	6 ½	60036	71.95	60136	83.55
	37/64	.5781	4 ¾	6 ½	60037	79.45	60137	92.35
	19/32	.5938	5 ¼	7 ½	60038	77.20	60138	89.75
7/8		.6094	5 ¼	7 ½	60039	91.30	60139	106.00
	5/8	.6250	5 ¼	7 ½	60040	87.55	60140	101.50
	41/64	.6406	5 ¼	7 ½	60041	101.00	60141	117.30
	21/32	.6562	5 ¼	7 ½	60042	89.05	60142	103.30
43/64		.6719	5 ¼	7 ½	60043	115.90	60143	134.50
	11/16	.6875	5 ¼	7 ½	60044	90.75	60144	105.30
	45/64	.7031	5 ¼	7 ½	60045	106.00	60145	117.95
	23/32	.7188	5 ¼	7 ½	60046	107.15	60146	119.00
3/4		.7344	5 ¼	7 ½	60047	107.70	60147	119.65
		.7500	5 ¼	8	60048	109.30	60148	121.55
	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-

*Solid carbide



JOBBERS LENGTH DRILLS CARBIDE TIPPED TYPES 600 & 601 METRIC

**MATERIAL
SPECIFIC**

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.	
	FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE	
	mm	INCH	mm	INCH					mm
3.0	.1181	41	1 3/8	70	2 3/4	600030	\$23.40	601030	\$24.00
3.1	.1220	41	1 3/8	70	2 3/4	600031	24.55	601031	24.85
3.2	.1260	41	1 3/8	70	2 3/4	600032	24.55	601032	24.85
3.3	.1299	44	1 3/4	73	2 7/8	600033	24.55	601033	24.85
3.4	.1339	44	1 3/4	73	2 7/8	600034	24.55	601034	24.85
3.5	.1378	44	1 3/4	73	2 7/8	600035	22.70	601035	23.40
3.6	.1417	48	1 7/8	76	3	600036	23.40	601036	24.00
3.7	.1457	48	1 7/8	76	3	600037	23.40	601037	24.00
3.8	.1496	48	1 7/8	76	3	600038	23.40	601038	24.00
3.9	.1535	51	2	79	3 1/8	600039	23.40	601039	24.00
4.0	.1575	54	2 1/8	83	3 1/4	600040	22.10	601040	22.70
4.1	.1614	54	2 1/8	83	3 1/4	600041	21.30	601041	24.20
4.2	.1654	54	2 1/8	83	3 1/4	600042	22.70	601042	24.20
4.3	.1693	54	2 1/8	83	3 1/4	600043	22.70	601043	24.20
4.4	.1732	56	2 3/8	86	3 3/8	600044	22.70	601044	24.20
4.5	.1772	56	2 3/8	86	3 3/8	600045	23.40	601045	24.20
4.6	.1811	56	2 3/8	86	3 3/8	600046	25.60	601046	25.90
4.7	.1850	59	2 3/8	89	3 1/2	60213	21.70	60313	22.95
4.8	.1890	59	2 3/8	89	3 1/2	60212	22.70	60312	24.00
4.9	.1929	62	2 3/8	92	3 3/8	600049	25.60	601049	25.90
5.0	.1969	62	2 3/8	92	3 3/8	600050	24.55	601050	25.25
5.1	.2008	62	2 3/8	92	3 3/8	600051	26.70	601051	27.00
5.2	.2047	64	2 1/2	95	3 3/4	600052	26.70	601052	27.00
5.3	.2087	64	2 1/2	95	3 3/4	600053	26.70	601053	27.00
5.4	.2126	64	2 1/2	95	3 3/4	600054	26.70	601054	27.00
5.5	.2165	64	2 1/2	95	3 3/4	600055	26.05	601055	26.25
5.6	.2205	67	2 5/8	98	3 3/8	600056	27.45	601056	27.85
5.7	.2244	67	2 5/8	98	3 3/8	600057	27.45	601057	27.85
5.8	.2283	67	2 5/8	98	3 3/8	600058	27.45	601058	27.85
5.9	.2323	67	2 5/8	98	3 3/8	600059	27.45	601059	27.85
6.0	.2362	70	2 3/4	102	4	600060	27.00	601060	28.55
6.1	.2402	70	2 3/4	102	4	600061	28.55	601061	29.40
6.2	.2441	70	2 3/4	102	4	600062	28.55	601062	29.40
6.3	.2480	70	2 3/4	102	4	600063	28.55	601063	29.40
6.4	.2520	73	2 7/8	105	4 1/8	600064	28.55	601064	29.40
6.5	.2559	73	2 7/8	105	4 1/8	600065	27.90	601065	28.55
6.6	.2598	73	2 7/8	105	4 1/8	600066	29.85	601066	33.50
6.7	.2638	73	2 7/8	105	4 1/8	600067	29.85	601067	33.50
6.8	.2677	73	2 7/8	105	4 1/8	600068	29.85	601068	33.50
6.9	.2717	73	2 7/8	105	4 1/8	600069	29.85	601069	33.50
7.0	.2756	73	2 7/8	105	4 1/8	600070	29.25	601070	33.50
7.1	.2795	75	2 15/16	108	4 1/4	600071	30.65	601071	33.50
7.2	.2835	75	2 15/16	108	4 1/4	600072	30.65	601072	33.50
7.3	.2874	75	2 15/16	108	4 1/4	600073	30.65	601073	33.50
7.4	.2913	78	3 1/16	111	4 3/8	600074	30.65	601074	36.30
7.5	.2953	78	3 1/16	111	4 3/8	600075	30.65	601075	36.30
7.6	.2992	78	3 1/16	111	4 3/8	600076	32.15	601076	36.30
7.7	.3031	81	3 3/16	114	4 1/2	600077	32.15	601077	36.30
7.8	.3071	81	3 3/16	114	4 1/2	600078	32.15	601078	36.30
7.9	.3110	81	3 3/16	114	4 1/2	600079	32.15	601079	36.30
8.0	.3150	81	3 3/16	114	4 1/2	600080	31.35	601080	36.30
8.1	.3189	84	3 5/16	117	4 5/8	600081	34.30	601081	38.60
8.2	.3228	84	3 5/16	117	4 5/8	600082	34.30	601082	38.60
8.3	.3268	84	3 5/16	117	4 5/8	600083	34.30	601083	38.60
8.4	.3307	87	3 7/16	121	4 3/4	600084	34.30	601084	38.60
8.5	.3346	87	3 7/16	121	4 3/4	600085	32.80	601085	38.60
8.6	.3386	87	3 7/16	121	4 3/4	600086	34.30	601086	38.60

TOOL DIAMETER	LENGTH				TYPE 600 - 118° PT.		TYPE 601 - 135° PT.		
	FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE	
	mm	INCH	mm	INCH					mm
8.7	.3425	87	3 7/16	121	4 3/4	600087	\$34.30	601087	\$38.60
8.8	.3465	89	3 1/2	124	4 7/8	600088	34.30	601088	38.60
8.9	.3504	89	3 1/2	124	4 7/8	600089	34.30	601089	41.10
9.0	.3543	89	3 1/2	124	4 7/8	600090	33.50	601090	41.10
9.1	.3583	89	3 1/2	124	4 7/8	600091	37.15	601091	41.10
9.2	.3622	92	3 5/8	127	5	600092	37.15	601092	41.10
9.3	.3661	92	3 5/8	127	5	600093	37.15	601093	41.10
9.4	.3701	92	3 5/8	127	5	600094	37.15	601094	41.10
9.5	.3740	92	3 5/8	127	5	600095	36.40	601095	41.10
9.6	.3780	95	3 3/4	130	5 1/8	600096	37.65	601096	44.75
9.7	.3819	95	3 3/4	130	5 1/8	600097	37.65	601097	44.75
9.8	.3858	95	3 3/4	130	5 1/8	600098	37.65	601098	44.75
9.9	.3898	95	3 3/4	130	5 1/8	600099	37.65	601099	44.75
10.0	.3937	95	3 3/4	130	5 1/8	600100	37.65	601100	44.75
10.1	.3976	98	3 7/8	133	5 1/4	600101	44.95	601101	46.10
10.2	.4016	98	3 7/8	133	5 1/4	600102	44.95	601102	46.10
10.3	.4055	98	3 7/8	133	5 1/4	600103	44.95	601103	46.10
10.4	.4094	98	3 7/8	133	5 1/4	600104	44.95	601104	48.50
10.5	.4134	98	3 7/8	133	5 1/4	600105	43.40	601105	48.50
10.6	.4173	100	3 15/16	137	5 3/8	600106	49.20	601106	50.10
10.7	.4213	100	3 15/16	137	5 3/8	600107	49.20	601107	50.10
10.8	.4252	103	4 1/16	140	5 1/2	600108	49.20	601108	50.10
10.9	.4291	103	4 1/16	140	5 1/2	600109	49.20	601109	50.10
11.0	.4331	103	4 1/16	140	5 1/2	600110	47.10	601110	48.50
11.1	.4370	103	4 1/16	140	5 1/2	600111	54.95	601111	55.80
11.2	.4409	106	4 3/16	143	5 3/8	600112	54.95	601112	56.25
11.3	.4449	106	4 3/16	143	5 3/8	600113	54.95	601113	56.25
11.4	.4488	106	4 3/16	143	5 3/8	600114	54.95	601114	54.55
11.5	.4528	106	4 3/16	143	5 3/8	600115	52.80	601115	54.55
11.6	.4567	110	4 5/16	146	5 3/4	600116	59.85	601116	60.70
11.7	.4606	110	4 5/16	146	5 3/4	600117	59.85	601117	60.70
11.8	.4646	110	4 5/16	146	5 3/4	600118	59.85	601118	60.70
11.9	.4685	110	4 5/16	146	5 3/4	600119	59.85	601119	60.70
12.0	.4724	111	4 3/8	149	5 7/8	600120	57.25	601120	61.15
12.1	.4764	111	4 3/8	149	5 7/8	600121	62.20	601121	63.20
12.2	.4803	111	4 3/8	149	5 7/8	600122	62.20	601122	63.20
12.3	.4843	111	4 3/8	149	5 7/8	600123	62.20	601123	63.20
12.4	.4882	114	4 1/2	152	6	600124	62.20	601124	63.20
12.5	.4921	114	4 1/2	152	6	600125	59.30	601125	61.15
12.6	.4961	114	4 1/2	152	6	600126	64.40	601126	65.20
12.7	.5000	114	4 1/2	152	6	60032	54.70	60132	57.75
12.8	.5039	114	4 1/2	152	6	600128	70.70	601128	89.95
12.9	.5079	114	4 1/2	152	6	600129	70.70	601129	89.95
13.0	.5118	114	4 1/2	152	6	600130	70.70	601130	89.95
13.5	.5315	122	4 13/16	168	6 5/8	600135	91.60	601135	98.70
14.0	.5512	122	4 13/16	168	6 5/8	600140	97.00	601140	104.60
14.5	.5709	122	4 13/16	168	6 5/8	600145	104.00	601145	112.35
15.0	.5906	132	5 3/16	181	7 1/8	600150	104.00	601150	112.35
15.5	.6102	132	5 3/16	181	7 1/8	600155	105.35	601155	113.80
16.0	.6299	132	5 3/16	181	7 1/8	600160	107.30	601160	115.90
16.5	.6496	132	5 3/16	181	7 1/8	600165	107.30	601165	115.90
17.0	.6693	143	5 5/8	194	7 5/8	600170	111.40	601170	120.40
17.5	.6890	143	5 5/8	194	7 5/8	600175	111.40	601175	120.40
18.0	.7087	143	5 5/8	194	7 5/8	600180	112.75	601180	121.55
18.5	.7283	143	5 5/8	194	7 5/8	600185	113.35	601185	122.35
19.0	.7480	148	5 13/16	203	8	600190	114.80	601190	124.10

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	\$20.95	69108	\$24.60	3/32	J	.2770	2 7/8	4 1/8	69410	\$34.65	69510	\$40.30
	29	.1360	1 3/8	2 3/4	69230	21.50	69330	24.95		K	.2810	2 15/16	4 1/4	69411	34.65	69511	40.30
	28	.1405	1 3/4	2 7/8	69229	22.25	69329	25.65			L	.2900	2 15/16	4 1/4	69412	34.65	69512
9/64	27	.1406	1 3/4	2 7/8	69009	22.75	69109	26.70	1/16	M	.2950	3 1/16	4 3/8	69413	38.20	69513	44.50
		.1440	1 7/8	3	69227	23.05	69327	26.90			N	.2969	3 1/16	4 3/8	69019	36.65	69119
		.1470	1 7/8	3	69226	21.45	69326	24.95		O		.3020	3 1/16	4 3/8	69414	37.35	69514
		.1495	1 7/8	3	69225	21.45	69325	24.95			P	.3125	3 3/16	4 1/2	69020	35.75	69120
5/32	24	.1520	2	3 1/8	69224	23.05	69324	26.90	3/16	Q	.3160	3 3/16	4 1/2	69415	36.70	69515	42.45
		.1540	2	3 1/8	69223	22.40	69323	26.20			R	.3230	3 3/16	4 3/8	69416	39.25	69516
		.1562	2	3 1/8	69010	22.35	69110	26.20		S		.3281	3 5/16	4 5/8	69021	37.95	69121
		.1570	2	3 1/8	69222	24.90	69322	28.90			T	.3320	3 7/16	4 3/4	69417	40.20	69517
3/16	21	.1590	2 1/8	3 1/4	69221	23.75	69321	27.60	1/2	U	.3390	3 7/16	4 3/4	69418	39.25	69518	45.60
		.1610	2 1/8	3 1/4	69220	24.35	69320	28.40			V	.3438	3 7/16	4 3/4	69022	37.95	69122
		.1660	2 1/8	3 1/4	69219	24.35	69319	28.40		W		.3480	3 1/2	4 7/8	69419	42.25	69519
		.1695	2 1/8	3 1/4	69218	24.35	69318	28.40			X	.3580	3 1/2	4 7/8	69420	43.10	69520
1/4	17	.1719	2 1/8	3 1/4	69011	24.35	69111	28.40	5/8	Y	.3594	3 1/2	4 7/8	69023	40.45	69123	47.05
		.1730	2 3/16	3 3/8	69217	24.35	69317	28.40			Z	.3680	3 3/8	5	69421	41.55	69521
		.1770	2 3/16	3 3/8	69216	23.75	69316	27.60		1 1/4		.3750	3 5/8	5	69024	40.45	69124
		.1800	2 3/16	3 3/8	69215	24.90	69315	28.90			2 1/4	.3770	3 5/8	5	69422	42.25	69522
5/16	14	.1820	2 3/16	3 3/8	69214	23.75	69314	27.60	3/4	1 3/2	.3860	3 3/4	5 1/8	69423	46.35	69523	53.70
		.1850	2 3/16	3 1/2	69213	26.20	69313	27.60			2 1/2	.3906	3 3/4	5 1/8	69025	43.95	69125
		.1875	2 5/16	3 1/2	69012	23.75	69112	27.60		3 1/2		.3970	3 3/4	5 1/8	69424	44.35	69524
		.1890	2 5/16	3 1/2	69212	27.20	69312	28.90			4 1/2	.4040	3 7/8	5 1/4	69425	46.35	69525
3/8	11	.1910	2 5/16	3 1/2	69211	25.25	69311	29.15	2	4 1/2	.4062	3 7/8	5 1/4	69026	43.95	69126	51.15
		.1935	2 7/16	3 5/8	69210	24.90	69310	28.90			5 1/2	.4130	3 7/8	5 1/4	69426	51.30	69526
		.1960	2 7/16	3 5/8	69209	25.25	69309	29.15		6		.4219	3 15/16	5 3/8	69027	47.85	69127
		.1990	2 7/16	3 5/8	69208	25.25	69308	29.15			7 1/2	.4375	4 1/16	5 1/2	69028	47.85	69128
7/16	7	.2010	2 7/16	3 5/8	69207	25.25	69307	29.15	2 3/4	7 1/2	.4531	4 3/16	5 5/8	69029	54.80	69129	63.55
		.2031	2 7/16	3 5/8	69013	26.05	69113	30.10			3 1/4	.4688	4 5/16	5 3/4	69030	53.85	69130
		.2040	2 1/2	3 3/4	69206	25.70	69306	30.00		4 1/4		.4844	4 3/8	5 7/8	69031	60.05	69131
		.2055	2 1/2	3 3/4	69205	26.15	69305	29.15			5 1/4	.5000	4 1/2	6	69032	66.15	69132
1/2	4	.2090	2 1/2	3 3/4	69204	25.70	69304	30.00	3 1/2	5 1/4	.5156	4 13/16	6 3/8	69033	86.10	69133	100.00
		.2130	2 1/2	3 3/4	69203	26.15	69303	29.15			6 1/4	.5312	4 13/16	6 5/8	69034	86.10	69134
		.2188	2 1/2	3 3/4	69014	26.05	69114	30.35		7 1/4		.5469	4 13/16	6 5/8	69035	86.90	69135
		.2210	2 5/8	3 7/8	69202	27.10	69302	31.45			8 1/4	.5625	4 13/16	6 5/8	69036	86.90	69136
5/8	1	.2280	2 5/8	3 7/8	69201	26.85	69301	31.05	4 1/2	8 1/4	.5781	4 13/16	6 5/8	69037	95.90	69137	111.45
		.2340	2 5/8	3 7/8	69401	29.60	69501	34.25			9 1/4	.5938	5 3/16	7 1/8	69038	93.40	69138
		.2344	2 5/8	3 7/8	69015	28.10	69115	32.65		10 1/4		.6094	5 3/16	7 1/8	69039	110.25	69139
		.2380	2 3/4	4	69402	29.60	69502	34.25			11 1/4	.6250	5 3/16	7 1/8	69040	105.75	69140
3/4	A	.2420	2 3/4	4	69403	29.60	69503	34.25	5 1/4	11 3/4	.6406	5 3/16	7 1/8	69041	121.95	69141	141.65
		.2460	2 3/4	4	69404	28.85	69504	33.50			12 1/4	.6562	5 3/16	7 1/8	69042	107.45	69142
		.2500	2 3/4	4	69016	28.10	69116	32.65		13 1/4		.6719	5 5/8	7 5/8	69043	139.95	69143
		.2570	2 7/8	4 1/8	69406	33.10	69506	38.65			14 1/4	.6875	5 5/8	7 5/8	69044	109.55	69144
7/8	C	.2610	2 7/8	4 1/8	69407	34.05	69507	39.30	6 1/4	14 3/4	.7031	5 5/8	7 5/8	69045	128.20	69145	142.50
		.2656	2 7/8	4 1/8	69017	31.20	69117	35.65			15 1/4	.7188	5 5/8	7 5/8	69046	129.40	69146
		.2660	2 7/8	4 1/8	69408	34.65	69508	40.30		16 1/4		.7344	5 5/8	7 5/8	69047	130.05	69147
		.2720	2 7/8	4 1/8	69409	34.05	69509	39.30			17 1/4	.7500	5 13/16	8	69048	132.25	69148



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



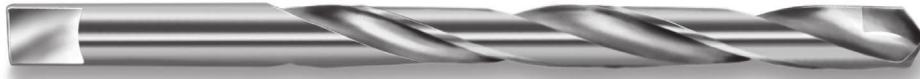
118° STANDARD OR 135° SPLIT POINT

DISCONTINUED - WHILE SUPPLIES LAST

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 3/8	70	2 3/4	690032	\$27.15	691032	\$27.45
3.3	.1299	44	1 3/4	73	2 7/8	690033	27.15	691033	27.45
3.4	.1339	44	1 3/4	73	2 7/8	690034	27.15	691034	27.45
3.5	.1378	44	1 3/4	73	2 7/8	690035	24.90	691035	25.90
3.6	.1417	48	1 7/8	76	3	690036	25.95	691036	26.35
3.7	.1457	48	1 7/8	76	3	690037	25.95	691037	26.35
3.8	.1496	48	1 7/8	76	3	690038	25.95	691038	26.35
3.9	.1535	51	2	79	3 1/8	690039	25.95	691039	26.35
4.0	.1575	54	2 1/8	83	3 1/4	690040	24.50	691040	25.05
4.1	.1614	54	2 1/8	83	3 1/4	690041	23.45	691041	26.60
4.2	.1654	54	2 1/8	83	3 1/4	690042	24.90	691042	26.60
4.3	.1693	54	2 1/8	83	3 1/4	690043	24.90	691043	26.60
4.4	.1732	56	2 3/16	86	3 3/8	690044	24.90	691044	26.60
4.5	.1772	56	2 3/16	86	3 3/8	690045	25.95	691045	26.60
4.6	.1811	56	2 3/16	86	3 3/8	690046	28.25	691046	28.55
4.7	.1850	59	2 3/16	89	3 1/2	69213	26.20	69313	27.60
4.8	.1890	59	2 3/16	89	3 1/2	69212	27.20	69312	28.90
4.9	.1929	62	2 7/16	92	3 5/8	690049	28.25	691049	28.55
5.0	.1969	62	2 7/16	92	3 5/8	690050	27.10	691050	27.85
5.1	.2008	62	2 7/16	92	3 5/8	690051	29.40	691051	29.80
5.2	.2047	64	2 1/2	95	3 3/4	690052	29.40	691052	29.80
5.3	.2087	64	2 1/2	95	3 3/4	690053	29.40	691053	29.80
5.4	.2126	64	2 1/2	95	3 3/4	690054	29.40	691054	29.80
5.5	.2165	64	2 1/2	95	3 3/4	690055	28.60	691055	29.10
5.6	.2205	67	2 5/8	98	3 7/8	690056	30.15	691056	30.85
5.7	.2244	67	2 5/8	98	3 7/8	690057	30.15	691057	30.85
5.8	.2283	67	2 5/8	98	3 7/8	690058	30.15	691058	30.85
5.9	.2323	67	2 5/8	98	3 7/8	690059	30.15	691059	30.85
6.0	.2362	70	2 3/4	102	4	690060	29.80	691060	31.50
6.1	.2402	70	2 3/4	102	4	690061	31.50	691061	32.40
6.2	.2441	70	2 3/4	102	4	690062	31.50	691062	32.40
6.3	.2480	70	2 3/4	102	4	690063	31.50	691063	32.40
6.4	.2520	73	2 7/8	105	4 1/8	690064	31.50	691064	32.40
6.5	.2559	73	2 7/8	105	4 1/8	690065	31.00	691065	31.50
6.6	.2598	73	2 7/8	105	4 1/8	690066	33.00	691066	37.00
6.7	.2638	73	2 7/8	105	4 1/8	690067	33.00	691067	37.00
6.8	.2677	73	2 7/8	105	4 1/8	690068	33.00	691068	37.00
6.9	.2717	73	2 7/8	105	4 1/8	690069	33.00	691069	37.00
7.0	.2756	73	2 7/8	105	4 1/8	690070	32.30	691070	37.00
7.1	.2795	75	2 15/16	108	4 1/4	690071	33.80	691071	37.00
7.2	.2835	75	2 15/16	108	4 1/4	690072	33.80	691072	37.00
7.3	.2874	75	2 15/16	108	4 1/4	690073	33.80	691073	37.00
7.4	.2913	78	3 1/16	111	4 3/8	690074	33.80	691074	39.95
7.5	.2953	78	3 1/16	111	4 3/8	690075	33.80	691075	39.95
7.6	.2992	78	3 1/16	111	4 3/8	690076	35.55	691076	39.95
7.7	.3031	81	3 3/16	114	4 1/2	690077	35.55	691077	39.95
7.8	.3071	81	3 3/16	114	4 1/2	690078	35.55	691078	39.95
7.9	.3110	81	3 3/16	114	4 1/2	690079	35.55	691079	39.95
8.0	.3150	81	3 3/16	114	4 1/2	690080	34.65	691080	39.95
8.1	.3189	84	3 5/16	117	4 5/8	690081	37.80	691081	42.50
8.2	.3228	84	3 5/16	117	4 5/8	690082	37.80	691082	42.50
8.3	.3268	84	3 5/16	117	4 5/8	690083	37.80	691083	42.50

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	\$37.80	691084	\$42.50
8.5	.3346	87	3 7/16	121	4 3/4	690085	36.05	691085	42.50
8.6	.3386	87	3 7/16	121	4 3/4	690086	37.80	691086	42.50
8.7	.3425	87	3 7/16	121	4 3/4	690087	37.80	691087	42.50
8.8	.3465	89	3 1/2	124	4 7/8	690088	37.80	691088	42.50
8.9	.3504	89	3 1/2	124	4 7/8	690089	37.80	691089	45.25
9.0	.3543	89	3 1/2	124	4 7/8	690090	36.95	691090	45.25
9.1	.3583	89	3 1/2	124	4 7/8	690091	40.95	691091	45.25
9.2	.3622	92	3 5/8	127	5	690092	40.95	691092	45.25
9.3	.3661	92	3 5/8	127	5	690093	40.95	691093	45.25
9.4	.3701	92	3 5/8	127	5	690094	40.95	691094	45.25
9.5	.3740	92	3 5/8	127	5	690095	40.10	691095	45.25
9.6	.3780	95	3 3/4	130	5 1/8	690096	41.70	691096	49.35
9.7	.3819	95	3 3/4	130	5 1/8	690097	41.70	691097	49.35
9.8	.3858	95	3 3/4	130	5 1/8	690098	41.70	691098	49.35
9.9	.3898	95	3 3/4	130	5 1/8	690099	41.70	691099	49.35
10.0	.3937	95	3 3/4	130	5 1/8	690100	41.70	691100	49.35
10.1	.3976	98	3 7/8	133	5 1/4	690101	49.50	691101	50.80
10.2	.4016	98	3 7/8	133	5 1/4	690102	49.50	691102	50.80
10.3	.4055	98	3 7/8	133	5 1/4	690103	49.50	691103	50.80
10.4	.4094	98	3 7/8	133	5 1/4	690104	49.55	691104	53.35
10.5	.4134	98	3 7/8	133	5 1/4	690105	48.00	691105	53.35
10.6	.4173	100	3 15/16	137	5 3/8	690106	54.45	691106	55.20
10.7	.4213	100	3 15/16	137	5 3/8	690107	54.45	691107	55.20
10.8	.4252	103	4 1/16	140	5 1/2	690108	54.45	691108	55.20
10.9	.4291	103	4 1/16	140	5 1/2	690109	54.45	691109	55.20
11.0	.4331	103	4 1/16	140	5 1/2	690110	51.90	691110	53.35
11.1	.4370	103	4 1/16	140	5 1/2	690111	60.55	691111	61.45
11.2	.4409	106	4 3/16	143	5 5/8	690112	60.60	691112	62.00
11.3	.4449	106	4 3/16	143	5 5/8	690113	60.60	691113	62.00
11.4	.4488	106	4 3/16	143	5 5/8	690114	60.55	691114	60.20
11.5	.4528	106	4 3/16	143	5 5/8	690115	58.10	691115	60.20
11.6	.4567	110	4 5/16	146	5 3/4	690116	65.75	691116	67.00
11.7	.4606	110	4 5/16	146	5 3/4	690117	65.75	691117	67.00
11.8	.4646	110	4 5/16	146	5 3/4	690118	65.75	691118	67.00
11.9	.4685	110	4 5/16	146	5 3/4	690119	65.75	691119	67.00
12.0	.4724	111	4 3/8	149	5 7/8	690120	63.05	691120	67.35
12.5	.4921	114	4 1/2	152	6	690125	65.45	691125	67.35
13.0	.5118	114	4 1/2	152	6	690130	78.00	691130	99.35
13.5	.5315	122	4 13/16	168	6 5/8	690135	100.80	691135	108.80
14.0	.5512	122	4 13/16	168	6 5/8	690140	106.95	691140	115.35
14.5	.5709	122	4 13/16	168	6 5/8	690145	114.70	691145	124.05
15.0	.5906	132	5 3/16	181	7 1/8	690150	114.70	691150	124.05
15.5	.6102	132	5 3/16	181	7 1/8	690155	116.25	691155	125.60
16.0	.6299	132	5 3/16	181	7 1/8	690160	118.30	691160	127.70
16.5	.6496	132	5 3/16	181	7 1/8	690165	118.30	691165	127.70
17.0	.6693	143	5 5/8	194	7 7/8	690170	122.80	691170	132.85
17.5	.6890	143	5 5/8	194	7 7/8	690175	122.80	691175	132.85
18.0	.7087	143	5 5/8	194	7 7/8	690180	124.15	691180	134.05
18.5	.7283	143	5 5/8	194	7 7/8	690185	124.95	691185	134.85
19.0	.7480	148	5 13/16	203	8	690190	126.60	691190	136.80

DRILLS



JOBBERS LENGTH DRILLS SOLID CARBIDE TYPE 860 FRACTIONAL



118° SPLIT POINT

DISCONTINUED - WHILE SUPPLIES LAST

TYPE 860 - 118° SPLIT POINT

- Solid Carbide Jobbers 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.

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

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

MODIFICATIONS (Prompt delivery)

- Coatings available:

TITANIUM NITRIDE - TiN

TITANIUM CARBONITRIDE - TiCN

ZIRCONIUM NITRIDE - ZrN

AL TITANIUM NITRIDE - AlTiN



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

TOOL DIAMETER							LENGTH					TYPE 860 - 118°				
FRACTIONAL	WIRE	DEC. EQUIV.	FLT.	OVER-ALL	EDP NO.	PRICE	FRACTIONAL	WIRE LTR.	DEC. EQUIV.	FLT.	OVER-ALL	EDP NO.	PRICE			
60	.0400	3/4	1 1/2	8600400	\$14.05	27	.1440	1 3/8	2 1/2	8601440	\$19.95					
	.0410	3/4	1 1/2	8600410	14.05		26	.1470	1 3/8	2 1/2	8601470	20.25				
	.0420	3/4	1 1/2	8600420	14.05		25	.1495	1 3/8	2 1/2	8601495	20.50				
	.0430	3/4	1 1/2	8600430	14.05		24	.1520	1 3/8	2 1/2	8601520	20.95				
	3/64	.0465	3/4	1 1/2	8600465		14.05	5/32	.1540	1 3/8	2 1/2	8601540	21.85			
.0469		3/4	1 1/2	86003	14.05	23	.1562		1 3/8	2 1/2	86010	21.50				
.0520		3/4	1 1/2	8600520	14.05	22	.1570		1 3/8	2 1/2	8601570	23.15				
.0550		3/4	1 1/2	8600550	14.05	21	.1590		1 3/8	2 1/2	8601590	23.45				
1/16	.0595	3/4	1 1/2	8600595	14.05	11/64	.1610	1 3/8	2 1/2	8601610	23.65					
	.0625	3/4	1 1/2	86004	13.30		20	.1660	1 3/8	2 3/4	8601660	24.60				
	.0635	3/4	1 1/2	8600635	14.05		19	.1660	1 3/8	2 3/4	8601660	24.60				
5/64	.0760	3/4	1 1/2	8600670	14.05	3/16	.1730	1 3/8	2 3/4	8601730	25.25					
	.0781	3/4	1 1/2	8600700	14.45		17	.1730	1 3/8	2 3/4	8601730	25.25				
	49	.0730	7/8	1 3/4	8600730		14.80	16	.1770	1 3/8	2 3/4	8601770	25.75			
.0760		7/8	1 3/4	8600760	14.95	15	.1800	1 3/8	2 3/4	8601800	25.90					
47	.0785	7/8	1 3/4	8600785	14.95	14	.1820	1 3/8	2 3/4	8601820	25.80					
	.0810	7/8	1 3/4	8600810	14.95		13	.1850	1 3/8	2 3/4	8601850	26.35				
	.0820	7/8	1 3/4	8600820	15.35			12	.1890	1 3/8	2 3/4	8601890	26.70			
	.0860	1	2	8600860	15.80			11	.1910	1 3/8	2 3/4	8601910	27.20			
43	.0890	1	2	8600890	15.80	10	.1935	1 3/8	2 3/4	8601935	27.60					
	.0935	1	2	8600935	15.95		9	.1960	1 3/4	3	8601960	28.20				
	.0938	1	2	86006	15.30		8	.1990	1 3/4	3	8601990	28.95				
41	.0960	1	2	8600960	16.00	7	.2010	1 3/4	3	8602010	29.30					
	40	.0980	1	2	8600980	16.10	13/64	.2031	1 3/4	3	86013	30.90				
.0995		1 1/4	2 1/4	8600995	16.30	6		.2040	1 3/4	3	8602040	30.45				
.1015		1 1/4	2 1/4	8601015	16.30	5		.2055	1 3/4	3	8602055	30.90				
.1040		1 1/4	2 1/4	8601040	16.30	4		.2090	1 3/4	3	8602090	31.65				
36		.1065	1 1/4	2 1/4	8601065	16.30		7/32	.2130	1 3/4	3	8602130	32.50			
	.1094	1 1/4	2 1/4	86007	16.70	3	.2188		1 3/4	3	86014	31.90				
	.1100	1 1/4	2 1/4	8601100	16.70	2	.2210		1 3/4	3	8602210	33.80				
	.1110	1 1/4	2 1/4	8601110	17.10	1	.2280		1 3/4	3	8602280	35.55				
33	.1130	1 1/4	2 1/4	8601130	17.10	15/64	.2340	2	3 1/4	8602340	39.40					
	.1160	1 1/4	2 1/4	8601160	17.50		A	.2344	2	3 1/4	86015	35.40				
	.1200	1 1/4	2 1/4	8601200	17.80		B	.2380	2	3 1/4	8602380	40.45				
	.1250	1 1/4	2 1/4	86008	17.30		C	.2420	2	3 1/4	8602420	40.55				
30	.1285	1 1/4	2 1/4	8601285	18.50	1/4	.2460	2	3 1/4	8602460	41.65					
	.1360	1 3/8	2 1/2	8601360	18.65		D	.2500	2	3 1/4	86016	36.15				
	.1405	1 3/8	2 1/2	8601405	19.15		E	.2570	2	3 1/4	8602570	44.25				
	.1406	1 3/8	2 1/2	86009	20.60		F	.2610	2 1/8	3 1/2	8602610	44.95				
17/64	H	.2656	2 1/8	3 1/2	86017	\$39.45	19/64	N	.2969	2 3/8	3 3/4	86019	48.50			
		.2660	2 1/8	3 1/2	8602660	46.15			5/16	O	.3125	2 3/8	3 3/4	8603020	55.95	
		.2720	2 1/8	3 1/2	8602720	47.15					21/64	P	.3230	2 3/8	3 3/4	8603230
	.2770	2 1/8	3 1/2	8602770	48.25	11/32		S					.3438	2 1/2	4	86021
	K	.2810	2 1/8	3 1/2	8602810				48.65	23/64			T	.3580	2 3/4	4 1/4
		.2812	2 1/8	3 1/2	86018				42.65		3/8	U		.3580	2 3/4	4 1/4
		.2900	2 1/8	3 1/2	8602900	51.05		29/64	V					.3594	2 3/4	4 1/4
	.2950	2 3/8	3 3/4	8602950	52.80	1/2				W			.3680	2 3/4	4 1/4	8603680
	L	.2969	2 3/8	3 3/4	86019						48.50	25/64	X	.3750	2 3/4	4 1/4
		.3020	2 3/8	3 3/4	8603020			55.95	13/32		Y			.3770	2 3/4	4 1/4
		.3125	2 3/8	3 3/4	86020	51.05		7/16		Z				.3860	2 7/8	4 1/2
	.3160	2 3/8	3 3/4	8603160	59.25	27/64						Z	.3906	2 7/8	4 1/2	86025
M	.3230	2 3/8	3 3/4	8603230	61.15		29/64		Z		.3970		2 7/8	4 1/2	8603970	98.35
	.3281	2 1/2	4	86021	56.15			15/32		31/64	.4040		2 7/8	4 1/2	8604040	97.55
	.3320	2 1/2	4	8603320	64.90	9/16					31/64	.4062	2 7/8	4 1/2	86026	92.45
.3390	2 1/2	4	8603390	66.95	1/2		31/64		.4130			2 7/8	4 1/2	8604130	107.75	
Q	.3438	2 1/2	4	86022				62.25	7/16	31/64		.4219	2 7/8	4 1/2	86027	101.20
	.3480	2 1/2	4	8603480		73.45		29/64			31/64	.4375	2 7/8	4 1/2	86028	109.55
	.3580	2 3/4	4 1/4	8603580	76.15	15/32	31/64					.4531	3	4 3/4	86029	118.75
.3594	2 3/4	4 1/4	86023	67.95	3/8				31/64	.4688		3	4 3/4	86030	127.80	
R	.3680	2 3/4	4 1/4	8603680				77.65		1/2	31/64	.4844	3	4 3/4	86031	131.55
	.3750	2 3/4	4 1/4	86024		73.75	9/16	31/64				.5000	3	4 3/4	86032	134.85
	.3770	2 3/4	4 1/4	8603770	85.70	3/4			31/64			.5625	3 1/4	5	86036	248.00
.3860	2 7/8	4 1/2	8603860	90.90	5/8					31/64	.6250	3 1/4	5	86040	299.65	
U	.3906	2 7/8	4 1/2	86025			83.40	3/4			31/64	.7500	3 3/4	6	86048	363.60
	.3970	2 7/8	4 1/2	8603970		98.35	-		-			-	-	-	-	
	.4040	2 7/8	4 1/2	8604040	97.55	-	-		-	-		-	-			
.4062	2 7/8	4 1/2	86026	92.45	-	-	-	-	-	-						
V	.4130	2 7/8	4 1/2	8604130	107.75	-	-	-	-	-	-					
	.4219	2 7/8	4 1/2	86027	101.20	-	-	-	-	-	-					
	.4375	2 7/8	4 1/2	86028	109.55	-	-	-	-	-	-					
.4531	3	4 3/4	86029	118.75	-	-	-	-	-	-						
W	.4688	3	4 3/4	86030	127.80	-	-	-	-	-	-					
	.4844	3	4 3/4	86031	131.55	-	-	-	-	-	-					
	.5000	3	4 3/4	86032	134.85	-	-	-	-	-	-					
.5625	3 1/4	5	86036	248.00	-	-	-	-	-	-						

*Smaller sizes available. Call for pricing.



JOBBER LENGTH DRILLS

SOLID CARBIDE TYPE 860 METRIC



118° SPLIT POINT

DISCONTINUED - WHILE SUPPLIES LAST

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	\$16.85
1.1	.0433	19	38	860011	20.75
1.2	.0472	19	38	860012	20.90
1.3	.0512	19	38	860013	21.35
1.4	.0551	19	38	860014	21.70
1.5	.0591	19	38	860015	16.80
1.6	.0630	19	38	860016	20.85
1.7	.0669	19	38	860017	21.20
1.8	.0709	22	44	860018	21.45
1.9	.0748	22	44	860019	21.70
2.0	.0787	22	44	860020	17.85
2.1	.0827	22	44	860021	17.50
2.2	.0866	25	50	860022	17.50
2.3	.0906	25	50	860023	17.85
2.4	.0945	25	50	860024	18.05
2.5	.0984	25	50	860025	18.40
2.6	.1024	31	57	860026	19.65
2.7	.1063	31	57	860027	19.65
2.8	.1102	31	57	860028	19.95
2.9	.1142	31	57	860029	20.70
3.0	.1181	32	57	860030	20.50
3.1	.1220	31	57	860031	21.20
3.2	.1260	31	57	860032	21.50
3.3	.1299	31	57	860033	21.70
3.4	.1339	34	63	860034	21.70
3.5	.1378	35	63	860035	21.50
3.6	.1417	34	63	860036	22.15
3.7	.1457	34	63	860037	23.10
3.8	.1496	34	63	860038	24.15
3.9	.1535	34	63	860039	25.15
4.0	.1575	35	63	860040	25.75
4.1	.1614	34	63	860041	26.50
4.2	.1654	41	70	860042	27.20
4.3	.1693	41	70	860043	27.55
4.4	.1732	41	70	860044	28.10
4.5	.1772	41	70	860045	28.40
4.6	.1811	41	70	860046	29.05
4.7	.1850	41	70	860047	29.30
4.8	.1890	41	70	860048	30.30
4.9	.1929	41	70	860049	31.20
5.0	.1969	44	75	860050	31.70
5.1	.2008	44	76	860051	33.55
5.2	.2047	44	76	860052	34.05
5.3	.2087	44	76	860053	35.55

TOOL DIAMETER		LENGTH		TYPE 860 - 118° PT.	
mm	INCH	mm	OAL	METRIC EDP NO.	METRIC PRICE
5.4	.2126	44	76	860054	\$36.35
5.5	.2165	44	75	860055	35.75
5.6	.2205	44	76	860056	37.95
5.7	.2244	44	76	860057	37.90
5.8	.2283	44	76	860058	38.65
5.9	.2323	51	82	860059	40.25
6.0	.2362	50	82	860060	39.70
6.1	.2402	51	82	860061	42.85
6.2	.2441	51	82	860062	43.75
6.3	.2480	51	82	860063	44.80
6.4	.2520	51	82	860064	50.30
6.5	.2559	50	82	860065	47.10
6.6	.2598	54	89	860066	47.20
6.7	.2638	54	89	860067	46.05
6.8	.2677	54	89	860068	48.60
6.9	.2717	54	89	860069	49.55
7.0	.2756	54	89	860070	52.60
7.1	.2795	54	89	860071	50.90
7.2	.2835	54	89	860072	53.75
7.3	.2874	54	89	860073	56.35
7.4	.2913	60	95	860074	57.50
7.5	.2953	60	95	860075	57.50
7.6	.2992	60	95	860076	58.90
7.7	.3031	60	95	860077	59.55
7.8	.3071	60	95	860078	62.85
7.9	.3110	60	95	860079	62.85
8.0	.3150	60	95	860080	58.40
8.1	.3189	60	95	860081	64.00
8.2	.3228	60	95	860082	64.90
8.3	.3268	63	101	860083	67.20
8.4	.3307	63	101	860084	68.20
8.5	.3346	63	100	860085	69.30
8.6	.3386	63	101	860086	70.45
8.7	.3425	63	101	860087	71.25
8.8	.3465	63	101	860088	74.10
8.9	.3504	63	101	860089	76.45
9.0	.3543	70	100	860090	78.95
9.1	.3583	70	108	860091	81.35
9.2	.3622	70	108	860092	81.35
9.3	.3661	70	108	860093	84.30
9.4	.3701	70	108	860094	86.35
9.5	.3740	70	108	860095	81.65
9.6	.3780	70	108	860096	90.85
9.7	.3819	70	108	860097	93.55

TOOL DIAMETER		LENGTH		TYPE 860 - 118° PT.	
mm	INCH	mm	OAL	METRIC EDP NO.	METRIC PRICE
9.8	.3858	70	108	860098	\$97.30
9.9	.3900	73	114	860099	99.50
10.0	.3937	73	114	860100	97.15
10.1	.3976	73	114	860101	103.70
10.2	.4016	73	114	860102	106.10
10.3	.4055	73	114	860103	110.25
10.4	.4094	73	114	860104	112.95
10.5	.4134	73	114	860105	111.15
10.6	.4173	73	114	860106	118.10
10.7	.4213	73	114	860107	120.80
10.8	.4252	73	114	860108	125.10
10.9	.4291	73	114	860109	127.25
11.0	.4331	73	114	860110	124.05
11.1	.4370	73	114	860111	131.40
11.2	.4409	76	120	860112	132.80
11.3	.4449	76	120	860113	137.20
11.4	.4488	76	120	860114	139.45
11.5	.4528	76	120	860115	135.45
11.6	.4567	76	120	860116	143.90
11.7	.4606	76	120	860117	146.00
11.8	.4646	76	120	860118	150.30
11.9	.4685	76	120	860119	152.55
12.0	.4724	76	120	860120	144.05
12.1	.4764	76	120	860121	154.70
12.2	.4803	76	120	860122	155.75
12.3	.4843	76	120	860123	157.75
12.4	.4882	76	120	860124	159.00
12.5	.4921	76	120	860125	160.00
12.6	.4961	76	120	860126	161.15
12.7	.5000	76	120	860127	162.75
13.0	.5118	82	127	860130	190.60
13.5	.5315	82	127	860135	250.45
14.0	.5512	82	127	860140	240.00
14.5	.5709	82	127	860145	309.85
15.0	.5906	82	127	860150	296.45
15.5	.6102	82	127	860155	296.45
16.0	.6299	82	127	860160	268.30
16.5	.6496	89	140	860165	402.30
17.0	.6693	89	140	860170	402.30
17.5	.6890	89	140	860175	374.10
18.0	.7087	89	140	860180	465.85
18.5	.7283	89	140	860185	465.85
19.0	.7480	95	152	860190	437.60
-	-	-	-	-	-

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 - DISCONTINUED WHILE SUPPLIES LAST

- 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	.1250	2 3/4	5 1/8	63008	\$23.40	63108	\$26.60
		.1285	3	5 3/8	63230	32.70	63330	32.30
		.1360	3	5 3/8	63229	32.70	63329	32.30
		.1405	3	5 3/8	63228	32.70	63328	32.30
3/64	27	.1406	3	5 3/8	63009	27.00	63109	28.15
		.1440	3	5 3/8	63227	32.70	63327	32.30
		.1470	3	5 3/8	63226	32.70	63326	32.30
		.1495	3	5 3/8	63225	32.70	63325	32.30
1/2	24	.1520	3	5 3/8	63224	32.70	63324	32.30
		.1540	3	5 3/8	63223	32.70	63323	32.30
		.1562	3	5 3/8	63010	24.85	63110	28.15
		.1570	3	5 3/4	63222	33.90	63322	33.50
5/32	21	.1590	3 3/8	5 3/4	63221	33.90	63321	33.50
		.1610	3 3/8	5 3/4	63220	33.90	63320	33.50
		.1660	3 3/8	5 3/4	63219	33.90	63319	33.50
		.1695	3 3/8	5 3/4	63218	33.90	63318	33.50
11/64	17	.1719	3 3/8	5 3/4	63011	25.25	63111	29.15
		.1730	3 3/8	5 3/4	63217	33.90	63317	33.50
		.1770	3 3/8	5 3/4	63216	33.90	63316	33.50
		.1800	3 3/8	5 3/4	63215	33.90	63315	33.50
3/16	14	.1820	3 3/8	5 3/4	63214	33.90	63314	33.50
		.1850	3 3/8	5 3/4	63213	33.90	63313	33.50
		.1875	3 3/8	5 3/4	63012	25.25	63112	29.15
		.1890	3 3/8	6	63212	35.75	63312	35.30
1/2	11	.1910	3 3/8	6	63211	35.75	63311	35.30
		.1935	3 3/8	6	63210	35.75	63310	35.30
		.1960	3 3/8	6	63209	35.75	63309	35.30
		.1990	3 3/8	6	63208	35.75	63308	35.30
13/64	7	.2010	3 3/8	6	63207	35.75	63307	35.30
		.2031	3 3/8	6	63013	26.80	63113	30.75
		.2040	3 3/8	6	63206	35.75	63306	35.30
		.2055	3 3/8	6	63205	35.75	63305	35.30
7/32	4	.2090	3 3/8	6	63204	35.75	63304	35.30
		.2130	3 3/8	6	63203	35.75	63303	35.30
		.2188	3 3/8	6	63014	26.80	63114	30.75
		.2210	3 3/4	6 1/8	63202	40.50	63302	40.05
15/64	1	.2280	3 3/4	6 1/8	63201	40.50	63301	40.05
		.2340	3 3/4	6 1/8	63401	40.50	63501	40.05
		.2344	3 3/4	6 1/8	63015	30.35	63115	34.70
		.2380	3 3/4	6 1/8	63402	40.50	63502	40.05
1/4	C	.2420	3 3/4	6 1/8	63403	40.50	63503	40.05
		.2460	3 3/4	6 1/8	63404	40.50	63504	40.05
		.2500	3 3/4	6 1/8	63016	30.35	63116	34.70
		.2570	3 7/8	6 1/4	63406	45.30	63506	44.75
17/64	G	.2610	3 7/8	6 1/4	63407	45.30	63507	44.75
		.2656	3 7/8	6 1/4	63017	33.90	63117	38.90
		.2660	3 7/8	6 1/4	63408	45.30	63508	44.75
		.2720	3 7/8	6 1/4	63409	45.30	63509	44.75
9/32	J	.2770	3 7/8	6 1/4	63410	45.30	63510	44.75
		.2810	3 7/8	6 1/4	63411	45.30	63511	44.75
		.2812	3 7/8	6 1/4	63018	33.90	63118	38.90
		.2900	4	6 3/8	63412	49.15	63512	48.35
19/64	M	.2950	4	6 3/8	63413	49.15	63513	48.35
		.2969	4	6 3/8	63019	36.55	63119	42.05
		.3020	4	6 3/8	63414	49.15	63514	48.35
		.3125	4	6 3/8	63020	36.55	63120	42.05
5/16	O	.3160	4 1/8	6 1/2	63415	55.75	63515	54.95
		.3230	4 1/8	6 1/2	63416	55.75	63516	54.95
		.3281	4 1/8	6 1/2	63021	40.30	63121	47.90

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	\$55.75	63517	\$54.95
	R	.3390	4 1/8	6 1/2	63418	55.75	63518	54.95
	S	.3438	4 1/8	6 1/2	63022	40.30	63122	48.35
23/64	T	.3580	4 1/4	6 3/4	63419	60.95	63519	60.20
	U	.3594	4 1/4	6 3/4	63023	45.40	63123	52.40
		.3680	4 1/4	6 3/4	63421	60.95	63521	60.20
3/8	V	.3750	4 1/4	6 3/4	63024	45.40	63124	52.40
		.3770	4 3/8	7	63422	65.25	63522	64.50
		.3860	4 3/8	7	63423	65.25	63523	64.50
25/64	W	.3906	4 3/8	7	63025	48.70	63125	56.10
		.3970	4 3/8	7	63424	65.25	63524	64.50
		.4040	4 3/8	7	63425	65.25	63525	64.50
13/32	Y	.4062	4 3/8	7	63026	48.70	63126	56.10
		.4130	4 3/8	7 1/4	63426	75.30	63526	74.20
		.4219	4 3/8	7 1/4	63027	56.25	63127	64.50
7/16	Z	.4375	4 3/8	7 1/4	63028	56.25	63128	64.50
		.4531	4 3/4	7 1/2	63029	62.50	63129	72.60
		.4688	4 3/4	7 1/2	63030	62.50	63130	72.60
15/32	1	.4844	4 3/4	7 3/4	63031	65.50	63131	74.95
		.5000	4 3/4	7 3/4	63032	71.95	63132	74.95
		.5156	4 3/4	8	63033	93.85	63133	107.50
17/32	2	.5312	4 3/4	8	63034	93.85	63134	107.50
		.5469	4 7/8	8 1/4	63035	94.60	63135	108.45
		.5625	4 7/8	8 1/4	63036	94.60	63136	108.45
33/64	3	.5781	4 7/8	8 3/4	63037	104.45	63137	119.90
		.5938	4 7/8	8 3/4	63038	101.50	63138	116.40
		.6094	4 7/8	8 3/4	63039	120.10	63139	137.60
19/32	4	.6250	4 7/8	8 3/4	63040	115.15	63140	131.80
		.6406	5 1/8	9	63041	132.80	63141	152.30
		.6562	5 1/8	9	63042	117.05	63142	134.10
39/64	5	.6719	5 3/8	9 1/4	63043	152.35	63143	174.65
		.6875	5 3/8	9 1/4	63044	119.30	63144	136.65
		.7031	5 5/8	9 1/2	63045	139.25	63145	153.05
41/64	6	.7188	5 5/8	9 1/2	63046	140.90	63146	154.55
		.7344	5 7/8	9 3/4	63047	141.65	63147	155.40
		.7500	5 7/8	9 3/4	63048	143.75	63148	157.80
49/64	7	.7656	6	9 7/8	63049	146.70	63149	161.10
		.7812	6	9 7/8	63050	149.70	63150	164.40
		.7969	6 1/8	10	63051	152.65	63151	167.70
51/64	8	.8125	6 1/8	10	63052	155.65	63152	171.00
		.8281	6 1/8	10	63053	158.65	63153	174.30
		.8438	6 1/8	10	63054	161.60	63154	177.60
55/64	9	.8594	6 1/8	10	63055	164.60	63155	180.90
		.8750	6 1/8	10	63056	167.55	63156	184.25
		.8906	6 1/8	10	63057	170.55	63157	187.55
57/64	10	.9062	6 1/8	10	63058	173.55	63158	190.85
		.9219	6 1/8	10 3/4	63059	176.55	63159	194.15
		.9375	6 1/8	10 3/4	63060	179.50	63160	197.40
61/64	11	.9531	6 3/8	11	63061	182.45	63161	200.75
		.9688	6 3/8	11	63062	185.45	63162	204.05
		.9844	6 3/8	11	63063	188.45	63163	207.35
1	1.0000	6 3/8	11	63064	191.45	63164	210.65	

DRILLS



TAPER LENGTH DRILLS

CARBIDE TIPPED TYPES 630 & 631 METRIC

MATERIAL SPECIFIC

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 - DISCONTINUED WHILE SUPPLIES LAST



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	\$30.20	631032	\$29.75		
3.3	.1299	76	3	137	5 3/8	630033	30.20	631033	29.75		
3.4	.1339	76	3	137	5 3/8	630034	30.20	631034	29.75		
3.5	.1378	76	3	137	5 3/8	630035	29.25	631035	29.10		
3.6	.1417	76	3	137	5 3/8	630036	29.25	631036	29.10		
3.7	.1457	76	3	137	5 3/8	630037	29.25	631037	29.10		
3.8	.1496	76	3	137	5 3/8	630038	29.25	631038	29.10		
3.9	.1535	76	3	137	5 3/8	630039	29.25	631039	29.10		
4.0	.1575	86	3 3/8	146	5 3/4	630040	28.60	631040	28.30		
4.1	.1614	86	3 3/8	146	5 3/4	630041	30.20	631041	29.75		
4.2	.1654	86	3 3/8	146	5 3/4	630042	30.20	631042	29.75		
4.3	.1693	86	3 3/8	146	5 3/4	630043	30.20	631043	29.75		
4.4	.1732	86	3 3/8	146	5 3/4	630044	31.85	631044	31.30		
4.5	.1772	86	3 3/8	146	5 3/4	630045	31.85	631045	31.30		
4.6	.1811	86	3 3/8	146	5 3/4	630046	31.85	631046	31.30		
4.7	.1850	86	3 3/8	146	5 3/4	63213	33.90	63313	33.50		
4.8	.1890	92	3 3/8	152	6	63212	35.75	63312	35.30		
4.9	.1929	92	3 3/8	152	6	630049	31.85	631049	31.30		
5.0	.1969	92	3 3/8	152	6	630050	31.70	631050	31.30		
5.1	.2008	92	3 3/8	152	6	630051	33.00	631051	32.60		
5.2	.2047	92	3 3/8	152	6	630052	28.40	631052	32.60		
5.3	.2087	92	3 3/8	152	6	630053	33.00	631053	32.60		
5.4	.2126	92	3 3/8	152	6	630054	33.00	631054	32.60		
5.5	.2165	92	3 3/8	152	6	630055	33.80	631055	32.60		
5.6	.2205	95	3 3/4	156	6 1/8	630056	33.00	631056	32.60		
5.7	.2244	95	3 3/4	156	6 1/8	630057	33.00	631057	32.60		
5.8	.2283	95	3 3/4	156	6 1/8	630058	33.00	631058	32.60		
5.9	.2323	95	3 3/4	156	6 1/8	630059	34.40	631059	34.05		
6.0	.2362	95	3 3/4	156	6 1/8	630060	35.10	631060	35.35		
6.1	.2402	95	3 3/4	156	6 1/8	630061	36.65	631061	36.05		
6.2	.2441	95	3 3/4	156	6 1/8	630062	36.65	631062	36.05		
6.3	.2480	95	3 3/4	156	6 1/8	630063	36.65	631063	36.05		
6.4	.2520	98	3 7/8	159	6 1/4	630064	40.30	631064	39.75		
6.5	.2559	98	3 7/8	159	6 1/4	630065	36.40	631065	39.75		
6.6	.2598	98	3 7/8	159	6 1/4	630066	41.55	631066	40.80		
6.7	.2638	98	3 7/8	159	6 1/4	630067	41.55	631067	40.80		
6.8	.2677	98	3 7/8	159	6 1/4	630068	41.55	631068	40.80		
6.9	.2717	98	3 7/8	159	6 1/4	630069	41.55	631069	40.80		
7.0	.2756	98	3 7/8	159	6 1/4	630070	37.95	631070	39.75		
7.1	.2795	98	3 7/8	159	6 1/4	630071	41.55	631071	40.80		
7.2	.2835	102	4	162	6 3/8	630072	41.55	631072	40.80		
7.3	.2874	102	4	162	6 3/8	630073	41.55	631073	40.80		
7.4	.2913	102	4	162	6 3/8	630074	41.55	631074	40.80		
7.5	.2953	102	4	162	6 3/8	630075	40.25	631075	43.00		
7.6	.2992	102	4	162	6 3/8	630076	43.45	631076	43.00		
7.7	.3031	102	4	162	6 3/8	630077	43.45	631077	43.00		
7.8	.3071	102	4	162	6 3/8	630078	43.45	631078	43.00		
7.9	.3110	102	4	162	6 3/8	630079	43.45	631079	43.00		
8.0	.3150	105	4 1/8	165	6 1/2	630080	40.80	631080	43.00		
8.1	.3189	105	4 1/8	165	6 1/2	630081	43.45	631081	43.00		
8.2	.3228	105	4 1/8	165	6 1/2	630082	46.35	631082	45.65		
8.3	.3268	105	4 1/8	165	6 1/2	630083	46.35	631083	45.65		
8.4	.3307	105	4 1/8	165	6 1/2	630084	46.35	631084	45.65		
8.5	.3346	105	4 1/8	165	6 1/2	630085	42.75	631085	48.65		
8.6	.3386	105	4 1/8	165	6 1/2	630086	49.35	631086	48.65		
8.7	.3425	105	4 1/8	165	6 1/2	630087	49.35	631087	48.65		

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	\$49.35	631088	\$48.65		
8.9	.3504	108	4 1/4	171	6 3/4	630089	49.35	631089	48.65		
9.0	.3543	108	4 1/4	171	6 3/4	630090	46.20	631090	53.40		
9.1	.3583	108	4 1/4	171	6 3/4	630091	54.05	631091	53.40		
9.2	.3622	108	4 1/4	171	6 3/4	630092	54.05	631092	53.40		
9.3	.3661	108	4 1/4	171	6 3/4	630093	54.05	631093	53.40		
9.4	.3701	108	4 1/4	171	6 3/4	630094	54.05	631094	53.40		
9.5	.3740	108	4 1/4	171	6 3/4	630095	47.30	631095	53.40		
9.6	.3780	111	4 3/8	178	7	630096	56.75	631096	56.00		
9.7	.3819	111	4 3/8	178	7	630097	56.75	631097	56.00		
9.8	.3858	111	4 3/8	178	7	630098	56.75	631098	56.00		
9.9	.3898	111	4 3/8	178	7	630099	56.75	631099	56.00		
10.0	.3937	111	4 3/8	178	7	630100	49.80	631100	57.35		
10.1	.3976	111	4 3/8	178	7	630101	58.10	631101	57.35		
10.2	.4016	111	4 3/8	178	7	630102	60.60	631102	59.70		
10.3	.4055	111	4 3/8	178	7	630103	60.60	631103	59.70		
10.4	.4094	117	4 5/8	184	7 1/4	630104	63.30	631104	62.25		
10.5	.4134	117	4 5/8	184	7 1/4	630105	56.65	631105	62.25		
10.6	.4173	117	4 5/8	184	7 1/4	630106	66.30	631106	65.45		
10.7	.4213	117	4 5/8	184	7 1/4	630107	66.30	631107	65.45		
10.8	.4252	117	4 5/8	184	7 1/4	630108	66.30	631108	65.45		
10.9	.4291	117	4 5/8	184	7 1/4	630109	66.30	631109	65.45		
11.0	.4331	117	4 5/8	184	7 1/4	630110	61.25	631110	65.70		
11.5	.4528	121	4 3/4	190	7 1/2	630115	68.75	631115	72.70		
12.0	.4724	121	4 3/4	197	7 3/4	630120	75.20	631120	76.45		
12.5	.4921	121	4 3/4	197	7 3/4	630125	78.05	631125	76.45		
13.0	.5118	121	4 3/4	203	8	630130	93.85	631130	107.50		
13.5	.5315	121	4 3/4	203	8	630135	94.60	631135	108.45		
14.0	.5512	124	4 7/8	210	8 1/4	630140	94.60	631140	108.45		
14.5	.5709	124	4 7/8	222	8 3/4	630145	104.45	631145	119.90		
15.0	.5906	124	4 7/8	222	8 3/4	630150	104.45	631150	119.90		
15.5	.6102	124	4 7/8	222	8 3/4	630155	120.10	631155	137.60		
16.0	.6299	130	5 1/8	229	9	630160	132.80	631160	152.30		
16.5	.6496	130	5 1/8	229	9	630165	132.80	631165	152.30		
17.0	.6693	137	5 3/8	235	9 1/4	630170	152.35	631170	174.65		
17.5	.6890	143	5 5/8	241	9 1/2	630175	139.25	631175	153.05		
18.0	.7087	143	5 5/8	241	9 1/2	630180	140.90	631180	154.55		
18.5	.7283	149	5 7/8	248	9 3/4	630185	141.65	631185	155.40		
19.0	.7480	149	5 7/8	248	9 3/4	630190	143.75	631190	157.80		
19.5	.7677	152	6	251	9 7/8	630195	149.70	631195	164.40		
20.0	.7874	156	6 1/8	254	10	630200	152.65	631200	167.70		
20.5	.8071	156	6 1/8	254	10	630205	155.65	631205	171.00		
21.0	.8268	156	6 1/8	254	10	630210	158.65	631210	174.30		
21.5	.8465	156	6 1/8	254	10	630215	164.60	631215	180.90		
22.0	.8661	156	6 1/8	254	10	630220	167.55	631220	184.25		
22.5	.8858	156	6 1/8	254	10	630225	170.55	631225	187.55		
23.0	.9055	156	6 1/8	254	10	630230	173.55	631230	190.85		
23.5	.9252										



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

DISCONTINUED - WHILE SUPPLIES LAST

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	\$53.90	66116	\$61.15
17/64	.2656	3	6 1/4	1	66017	NA	66117	NA
9/32	.2812	3	6 1/4	1	66018	NA	66118	NA
19/64	.2969	3 1/8	6 3/8	1	66019	NA	66119	NA
5/16	.3125	3 1/8	6 3/8	1	66020	55.15	66120	62.50
21/64	.3281	3 3/4	6 1/2	1	66021	70.20	66121	79.35
11/32	.3438	3 3/4	6 1/2	1	66022	70.20	66122	79.35
23/64	.3594	3 1/2	6 3/4	1	66023	70.20	66123	79.35
3/8	.3750	3 1/2	6 3/4	1	66024	70.20	66124	79.35
25/64	.3906	3 5/8	7	1	66025	81.20	66125	92.00
13/32	.4062	3 5/8	7	1	66026	81.20	66126	92.00
27/64	.4219	3 7/8	7 1/4	1	66027	81.20	66127	92.00
7/16	.4375	3 7/8	7 1/4	1	66028	71.00	66128	80.55
29/64	.4531	4 1/8	7 1/2	1	66029	86.30	66129	97.85
15/32	.4688	4 1/8	7 1/2	1	66030	86.30	66130	97.85
31/64	.4844	4 3/8	8 1/4	2	66031	86.30	66131	97.85
1/2	.5000	4 3/8	8 1/4	2	66032	67.95	66132	90.45
33/64	.5156	4 5/8	8 1/2	2	66033	87.70	66133	105.25
17/32	.5312	4 5/8	8 1/2	2	66034	71.65	66134	93.05
35/64	.5469	4 7/8	8 3/4	2	66035	89.00	66135	106.70
9/16	.5625	4 7/8	8 3/4	2	66036	72.25	66136	94.35
37/64	.5781	4 7/8	8 3/4	2	66037	93.05	66137	111.80
19/32	.5938	4 7/8	8 3/4	2	66038	79.70	66138	104.40
39/64	.6094	4 7/8	8 3/4	2	66039	107.85	66139	129.50
5/8	.6250	4 7/8	8 3/4	2	66040	87.80	66140	114.30
41/64	.6406	5 1/8	9	2	66041	109.55	66141	131.50
21/32	.6562	5 1/8	9	2	66042	85.60	66142	116.25
43/64	.6719	5 3/8	9 1/4	2	66043	110.85	66143	133.15
11/16	.6875	5 3/8	9 1/4	2	66044	88.35	66144	117.60
45/64	.7031	5 5/8	9 1/2	2	66045	113.95	66145	136.65
23/32	.7188	5 5/8	9 1/2	2	66046	98.15	66146	131.10
47/64	.7344	5 7/8	9 3/4	2	66047	116.20	66147	139.45
3/4	.7500	5 7/8	9 3/4	2	66048	100.50	66148	126.80
49/64	.7656	6	9 7/8	2	66049	123.55	66149	148.40
25/32	.7812	6	9 7/8	2	66050	119.65	66150	148.35
51/64	.7969	6 1/8	10 3/4	3	66051	124.85	66151	149.80
13/16	.8125	6 1/8	10 3/4	3	66052	120.95	66152	149.90
53/64	.8281	6 1/8	10 3/4	3	66053	135.45	66153	162.60
27/32	.8438	6 1/8	10 3/4	3	66054	123.50	66154	149.90
55/64	.8594	6 1/8	10 3/4	3	66055	NA	66155	NA

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	\$131.35	66156	\$158.40
57/64	.8906	6 1/8	10 3/4	3	66057	141.50	66157	169.55
29/32	.9062	6 1/8	10 3/4	3	66058	142.45	66158	165.00
59/64	.9219	6 1/8	10 3/4	3	66059	144.05	66159	172.70
15/16	.9375	6 1/8	10 3/4	3	66060	144.50	66160	159.75
61/64	.9531	6 3/8	11	3	66061	NA	66161	NA
31/32	.9688	6 3/8	11	3	66062	150.75	66162	174.70
63/64	.9844	6 3/8	11	3	66063	157.80	66163	189.30
1	1.0000	6 3/8	11	3	66064	142.25	66164	171.85
1 1/64	1.0156	6 1/2	11 1/8	3	66065	NA	66165	NA
1 1/32	1.0312	6 1/2	11 1/8	3	66066	191.80	66166	217.50
1 1/64	1.0469	6 5/8	11 1/4	3	66067	NA	66167	NA
1 1/16	1.0625	6 5/8	11 1/4	3	66068	184.30	66168	233.55
1 1/64	1.0781	6 7/8	12 1/2	4	66069	NA	66169	NA
1 1/32	1.0938	6 7/8	12 1/2	4	66070	NA	66170	NA
1 1/64	1.1094	7 1/8	12 3/4	4	66071	NA	66171	NA
1 1/8	1.1250	7 1/8	12 3/4	4	66072	204.05	66172	259.00
1 1/64	1.1406	7 1/4	12 7/8	4	66073	NA	66173	NA
1 1/32	1.1562	7 1/4	12 7/8	4	66074	NA	66174	NA
1 1/64	1.1719	7 3/8	13	4	66075	NA	66175	NA
1 3/16	1.1875	7 3/8	13	4	66076	233.80	66176	296.40
1 13/64	1.2031	7 1/2	13 1/8	4	66077	NA	66177	NA
1 7/32	1.2188	7 1/2	13 1/8	4	66078	NA	66178	NA
1 15/64	1.2344	7 7/8	13 1/2	4	66079	NA	66179	NA
1 1/4	1.2500	7 7/8	13 1/2	4	66080	250.20	66180	317.50
1 9/32	1.2812	8 1/2	14 1/8	4	66082	NA	66182	NA
1 5/16	1.3125	8 5/8	14 1/4	4	66084	353.90	66184	400.85
1 11/32	1.3438	8 3/4	14 3/8	4	66086	NA	66186	NA
1 3/8	1.3750	8 7/8	14 1/2	4	66088	396.65	66188	449.35
1 13/32	1.4062	9	14 5/8	4	66090	NA	66190	NA
1 7/16	1.4375	9 1/8	14 3/4	4	66092	NA	66192	NA
1 15/32	1.4688	9 1/4	14 7/8	4	66094	NA	66194	NA
1 1/2	1.5000	9 3/8	15	4	66096	435.10	66196	493.05



TAPER SHANK DRILLS CARBIDE TIPPED TYPE 660 METRIC



118° STANDARD POINT

DISCONTINUED - WHILE SUPPLIES LAST

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	\$89.40
13.5	.5315	117	4 5/8	216	8 1/2	2	660135	82.85
14.0	.5512	124	4 7/8	222	8 3/4	2	660140	83.95
14.5	.5709	124	4 7/8	222	8 3/4	2	660145	94.90
15.0	.5906	124	4 7/8	222	8 3/4	2	660150	88.00
15.5	.6102	124	4 7/8	222	8 3/4	2	660155	110.05
16.0	.6299	130	5 1/8	229	9	2	660160	111.80
16.5	.6496	130	5 1/8	229	9	2	660165	103.65
17.0	.6693	137	5 3/8	235	9 1/4	2	660170	113.00
17.5	.6890	143	5 5/8	241	9 1/2	2	660175	116.20
18.0	.7087	143	5 5/8	241	9 1/2	2	660180	107.60
18.5	.7283	149	5 7/8	248	9 3/4	2	660185	118.50
19.0	.7480	149	5 7/8	248	9 3/4	2	660190	109.60
20.0	.7874	156	6 1/8	273	10 3/4	3	660200	127.20
21.0	.8268	156	6 1/8	273	10 3/4	3	660210	127.20
22.0	.8661	156	6 1/8	273	10 3/4	3	660220	124.50
23.0	.9055	156	6 1/8	273	10 3/4	3	660230	128.70
24.0	.9449	162	6 3/8	279	11	3	660240	148.50
25.0	.9843	162	6 3/8	279	11	3	660250	152.35
26.0	1.0236	165	6 1/2	283	11 1/8	3	660260	228.20
28.0	1.1024	181	7 1/8	324	12 3/4	4	660280	253.00
30.0	1.1811	187	7 3/8	330	13	4	660300	304.60
32.0	1.2598	216	8 1/2	359	14 1/8	4	660320	378.30
34.0	1.3386	222	8 3/4	365	14 3/8	4	660340	406.40
36.0	1.4173	232	9 1/8	375	14 3/4	4	660360	465.30
38.0	1.4961	238	9 3/8	381	15	4	660380	483.85

DRILLS



TAPER SHANK DRILLS CARBIDE TIPPED TYPE 668 FRACTIONAL

SMALLER TAPER SHANK NUMBER 118° STANDARD POINT

DISCONTINUED - WHILE SUPPLIES LAST

While supplies last



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

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	\$98.75
1/2	.5000	4 3/8	7 3/4	1	66832	77.55
33/64	.5156	4 5/8	8	1	66833	95.65
17/32	.5312	4 5/8	8	1	66834	81.95
35/64	.5469	4 7/8	8 1/4	1	66835	97.00
9/16	.5625	4 7/8	8 1/4	1	66836	82.55
51/64	.7969	6 1/8	10	2	66851	136.20
13/16	.8125	6 1/8	10	2	66852	115.55
53/64	.8281	6 1/8	10	2	66853	136.20
27/32	.8438	6 1/8	10	2	66854	118.00
55/64	.8594	6 1/8	10	2	66855	143.85
7/8	.8750	6 1/8	10	2	66856	125.65
29/32	.9062	6 1/8	10	2	66858	135.00
1 3/32	1.0938	6 7/8	11 1/2	3	66870	286.75
1 1/8	1.1250	7 1/8	11 3/4	3	66872	206.05
1 5/32	1.1562	7 1/4	11 7/8	3	66874	279.65
1 3/16	1.1875	7 3/8	12	3	66876	236.00
1 1/4	1.2500	7 7/8	12 1/2	3	66880	252.50



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



DISCONTINUED - WHILE SUPPLIES LAST

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	\$167.45
17/32	.5312	8	12	2	66434	193.65
9/16	.5625	8	12	2	66436	193.65
19/32	.5938	8	12	2	66438	193.65
5/8	.6250	8	12	2	66440	256.35
21/32	.6562	8	12	2	66442	269.15
11/16	.6875	8	12	2	66444	269.15
23/32	.7188	8	12	2	66446	282.65
3/4	.7500	8	12	2	66448	282.65
25/32	.7812	8	12	2	66450	296.75

TYPE 665 – 11" FLUTE LENGTH

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	\$274.35
21/32	.6562	11	14 3/4	2	66542	288.00
43/64	.6719	11	14 3/4	2	66543	305.25
11/16	.6875	11	14 3/4	2	66544	288.00
23/32	.7188	11	14 3/4	2	66546	302.40
3/4	.7500	11	14 3/4	2	66548	302.40
25/32	.7812	11	14 3/4	2	66550	317.50
13/16	.8125	11	15 1/2	3	66552	347.00
27/32	.8438	11	15 1/2	3	66554	347.00
7/8	.8750	11	15 1/2	3	66556	347.00
29/32	.9062	11	15 1/2	3	66558	423.80
15/16	.9375	11	15 1/2	3	66560	423.80
31/32	.9688	11	15 1/2	3	66562	445.10
1	1.0000	11	15 1/2	3	66564	445.10
1 1/32	1.0312	11	15 1/2	3	66566	458.45
1 1/16	1.0625	11	15 1/2	3	66568	472.20

While supplies last

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	\$33.00	61332	\$39.00
	31	.1200	1 3/8	61231	29.60	61331	34.80
		.1250	1 3/8	61008	22.95	61108	27.00
	30	.1285	1 3/8	61230	31.20	61330	36.65
9/64	29	.1360	1 3/4	61229	32.20	61329	37.90
	28	.1405	1 3/4	61228	32.70	61328	38.60
		.1406	1 3/4	61009	24.90	61109	29.25
	27	.1440	1 7/8	61227	33.50	61327	39.30
5/32	26	.1470	1 7/8	61226	32.70	61326	38.60
	25	.1495	1 7/8	61225	32.70	61325	38.60
	24	.1520	2	61224	33.50	61324	39.30
	23	.1540	2	61223	32.70	61323	38.60
1/4	22	.1562	2	61010	24.35	61110	28.75
		.1570	2	61222	35.75	61322	42.10
	21	.1590	2 1/8	61221	34.65	61321	40.90
	20	.1610	2 1/8	61220	35.60	61320	41.80
11/64	19	.1660	2 1/8	61219	35.60	61319	41.80
	18	.1695	2 1/8	61218	35.60	61318	41.80
		.1719	2 1/8	61011	26.70	61111	31.30
	17	.1730	2 3/16	61217	35.60	61317	41.80
3/16	16	.1770	2 3/16	61216	34.65	61316	40.90
	15	.1800	2 3/16	61215	35.75	61315	42.10
	14	.1820	2 3/16	61214	34.65	61314	40.90
	13	.1850	2 3/16	61213	34.65	61313	40.90
5/16	12	.1875	2 5/16	61012	25.95	61112	30.65
		.1890	2 5/16	61212	36.20	61312	42.50
	11	.1910	2 5/16	61211	36.55	61311	43.15
	10	.1935	2 5/16	61210	36.20	61310	42.50
3/8	9	.1960	2 7/16	61209	36.55	61309	43.15
	8	.1990	2 7/16	61208	36.55	61308	43.15
	7	.2010	2 7/16	61207	36.55	61307	43.15
		.2031	2 7/16	61013	28.50	61113	33.50
7/16	6	.2040	2 1/2	61206	37.60	61306	44.30
	5	.2055	2 1/2	61205	36.55	61305	43.15
	4	.2090	2 1/2	61204	34.40	61304	40.50
	3	.2130	2 1/2	61203	36.55	61303	43.15
1/2	2	.2188	2 1/2	61014	28.50	61114	33.50
		.2210	2 3/8	61202	36.00	61302	42.35
	1	.2280	2 3/8	61201	35.60	61301	41.80
	A	.2340	2 3/8	61401	42.75	61501	50.15
5/8		.2344	2 3/8	61015	30.65	61115	36.05

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	\$42.75	61502	\$50.15
	C	.2420	2 3/4	61403	42.75	61503	50.15
	D	.2460	2 3/4	61404	42.00	61504	49.35
	E	.2500	2 3/4	61016	30.65	61116	36.05
5/16	F	.2570	2 7/8	61406	43.85	61506	51.55
	G	.2610	2 7/8	61407	44.80	61507	52.80
		.2656	2 7/8	61017	32.70	61117	38.60
	H	.2660	2 7/8	61408	45.80	61508	53.90
3/8	I	.2720	2 7/8	61409	44.80	61509	52.80
	J	.2770	2 7/8	61410	45.80	61510	53.90
	K	.2810	2 15/16	61411	45.80	61511	53.90
		.2812	2 15/16	61018	32.70	61118	38.60
7/16	L	.2900	2 15/16	61412	45.80	61512	53.90
	M	.2950	3 1/16	61413	50.50	61513	59.40
		.2969	3 1/16	61019	35.60	61119	41.80
	N	.3020	3 1/16	61414	49.35	61514	58.10
1/2	O	.3125	3 3/16	61020	35.60	61120	41.80
		.3160	3 3/16	61415	47.00	61515	55.20
	P	.3230	3 5/16	61416	49.95	61516	58.70
		.3281	3 5/16	61021	37.80	61121	44.50
5/8	Q	.3320	3 7/16	61417	51.30	61517	60.30
	R	.3390	3 7/16	61418	49.95	61518	58.70
		.3438	3 7/16	61022	37.80	61122	44.50
	S	.3480	3 1/2	61419	54.00	61519	63.45
3/4	T	.3580	3 1/2	61420	55.35	61520	65.05
		.3594	3 1/2	61023	40.30	61123	47.25
	U	.3680	3 5/8	61421	53.20	61521	62.65
		.3750	3 5/8	61024	40.30	61124	47.25
7/8	V	.3770	3 5/8	61422	54.00	61522	63.45
	W	.3860	3 3/4	61423	57.95	61523	68.10
		.3906	3 3/4	61025	41.35	61125	48.70
	X	.3970	3 3/4	61424	54.80	61524	64.55
1 1/8	Y	.4040	3 7/8	61425	56.90	61525	66.95
		.4062	3 7/8	61026	40.80	61126	47.95
	Z	.4130	3 7/8	61426	64.20	61526	75.50
		.4219	3 15/16	61027	44.80	61127	52.80
1 1/4		.4375	4 1/16	61028	44.80	61128	52.80
		.4531	4 3/16	61029	51.50	61129	60.65
		.4688	4 3/16	61030	50.50	61130	59.40
		.4844	4 3/8	61031	56.65	61131	66.65
1 1/2		.5000	4 1/2	61032	56.65	61132	66.65



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	-	-	\$35.20
* 5/64	.0781	-	1 1/2	67005	67105	-	-	35.20
* 3/32	.0938	-	2	67006	67106	-	-	38.65
* 7/64	.1094	-	2	67007	67107	-	-	38.65
* 1/8	.1250	-	2	67008	67108	-	-	39.80
* 9/64	.1406	-	2	67009	67109	-	-	39.80
* 5/32	.1562	-	2	67010	67110	-	-	41.90
* 11/64	.1719	-	2 3/8	67011	67111	-	-	41.90
3/16	.1875	1 1/2	3 1/2	67012	67112	67212	67312	38.00
13/64	.2031	1 1/2	3 1/2	67013	67113	67213	67313	38.00
7/32	.2188	1 3/4	3 3/4	67014	67114	67214	67314	39.25
15/64	.2344	1 3/4	3 3/4	67015	67115	67215	67315	40.50
1/4	.2500	2	4	67016	67116	67216	67316	40.50
17/64	.2656	2	4	67017	67117	67217	67317	42.80
9/32	.2812	2 1/4	4 1/4	67018	67118	67218	67318	42.80
19/64	.2969	2 1/4	4 1/4	67019	67119	67219	67319	44.80
5/16	.3125	2 1/2	4 1/2	67020	67120	67220	67320	44.80
21/64	.3281	2 1/2	4 1/2	67021	67121	67221	67321	47.75
11/32	.3438	2 3/4	4 3/4	67022	67122	67222	67322	47.75
23/64	.3594	2 3/4	4 3/4	67023	67123	67223	67323	51.40
3/8	.3750	3	5	67024	67124	67224	67324	51.40
25/64	.3906	3	5	67025	67125	67225	67325	57.95
13/32	.4062	3	5 1/4	67026	67126	67226	67326	60.05
27/64	.4219	3	5 1/4	67027	67127	67227	67327	64.90
7/16	.4375	3	5 1/2	67028	67128	67228	67328	69.75
29/64	.4531	3	5 1/2	67029	67129	67229	67329	73.15
15/32	.4688	3 1/4	5 3/4	67030	67130	67230	67330	76.70
31/64	.4844	3 1/4	5 3/4	67031	67131	67231	67331	92.95
1/2	.5000	3 1/2	6	67032	67132	67232	67332	89.85
17/32	.5312	3 1/2	6	67034	67134	67234	67334	103.05
9/16	.5625	3 1/2	6	67036	67136	67236	67336	106.60
19/32	.5938	4	7	67038	67138	67238	67338	112.80
5/8	.6250	4	7	67040	67140	67240	67340	116.25
21/32	.6562	4 1/2	7 1/2	67042	67142	67242	67342	124.45
11/16	.6875	4 1/2	7 1/2	67044	67144	67244	67344	127.70
23/32	.7188	4 3/4	8	67046	67146	67246	67346	133.85
3/4	.7500	4 3/4	8	67048	67148	67248	67348	137.60
25/32	.7812	4 3/4	8	67050	67150	67250	67350	265.65
13/16	.8125	4 3/4	8	67052	67152	67252	67352	246.55
7/8	.8750	4 3/4	8	67056	67156	67256	67356	251.70
15/16	.9375	4 3/4	8	67060	67160	67260	67360	280.30
1	1.0000	4 3/4	8	67064	67164	67264	67364	297.40

*Solid carbide

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	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

DISCONTINUED - WHILE SUPPLIES LAST (BELOW)

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
mm	INCH	FLUTE		OVERALL				
5.0	.1969	38	1 1/2	89	3 1/2	670050	672050	\$35.55
5.5	.2165	45	1 3/4	95	3 3/4	670055	672055	39.45
6.0	.2362	51	2	102	4	670060	672060	39.75
6.5	.2559	51	2	102	4	670065	672065	42.05
7.0	.2756	57	2 1/4	108	4 1/4	670070	672070	42.05
7.5	.2953	57	2 1/4	108	4 1/4	670075	672075	43.95
8.0	.3150	64	2 1/2	114	4 1/2	670080	672080	47.40
8.5	.3346	70	2 3/4	121	4 3/4	670085	672085	47.40
9.0	.3543	70	2 3/4	121	4 3/4	670090	672090	50.55
9.5	.3740	76	3	127	5	670095	672095	47.95
10.0	.3937	76	3	133	5 1/4	670100	672100	58.95
10.5	.4134	76	3	133	5 1/4	670105	672105	68.35
11.0	.4331	76	3	140	5 1/2	670110	672110	96.25
11.5	.4528	76	3	140	5 1/2	670115	672115	72.00
12.0	.4724	83	3 1/4	146	5 3/4	670120	672120	88.00
12.5	.4921	89	3 1/2	152	6	670125	672125	88.00
13.0	.5118	89	3 1/2	152	6	670130	672130	101.00
13.5	.5315	89	3 1/2	152	6	670135	672135	101.00
14.0	.5512	89	3 1/2	152	6	670140	672140	104.60



HARD STEEL DIE DRILLS SOLID CARBIDE TYPES 674 & 675 FRACTIONAL

MATERIAL SPECIFIC

SPADE TYPE 120° OR 140° POINT



DISCONTINUED - WHILE SUPPLIES LAST

TYPE 674 – 120° POINT SPADE TYPE

- Cam relieved 120° point
- 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 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				
* 3/32	.0938	2	67406	67506	\$22.45
* 7/64	.1094	2	67407	67507	22.95
* 1/8	.1250	2	67408	67508	22.95
* 9/64	.1406	2	67409	67509	24.85
* 5/32	.1562	2	67410	67510	28.55
* 11/64	.1719	3	67411	67511	30.50
* 3/16	.1875	3	67412	67512	36.05
* 13/64	.2031	3	67413	67513	40.60

*Solid carbide

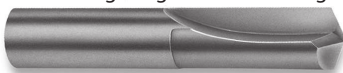


SOLID CARBIDE DIE DRILLS TYPE 893 FRACTIONAL

MATERIAL SPECIFIC

TYPE 893 DISCONTINUED - WHILE SUPPLIES LAST

- 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	\$12.45
1/16	.0625	5/8	1 3/4	89304	12.45
5/64	.0781	3/4	1 3/4	89305	12.95
3/32	.0938	3/4	1 3/4	89306	13.40
7/64	.1094	7/8	1 7/8	89307	14.10
1/8	.1250	7/8	1 7/8	89308	14.85
9/64	.1406	1	2	89309	17.40
5/32	.1562	1	2 1/8	89310	18.25
11/64	.1719	1 1/8	2 1/8	89311	22.45
3/16	.1875	1 1/8	2 1/4	89312	24.40
13/64	.2031	1 3/16	2 1/4	89313	26.90
7/32	.2188	1 1/4	2 1/2	89314	28.10

TOOL DIAMETER		LENGTH		TYPE 893 140° PT. EDP NO.	PRICE
FRACTIONAL	DECIMAL	FLUTE	OVERALL		
15/64	.2344	1 5/16	2 1/2	89315	\$32.60
1/4	.2500	1 3/8	2 1/2	89316	30.75
17/64	.2656	1 7/16	2 3/4	89317	50.35
9/32	.2812	1 1/2	2 3/4	89318	52.05
19/64	.2969	1 9/16	2 3/4	89319	54.70
5/16	.3125	1 5/8	2 3/4	89320	47.85
21/64	.3281	1 3/4	3	89321	56.95
11/32	.3438	1 3/4	3	89322	59.70
23/64	.3594	1 3/4	3	89323	66.10
3/8	.3750	1 7/8	3	89324	62.95
25/64	.3906	2	3 1/4	89325	74.10
13/32	.4062	2	3 1/4	89326	82.20
27/64	.4219	2	3 1/2	89327	84.30
7/16	.4375	2 1/16	3 1/2	89328	84.45
29/64	.4531	2 1/8	3 3/4	89329	103.70
15/32	.4688	2 1/8	3 3/4	89330	104.10
31/64	.4844	2 1/4	3 3/4	89331	104.75
1/2	.5000	2 1/4	3 3/4	89332	93.40

DRILLS



REDUCED SHANK DIAMETER DRILLS

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



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

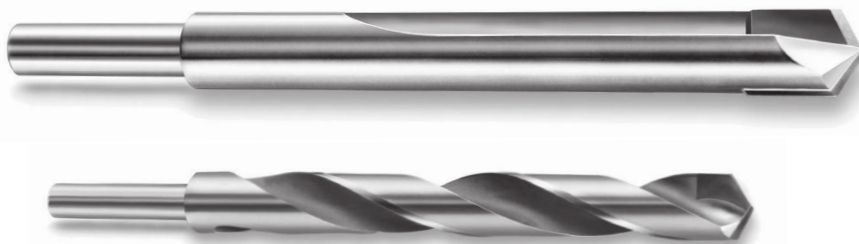
MODIFICATIONS (Prompt delivery)

- 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

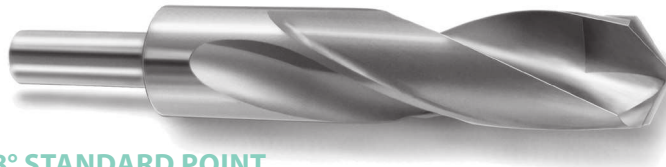
SHANK DIAM.	TOOL DIAMETER		STUB LENGTH DRILLS (reference pg. 120)				JOBBER'S LENGTH DRILLS (reference pg. 122)				HARD STEEL DIE DRILLS (reference pg. 134)				
			OVER-ALL LENGTH	TYPE 640 118° PT.		TYPE 641 135° PT.		OVER-ALL LENGTH	TYPE 600 118° PT.		TYPE 601 135° PT.		OVER-ALL LENGTH	TYPE 670 NEG. 118° PT.	BOTH TYPES PRICE
	FRAC.	DEC.		EDP NO.	PRICE	EDP NO.	PRICE		EDP NO.	PRICE	EDP NO.	PRICE			
1/4	9/32	.2812	2 1/16	640618	\$41.55	641618	\$48.20	4 1/4	600618	\$41.10	601618	\$47.65	-	-	-
	5/16	.3125	2 13/16	640620	44.10	641620	51.30	4 1/2	600620	44.40	601620	51.60	4 1/2	670620	\$67.30
	11/32	.3438	3	640622	51.40	641622	59.50	4 3/4	600622	47.20	601622	54.95	4 3/4	670622	71.65
	3/8	.3750	3 1/8	640624	52.60	641624	61.15	5	600624	50.15	601624	58.35	5	670624	77.00
	13/32	.4062	3 5/16	640626	62.40	641626	72.65	5 1/4	600626	54.55	601626	63.50	5 1/4	670626	90.30
	7/16	.4375	3 7/16	640628	66.70	641628	74.00	5 1/2	600628	59.40	601628	68.95	5 1/2	670628	104.60
	15/32	.4688	3 5/8	640630	94.95	641630	110.45	5 3/4	600630	66.80	601630	77.40	5 3/4	670630	114.90
	1/2	.5000	3 3/4	640632	90.85	641632	105.60	6	600632	82.20	601632	86.55	6	670632	134.80
3/8	13/32	.4062	3 5/16	640726	62.40	641726	72.65	5 1/4	600726	54.55	601726	63.50	-	-	-
	7/16	.4375	3 7/16	640728	66.70	641728	74.00	5 1/2	600728	59.40	601728	68.95	5 1/2	670728	104.60
	15/32	.4688	3 5/8	640730	94.95	641730	110.45	5 3/4	600730	66.80	601730	77.40	5 3/4	670730	114.90
	1/2	.5000	3 3/4	640732	90.85	641732	105.60	6	600732	82.20	601732	86.55	6	670732	134.80
	17/32	.5312	3 7/8	640734	113.30	641734	127.60	6 5/8	600734	106.95	601734	124.30	6	670734	154.60
	9/16	.5625	4	640736	113.30	641736	127.60	6 3/8	600736	108.00	601736	125.40	6	670736	159.95
	19/32	.5938	4 1/8	640738	129.90	641738	146.45	7 1/8	600738	116.00	601738	134.50	7	670738	169.25
	5/8	.6250	4 1/4	640740	129.90	641740	146.45	7 1/8	600740	131.45	601740	152.35	7	670740	174.40
	21/32	.6562	4 1/2	640742	156.20	641742	176.20	7 1/8	600742	133.55	601742	154.95	7 1/2	670742	186.60
	11/16	.6875	4 5/8	640744	160.25	641744	180.85	7 5/8	600744	136.15	601744	157.90	7 1/2	670744	191.70
	23/32	.7188	4 3/4	640746	181.75	641746	211.05	7 5/8	600746	160.70	601746	178.75	8	670746	200.85
	3/4	.7500	5	640748	182.20	641748	205.20	8	600748	164.05	601748	182.35	8	670748	206.15
1/2	17/32	.5312	3 7/8	640834	113.30	641834	127.60	6 5/8	600834	106.95	601834	124.30	-	-	-
	9/16	.5625	4	640836	113.30	641836	127.60	6 3/8	600836	108.00	601836	125.40	6	670836	159.95
	19/32	.5938	4 1/8	640838	129.90	641838	146.45	7 1/8	600838	116.00	601838	134.50	7	670838	169.25
	5/8	.6250	4 1/4	640840	129.90	641840	146.45	7 1/8	600840	131.45	601840	152.35	7	670840	174.40
	21/32	.6562	4 1/2	640842	156.20	641842	176.20	7 1/8	600842	133.55	601842	154.95	7 1/2	670842	186.60
	11/16	.6875	4 5/8	640844	160.25	641844	180.85	7 5/8	600844	136.15	601844	157.90	7 1/2	670844	191.70
	23/32	.7188	4 3/4	640846	181.75	641846	211.05	7 5/8	600846	160.70	601846	178.75	8	670846	200.85
	3/4	.7500	5	640848	182.20	641848	205.20	8	600848	164.05	601848	182.35	8	670848	206.15
	13/16	.8125	5 1/4	640852	225.15	641852	254.10	-	-	-	-	-	8	670852	369.75
	7/8	.8750	5 1/2	640856	247.15	641856	278.60	-	-	-	-	-	8	670856	377.45
	15/16	.9375	5 3/4	640860	265.30	641860	299.25	-	-	-	-	-	8	670860	420.60
	1	1.0000	6	640864	280.25	641864	316.20	-	-	-	-	-	8	670864	446.20
3/4	13/16	.8125	5 1/4	640952	225.15	641952	254.10	-	-	-	-	-	8	670952	369.75
	7/8	.8750	5 1/2	640956	247.15	641956	278.60	-	-	-	-	-	8	670956	377.45
	15/16	.9375	5 3/4	640960	265.30	641960	299.25	-	-	-	-	-	8	670960	420.60
	1	1.0000	6	640964	280.25	641964	316.20	-	-	-	-	-	8	670964	446.20
	1 1/16	1.0625	6 1/4	640968	351.20	641968	396.00	-	-	-	-	-	-	-	-
	1 1/8	1.1250	6 3/8	640972	390.00	641972	439.65	-	-	-	-	-	-	-	-
	1 3/16	1.1875	6 5/8	640976	475.85	641976	533.40	-	-	-	-	-	-	-	-
	1 1/4	1.2500	6 3/4	640980	475.85	641980	533.40	-	-	-	-	-	-	-	-



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 - DISCONTINUED - WHILE SUPPLIES LAST

- 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	\$68.90	61832	\$72.35
17/32	.5312	3 3/8	6	61634	100.75	61834	105.90
9/16	.5625	3 3/8	6	61636	104.45	61836	109.75
19/32	.5938	3 3/8	6	61638	108.60	61838	114.05
5/8	.6250	3 3/8	6	61640	120.75	61840	126.70
21/32	.6562	3 3/8	6	61642	130.90	61842	137.40
11/16	.6875	3 3/8	6	61644	135.95	61844	142.90
23/32	.7188	3 3/8	6	61646	141.05	61846	148.10
3/4	.7500	3 3/8	6	61648	147.80	61848	155.30
25/32	.7812	3 3/8	6	61650	162.95	61850	171.15
13/16	.8125	3 3/8	6	61652	163.40	61852	171.60
27/32	.8438	3 3/8	6	61654	163.40	61854	171.60
7/8	.8750	3 3/8	6	61656	170.00	61856	178.45

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	\$174.05	61858	\$182.80
15/16	.9375	3 3/8	6	61660	175.80	61860	184.55
31/32	.9688	3 3/8	6	61662	181.75	61862	190.80
1	1.0000	3 3/8	6	61664	185.65	61864	195.00
1 1/32	1.0312	3 3/8	6	61666	179.15	61866	188.20
1 1/16	1.0625	3 3/8	6	61668	194.35	61868	204.00
1 3/32	1.0938	3 3/8	6	61670	198.95	61870	208.95
1 1/8	1.1250	3 3/8	6	61672	202.90	61872	212.90
1 5/32	1.1562	3 3/8	6	61674	246.20	61874	258.55
1 3/16	1.1875	3 3/8	6	61676	250.65	61876	263.20
1 7/32	1.2188	3 3/8	6	61678	263.15	61878	276.45
1 1/4	1.2500	3 3/8	6	61680	240.30	61880	252.35



CNC SPOTTING/CENTERING DRILLS CARBIDE TIPPED TYPES 647, 648, 649 & 677, 678, 679 FRACTIONAL



DISCONTINUED - WHILE SUPPLIES LAST

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	\$97.45
3/8	.3750	1 1/8	5	67724	67824	67924	113.80
1/2	.5000	1 1/2	6	67732	67832	67932	153.00
5/8	.6250	1 3/8	7	67740	67840	67940	221.55
3/4	.7500	1 7/8	8	67748	67848	67948	257.05
1	1.0000	2 1/4	8	67764	67864	67964	340.80

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	\$92.60
3/8	.3750	1 1/8	3 3/8	64724	64824	64924	108.10
1/2	.5000	1 1/2	3 3/4	64732	64832	64932	145.40
5/8	.6250	1 3/8	4 1/4	64740	64840	64940	210.55
3/4	.7500	1 7/8	5	64748	64848	64948	244.25
1	1.0000	2 1/4	6	64764	64864	64964	323.70



COBALT DRILLS FOR STEEL

COBALT TYPES 699 FRACTIONAL, WIRE, LETTER, & NUMBER

135° SPLIT POINT

DISCONTINUED - WHILE SUPPLIES LAST



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		
FRACTIONAL	DECIMAL	WIRE LETTER	FLUTE	OAL	TYPE 699 EDP NO.	PRICE EACH
	.0400	60	1 1/16	1 3/8	6990400	\$2.40
	.0410	59	1 1/16	1 5/8	6990410	2.40
	.0420	58	1 1/16	1 7/8	6990420	2.40
	.0430	57	3/4	1 3/4	6990430	2.40
	.0465	56	3/4	1 3/4	6990465	2.40
	.0520	55	7/8	1 7/8	6990520	2.05
	.0550	54	7/8	1 7/8	6990550	2.05
	.0595	53	7/8	1 7/8	6990595	2.05
1/16	.0625		7/8	1 7/8	69904	1.90
	.0635	52	7/8	1 7/8	6990635	1.90
	.0670	51	1	2	6990670	1.90
	.0700	50	1	2	6990700	1.90
5/64	.0730	49	1	2	6990730	1.90
	.0760	48	1	2	6990760	1.90
	.0781		1	2	69905	1.90
	.0785	47	1	2	6990785	1.90
	.0810	46	1 1/8	2 1/8	6990810	1.90
	.0820	45	1 1/8	2 1/8	6990820	1.90
	.0860	44	1 1/8	2 1/8	6990860	1.90
	.0890	43	1 1/4	2 1/4	6990890	1.90
3/32	.0935	42	1 1/4	2 1/4	6990935	1.90
	.0938		1 1/4	2 1/4	69906	1.90
	.0960	41	1 3/8	2 3/8	6990960	1.90
	.0980	40	1 3/8	2 3/8	6990980	1.95
	.0995	39	1 3/8	2 3/8	6990995	1.95
	.1015	38	1 7/16	2 1/2	6991015	1.95
	.1040	37	1 7/16	2 1/2	6991040	2.05
	.1065	36	1 7/16	2 1/2	6991065	2.05
7/64	.1094		1 1/2	2 5/8	69907	2.00
	.1100	35	1 1/2	2 5/8	6991100	2.05
	.1110	34	1 1/2	2 5/8	6991110	2.05
	.1130	33	1 1/2	2 5/8	6991130	2.05
1/8	.1160	32	1 5/8	2 3/4	6991160	2.20
	.1200	31	1 5/8	2 3/4	6991200	2.20
	.1250		1 5/8	2 3/4	69908	2.45
	.1285	30	1 5/8	2 3/4	6991285	2.25
	.1360	29	1 3/4	2 7/8	6991360	2.40
	.1405	28	1 3/4	2 7/8	6991405	2.45

TOOL DIAMETER		LENGTH		135° POINT		
FRACTIONAL	DECIMAL	WIRE LETTER	FLUTE	OAL	TYPE 699 EDP NO.	PRICE EACH
9/64	.1406		1 3/4	2 7/8	69909	\$2.45
	.1440	27	1 7/8	3	6991440	2.60
	.1470	26	1 7/8	3	6991470	2.60
	.1495	25	1 7/8	3	6991495	2.60
5/32	.1520	24	2	3 1/8	6991520	2.95
	.1540	23	2	3 1/8	6991540	2.95
	.1562		2	3 1/8	69910	2.75
	.1570	22	2	3 1/8	6991570	2.95
11/64	.1590	21	2 1/8	3 1/4	6991590	2.95
	.1610	20	2 1/8	3 1/4	6991610	2.95
	.1660	19	2 1/8	3 1/4	6991660	2.95
	.1695	18	2 1/8	3 1/4	6991695	3.00
1/4	.1719		2 1/8	3 1/4	69911	2.85
	.1730	17	2 3/8	3 3/8	6991730	3.30
	.1770	16	2 3/8	3 3/8	6991770	3.35
	.1800	15	2 3/8	3 3/8	6991800	3.60
3/16	.1820	14	2 3/8	3 3/8	6991820	3.60
	.1850	13	2 5/8	3 1/2	6991850	3.60
	.1875		2 5/8	3 1/2	69912	3.25
	.1890	12	2 5/8	3 1/2	6991890	3.80
1/2	.1910	11	2 5/8	3 1/2	6991910	3.80
	.1935	10	2 7/8	3 5/8	6991935	3.80
	.1960	9	2 7/8	3 5/8	6991960	3.80
	.1990	8	2 7/8	3 5/8	6991990	3.80
13/64	.2010	7	2 7/8	3 5/8	6992010	3.80
	.2031		2 7/8	3 5/8	69913	3.90
	.2040	6	2 1/2	3 3/4	6992040	4.90
	.2055	5	2 1/2	3 3/4	6992055	4.90
7/32	.2090	4	2 1/2	3 3/4	6992090	4.90
	.2130	3	2 1/2	3 3/4	6992130	4.90
	.2188		2 1/2	3 3/4	69914	4.25
	.2210	2	2 5/8	3 7/8	6992210	5.20
15/64	.2280	1	2 5/8	3 7/8	6992280	5.20
	.2340	A	2 5/8	3 7/8	6992340	6.00
	.2344		2 5/8	3 7/8	69915	4.50
	.2380	B	2 3/4	4	6992380	6.90
	.2420	C	2 3/4	4	6992420	6.90
	.2460	D	2 3/4	4	6992460	6.95

TOOL DIAMETER		LENGTH		135° POINT		
FRACTIONAL	DECIMAL	WIRE LETTER	FLUTE	OAL	TYPE 699 EDP NO.	PRICE EACH
1/4	.2500	E	2 3/4	4	69916	\$4.80
	.2570	F	2 7/8	4 1/8	6992570	7.25
	.2610	G	2 7/8	4 1/8	6992610	7.50
17/64	.2656		2 7/8	4 1/8	69917	5.50
	.2660	H	2 7/8	4 1/8	6992660	7.75
	.2720	I	2 7/8	4 1/8	6992720	7.80
	.2770	J	2 7/8	4 1/8	6992770	8.00
	.2810	K	2 15/16	4 1/4	6992810	8.15
	.2812		2 15/16	4 1/4	69918	5.75
9/32	.2900	L	2 15/16	4 1/4	6992900	8.80
	.2950	M	3 1/16	4 3/8	6992950	9.35
19/64	.2969		3 1/16	4 3/8	69919	7.00
	.3020	N	3 1/8	4 3/8	6993020	9.35
5/16	.3125		3 1/8	4 1/2	69920	7.45
	.3160	O	3 1/8	4 1/2	6993160	10.30
	.3230	P	3 5/16	4 5/8	6993230	11.00
	.3281		3 5/16	4 5/8	69921	8.25
21/64	.3320	Q	3 7/16	4 3/4	6993320	11.35
	.3390	R	3 7/16	4 3/4	6993390	11.35
	.3438		3 7/16	4 3/4	69922	9.05
11/32	.3480	S	3 1/2	4 7/8	6993480	13.90
	.3594		3 1/2	4 7/8	69923	9.95
	.3580	T	3 1/2	4 7/8	6993580	13.90
	.3680	U	3 5/8	5	6993680	13.90
3/8	.3750	V	3 5/8	5	69924	10.30
	.3770		3 5/8	5	6993770	15.30
	.3860	W	3 3/4	5 1/8	6993860	15.30
25/64	.3960		3 3/4	5 1/8	69925	11.85
	.3970	X	3 3/4	5 1/8	6993970	15.30
13/32	.4040	Y	3 7/8	5 1/4	6994040	16.25
	.4062		3 7/8	5 1/4	69926	12.30
	.4130	Z	3 7/8	5 1/4	6994130	17.70
	.4210		3 15/16	5 3/8	69927	13.60
7/16	.4375		4 1/16	5 1/2	69928	13.90
	.4531		4 3/16	5 5/8	69929	16.70
15/32	.4688		4 5/16	5 3/4	69930	17.00
	.4844		4 3/8	5 7/8	69931	17.55
1/2	.5000		4 1/2	6	69932	17.70



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	\$45.35	7/16	1/4	1	9/64	59201	\$83.55
2	4 3/16	9/16	3/16	59502	54.00	9/16	3/16	1 3/8	1 1/64	59202	103.45
3	5 1/4	7/8	1/2	59503	99.00	1 1/16	3/8	1 1 1/16	13/64	59203	156.35
4	6 3/4	7/8	1/2	59504	150.50	7/8	1/2	2 1/4	1 1/64	59204	228.60
5	8 1/2	1 1/16	5/8	59505	246.25	1 1/16	5/8	2 3/4	2 1/64	59205	382.10

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	\$69.25	9/16	5/16	1 1/8	1 1/64	59307	\$117.30
8	5 1 1/32	1 1/16	3/8	59608	97.15	9/16	5/16	1 5/16	1 1/64	59308	154.00
9	6	7/8	1/2	59609	123.25	1 1/16	3/8	1 1/2	13/64	59309	183.45
10	8 1 1/32	7/8	1/2	59610	176.10	7/8	1/2	2 1/4	1 1/64	59310	256.95
11	10 1/8	1 1/16	5/8	59611	233.95	1 1/16	5/8	2 1/2	3/8	59311	352.90

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	\$49.55	7/16	1/4	2 5/32	9/64	59404	\$91.15
5	3 3/8	7/16	1/4	59705	54.80	7/16	1/4	1 5/16	9/64	59405	100.95
6	4 1/2	9/16	5/16	59706	67.65	9/16	5/16	1 1/8	1 1/64	59406	112.50
7	5 1/4	1 1/16	3/8	59707	87.65	1 1/16	3/8	1 3/16	13/64	59407	147.40
8	6	7/8	1/2	59708	113.35	7/8	1/2	1 3/8	1 1/64	59408	182.15
9	6 3/4	7/8	1/2	59709	123.00	7/8	1/2	1 5/8	1 1/64	59409	205.20
10	7 1/2	7/8	1/2	59710	156.35	7/8	1/2	2	1 1/64	59410	242.90
11	8 1/4	7/8	1/2	59711	175.95	7/8	1/2	2	1 1/64	59411	268.85
12	9	1 1/16	5/8	59712	194.60	1 1/16	5/8	2 1/4	2 1/64	59412	302.90



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	\$114.00	0.3471 - 0.3780	\$155.65	\$134.70	\$127.75	\$124.45	\$120.80	\$118.15
* 13/32	.4062	.284	5/8	3 5/8	7	13/32	62013	1	62213	114.00	0.3781 - 0.4090	155.65	134.70	127.75	124.45	120.80	118.15
* 7/16	.4375	.306	3/4	3 7/8	7 1/4	7/16	62014	1	62214	114.00	0.4091 - 0.4410	155.65	134.70	127.75	124.45	120.80	118.15
* 15/32	.4688	.328	3/4	4 1/8	7 1/2	15/32	62015	1	62215	114.00	0.4411 - 0.4720	155.65	134.70	127.75	124.45	120.80	118.15
1/2	.5000	.350	3/4	4 3/8	8 1/4	1/2	62016	2	62216	114.00	0.4721 - 0.5030	155.65	134.70	127.75	124.45	120.80	118.15
17/32	.5312	.372	3/4	4 3/8	8 1/4	17/32	62017	2	62217	114.45	0.5031 - 0.5340	156.20	135.30	128.25	125.00	121.40	118.50
9/16	.5625	.394	3/4	4 3/8	8 1/4	9/16	62018	2	62218	114.45	0.5341 - 0.5660	156.20	135.30	128.25	125.00	121.40	118.50
19/32	.5938	.416	3/4	4 3/8	8 1/4	19/32	62019	2	62219	120.20	0.5661 - 0.5970	161.85	140.95	134.05	130.70	127.10	124.35
5/8	.6250	.438	3/4	4 3/8	8 1/4	5/8	62020	2	62220	120.20	0.5971 - 0.6280	161.85	140.95	134.05	130.70	127.10	124.35
21/32	.6562	.459	3/4	4 3/8	8 1/4	21/32	62021	2	62221	121.55	0.6281 - 0.6590	163.30	142.40	135.50	132.05	128.65	125.75
11/16	.6875	.481	7/8	4 3/8	8 1/4	11/16	62022	2	62222	122.70	0.6591 - 0.6910	164.40	143.55	136.45	133.15	129.60	126.75
23/32	.7188	.503	7/8	4 3/8	8 1/4	23/32	62023	2	62223	122.70	0.6911 - 0.7220	164.40	143.55	136.45	133.15	129.60	126.75
3/4	.7500	.525	7/8	4 3/8	8 1/4	3/4	62024	2	62224	122.70	0.7221 - 0.7530	164.40	143.55	136.45	133.15	129.60	126.75
25/32	.7812	.547	7/8	4 3/8	8 1/4	25/32	62025	2	62225	125.35	0.7531 - 0.7840	167.00	146.20	139.20	135.85	132.35	129.50
13/16	.8125	.569	7/8	4 7/8	9 1/2	13/16	62026	3	62226	128.85	0.7841 - 0.8160	170.60	149.75	142.65	139.45	135.70	133.05
27/32	.8438	.591	7/8	4 7/8	9 1/2	27/32	62027	3	62227	135.70	0.8161 - 0.8470	177.45	156.60	149.60	146.25	142.65	139.85
7/8	.8750	.612	7/8	4 7/8	9 1/2	7/8	62028	3	62228	135.70	0.8471 - 0.8780	177.45	156.60	149.60	146.25	142.65	139.85
29/32	.9062	.634	7/8	4 7/8	9 1/2	29/32	62029	3	62229	136.55	0.8781 - 0.9090	178.25	157.45	150.40	147.10	143.60	140.70
15/16	.9375	.656	7/8	4 7/8	9 1/2	15/16	62030	3	62230	136.55	0.9091 - 0.9410	178.25	157.45	150.40	147.10	143.60	140.70
31/32	.9688	.678	7/8	4 7/8	9 1/2	31/32	62031	3	62231	141.75	0.9411 - 0.9720	183.30	162.40	155.50	152.25	148.55	145.80
1	1.0000	.700	7/8	4 7/8	9 1/2	1	62032	3	62232	144.35	0.9721 - 1.0030	186.05	165.15	158.05	154.80	151.20	148.40
1 1/32	1.0312	.722	7/8	4 7/8	9 1/2	1 1/32	62033	3	62233	145.55	1.0031 - 1.0340	187.15	166.20	159.35	155.95	152.45	149.60
1 1/16	1.0625	.744	7/8	4 7/8	9 1/2	1 1/16	62034	3	62234	147.55	1.0341 - 1.0660	189.25	168.30	161.35	158.00	154.40	151.65
1 1/32	1.0938	.766	1	4 7/8	10 1/2	1 1/32	62035	4	62235	171.85	1.0661 - 1.0970	213.45	192.65	185.65	182.35	178.75	175.95
1 1/8	1.1250	.787	1	4 7/8	10 1/2	1 1/8	62036	4	62236	171.85	1.0971 - 1.1280	213.45	192.65	185.65	182.35	178.75	175.95
1 5/32	1.1562	.809	1	4 7/8	10 1/2	1 5/32	62037	4	62237	187.60	1.1281 - 1.1590	229.25	208.45	201.45	198.15	194.55	191.70
1 3/16	1.1875	.831	1	4 7/8	10 1/2	1 3/16	62038	4	62238	193.05	1.1591 - 1.1905	234.70	213.95	206.80	203.55	200.00	197.20
1 7/32	1.2188	.853	1	4 7/8	10 1/2	1 7/32	62039	4	62239	193.75	1.1906 - 1.2220	235.45	214.55	207.65	204.25	200.60	197.85
1 1/4	1.2500	.875	1	4 7/8	10 1/2	1 1/4	62040	4	62240	194.55	1.2221 - 1.2530	236.25	215.35	208.40	205.00	201.45	198.60
1 9/32	1.2812	.897	1	4 7/8	10 1/2	1 9/32	62041	4	62241	208.45	1.2531 - 1.2840	250.15	229.20	222.25	218.85	215.35	212.45
1 5/16	1.3125	.919	1	4 7/8	10 1/2	1 5/16	62042	4	62242	214.20	1.2841 - 1.3150	255.95	235.05	228.00	224.75	221.15	218.25
1 11/32	1.3438	.940	1	4 7/8	10 1/2	1 11/32	62043	4	62243	218.70	1.3151 - 1.3470	260.40	239.55	232.50	229.20	225.70	222.75
1 3/8	1.3750	.962	1	4 7/8	10 1/2	1 3/8	62044	4	62244	224.05	1.3471 - 1.3780	265.70	244.85	237.80	234.50	230.95	228.05
1 13/32	1.4062	.984	1	4 7/8	10 1/2	1 13/32	62045	4	62245	229.10	1.3781 - 1.4090	270.80	250.00	242.90	239.60	236.05	233.25
1 7/16	1.4375	1.006	1	4 7/8	10 1/2	1 7/16	62046	4	62246	235.80	1.4091 - 1.4410	277.55	256.70	249.65	246.35	242.80	240.00
1 15/32	1.4688	1.025	1	4 7/8	10 1/2	1 15/32	62047	4	62247	242.85	1.4411 - 1.4720	284.45	263.65	256.70	253.35	249.70	247.00
1 1/2	1.5000	1.050	1	4 7/8	10 1/2	1 1/2	62048	4	62248	248.15	1.4721 - 1.5030	289.75	268.80	261.90	258.55	254.95	252.25

*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	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	\$127.75	8.815 - 9.601	\$159.15	\$138.35	\$131.25	\$127.85	\$124.45	\$121.50	\$117.50
*10.0	.3937	.284	5/8	3 5/8	7	13/32	620100	1	622100	127.75	9.602 - 10.389	159.15	138.35	131.25	127.85	124.45	121.50	117.50
*11.0	.4331	.306	3/4	3 7/8	7 1/4	7/16	620110	1	622110	127.75	10.390 - 11.201	159.15	138.35	131.25	127.85	124.45	121.50	117.50
*	-	.328	3/4	4 1/8	7 1/2	15/32	620119	1	622119	-	11.202 - 11.989	159.15	138.35	131.25	127.85	124.45	121.50	117.50
12.0	.4724	.350	3/4	4 3/8	8 1/4	1/2	620120	2	622120	127.75	11.990 - 12.776	159.15	138.35	131.25	127.85	124.45	121.50	117.50
13.0	.5118	.372	3/4	4 3/8	8 1/4	17/32	620130	2	622130	128.25	12.777 - 13.564	159.55	138.90	131.85	128.55	125.00	122.10	118.15
14.0	.5512	.394	3/4	4 3/8	8 1/4	9/16	620140	2	622140	128.25	13.565 - 14.376	159.55	138.90	131.85	128.55	125.00	122.10	118.15
15.0	.5906	.416	3/4	4 3/8	8 1/4	19/32	620150	2	622150	134.05	14.377 - 15.164	165.40	144.55	137.60	134.20	130.70	127.75	123.75
-	-	.438	3/4	4 3/8	8 1/4	5/8	620159	2	622159	-	15.165 - 15.951	165.40	144.55	137.60	134.20	130.70	127.75	123.75
16.0	.6299	.459	3/4	4 3/8	8 1/4	21/32	620160	2	622160	135.50	15.952 - 16.739	166.85	146.00	139.00	135.60	132.05	129.10	125.25
17.0	.6693	.481	7/8	4 3/8	8 1/4	11/16	620170	2	622170	136.45	16.740 - 17.551	167.90	147.00	139.95	136.55	133.15	130.20	126.20
18.0	.7087	.503	7/8	4 3/8	8 1/4	23/32	620180	2	622180	136.45	17.552 - 18.339	167.90	147.00	139.95	136.55	133.15	130.20	126.20
19.0	.7480	.525	7/8	4 3/8	8 1/4	3/4	620190	2	622190	136.45	18.340 - 19.126	167.90	147.00	139.95	136.55	133.15	130.20	126.20
-	-	.547	7/8	4 3/8	8 1/4	25/32	620199	2	622199	-	19.127 - 19.914	170.60	149.85	142.90	139.45	135.85	133.05	128.95
20.0	.7874	.569	7/8	4 7/8	9 1/2	13/16	620200	3	622200	142.65	19.915 - 20.726	174.05	153.30	146.25	142.95	139.45	136.45	132.45
21.0	.8268	.591	7/8	4 7/8	9 1/2	27/32	620210	3	622210	149.60	20.727 - 21.514	181.00	160.15	153.20	149.85	146.25	143.40	139.45
22.0	.8661	.612	7/8	4 7/8	9 1/2	7/8	620220	3	622220	149.60	21.515 - 22.301	181.00	160.15	153.20	149.85	146.25	143.40	139.45
23.0	.9055	.634	7/8	4 7/8	9 1/2	29/32	620230	3	622230	150.40	22.302 - 23.089	181.80	161.05	154.10	150.55	147.10	144.30	140.25
-	-	.656	7/8	4 7/8	9 1/2	15/16	620239	3	622239	-	23.090 - 23.901	181.80	161.05	154.10	150.55	147.10	144.30	140.25
24.0	.9449	.678	7/8	4 7/8	9 1/2	31/32	620240	3	622240	155.50	23.902 - 24.689	186.85	166.05	159.10	155.65	152.25	149.20	145.20
25.0	.9843	.700	7/8	4 7/8	9 1/2	1	620250	3	622250	158.05	24.690 - 25.476	189.50	168.70	161.75	158.25	154.80	151.90	147.90
26.0	1.0236	.722	7/8	4 7/8	9 1/2	1 1/32	620260	3	622260	159.35	25.477 - 26.264	190.65	169.90	162.90	159.45	155.95	153.15	149.05
27.0	1.0630	.744	7/8	4 7/8	9 1/2	1 1/16	620270	3	622270	161.35	26.265 - 27.076	192.85	171.90	164.90	161.55	158.00	155.15	151.15
-	-	.766	1	4 7/8	10 1/2	1 3/32	620279	4	622279	-	27.077 - 27.864	217.05	196.20	189.25	185.75	182.35	179.40	175.50
28.0	1.1024	.787	1	4 7/8	10 1/2	1 1/8	620280	4	622280	185.65	27.865 - 28.651	217.05	196.20	189.25	185.75	182.35	179.40	175.50
29.0	1.1417	.809	1	4 7/8	10 1/2	1 5/32	620290	4	622290	201.45	28.652 - 29.439	232.80	212.05	205.00	201.65	198.15	195.15	191.10
30.0	1.1811	.831	1	4 7/8	10 1/2	1 3/16	620300	4	622300	206.80	29.440 - 30.239	238.25	217.40	210.55	206.95	203.55	200.60	196.65
31.0	1.2205	.853	1	4 7/8	10 1/2	1 7/32	620310	4	622310	207.65	30.240 - 31.039	238.95	218.10	211.20	207.75	204.25	201.25	197.30
-	-	.875	1	4 7/8	10 1/2	1 1/4	620319	4	622319	-	31.040 - 31.826	239.65	218.85	212.00	208.55	205.00	202.10	198.15
32.0	1.2598	.897	1	4 7/8	10 1/2	1 9/32	620320	4	622320	222.25	31.827 - 32.614	253.70	232.80	225.85	222.45	218.85	216.00	212.05
33.0	1.2992	.919	1	4 7/8	10 1/2	1 5/16	620330	4	622330	228.00	32.615 - 33.401	259.35	238.50	231.55	228.15	224.75	221.85	217.85
34.0	1.3386	.940	1	4 7/8	10 1/2	1 11/32	620340	4	622340	232.50	33.402 - 34.214	264.00	243.20	236.15	232.75	229.20	226.35	222.35
35.0	1.3780	.962	1	4 7/8	10 1/2	1 3/8	620350	4	622350	237.80	34.215 - 35.001	269.30	248.40	241.45	238.00	234.50	231.55	227.65
-	-	.984	1	4 7/8	10 1/2	1 13/32	620359	4	622359	-	35.002 - 35.789	274.30	253.60	246.45	243.20	239.60	236.75	232.75
36.0	1.4173	1.006	1	4 7/8	10 1/2	1 7/16	620360	4	622360	249.65	35.790 - 36.601	281.05	260.25	253.30	249.75	246.35	243.45	239.50
37.0	1.4567	1.025	1	4 7/8	10 1/2	1 15/32	620370	4	622370	256.70	36.602 - 37.389	288.05	267.25	260.25	256.90	253.35	250.40	246.40
38.0	1.4961	1.050	1	4 7/8	10 1/2	1 1/2	620380	4	622380	261.90	37.390 - 38.176	293.20	272.45	265.50	262.00	258.55	255.65	251.60

*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						
FRACTIONAL	DECIMAL	MIN. CUT DIAM.	LENGTH			SHANK DIAM.	STEEL EDP NO.	TAPER SHANK NO.	STEEL 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	62112	1	62312	\$125.50	0.3471 - 0.3780	\$167.20	\$146.25	\$139.25	\$135.95	\$132.40	\$129.60
* 13/32	.4062	.284	5/8	3 5/8	7	13/32	62113	1	62313	125.50	0.3781 - 0.4090	167.20	146.25	139.25	135.95	132.40	129.60
* 7/16	.4375	.306	3/4	3 7/8	7 1/4	7/16	62114	1	62314	125.50	0.4091 - 0.4410	167.20	146.25	139.25	135.95	132.40	129.60
* 15/32	.4688	.328	3/4	4 1/8	7 1/2	15/32	62115	1	62315	125.50	0.4411 - 0.4720	167.20	146.25	139.25	135.95	132.40	129.60
1/2	.5000	.350	3/4	4 3/8	8 1/4	1/2	62116	2	62316	125.50	0.4721 - 0.5030	167.20	146.25	139.25	135.95	132.40	129.60
17/32	.5312	.372	3/4	4 3/8	8 1/4	17/32	62117	2	62317	125.95	0.5031 - 0.5340	167.55	146.75	139.70	136.40	132.80	130.05
9/16	.5625	.394	3/4	4 3/8	8 1/4	9/16	62118	2	62318	125.95	0.5341 - 0.5660	167.55	146.75	139.70	136.40	132.80	130.05
19/32	.5938	.416	3/4	4 3/8	8 1/4	19/32	62119	2	62319	132.35	0.5661 - 0.5970	173.95	153.15	146.05	142.90	139.20	136.40
5/8	.6250	.438	3/4	4 3/8	8 1/4	5/8	62120	2	62320	132.35	0.5971 - 0.6280	173.95	153.15	146.05	142.90	139.20	136.40
21/32	.6562	.459	3/4	4 3/8	8 1/4	21/32	62121	2	62321	133.85	0.6281 - 0.6590	175.50	154.50	147.55	144.30	140.65	137.80
11/16	.6875	.481	7/8	4 3/8	8 1/4	11/16	62122	2	62322	135.00	0.6591 - 0.6910	176.65	155.70	148.75	145.40	141.90	139.00
23/32	.7188	.503	7/8	4 3/8	8 1/4	23/32	62123	2	62323	135.00	0.6911 - 0.7220	176.65	155.70	148.75	145.40	141.90	139.00
3/4	.7500	.525	7/8	4 3/8	8 1/4	3/4	62124	2	62324	135.00	0.7221 - 0.7530	176.65	155.70	148.75	145.40	141.90	139.00
25/32	.7812	.547	7/8	4 3/8	8 1/4	25/32	62125	2	62325	137.80	0.7531 - 0.7840	179.45	158.70	151.65	148.30	144.65	141.95
13/16	.8125	.569	7/8	4 7/8	9 1/2	13/16	62126	3	62326	141.80	0.7841 - 0.8160	183.45	162.60	155.55	152.35	148.70	145.85
27/32	.8438	.591	7/8	4 7/8	9 1/2	27/32	62127	3	62327	149.35	0.8161 - 0.8470	191.00	170.15	163.15	159.85	156.35	153.45
7/8	.8750	.612	7/8	4 7/8	9 1/2	7/8	62128	3	62328	149.35	0.8471 - 0.8780	191.00	170.15	163.15	159.85	156.35	153.45
29/32	.9062	.634	7/8	4 7/8	9 1/2	29/32	62129	3	62329	150.25	0.8781 - 0.9090	191.90	171.15	164.10	160.75	157.25	154.35
15/16	.9375	.656	7/8	4 7/8	9 1/2	15/16	62130	3	62330	150.25	0.9091 - 0.9410	191.90	171.15	164.10	160.75	157.25	154.35
31/32	.9688	.678	7/8	4 7/8	9 1/2	31/32	62131	3	62331	155.75	0.9411 - 0.9720	197.40	176.65	169.55	166.20	162.80	159.95
1	1.0000	.700	7/8	4 7/8	9 1/2	1	62132	3	62332	158.80	0.9721 - 1.0030	200.45	179.65	172.60	169.30	165.80	162.90
1 1/32	1.0312	.722	7/8	4 7/8	9 1/2	1 1/32	62133	3	62333	160.00	1.0031 - 1.0340	201.70	180.75	173.75	170.55	166.90	164.10
1 1/16	1.0625	.744	7/8	4 7/8	9 1/2	1 1/16	62134	3	62334	162.20	1.0341 - 1.0660	203.90	183.00	176.00	172.65	169.20	166.20
1 1/32	1.0938	.766	1	4 7/8	10 1/2	1 1/32	62135	4	62335	189.05	1.0661 - 1.0970	230.60	209.80	202.75	199.55	195.90	193.05
1 1/8	1.1250	.787	1	4 7/8	10 1/2	1 1/8	62136	4	62336	197.50	1.0971 - 1.1280	239.25	218.45	211.40	208.00	204.50	201.70
1 5/32	1.1562	.809	1	4 7/8	10 1/2	1 5/32	62137	4	62337	206.45	1.1281 - 1.1590	248.15	227.20	220.20	216.85	213.25	210.55
1 3/16	1.1875	.831	1	4 7/8	10 1/2	1 3/16	62138	4	62338	212.35	1.1591 - 1.1905	254.00	233.25	226.20	222.85	219.35	216.55
1 7/32	1.2188	.853	1	4 7/8	10 1/2	1 7/32	62139	4	62339	213.15	1.1906 - 1.2220	254.85	234.00	227.00	223.60	220.15	217.30
1 1/4	1.2500	.875	1	4 7/8	10 1/2	1 1/4	62140	4	62340	214.00	1.2221 - 1.2530	255.65	234.70	227.75	224.50	220.90	218.05
1 9/32	1.2812	.897	1	4 7/8	10 1/2	1 9/32	62141	4	62341	229.20	1.2531 - 1.2840	270.85	250.05	242.95	239.65	236.15	233.30
1 5/16	1.3125	.919	1	4 7/8	10 1/2	1 5/16	62142	4	62342	235.55	1.2841 - 1.3150	277.25	256.40	249.45	246.10	242.55	239.65
1 11/32	1.3438	.940	1	4 7/8	10 1/2	1 11/32	62143	4	62343	240.60	1.3151 - 1.3470	282.35	261.45	254.50	251.20	247.50	244.80
1 3/8	1.3750	.962	1	4 7/8	10 1/2	1 3/8	62144	4	62344	246.40	1.3471 - 1.3780	288.10	267.25	260.25	256.95	253.35	250.45
1 13/32	1.4062	.984	1	4 7/8	10 1/2	1 13/32	62145	4	62345	252.25	1.3781 - 1.4090	293.80	272.95	265.95	262.65	259.10	256.25
1 7/16	1.4375	1.006	1	4 7/8	10 1/2	1 7/16	62146	4	62346	259.50	1.4091 - 1.4410	301.20	280.20	273.25	269.95	266.45	263.50
1 15/32	1.4688	1.025	1	4 7/8	10 1/2	1 15/32	62147	4	62347	267.20	1.4411 - 1.4720	308.90	288.00	280.95	277.65	274.00	271.25
1 1/2	1.5000	1.050	1	4 7/8	10 1/2	1 1/2	62148	4	62348	272.80	1.4721 - 1.5030	314.50	293.65	286.70	283.35	279.90	277.00

*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.	LENGTH			SHANK DIAM.	STEEL METRIC EDP NO.	TAPER SHANK NO.	STEEL METRIC EDP NO.		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
			CARBIDE	FLT	OVER-ALL						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	\$139.25	8.815-9.601	\$170.65	\$149.90	\$142.95	\$139.50	\$135.95	\$133.10	\$129.00
*10.0	.3937	.284	3/8	3 5/8	7	13/32	621100	1	623100	139.25	9.602-10.389	170.65	149.90	142.95	139.50	135.95	133.10	129.00
*11.0	.4331	.306	3/4	3 7/8	7 1/4	7/16	621110	1	623110	139.25	10.390-11.201	170.65	149.90	142.95	139.50	135.95	133.10	129.00
* -	-	.328	3/4	4 1/8	7 1/2	15/32	621119	1	623119	-	11.202-11.989	170.65	149.90	142.95	139.50	135.95	133.10	129.00
12.0	.4724	.350	3/4	4 3/8	8 1/4	1/2	621120	2	623120	139.25	11.990-12.776	170.65	149.90	142.95	139.50	135.95	133.10	129.00
13.0	.5118	.372	3/4	4 3/8	8 1/4	17/32	621130	2	623130	139.70	12.777-13.564	171.15	150.25	143.20	139.85	136.40	133.40	129.50
14.0	.5512	.394	3/4	4 3/8	8 1/4	9/16	621140	2	623140	139.70	13.565-14.376	171.15	150.25	143.20	139.85	136.40	133.40	129.50
15.0	.5906	.416	3/4	4 3/8	8 1/4	19/32	621150	2	623150	146.05	14.377-15.164	177.45	156.65	149.75	146.25	142.90	139.85	135.85
-	-	.438	3/4	4 3/8	8 1/4	5/8	621159	2	623159	-	15.165-15.951	177.45	156.65	149.75	146.25	142.90	139.85	135.85
16.0	.6299	.459	3/4	4 3/8	8 1/4	21/32	621160	2	623160	147.55	15.952-16.739	178.90	158.05	151.15	147.70	144.30	141.30	137.30
17.0	.6693	.481	7/8	4 3/8	8 1/4	11/16	621170	2	623170	148.75	16.740-17.551	180.15	159.35	152.40	148.95	145.40	142.45	138.55
18.0	.7087	.503	7/8	4 3/8	8 1/4	23/32	621180	2	623180	148.75	17.552-18.339	180.15	159.35	152.40	148.95	145.40	142.45	138.55
19.0	.7480	.525	7/8	4 3/8	8 1/4	3/4	621190	2	623190	148.75	18.340-19.126	180.15	159.35	152.40	148.95	145.40	142.45	138.55
-	-	.547	7/8	4 3/8	8 1/4	25/32	621199	2	623199	-	19.127-19.914	183.00	162.20	155.35	151.80	148.30	145.40	141.45
20.0	.7874	.569	7/8	4 7/8	9 1/2	13/16	621200	3	623200	155.55	19.915-20.726	186.90	166.10	159.15	155.70	152.35	149.35	145.25
21.0	.8268	.591	7/8	4 7/8	9 1/2	27/32	621210	3	623210	163.15	20.727-21.514	194.55	173.70	166.75	163.30	159.85	156.90	153.00
22.0	.8661	.612	7/8	4 7/8	9 1/2	7/8	621220	3	623220	163.15	21.515-22.301	194.55	173.70	166.75	163.30	159.85	156.90	153.00
23.0	.9055	.634	7/8	4 7/8	9 1/2	29/32	621230	3	623230	164.10	22.302-23.089	195.50	174.75	167.60	164.30	160.75	157.90	153.85
-	-	.656	7/8	4 7/8	9 1/2	15/16	621239	3	623239	-	23.090-23.901	195.50	174.75	167.60	164.30	160.75	157.90	153.85
24.0	.9449	.678	7/8	4 7/8	9 1/2	31/32	621240	3	623240	169.55	23.902-24.689	201.05	180.25	173.30	169.80	166.20	163.35	159.40
25.0	.9843	.700	7/8	4 7/8	9 1/2	1	621250	3	623250	172.60	24.690-25.476	204.00	183.10	176.20	172.70	169.30	166.25	162.30
26.0	1.0236	.722	7/8	4 7/8	9 1/2	1 1/32	621260	3	623260	173.75	25.477-26.264	205.25	184.35	177.35	173.95	170.55	167.55	163.60
27.0	1.0630	.744	7/8	4 7/8	9 1/2	1 1/16	621270	3	623270	176.00	26.265-27.076	207.45	186.60	179.65	176.20	172.65	169.80	165.85
-	-	.766	1	4 7/8	10 1/2	1 3/32	621279	4	623279	-	27.077-27.864	234.20	213.35	206.45	202.95	199.55	196.50	192.55
28.0	1.1024	.787	1	4 7/8	10 1/2	1 1/8	621280	4	623280	211.40	27.865-28.651	242.80	222.00	214.95	211.65	208.00	205.25	201.15
29.0	1.1417	.809	1	4 7/8	10 1/2	1 5/32	621290	4	623290	220.20	28.652-29.439	251.55	230.80	223.70	220.35	216.85	214.00	209.95
30.0	1.1811	.831	1	4 7/8	10 1/2	1 3/16	621300	4	623300	226.20	29.440-30.239	257.65	236.80	229.90	226.40	222.85	219.95	216.00
31.0	1.2205	.853	1	4 7/8	10 1/2	1 7/32	621310	4	623310	227.00	30.240-31.039	258.35	237.65	230.55	227.20	223.60	220.85	216.75
-	-	.875	1	4 7/8	10 1/2	1 1/4	621319	4	623319	-	31.040-31.826	259.15	238.35	231.40	227.95	224.50	221.45	217.45
32.0	1.2598	.897	1	4 7/8	10 1/2	1 9/32	621320	4	623320	242.95	31.827-32.614	274.50	253.70	246.55	243.25	239.65	236.80	232.80
33.0	1.2992	.919	1	4 7/8	10 1/2	1 5/16	621330	4	623330	249.45	32.615-33.401	280.80	260.00	252.95	249.60	246.10	243.25	239.15
34.0	1.3386	.940	1	4 7/8	10 1/2	1 11/32	621340	4	623340	254.50	33.402-34.214	285.75	265.05	258.05	254.65	251.20	248.25	244.20
35.0	1.3780	.962	1	4 7/8	10 1/2	1 3/8	621350	4	623350	260.25	34.215-35.001	291.70	270.80	263.90	260.40	256.95	253.95	250.05
-	-	.984	1	4 7/8	10 1/2	1 13/32	621359	4	623359	-	35.002-35.789	297.30	276.50	269.55	266.10	262.65	259.70	255.70
36.0	1.4173	1.006	1	4 7/8	10 1/2	1 7/16	621360	4	623360	273.25	35.790-36.601	304.70	283.90	276.85	273.45	269.95	267.15	263.10
37.0	1.4567	1.025	1	4 7/8	10 1/2	1 15/32	621370	4	623370	280.95	36.602-37.389	312.30	291.55	284.45	281.20	277.65	274.75	270.75
38.0	1.4961	1.050	1	4 7/8	10 1/2	1 1/2	621380	4	623380	286.70	37.390-38.176	318.00	297.15	290.25	286.80	283.35	280.50	276.35

*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	\$5.50
3/16	3/16	3	68112	68212	5.50
1/4	1/4	4	68116	68216	5.50
1/4	1/4	6	68117	68217	6.25
5/16	1/4	4	68120	68220	6.25
5/16	1/4	6	68121	68221	6.80
3/8	1/4	4	68124	68224	6.80
3/8	1/4	6	68125	68225	6.80
7/16	1/4	4	68128	68228	7.50
7/16	1/4	6	68129	68229	7.70
1/2	1/4	4	68132	68232	8.30
1/2	1/4	6	68133	68233	8.30
1/2	3/8	6	68134	68234	8.30
9/16	3/8	6	68136	68236	11.25
5/8	1/2	6	68140	68240	11.95
11/16	1/2	6	68144	68244	13.55
3/4	1/2	6	68148	68248	14.80
7/8	1/2	6	68156	68256	18.45
1	1/2	6	68164	68264	22.85

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	\$14.30	68416	\$19.30
3/16	1/4	68320	16.35	68420	22.35
3/8	1/4	68324	18.00	68424	23.60
7/16	1/4	68328	19.70	68428	25.80
1/2	3/8	68332	22.55	68432	26.50
9/16	3/8	68336	25.80	68436	28.90
5/8	1/2	68340	28.90	68440	32.40
11/16	1/2	68344	32.35	68444	34.95
3/4	1/2	68348	33.20	68448	37.35
7/8	1/2	68356	41.00	68456	46.70
1	1/2	68364	45.35	68464	51.15



GLASS & TILE DRILLS CARBIDE TIPPED TYPE 680 FRACTIONAL



DISCONTINUED - WHILE SUPPLIES LAST

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	\$28.80
3/16	.1875	5/32	2 1/2	68012	28.80
1/4	.2500	7/32	2 1/2	68016	33.05
5/16	.3125	1/4	3	68020	42.50
3/8	.3750	5/16	3 1/2	68024	47.30
7/16	.4375	3/8	3 1/2	68028	53.70
1/2	.5000	7/16	3 1/2	68032	58.60
5/8	.6250	1/2	4	68036	82.30
3/4	.7500	5/8	4	68040	99.15

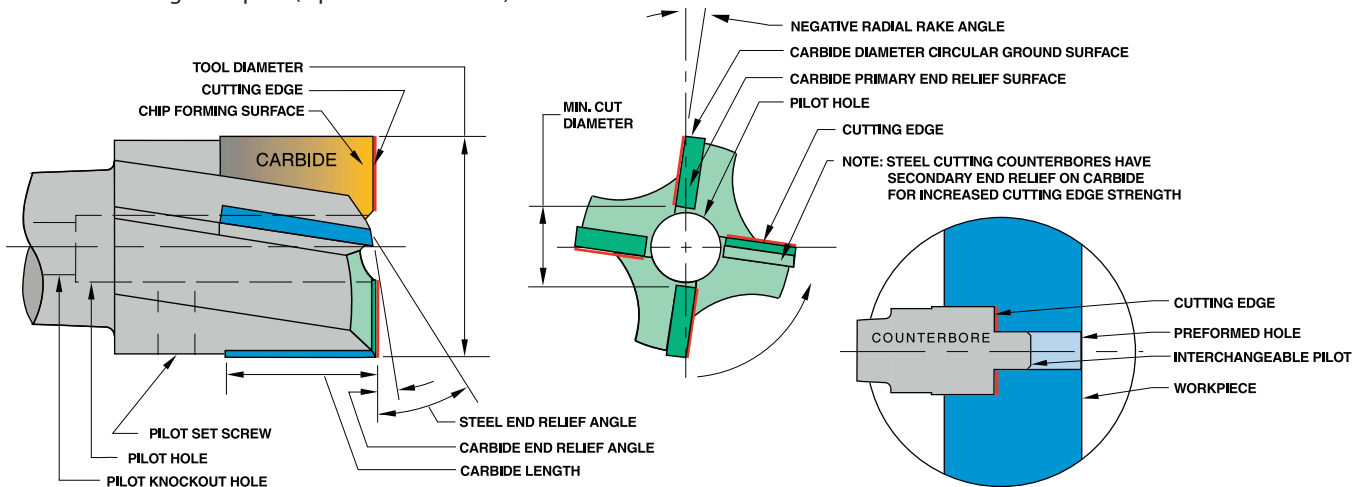


CARBIDE TIPPED COUNTERBORES INDEX AND TECHNICAL INFORMATION

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	\$67.30	0.2381-0.2530	\$114.45	\$91.00	\$83.00	\$79.25	\$75.30	\$72.00
9/32	.2812	.1250	.0938	1/4	2 3/8	52209	67.40	0.2531-0.2840	114.55	91.05	83.15	79.35	75.35	72.10
5/16	.3125	.1250	.0938	1/4	2 3/8	52210	69.15	0.2841-0.3150	116.35	92.65	84.80	80.90	77.00	73.80
11/32	.3438	.1250	.0938	1/4	2 3/8	52211	70.50	0.3151-0.3470	117.70	94.00	86.25	82.35	78.40	75.20
3/8	.3750	.1250	.0938	1/4	2 3/8	52212	70.75	0.3471-0.3780	117.85	94.25	86.50	82.55	78.50	75.35
13/32	.4062	.1560	.1250	1/4	2 3/4	52213	80.40	0.3781-0.4090	127.45	104.05	96.05	92.30	88.25	85.10
7/16	.4375	.1560	.1250	1/4	2 3/4	52214	86.65	0.4091-0.4410	133.80	110.20	102.45	98.45	94.60	91.30
15/32	.4688	.1560	.1250	1/4	2 3/4	52215	88.15	0.4411-0.4720	135.25	111.65	103.85	100.05	96.00	92.75
1/2	.5000	.1560	.1250	1/4	2 3/4	52216	89.20	0.4721-0.5030	136.40	112.80	104.90	101.00	97.05	93.80
17/32	.5312	.1560	.1250	1/4	2 3/4	52217	89.70	0.5031-0.5340	136.80	113.20	105.35	101.45	97.45	94.25
9/16	.5625	.1560	.1250	1/4	2 3/4	52218	90.05	0.5341-0.5660	137.15	113.65	105.75	101.85	97.95	94.65
19/32	.5938	.1560	.1250	1/4	2 3/4	52219	90.50	0.5661-0.5970	137.75	114.15	106.40	102.45	98.40	95.15
5/8	.6250	.1560	.1250	1/4	2 3/4	52220	91.55	0.5971-0.6280	138.65	115.20	107.25	103.45	99.45	96.10
21/32	.6562	.2190	.1875	1/4	2 3/4	52221	101.70	0.6281-0.6590	148.80	125.25	117.50	113.65	109.60	106.45
11/16	.6875	.2190	.1875	1/4	2 3/4	52222	106.85	0.6591-0.6910	153.95	130.45	122.55	118.70	114.60	111.45
23/32	.7188	.2190	.1875	1/4	2 3/4	52223	110.45	0.6911-0.7220	157.45	134.05	126.10	122.35	118.25	115.15
3/4	.7500	.2190	.1875	1/4	2 3/4	52224	111.85	0.7221-0.7530	158.90	135.45	127.45	123.70	119.70	116.50
25/32	.7812	.2190	.1875	1/4	2 3/4	52225	112.25	0.7531-0.7840	159.45	135.85	128.05	124.05	120.15	116.90
13/16	.8125	.2190	.1875	1/4	2 3/4	52226	113.25	0.7841-0.8160	160.55	136.85	129.00	125.10	121.20	117.90
27/32	.8438	.2190	.1875	1/4	2 3/4	52227	114.10	0.8161-0.8470	161.25	137.50	129.70	125.85	121.90	118.70
7/8	.8750	.2190	.1875	1/4	2 3/4	52228	115.20	0.8471-0.8780	162.25	138.65	130.90	127.00	122.95	119.75
29/32	.9062	.2190	.1875	1/4	2 3/4	52229	115.90	0.8781-0.9090	163.10	139.55	131.75	127.80	123.80	120.60
15/16	.9375	.2190	.1875	1/4	2 3/4	52230	117.00	0.9091-0.9410	164.20	140.65	132.80	128.90	125.00	121.60
31/32	.9688	.2190	.1875	1/4	2 3/4	52231	117.85	0.9411-0.9720	164.95	141.35	133.65	129.65	125.70	122.45
1	1.0000	.2190	.1875	1/4	2 3/4	52232	118.20	0.9721-1.0030	165.40	141.80	133.85	130.05	126.00	122.80
1 1/16	1.0625	.2190	.1875	3/8	2 3/4	52234	150.90	1.0031-1.0660	197.95	174.35	166.65	162.65	158.65	155.45
1 1/8	1.1250	.2190	.1875	3/8	2 3/4	52236	160.95	1.0661-1.1280	208.05	184.50	176.75	172.85	168.80	165.55
1 3/16	1.1875	.2190	.1875	3/8	2 3/4	52238	163.05	1.1281-1.1905	210.15	186.60	178.75	174.90	170.90	167.65
1 1/4	1.2500	.2810	.2500	3/8	2 3/4	52240	166.05	1.1906-1.2530	213.35	189.65	181.70	177.90	174.05	170.75
1 5/16	1.3125	.2810	.2500	3/8	2 3/4	52242	169.15	1.2531-1.3155	216.20	192.65	184.90	181.00	176.90	173.70
1 3/8	1.3750	.2810	.2500	3/8	2 3/4	52244	171.05	1.3156-1.3780	218.30	194.85	186.90	182.95	179.05	175.70
1 7/16	1.4375	.2810	.2500	3/8	2 3/4	52246	173.10	1.3781-1.4405	220.35	196.70	188.95	185.00	181.05	177.80
1 1/2	1.5000	.2810	.2500	3/8	2 3/4	52248	182.30	1.4406-1.5030	231.10	206.70	198.55	194.55	190.35	187.10
1 9/16	1.5625	.3430	.3125	1/2	3 1/16	52250	202.75	1.5031-1.5660	251.60	227.25	219.10	215.10	211.00	207.70
1 5/8	1.6250	.3430	.3125	1/2	3 1/16	52252	205.40	1.5661-1.6280	254.35	229.90	221.85	217.80	213.60	210.20
1 11/16	1.6875	.3430	.3125	1/2	3 1/16	52254	208.10	1.6281-1.6910	257.05	232.65	224.50	220.50	216.40	213.00
1 3/4	1.7500	.3430	.3125	1/2	3 1/16	52256	211.35	1.6911-1.7530	260.25	235.70	227.60	223.55	219.50	216.15
1 13/16	1.8125	.3430	.3125	1/2	3 1/16	52258	213.90	1.7531-1.8160	262.30	237.90	229.75	225.75	221.50	218.20
1 7/8	1.8750	.3430	.3125	1/2	3 1/16	52260	215.40	1.8161-1.8780	264.35	239.85	231.65	227.75	223.55	220.20
1 15/16	1.9375	.3430	.3125	1/2	3 1/16	52262	237.70	1.8781-1.9410	286.60	262.10	253.95	249.95	245.80	242.50
2	2.0000	.3430	.3125	1/2	3 1/16	52264	295.75	1.9411-2.0030	344.85	320.40	312.25	308.20	304.00	300.60

*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	5/64	3 13/16	-	-	3	51408	\$83.45	0.2381-0.2530	\$130.55	\$107.05	\$99.20	\$95.25	\$91.25	\$88.00
5/32	.2812	.1140	.0938	17/64	3 13/16	-	-	3	51409	102.00	0.2531-0.2840	149.00	125.60	117.70	113.85	109.90	106.60
3/16	.3125	.1140	.0938	19/64	3 13/16	-	-	3	51410	87.05	0.2841-0.3150	131.20	109.20	101.85	98.15	94.45	91.35
11/32	.3438	.1140	.0938	5/16	3 13/16	-	-	3	51411	110.20	0.3151-0.3470	154.35	132.20	124.85	121.25	117.50	114.35
3/8	.3750	.1820	.1562	5/16	4 1/16	-	-	3	51412	92.30	0.3471-0.3780	133.10	112.70	105.90	102.55	99.10	96.35
13/32	.4062	.1820	.1562	3/8	4 1/16	-	-	3	51413	104.05	0.3781-0.4090	144.85	124.50	117.65	114.30	110.85	108.10
7/16	.4375	.1820	.1562	3/8	4 1/16	-	-	3	51414	94.70	0.4091-0.4410	135.50	115.05	108.25	105.05	101.45	98.70
15/32	.4688	.2280	.1875	7/16	4 3/16	-	-	3	51415	115.60	0.4411-0.4720	156.40	135.95	129.30	125.95	122.35	119.60
1/2	.5000	.2280	.1875	7/16	4 3/16	4	51216	3	51416	105.15	0.4721-0.5030	145.85	125.40	118.75	115.30	111.90	109.15
17/32	.5312	.2280	.1875	1/2	4 3/16	4	51217	3	51417	118.95	0.5031-0.5340	159.75	139.45	132.60	129.30	125.75	122.95
9/16	.5625	.2280	.1875	1/2	4 3/16	4	51218	3	51418	108.20	0.5341-0.5660	149.00	128.55	121.80	118.35	115.00	112.10
19/32	.5938	.2280	.1875	1/2	5 1/8	4	51219	3	51419	120.25	0.5661-0.5970	160.95	140.60	133.85	130.45	126.95	124.20
5/8	.6250	.2280	.1875	1/2	5 1/8	4	51220	3	51420	109.30	0.5971-0.6280	150.00	129.55	122.80	119.50	116.00	113.25
21/32	.6562	.2280	.1875	1/2	5 1/8	4	51221	3	51421	127.20	0.6281-0.6590	167.95	147.65	140.80	137.45	134.05	131.20
11/16	.6875	.2280	.1875	1/2	5 1/8	4	51222	3	51422	115.70	0.6591-0.6910	156.50	136.10	129.35	126.00	122.60	119.65
23/32	.7188	.2900	.2500	1/2	5 3/8	4	51223	3	51423	130.25	0.6911-0.7220	170.90	150.60	143.80	140.55	137.00	134.25
3/4	.7500	.2900	.2500	1/2	5 3/8	4	51224	3	51424	118.30	0.7221-0.7530	159.15	138.75	131.90	128.55	125.15	122.25
25/32	.7812	.2900	.2500	5/8	5 3/8	4	51225	3	51425	133.05	0.7531-0.7840	173.70	153.30	146.60	143.20	139.70	136.95
13/16	.8125	.2900	.2500	5/8	5 3/8	4	51226	3	51426	120.80	0.7841-0.8160	161.55	141.15	134.40	130.95	127.65	124.85
27/32	.8438	.2900	.2500	3/4	5 3/8	4	51227	3	51427	140.85	0.8161-0.8470	181.65	161.20	154.50	151.10	147.70	144.85
7/8	.8750	.2900	.2500	3/4	5 3/8	4	51228	3	51428	128.10	0.8471-0.8780	168.85	148.50	141.75	138.30	134.90	132.05
29/32	.9062	.2900	.2500	3/4	6 1/8	4	51229	3	51429	143.70	0.8781-0.9090	184.50	164.10	157.30	154.00	150.55	147.75
15/16	.9375	.2900	.2500	3/4	6 1/8	4	51230	3	51430	130.75	0.9091-0.9410	171.55	151.10	144.35	140.95	137.50	134.70
31/32	.9688	.3530	.3125	3/4	6 3/8	4	51231	3	51431	147.90	0.9411-0.9720	188.60	168.20	161.45	158.10	154.70	151.90
1	1.0000	.3530	.3125	3/4	6 3/8	4	51232	3	51432	134.45	0.9721-1.0030	175.30	154.80	148.00	144.65	141.25	138.40
1 1/16	1.0625	.3530	.3125	3/4	6 3/8	4	51234	3	51434	135.85	1.0031-1.0660	176.70	156.20	149.40	146.20	142.65	139.85
1 1/8	1.1250	.3530	.3125	1	6 3/8	4	51236	3	51436	139.45	1.0661-1.1280	180.10	159.75	153.05	149.55	146.20	143.35
1 3/16	1.1875	.3530	.3125	1	6 3/8	4	51238	3	51438	145.55	1.1281-1.1905	186.25	166.00	159.20	155.80	152.35	149.55
1 1/4	1.2500	.4260	.3750	1	6 3/8	-	-	4	51440	162.10	1.1906-1.2530	206.25	184.25	176.85	173.25	169.40	166.55
1 5/16	1.3125	.4260	.3750	1	6 3/8	-	-	4	51442	174.95	1.2531-1.3155	219.25	197.15	189.70	186.10	182.35	179.35
1 3/8	1.3750	.4260	.3750	1	6 3/8	-	-	4	51444	184.15	1.3156-1.3780	228.25	206.10	198.70	195.05	191.45	188.35
1 7/16	1.4375	.4260	.3750	1 1/4	7 7/8	-	-	4	51446	201.80	1.3781-1.4405	249.75	225.75	217.75	213.75	209.80	206.45
1 1/2	1.5000	.4260	.3750	1 1/4	7 7/8	-	-	4	51448	233.30	1.4406-1.5030	283.10	258.10	249.85	245.85	241.60	238.15
1 9/16	1.5625	.4890	.4375	1 1/4	8 1/8	-	-	4	51450	240.15	1.5031-1.5660	290.05	265.05	256.70	252.60	248.45	245.05
1 5/8	1.6250	.4890	.4375	1 1/4	8 1/8	-	-	4	51452	245.15	1.5661-1.6280	295.05	270.10	261.90	257.75	253.55	250.15
1 11/16	1.6875	.4890	.4375	1 1/4	8 1/8	-	-	4	51454	293.40	1.6281-1.6910	347.10	320.25	311.25	306.75	302.30	298.55
1 3/4	1.7500	.4890	.4375	1 1/4	8 1/8	-	-	4	51456	293.40	1.6911-1.7530	347.10	320.25	311.25	306.75	302.30	298.55
1 13/16	1.8125	.4890	.4375	1 1/2	8 1/8	-	-	4	51458	347.25	1.7531-1.8160	401.05	374.20	365.25	360.85	356.15	352.55
1 7/8	1.8750	.4890	.4375	1 1/2	8 1/8	-	-	4	51460	347.25	1.8161-1.8780	401.05	374.20	365.25	360.85	356.15	352.55
1 15/16	1.9375	.4890	.4375	1 1/2	8 1/8	-	-	4	51462	379.50	1.8781-1.9410	433.40	406.50	397.50	392.95	388.50	384.80
2	2.0000	.5510	.5000	1 1/2	8 3/8	-	-	4	51464	379.50	1.9411-2.0030	433.40	406.50	397.50	392.95	388.50	384.80

*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 FLT.	METRIC EDP NO.	NO. OF FLT.	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	1/64	3 13/16	-	-	3	514060	\$99.20	6.000-6.426	\$134.30	\$110.75	\$102.90	\$99.20	\$95.20	\$92.05	\$87.35
6.5	.2559	.1140	.0938	1/64	3 13/16	-	-	3	514065	117.70	6.427-7.214	152.85	129.35	121.50	117.70	113.80	110.60	105.90
7.0	.2756	.1140	.0938	1/64	3 13/16	-	-	3	514070	117.70	-	-	-	-	-	-	-	
7.5	.2953	.1140	.0938	1/64	3 13/16	-	-	3	514075	101.85	7.215-8.001	134.80	112.70	105.30	101.85	98.10	95.10	90.70
8.0	.3150	.1140	.0938	1/64	3 13/16	-	-	3	514080	101.85	-	-	-	-	-	-	-	
8.5	.3346	.1140	.0938	3/16	3 13/16	-	-	3	514085	124.85	8.002-8.814	157.90	135.75	128.35	124.85	121.10	118.10	113.85
9.0	.3543	.1820	.1562	5/16	4 1/16	-	-	3	514090	105.90	8.815-9.601	136.35	115.95	109.20	105.90	102.50	99.65	95.70
9.5	.3740	.1820	.1562	5/16	4 1/16	-	-	3	514095	105.90	-	-	-	-	-	-	-	
10.0	.3937	.1820	.1562	3/8	4 1/16	-	-	3	514100	117.65	9.602-10.389	148.10	127.75	120.95	117.65	114.25	111.50	107.55
10.5	.4134	.1820	.1562	3/8	4 1/16	-	-	3	514105	108.25	10.390-11.201	138.75	118.30	111.55	108.25	104.90	102.05	98.10
11.0	.4331	.1820	.1562	3/8	4 1/16	-	-	3	514110	108.25	-	-	-	-	-	-	-	
11.5	.4528	.2280	.1875	7/16	4 5/16	-	-	3	514115	129.30	11.202-11.989	159.55	139.25	132.50	129.30	125.75	122.95	118.95
12.0	.4724	.2280	.1875	7/16	4 5/16	4	512120	3	514120	118.75	11.990-12.776	149.15	128.80	122.00	118.75	115.25	112.50	108.40
12.5	.4921	.2280	.1875	7/16	4 5/16	4	512125	3	514125	118.75	-	-	-	-	-	-	-	
13.0	.5118	.2280	.1875	1/2	4 5/16	4	512130	3	514130	132.60	12.777-13.564	162.95	142.60	135.80	132.60	129.10	126.35	122.25
13.5	.5315	.2280	.1875	1/2	4 5/16	4	512135	3	514135	132.60	-	-	-	-	-	-	-	
14.0	.5512	.2280	.1875	1/2	4 5/16	4	512140	3	514140	121.80	13.565-14.376	152.25	131.85	125.10	121.80	118.30	115.55	111.55
14.5	.5709	.2280	.1875	1/2	5 1/8	4	512145	3	514145	133.85	14.377-15.164	164.25	143.80	137.00	133.85	130.35	127.60	123.50
15.0	.5906	.2280	.1875	1/2	5 1/8	4	512150	3	514150	133.85	-	-	-	-	-	-	-	
15.5	.6102	.2280	.1875	1/2	5 1/8	4	512155	3	514155	122.80	15.165-15.951	153.25	133.00	126.15	122.80	119.45	116.60	112.65
16.0	.6299	.2280	.1875	1/2	5 1/8	4	512160	3	514160	140.80	15.952-16.739	171.20	150.80	144.00	140.80	137.40	134.55	130.65
16.5	.6496	.2280	.1875	1/2	5 1/8	4	512165	3	514165	140.80	-	-	-	-	-	-	-	
17.0	.6693	.2280	.1875	1/2	5 1/8	4	512170	3	514170	129.35	16.740-17.551	159.75	139.45	132.60	129.35	125.95	123.05	119.05
17.5	.6890	.2280	.1875	1/2	5 1/8	4	512175	3	514175	129.35	-	-	-	-	-	-	-	
18.0	.7087	.2900	.2500	1/2	5 3/8	4	512180	3	514180	143.80	17.552-18.339	174.30	153.90	147.10	143.80	140.40	137.60	133.55
18.5	.7283	.2900	.2500	1/2	5 3/8	4	512185	3	514185	131.90	18.340-19.126	162.30	142.00	135.20	131.90	128.45	125.60	121.70
19.0	.7480	.2900	.2500	1/2	5 3/8	4	512190	3	514190	131.90	-	-	-	-	-	-	-	
19.5	.7677	.2900	.2500	5/8	5 3/8	4	512195	3	514195	146.60	19.127-19.914	176.95	156.65	149.85	146.60	143.15	140.30	136.35
20.0	.7874	.2900	.2500	5/8	5 3/8	4	512200	3	514200	134.40	19.915-20.726	164.80	144.50	137.65	134.40	130.90	128.20	124.20
20.5	.8071	.2900	.2500	5/8	5 3/8	4	512205	3	514205	134.40	-	-	-	-	-	-	-	
21.0	.8268	.2900	.2500	3/4	5 3/8	4	512210	3	514210	154.50	20.727-21.514	184.90	164.55	157.85	154.50	151.00	148.20	144.25
21.5	.8465	.2900	.2500	3/4	5 3/8	4	512215	3	514215	154.50	-	-	-	-	-	-	-	
22.0	.8661	.2900	.2500	3/4	5 3/8	4	512220	3	514220	141.75	21.515-22.301	172.15	151.80	144.95	141.75	138.25	135.50	131.50
22.5	.8858	.2900	.2500	3/4	6 1/8	4	512225	3	514225	157.30	22.302-23.089	187.75	167.40	160.60	157.30	153.90	151.10	147.10
23.0	.9055	.2900	.2500	3/4	6 1/8	4	512230	3	514230	157.30	-	-	-	-	-	-	-	
23.5	.9252	.2900	.2500	3/4	6 1/8	4	512235	3	514235	144.35	23.090-23.901	174.75	154.40	147.65	144.35	140.85	138.10	134.10
24.0	.9449	.3530	.3125	3/4	6 3/8	4	512240	3	514240	161.45	23.902-24.689	191.85	171.60	164.75	161.45	158.05	155.35	151.20
24.5	.9646	.3530	.3125	3/4	6 3/8	4	512245	3	514245	161.45	-	-	-	-	-	-	-	
25.0	.9843	.3530	.3125	3/4	6 3/8	4	512250	3	514250	148.00	24.690-25.476	178.50	158.10	151.35	148.00	144.60	141.90	137.90
25.5	1.0039	.3530	.3125	3/4	6 3/8	4	512255	3	514255	149.40	25.477-27.076	179.85	159.50	152.75	149.40	146.05	143.30	139.25
26.0	1.0236	.3530	.3125	3/4	6 3/8	4	512260	3	514260	149.40	-	-	-	-	-	-	-	
27.0	1.0630	.3530	.3125	3/4	6 3/8	4	512270	3	514270	149.40	-	-	-	-	-	-	-	
28.0	1.1024	.3530	.3125	1	6 3/8	4	512280	3	514280	153.05	27.077-28.651	183.45	162.95	156.15	153.05	149.40	146.70	142.65
29.0	1.1417	.3530	.3125	1	6 3/8	4	512290	3	514290	159.20	28.652 30.239	189.50	169.25	162.40	159.20	155.75	153.05	149.00
30.0	1.1811	.3530	.3125	1	6 3/8	4	512300	3	514300	159.20	-	-	-	-	-	-	-	
31.0	1.2205	.4260	.3750	1	6 3/8	-	-	4	514310	176.85	30.240-31.826	209.85	187.75	180.40	176.85	173.10	170.05	165.80
32.0	1.2598	.4260	.3750	1	6 3/8	-	-	4	514320	189.70	31.827-33.414	222.75	200.60	193.30	189.70	186.05	183.00	178.65
33.0	1.2992	.4260	.3750	1	6 3/8	-	-	4	514330	189.70	-	-	-	-	-	-	-	
34.0	1.3386	.4260	.3750	1	6 3/8	-	-	4	514340	198.70	33.415-35.001	231.70	209.75	202.25	198.70	195.00	191.90	187.60
35.0	1.3780	.4260	.3750	1	6 3/8	-	-	4	514350	198.70	-	-	-	-	-	-	-	
36.0	1.4173	.4260	.3750	1 1/4	7 7/8	-	-	4	514360	217.75	35.002-36.589	253.60	229.70	221.55	217.75	213.60	210.40	205.75
37.0	1.4567	.4260	.3750	1 1/4	7 7/8	-	-	4	514370	240.80	36.590-38.176	276.70	252.70	244.75	240.80	236.80	233.45	228.80
38.0	1.4961	.4260	.3750	1 1/4	7 7/8	-	-	4	514380	240.80	-	-	-	-	-	-	-	

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						
FRAC.	DEC.	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					
											1	2	3	4	5-7	8-14*	
1/4	.2500	.1140	.0938	1	3 13/16	-	-	3	51608	\$101.25	0.2381-0.2530	\$150.10	\$125.70	\$117.55	\$113.50	\$109.40	\$106.05
5/32	.2812	.1140	.0938	1	3 13/16	-	-	3	51609	121.90	0.2531-0.2840	170.60	146.10	138.00	134.05	130.05	126.50
3/16	.3125	.1140	.0938	1	3 13/16	-	-	3	51610	104.05	0.2841-0.3150	149.90	126.95	119.40	115.60	111.65	108.55
11/32	.3438	.1140	.0938	1	3 13/16	-	-	3	51611	128.25	0.3151-0.3470	174.10	151.10	143.40	139.70	135.80	132.70
3/8	.3750	.1820	.1562	1	4 1/16	-	-	3	51612	107.45	0.3471-0.3780	149.60	128.55	121.45	118.05	114.50	111.60
13/32	.4062	.1820	.1562	1	4 1/16	-	-	3	51613	121.35	0.3781-0.4090	163.60	142.45	135.50	131.90	128.40	125.50
7/16	.4375	.1820	.1562	1	4 1/16	-	-	3	51614	110.30	0.4091-0.4410	152.50	131.45	124.35	120.95	117.40	114.50
15/32	.4688	.2280	.1875	1	4 5/16	-	-	3	51615	133.95	0.4411-0.4720	176.20	155.05	148.00	144.55	141.05	138.15
1/2	.5000	.2280	.1875	1	4 5/16	4	51816	3	51616	121.80	0.4721-0.5030	164.15	142.95	135.80	132.50	128.80	125.95
17/32	.5312	.2280	.1875	1	4 5/16	4	51817	3	51617	136.40	0.5031-0.5340	178.65	157.50	150.45	147.00	143.40	140.55
9/16	.5625	.2280	.1875	1	4 5/16	4	51818	3	51618	124.05	0.5341-0.5660	166.30	145.15	138.20	134.60	131.15	128.25
19/32	.5938	.2280	.1875	2	5 1/8	4	51819	3	51619	140.15	0.5661-0.5970	182.45	161.30	154.30	150.75	147.25	144.30
5/8	.6250	.2280	.1875	2	5 1/8	4	51820	3	51620	127.40	0.5971-0.6280	169.55	148.55	141.45	138.10	134.35	131.50
21/32	.6562	.2280	.1875	2	5 1/8	4	51821	3	51621	147.95	0.6281-0.6590	190.25	169.15	162.00	158.65	155.00	152.10
11/16	.6875	.2280	.1875	2	5 1/8	4	51822	3	51622	134.35	0.6591-0.6910	176.75	155.50	148.55	145.00	141.45	138.55
23/32	.7188	.2900	.2500	2	5 3/8	4	51823	3	51623	150.40	0.6911-0.7220	192.65	171.55	164.50	161.10	157.45	154.60
3/4	.7500	.2900	.2500	2	5 3/8	4	51824	3	51624	136.75	0.7221-0.7530	178.90	157.85	150.75	147.35	143.70	140.70
25/32	.7812	.2900	.2500	2	5 3/8	4	51825	3	51625	153.00	0.7531-0.7840	195.15	174.10	166.95	163.50	159.95	157.10
13/16	.8125	.2900	.2500	2	5 3/8	4	51826	3	51626	139.05	0.7841-0.8160	181.30	160.20	153.20	149.60	146.10	143.20
27/32	.8438	.2900	.2500	2	5 3/8	4	51827	3	51627	160.75	0.8161-0.8470	203.10	182.00	174.95	171.50	167.95	165.00
7/8	.8750	.2900	.2500	2	5 3/8	4	51828	3	51628	146.20	0.8471-0.8780	188.45	167.30	160.35	156.75	153.25	150.30
29/32	.9062	.2900	.2500	3	6 1/8	4	51829	3	51629	165.20	0.8781-0.9090	207.40	186.25	179.35	175.70	172.25	169.35
15/16	.9375	.2900	.2500	3	6 1/8	4	51830	3	51630	150.15	0.9091-0.9410	192.40	171.30	164.25	160.70	157.30	154.35
31/32	.9688	.3530	.3125	3	6 3/8	4	51831	3	51631	169.05	0.9411-0.9720	211.25	190.20	183.10	179.65	176.00	173.05
1	1.0000	.3530	.3125	3	6 3/8	4	51832	3	51632	159.45	0.9721-1.0030	203.35	181.40	174.10	170.55	166.70	163.75
1 1/16	1.0625	.3530	.3125	3	6 3/8	4	51834	3	51634	161.55	1.0031-1.0660	205.30	183.45	176.15	172.55	168.75	165.80
1 1/8	1.1250	.3530	.3125	3	6 3/8	4	51836	3	51636	166.65	1.0661-1.1280	210.55	188.70	181.20	177.65	173.95	170.95
1 3/16	1.1875	.3530	.3125	3	6 3/8	4	51838	3	51638	172.30	1.1281-1.1905	216.30	194.30	186.90	183.40	179.65	176.65
1 1/4	1.2500	.4260	.3750	3	6 5/8	-	-	4	51640	191.60	1.1906-1.2530	239.10	215.35	207.40	203.55	199.55	196.20
1 5/16	1.3125	.4260	.3750	3	6 5/8	-	-	4	51642	205.30	1.2531-1.3155	253.05	229.05	221.25	217.25	213.35	210.00
1 3/8	1.3750	.4260	.3750	3	6 5/8	-	-	4	51644	215.20	1.3156-1.3780	262.70	238.95	231.00	227.05	223.20	219.80
1 7/16	1.4375	.4260	.3750	4	7 7/8	-	-	4	51646	239.40	1.3781-1.4405	291.10	265.25	256.50	252.30	247.95	244.40
1 1/2	1.5000	.4260	.3750	4	7 7/8	-	-	4	51648	265.35	1.4406-1.5030	317.10	291.30	282.65	278.35	274.05	270.50
1 9/16	1.5625	.4890	.4375	4	8 1/8	-	-	4	51650	285.10	1.5031-1.5660	339.30	312.30	303.30	298.75	294.25	290.55
1 5/8	1.6250	.4890	.4375	4	8 1/8	-	-	4	51652	290.25	1.5661-1.6280	344.35	317.40	308.35	303.85	299.25	295.65
1 11/16	1.6875	.4890	.4375	4	8 1/8	-	-	4	51654	347.25	1.6281-1.6910	405.80	376.60	366.90	362.05	357.05	353.05
1 3/4	1.7500	.4890	.4375	4	8 1/8	-	-	4	51656	347.25	1.6911-1.7530	405.80	376.60	366.90	362.05	357.05	353.05
1 13/16	1.8125	.4890	.4375	4	8 1/8	-	-	4	51658	411.05	1.7531-1.8160	469.50	440.30	430.55	425.70	420.75	416.65
1 7/8	1.8750	.4890	.4375	4	8 1/8	-	-	4	51660	411.05	1.8161-1.8780	469.50	440.30	430.55	425.70	420.75	416.65
1 15/16	1.9375	.4890	.4375	4	8 1/8	-	-	4	51662	449.10	1.8781-1.9410	507.65	478.40	468.55	463.80	458.90	454.85
2	2.0000	.5510	.5000	4	8 3/8	-	-	4	51664	449.10	1.9411-2.0030	507.65	478.40	468.55	463.80	458.90	454.85

*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	\$117.55	6.000-6.426	\$154.00	\$129.55	\$121.45	\$117.55	\$113.45	\$110.05	\$105.30
6.5	.2559	.1140	.0938	1	3 1/16	-	-	3	516065	138.00	6.427-7.214	174.45	150.10	141.90	138.00	133.95	130.65	125.80
7.0	.2756	.1140	.0938	1	3 1/16	-	-	3	516070	138.00	-	-	-	-	-	-	-	
7.5	.2953	.1140	.0938	1	3 1/16	-	-	3	516075	119.40	7.215-8.001	153.60	130.70	122.95	119.40	115.50	112.25	107.80
8.0	.3150	.1140	.0938	1	3 1/16	-	-	3	516080	119.40	-	-	-	-	-	-	-	
8.5	.3346	.1140	.0938	1	3 1/16	-	-	3	516085	143.40	8.002-8.814	177.75	154.80	147.25	143.40	139.65	136.50	131.90
9.0	.3543	.1820	.1562	1	4 1/16	-	-	3	516090	121.45	8.815-9.601	153.10	131.90	124.90	121.45	117.90	115.00	110.85
9.5	.3740	.1820	.1562	1	4 1/16	-	-	3	516095	121.45	-	-	-	-	-	-	-	
10.0	.3937	.1820	.1562	1	4 1/16	-	-	3	516100	135.50	9.602-10.389	166.95	145.90	138.90	135.50	131.80	128.85	124.85
10.5	.4134	.1820	.1562	1	4 1/16	-	-	3	516105	124.35	10.390-11.201	156.00	134.85	127.80	124.35	120.80	117.90	113.70
11.0	.4331	.1820	.1562	1	4 1/16	-	-	3	516110	124.35	-	-	-	-	-	-	-	
11.5	.4528	.2280	.1875	1	4 3/16	-	-	3	516115	148.00	11.202-11.989	179.65	158.55	151.45	148.00	144.50	141.50	137.30
12.0	.4724	.2280	.1875	1	4 3/16	4	518120	3	516120	135.80	11.990-12.776	167.55	146.30	139.25	135.80	132.45	129.45	125.30
12.5	.4921	.2280	.1875	1	4 3/16	4	518125	3	516125	135.80	-	-	-	-	-	-	-	
13.0	.5118	.2280	.1875	1	4 3/16	4	518130	3	516130	150.45	12.777-13.564	182.10	161.05	153.85	150.45	146.95	144.00	139.85
13.5	.5315	.2280	.1875	1	4 3/16	4	518135	3	516135	150.45	-	-	-	-	-	-	-	
14.0	.5512	.2280	.1875	1	4 3/16	4	518140	3	516140	138.20	13.565-14.376	169.80	148.65	141.50	138.20	134.45	131.60	127.50
14.5	.5709	.2280	.1875	2	5 1/8	4	518145	3	516145	154.30	14.377-15.164	185.90	164.60	157.55	154.30	150.70	147.70	143.60
15.0	.5906	.2280	.1875	2	5 1/8	4	518150	3	516150	154.30	-	-	-	-	-	-	-	
15.5	.6102	.2280	.1875	2	5 1/8	4	518155	3	516155	141.45	15.165-15.951	173.00	151.90	144.85	141.45	137.95	135.05	130.85
16.0	.6299	.2280	.1875	2	5 1/8	4	518160	3	516160	162.00	15.952-16.739	193.65	172.40	165.40	162.00	158.55	155.50	151.45
16.5	.6496	.2280	.1875	2	5 1/8	4	518165	3	516165	162.00	-	-	-	-	-	-	-	
17.0	.6693	.2280	.1875	2	5 1/8	4	518170	3	516170	148.55	16.740-17.551	180.05	158.90	151.90	148.55	144.95	142.00	137.95
17.5	.6890	.2280	.1875	2	5 1/8	4	518175	3	516175	148.55	-	-	-	-	-	-	-	
18.0	.7087	.2900	.2500	2	5 3/8	4	518180	3	516180	164.50	17.552-18.339	196.05	174.95	167.95	164.50	161.05	158.00	153.85
18.5	.7283	.2900	.2500	2	5 3/8	4	518185	3	516185	150.75	18.340-19.126	182.35	161.20	154.10	150.75	147.25	144.30	140.15
19.0	.7480	.2900	.2500	2	5 3/8	4	518190	3	516190	150.75	-	-	-	-	-	-	-	
19.5	.7677	.2900	.2500	2	5 3/8	4	518195	3	516195	166.95	19.127-19.914	198.60	177.40	170.50	166.95	163.45	160.55	156.40
20.0	.7874	.2900	.2500	2	5 3/8	4	518200	3	516200	153.20	19.915-20.726	184.75	163.60	156.50	153.20	149.55	146.70	142.55
20.5	.8071	.2900	.2500	2	5 3/8	4	518205	3	516205	153.20	-	-	-	-	-	-	-	
21.0	.8268	.2900	.2500	2	5 3/8	4	518210	3	516210	174.95	20.727-21.514	206.60	185.40	178.35	174.95	171.40	168.50	164.30
21.5	.8465	.2900	.2500	2	5 3/8	4	518215	3	516215	174.95	-	-	-	-	-	-	-	
22.0	.8661	.2900	.2500	2	5 3/8	4	518220	3	516220	160.35	21.515-22.301	191.80	170.75	163.75	160.35	156.65	153.80	149.60
22.5	.8858	.2900	.2500	3	6 1/8	4	518225	3	516225	179.35	22.302-23.089	210.85	189.75	182.65	179.35	175.65	172.80	168.60
23.0	.9055	.2900	.2500	3	6 1/8	4	518230	3	516230	179.35	-	-	-	-	-	-	-	
23.5	.9252	.2900	.2500	3	6 1/8	4	518235	3	516235	164.25	23.090-23.901	195.85	174.70	167.65	164.25	160.65	157.85	153.65
24.0	.9449	.3530	.3125	3	6 3/8	4	518240	3	516240	183.10	23.902-24.689	214.70	193.50	186.45	183.10	179.60	176.65	172.40
24.5	.9646	.3530	.3125	3	6 3/8	4	518245	3	516245	183.10	-	-	-	-	-	-	-	
25.0	.9843	.3530	.3125	3	6 3/8	4	518250	3	516250	167.80	24.690-25.476	199.30	178.20	171.15	167.80	164.20	161.30	157.25
25.5	1.0039	.3530	.3125	3	6 3/8	4	518255	3	516255	176.15	25.477-27.076	208.95	186.90	179.65	176.15	172.40	169.40	165.10
26.0	1.0236	.3530	.3125	3	6 3/8	4	518260	3	516260	176.15	-	-	-	-	-	-	-	
27.0	1.0630	.3530	.3125	3	6 3/8	4	518270	3	516270	176.15	-	-	-	-	-	-	-	
28.0	1.1024	.3530	.3125	3	6 3/8	4	518280	3	516280	181.20	27.077-28.651	214.05	192.15	184.85	181.20	177.55	174.65	170.25
29.0	1.1417	.3530	.3125	3	6 3/8	4	518290	3	516290	186.90	28.652-30.239	219.75	197.85	190.50	186.90	183.30	180.30	176.00
30.0	1.1811	.3530	.3125	3	6 3/8	4	518300	3	516300	186.90	-	-	-	-	-	-	-	
31.0	1.2205	.4260	.3750	3	6 5/8	-	-	4	516310	207.40	30.240-31.826	242.95	219.20	211.25	207.40	203.45	200.25	195.45
32.0	1.2598	.4260	.3750	3	6 5/8	-	-	4	516320	221.25	31.827-33.414	256.90	233.00	225.05	221.25	217.20	214.00	209.25
33.0	1.2992	.4260	.3750	3	6 5/8	-	-	4	516330	221.25	-	-	-	-	-	-	-	
34.0	1.3386	.4260	.3750	3	6 5/8	-	-	4	516340	231.00	33.415-35.001	266.65	242.80	234.80	231.00	227.00	223.85	219.00
35.0	1.3780	.4260	.3750	3	6 5/8	-	-	4	516350	231.00	-	-	-	-	-	-	-	
36.0	1.4173	.4260	.3750	4	7 7/8	-	-	4	516360	256.50	35.002-36.589	295.20	269.35	260.75	256.50	252.25	248.80	243.55
37.0	1.4567	.4260	.3750	4	7 7/8	-	-	4	516370	282.65	36.590-38.176	321.25	295.45	286.75	282.65	278.30	274.70	269.70
38.0	1.4961	.4260	.3750	4	7 7/8	-	-	4	516380	282.65	-	-	-	-	-	-	-	

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	\$101.25	0.2381-0.2530	\$150.10	\$125.70	\$117.55	\$113.50	\$109.40	\$106.05
9/32	.2812	.1140	.0938	3 13/16	3	17/64	51009	1	51109	121.90	0.2531-0.2840	170.60	146.10	138.00	134.05	130.05	126.50
5/16	.3125	.1140	.0938	3 13/16	3	19/64	51010	1	51110	104.05	0.2841-0.3150	149.90	126.95	119.40	115.60	111.65	108.55
11/32	.3438	.1140	.0938	3 13/16	3	5/16	51011	1	51111	128.25	0.3151-0.3470	174.10	151.10	143.40	139.70	135.80	132.70
3/8	.3750	.1820	.1562	4 1/16	3	5/16	51012	1	51112	107.45	0.3471-0.3780	149.60	128.55	121.45	118.05	114.50	111.60
13/32	.4062	.1820	.1562	4 1/16	3	3/8	51013	1	51113	121.35	0.3781-0.4090	163.60	142.45	135.50	131.90	128.40	125.50
7/16	.4375	.1820	.1562	4 1/16	3	3/8	51014	1	51114	110.30	0.4091-0.4410	152.50	131.45	124.35	120.95	117.40	114.50
15/32	.4688	.2280	.1875	4 5/16	3	7/16	51015	1	51115	133.95	0.4411-0.4720	176.20	155.05	148.00	144.55	141.05	138.15
1/2	.5000	.2280	.1875	4 5/16	3	7/16	51016	1	51116	121.80	0.4721-0.5030	164.15	142.95	135.80	132.50	128.80	125.95
17/32	.5312	.2280	.1875	4 5/16	3	1/2	51017	1	51117	131.50	0.5031-0.5340	172.20	151.85	145.05	141.75	138.25	135.50
9/16	.5625	.2280	.1875	4 5/16	3	1/2	51018	1	51118	119.55	0.5341-0.5660	160.35	139.85	133.15	129.65	126.35	123.50
19/32	.5938	.2280	.1875	5 1/8	3	1/2	51019	2	51119	135.05	0.5661-0.5970	175.75	155.45	148.65	145.25	141.90	139.00
5/8	.6250	.2280	.1875	5 1/8	3	1/2	51020	2	51120	122.75	0.5971-0.6280	163.50	143.15	136.35	133.05	129.50	126.75
21/32	.6562	.2280	.1875	5 1/8	3	1/2	51021	2	51121	142.55	0.6281-0.6590	183.30	162.90	156.10	152.75	149.30	146.60
11/16	.6875	.2280	.1875	5 1/8	3	1/2	51022	2	51122	129.50	0.6591-0.6910	170.30	149.90	143.15	139.70	136.35	133.45
23/32	.7188	.2900	.2500	5 3/8	3	1/2	51023	2	51123	144.95	0.6911-0.7220	185.70	165.35	158.60	155.20	151.80	149.00
3/4	.7500	.2900	.2500	5 3/8	3	1/2	51024	2	51124	131.75	0.7221-0.7530	172.40	152.00	145.25	141.95	138.40	135.65
25/32	.7812	.2900	.2500	5 3/8	3	5/8	51025	2	51125	147.40	0.7531-0.7840	188.10	167.80	160.95	157.50	154.15	151.35
13/16	.8125	.2900	.2500	5 3/8	3	5/8	51026	2	51126	134.05	0.7841-0.8160	174.75	154.40	147.65	144.25	140.80	138.00
27/32	.8438	.2900	.2500	5 3/8	3	3/4	51027	2	51127	154.95	0.8161-0.8470	195.80	175.40	168.60	165.20	161.85	159.00
7/8	.8750	.2900	.2500	5 3/8	3	3/4	51028	2	51128	140.85	0.8471-0.8780	181.65	161.20	154.50	151.10	147.70	144.85
29/32	.9062	.2900	.2500	6 1/8	3	3/4	51029	3	51129	159.20	0.8781-0.9090	199.85	179.50	172.80	169.35	166.00	163.20
15/16	.9375	.2900	.2500	6 1/8	3	3/4	51030	3	51130	144.65	0.9091-0.9410	185.40	165.00	158.20	154.85	151.50	148.70
31/32	.9688	.3530	.3125	6 3/8	3	3/4	51031	3	51131	162.85	0.9411-0.9720	203.55	183.20	176.40	173.05	169.50	166.80
1	1.0000	.3530	.3125	6 3/8	3	3/4	51032	3	51132	153.65	0.9721-1.0030	196.00	174.85	167.80	164.30	160.60	157.85
1 1/16	1.0625	.3530	.3125	6 3/8	3	3/4	51034	3	51134	155.70	1.0031-1.0660	197.85	176.75	169.70	166.20	162.65	159.80
1 1/8	1.1250	.3530	.3125	6 3/8	3	1	51036	3	51136	160.55	1.0661-1.1280	202.90	181.80	174.70	171.20	167.60	164.75
1 3/16	1.1875	.3530	.3125	6 3/8	3	1	51038	3	51138	166.05	1.1281-1.1905	208.45	187.25	180.15	176.70	173.05	170.25
1 1/4	1.2500	.4260	.3750	6 5/8	4	1	51040	3	51140	184.65	1.1906-1.2530	230.40	207.45	199.85	196.15	192.25	189.10
1 5/16	1.3125	.4260	.3750	6 5/8	4	1	51042	3	51142	197.85	1.2531-1.3155	243.80	220.80	213.25	209.35	205.60	202.40
1 3/8	1.3750	.4260	.3750	6 5/8	4	1	51044	3	51144	207.35	1.3156-1.3780	253.15	230.25	222.65	218.85	214.95	211.80
1 7/16	1.4375	.4260	.3750	7 7/8	4	1 1/4	51046	4	51146	230.60	1.3781-1.4405	280.55	255.65	247.20	243.20	238.95	235.50
1 1/2	1.5000	.4260	.3750	7 7/8	4	1 1/4	51048	4	51148	265.35	1.4406-1.5030	317.10	291.30	282.65	278.35	274.05	270.50
1 9/16	1.5625	.4890	.4375	8 1/8	4	1 1/4	51050	4	51150	285.10	1.5031-1.5660	339.30	312.30	303.30	298.75	294.25	290.55
1 5/8	1.6250	.4890	.4375	8 1/8	4	1 1/4	51052	4	51152	290.25	1.5661-1.6280	344.35	317.40	308.35	303.85	299.25	295.65
1 11/16	1.6875	.4890	.4375	8 1/8	4	1 1/4	51054	4	51154	347.25	1.6281-1.6910	405.80	376.60	366.90	362.05	357.05	353.05
1 3/4	1.7500	.4890	.4375	8 1/8	4	1 1/4	51056	4	51156	347.25	1.6911-1.7530	405.80	376.60	366.90	362.05	357.05	353.05
1 13/16	1.8125	.4890	.4375	8 1/8	4	1 1/2	51058	4	51158	411.05	1.7531-1.8160	469.50	440.30	430.55	425.70	420.75	416.65
1 7/8	1.8750	.4890	.4375	8 1/8	4	1 1/2	51060	4	51160	411.05	1.8161-1.8780	469.50	440.30	430.55	425.70	420.75	416.65
1 15/16	1.9375	.4890	.4375	8 1/8	4	1 1/2	51062	4	51162	449.10	1.8781-1.9410	507.65	478.40	468.55	463.80	458.90	454.85
2	2.0000	.5510	.5000	8 3/8	4	1 1/2	51064	4	51164	449.10	1.9411-2.0030	507.65	478.40	468.55	463.80	458.90	454.85

*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	\$117.55	6.000-6.426	\$154.00	\$129.55	\$121.45	\$117.55	\$113.45	\$110.05	\$105.30
6.5	.2559	.1140	.0938	3 1/16	3	17/64	510065	1	511065	138.00	6.427-7.214	174.45	150.10	141.90	138.00	133.95	130.65	125.80
7.0	.2756	.1140	.0938	3 1/16	3	17/64	510070	1	511070	138.00	-	-	-	-	-	-	-	
7.5	.2953	.1140	.0938	3 1/16	3	19/64	510075	1	511075	119.40	7.215-8.001	153.60	130.70	122.95	119.40	115.50	112.25	107.80
8.0	.3150	.1140	.0938	3 1/16	3	19/64	510080	1	511080	119.40	-	-	-	-	-	-	-	
8.5	.3346	.1140	.0938	3 1/16	3	5/16	510085	1	511085	143.40	8.002-8.814	177.75	154.80	147.25	143.40	139.65	136.50	131.90
9.0	.3543	.1820	.1562	4 1/16	3	5/16	510090	1	511090	121.45	8.815-9.601	153.10	131.90	124.90	121.45	117.90	115.00	110.85
9.5	.3740	.1820	.1562	4 1/16	3	5/16	510095	1	511095	121.45	-	-	-	-	-	-	-	
10.0	.3937	.1820	.1562	4 1/16	3	3/8	510100	1	511100	135.50	9.602-10.389	166.95	145.90	138.90	135.50	131.80	128.85	124.85
10.5	.4134	.1820	.1562	4 1/16	3	3/8	510105	1	511105	124.35	10.390-11.201	156.00	134.85	127.80	124.35	120.80	117.90	113.70
11.0	.4331	.1820	.1562	4 1/16	3	3/8	510110	1	511110	124.35	-	-	-	-	-	-	-	
11.5	.4528	.2280	.1875	4 5/16	3	7/16	510115	1	511115	148.00	11.202-11.989	179.65	158.55	151.45	148.00	144.50	141.50	137.30
12.0	.4724	.2280	.1875	4 5/16	3	7/16	510120	1	511120	135.80	11.990-12.776	167.55	146.30	139.25	135.80	132.45	129.45	125.30
12.5	.4921	.2280	.1875	4 5/16	3	7/16	510125	1	511125	135.80	-	-	-	-	-	-	-	
13.0	.5118	.2280	.1875	4 5/16	3	1/2	510130	1	511130	145.05	12.777-13.564	175.50	155.15	148.25	145.05	141.65	138.85	134.80
13.5	.5315	.2280	.1875	4 5/16	3	1/2	510135	1	511135	145.05	-	-	-	-	-	-	-	
14.0	.5512	.2280	.1875	4 5/16	3	1/2	510140	1	511140	133.15	13.565-14.376	163.55	143.20	136.40	133.15	129.60	126.85	122.85
14.5	.5709	.2280	.1875	5 1/8	3	1/2	510145	2	511145	148.65	14.377-15.164	179.10	158.70	151.90	148.65	145.20	142.35	138.35
15.0	.5906	.2280	.1875	5 1/8	3	1/2	510150	2	511150	148.65	-	-	-	-	-	-	-	
15.5	.6102	.2280	.1875	5 1/8	3	1/2	510155	2	511155	136.35	15.165-15.951	166.75	146.40	139.60	136.35	133.00	130.15	126.15
16.0	.6299	.2280	.1875	5 1/8	3	1/2	510160	2	511160	136.35	15.952-16.739	166.75	146.40	139.60	136.35	133.00	130.15	126.15
16.5	.6496	.2280	.1875	5 1/8	3	1/2	510165	2	511165	156.10	-	-	-	-	-	-	-	
17.0	.6693	.2280	.1875	5 1/8	3	1/2	510170	2	511170	143.15	16.740-17.551	173.50	153.20	146.40	143.15	139.65	136.85	133.00
17.5	.6890	.2280	.1875	5 1/8	3	1/2	510175	2	511175	143.15	-	-	-	-	-	-	-	
18.0	.7087	.2900	.2500	5 3/8	3	1/2	510180	2	511180	158.60	17.552-18.339	188.95	168.60	161.85	158.60	155.15	152.30	148.25
18.5	.7283	.2900	.2500	5 3/8	3	1/2	510185	2	511185	145.25	18.340-19.126	175.70	155.40	148.55	145.25	141.90	139.00	135.05
19.0	.7480	.2900	.2500	5 3/8	3	1/2	510190	2	511190	145.25	-	-	-	-	-	-	-	
19.5	.7677	.2900	.2500	5 3/8	3	5/8	510195	2	511195	160.95	19.127-19.914	191.45	170.90	164.25	160.95	157.45	154.70	150.70
20.0	.7874	.2900	.2500	5 3/8	3	5/8	510200	2	511200	147.65	19.915-20.726	178.05	157.70	150.80	147.65	144.20	141.30	137.40
20.5	.8071	.2900	.2500	5 3/8	3	5/8	510205	2	511205	147.65	-	-	-	-	-	-	-	
21.0	.8268	.2900	.2500	5 3/8	3	3/4	510210	2	511210	168.60	20.727-21.514	199.05	178.65	171.85	168.60	165.15	162.30	158.25
21.5	.8465	.2900	.2500	5 3/8	3	3/4	510215	2	511215	168.60	-	-	-	-	-	-	-	
22.0	.8661	.2900	.2500	5 3/8	3	3/4	510220	2	511220	154.50	21.515-22.301	184.90	164.55	157.85	154.50	151.00	148.20	144.25
22.5	.8858	.2900	.2500	6 1/8	3	3/4	510225	3	511225	172.80	22.302-23.089	203.25	182.85	176.00	172.80	169.30	166.60	162.50
23.0	.9055	.2900	.2500	6 1/8	3	3/4	510230	3	511230	172.80	-	-	-	-	-	-	-	
23.5	.9252	.2900	.2500	6 1/8	3	3/4	510235	3	511235	158.20	23.090-23.901	188.70	168.25	161.55	158.20	154.80	152.00	148.00
24.0	.9449	.3530	.3125	6 3/8	3	3/4	510240	3	511240	176.40	23.902-24.689	206.80	186.50	179.65	176.40	173.00	170.25	166.15
24.5	.9646	.3530	.3125	6 3/8	3	3/4	510245	3	511245	176.40	-	-	-	-	-	-	-	
25.0	.9843	.3530	.3125	6 3/8	3	3/4	510250	3	511250	161.60	24.690-25.476	192.10	171.70	164.90	161.60	158.15	155.45	151.45
25.5	1.0039	.3530	.3125	6 3/8	3	3/4	510255	3	511255	169.70	25.477-27.076	201.25	180.15	173.05	169.70	166.15	163.30	159.10
26.0	1.0236	.3530	.3125	6 3/8	3	3/4	510260	3	511260	169.70	-	-	-	-	-	-	-	
27.0	1.0630	.3530	.3125	6 3/8	3	3/4	510270	3	511270	169.70	-	-	-	-	-	-	-	
28.0	1.1024	.3530	.3125	6 3/8	3	1	510280	3	511280	174.70	27.077-28.651	206.25	185.10	178.10	174.70	171.15	168.20	164.10
29.0	1.1417	.3530	.3125	6 3/8	3	1	510290	3	511290	180.15	28.652-30.239	211.75	190.60	183.60	180.15	176.65	173.70	169.50
30.0	1.1811	.3530	.3125	6 3/8	3	1	510300	3	511300	180.15	-	-	-	-	-	-	-	
31.0	1.2205	.4260	.3750	6 5/8	4	1	510310	3	511310	199.85	30.240-31.826	234.15	211.20	203.55	199.85	196.05	192.95	188.35
32.0	1.2598	.4260	.3750	6 5/8	4	1	510320	3	511320	213.25	31.827-33.414	247.50	224.55	216.85	213.25	209.30	206.15	201.70
33.0	1.2992	.4260	.3750	6 5/8	4	1	510330	3	511330	213.25	-	-	-	-	-	-	-	
34.0	1.3386	.4260	.3750	6 5/8	4	1	510340	3	511340	222.65	33.415-35.001	257.00	233.95	226.35	222.65	218.80	215.60	211.05
35.0	1.3780	.4260	.3750	6 5/8	4	1	510350	3	511350	222.65	-	-	-	-	-	-	-	
36.0	1.4173	.4260	.3750	7 7/8	4	1 1/4	510360	4	511360	247.20	35.002-36.589	284.45	259.60	251.30	247.20	243.00	239.65	234.70
37.0	1.4567	.4260	.3750	7 7/8	4	1 1/4	510370	4	511370	272.40	36.590-38.176	309.60	284.65	276.30	272.40	268.20	264.75	259.90
38.0	1.4961	.4260	.3750	7 7/8	4	1 1/4	510380	4	511380	272.40	-	-	-	-	-	-	-	

C'BORES

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



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 = 1¼" through 1.9410" tool diameter; 1½" 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*	
½	.5000	.2188	.1875	1	¾	2 ½	3	57516	57616	\$215.05	0.4721-0.5030	\$296.95	\$256.10	\$242.35	\$235.60	\$228.70	\$223.10
⅝	.6250	.2188	.1875	1	¾	2 ½	3	57518	57618	215.05	0.5341-0.5660	296.95	256.10	242.35	235.60	228.70	223.10
⅞	.8750	.2188	.1875	1	¾	2 ½	3	57520	57620	215.05	0.5971-0.6280	296.95	256.10	242.35	235.60	228.70	223.10
1 ¼	1.2500	.2188	.1875	1	¾	2 ½	3	57522	57622	215.05	0.6591-0.6910	296.95	256.10	242.35	235.60	228.70	223.10
¾	.7500	.2969	.2500	2	¾	2 ⅞	4	57524	57624	201.50	0.7221-0.7530	283.40	242.60	228.85	222.15	215.30	209.60
13/16	.8125	.2969	.2500	2	¾	2 ⅞	4	57526	57626	201.50	0.7841-0.8160	283.40	242.60	228.85	222.15	215.30	209.60
7/8	.8750	.2969	.2500	2	¾	2 ⅞	4	57528	57628	201.50	0.8471-0.8780	283.40	242.60	228.85	222.15	215.30	209.60
15/16	.9375	.2969	.2500	2	¾	2 ⅞	4	57530	57630	194.35	0.9091-0.9410	276.30	235.35	221.70	215.00	208.10	202.45
1	1.0000	.3594	.3125	2	¾	2 ⅞	4	57532	57632	194.35	0.9721-1.0030	276.30	235.35	221.70	215.00	208.10	202.45
1 1/16	1.0625	.3594	.3125	2	¾	2 ⅞	4	57534	57634	194.35	1.0031-1.0660	276.30	235.35	221.70	215.00	208.10	202.45
1 1/8	1.1250	.3594	.3125	2	¾	2 ⅞	4	57536	57636	194.35	1.0661-1.1280	276.30	235.35	221.70	215.00	208.10	202.45
1 3/16	1.1875	.3594	.3125	2	¾	2 ⅞	4	57538	57638	201.50	1.1281-1.1905	283.40	242.60	228.85	222.15	215.30	209.60
1 ¼	1.2500	.3594	.3125	2	¾	2 ⅞	4	57540	57640	201.50	1.1906-1.2530	283.40	242.60	228.85	222.15	215.30	209.60
1 5/16	1.3125	.3594	.3125	2	¾	2 ⅞	4	57542	57642	204.75	1.2531-1.3155	286.65	245.75	232.05	225.20	218.50	212.80
1 3/8	1.3750	.3594	.3125	2	¾	2 ⅞	4	57544	57644	225.65	1.3156-1.3780	307.50	266.70	252.95	246.20	239.40	233.75
1 7/16	1.4375	.3594	.3125	2	½	2 ⅞	4	57546	57646	246.50	1.3781-1.4405	328.35	287.45	273.75	266.95	260.10	254.30
1 ½	1.5000	.3594	.3125	2	½	2 ⅞	4	57548	57648	267.10	1.4406-1.5030	349.10	308.10	294.50	287.70	280.90	275.15
1 5/8	1.5625	.4844	.4375	3	½	3 3/16	6	57550	57650	284.45	1.5031-1.5660	366.40	325.40	311.80	305.15	298.20	292.60
1 5/8	1.6250	.4844	.4375	3	½	3 3/16	6	57552	57652	319.30	1.5661-1.6280	401.05	360.20	346.55	339.75	332.80	327.20
1 11/16	1.6875	.4844	.4375	3	½	3 3/16	6	57554	57654	346.80	1.6281-1.6910	428.70	387.80	374.15	367.45	360.60	354.90
1 ¾	1.7500	.4844	.4375	3	½	3 3/16	6	57556	57656	374.60	1.6911-1.7530	456.45	415.60	401.95	395.20	388.25	382.70
1 13/16	1.8125	.4844	.4375	3	½	3 3/16	6	57558	57658	395.55	1.7531-1.8160	477.50	436.60	422.80	416.15	409.30	403.65
1 7/8	1.8750	.4844	.4375	3	½	3 3/16	6	57560	57660	416.25	1.8161-1.8780	498.15	457.15	443.50	436.70	429.80	424.15
1 15/16	1.9375	.4844	.4375	3	½	3 3/16	6	57562	57662	437.25	1.8781-1.9410	519.15	478.15	464.55	457.75	450.95	445.15
2	2.0000	.5625	.5000	4	½	3 ¾	6	57564	57664	457.80	1.9411-2.0030	539.65	498.90	485.15	478.45	471.60	465.85
2 1/8	2.1250	.5625	.5000	4	½	3 ¾	6	57568	57668	471.75	2.0661-2.1280	553.65	512.70	499.00	492.30	485.50	479.75
2 ¼	2.2500	.5625	.5000	4	½	3 ¾	6	57572	57672	485.45	2.1906-2.2530	567.25	526.40	512.65	505.95	499.00	493.40
2 3/8	2.3750	.5625	.5000	4	½	3 ¾	6	57576	57676	522.00	2.3156-2.3780	606.85	564.40	550.30	543.30	536.20	530.35
2 ½	2.5000	.5625	.5000	4	½	3 ¾	6	57580	57680	540.15	2.4406-2.5030	625.20	582.70	568.55	561.55	554.45	548.50
2 5/8	2.6250	.5625	.5000	4	½	3 ¾	6	57588	57688	568.85	2.6911-2.7530	653.80	611.30	597.10	590.15	583.05	577.15
3	3.0000	.5625	.5000	4	½	3 ¾	6	57596	57696	597.60	2.9411-3.0030	682.40	640.10	625.85	618.80	611.70	605.90

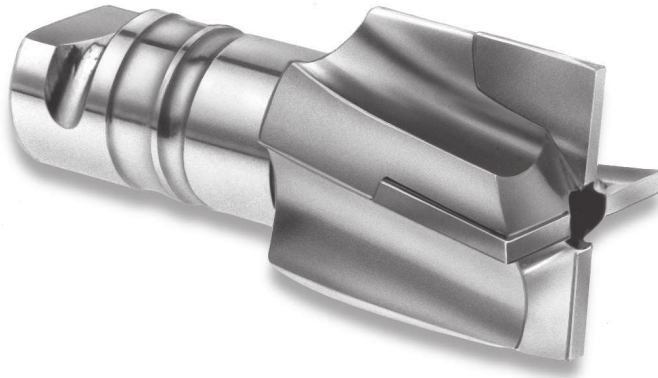
*Quantities of 15 or more - price of fractional size in same size range.



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

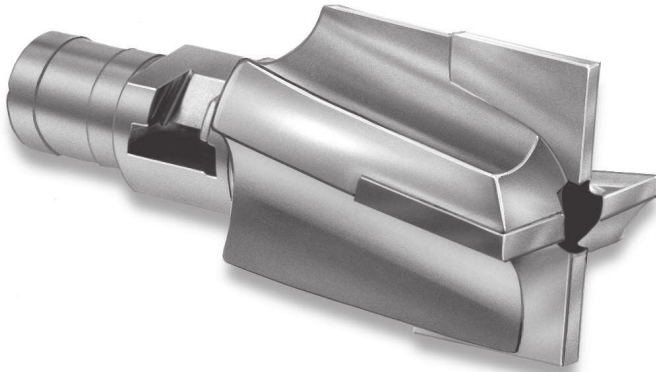
TOOL DIAMETER		DIMENSIONS							TYPE 573 N-F/CI EDP NO.	TYPE 574 STEEL EDP NO.	BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
FRACTIONAL	DECIMAL	MIN. CUT DIAM.	PILOT HOLE DIAM.	PIN DRIVE NO.	SHANK DIAM.	LENGTH		NO. OF FLTS				MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
						CARBIDE	OVER-ALL					1	2	3	4	5-7	8-14*	
1/2	.5000	.2188	.1875	1	9/16	3/4	2 7/8	3	57316	57416	\$185.00	0.4721-0.5030	\$274.05	\$229.55	\$214.55	\$207.30	\$199.80	\$193.60
9/16	.5625	.2188	.1875	1	9/16	3/4	2 7/8	3	57318	57418	185.00	0.5341-0.5660	274.05	229.55	214.55	207.30	199.80	193.60
5/8	.6250	.2188	.1875	1	9/16	3/4	2 7/8	3	57320	57420	185.00	0.5971-0.6280	274.05	229.55	214.55	207.30	199.80	193.60
11/16	.6875	.2969	.2500	1	9/16	3/4	2 7/8	3	57322	57422	173.80	0.6591-0.6910	262.85	218.30	203.50	196.25	188.75	182.50
3/4	.7500	.2969	.2500	1	9/16	3/4	2 7/8	3	57324	57424	173.80	0.7221-0.7530	262.85	218.30	203.50	196.25	188.75	182.50
13/16	.8125	.2969	.2500	1	9/16	3/4	2 7/8	4	57326	57426	173.80	0.7841-0.8160	262.85	218.30	203.50	196.25	188.75	182.50
7/8	.8750	.2969	.2500	1	9/16	3/4	2 7/8	4	57328	57428	173.80	0.8471-0.8780	262.85	218.30	203.50	196.25	188.75	182.50
15/16	.9375	.2969	.2500	1	9/16	3/4	2 7/8	4	57330	57430	177.70	0.9091-0.9410	266.80	222.35	207.45	200.20	192.60	186.45
1	1.0000	.2969	.2500	1	9/16	3/4	2 7/8	4	57332	57432	181.05	0.9721-1.0030	270.05	225.60	210.60	203.30	195.85	189.70
1 1/16	1.0625	.2969	.2500	1	9/16	3/4	2 7/8	4	57334	57434	200.20	1.0031-1.0660	289.10	244.70	229.85	222.50	215.00	208.85
1 1/8	1.1250	.3594	.3125	2	7/8	3/4	3	4	57335	57435	211.50	1.0031-1.0660	300.45	255.95	241.05	233.75	226.25	220.15
1 1/8	1.1250	.2969	.2500	1	9/16	3/4	2 7/8	4	57336	57436	200.20	1.0661-1.1280	289.10	244.70	229.85	222.50	215.00	208.85
1 1/8	1.1250	.3594	.3125	2	7/8	3/4	3	4	57337	57437	211.50	1.0661-1.1280	300.45	255.95	241.05	233.75	226.25	220.15
1 1/16	1.1875	.3594	.3125	2	7/8	3/4	3	4	57338	57438	219.20	1.1281-1.1905	308.30	263.80	248.90	241.50	234.10	228.00
1 1/4	1.2500	.3594	.3125	2	7/8	3/4	3	4	57340	57440	219.20	1.1906-1.2530	308.30	263.80	248.90	241.50	234.10	228.00
1 1/4	1.3125	.3594	.3125	2	7/8	3/4	3	4	57342	57442	222.65	1.2531-1.3155	311.75	267.25	252.30	244.95	237.55	231.40
1 3/8	1.3750	.3594	.3125	2	7/8	3/4	3	4	57344	57444	222.65	1.3156-1.3780	311.75	267.25	252.30	244.95	237.55	231.40
1 7/16	1.4375	.3594	.3125	2	7/8	1/2	3	4	57346	57446	233.90	1.3781-1.4405	322.85	278.45	263.50	256.20	248.70	242.55
1 1/2	1.5000	.3594	.3125	2	7/8	1/2	3	4	57348	57448	245.45	1.4406-1.5030	334.30	289.90	275.05	267.70	260.20	254.05
1 5/16	1.5625	.3594	.3125	2	7/8	1/2	3	4	57350	57450	263.90	1.5031-1.5660	352.90	308.40	293.60	286.15	278.80	272.60
1 5/8	1.6250	.3594	.3125	2	7/8	1/2	3	4	57352	57452	275.35	1.5661-1.6280	364.40	319.95	305.10	297.75	290.35	284.15
1 11/16	1.6875	.3594	.3125	2	7/8	1/2	3	4	57354	57454	286.60	1.6281-1.6910	375.75	331.15	316.35	309.00	301.55	295.40
1 3/4	1.7500	.3594	.3125	2	7/8	1/2	3	4	57356	57456	301.90	1.6911-1.7530	390.80	346.35	331.55	324.15	316.80	310.65
1 3/4	1.7500	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57357	57457	343.60	1.6911-1.7530	432.75	388.20	373.30	365.95	358.60	352.40
1 7/8	1.8750	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57360	57460	343.60	1.8161-1.8780	432.75	388.20	373.30	365.95	358.60	352.40
2	2.0000	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57364	57464	388.95	1.9411-2.0030	477.90	433.50	418.60	411.35	403.75	397.60
2 1/8	2.1250	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57368	57468	399.80	2.0661-2.1280	488.70	444.30	429.40	422.05	414.65	408.50
2 1/4	2.2500	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57372	57472	415.00	2.1906-2.2530	504.10	459.50	444.60	437.30	429.90	423.70
2 3/8	2.3750	.4844	.4375	3	1 1/4	1/2	3 1/16	6	57376	57476	465.60	2.3156-2.3780	558.10	511.80	496.50	488.80	481.10	474.70
2 1/2	2.5000	.5625	.5000	3	1 1/4	1/2	3 1/16	6	57380	57480	500.70	2.4406-2.5030	593.25	547.05	531.45	523.95	516.25	509.85
2 3/4	2.7500	.5625	.5000	3	1 1/4	1/2	3 1/16	6	57388	57488	555.90	2.6911-2.7530	648.30	602.10	586.60	579.00	571.30	564.95
3	3.0000	.5625	.5000	3	1 1/4	1/2	3 1/16	6	57396	57496	587.25	2.9411-3.0030	679.75	633.55	618.15	610.50	602.85	596.40

*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 = 1½"
- 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	\$192.60	0.4721-0.5030	\$281.60	\$237.25	\$222.35	\$215.00	\$207.55	\$201.40
9/16	.5625	.2188	.1875	RB	5/8	3/4	2 7/8	3	57718	57818	192.60	0.5341-0.5660	281.60	237.25	222.35	215.00	207.55	201.40
5/8	.6250	.2188	.1875	RB	5/8	3/4	2 7/8	3	57720	57820	192.60	0.5971-0.6280	281.60	237.25	222.35	215.00	207.55	201.40
11/16	.6875	.2969	.2500	RB	5/8	3/4	2 7/8	3	57722	57822	192.60	0.6591-0.6910	281.60	237.25	222.35	215.00	207.55	201.40
3/4	.7500	.2969	.2500	RB	5/8	3/4	2 7/8	4	57724	57824	192.60	0.7221-0.7530	281.60	237.25	222.35	215.00	207.55	201.40
13/16	.8125	.2969	.2500	RB	5/8	3/4	2 7/8	4	57726	57826	196.30	0.7841-0.8160	285.30	240.85	225.90	218.70	211.25	205.00
7/8	.8750	.2969	.2500	RB	5/8	3/4	2 7/8	4	57728	57828	196.30	0.8471-0.8780	285.30	240.85	225.90	218.70	211.25	205.00
15/16	.9375	.2969	.2500	RB	5/8	3/4	2 7/8	4	57730	57830	207.80	0.9091-0.9410	296.80	252.30	237.40	230.05	222.65	216.55
1	1.0000	.2969	.2500	RB	5/8	3/4	2 7/8	4	57732	57832	207.80	0.9721-1.0030	296.80	252.30	237.40	230.05	222.65	216.55
1	1.0000	.3594	.3125	RC	3/4	3/4	2 7/8	4	57733	57833	211.50	0.9721-1.0030	300.45	255.95	241.05	233.75	226.25	220.15
1 1/16	1.0625	.3594	.3125	RC	3/4	3/4	2 7/8	4	57734	57834	211.50	1.0031-1.0660	300.45	255.95	241.05	233.75	226.25	220.15
1 1/8	1.1250	.3594	.3125	RC	3/4	3/4	2 7/8	4	57736	57836	211.50	1.0661-1.1280	300.45	255.95	241.05	233.75	226.25	220.15
1 1/16	1.1875	.3594	.3125	RC	3/4	3/4	2 7/8	4	57738	57838	226.25	1.1281-1.1905	315.25	270.75	255.95	248.60	241.20	235.05
1 1/4	1.2500	.3594	.3125	RC	3/4	3/4	2 7/8	4	57740	57840	226.25	1.1906-1.2530	315.25	270.75	255.95	248.60	241.20	235.05
1 5/16	1.3125	.3594	.3125	RC	3/4	3/4	2 7/8	4	57742	57842	226.25	1.2531-1.3155	315.25	270.75	255.95	248.60	241.20	235.05
1 3/8	1.3750	.3594	.3125	RC	3/4	3/4	2 7/8	4	57744	57844	226.25	1.3156-1.3780	315.25	270.75	255.95	248.60	241.20	235.05
1 3/8	1.3750	.3594	.3125	RE	1	3/4	3	4	57745	57845	245.45	1.3151-1.3780	334.30	289.90	275.05	267.70	260.20	254.05
1 1/2	1.5000	.3594	.3125	RE	1	1/2	3	4	57748	57848	275.35	1.4406-1.5030	364.40	319.95	305.10	297.75	290.35	284.15
1 1/2	1.5000	.4844	.4375	RF	1 1/8	1/2	3 1/16	4	57749	57849	286.60	1.4406-1.5030	375.75	331.15	316.35	309.00	301.55	295.40
1 5/8	1.6250	.3594	.3125	RE	1	1/2	3	4	57752	57852	286.60	1.5661-1.6280	375.75	331.15	316.35	309.00	301.55	295.40
1 5/8	1.6250	.4844	.4375	RF	1 1/8	1/2	3 1/16	4	57753	57853	294.40	1.5661-1.6280	383.40	338.95	324.10	316.80	309.40	303.20
1 3/4	1.7500	.4844	.4375	RF	1 1/8	1/2	3 1/16	6	57756	57856	361.95	1.6911-1.7530	450.95	406.45	391.65	384.30	376.90	370.75
1 7/8	1.8750	.4844	.4375	RF	1 1/8	1/2	3 1/16	6	57760	57860	381.00	1.8161-1.8780	470.00	425.55	410.75	403.35	395.85	389.70
2	2.0000	.4844	.4375	RF	1 1/8	1/2	3 1/16	6	57764	57864	415.00	1.9411-2.0030	504.10	459.50	444.60	437.30	429.90	423.70
2	2.0000	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57765	57865	415.00	1.9411-2.0030	504.10	459.50	444.60	437.30	429.90	423.70
2 1/8	2.1250	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57768	57868	426.20	2.0661-2.1280	515.25	470.90	456.00	448.70	441.25	435.05
2 1/4	2.2500	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57772	57872	444.95	2.1906-2.2530	533.95	489.50	474.65	467.30	459.85	453.75
2 3/8	2.3750	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57776	57876	469.65	2.3156-2.3780	562.05	515.85	500.40	492.95	485.00	478.55
2 1/2	2.5000	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57780	57880	489.45	2.4406-2.5030	581.90	535.70	520.25	512.65	505.00	498.50
2 5/8	2.6250	.5625	.5000	RJ	1 3/8	1/2	3 1/16	6	57784	57884	500.70	2.5661-2.6280	593.25	547.05	531.45	523.95	516.25	509.85
2 3/4	2.7500	.5625	.5000	RS	1 3/4	1/2	3 1/8	6	57788	57888	508.80	2.6911-2.7530	601.10	555.05	539.60	531.95	524.35	517.90
2 7/8	2.8750	.5625	.5000	RS	1 3/4	1/2	3 1/8	6	57792	57892	536.25	2.8161-2.8780	628.70	582.50	567.10	559.40	551.70	545.30
3	3.0000	.5625	.5000	RS	1 3/4	1/2	3 1/8	6	57796	57896	575.40	2.9411-3.0030	667.70	621.55	606.15	598.55	590.85	584.45

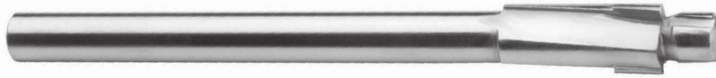
*Quantities of 15 or more - price of fractional size in same size range.



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	\$97.05	5152500	\$106.70
.3980	1/4	.2650	.3125	5/16	5 5/8	3	5132650	107.80	5152650	118.65
.4140	1/4	.2810	.3125	5/16	5 5/8	3	5132810	107.80	5152810	118.65
.4750	5/16	.3125	.3750	3/8	6 1/8	3	5133125	108.50	5153125	119.45
.4910	5/16	.3280	.3750	3/8	6 1/8	3	5133280	108.50	5153280	119.45
.5070	5/16	.3430	.3750	3/8	6 1/8	3	5133430	108.50	5153430	119.45
.5720	3/8	.3750	.5000	1/2	6 1/2	3	5133750	122.35	5153750	134.60
.5880	3/8	.3900	.5000	1/2	6 1/2	3	5133900	122.35	5153900	134.60
.6040	3/8	.4060	.5000	1/2	6 1/2	3	5134060	122.35	5154060	134.60
.6630	7/16	.4375	.5000	1/2	7	3	5134375	118.20	5154375	130.05
.6790	7/16	.4530	.5000	1/2	7	3	5134530	118.20	5154530	130.05
.6950	7/16	.4680	.5000	1/2	7	3	5134680	118.20	5154680	130.05
.7570	1/2	.5000	.5000	1/2	7 1/2	3	5135000	134.05	5155000	147.55
.7730	1/2	.5150	.5000	1/2	7 1/2	3	5135150	134.05	5155150	147.55
.7890	1/2	.5310	.5000	1/2	7 1/2	3	5135310	134.05	5155310	147.55
.8510	9/16	.5625	.5625	5/8	7 5/8	3	5135625	129.55	5155625	142.55
.8670	9/16	.5780	.5625	5/8	7 5/8	3	5135780	129.55	5155780	142.55
.8830	9/16	.5930	.5625	5/8	7 5/8	3	5135930	129.55	5155930	142.55
.9450	5/8	.6250	.6250	5/8	7 5/8	3	5136250	147.70	5156250	162.50
.9610	5/8	.6400	.6250	5/8	7 5/8	3	5136400	147.70	5156400	162.50
.9770	5/8	.6560	.6250	5/8	7 5/8	3	5136560	147.70	5156560	162.50
1.1330	3/4	.7500	.7500	3/4	7 3/4	3	5137500	145.60	5157500	160.15
1.1490	3/4	.7650	.7500	3/4	7 3/4	3	5137650	145.60	5157650	160.15
1.1650	3/4	.7810	.7500	3/4	7 3/4	3	5137810	145.60	5157810	160.15
1.3220	7/8	.8750	.8750	7/8	8 1/8	4	5138750	161.85	5158750	178.15
1.3380	7/8	.8910	.8750	7/8	8 1/8	4	5138910	161.85	5158910	178.15
1.3540	7/8	.9060	.8750	7/8	8 1/8	4	5139060	161.85	5159060	178.15
1.5100	1	1.0000	1.0000	1	8 1/2	4	5130000	185.35	5150000	203.90
1.5260	1	1.0150	1.0000	1	8 1/2	4	5130156	185.35	5150156	203.90
1.5420	1	1.0310	1.0000	1	8 1/2	4	5130313	185.35	5150313	203.90

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.

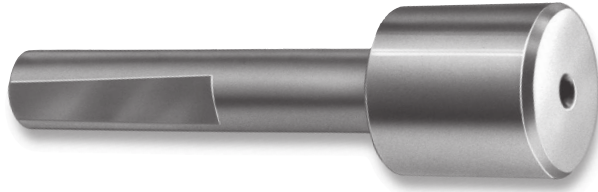
TOOL DIAMETER		PILOT DIAMETER mm	PILOT LENGTH	SHANK DIAMETER	OVERALL LENGTH	NO. OF FLUTES	TYPE 513		TYPE 515	
DECIMAL	SCREW SIZE mm						NON-FERR/CI EDP NO.	PRICE EACH	STEEL EDP NO.	PRICE EACH
.3543	5	5.5	9/32	5/16	5 5/8	3	513055	\$107.50	515055	\$118.20
.4134	6	6.5	5/16	5/16	5 5/8	3	513065	113.45	515065	124.85
.5315	8	8.5	3/8	1/2	6 1/2	3	513085	134.80	515085	148.20
.6496	10	10.5	1/2	1/2	7	3	513105	146.60	515105	161.25
.7283	12	12.5	1/2	1/2	7 1/2	3	513125	137.55	515125	151.20
.8465	14	14.5	9/16	5/8	7 5/8	3	513145	160.40	515145	176.30
.9646	16	16.5	5/8	5/8	7 5/8	3	513165	167.55	515165	184.30
1.2008	20	20.5	3/4	7/8	8	3	513205	155.40	515205	170.90

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					
		3/32	1/8	5/32	3/16	1/4	5/16	3/8	7/16	1/2	PRICE EACH - BASED ON QUANTITY ORDERED							
FRACTIONAL	DECIMAL	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	-	-	-	-	-	-	-	-	\$27.75	\$110.35	\$69.10	\$55.35	\$48.60	\$41.55	\$35.80	
5/32	.1562	50105	50205	-	-	-	-	-	-	-	22.55	105.05	63.90	50.10	43.10	36.35	30.60	
3/16	.1875	50106	50206	50306	-	-	-	-	-	-	23.00	105.50	64.30	50.55	43.70	36.70	31.00	
7/32	.2188	50107	50207	50307	50407	-	-	-	-	-	26.05	108.60	67.30	53.50	46.80	39.85	34.10	
1/4	.2500	50108	50208	50308	50408	-	-	-	-	-	26.05	108.60	67.30	53.50	46.80	39.85	34.10	
9/32	.2812	50109	50209	50309	50409	50509	-	-	-	-	27.75	110.35	69.10	55.35	48.60	41.55	35.80	
5/16	.3125	50110	50210	50310	50410	50510	-	-	-	-	27.75	110.35	69.10	55.35	48.60	41.55	35.80	
11/32	.3438	50111	50211	50311	50411	50511	50611	-	-	-	27.75	110.35	69.10	55.35	48.60	41.55	35.80	
3/8	.3750	-	50212	50312	50412	50512	50612	-	-	-	30.60	113.20	71.95	58.15	51.25	44.40	38.75	
13/32	.4062	-	50213	50313	50413	50513	50613	-	-	-	30.60	113.20	71.95	58.15	51.25	44.40	38.75	
7/16	.4375	-	50214	50314	50414	50514	50614	50714	-	-	31.35	113.85	72.60	58.90	52.00	45.15	39.40	
15/32	.4688	-	50215	-	50415	50515	50615	-	-	-	31.35	113.85	72.60	58.90	52.00	45.15	39.40	
1/2	.5000	-	50216	-	50416	50516	50616	50716	50816	-	35.80	118.50	77.15	63.35	56.75	49.70	44.00	
17/32	.5312	-	50217	-	50417	50517	50617	-	50817	-	41.80	124.35	83.15	69.45	62.55	55.60	49.95	
9/16	.5625	-	50218	-	50418	50518	50618	50718	50818	50918	46.90	129.55	88.25	74.45	67.80	60.80	55.10	
19/32	.5938	-	50219	-	-	50519	50619	-	50819	50919	51.60	134.10	92.85	79.05	72.15	65.25	59.65	
5/8	.6250	-	50220	-	50420	50520	50620	50720	50820	50920	51.60	134.10	92.85	79.05	72.15	65.25	59.65	
21/32	.6562	-	-	-	50421	50521	50621	-	50821	-	52.80	135.35	94.00	80.25	73.55	66.60	60.85	
11/16	.6875	-	-	-	50422	50522	50622	50722	50822	50922	52.80	135.35	94.00	80.25	73.55	66.60	60.85	
23/32	.7188	-	-	-	-	50523	50623	-	50823	50923	59.80	142.30	101.05	87.30	80.50	73.55	67.90	
3/4	.7500	-	-	-	50424	50524	50624	50724	50824	50924	59.80	142.30	101.05	87.30	80.50	73.55	67.90	
25/32	.7812	-	-	-	-	50525	50625	-	50825	50925	67.15	149.80	108.50	94.70	88.10	81.00	75.30	
13/16	.8125	-	-	-	50426	50526	50626	50726	50826	50926	67.15	149.80	108.50	94.70	88.10	81.00	75.30	
27/32	.8438	-	-	-	-	50527	-	-	-	-	74.35	156.90	115.65	101.90	94.95	88.15	82.40	
7/8	.8750	-	-	-	50428	50528	50628	50728	50828	50928	74.35	156.90	115.65	101.90	94.95	88.15	82.40	
15/16	.9375	-	-	-	50430	50530	50630	50730	50830	50930	78.45	160.95	119.70	105.95	99.15	92.15	86.55	
1	1.0000	-	-	-	50432	50532	50632	50732	50832	50932	81.15	163.65	122.40	108.60	101.90	94.90	89.25	
1 1/16	1.0625	-	-	-	-	-	50634	50734	50834	50934	84.10	166.65	125.30	111.55	104.65	97.90	92.15	
1 1/8	1.1250	-	-	-	-	-	50636	50736	50836	50936	101.35	183.95	142.65	128.80	122.15	115.05	109.50	
1 3/16	1.1875	-	-	-	-	-	50638	50738	50838	50938	104.50	186.95	145.65	131.95	125.20	118.20	112.55	
1 1/4	1.2500	-	-	-	-	-	50640	50740	50840	50940	110.10	192.70	151.45	137.60	131.00	123.85	118.20	
1 5/16	1.3125	-	-	-	-	-	-	50742	50842	50942	115.90	198.45	157.25	143.50	136.70	129.70	123.95	
1 3/8	1.3750	-	-	-	-	-	50644	50744	50844	50944	126.55	209.30	168.00	154.25	147.35	140.45	134.80	
1 7/16	1.4375	-	-	-	-	-	-	50746	50846	50946	128.15	210.70	169.35	155.55	148.85	141.80	136.20	
1 1/2	1.5000	-	-	-	-	-	-	-	50848	50948	129.70	212.40	171.10	157.30	150.35	143.60	137.90	
1 9/16	1.5625	-	-	-	-	-	-	-	50850	50950	131.25	214.05	172.80	159.00	152.10	145.20	139.50	
1 5/8	1.6250	-	-	-	-	-	-	-	-	50952	132.70	215.20	174.00	160.15	153.40	146.40	140.90	
1 11/16	1.6875	-	-	-	-	-	-	-	-	50954	134.50	216.95	175.70	161.85	155.15	148.10	142.55	
1 3/4	1.7500	-	-	-	-	-	-	-	50856	50956	136.55	219.00	177.70	163.95	157.25	150.20	144.55	
1 7/8	1.8750	-	-	-	-	-	-	-	-	50960	164.40	247.25	205.90	192.10	185.25	178.35	172.80	
2	2.0000	-	-	-	-	-	-	-	-	50964	164.40	247.25	205.90	192.10	185.25	178.35	172.80	

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: $\frac{\text{SFM} \times 3.82}{\text{Diameter}}$

IPM FORMULA: IPT X RPM X Number of teeth



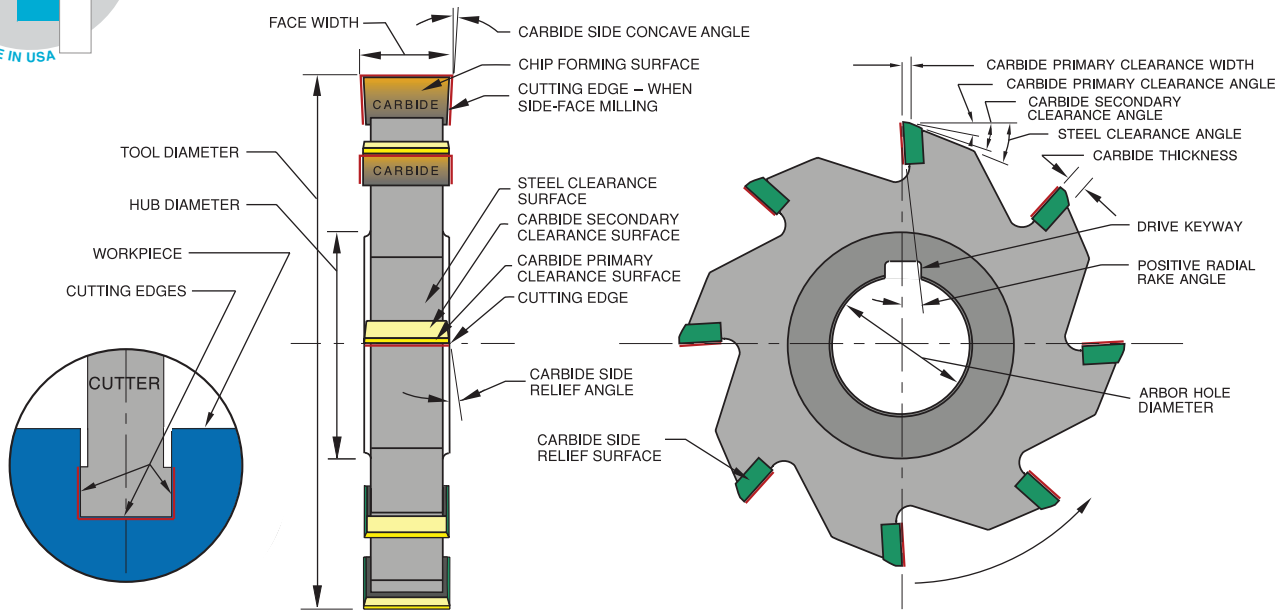
Feeds & speeds are starting recommendations only. Factors including fixturing, available horsepower, depth of cut, and coolant capabilities may significantly affect performance. Use this chart for half and full side mill & face mill cutters.

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	-	\$434.10
	1/4	.2500	8	54712	-	444.45
	5/16	.3125	8	54714	-	448.40
	3/8	.3750	8	54716	-	450.20
	1/2	.5000	8	54718	-	464.20
	5/8	.6250	8	54720	-	496.95
4	3/16	.1875	10	54722	-	471.65
	1/4	.2500	10	54724	-	477.55
	5/16	.3125	10	54726	-	483.30
	3/8	.3750	10	54728	-	489.15
	1/2	.5000	10	54730	-	496.00
	5/8	.6250	10	54732	-	505.25
6	3/4	.7500	10	54734	-	510.95
	1/4	.2500	14	-	54750	613.15
	5/16	.3125	14	-	54752	617.80
	3/8	.3750	14	-	54754	618.65
	1/2	.5000	14	-	54756	626.75
	5/8	.6250	14	-	54758	630.30
	3/4	.7500	14	-	54760	650.85
1	1.0000	14	-	54762	696.85	



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

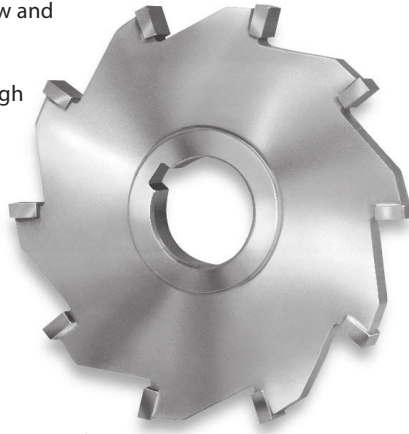
- Steel carbide grade permits longer production runs

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			
	FRAC.	DEC.	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	-	\$146.60	6	54130	-	\$183.40	6	54230	-	\$181.05	8	54330	-	\$225.85
	5/16	.3125	4	54031	-	153.90	6	54131	-	184.20	6	54231	-	183.50	8	54331	-	236.65
	3/8	.3750	4	54032	-	159.50	6	54132	-	187.80	6	54232	-	185.85	8	54332	-	239.80
	7/16	.4375	4	54033	-	166.05	6	54133	-	203.10	6	54233	-	207.25	-	-	-	-
	1/2	.5000	4	54034	-	174.10	6	54134	-	211.50	6	54234	-	210.00	8	54334	-	268.15
4	1/4	.2500	4	54040	-	191.05	8	54140	-	236.90	8	54240	-	238.40	10	54340	-	282.40
	5/16	.3125	4	54041	-	196.50	8	54141	-	244.85	8	54241	-	253.15	10	54341	-	296.70
	3/8	.3750	4	54042	54043	201.65	8	54142	54143	257.25	8	54242	54243	253.15	10	54342	54343	303.30
	7/16	.4375	4	54074	-	202.55	8	54174	-	262.50	8	54274	-	260.70	10	54374	-	329.35
	1/2	.5000	4	54044	54045	202.55	8	54144	54145	271.15	8	54244	54245	269.75	10	54344	54345	331.85
	5/16	.5625	4	54094	-	220.20	8	54194	-	278.65	8	54294	-	283.10	-	-	-	-
	3/8	.6250	4	54046	54047	236.30	8	54146	54147	301.95	8	54246	54247	330.95	10	54346	54347	349.45
	3/4	.7500	4	54048	54049	264.75	8	54148	54149	301.95	8	54248	54249	335.10	10	54348	54349	359.90
5	1/4	.2500	6	54050	-	266.90	10	54150	-	313.70	10	54250	-	313.85	-	-	-	-
	5/16	.3125	-	-	-	-	10	54151	-	313.70	10	54251	-	313.85	-	-	-	-
	3/8	.3750	-	-	-	-	10	-	54153	321.25	10	-	54253	329.50	-	-	-	-
	7/16	.4375	6	-	54075	277.65	10	-	54175	322.85	10	-	54275	340.10	-	-	-	-
	1/2	.5000	6	54054	54055	280.95	10	54154	54155	342.75	10	54254	54255	340.20	12	54354	54355	381.20
	5/16	.5625	6	-	54095	290.00	10	-	54195	348.60	10	-	54295	355.20	-	-	-	-
	3/8	.6250	6	-	54057	305.05	10	-	54157	371.05	10	-	54257	416.90	12	-	54357	416.35
3/4	.7500	6	54058	54059	325.20	10	54158	54159	420.10	10	54258	54259	461.40	12	54358	54359	466.90	
1	1.0000	6	-	54015	325.75	10	-	54115	457.20	10	-	54215	486.65	-	-	-	-	
6	3/8	.3750	6	54062	-	286.40	12	-	54163	394.70	12	-	54263	417.00	-	-	-	-
	1/2	.5000	6	54064	54065	313.70	12	54164	54165	419.15	12	54264	54265	429.45	14	54364	54365	490.35
	5/8	.6250	6	-	54067	343.75	12	-	54167	458.10	12	-	54267	467.20	14	-	54367	494.30
	3/4	.7500	6	54068	54069	395.35	12	54168	54169	513.95	12	54268	54269	532.20	14	54368	54369	533.40
	1	1.0000	6	-	54016	453.15	12	-	54116	519.35	12	-	54216	542.95	-	-	-	-
8	3/4	.7500	8	54088	54089	514.30	12	54188	54189	539.40	12	54288	54289	559.55	14	54388	-	571.90
	1	1.0000	8	54080	54081	558.15	12	54180	54181	562.15	12	54280	54281	582.40	-	-	-	-
				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



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:

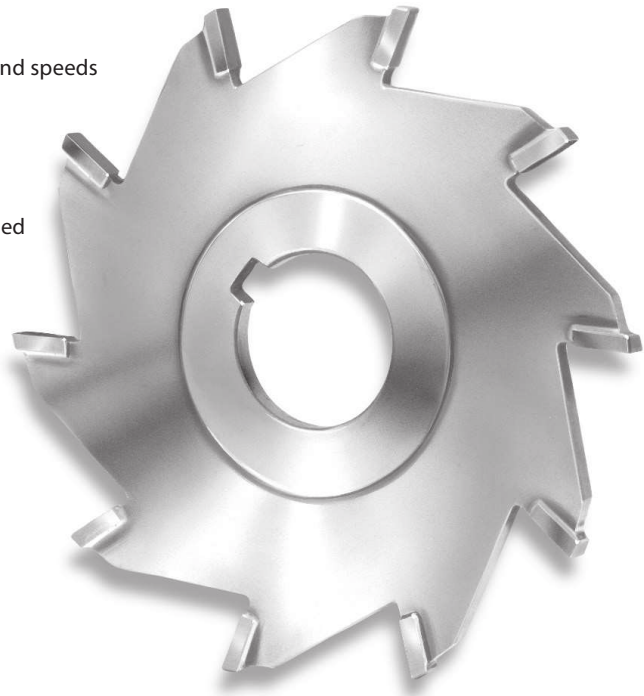
TITANIUM NITRIDE – TiN

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	\$173.85	6	55232	\$200.05	8	55432	\$198.35	8	55832	\$185.85
	1/8	.1250	1	6	55034	179.05	6	55234	211.85	8	55434	222.00	8	55834	192.95
	3/16	.1875	1	6	55036	186.15	6	55236	224.10	8	55436	224.10	8	55836	200.40
	1/4	.2500	1	6	55037	126.60	6	55237	183.70	8	55437	183.70	8	55837	220.50
	5/16	.3125	1	6	55031	133.00	6	55231	183.70	8	55431	183.70	8	55831	220.50
	3/8	.3750	1	6	55038	135.60	6	55238	186.70	8	55438	186.70	8	55838	224.10
4	3/32	.0938	1	6	55042	213.40	8	55242	256.50	8	55442	256.50	10	55842	267.40
	1/8	.1250	1	6	55044	219.75	8	55244	259.95	8	55444	259.95	10	55844	270.75
	3/16	.1875	1	6	55046	223.00	8	55246	280.10	8	55446	280.10	10	55846	274.50
	1/4	.2500	1	6	55047	162.70	8	55247	237.85	8	55447	237.85	10	55847	285.60
	5/16	.3125	1	6	55041	167.30	8	55241	247.10	8	55441	247.10	10	55841	296.35
	3/8	.3750	1	6	55048	171.70	8	55248	256.05	8	55448	256.05	10	55848	307.25
5	3/8	.3750	1 1/4	6	55049	171.70	8	55249	256.05	8	55449	256.05	10	55849	307.25
	3/32	.0938	1	8	55052	230.90	10	55252	344.35	10	55452	344.35	12	55852	363.45
	1/8	.1250	1	8	55054	230.90	10	55254	370.40	10	55454	370.40	12	55854	371.05
6	3/16	.1875	1	-	-	-	10	55256	417.00	10	55456	417.00	12	55856	385.85
	1/8	.1250	1 1/4	8	55063	314.45	12	55263	452.05	12	55463	452.05	14	55863	434.05
	3/16	.1875	1 1/4	8	55065	414.40	12	55265	466.95	12	55465	466.95	14	55865	445.25
8	1/4	.2500	1 1/4	8	55067	429.25	12	55267	476.70	12	55467	476.70	14	55867	452.50
	1/8	.1250	1 1/4	10	55083	402.00	-	-	-	-	-	-	-	-	-
	3/16	.1875	1 1/4	-	-	-	16	55285	642.60	16	55485	642.60	-	-	-
8	1/4	.2500	1 1/4	-	-	-	16	55287	667.15	16	55487	667.15	-	-	-

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	-	\$273.90	12	55398	-	\$273.90	16	55698	-	\$327.45	12	55998	-	\$308.05
	5/64	.0781	12	55100	-	323.90	12	55300	-	323.90	16	55600	-	396.00	12	55900	-	345.05
	3/32	.0938	12	55102	-	273.90	12	55302	-	273.90	16	55602	-	327.45	12	55902	-	308.05
	7/64	.1094	12	55104	-	272.85	12	55304	-	272.85	16	55604	-	302.25	12	55904	-	294.05
	1/8	.1250	12	55106	55107	220.20	12	55306	55307	220.20	16	55606	-	273.85	12	55906	55907	280.85
	5/32	.1562	12	55108	-	262.45	12	55308	-	262.45	16	55608	-	287.60	12	55908	-	287.60
	3/16	.1875	12	55109	-	234.70	12	55309	-	234.70	16	55609	-	301.50	12	55909	-	294.50
	7/32	.2188	12	55110	-	271.50	12	55310	-	271.50	16	55610	-	315.30	12	55910	-	303.85
	1/4	.2500	12	55111	-	285.50	12	55311	-	285.50	16	55611	-	329.25	12	55911	-	313.00
	5/16	.3125	12	55112	-	313.00	12	55312	-	313.00	16	55612	-	360.95	12	55912	-	342.90
	3/8	.3750	12	55113	-	340.65	12	55313	-	340.65	16	55613	-	392.80	12	55913	-	375.10
	7/16	.4375	-	-	-	-	-	-	-	-	16	55614	-	436.50	12	55914	-	407.60
1/2	.5000	-	-	-	-	-	-	-	-	16	55615	-	485.05	12	55915	-	439.90	
4	1/16	.0625	14	55116	55117	318.90	14	55316	-	318.90	20	55616	-	396.00	14	55916	55917	350.35
	5/64	.0781	14	55118	55119	376.70	14	55318	55319	376.70	20	55618	55619	433.30	14	55918	55919	401.45
	3/32	.0938	14	55120	55121	318.90	14	55320	55321	318.90	20	55620	55621	396.00	14	55920	55921	350.35
	7/64	.1094	14	55122	55123	325.65	14	55322	55323	325.65	20	55622	55623	374.50	14	55922	55923	415.35
	1/8	.1250	14	55124	55125	287.60	14	55324	55325	287.60	20	55624	55625	349.80	14	55924	55925	349.80
	5/32	.1562	14	55126	55127	326.70	14	55326	55327	326.70	20	55626	55627	375.85	14	55926	55927	359.05
	3/16	.1875	14	55128	55129	306.20	14	55328	55329	306.20	20	55628	55629	377.45	14	55928	55929	370.45
	7/32	.2188	14	55130	55131	347.50	14	55330	55331	347.50	20	55630	55631	399.65	14	55930	55931	382.15
	1/4	.2500	14	55132	55133	354.25	14	55332	55333	354.25	20	55632	55633	404.85	14	55932	55933	391.30
	5/16	.3125	14	55134	55135	382.15	14	55334	55335	382.15	20	55634	55635	439.30	14	55934	55935	418.90
	3/8	.3750	14	55136	55137	409.65	14	55336	55337	409.65	20	55636	55637	471.10	14	55936	55937	451.00
	7/16	.4375	-	-	-	-	-	-	-	-	20	55638	-	523.40	14	55938	-	483.50
1/2	.5000	-	-	-	-	-	-	-	-	20	55640	-	581.70	14	55940	-	515.90	
5	5/64	.0781	16	55142	55143	466.65	16	55342	55343	466.65	24	55642	55643	536.55	16	55942	55943	494.65
	3/32	.0938	16	55144	55145	385.00	16	55344	55345	385.00	24	55644	55645	540.30	16	55944	55945	424.20
	7/64	.1094	16	55146	55147	438.30	16	55346	55347	438.30	24	55646	55647	504.15	16	55946	55947	466.65
	1/8	.1250	16	55148	55149	355.65	16	55348	55349	355.65	24	55648	55649	437.15	16	55948	55949	411.95
	5/32	.1562	16	55150	55151	388.90	16	55350	55351	388.90	24	55650	55651	447.15	16	55950	55951	425.55
	3/16	.1875	16	55152	55153	398.30	16	55352	55353	398.30	24	55652	55653	478.65	16	55952	55953	448.75
	7/32	.2188	16	55154	55155	428.00	16	55354	55355	428.00	24	55654	55655	492.25	16	55954	55955	471.80
	1/4	.2500	16	55156	55157	446.45	16	55356	55357	446.45	24	55656	55657	513.45	16	55956	55957	494.70
	5/16	.3125	16	55158	55159	485.45	16	55358	55359	485.45	24	55658	55659	558.40	16	55958	55959	533.85
	3/8	.3750	16	55160	55161	524.65	16	55360	55361	524.65	24	55660	55661	603.30	16	55960	55961	575.30
	7/16	.4375	-	-	-	-	-	-	-	-	24	55662	-	670.40	16	55962	-	607.70
	1/2	.5000	-	-	-	-	-	-	-	-	24	55664	-	744.90	16	55964	-	640.10
6	5/64	.0781	18	55166	55167	524.60	18	55366	55367	524.60	28	55666	55667	603.25	18	55966	55967	556.25
	3/32	.0938	18	55168	55169	467.20	18	55368	55369	467.20	28	55668	55669	552.65	18	55968	55969	512.25
	7/64	.1094	18	55170	55171	526.40	18	55370	55371	526.40	28	55670	55671	605.35	18	55970	55971	558.15
	1/8	.1250	18	55172	55173	445.30	18	55372	55373	445.30	28	55672	55673	579.85	18	55972	55973	526.95
	5/32	.1562	18	55174	55175	503.80	18	55374	55375	503.80	28	55674	55675	579.60	18	55974	55975	549.95
	3/16	.1875	18	55176	55177	487.85	18	55376	55377	487.85	28	55676	55677	621.75	18	55976	55977	572.90
	7/32	.2188	18	55178	55179	549.95	18	55378	55379	549.95	28	55678	55679	632.45	18	55978	55979	596.00
	1/4	.2500	18	55180	55181	573.00	18	55380	55381	573.00	28	55680	55681	676.05	18	55980	55981	627.75
	5/16	.3125	18	55182	55183	596.10	18	55382	55383	596.10	28	55682	55683	685.50	18	55982	55983	655.85
	3/8	.3750	18	55184	55185	618.95	18	55384	55385	618.95	28	55684	55685	711.85	18	55984	55985	681.05
	7/16	.4375	-	-	-	-	-	-	-	-	28	55690	-	790.85	18	55990	-	713.45
	1/2	.5000	-	-	-	-	-	-	-	-	28	55692	-	878.75	18	55992	-	745.90
8	1/8	.1250	24	-	55186	739.30	24	-	55386	739.30	24	-	55686	781.55	24	-	55986	781.55
	5/32	.1562	24	-	55187	748.10	24	-	55387	748.10	24	-	55687	790.40	24	-	55987	790.40
	3/16	.1875	24	-	55188	756.90	24	-	55388	756.90	24	-	55688	799.15	24	-	55988	799.15
	1/4	.2500	24	-	55189	802.55	24	-	55389	802.55	24	-	55689	844.90	24	-	55989	844.90

CUTTERS



3" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

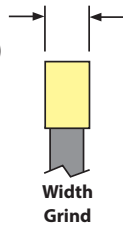
FOR STEEL

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	\$399.00	\$372.05	\$367.05	\$364.55	\$363.00	\$327.45
3	.0711	55600D	0.0704 - 0.0859	467.40	440.50	435.55	433.15	431.55	396.00
3	.0867	55602D	0.0860 - 0.1015	399.00	372.05	367.05	364.55	363.00	327.45
3	.1024	55604D	0.1016 - 0.1171	373.55	346.55	341.65	339.25	337.60	302.25
3	.1180	55606D	0.1172 - 0.1406	345.20	318.30	313.40	311.00	309.25	273.85
3	.1562	55608D	0.1407 - 0.1718	359.10	332.15	327.25	324.75	323.10	287.60
3	.1875	55609D	0.1719 - 0.2031	372.90	346.00	341.05	338.60	336.95	301.50
3	.2188	55610D	0.2032 - 0.2343	386.70	359.80	354.95	352.35	350.90	315.30
3	.2500	55611D	0.2344 - 0.2812	400.70	373.70	368.80	366.40	364.70	329.25
3	.3125	55612D	0.2813 - 0.3437	432.45	405.40	400.55	398.10	396.45	361.00
3	.3750	55613D	0.3438 - 0.4062	464.35	437.40	432.45	429.95	428.35	392.80
3	.4375	55614D	0.4063 - 0.4687	507.85	480.90	476.05	473.60	471.95	436.50
3	.5000	55615D	0.4688 - 0.5312	556.40	529.45	524.60	522.15	520.50	485.05

Corner Radius or Chamfer on ONE Side

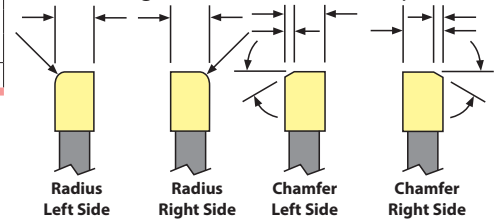
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH							
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED						
				1	2	3	4	5	6	
3	.0555	55698R1	0.0600 - 0.0703	\$417.00	\$377.55	\$372.05	\$369.15	\$367.40	\$366.55	
3	.0711	55600R1	0.0704 - 0.0859	485.50	446.05	440.55	437.65	435.95	435.10	
3	.0867	55602R1	0.0860 - 0.1015	417.00	377.55	372.05	369.15	367.40	366.55	
3	.1024	55604R1	0.1016 - 0.1171	391.65	352.15	346.65	343.80	342.15	341.10	
3	.1180	55606R1	0.1172 - 0.1406	363.30	323.85	318.35	315.50	313.75	312.80	
3	.1562	55608R1	0.1407 - 0.1718	377.10	337.70	332.20	329.40	327.50	326.70	
3	.1875	55609R1	0.1719 - 0.2031	391.00	351.55	346.10	343.15	341.50	340.60	
3	.2188	55610R1	0.2032 - 0.2343	404.85	365.35	359.85	357.00	355.30	354.35	
3	.2500	55611R1	0.2344 - 0.2812	418.75	379.25	373.75	371.00	369.15	368.25	
3	.3125	55612R1	0.2813 - 0.3437	450.45	410.95	405.45	402.60	400.90	400.05	
3	.3750	55613R1	0.3438 - 0.4062	482.25	442.95	437.45	434.55	432.75	431.90	
3	.4375	55614R1	0.4063 - 0.4687	526.00	486.50	481.05	478.15	476.50	475.65	
3	.5000	55615R1	0.4688 - 0.5312	574.55	535.10	529.60	526.75	524.95	524.20	

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

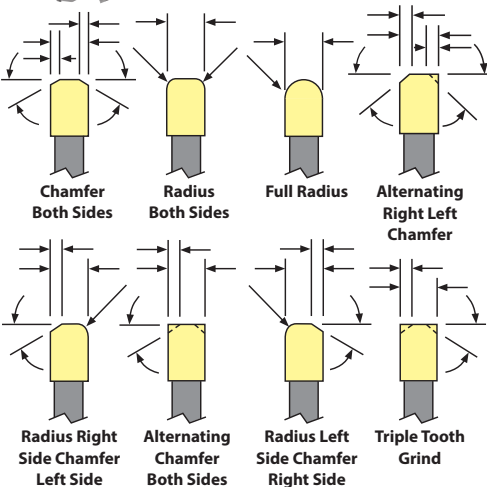


Specify right or left side for radius or chamfer



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	\$426.90	\$383.20	\$376.95	\$373.75	\$371.95	\$370.95	
3	.0711	55600R2	0.0704 - 0.0859	495.50	451.65	445.45	442.30	440.40	439.30	
3	.0867	55602R2	0.0860 - 0.1015	426.90	383.20	376.95	373.75	371.95	370.95	
3	.1024	55604R2	0.1016 - 0.1171	401.55	357.75	351.55	348.40	346.50	345.50	
3	.1180	55606R2	0.1172 - 0.1406	373.30	329.40	323.25	320.10	318.15	317.10	
3	.1562	55608R2	0.1407 - 0.1718	387.05	343.15	337.10	334.00	332.00	331.00	
3	.1875	55609R2	0.1719 - 0.2031	400.90	357.10	351.00	347.85	345.85	344.90	
3	.2188	55610R2	0.2032 - 0.2343	414.90	371.00	364.75	361.65	359.75	358.60	
3	.2500	55611R2	0.2344 - 0.2812	428.70	384.80	378.65	375.50	373.55	372.60	
3	.3125	55612R2	0.2813 - 0.3437	460.45	416.55	410.40	407.20	405.30	404.30	
3	.3750	55613R2	0.3438 - 0.4062	492.25	448.35	442.30	439.20	437.30	436.20	
3	.4375	55614R2	0.4063 - 0.4687	535.95	492.10	486.00	482.85	480.85	479.85	
3	.5000	55615R2	0.4688 - 0.5312	584.50	540.55	534.55	531.40	529.40	528.40	



4" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

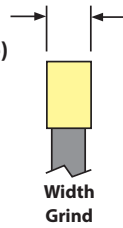
FOR STEEL

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	\$480.35	\$449.15	\$443.30	\$440.25	\$438.45	\$396.00
4	.0701	55618D	0.0704 - 0.0859	517.50	486.40	480.55	477.50	475.75	433.30
4	.0858	55620D	0.0860 - 0.1015	480.35	449.15	443.30	440.25	438.45	396.00
4	.1014	55622D	0.1016 - 0.1171	458.85	427.70	421.85	418.80	416.95	374.50
4	.1170	55624D	0.1172 - 0.1406	434.05	402.90	397.05	394.05	392.25	349.75
4	.1562	55626D	0.1407 - 0.1718	460.15	429.00	423.20	420.10	418.35	375.90
4	.1875	55628D	0.1719 - 0.2031	461.65	430.55	424.65	421.65	419.75	377.30
4	.2188	55630D	0.2032 - 0.2343	483.90	452.85	446.95	443.90	442.15	399.70
4	.2500	55632D	0.2344 - 0.2812	489.20	458.05	452.15	449.15	447.40	404.85
4	.3125	55634D	0.2813 - 0.3437	523.55	492.50	486.60	483.60	481.80	439.30
4	.3750	55636D	0.3438 - 0.4062	555.40	524.30	518.50	515.45	513.50	471.10
4	.4375	55638D	0.4063 - 0.4687	607.70	576.55	570.80	567.65	565.85	523.40
4	.5000	55640D	0.4688 - 0.5312	665.85	634.80	628.90	625.90	624.10	581.70

Corner Radius or Chamfer on ONE Side

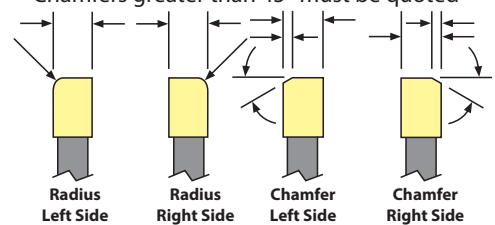
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55616R1	0.0600 - 0.0703	\$499.75	\$455.10	\$448.75	\$445.30	\$443.25	\$442.15
4	.0701	55618R1	0.0704 - 0.0859	537.10	492.50	486.00	482.50	480.55	479.40
4	.0858	55620R1	0.0860 - 0.1015	499.75	455.10	448.75	445.30	443.25	442.15
4	.1014	55622R1	0.1016 - 0.1171	478.20	433.65	427.25	423.85	421.80	420.70
4	.1170	55624R1	0.1172 - 0.1406	453.55	409.00	402.50	399.10	397.00	396.00
4	.1562	55626R1	0.1407 - 0.1718	479.70	435.10	428.65	425.20	423.20	422.05
4	.1875	55628R1	0.1719 - 0.2031	481.10	436.55	430.10	426.60	424.60	423.50
4	.2188	55630R1	0.2032 - 0.2343	503.50	458.90	452.40	448.95	446.95	445.90
4	.2500	55632R1	0.2344 - 0.2812	508.65	463.95	457.60	454.25	452.10	451.05
4	.3125	55634R1	0.2813 - 0.3437	543.00	498.60	491.95	488.60	486.60	485.45
4	.3750	55636R1	0.3438 - 0.4062	574.90	530.30	523.70	520.35	518.35	517.20
4	.4375	55638R1	0.4063 - 0.4687	627.20	582.60	576.20	572.80	570.65	569.65
4	.5000	55640R1	0.4688 - 0.5312	685.35	640.85	634.30	630.90	628.85	627.75

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

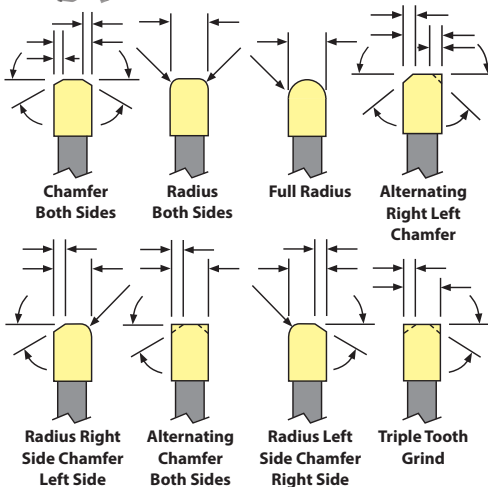


Specify right or left side for radius or chamfer



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	\$510.35	\$461.20	\$454.10	\$450.35	\$448.05	\$446.85
4	.0701	55618R2	0.0704 - 0.0859	547.60	498.60	491.45	487.55	485.35	484.10
4	.0858	55620R2	0.0860 - 0.1015	510.35	461.20	454.10	450.35	448.05	446.85
4	.1014	55622R2	0.1016 - 0.1171	488.85	439.80	432.55	428.85	426.55	425.35
4	.1170	55624R2	0.1172 - 0.1406	464.25	415.05	407.90	404.10	401.85	400.70
4	.1562	55626R2	0.1407 - 0.1718	490.30	441.15	434.00	430.20	427.95	426.75
4	.1875	55628R2	0.1719 - 0.2031	491.80	442.55	435.35	431.80	429.45	428.20
4	.2188	55630R2	0.2032 - 0.2343	514.15	464.90	457.85	454.00	451.75	450.50
4	.2500	55632R2	0.2344 - 0.2812	519.20	470.10	463.00	459.20	456.90	455.75
4	.3125	55634R2	0.2813 - 0.3437	553.75	504.60	497.40	493.60	491.50	490.10
4	.3750	55636R2	0.3438 - 0.4062	585.45	536.35	529.15	525.40	523.20	522.00
4	.4375	55638R2	0.4063 - 0.4687	637.85	588.65	581.40	577.75	575.55	574.30
4	.5000	55640R2	0.4688 - 0.5312	696.00	646.80	639.70	635.95	633.75	632.50

CUTTERS



5" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

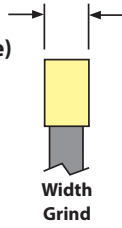
FOR STEEL

Modified width between .0704" and .5312"

TYPE 556

Cutter Notes (All cutters on page)

- 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	\$622.65	\$590.90	\$585.05	\$581.85	\$580.00	\$536.55
5	.0848	55644D	0.0860 - 0.1015	626.50	594.65	588.75	585.65	583.75	540.30
5	.1004	55646D	0.1016 - 0.1171	590.15	558.45	552.55	549.35	547.50	504.15
5	.1160	55648D	0.1172 - 0.1406	523.30	491.55	485.50	482.40	480.55	437.15
5	.1562	55650D	0.1407 - 0.1718	533.35	501.60	495.60	492.50	490.65	447.15
5	.1875	55652D	0.1719 - 0.2031	564.80	533.00	527.05	523.90	522.05	478.65
5	.2188	55654D	0.2032 - 0.2343	578.45	546.70	540.55	537.50	535.70	492.25
5	.2500	55656D	0.2344 - 0.2812	599.55	567.75	561.80	558.75	556.90	513.45
5	.3125	55658D	0.2813 - 0.3437	644.45	612.75	606.75	603.65	601.70	558.40
5	.3750	55660D	0.3438 - 0.4062	689.55	657.75	651.65	648.65	646.70	603.35
5	.4375	55662D	0.4063 - 0.4687	756.60	724.75	718.80	715.60	713.85	670.40
5	.5000	55664D	0.4688 - 0.5312	831.05	799.20	793.30	790.15	788.40	744.90

Corner Radius or Chamfer on ONE Side

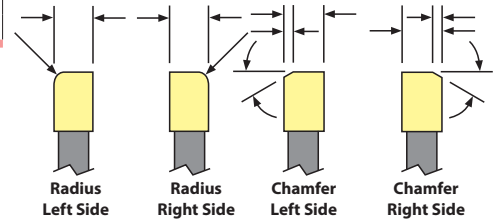
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55642R1	0.0704 - 0.0859	\$642.45	\$596.95	\$590.35	\$586.85	\$584.80	\$583.70
5	.0848	55644R1	0.0860 - 0.1015	646.25	600.80	594.15	590.70	588.60	587.45
5	.1004	55646R1	0.1016 - 0.1171	610.00	564.45	557.80	554.35	552.35	551.30
5	.1160	55648R1	0.1172 - 0.1406	542.95	497.50	490.85	487.45	485.35	484.25
5	.1562	55650R1	0.1407 - 0.1718	553.10	507.65	501.00	497.50	495.50	494.30
5	.1875	55652R1	0.1719 - 0.2031	584.50	539.05	532.45	529.00	526.95	525.80
5	.2188	55654R1	0.2032 - 0.2343	598.15	552.70	546.00	542.65	540.45	539.40
5	.2500	55656R1	0.2344 - 0.2812	619.40	573.90	567.20	563.75	561.65	560.50
5	.3125	55658R1	0.2813 - 0.3437	664.25	618.75	612.20	608.75	606.65	605.55
5	.3750	55660R1	0.3438 - 0.4062	709.35	663.75	657.05	653.60	651.50	650.50
5	.4375	55662R1	0.4063 - 0.4687	776.25	730.85	724.15	720.75	718.70	717.55
5	.5000	55664R1	0.4688 - 0.5312	850.75	805.30	798.60	795.20	793.15	791.95

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

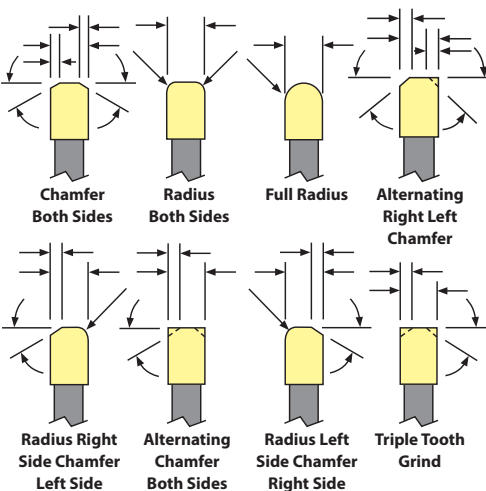


Specify right or left side for radius or chamfer



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	55642R2	0.0704 - 0.0859	\$663.60	\$609.00	\$601.15	\$596.95	\$594.50	\$593.15
5	.0848	55644R2	0.0860 - 0.1015	667.45	612.85	604.90	600.65	598.15	596.90
5	.1004	55646R2	0.1016 - 0.1171	631.15	576.55	568.60	564.40	561.90	560.65
5	.1160	55648R2	0.1172 - 0.1406	564.20	509.60	501.65	497.45	494.95	493.65
5	.1562	55650R2	0.1407 - 0.1718	574.30	519.75	511.75	507.55	505.05	503.75
5	.1875	55652R2	0.1719 - 0.2031	605.70	551.10	543.15	539.05	536.55	535.15
5	.2188	55654R2	0.2032 - 0.2343	619.40	564.80	556.90	552.65	550.15	548.75
5	.2500	55656R2	0.2344 - 0.2812	640.50	585.90	577.95	573.85	571.30	569.95
5	.3125	55658R2	0.2813 - 0.3437	685.50	630.90	622.90	618.70	616.25	614.90
5	.3750	55660R2	0.3438 - 0.4062	730.35	675.85	667.85	663.65	661.20	659.90
5	.4375	55662R2	0.4063 - 0.4687	797.45	743.00	734.95	730.75	728.20	726.95
5	.5000	55664R2	0.4688 - 0.5312	871.95	817.40	809.35	805.25	802.80	801.45



6" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

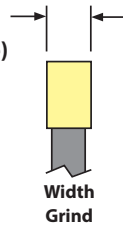
FOR STEEL

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	\$699.80	\$664.90	\$658.10	\$654.60	\$652.50	\$603.25
6	.0838	55668D	0.0860 - 0.1015	649.20	614.35	607.55	604.00	601.95	552.65
6	.0994	55670D	0.1016 - 0.1171	701.90	667.00	660.20	656.70	654.55	605.35
6	.1150	55672D	0.1172 - 0.1406	676.45	641.55	634.80	631.20	629.15	579.85
6	.1562	55674D	0.1407 - 0.1718	676.15	641.15	634.40	630.90	628.80	579.60
6	.1875	55676D	0.1719 - 0.2031	718.35	683.50	676.75	673.20	671.05	621.75
6	.2188	55678D	0.2032 - 0.2343	729.00	694.10	687.35	683.85	681.70	632.45
6	.2500	55680D	0.2344 - 0.2812	772.70	737.70	730.95	727.45	725.35	676.05
6	.3125	55682D	0.2813 - 0.3437	782.05	747.10	740.30	736.80	734.65	685.50
6	.3750	55684D	0.3438 - 0.4062	808.45	773.40	766.60	763.05	761.00	711.85
6	.4375	55690D	0.4063 - 0.4687	887.50	852.55	845.80	842.15	840.15	790.85
6	.5000	55692D	0.4688 - 0.5312	975.30	940.45	933.70	930.05	928.05	878.75

Corner Radius or Chamfer on ONE Side

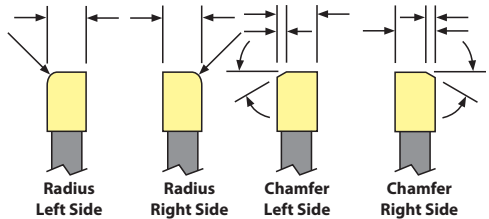
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55666R1	0.0704 - 0.0859	\$720.70	\$671.50	\$664.05	\$660.05	\$657.75	\$656.50
6	.0838	55668R1	0.0860 - 0.1015	670.00	620.95	613.45	609.50	607.10	605.85
6	.0994	55670R1	0.1016 - 0.1171	722.70	673.55	666.05	662.20	659.85	658.55
6	.1150	55672R1	0.1172 - 0.1406	697.20	648.15	640.65	636.70	634.35	633.05
6	.1562	55674R1	0.1407 - 0.1718	697.00	647.85	640.35	636.40	634.05	632.85
6	.1875	55676R1	0.1719 - 0.2031	739.20	690.05	682.55	678.55	676.30	675.05
6	.2188	55678R1	0.2032 - 0.2343	749.90	700.75	693.20	689.35	687.00	685.70
6	.2500	55680R1	0.2344 - 0.2812	793.50	744.35	736.80	732.95	730.60	729.30
6	.3125	55682R1	0.2813 - 0.3437	802.95	753.70	746.25	742.35	740.00	738.70
6	.3750	55684R1	0.3438 - 0.4062	829.15	780.00	772.50	768.65	766.25	764.95
6	.4375	55690R1	0.4063 - 0.4687	908.30	859.05	851.60	847.65	845.35	844.05
6	.5000	55692R1	0.4688 - 0.5312	996.15	946.95	939.50	935.55	933.15	932.00

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

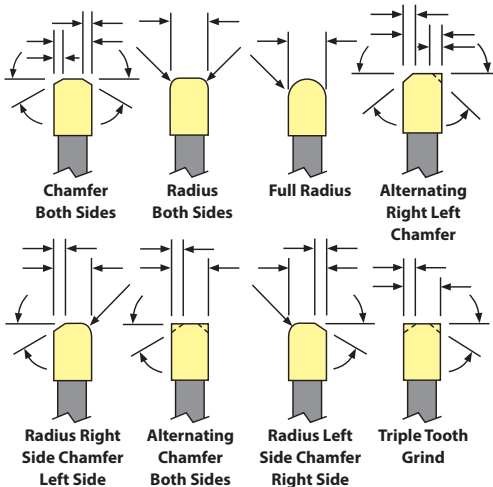


Specify right or left side for radius or chamfer



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
6	.0681	55666R2	0.0704 - 0.0859	\$743.25	\$684.65	\$675.60	\$671.05	\$668.25	\$666.75
6	.0838	55668R2	0.0860 - 0.1015	692.65	634.00	625.05	620.40	617.60	616.15
6	.0994	55670R2	0.1016 - 0.1171	745.30	686.65	677.75	673.00	670.35	668.75
6	.1150	55672R2	0.1172 - 0.1406	719.85	661.20	652.25	647.55	644.90	643.35
6	.1562	55674R2	0.1407 - 0.1718	719.55	660.95	652.05	647.30	644.55	643.05
6	.1875	55676R2	0.1719 - 0.2031	761.80	703.20	694.15	689.55	686.75	685.20
6	.2188	55678R2	0.2032 - 0.2343	772.45	713.85	704.85	700.20	697.50	695.95
6	.2500	55680R2	0.2344 - 0.2812	816.00	757.40	748.55	743.80	741.05	739.50
6	.3125	55682R2	0.2813 - 0.3437	825.50	766.85	757.90	753.25	750.50	748.95
6	.3750	55684R2	0.3438 - 0.4062	851.75	793.15	784.20	779.45	776.80	775.15
6	.4375	55690R2	0.4063 - 0.4687	930.80	872.20	863.25	858.60	855.85	854.35
6	.5000	55692R2	0.4688 - 0.5312	1018.75	960.10	951.15	946.50	943.75	942.20

CUTTERS



3" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559



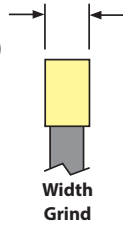
SUITABLE FOR MOST MATERIALS

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	\$378.70	\$351.30	\$346.65	\$344.15	\$342.70	\$308.05
3	.0711	55900D	0.0704 - 0.0859	415.80	388.40	383.65	381.20	379.60	345.05
3	.0867	55902D	0.0860 - 0.1015	378.70	351.30	346.65	344.15	342.70	308.05
3	.1024	55904D	0.1016 - 0.1171	364.70	337.45	332.65	330.15	328.65	294.05
3	.1180	55906D	0.1172 - 0.1406	351.55	324.15	319.35	316.85	315.40	280.85
3	.1562	55908D	0.1407 - 0.1718	358.35	331.05	326.25	323.80	322.35	287.60
3	.1875	55909D	0.1719 - 0.2031	365.25	337.80	333.00	330.60	329.15	294.50
3	.2188	55910D	0.2032 - 0.2343	374.50	347.25	342.45	339.95	338.45	303.85
3	.2500	55911D	0.2344 - 0.2812	383.85	356.50	351.60	349.10	347.70	313.00
3	.3125	55912D	0.2813 - 0.3437	413.65	386.30	381.50	379.10	377.60	342.90
3	.3750	55913D	0.3438 - 0.4062	445.70	418.40	413.65	411.05	409.60	375.10
3	.4375	55914D	0.4063 - 0.4687	478.15	450.85	446.10	443.60	442.10	407.60
3	.5000	55915D	0.4688 - 0.5312	510.75	483.25	478.50	476.05	474.65	439.90

Corner Radius or Chamfer on ONE Side

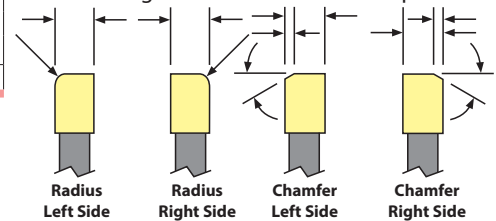
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
3	.0555	55998R1	0.0600 - 0.0703	\$397.20	\$356.80	\$351.30	\$348.70	\$347.05	\$346.20
3	.0711	55900R1	0.0704 - 0.0859	434.30	393.80	388.40	385.65	384.00	383.20
3	.0867	55902R1	0.0860 - 0.1015	397.20	356.80	351.30	348.70	347.05	346.20
3	.1024	55904R1	0.1016 - 0.1171	383.30	342.80	337.45	334.70	332.95	332.10
3	.1180	55906R1	0.1172 - 0.1406	370.05	329.50	324.15	321.40	319.80	318.80
3	.1562	55908R1	0.1407 - 0.1718	376.80	336.35	331.05	328.20	326.60	325.65
3	.1875	55909R1	0.1719 - 0.2031	383.80	343.15	337.80	335.10	333.55	332.60
3	.2188	55910R1	0.2032 - 0.2343	392.95	352.65	347.25	344.35	342.80	341.80
3	.2500	55911R1	0.2344 - 0.2812	402.25	361.75	356.50	353.65	352.05	351.10
3	.3125	55912R1	0.2813 - 0.3437	432.10	391.70	386.30	383.50	381.95	380.90
3	.3750	55913R1	0.3438 - 0.4062	464.35	423.80	418.40	415.65	414.00	413.15
3	.4375	55914R1	0.4063 - 0.4687	496.70	456.25	450.85	448.10	446.45	445.55
3	.5000	55915R1	0.4688 - 0.5312	529.15	488.65	483.25	480.60	478.80	478.00

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 1/3 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

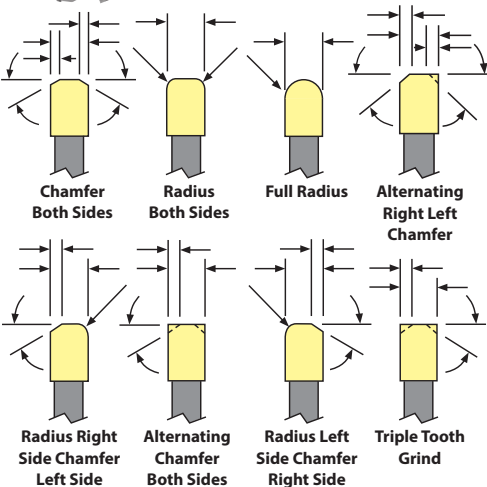


Specify right or left side for radius or chamfer



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
3	.0555	55998R2	0.0600 - 0.0703	\$407.10	\$362.25	\$356.30	\$353.10	\$351.25	\$350.35
3	.0711	55900R2	0.0704 - 0.0859	444.20	399.20	393.35	390.20	388.25	387.25
3	.0867	55902R2	0.0860 - 0.1015	407.10	362.25	356.30	353.10	351.25	350.35
3	.1024	55904R2	0.1016 - 0.1171	393.30	348.20	342.30	339.25	337.35	336.30
3	.1180	55906R2	0.1172 - 0.1406	379.95	335.00	329.00	325.95	324.05	323.10
3	.1562	55908R2	0.1407 - 0.1718	386.80	341.75	335.90	332.80	330.95	329.90
3	.1875	55909R2	0.1719 - 0.2031	393.55	348.70	342.75	339.60	337.75	336.80
3	.2188	55910R2	0.2032 - 0.2343	403.05	357.95	352.10	349.00	347.10	346.20
3	.2500	55911R2	0.2344 - 0.2812	412.15	367.15	361.25	358.15	356.30	355.30
3	.3125	55912R2	0.2813 - 0.3437	442.05	397.05	391.05	388.05	386.25	385.25
3	.3750	55913R2	0.3438 - 0.4062	474.25	429.25	423.25	420.15	418.30	417.35
3	.4375	55914R2	0.4063 - 0.4687	506.55	461.70	455.75	452.55	450.80	449.75
3	.5000	55915R2	0.4688 - 0.5312	539.05	494.20	488.15	485.10	483.20	482.20



4" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559



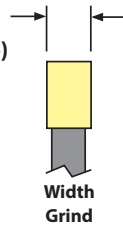
SUITABLE FOR MOST MATERIALS

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	\$433.60	\$402.25	\$396.50	\$393.55	\$391.75	\$350.40
4	.0701	55918D	0.0704 - 0.0859	484.75	453.30	447.55	444.60	442.90	401.45
4	.0858	55920D	0.0860 - 0.1015	433.60	402.25	396.50	393.55	391.75	350.40
4	.1014	55922D	0.1016 - 0.1171	498.75	467.30	461.60	458.75	456.85	415.35
4	.1170	55924D	0.1172 - 0.1406	433.20	401.65	395.85	392.90	391.25	349.80
4	.1562	55926D	0.1407 - 0.1718	442.30	410.90	405.15	402.25	400.40	359.05
4	.1875	55928D	0.1719 - 0.2031	453.70	422.30	416.55	413.70	411.85	370.45
4	.2188	55930D	0.2032 - 0.2343	465.45	434.00	428.20	425.30	423.40	382.10
4	.2500	55932D	0.2344 - 0.2812	474.65	443.10	437.40	434.45	432.60	391.30
4	.3125	55934D	0.2813 - 0.3437	502.10	470.65	464.90	461.95	460.15	418.90
4	.3750	55936D	0.3438 - 0.4062	534.40	502.95	497.25	494.25	492.35	451.00
4	.4375	55938D	0.4063 - 0.4687	566.80	535.40	529.60	526.65	524.75	483.50
4	.5000	55940D	0.4688 - 0.5312	599.30	567.70	562.05	559.05	557.30	515.90

Corner Radius or Chamfer on ONE Side

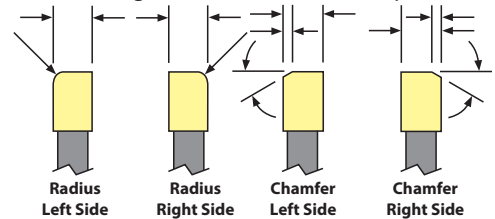
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55916R1	0.0600 - 0.0703	\$453.65	\$408.15	\$401.80	\$398.40	\$396.50	\$395.45
4	.0701	55918R1	0.0704 - 0.0859	504.70	459.15	452.85	449.45	447.55	446.45
4	.0858	55920R1	0.0860 - 0.1015	453.65	408.15	401.80	398.40	396.50	395.45
4	.1014	55922R1	0.1016 - 0.1171	518.85	473.20	466.85	463.60	461.60	460.50
4	.1170	55924R1	0.1172 - 0.1406	453.15	407.60	401.20	397.85	395.85	394.85
4	.1562	55926R1	0.1407 - 0.1718	462.30	416.65	410.40	407.10	405.15	404.05
4	.1875	55928R1	0.1719 - 0.2031	473.80	428.20	421.85	418.50	416.55	415.40
4	.2188	55930R1	0.2032 - 0.2343	485.45	439.85	433.45	430.20	428.20	427.10
4	.2500	55932R1	0.2344 - 0.2812	494.60	448.95	442.60	439.30	437.40	436.30
4	.3125	55934R1	0.2813 - 0.3437	522.15	476.50	470.20	466.90	464.90	463.75
4	.3750	55936R1	0.3438 - 0.4062	554.30	508.75	502.35	499.05	497.25	496.05
4	.4375	55938R1	0.4063 - 0.4687	586.80	541.30	534.80	531.60	529.60	528.50
4	.5000	55940R1	0.4688 - 0.5312	619.25	573.75	567.40	564.05	562.05	561.00

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 1/3 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

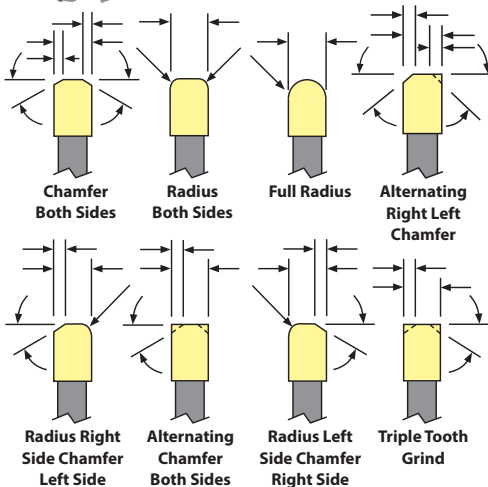


Specify right or left side for radius or chamfer



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	\$464.35	\$414.05	\$407.00	\$403.40	\$401.20	\$400.05
4	.0701	55918R2	0.0704 - 0.0859	515.20	465.05	458.05	454.40	452.15	451.00
4	.0858	55920R2	0.0860 - 0.1015	464.35	414.05	407.00	403.40	401.20	400.05
4	.1014	55922R2	0.1016 - 0.1171	529.30	479.15	472.00	468.50	466.25	465.05
4	.1170	55924R2	0.1172 - 0.1406	463.65	413.40	406.40	402.80	400.65	399.40
4	.1562	55926R2	0.1407 - 0.1718	472.90	422.70	415.60	412.00	409.70	408.55
4	.1875	55928R2	0.1719 - 0.2031	484.40	434.10	427.10	423.40	421.20	420.10
4	.2188	55930R2	0.2032 - 0.2343	496.00	445.70	438.75	435.15	432.95	431.80
4	.2500	55932R2	0.2344 - 0.2812	505.05	454.90	447.90	444.20	442.05	440.80
4	.3125	55934R2	0.2813 - 0.3437	532.65	482.45	475.40	471.80	469.55	468.45
4	.3750	55936R2	0.3438 - 0.4062	564.95	514.65	507.65	504.05	501.90	500.65
4	.4375	55938R2	0.4063 - 0.4687	597.35	547.15	540.15	536.45	534.20	533.20
4	.5000	55940R2	0.4688 - 0.5312	629.80	579.65	572.50	568.90	566.70	565.45

CUTTERS



5" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559



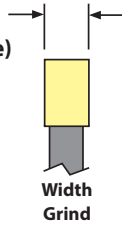
SUITABLE FOR MOST MATERIALS

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	\$579.85	\$547.60	\$541.75	\$538.80	\$537.05	\$494.65
5	.0848	55944D	0.0860 - 0.1015	509.50	477.30	471.55	468.50	466.70	424.20
5	.1004	55946D	0.1016 - 0.1171	551.70	519.65	513.70	510.80	508.95	466.65
5	.1160	55948D	0.1172 - 0.1406	497.25	464.90	459.15	456.10	454.35	411.95
5	.1562	55950D	0.1407 - 0.1718	510.85	478.65	472.90	469.75	467.95	425.55
5	.1875	55952D	0.1719 - 0.2031	533.95	501.80	496.00	493.00	491.15	448.75
5	.2188	55954D	0.2032 - 0.2343	557.05	524.75	519.00	515.95	514.15	471.80
5	.2500	55956D	0.2344 - 0.2812	579.90	547.65	541.95	538.90	537.15	494.70
5	.3125	55958D	0.2813 - 0.3437	618.95	586.80	581.00	577.95	576.20	533.85
5	.3750	55960D	0.3438 - 0.4062	660.40	628.25	622.50	619.45	617.60	575.30
5	.4375	55962D	0.4063 - 0.4687	692.85	660.80	655.00	651.95	650.05	607.70
5	.5000	55964D	0.4688 - 0.5312	725.40	693.20	687.35	684.40	682.55	640.10

Corner Radius or Chamfer on ONE Side

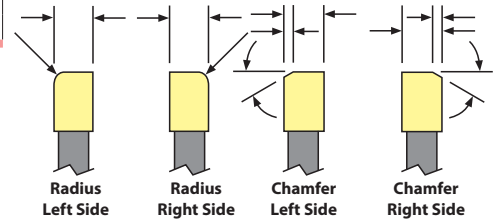
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55942R1	0.0704 - 0.0859	\$600.05	\$553.50	\$547.05	\$543.60	\$541.55	\$540.55
5	.0848	55944R1	0.0860 - 0.1015	529.80	483.20	476.70	473.40	471.30	470.20
5	.1004	55946R1	0.1016 - 0.1171	572.00	525.55	519.00	515.65	513.55	512.50
5	.1160	55948R1	0.1172 - 0.1406	517.35	470.85	464.45	461.05	459.00	457.95
5	.1562	55950R1	0.1407 - 0.1718	531.10	484.50	478.05	474.75	472.60	471.65
5	.1875	55952R1	0.1719 - 0.2031	554.15	507.70	501.15	497.85	495.85	494.70
5	.2188	55954R1	0.2032 - 0.2343	577.20	530.70	524.25	520.95	518.85	517.75
5	.2500	55956R1	0.2344 - 0.2812	600.15	553.75	547.15	543.85	541.75	540.65
5	.3125	55958R1	0.2813 - 0.3437	639.25	592.65	586.20	582.80	580.90	579.75
5	.3750	55960R1	0.3438 - 0.4062	680.70	634.20	627.65	624.30	622.40	621.25
5	.4375	55962R1	0.4063 - 0.4687	713.20	666.70	660.15	656.80	654.75	653.65
5	.5000	55964R1	0.4688 - 0.5312	745.60	699.15	692.65	689.35	687.15	686.10

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

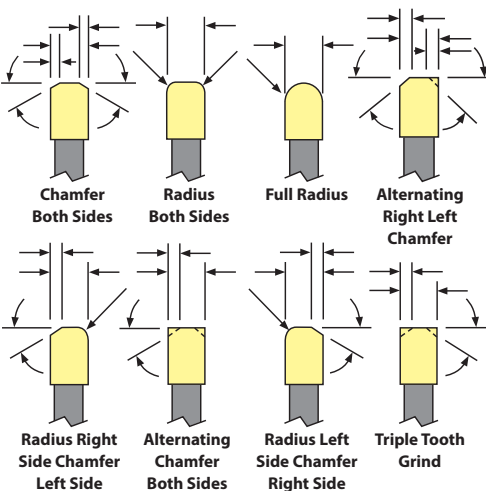


Specify right or left side for radius or chamfer



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	\$621.15	\$565.35	\$557.50	\$553.45	\$551.00	\$549.75
5	.0848	55944R2	0.0860 - 0.1015	550.85	494.95	487.20	483.15	480.70	479.45
5	.1004	55946R2	0.1016 - 0.1171	593.10	537.25	529.45	525.40	523.05	521.70
5	.1160	55948R2	0.1172 - 0.1406	538.50	482.65	474.90	470.75	468.45	467.10
5	.1562	55950R2	0.1407 - 0.1718	552.15	496.30	488.55	484.50	482.10	480.70
5	.1875	55952R2	0.1719 - 0.2031	575.30	519.50	511.60	507.65	505.20	503.95
5	.2188	55954R2	0.2032 - 0.2343	598.20	542.60	534.70	530.70	528.30	527.00
5	.2500	55956R2	0.2344 - 0.2812	621.25	565.40	557.55	553.60	551.30	549.95
5	.3125	55958R2	0.2813 - 0.3437	660.25	604.50	596.75	592.60	590.15	588.90
5	.3750	55960R2	0.3438 - 0.4062	701.85	645.95	638.25	634.10	631.70	630.50
5	.4375	55962R2	0.4063 - 0.4687	734.35	678.40	670.55	666.65	664.20	662.90
5	.5000	55964R2	0.4688 - 0.5312	766.70	710.90	703.15	699.15	696.60	695.30



6" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559



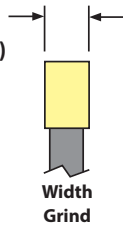
SUITABLE FOR MOST MATERIALS

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	\$645.25	\$611.60	\$605.55	\$602.40	\$600.45	\$556.25
6	.0838	55968D	0.0860 - 0.1015	601.20	567.60	561.50	558.40	556.40	512.25
6	.0994	55970D	0.1016 - 0.1171	647.15	613.60	607.40	604.25	602.40	558.15
6	.1150	55972D	0.1172 - 0.1406	615.75	582.25	576.20	573.00	571.10	526.95
6	.1562	55974D	0.1407 - 0.1718	638.75	605.35	599.25	596.05	594.15	549.95
6	.1875	55976D	0.1719 - 0.2031	661.90	628.25	622.35	618.95	617.05	572.90
6	.2188	55978D	0.2032 - 0.2343	684.90	651.30	645.25	642.05	640.10	596.00
6	.2500	55980D	0.2344 - 0.2812	716.70	683.20	677.00	673.85	672.05	627.75
6	.3125	55982D	0.2813 - 0.3437	744.80	711.20	705.15	701.95	700.10	655.85
6	.3750	55984D	0.3438 - 0.4062	770.05	736.35	730.35	727.15	725.25	681.00
6	.4375	55990D	0.4063 - 0.4687	802.40	768.80	762.80	759.55	757.65	713.45
6	.5000	55992D	0.4688 - 0.5312	834.85	801.30	795.20	792.05	790.15	745.90

Corner Radius or Chamfer on ONE Side

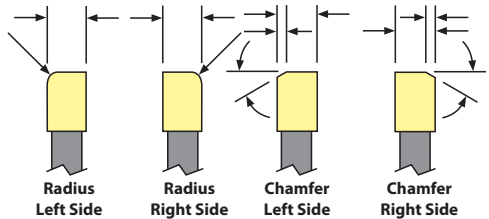
TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55966R1	0.0704 - 0.0859	\$665.80	\$617.50	\$610.70	\$607.30	\$605.10	\$604.00
6	.0838	55968R1	0.0860 - 0.1015	621.80	573.45	566.70	563.25	561.15	560.05
6	.0994	55970R1	0.1016 - 0.1171	667.80	619.40	612.60	609.10	606.95	605.90
6	.1150	55972R1	0.1172 - 0.1406	636.50	588.10	581.30	577.80	575.75	574.60
6	.1562	55974R1	0.1407 - 0.1718	659.55	611.25	604.35	601.00	598.80	597.65
6	.1875	55976R1	0.1719 - 0.2031	682.55	634.20	627.45	623.90	621.80	620.75
6	.2188	55978R1	0.2032 - 0.2343	705.55	657.25	650.55	646.85	644.90	643.75
6	.2500	55980R1	0.2344 - 0.2812	737.40	689.10	682.30	678.85	676.65	675.50
6	.3125	55982R1	0.2813 - 0.3437	765.45	717.10	710.40	706.90	704.75	703.55
6	.3750	55984R1	0.3438 - 0.4062	790.60	742.35	735.55	732.00	729.95	728.85
6	.4375	55990R1	0.4063 - 0.4687	823.05	774.85	768.05	764.55	762.35	761.30
6	.5000	55992R1	0.4688 - 0.5312	855.60	807.20	800.40	796.95	794.90	793.65

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

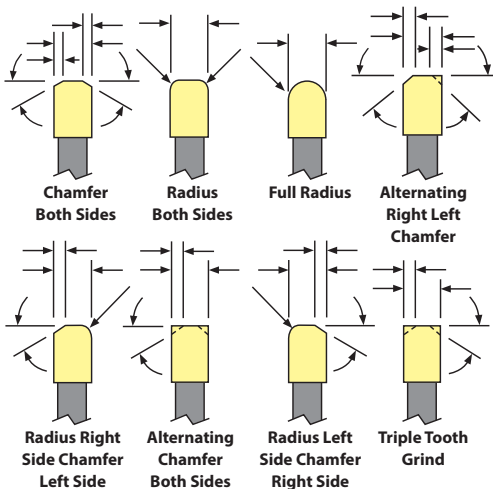


Specify right or left side for radius or chamfer



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	\$687.00	\$629.30	\$621.25	\$617.05	\$614.50	\$613.10
6	.0838	55968R2	0.0860 - 0.1015	642.90	585.30	577.20	573.05	570.55	569.10
6	.0994	55970R2	0.1016 - 0.1171	688.95	631.20	623.10	618.95	616.40	615.10
6	.1150	55972R2	0.1172 - 0.1406	657.65	600.00	591.85	587.70	585.20	583.80
6	.1562	55974R2	0.1407 - 0.1718	680.65	622.95	614.90	610.70	608.20	606.85
6	.1875	55976R2	0.1719 - 0.2031	703.55	645.95	637.90	633.80	631.30	629.90
6	.2188	55978R2	0.2032 - 0.2343	726.60	669.05	660.95	656.80	654.25	652.90
6	.2500	55980R2	0.2344 - 0.2812	758.50	700.80	692.75	688.55	686.00	684.75
6	.3125	55982R2	0.2813 - 0.3437	786.50	728.95	720.85	716.70	714.15	712.80
6	.3750	55984R2	0.3438 - 0.4062	811.65	754.10	746.05	741.90	739.35	738.05
6	.4375	55990R2	0.4063 - 0.4687	844.20	786.50	778.50	774.35	771.80	770.45
6	.5000	55992R2	0.4688 - 0.5312	876.65	819.00	810.95	806.85	804.35	802.95

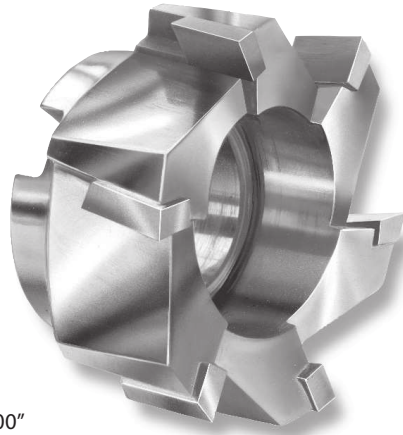
CUTTERS



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	\$219.20	4	53124	\$219.20	4	53224	\$228.00
1 ½	½	½	1 ½	¼	5/32	4	53026	228.25	4	53126	228.25	4	53226	237.35
1 ¾	¾	½	1 ¼	5/16	3/16	4	53028	284.40	4	53128	284.40	4	53228	295.70
2	¾	5/8	1 ¾	5/16	3/16	4	53032	298.65	4	53132	317.80	4	53232	330.45
2 ¼	1	5/8	1 ½	3/8	7/32	6	53036	315.50	6	53136	344.05	6	53236	357.80
2 ½	1	5/8	1 5/8	3/8	7/32	6	53040	332.20	6	53140	375.00	6	53240	375.00
2 ¾	1	5/8	1 5/8	3/8	7/32	6	53044	350.55	6	53144	393.40	6	53244	393.40
3	1 ¼	¾	1 ¾	½	9/32	6	53048	384.25	6	53148	427.85	6	53248	427.85
3 ½	1 ¼	¾	1 7/8	½	9/32	6	53056	470.40	8	53156	503.15	6	53256	531.90
4	1 ½	¾	2 ¼	5/8	3/8	6	53064	591.10	8	53164	622.50	6	53264	660.75

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	\$457.65
4	½	1 ¼	10	71416	71616	72416	72616	566.35
4	¾	1 ¼	10	71424	71624	72424	72624	614.40

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	\$385.30
3	½	1	8	75008	75208	75408	480.50
4	½	1 ¼	10	75016	75216	75416	594.65
4	¾	1 ¼	10	75024	75224	75424	645.05
4	1	1 ¼	10	-	75232	75432	754.90



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

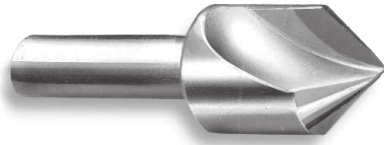


SPIRAL FLUTE COUNTERSINKS CARBIDE TIPPED



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	\$72.25
3/8	1/4	5/64	56112	58112	59112	58412	72.25
1/2	3/8	3/32	56116	58116	59116	58416	85.80
3/4	1/2	1/8	56124	58124	59124	58424	107.30
1	1/2	1/8	56132	58132	59132	58432	140.15
1 1/4	1/2	5/32	56140	58140	59140	58440	178.35
1 1/2	1/2	3/16	56148	58148	59148	58448	199.95

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	\$79.50
3/8	1/4	7/64	56312	58312	59012	58512	79.50
1/2	3/8	9/64	56316	58316	59016	58516	94.40
3/8	3/8	9/64	56320	58320	59020	58520	99.30
3/4	1/2	3/16	56324	58324	59024	58524	119.40
7/8	1/2	3/16	56328	58328	59028	58528	136.85
1	1/2	1/4	56332	58332	59032	58532	149.25
1 1/4	1/2	5/16	56340	58340	59040	58540	185.65
1 1/2	1/2	3/8	56348	58348	59048	58548	216.55



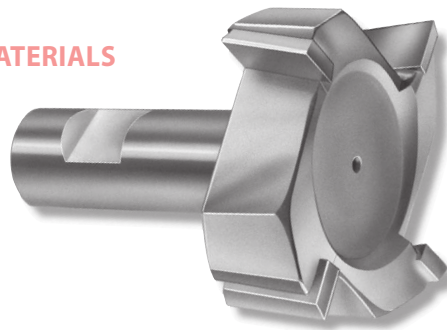
FACE MILLING CUTTERS - SHANK TYPE CARBIDE TIPPED



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	
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	\$204.30	4	53724	204.30	4	53824	\$210.20
2	3/4	3/4	1/4	1/2	2 7/8	4	53632	249.75	4	53732	249.75	4	53832	255.65
2 1/2	3/4	3/4	1/4	1/2	2 7/8	6	53640	281.25	6	53740	281.25	6	53840	288.80
3 1/2	1 1/4	1 1/8	5/16	3/8	4	6	53656	485.35	6	53756	485.35	8	53856	502.05
3 1/2	1 1/2	1 1/8	5/16	3/8	4	6	53657	509.65	6	53757	509.65	8	53857	527.05
4	1 1/2	1 1/2	3/8	3/4	5	8	53664	545.35	8	53764	545.35	8	53864	546.00

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

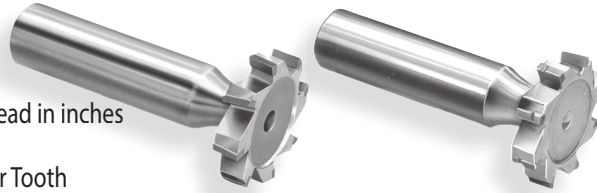
RPM = Rotations Per Minute

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	\$138.30	.0575 - .0787	-	1 3/8	3/32	.312	2 3/32	3	7044403	\$190.20	.0788 - .1088
305	5/8	3/32	.191	2 3/32	2	7040305	138.30	.0788 - .1099	-	1 3/8	1/8	.342	2 1/8	3	7044404	190.20	.1089 - .1400
405	5/8	1/8	.223	2 1/8	2	7040405	138.30	.1100 - .1400	-	1 3/8	9/32	.374	2 9/32	3	7044405	190.20	.1401 - .1713
505	5/8	5/32	.252	2 5/32	2	7040505	138.30	.1401 - .1713	-	1 3/8	3/16	.401	2 3/16	3	7044406	190.20	.1714 - .2025
605	5/8	3/16	.279	2 3/16	2	7040605	138.30	.1714 - .2025	-	1 3/8	7/32	.401	2 7/32	3	7044407	190.20	.2026 - .2339
-	5/8	7/32	.342	2 7/32	2	7042007	138.30	.2026 - .2339	811	1 3/8	1/4	.401	2 1/4	3	7040811	190.20	.2340 - .2650
-	5/8	1/4	.342	2 1/4	2	7042008	138.30	.2340 - .2650	-	1 3/8	9/32	.467	2 9/32	3	7044409	190.20	.2651 - .2968
-	3/4	1/16	.160	2 1/16	2	7042402	145.20	.0575 - .0787	1011	1 3/8	5/16	.467	2 5/16	3	7041011	190.20	.2969 - .3281
-	3/4	3/32	.191	2 3/32	2	7042403	145.20	.0788 - .1099	-	1 3/8	11/32	.467	2 11/32	3	7044411	190.20	.3282 - .3593
406	3/4	1/8	.217	2 1/8	2	7040406	145.20	.1100 - .1400	1211	1 3/8	3/8	.467	2 3/8	3	7041211	190.20	.3594 - .3900
506	3/4	5/32	.246	2 5/32	2	7040506	145.20	.1401 - .1713	-	1 1/2	3/32	.435	2 3/32	3	7044803	216.15	.0788 - .1088
606	3/4	3/16	.279	2 3/16	2	7040606	145.20	.1714 - .2025	-	1 1/2	1/8	.435	2 1/8	3	7044804	216.15	.1089 - .1400
-	3/4	7/32	.342	2 7/32	2	7042407	145.20	.2026 - .2339	-	1 1/2	5/32	.435	2 5/32	3	7044805	216.15	.1401 - .1713
806	3/4	1/4	.342	2 1/4	2	7040806	145.20	.2340 - .2650	-	1 1/2	3/16	.435	2 3/16	3	7044806	216.15	.1714 - .2025
-	7/8	1/16	.160	2 1/16	2	7042802	155.65	.0575 - .0787	-	1 1/2	7/32	.435	2 7/32	3	7044807	216.15	.2026 - .2339
-	7/8	3/32	.191	2 3/32	2	7042803	155.65	.0788 - .1099	812	1 1/2	1/4	.435	2 1/4	3	7040812	216.15	.2340 - .2650
-	7/8	1/8	.217	2 1/8	2	7042804	155.65	.1100 - .1400	-	1 1/2	9/32	.467	2 9/32	3	7044809	216.15	.2651 - .2968
507	7/8	5/32	.246	2 5/32	2	7040507	155.65	.1401 - .1713	1012	1 1/2	1/16	.467	2 3/16	3	7041012	216.15	.2969 - .3281
607	7/8	3/16	.279	2 3/16	2	7040607	155.65	.1714 - .2025	-	1 1/2	11/32	.467	2 11/32	3	7044811	216.15	.3282 - .3593
707	7/8	7/32	.312	2 7/32	2	7040707	155.65	.2026 - .2339	1212	1 1/2	3/8	.467	2 3/8	3	7041212	259.35	.3594 - .3900
807	7/8	1/4	.342	2 1/4	2	7040807	155.65	.2340 - .2650	-	1 1/2	13/32	.467	2 13/32	3	7044813	259.35	.3901 - .4219
-	1	3/32	.191	2 3/32	2	7043203	164.25	.0788 - .1088	-	1 1/2	7/16	.467	2 7/16	3	7044814	259.35	.4220 - .4531
-	1	1/8	.217	2 1/8	2	7043204	164.25	.1089 - .1400	-	1 1/2	15/32	.467	2 15/32	3	7044815	259.35	.4532 - .4843
-	1	5/32	.246	2 5/32	2	7043205	164.25	.1401 - .1713	-	1 1/2	1/2	.467	2 1/2	3	7044816	259.35	.4844 - .5150
608	1	3/16	.279	2 3/16	2	7040608	164.25	.1714 - .2025	-	1 3/4	1/8	.718	3 1/8	4	7045604	238.55	.1089 - .1400
708	1	7/32	.312	2 7/32	2	7040708	164.25	.2026 - .2339	-	1 3/4	5/32	.718	3 5/32	4	7045605	238.55	.1401 - .1713
808	1	1/4	.342	2 1/4	2	7040808	164.25	.2340 - .2650	-	1 3/4	3/16	.718	3 3/16	4	7045606	238.55	.1714 - .2025
-	1	9/32	.401	2 9/32	2	7043209	164.25	.2651 - .2968	-	1 3/4	7/32	.718	3 7/32	4	7045607	238.55	.2026 - .2339
1008	1	5/16	.401	2 5/16	2	7041008	164.25	.2969 - .3281	-	1 3/4	1/4	.718	3 1/4	4	7045608	238.55	.2340 - .2650
-	1	11/32	.467	2 11/32	2	7043211	164.25	.3282 - .3593	-	1 3/4	9/32	.718	3 9/32	4	7045609	238.55	.2651 - .2968
1208	1	3/8	.467	2 3/8	2	7041208	164.25	.3594 - .3900	-	1 3/4	5/16	.718	3 5/16	4	7045610	238.55	.2969 - .3281
-	1 1/8	3/32	.217	2 3/32	2	7043603	164.25	.0788 - .1088	-	1 3/4	11/32	.718	3 11/32	4	7045611	238.55	.3282 - .3593
-	1 1/8	1/8	.246	2 1/8	2	7043604	164.25	.1089 - .1400	-	1 3/4	3/8	.718	3 3/8	4	7045612	280.15	.3594 - .3900
-	1 1/8	5/32	.279	2 5/32	2	7043605	164.25	.1401 - .1713	-	1 3/4	13/32	.718	3 13/32	4	7045613	280.15	.3901 - .4219
609	1 1/8	3/16	.312	2 3/16	2	7040609	164.25	.1714 - .2025	-	1 3/4	7/16	.718	3 7/16	4	7045614	280.15	.4220 - .4531
709	1 1/8	7/32	.342	2 7/32	2	7040709	164.25	.2026 - .2339	-	1 3/4	15/32	.718	3 15/32	4	7045615	280.15	.4532 - .4843
809	1 1/8	1/4	.374	2 1/4	2	7040809	164.25	.2340 - .2650	-	1 3/4	1/2	.718	3 1/2	4	7045616	280.15	.4844 - .5150
-	1 1/8	9/32	.435	2 9/32	2	7043609	164.25	.2651 - .2968	-	2	1/8	.718	3 1/8	4	7046404	276.60	.1089 - .1400
1009	1 1/8	5/16	.435	2 5/16	2	7041009	164.25	.2969 - .3281	-	2	5/32	.718	3 5/32	4	7046405	276.60	.1401 - .1713
-	1 1/8	11/32	.467	2 11/32	2	7043611	164.25	.3282 - .3593	-	2	3/16	.718	3 3/16	4	7046406	276.60	.1714 - .2025
-	1 1/8	3/8	.467	2 3/8	2	7043612	164.25	.3594 - .3900	-	2	7/32	.718	3 7/32	4	7046407	276.60	.2026 - .2339
-	1 1/4	3/32	.217	2 3/32	3	7044003	172.85	.0788 - .1088	-	2	1/4	.718	3 1/4	4	7046408	276.60	.2340 - .2650
-	1 1/4	1/8	.246	2 1/8	3	7044004	172.85	.1089 - .1400	-	2	9/32	.718	3 9/32	4	7046409	276.60	.2651 - .2968
-	1 1/4	5/32	.279	2 5/32	3	7044005	172.85	.1401 - .1713	-	2	3/16	.718	3 3/16	4	7046410	276.60	.2969 - .3281
610	1 1/4	3/16	.312	2 3/16	3	7040610	172.85	.1714 - .2025	-	2	11/32	.718	3 11/32	4	7046411	276.60	.3282 - .3593
710	1 1/4	7/32	.342	2 7/32	3	7040710	172.85	.2026 - .2339	-	2	3/8	.718	3 3/8	4	7046412	319.90	.3594 - .3900
810	1 1/4	1/4	.374	2 1/4	3	7040810	172.85	.2340 - .2650	-	2	13/32	.718	3 13/32	4	7046413	319.90	.3901 - .4219
-	1 1/4	9/32	.435	2 9/32	3	7044009	172.85	.2651 - .2968	-	2	7/16	.718	3 7/16	4	7046414	319.90	.4220 - .4531
1010	1 1/4	5/16	.435	2 5/16	3	7041010	172.85	.2969 - .3281	-	2	15/32	.718	3 15/32	4	7046415	319.90	.4532 - .4843
-	1 1/4	11/32	.467	2 11/32	3	7044011	172.85	.3282 - .3593	-	2	1/2	.718	3 1/2	4	7046416	319.90	.4844 - .5150
1210	1 1/4	3/8	.467	2 3/8	3	7041210	172.85	.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	\$112.80	.0575 - .0787	\$151.95	\$135.05	\$129.45	\$126.75	\$123.90	\$121.50
304	1/2	3/32	.160	2 3/32	6	7000304	112.80	.0788 - .1088	151.95	135.05	129.45	126.75	123.90	121.50
404	1/2	1/8	.191	2 1/8	6	7000404	112.80	.1089 - .1400	151.95	135.05	129.45	126.75	123.90	121.50
305	5/8	3/32	.191	2 3/32	6	7000305	116.90	.0788 - .1088	156.20	139.30	133.65	130.85	128.05	125.75
405	5/8	1/8	.223	2 1/8	6	7000405	116.90	.1089 - .1400	156.20	139.30	133.65	130.85	128.05	125.75
505	5/8	5/32	.252	2 5/32	6	7000505	116.90	.1401 - .1713	156.20	139.30	133.65	130.85	128.05	125.75
605	5/8	3/16	.279	2 3/16	6	7000605	116.90	.1714 - .2025	156.20	139.30	133.65	130.85	128.05	125.75
406	3/4	1/8	.217	2 1/8	6	7000406	122.00	.1100 - .1400	161.55	144.65	138.95	136.30	133.45	131.10
506	3/4	5/32	.246	2 5/32	6	7000506	122.00	.1401 - .1713	161.55	144.65	138.95	136.30	133.45	131.10
606	3/4	3/16	.279	2 3/16	6	7000606	122.00	.1714 - .2025	161.55	144.65	138.95	136.30	133.45	131.10
-	3/4	7/32	.342	2 7/32	6	7002407	133.65	.2026 - .2339	161.55	144.65	138.95	136.30	133.45	131.10
806	3/4	1/4	.342	2 1/4	6	7000806	122.00	.2340 - .2650	161.55	144.65	138.95	136.30	133.45	131.10
507	7/8	5/32	.246	2 5/32	6	7000507	127.75	.1401 - .1713	167.55	150.70	145.00	142.40	139.50	137.10
607	7/8	3/16	.279	2 3/16	6	7000607	127.75	.1714 - .2025	167.55	150.70	145.00	142.40	139.50	137.10
707	7/8	7/32	.312	2 7/32	6	7000707	127.75	.2026 - .2339	167.55	150.70	145.00	142.40	139.50	137.10
807	7/8	1/4	.342	2 1/4	6	7000807	127.75	.2340 - .2650	167.55	150.70	145.00	142.40	139.50	137.10
608	1	3/16	.279	2 3/16	8	7000608	144.20	.1714 - .2025	184.75	167.90	162.10	159.45	156.60	154.30
708	1	7/32	.312	2 7/32	8	7000708	144.20	.2026 - .2339	184.75	167.90	162.10	159.45	156.60	154.30
808	1	1/4	.342	2 1/4	8	7000808	144.20	.2340 - .2650	184.75	167.90	162.10	159.45	156.60	154.30
-	1	9/32	.401	2 9/32	8	7003209	157.90	.2651 - .2968	184.75	167.90	162.10	159.45	156.60	154.30
1008	1	5/16	.401	2 5/16	8	7001008	144.20	.2969 - .3281	184.75	167.90	162.10	159.45	156.60	154.30
-	1	11/32	.467	2 11/32	8	7003211	157.90	.3282 - .3593	184.75	167.90	162.10	159.45	156.60	154.30
1208	1	3/8	.467	2 3/8	8	7001208	144.20	.3594 - .3900	184.75	167.90	162.10	159.45	156.60	154.30
609	1 1/8	3/16	.312	2 3/16	8	7000609	151.35	.1714 - .2025	192.30	175.50	169.80	167.10	164.20	161.90
709	1 1/8	7/32	.342	2 7/32	8	7000709	151.35	.2026 - .2339	192.30	175.50	169.80	167.10	164.20	161.90
809	1 1/8	1/4	.374	2 1/4	8	7000809	151.35	.2340 - .2650	192.30	175.50	169.80	167.10	164.20	161.90
-	1 1/8	9/32	.435	2 9/32	8	7003609	165.85	.2651 - .2968	192.30	175.50	169.80	167.10	164.20	161.90
1009	1 1/8	5/16	.435	2 5/16	8	7001009	151.35	.2969 - .3281	192.30	175.50	169.80	167.10	164.20	161.90
610	1 1/4	3/16	.312	2 3/16	8	7000610	158.90	.1714 - .2025	200.25	183.45	177.75	175.00	172.15	169.80
710	1 1/4	7/32	.342	2 7/32	8	7000710	158.90	.2026 - .2339	200.25	183.45	177.75	175.00	172.15	169.80
810	1 1/4	1/4	.374	2 1/4	8	7000810	158.90	.2340 - .2650	200.25	183.45	177.75	175.00	172.15	169.80
-	1 1/4	9/32	.435	2 9/32	8	7004009	174.10	.2651 - .2968	200.25	183.45	177.75	175.00	172.15	169.80
1010	1 1/4	5/16	.435	2 5/16	8	7001010	158.90	.2969 - .3281	200.25	183.45	177.75	175.00	172.15	169.80
-	1 1/4	11/32	.467	2 11/32	8	7004011	174.10	.3282 - .3593	200.25	183.45	177.75	175.00	172.15	169.80
1210	1 1/4	3/8	.467	2 3/8	8	7001210	158.90	.3594 - .3900	200.25	183.45	177.75	175.00	172.15	169.80
811	1 3/8	1/4	.401	2 1/4	8	7000811	167.00	.2340 - .2650	208.65	191.80	186.15	183.45	180.50	178.25
-	1 3/8	9/32	.467	2 9/32	8	7004409	182.90	.2651 - .2968	208.65	191.80	186.15	183.45	180.50	178.25
1011	1 3/8	5/16	.467	2 5/16	8	7001011	167.00	.2969 - .3281	208.65	191.80	186.15	183.45	180.50	178.25
-	1 3/8	11/32	.467	2 11/32	8	7004411	182.90	.3282 - .3593	208.65	191.80	186.15	183.45	180.50	178.25
1211	1 3/8	3/8	.467	2 3/8	8	7001211	167.00	.3594 - .3900	208.65	191.80	186.15	183.45	180.50	178.25
812	1 1/2	1/4	.435	2 1/4	8	7000812	175.35	.2340 - .2650	217.35	200.55	194.90	192.20	189.25	187.00
-	1 1/2	9/32	.467	2 9/32	8	7004809	192.10	.2651 - .2968	217.35	200.55	194.90	192.20	189.25	187.00
1012	1 1/2	5/16	.467	2 5/16	8	7001012	175.35	.2969 - .3281	217.35	200.55	194.90	192.20	189.25	187.00
-	1 1/2	11/32	.467	2 11/32	8	7004811	192.10	.3282 - .3593	217.35	200.55	194.90	192.20	189.25	187.00
1212	1 1/2	3/8	.467	2 3/8	8	7001212	175.35	.3594 - .3900	217.35	200.55	194.90	192.20	189.25	187.00
-	1 1/2	13/32	.467	2 13/32	8	7004813	192.10	.3901 - .4219	217.35	200.55	194.90	192.20	189.25	187.00
-	1 1/2	7/16	.467	2 7/16	8	7004814	192.10	.4220 - .4531	217.35	200.55	194.90	192.20	189.25	187.00
-	1 1/2	15/32	.467	2 15/32	8	7004815	192.10	.4532 - .4843	217.35	200.55	194.90	192.20	189.25	187.00
-	1 1/2	1/2	.467	2 1/2	8	7004816	192.10	.4844 - .5150	217.35	200.55	194.90	192.20	189.25	187.00

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



KEYSEAT CUTTERS

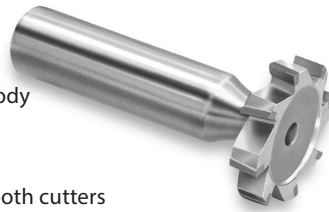
CHIP CLASS 20, 40, 60, 140 - CARBIDE TIPPED TYPE 701

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	\$132.75	.0575 - .0787	\$172.80	\$155.95	\$150.25	\$147.60	\$144.65	\$142.40
304	1/2	3/32	.160	2 3/32	6	7010304	132.75	.0788 - .1088	172.80	155.95	150.25	147.60	144.65	142.40
404	1/2	1/8	.191	2 1/8	6	7010404	132.75	.1089 - .1400	172.80	155.95	150.25	147.60	144.65	142.40
305	5/8	3/32	.191	2 3/32	6	7010305	137.50	.0788 - .1088	177.80	160.95	155.25	152.50	149.65	147.35
405	5/8	1/8	.223	2 1/8	6	7010405	137.50	.1089 - .1400	177.80	160.95	155.25	152.50	149.65	147.35
505	5/8	5/32	.252	2 5/32	6	7010505	137.50	.1401 - .1713	177.80	160.95	155.25	152.50	149.65	147.35
605	5/8	3/16	.279	2 3/16	6	7010605	137.50	.1714 - .2025	177.80	160.95	155.25	152.50	149.65	147.35
406	3/4	1/8	.217	2 1/8	6	7010406	143.65	.1100 - .1400	184.25	167.40	161.70	158.90	156.15	153.85
506	3/4	5/32	.246	2 5/32	6	7010506	143.65	.1401 - .1713	184.25	167.40	161.70	158.90	156.15	153.85
606	3/4	3/16	.279	2 3/16	6	7010606	143.65	.1714 - .2025	184.25	167.40	161.70	158.90	156.15	153.85
-	3/4	7/32	.342	2 7/32	6	7012407	157.35	.2026 - .2339	184.25	167.40	161.70	158.90	156.15	153.85
806	3/4	1/4	.342	2 1/4	6	7010806	143.65	.2340 - .2650	184.25	167.40	161.70	158.90	156.15	153.85
507	7/8	5/32	.246	2 5/32	6	7010507	150.25	.1401 - .1713	191.10	174.20	168.60	165.85	162.95	160.70
607	7/8	3/16	.279	2 3/16	6	7010607	150.25	.1714 - .2025	191.10	174.20	168.60	165.85	162.95	160.70
707	7/8	5/32	.312	2 7/32	6	7010707	150.25	.2026 - .2339	191.10	174.20	168.60	165.85	162.95	160.70
807	7/8	1/4	.342	2 1/4	6	7010807	150.25	.2340 - .2650	191.10	174.20	168.60	165.85	162.95	160.70
608	1	3/16	.279	2 3/16	8	7010608	169.50	.1714 - .2025	211.35	194.40	188.80	186.05	183.15	180.95
708	1	7/32	.312	2 7/32	8	7010708	169.50	.2026 - .2339	211.35	194.40	188.80	186.05	183.15	180.95
808	1	1/4	.342	2 1/4	8	7010808	169.50	.2340 - .2650	211.35	194.40	188.80	186.05	183.15	180.95
-	1	9/32	.401	2 9/32	8	7013209	185.70	.2651 - .2968	211.35	194.40	188.80	186.05	183.15	180.95
1008	1	5/16	.401	2 5/16	8	7011008	169.50	.2969 - .3281	211.35	194.40	188.80	186.05	183.15	180.95
-	1	11/32	.467	2 11/32	8	7013211	185.70	.3282 - .3593	211.35	194.40	188.80	186.05	183.15	180.95
1208	1	3/8	.467	2 3/8	8	7011208	169.50	.3594 - .3900	211.35	194.40	188.80	186.05	183.15	180.95
609	1 1/8	3/16	.312	2 3/16	8	7010609	178.00	.1714 - .2025	220.15	203.25	197.60	194.90	192.10	189.70
709	1 1/8	7/32	.342	2 7/32	8	7010709	178.00	.2026 - .2339	220.15	203.25	197.60	194.90	192.10	189.70
809	1 1/8	1/4	.374	2 1/4	8	7010809	178.00	.2340 - .2650	220.15	203.25	197.60	194.90	192.10	189.70
-	1 1/8	9/32	.435	2 9/32	8	7013609	194.90	.2651 - .2968	220.15	203.25	197.60	194.90	192.10	189.70
1009	1 1/8	5/16	.435	2 5/16	8	7011009	178.00	.2969 - .3281	220.15	203.25	197.60	194.90	192.10	189.70
610	1 1/4	3/16	.312	2 3/16	8	7010610	186.95	.1714 - .2025	229.50	212.65	207.05	204.25	201.30	199.05
710	1 1/4	7/32	.342	2 7/32	8	7010710	186.95	.2026 - .2339	229.50	212.65	207.05	204.25	201.30	199.05
810	1 1/4	1/4	.374	2 1/4	8	7010810	186.95	.2340 - .2650	229.50	212.65	207.05	204.25	201.30	199.05
-	1 1/4	9/32	.435	2 9/32	8	7014009	204.70	.2651 - .2968	229.50	212.65	207.05	204.25	201.30	199.05
1010	1 1/4	5/16	.435	2 5/16	8	7011010	186.95	.2969 - .3281	229.50	212.65	207.05	204.25	201.30	199.05
-	1 1/4	11/32	.467	2 11/32	8	7014011	204.70	.3282 - .3593	229.50	212.65	207.05	204.25	201.30	199.05
1210	1 1/4	3/8	.467	2 3/8	8	7011210	186.95	.3594 - .3900	229.50	212.65	207.05	204.25	201.30	199.05
811	1 3/8	1/4	.401	2 1/4	8	7010811	196.35	.2340 - .2650	239.45	222.65	216.95	214.15	211.35	209.00
-	1 3/8	9/32	.467	2 9/32	8	7014409	215.10	.2651 - .2968	239.45	222.65	216.95	214.15	211.35	209.00
1011	1 3/8	5/16	.467	2 5/16	8	7011011	196.35	.2969 - .3281	239.45	222.65	216.95	214.15	211.35	209.00
-	1 3/8	11/32	.467	2 11/32	8	7014411	215.10	.3282 - .3593	239.45	222.65	216.95	214.15	211.35	209.00
1211	1 3/8	3/8	.467	2 3/8	8	7011211	196.35	.3594 - .3900	239.45	222.65	216.95	214.15	211.35	209.00
812	1 1/2	1/4	.435	2 1/4	8	7010812	206.25	.2340 - .2650	249.70	232.85	227.20	224.55	221.60	219.30
-	1 1/2	9/32	.467	2 9/32	8	7014809	225.90	.2651 - .2968	249.70	232.85	227.20	224.55	221.60	219.30
1012	1 1/2	5/16	.467	2 5/16	8	7011012	206.25	.2969 - .3281	249.70	232.85	227.20	224.55	221.60	219.30
-	1 1/2	11/32	.467	2 11/32	8	7014811	225.90	.3282 - .3593	249.70	232.85	227.20	224.55	221.60	219.30
1212	1 1/2	3/8	.467	2 3/8	8	7011212	206.25	.3594 - .3900	249.70	232.85	227.20	224.55	221.60	219.30
-	1 1/2	13/32	.467	2 13/32	8	7014813	225.90	.3901 - .4219	249.70	232.85	227.20	224.55	221.60	219.30
-	1 1/2	7/16	.467	2 7/16	8	7014814	225.90	.4220 - .4531	249.70	232.85	227.20	224.55	221.60	219.30
-	1 1/2	15/32	.467	2 15/32	8	7014815	225.90	.4532 - .4843	249.70	232.85	227.20	224.55	221.60	219.30
-	1 1/2	1/2	.467	2 1/2	8	7014816	225.90	.4844 - .5150	249.70	232.85	227.20	224.55	221.60	219.30

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

CUTTERS



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	\$130.35	.0575 - .0787	\$172.00	\$154.30	\$148.30	\$145.50	\$142.45	\$140.00
304	1/2	3/32	.160	2 3/32	6	7020304	130.35	.0788 - .1088	172.00	154.30	148.30	145.50	142.45	140.00
404	1/2	1/8	.191	2 1/8	6	7020404	130.35	.1089 - .1400	172.00	154.30	148.30	145.50	142.45	140.00
305	5/8	3/32	.191	2 3/32	6	7020305	135.05	.0788 - .1088	176.80	159.10	153.20	150.30	147.35	144.90
405	5/8	1/8	.223	2 1/8	6	7020405	135.05	.1089 - .1400	176.80	159.10	153.20	150.30	147.35	144.90
505	5/8	5/32	.252	2 5/32	6	7020505	135.05	.1401 - .1713	176.80	159.10	153.20	150.30	147.35	144.90
605	5/8	3/16	.279	2 3/16	6	7020605	135.05	.1714 - .2025	176.80	159.10	153.20	150.30	147.35	144.90
406	3/4	1/8	.217	2 1/8	6	7020406	140.95	.1100 - .1400	183.10	165.40	159.40	156.50	153.50	151.10
506	3/4	5/32	.246	2 5/32	6	7020506	140.95	.1401 - .1713	183.10	165.40	159.40	156.50	153.50	151.10
606	3/4	3/16	.279	2 3/16	6	7020606	140.95	.1714 - .2025	183.10	165.40	159.40	156.50	153.50	151.10
-	3/4	7/32	.342	2 7/32	6	7022407	154.35	.2026 - .2339	183.10	165.40	159.40	156.50	153.50	151.10
806	3/4	1/4	.342	2 1/4	6	7020806	140.95	.2340 - .2650	183.10	165.40	159.40	156.50	153.50	151.10
507	7/8	5/32	.246	2 5/32	6	7020507	147.65	.1401 - .1713	190.05	172.30	166.30	163.45	160.50	158.00
607	7/8	3/16	.279	2 3/16	6	7020607	147.65	.1714 - .2025	190.05	172.30	166.30	163.45	160.50	158.00
707	7/8	7/32	.312	2 7/32	6	7020707	147.65	.2026 - .2339	190.05	172.30	166.30	163.45	160.50	158.00
807	7/8	1/4	.342	2 1/4	6	7020807	147.65	.2340 - .2650	190.05	172.30	166.30	163.45	160.50	158.00
608	1	3/16	.279	2 3/16	8	7020608	166.55	.1714 - .2025	209.75	192.15	186.10	183.30	180.30	177.90
708	1	7/32	.312	2 7/32	8	7020708	166.55	.2026 - .2339	209.75	192.15	186.10	183.30	180.30	177.90
808	1	1/4	.342	2 1/4	8	7020808	166.55	.2340 - .2650	209.75	192.15	186.10	183.30	180.30	177.90
-	1	9/32	.401	2 9/32	8	7023209	182.40	.2651 - .2968	209.75	192.15	186.10	183.30	180.30	177.90
1008	1	5/16	.401	2 5/16	8	7021008	166.55	.2969 - .3281	209.75	192.15	186.10	183.30	180.30	177.90
-	1	11/32	.467	2 11/32	8	7023211	182.40	.3282 - .3593	209.75	192.15	186.10	183.30	180.30	177.90
1208	1	3/8	.467	2 3/8	8	7021208	166.55	.3594 - .3900	209.75	192.15	186.10	183.30	180.30	177.90
609	1 1/8	3/16	.312	2 3/16	8	7020609	174.90	.1714 - .2025	218.60	200.95	194.90	192.15	189.10	186.60
709	1 1/8	7/32	.342	2 7/32	8	7020709	174.90	.2026 - .2339	218.60	200.95	194.90	192.15	189.10	186.60
809	1 1/8	1/4	.374	2 1/4	8	7020809	174.90	.2340 - .2650	218.60	200.95	194.90	192.15	189.10	186.60
-	1 1/8	9/32	.435	2 9/32	8	7023609	191.55	.2651 - .2968	218.60	200.95	194.90	192.15	189.10	186.60
1009	1 1/8	5/16	.435	2 5/16	8	7021009	174.90	.2969 - .3281	218.60	200.95	194.90	192.15	189.10	186.60
610	1 1/4	3/16	.312	2 3/16	8	7020610	183.60	.1714 - .2025	227.75	210.00	204.10	201.20	198.20	195.80
710	1 1/4	7/32	.342	2 7/32	8	7020710	183.60	.2026 - .2339	227.75	210.00	204.10	201.20	198.20	195.80
810	1 1/4	1/4	.374	2 1/4	8	7020810	183.60	.2340 - .2650	227.75	210.00	204.10	201.20	198.20	195.80
-	1 1/4	9/32	.435	2 9/32	8	7024009	201.10	.2651 - .2968	227.75	210.00	204.10	201.20	198.20	195.80
1010	1 1/4	5/16	.435	2 5/16	8	7021010	183.60	.2969 - .3281	227.75	210.00	204.10	201.20	198.20	195.80
-	1 1/4	11/32	.467	2 11/32	8	7024011	201.10	.3282 - .3593	227.75	210.00	204.10	201.20	198.20	195.80
1210	1 1/4	3/8	.467	2 3/8	8	7021210	183.60	.3594 - .3900	227.75	210.00	204.10	201.20	198.20	195.80
811	1 3/8	1/4	.401	2 1/4	8	7020811	192.90	.2340 - .2650	237.60	219.80	213.85	210.90	207.90	205.50
-	1 3/8	9/32	.467	2 9/32	8	7024409	211.20	.2651 - .2968	237.60	219.80	213.85	210.90	207.90	205.50
1011	1 3/8	5/16	.467	2 5/16	8	7021011	192.90	.2969 - .3281	237.60	219.80	213.85	210.90	207.90	205.50
-	1 3/8	11/32	.467	2 11/32	8	7024411	211.20	.3282 - .3593	237.60	219.80	213.85	210.90	207.90	205.50
1211	1 3/8	3/8	.467	2 3/8	8	7021211	192.90	.3594 - .3900	237.60	219.80	213.85	210.90	207.90	205.50
812	1 1/2	1/4	.435	2 1/4	8	7020812	202.50	.2340 - .2650	247.60	229.95	224.00	221.15	218.05	215.75
-	1 1/2	9/32	.467	2 9/32	8	7024809	221.80	.2651 - .2968	247.60	229.95	224.00	221.15	218.05	215.75
1012	1 1/2	5/16	.467	2 5/16	8	7021012	202.50	.2969 - .3281	247.60	229.95	224.00	221.15	218.05	215.75
-	1 1/2	11/32	.467	2 11/32	8	7024811	221.80	.3282 - .3593	247.60	229.95	224.00	221.15	218.05	215.75
1212	1 1/2	3/8	.467	2 3/8	8	7021212	202.50	.3594 - .3900	247.60	229.95	224.00	221.15	218.05	215.75
-	1 1/2	13/32	.467	2 13/32	8	7024813	221.80	.3901 - .4219	247.60	229.95	224.00	221.15	218.05	215.75
-	1 1/2	7/16	.467	2 7/16	8	7024814	221.80	.4220 - .4531	247.60	229.95	224.00	221.15	218.05	215.75
-	1 1/2	15/32	.467	2 15/32	8	7024815	221.80	.4532 - .4843	247.60	229.95	224.00	221.15	218.05	215.75
-	1 1/2	1/2	.467	2 1/2	8	7024816	221.80	.4844 - .5150	247.60	229.95	224.00	221.15	218.05	215.75

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

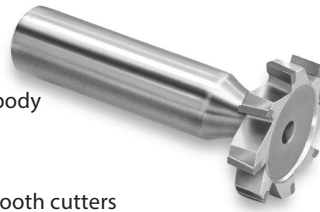


KEYSEAT CUTTERS

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	\$153.35	.0575 - .0787	\$196.05	\$178.35	\$172.40	\$169.50	\$166.55	\$164.15
304	1/2	3/32	.160	2 3/32	6	7030304	153.35	.0788 - .1088	196.05	178.35	172.40	169.50	166.55	164.15
404	1/2	1/8	.191	2 1/8	6	7030404	153.35	.1089 - .1400	196.05	178.35	172.40	169.50	166.55	164.15
305	5/8	3/32	.191	2 3/32	6	7030305	158.75	.0788 - .1088	201.75	184.10	178.15	175.30	172.30	169.85
405	5/8	1/8	.223	2 1/8	6	7030405	158.75	.1089 - .1400	201.75	184.10	178.15	175.30	172.30	169.85
505	5/8	5/32	.252	2 5/32	6	7030505	158.75	.1401 - .1713	201.75	184.10	178.15	175.30	172.30	169.85
605	5/8	3/16	.279	2 3/16	6	7030605	158.75	.1714 - .2025	201.75	184.10	178.15	175.30	172.30	169.85
406	3/4	1/8	.217	2 1/8	6	7030406	165.95	.1100 - .1400	209.25	191.60	185.65	182.80	179.70	177.30
506	3/4	5/32	.246	2 5/32	6	7030506	165.95	.1401 - .1713	209.25	191.60	185.65	182.80	179.70	177.30
606	3/4	3/16	.279	2 3/16	6	7030606	165.95	.1714 - .2025	209.25	191.60	185.65	182.80	179.70	177.30
-	3/4	7/32	.342	2 7/32	6	7032407	181.70	.2026 - .2339	209.25	191.60	185.65	182.80	179.70	177.30
806	3/4	1/4	.342	2 1/4	6	7030806	165.95	.2340 - .2650	209.25	191.60	185.65	182.80	179.70	177.30
507	7/8	5/32	.246	2 5/32	6	7030507	173.60	.1401 - .1713	217.20	199.55	193.55	190.55	187.60	185.35
607	7/8	3/16	.279	2 3/16	6	7030607	173.60	.1714 - .2025	217.20	199.55	193.55	190.55	187.60	185.35
707	7/8	7/32	.312	2 7/32	6	7030707	173.60	.2026 - .2339	217.20	199.55	193.55	190.55	187.60	185.35
807	7/8	1/4	.342	2 1/4	6	7030807	173.60	.2340 - .2650	217.20	199.55	193.55	190.55	187.60	185.35
608	1	3/16	.279	2 3/16	8	7030608	195.80	.1714 - .2025	240.45	222.85	216.85	214.00	211.00	208.60
708	1	7/32	.312	2 7/32	8	7030708	195.80	.2026 - .2339	240.45	222.85	216.85	214.00	211.00	208.60
808	1	1/4	.342	2 1/4	8	7030808	195.80	.2340 - .2650	240.45	222.85	216.85	214.00	211.00	208.60
-	1	9/32	.401	2 9/32	8	7033209	214.55	.2651 - .2968	240.45	222.85	216.85	214.00	211.00	208.60
1008	1	5/16	.401	2 5/16	8	7031008	195.80	.2969 - .3281	240.45	222.85	216.85	214.00	211.00	208.60
-	1	11/32	.467	2 11/32	8	7033211	214.55	.3282 - .3593	240.45	222.85	216.85	214.00	211.00	208.60
1208	1	3/8	.467	2 3/8	8	7031208	195.80	.3594 - .3900	240.45	222.85	216.85	214.00	211.00	208.60
609	1 1/8	3/16	.312	2 3/16	8	7030609	205.50	.1714 - .2025	250.70	232.95	227.05	224.20	221.25	218.70
709	1 1/8	7/32	.342	2 7/32	8	7030709	205.50	.2026 - .2339	250.70	232.95	227.05	224.20	221.25	218.70
809	1 1/8	1/4	.374	2 1/4	8	7030809	205.50	.2340 - .2650	250.70	232.95	227.05	224.20	221.25	218.70
-	1 1/8	9/32	.435	2 9/32	8	7033609	225.05	.2651 - .2968	250.70	232.95	227.05	224.20	221.25	218.70
1009	1 1/8	5/16	.435	2 5/16	8	7031009	205.50	.2969 - .3281	250.70	232.95	227.05	224.20	221.25	218.70
610	1 1/4	3/16	.312	2 3/16	8	7030610	215.90	.1714 - .2025	261.50	243.80	237.90	235.05	232.10	229.60
710	1 1/4	7/32	.342	2 7/32	8	7030710	215.90	.2026 - .2339	261.50	243.80	237.90	235.05	232.10	229.60
810	1 1/4	1/4	.374	2 1/4	8	7030810	215.90	.2340 - .2650	261.50	243.80	237.90	235.05	232.10	229.60
-	1 1/4	9/32	.435	2 9/32	8	7034009	236.50	.2651 - .2968	261.50	243.80	237.90	235.05	232.10	229.60
1010	1 1/4	5/16	.435	2 5/16	8	7031010	215.90	.2969 - .3281	261.50	243.80	237.90	235.05	232.10	229.60
-	1 1/4	11/32	.467	2 11/32	8	7034011	236.50	.3282 - .3593	261.50	243.80	237.90	235.05	232.10	229.60
1210	1 1/4	3/8	.467	2 3/8	8	7031210	215.90	.3594 - .3900	261.50	243.80	237.90	235.05	232.10	229.60
811	1 3/8	1/4	.401	2 1/4	8	7030811	226.90	.2340 - .2650	273.00	255.35	249.30	246.50	243.50	241.05
-	1 3/8	9/32	.467	2 9/32	8	7034409	248.40	.2651 - .2968	273.00	255.35	249.30	246.50	243.50	241.05
1011	1 3/8	5/16	.467	2 5/16	8	7031011	226.90	.2969 - .3281	273.00	255.35	249.30	246.50	243.50	241.05
-	1 3/8	11/32	.467	2 11/32	8	7034411	248.40	.3282 - .3593	273.00	255.35	249.30	246.50	243.50	241.05
1211	1 3/8	3/8	.467	2 3/8	8	7031211	226.90	.3594 - .3900	273.00	255.35	249.30	246.50	243.50	241.05
812	1 1/2	1/4	.435	2 1/4	8	7030812	238.20	.2340 - .2650	284.90	267.20	261.25	258.40	255.35	253.05
-	1 1/2	9/32	.467	2 9/32	8	7034809	260.85	.2651 - .2968	284.90	267.20	261.25	258.40	255.35	253.05
1012	1 1/2	5/16	.467	2 5/16	8	7031012	238.20	.2969 - .3281	284.90	267.20	261.25	258.40	255.35	253.05
-	1 1/2	11/32	.467	2 11/32	8	7034811	260.85	.3282 - .3593	284.90	267.20	261.25	258.40	255.35	253.05
1212	1 1/2	3/8	.467	2 3/8	8	7031212	238.20	.3594 - .3900	284.90	267.20	261.25	258.40	255.35	253.05
-	1 1/2	13/32	.467	2 13/32	8	7034813	260.85	.3901 - .4219	284.90	267.20	261.25	258.40	255.35	253.05
-	1 1/2	7/16	.467	2 7/16	8	7034814	260.85	.4220 - .4531	284.90	267.20	261.25	258.40	255.35	253.05
-	1 1/2	15/32	.467	2 15/32	8	7034815	260.85	.4532 - .4843	284.90	267.20	261.25	258.40	255.35	253.05
-	1 1/2	1/2	.467	2 1/2	8	7034816	260.85	.4844 - .5150	284.90	267.20	261.25	258.40	255.35	253.05

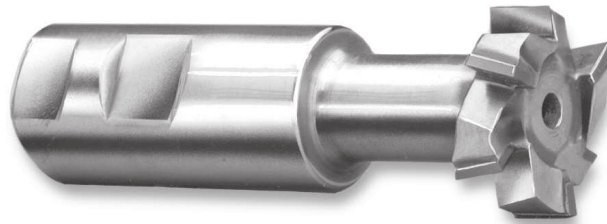
*Quantities of 15 or more - price of fractional size in same size range

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	\$155.20	72108	\$167.60
5/16	21/32	17/64	1/2	21/64	39/64	2 11/16	6	72010	153.30	72110	165.55
3/8	25/32	21/64	3/4	13/32	59/64	3 1/4	6	72012	192.95	72112	208.45
1/2	31/32	25/64	3/4	17/32	63/64	3 7/16	6	72016	209.80	72116	226.55
5/8	1 1/4	31/64	1	21/32	1 9/64	3 15/16	6	72020	278.40	72120	300.80
3/4	1 15/32	5/8	1	25/32	1 1/2	4 7/16	6	72024	311.15	72124	336.00
1	1 27/32	53/64	1 1/4	1 1/32	1 43/64	4 13/16	8	72032	444.20	72132	479.80
1 1/4	2 7/32	1 3/32	1 1/4	1 7/32	1 31/32	5 3/8	8	72040	560.55	72140	605.45
1 1/2	2 21/32	1 11/32	1 1/4	1 17/32	2 1/8	5 29/32	8	72048	649.15	72148	701.10



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	\$142.40	74102	\$153.90
3/32	1/2	3/8	17/64	13/32	2 3/4	74003	142.40	74103	153.90
1/8	5/8	1/2	19/64	13/32	3	74004	147.45	74104	159.15
5/32	3/4	1/2	23/64	13/32	3	74005	156.40	74105	168.85
3/16	7/8	3/4	13/32	13/32	3 1/4	74006	165.45	74106	178.65
1/4	1	3/4	13/32	15/32	3 1/2	74008	188.55	74108	203.60
5/16	1 1/8	7/8	13/32	19/32	3 1/2	74010	193.70	74110	209.20
3/8	1 1/4	7/8	13/32	25/32	3 3/4	74012	201.20	74112	217.35
7/16	1 3/8	1	13/32	7/8	4	74014	224.10	74114	242.05
1/2	1 1/2	1	13/32	1	4	74016	249.35	74116	269.45
5/8	2	1 1/4	21/32	1 7/32	4 1/4	74020	306.90	74120	331.50



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:

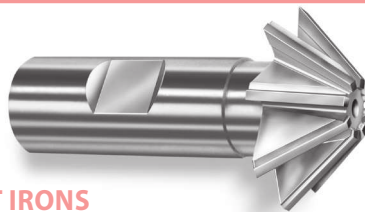
TITANIUM NITRIDE - TiN
TITANIUM CARBONITRIDE - TiCN
ZIRCONIUM NITRIDE - ZrN
AL TITANIUM NITRIDE - AlTiN

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	\$155.40	73516	\$157.75	7/32	73616	\$155.40	73716	\$157.75
3/4	3/8	1/4	2 1/4	3	1/4	73424	167.65	73524	170.00	1/4	73624	167.65	73724	170.00
1	1/2	3/8	2 1/2	4	5/16	73432	179.35	73532	181.95	3/8	73632	179.35	73732	181.95
1 1/4	5/8	1/2	2 3/4	4	3/8	73440	203.90	73540	206.80	1/2	73640	203.90	73740	206.80
1 1/2	3/4	1/2	3 1/4	4	1/2	73448	238.20	73548	241.65	5/8	73648	238.20	73748	241.65
2	1	3/4	4 1/4	6	5/8	73464	382.75	73564	388.20	3/4	73664	382.75	73764	388.20
2 1/2	1 1/4	1	4 3/8	6	3/4	73480	517.65	73580	524.90	7/8	73680	517.65	73780	524.90
3	1 1/4	1	4 1/2	6	1	73496	610.35	73596	619.15	1 1/8	73696	610.35	73796	619.15



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	\$189.85	73116	\$208.75	7/32	73216	\$189.85	73316	\$208.75
3/4	3/8	2 1/8	6	3/16	73024	204.65	73124	225.05	5/16	73224	204.65	73324	225.05
1	1/2	2 1/2	6	5/16	73032	240.15	73132	264.05	7/16	73232	240.15	73332	264.05
1 1/2	3/4	2 3/4	8	1/2	73048	304.30	73148	334.90	5/8	73248	304.30	73348	334.90

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	\$180.25	74724	\$198.30	1/4	2 3/8	74824	\$180.25	74924	\$198.30
1	1/2	6	5/16	2 27/32	74632	212.85	74732	234.20	3/8	2 29/32	74832	212.85	74932	234.20
1 3/8	5/8	6	7/16	3 7/32	74644	246.55	74744	271.30	1/2	3 3/32	74844	246.55	74944	271.30
1 1/2	5/8	6	1/2	3 3/8	74648	259.00	74748	284.85	9/16	3 7/16	74848	259.00	74948	284.85
1 7/8	3/4	6	5/8	3 25/32	74660	393.25	74760	432.60	5/8	3 25/32	74860	393.25	74960	432.60
2 1/4	7/8	6	3/4	4 5/32	74672	532.30	74772	585.50	3/4	4 5/32	74872	532.30	74972	585.50



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

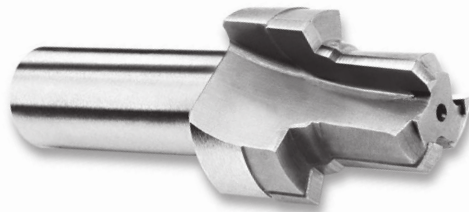
AL TITANIUM NITRIDE – AlTiN

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	\$224.85	71901	\$247.35
1/16	3/4	1/8	1/2	3	6	71802	224.85	71902	247.35
3/32	7/8	3/16	1/2	3	6	71803	245.85	71903	270.30
1/8	1 1/4	1/4	3/4	3 1/2	6	71804	267.50	71904	294.35
5/32	1 5/16	5/16	3/4	3 1/2	6	71805	307.90	71905	338.65
3/16	1 3/8	3/8	3/4	3 1/2	6	71806	325.80	71906	358.40
1/4	1 1/2	1/2	3/4	4	6	71808	337.25	71908	371.05



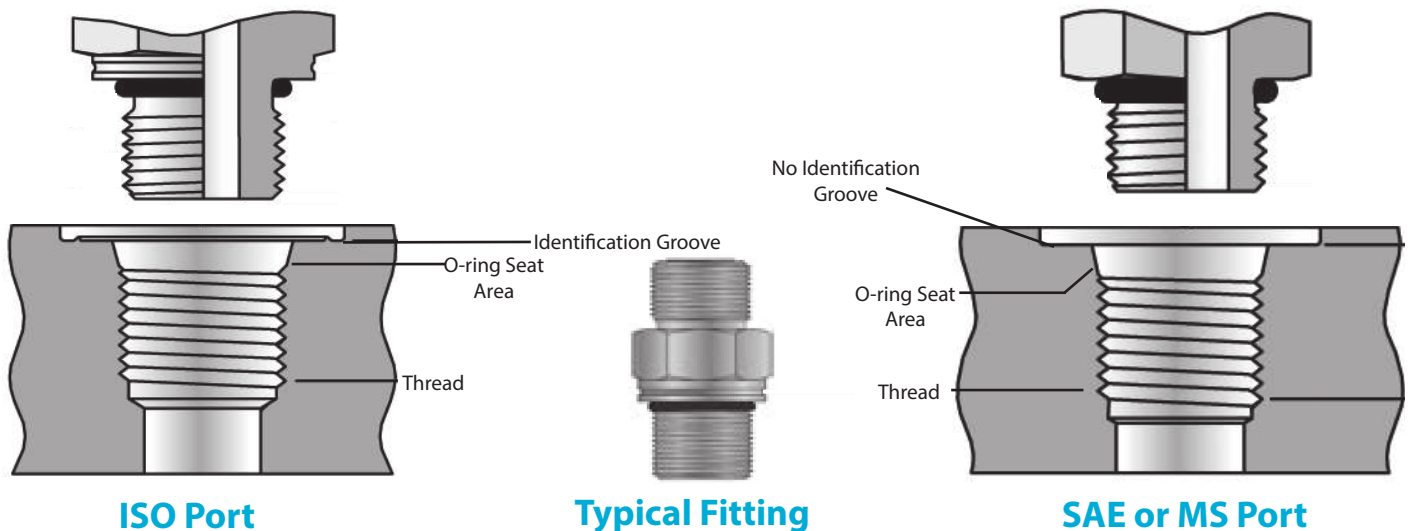
PORT CONTOUR TOOLS CARBIDE TIPPED

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

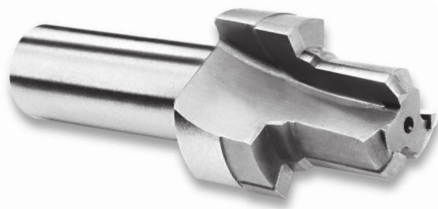
PORT CONTOUR TECHNICAL INFO:

- 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

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 Straight Shank - For Steels	186 186	780 781	MS16142-R	263	SAE-T
ISO 6149-1 Metric Port without I.D. Groove Straight Shank For Non-Ferrous & Cast Irons For Steels	187 187	786 787	ISO-6149	269-1	M1-T
MS33649 Integral Reamer Pilot Series Straight Shank For Non-Ferrous & Cast Irons For Steels	187 187	792 793	MS33649-R	264	MS49R-T

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	\$399.30
3	3/16	5/16-24	.3350	.7600	.5000	12°	2	.4730	1 1/4	3 1/4	78003	78103	399.30
4	1/4	7/16-20	.3890	.8380	.5000	12°	2	.5520	1 1/4	3 1/4	78004	78104	399.30
5	5/16	1/2-20	.4520	.9160	.5000	12°	2	.5520	1 1/4	3 1/4	78005	78105	411.90
6	3/8	9/16-18	.5090	.9790	.5000	12°	2	.6140	1 1/4	3 1/4	78006	78106	411.90
8	1/2	3/4-16	.6890	1.1980	.7500	15°	2	.6930	1 3/8	3 3/8	78008	78108	450.80
10	5/8	7/8-14	.8060	1.3540	.7500	15°	2	.7860	1 5/8	3 5/8	78010	78110	509.80
12	3/4	1 1/16-12	.9810	1.6350	.7500	15°	2 1/4	.9110	1 7/8	4 1/8	78012	78112	549.95
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	558.85
16	1	1 5/16-12	1.2310	1.9200	.7500	15°	2 1/4	.9110	1 7/8	4 1/8	78016	78116	601.50
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	662.65
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	814.90



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	\$429.30
M 10X1	.3560	.7870	.5000	3	12°	2	.4530	1 1/4	3 1/4	786100	787100	429.30
M 12X1.5	.4150	.9060	.5000	3	15°	2	.5510	1 1/4	3 1/4	786120	787120	449.65
M 14X1.5	.4930	.9840	.5000	3	15°	2	.5510	1 1/4	3 1/4	786140	787140	449.65
M 16X1.5	.5720	1.1020	.5000	3	15°	2	.6100	1 1/4	3 1/4	786160	787160	495.10
M 18X1.5	.6510	1.1810	.7500	3	15°	2	.6690	1 3/8	3 3/8	786180	787180	495.10
M 20X1.5	.7300	1.2600	.7500	3	15°	2	.6890	1 3/8	3 3/8	786200	787200	514.25
M 22X1.5	.8080	1.3390	.7500	3	15°	2	.7090	1 5/8	3 5/8	786220	787220	533.30
M 27X2	.9850	1.5750	.7500	3	15°	2 1/4	.8660	1 7/8	4 1/8	786270	787270	576.50
M 33X2	1.2210	1.9290	.7500	3	15°	2 1/4	.8660	1 7/8	4 1/8	786330	787330	663.05
M 42X2	1.5760	2.3620	1.0000	3	15°	2 1/4	.8860	1 7/8	4 1/8	786420	787420	724.55
M 48X2	1.8120	2.5890	1.0000	4	15°	2 1/4	.9840	2	4 1/4	786480	787480	766.00



**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	\$466.40
2	1/8	3/16-24	.2750	.7420	.5000	2	.5820	1 1/8	3 3/8	79202	79302	466.40
3	3/16	3/8-24	.3390	.8050	.5000	2	.5880	1 1/4	3 1/4	79203	79303	442.50
4	1/4	7/16-20	.3930	.8880	.5000	2	.6610	1 1/4	3 1/4	79204	79304	454.45
5	5/16	1/2-20	.4550	.9500	.5000	2	.6610	1 1/4	3 1/4	79205	79305	466.40
6	3/8	9/16-18	.5120	1.0120	.5000	2	.7140	1 1/2	3 1/2	79206	79306	490.30
7	7/16	5/8-18	.5750	1.1050	.5000	2	.7300	1 1/2	3 1/2	79207	79307	502.25
8	1/2	3/4-16	.6930	1.2400	.7500	2	.8390	1 5/8	3 5/8	79208	79308	514.25
9	5/8	13/16-16	.7560	1.3020	.7500	2	.8550	1 5/8	3 5/8	79209	79309	526.20
10	3/4	7/8-14	.8100	1.4150	.7500	2 1/4	.9350	1 7/8	4 1/8	79210	79310	538.15
11	7/8	1-12	.9250	1.6020	.7500	2 1/4	1.0690	2 1/8	4 3/8	79211	79311	585.95
12	1 1/8	1 1/16-12	.9870	1.6650	.7500	2 1/4	1.0690	2 1/8	4 3/8	79212	79312	621.85
14	1 1/4	1 3/16-12	1.1120	1.7900	.7500	2 1/4	1.0690	2 1/8	4 3/8	79214	79314	710.40
16	1 1/2	1 5/16-12	1.2370	1.9650	.7500	2 1/4	1.0690	2 1/8	4 3/8	79216	79316	797.60
18	1 3/4	1 1/2-12	1.4250	2.0900	.7500	2 1/4	1.1210	2 1/4	4 1/2	79218	79318	859.60
20	2	1 5/8-12	1.5500	2.3100	1.0000	2 1/4	1.1210	2 1/4	4 1/2	79220	79320	1001.50
24	2 1/2	1 7/8-12	1.8000	2.6000	1.0000	2 1/4	1.1320	2 1/4	4 1/2	79224	79324	1212.60

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

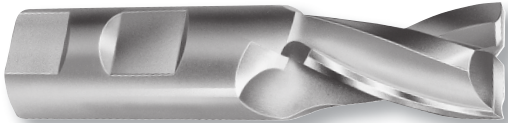
MILLING PROBLEMS	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. ROUGH FINISH	Dull cutting edge Wrong feeds & speeds	Resharpener to original tool geometry Increase speed—also try reduced feed
2. EXCESSIVE CUTTING EDGE WATER	Wrong feeds & speeds Rough cutting edge Insufficient coolant	Increase feed (should always 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

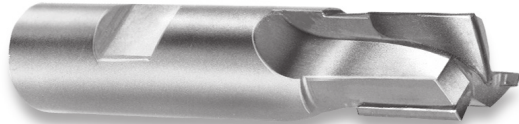
DESCRIPTION	HANNIBAL		FULLERTON	PUTNAM	MORSE	NIAGARA
	PAGE	TOOL TYPE				
CENTER CUTTING END MILLS						
Straight Flutes						
For Non-Ferrous & Cast Irons	189	314	60SK	SKM	5935	4800
For Steels	189	312	60SKS	-	5936	4780
25° Right Spiral Flutes						
For Non-Ferrous & Cast Irons	189	318	60CS	-	5966	-
HIGH 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



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

MODIFICATIONS (See list on page 190)

TOOL DIAMETER		DIMENSIONS				TYPE 318 FOR NON-FERR.	
		SHANK DIAM.	LENGTH		NO. OF FLUTES	EDP NO.	PRICE
FRACTIONAL	DECIMAL		CARBIDE	OVERALL			
1/2	.5000	1/2	1	3	2	31816	\$197.70
5/8	.6250	5/8	1 1/4	3 3/8	2	31820	220.95
3/4	.7500	3/4	1 1/4	3 3/8	2	31824	234.15
7/8	.8750	7/8	1 1/2	3 3/4	2	31828	257.55
1	1.0000	1	1 1/2	4	2	31832	295.90
1 1/4	1.2500	1 1/4	1 3/4	4 1/4	2	31840	402.25
1 1/2	1.5000	1 1/2	2	4 3/4	2	31848	469.35

TOOL DIAMETER		DIMENSIONS				TYPE 314 FOR NON-FERR. & C.I.		TYPE 312 FOR STEELS	
		SHANK DIAM.	LENGTH		NO. OF FLTS	EDP NO.	PRICE	EDP NO.	PRICE
FRACTIONAL	DECIMAL		CARBIDE	OVERALL					
3/8	.3750	3/8	1/2	2 1/2	3	31412	\$118.20	31212	\$122.85
7/16	.4375	3/8	3/4	2 1/2	3	31414	120.85	31214	125.60
1/2	.5000	1/2	3/4	3	3	31416	124.05	31216	128.70
9/16	.5625	1/2	3/4	3	3	31418	128.80	31218	133.80
5/8	.6250	5/8	3/4	3 1/4	3	31420	150.75	31220	156.45
3/4	.7500	5/8	3/4	3 3/8	3	31424	157.75	31224	163.85
7/8	.8750	7/8	3/4	3 3/4	3	31428	184.15	31228	191.25
1	1.0000	7/8	3/4	3 3/4	3	31432	202.30	31232	210.10
1 1/8	1.1250	1	3/4	4	3	31436	216.70	31236	224.90
1 1/4	1.2500	1	3/4	4	3	31440	251.05	31240	260.80
1 1/2	1.5000	1 1/4	3/4	4	3	31448	298.50	31248	310.00

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

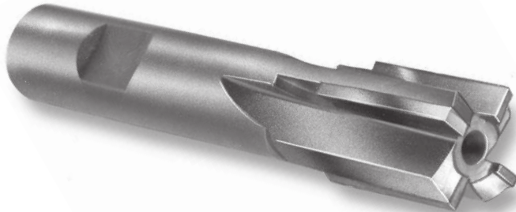
ZIRCONIUM NITRIDE - ZrN

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	\$64.25	4	30408	\$64.85	4	30508	\$64.85	2	30608	\$65.70	2	30708	\$69.65
5/16	.3125	3/8	5/8	2 1/2	2	30210	66.70	4	30410	69.30	-	-	-	2	30610	68.05	-	-	-
3/8	.3750	3/8	5/8	2 1/2	2	30212	71.55	4	30412	73.00	-	-	-	2	30612	72.85	-	-	-
7/16	.4375	3/8	1	2 1/16	2	30214	71.55	4	30414	73.00	4	30514	70.25	2	30614	72.85	2	30714	77.20
1/2	.5000	1/2	1	3 1/4	2	30216	73.35	4	30416	74.75	4	30516	74.65	2	30616	74.80	2	30716	79.15
9/16	.5625	1/2	1	3 3/8	2	30218	81.05	4	30418	83.90	4	30518	83.75	2	30618	82.85	2	30718	87.60
5/8	.6250	1/2	1	3 3/8	2	30220	81.05	4	30420	87.85	4	30520	87.75	4	30620	86.00	4	30720	91.05
11/16	.6875	5/8	1	3 3/8	2	30222	87.75	4	30422	96.70	4	30522	96.50	-	-	-	-	-	-
3/4	.7500	5/8	1	3 5/8	2	30224	91.05	4	30424	90.45	4	30524	100.20	4	30624	98.30	4	30724	103.95
13/16	.8125	5/8	1	3 5/8	2	30226	110.05	4	30426	106.85	4	30526	114.70	-	-	-	-	-	-
7/8	.8750	5/8	1 1/4	4	2	30228	110.75	4	30428	106.85	4	30528	118.65	4	30628	131.40	4	30728	139.20
15/16	.9375	7/8	1 1/4	4	2	30230	118.65	4	30430	118.70	4	30530	126.20	-	-	-	-	-	-
1	1.0000	7/8	1 1/4	4	2	30232	118.90	4	30432	123.45	4	30532	136.90	4	30632	151.80	4	30732	160.75
1 1/8	1.1250	1	1 1/4	4 1/4	2	30236	122.05	4	30436	140.00	4	30536	155.10	4	30636	172.15	-	-	-
1 1/4	1.2500	1	1 1/4	4 1/4	2	30240	147.15	4	30440	157.45	4	30540	174.40	4	30640	193.50	4	30740	204.55
1 1/2	1.5000	1 1/4	1 1/2	4 1/2	2	30248	182.25	4	30448	203.00	4	30548	216.05	4	30648	239.50	4	30748	244.25
1 3/4	1.7500	1 1/4	1 1/2	4 1/2	2	30256	216.05	6	30456	261.65	-	-	-	6	30656	309.15	-	-	-
2	2.0000	1 1/4	1 1/2	4 1/2	2	30264	241.00	6	30464	301.45	-	-	-	6	30664	355.95	6	30764	362.75

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	\$117.50	2	37516	\$108.25	-	-	-
1/2	.5000	1/2	1	3	2	-	32517	117.50	2	37517	108.25	4	32017	\$117.50
9/16	.5625	1/2	1	3	2	-	32518	126.20	2	37518	116.40	-	-	-
5/8	.6250	1/2	1 1/4	3 1/4	2	-	32520	135.85	2	37520	125.10	-	-	-
3/8	.6250	5/8	1 1/4	3 3/8	2	32721	32521	135.85	2	37521	125.10	4	32021	135.85
11/16	.6875	1/2	1 1/4	3 1/4	2	-	32522	141.55	2	37522	130.45	-	-	-
11/16	.6875	5/8	1 1/4	3 3/8	2	-	32523	141.55	2	37523	130.45	4	32023	141.55
3/4	.7500	1/2	1 1/4	3 1/4	2	32724	32524	151.15	2	37524	139.25	-	-	-
3/4	.7500	5/8	1 1/4	3 3/8	2	32725	32525	151.15	2	37525	139.25	4	32025	151.15
13/16	.8125	5/8	1 1/2	3 5/8	2	32726	32526	163.10	2	37526	150.30	4	32026	163.10
7/8	.8750	5/8	1 1/2	3 5/8	2	-	32528	173.05	2	37528	159.55	-	-	-
7/8	.8750	7/8	1 1/2	3 3/4	2	-	32529	173.05	2	37529	159.55	4	32029	173.05
15/16	.9375	5/8	1 1/2	3 3/4	2	-	32530	195.80	3	37530	236.25	-	-	-
15/16	.9375	7/8	1 1/2	3 3/4	2	-	32531	195.80	3	37531	236.25	-	-	-
1	1.0000	7/8	1 1/2	3 3/4	2	32732	32532	199.85	3	37532	223.60	-	-	-
1	1.0000	1	1 1/2	4	2	32733	32533	199.85	3	37533	223.60	6	32033	242.80
1 1/8	1.1250	1	1 3/4	4 1/4	2	-	32536	218.85	3	37536	263.35	6	32036	285.70
1 1/4	1.2500	1	1 3/4	4 1/4	3	32740	32540	290.25	4	37540	301.80	6	32040	327.45
1 3/8	1.3750	1	1 3/4	4 1/4	3	32744	32544	314.70	4	37544	352.40	6	32044	382.60
1 1/2	1.5000	1 1/4	2	4 1/2	3	32748	32548	351.50	4	37548	347.25	6	32048	376.80
1 5/8	1.6250	1 1/4	2	4 1/2	3	-	32552	416.00	4	37552	424.70	-	-	-
1 3/4	1.7500	1 1/4	2	4 1/2	3	-	32556	446.35	4	37556	452.90	8	32056	473.80
1 7/8	1.8750	1 1/4	2	4 1/2	3	-	32560	480.50	4	37560	484.45	-	-	-
2	2.0000	1 1/4	2	4 1/2	3	32764	32564	513.65	4	37564	511.70	8	32064	535.35

END MILLS



END MILLS FOR STEELS CARBIDE TIPPED TYPES 300, 308, 350, FRACTIONAL



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	\$73.85	2	30808	31008	\$76.05
5/16	.3125	3/8	5/8	2 1/2	2	30010	76.95	2	30810	31010	82.05
3/8	.3750	3/8	5/8	2 1/2	2	30012	82.15	2	30812	31012	86.95
7/16	.4375	3/8	1	2 11/16	2	30014	82.15	2	30814	31014	86.95
1/2	.5000	1/2	1	3 1/4	2	30016	84.00	4	30816	31016	93.65
9/16	.5625	1/2	1	3 3/8	2	30018	93.20	4	30818	31018	100.65
5/8	.6250	1/2	1	3 3/8	2	30020	93.20	4	30820	31020	124.20
3/4	.7500	5/8	1	3 3/8	2	30024	104.60	4	30824	31024	138.35
7/8	.8750	5/8	1 1/4	4	2	30028	123.60	4	30828	31028	166.70
1	1.0000	7/8	1 1/4	4	2	30032	136.55	6	30832	31032	191.65
1 1/8	1.1250	1	1 1/4	4 1/4	2	30036	139.90	6	30836	31036	203.25
1 1/4	1.2500	1	1 1/4	4 1/4	2	30040	156.00	6	30840	31040	245.65
1 1/2	1.5000	1 1/4	1 1/2	4 1/2	2	30048	200.95	6	30848	31048	298.75
1 3/4	1.7500	1 1/4	1 1/2	4 1/2	2	30056	225.35	8	30856	31056	359.75
2	2.0000	1 1/4	1 1/2	4 1/2	2	30064	269.10	8	30864	31064	401.60

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	\$117.50
1/2	.5000	1/2	1	3	4	35017	117.50
9/16	.5625	1/2	1	3	4	35018	126.20
5/8	.6250	1/2	1 1/4	3 1/4	4	35020	135.85
5/8	.6250	5/8	1 1/4	3 3/8	4	35021	135.85
11/16	.6875	1/2	1 1/4	3 1/4	4	35022	141.55
11/16	.6875	5/8	1 1/4	3 3/8	4	35023	141.55
3/4	.7500	1/2	1 1/4	3 1/4	4	35024	151.15
3/4	.7500	5/8	1 1/4	3 3/8	4	35025	151.15
13/16	.8125	5/8	1 1/2	3 5/8	4	35026	163.10
7/8	.8750	5/8	1 1/2	3 5/8	4	35028	173.05
7/8	.8750	7/8	1 1/2	3 3/4	4	35029	173.05
15/16	.9375	5/8	1 1/2	3 3/4	4	35030	256.40
15/16	.9375	7/8	1 1/2	3 3/4	4	35031	256.40
1	1.0000	7/8	1 1/2	3 3/4	6	35032	242.80
1	1.0000	1	1 1/2	4	6	35033	242.80
1 1/8	1.1250	1	1 3/4	4 1/4	6	35036	285.70
1 1/4	1.2500	1	1 3/4	4 1/4	6	35040	327.45
1 3/8	1.3750	1	1 3/4	4 1/4	6	35044	382.60
1 1/2	1.5000	1 1/4	2	4 1/2	6	35048	376.80
1 5/8	1.6250	1 1/4	2	4 1/2	8	35052	502.35
1 3/4	1.7500	1 1/4	2	4 1/2	8	35056	535.80
1 7/8	1.8750	1 1/4	2	4 1/2	8	35060	573.00
2	2.0000	1 1/4	2	4 1/2	8	35064	605.10

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



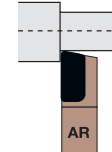
AR

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	\$12.35	11204	\$9.00	¼	¼	2	12
AR-5	11105	10.90	11205	9.60	⅜	⅜	2 ¼	12
AR-6	11106	11.10	11206	9.75	⅜	⅜	2 ½	12
AR-8	11108	10.25	11208	10.25	½	½	3 ½	12
AR-10	11110	15.25	11210	14.10	⅝	⅝	4	12
AR-12	11112	19.55	11212	17.50	¾	¾	4 ½	12
AR-16	11116	35.85	11216	34.95	1	1	7	6

*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	\$12.35	11504	\$9.00	¼	¼	2	12
AL-5	11405	10.90	11505	9.60	⅜	⅜	2 ¼	12
AL-6	11406	11.10	11506	9.75	⅜	⅜	2 ½	12
AL-8	11408	10.25	11508	10.25	½	½	3 ½	12
AL-10	11410	14.40	11510	14.10	⅝	⅝	4	12
AL-12	11412	18.65	11512	18.45	¾	¾	4 ½	12
AL-16	11416	36.35	11516	36.35	1	1	7	6

*Some sizes not available in premium grade carbide. Prices subject to change.



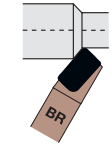
BR

15° SIDE CUTTING EDGE ANGLE

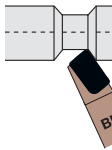
For interrupted or irregular cuts

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	\$12.35	12204	\$9.00	¼	¼	2	12
BR-5	12105	10.90	12205	9.60	⅜	⅜	2 ¼	12
BR-6	12106	11.10	12206	9.75	⅜	⅜	2 ½	12
BR-7	12107	12.00	12207	10.65	⅞	⅞	3	12
BR-8	12108	10.25	12208	10.25	½	½	3 ½	12
BR-10	12110	15.25	12210	14.10	⅝	⅝	4	12
BR-12	12112	19.55	12212	17.50	¾	¾	4 ½	12
BR-16	12116	35.85	12216	34.95	1	1	7	6

*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	\$12.35	12504	\$9.00	¼	¼	2	12
BL-5	12405	10.90	12505	9.60	⅜	⅜	2 ¼	12
BL-6	12406	11.10	12506	9.75	⅜	⅜	2 ½	12
BL-7	12407	12.00	12507	10.65	⅞	⅞	3	12
BL-8	12408	10.25	12508	10.25	½	½	3 ½	12
BL-10	12410	14.40	12510	14.10	⅝	⅝	4	12
BL-12	12412	18.65	12512	18.45	¾	¾	4 ½	12
BL-16	12416	36.35	12516	36.35	1	1	7	6

*Some sizes not available in premium grade carbide. Prices subject to change.



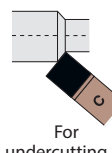
C

0° SQUARE NOSE

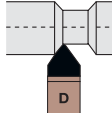
No nose radius

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	\$8.15	13804	\$8.15	¼	¼	2	12
C-5	13705	8.95	13805	8.65	⅜	⅜	2 ¼	12
C-6	13706	11.60	13806	9.60	⅜	⅜	2 ½	12
C-7	13707	8.85	13807	12.25	⅞	⅞	3	12
C-8	13708	14.25	13808	13.20	½	½	3 ½	12
C-10	13710	16.05	13810	17.50	⅝	⅝	4	12
C-12	13712	22.15	13812	25.10	¾	¾	4 ½	12
C-16	13716	45.95	13816	44.10	1	1	7	6

*Some sizes not available in premium grade carbide. Prices subject to change.



For undercutting or chamfering



For 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	\$7.55	14804	\$7.55	¼	¼	2	12
D-5	14705	8.75	14805	9.00	⅜	⅜	2 ¼	12
D-6	14706	8.95	14806	9.65	⅜	⅜	2 ½	12
D-7	14707	12.25	-	-	⅞	⅞	3	12
D-8	14708	11.75	14808	12.45	½	½	3 ½	12
D-10	14710	16.45	14810	18.25	⅝	⅝	4	12
D-12	14712	23.55	14812	20.70	¾	¾	4 ½	12
D-16	14716	35.00	14816	36.15	1	1	7	6

*Some sizes not available in premium grade carbide. Prices subject to change.

SINGLE POINTS



BRAZED SINGLE POINT TOOLS CARBIDE TIPPED

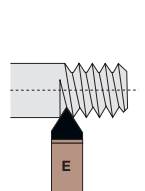
MATERIAL
SPECIFIC

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	\$7.55	15804	\$7.55	1/4	1/4	2	12
E-5	15705	8.25	15805	8.25	5/16	5/16	2 1/4	12
E-6	15706	8.60	15806	8.35	3/8	3/8	2 1/2	12
E-7	15707	13.30	15807	15.95	7/16	7/16	3	12
E-8	15708	19.70	15808	10.60	1/2	1/2	3 1/2	12
E-10	15710	16.35	15810	14.85	5/8	5/8	4	12
E-12	15712	20.30	15812	20.55	3/4	3/4	4 1/2	12
E-16	15716	35.60	15816	34.25	1	1	7	6

*Some sizes not available in premium grade carbide. Prices subject to change.



For cutting threads



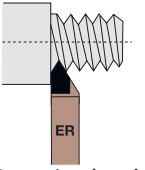
60° INCLUDED ANGLE;
30° SIDE CUTTING EDGE ANGLE

For threading, chamfering,
notching, or undercutting



30° SIDE CUTTING EDGE ANGLE

Offset for threading or boring



For cutting threads

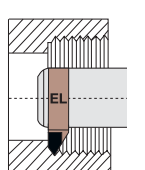


30° SIDE CUTTING EDGE ANGLE

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	\$9.40	15204	\$7.55	1/4	1/4	2	12
ER-5	15105	9.40	15205	8.40	5/16	5/16	2 1/4	12
ER-6	15106	9.55	15206	8.65	3/8	3/8	2 1/2	12
ER-8	15108	16.85	15208	16.85	1/2	1/2	3 1/2	12
ER-10	15110	18.35	15210	18.35	5/8	5/8	4	12
ER-12	15112	19.85	15212	21.55	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	\$10.80	15504	\$7.55	1/4	1/4	2	12
EL-5	15405	10.80	15505	10.35	5/16	5/16	2 1/4	12
EL-6	15406	10.80	15506	10.50	3/8	3/8	2 1/2	12
EL-8	15408	16.85	15508	18.50	1/2	1/2	3 1/2	12
EL-10	15410	18.35	15510	20.25	5/8	5/8	4	12
EL-12	15412	19.85	15512	21.55	3/4	3/4	4 1/2	12

*Some sizes not available in premium grade carbide. Prices subject to change.

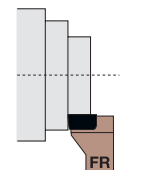


0° END CUTTING EDGE ANGLE

Offset for facing to a square shoulder or close to chuck jaws

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	\$14.15	16208	\$13.95	1/2	1/2	3 1/2	12
FR-10	16110	20.50	16210	19.50	5/8	5/8	4	12
FR-12	16112	26.50	16212	26.15	3/4	3/4	4 1/2	6
FR-16	16116	55.40	16216	58.30	1	1	7	4

*Some sizes not available in premium grade carbide. Prices subject to change.



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	
FL-8	16408	\$14.25	16508	\$13.55	1/2	1/2	3 1/2	12
FL-10	16410	21.40	16510	19.50	5/8	5/8	4	12
FL-12	16412	27.50	16512	24.30	3/4	3/4	4 1/2	6
FL-16	16416	51.70	16516	58.30	1	1	7	4

*Some sizes not available in premium grade carbide. Prices subject to change.

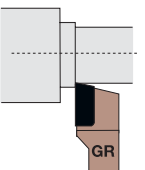


0° SIDE CUTTING EDGE ANGLE

Offset for facing or turning to a square shoulder
or close to chuck jaws

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	\$14.25	17208	\$13.55	1/2	1/2	3 1/2	12
GR-10	17110	21.40	17210	19.50	5/8	5/8	4	12
GR-12	17112	27.50	17212	24.30	3/4	3/4	4 1/2	6
GR-16	17116	57.90	17216	58.30	1	1	7	4

*Some sizes not available in premium grade carbide. Prices subject to change.



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	
GL-8	17408	\$14.15	17508	\$13.95	1/2	1/2	3 1/2	12
GL-10	17410	20.50	17510	19.50	5/8	5/8	4	12
GL-12	17412	26.50	17512	26.15	3/4	3/4	4 1/2	6
GL-16	17416	56.15	17516	58.30	1	1	7	4

*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	\$18.30	10211	\$19.05	1/2	1	5
CT-122	3/16	10122	18.85	10222	19.45	1/2	1	5
CT-121	1/4	10133	19.50	10233	20.15	1/2	1	5
CT-120	5/16	10144	19.45	10244	20.15	1/2	1	5
CT-130	3/8	10155	23.55	10255	25.05	5/8	1 1/4	5
CT-140	3/8	10166	26.10	10266	27.00	3/4	1 1/2	6

*Some sizes not available in premium grade carbide. Prices subject to change.

Standard packaging quantity is 6

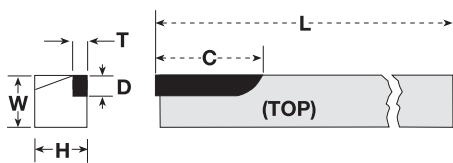
STANDARD CUT-OFF TOOL

For stock cut-off of solid bars
Finish ground - ready for use

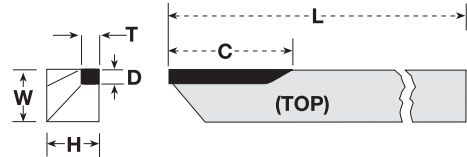
TOOL STYLE	CUT-OFF WIDTH	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS		
		EDP NO.	PRICE	EDP NO.	PRICE	W	H	L
CTL-111	1/8	10411	\$18.30	10511	\$19.05	1/2	1	5
CTL-122	3/16	10422	18.85	10522	19.45	1/2	1	5
CTL-121	1/4	10433	19.50	10533	20.15	1/2	1	5
CTL-120	5/16	10444	19.45	10544	20.15	1/2	1	5
CTL-130	3/8	10455	23.55	10555	25.05	5/8	1 1/4	5
CTL-140	3/8	10466	26.10	10566	27.00	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	\$16.60	1/4	1/4	6	3/32	1/8	1 1/4
SA7T	19902	17.75	5/32	5/32	6	3/32	1/8	1 1/4
SA8T	19903	19.40	3/16	3/16	6	3/32	3/16	1 1/4
SA9T	19904	20.55	3/8	3/8	6	3/32	3/16	1 1/4
SA10T	19905	22.25	13/32	13/32	6	3/32	3/16	1 1/4
SA11T	19906	23.05	7/16	7/16	6	1/8	1/4	1
SA11.5T	19907	23.20	15/32	15/32	6	1/8	1/4	1
SA12T	19908	24.60	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	\$16.60	1/4	1/4	6	1/8	3/32	1 1/4
SA7C	19922	17.75	5/32	5/32	6	1/8	3/32	1 1/4
SA8C	19923	19.40	3/16	3/16	6	1/8	3/32	1 1/4
SA9C	19924	20.55	3/8	3/8	6	1/8	3/32	1 1/4
SA10C	19925	22.25	13/32	13/32	6	1/8	3/32	1 1/4
SA11C	19926	23.05	7/16	7/16	6	3/32	1/8	1 1/4
SA11.5C	19927	23.20	15/32	15/32	6	3/32	1/8	1 1/4
SA12C	19928	24.60	1/2	1/2	6	3/32	1/8	1 1/4

*Prices subject to change

Standard packaging quantity is 10

SINGLE POINTS



CATALOG INDEX ALPHABETICAL BY PRODUCT SECTION

REAMERS - CARBIDE TIPPED

COOLANT FED REAMERS

Straight Flutes – Center Fed (Types 414/424/434).....	90-91
Straight Flutes – Flute Fed (Types 416/426/435).....	92-93
Right Spiral Flutes – Center Fed (Types 411/413/415).....	94
Right Spiral Flutes – Flute Fed (Types 417/418/419).....	95
Left Spiral Flutes – Flute Fed (Types 427/428/429).....	96
Metcut Type – Right Spiral Flutes (Type 490).....	97

EXTENDED LENGTH REAMERS

Straight Flutes (Types 457EL/458EL/459EL).....	35
Straight Flutes – Center Fed (Types 416EL/426EL/435EL).....	36
Right Spiral Flutes (Types 442EL/443EL/444EL).....	37
Right Spiral Flutes – Center Fed (Types 411EL/413EL/415EL).....	38
Left Spiral Flutes (Types 482EL/483EL/484EL).....	39
Left Spiral Flutes – Flute Fed (Types 427EL/428EL/429EL).....	40

GENERAL PURPOSE CHUCKING REAMERS

Stub Length – Straight Flutes (Type 430).....	42-43
Stub Length – Left Spiral Flutes (Type 440).....	42-43
Jobbers Drill Length – Straight Flutes (Type 401).....	44
Dowel Pin Sizes/Over & Under Sizes (Types 477/479).....	45
Straight Flutes – Straight Shank (Type 400).....	46-52
Dowel Pin Sizes/Over & Under Sizes (Types 476/478).....	47
Wire & Letter Sizes (Type 400).....	45
Stocked .0005 Increments (Type 400).....	48-51
Straight Flutes – Taper Shank (Type 402).....	54-55
Straight Flute Long Carbide – Straight Shank (Type 450).....	56-57
Stocked .0005 Increments (Type 450).....	59-61
Straight Flute Long Carbide – Taper Shank (Type 452).....	62-63
Expansion Type – Straight Shank (Type 465).....	64-65
Expansion Type – Taper Shank (Type 467).....	66-67
Right Spiral Flutes – Straight Shank (Type 410).....	68-69
Right Spiral Flutes – Taper Shank (Type 412).....	70
Left Spiral Flutes – Straight Shank (Type 420).....	68-69
Left Spiral Flutes – Taper Shank (Type 422).....	70
Jobbers – Taper Shank (Type 403).....	41

h6 SHANK REAMERS

Straight Flutes – Center Fed (Types 414h6/424h6/434h6).....	31
Straight Flutes – Flute Fed (Types 416h6/426h6/435h6).....	32
Left Hand Spiral Flutes – Flute Fed (Types 427h6/428h6/429h6).....	34
Right Hand Spiral Flutes – Center Fed (Types 411h6/413h6/415h6).....	33

MATERIAL SPECIFIC CHUCKING REAMERS

Stub Length – Straight Flutes (Types 470/471/475).....	88
Straight Flutes – Straight Shank – For Steels (Type 480).....	73-75
Dowel Pin Sizes/Over & Under Sizes (Types 486/488).....	75
Straight Flutes – Straight Shank (Types 407/408/409).....	76-77
Straight Flutes – Taper Shank (Types 472/473/474).....	80
Straight Flute Long Carbide – Straight Shank (Types 457/458/459).....	78-79
Straight Flute Long Carbide – Taper Shank (Types 453/454/455).....	81
Expansion Type – Straight Shank (Types 464/466/468).....	82
Expansion Type – Taper Shank (Types 461/462/463).....	83
Right Spiral Flutes – Straight Shank (Types 432/436/438).....	84
Right Spiral Flute Long Carbide – Straight Shank (Types 442/443/444).....	85
Left Spiral Flutes – Straight Shank (Types 433/437/439).....	86
Left Spiral Flute Long Carbide – Straight Shank (Types 482/483/484).....	87

PIPE TAP REAMERS

Straight Shank (Type 446).....	41
Taper Shank (Type 447).....	41

SEMI-FINISHED REAMERS

Types 400SF/402SF/410SF/430SF/440SF/450SF/465SF.....	53
--	----

SHELL REAMERS & ARBORS

Straight Flutes (Type 431).....	71
Left Spiral Flutes (Type 441).....	72
Arbors – Straight Shank (Type 481).....	72
Arbors – Taper Shank (481).....	72

STEP REAMERS

Straight Flute Long Carbide (Types 457ST/458ST/459ST).....	98
Right Spiral Flute Long Carbide (Types 442ST/443ST/444ST).....	99
Left Spiral Flute Long Carbide (Types 482ST/483ST/484ST).....	100

REAMERS - SOLID CARBIDE

COOLANT FED MATERIAL SPECIFIC SOLID CARBIDE REAMERS

Straight Flutes – Center Fed (Types 806/807).....	102
---	-----

REAMERS - SOLID CARBIDE (CONTINUED)

Straight Flutes – Flute Fed (Types 808/809).....	102
Right Spiral Flutes – Center Fed (Types 816/817).....	103
Left Spiral Flutes – Flute Fed (Types 828/829).....	103

GENERAL PURPOSE CHUCKING REAMERS

Straight Flutes (Type 804).....	105-109
Wire & Letter Sizes (Type 804).....	105
Stocked .0005 Increments (Type 804).....	58, 106-109

MATERIAL SPECIFIC CHUCKING REAMERS

Straight Flutes (Type 802/803).....	104
Right Spiral Flutes (Types 812/813).....	104
Left Spiral Flutes (Types 822/823).....	104

SOLID CARBIDE HEAD MATERIAL SPECIFIC REAMERS

Straight Flutes – Steel Shank (Types 800/801).....	110
Right Spiral Flutes – Steel Shank (Types 810/811).....	111
Left Spiral Flutes – Steel Shank (Types 820/821).....	111

DRILLS

AIRCRAFT EXTENSION DRILLS

6" Length, 135° Split Point (Type 610).....	133
12" Length, 135° Split Point (Type 611).....	133

COOLANT FED DRILLS

Short Length, Straight, 125° 4 Facet Pt. (Type 652).....	116
Long Length, Straight, 125° 4 Facet Pt. (Type 650).....	117
Extra Long Length, Straight 125° 4 Facet Pt. (Type 658).....	115
Short Length, Twist, 125° 4 Facet Pt. (Type 654).....	118
Short Length, Twist, 135° Split Pt. (Type 655).....	118
Long Length, Twist, 125° 4 Facet Pt. (Type 656).....	119
Long Length, Twist, 135° Split Pt. (Type 657).....	119

CORE DRILLS

Straight Shank (Type 620).....	140-141
Taper Shank (Type 622).....	140-141
Straight Shank - For Steels (Type 621).....	142-143
Taper Shank - For Steels (Type 623).....	142-143

GLASS & TILE DRILLS (Type 680).....

HARD STEEL DIE DRILLS

Negative Cutting Edge, 118° Pt. (Type 670).....	134
Negative Cutting Edge, 140° Pt. (Type 671).....	134
Positive Cutting Edge, 118° Pt. (Type 672).....	134
Positive Cutting Edge, 140° Pt. (Type 673).....	134
Spade Type, 120° Pt. (Type 674).....	135
Spade Type, 140° Pt. (Type 675).....	135

JOBBER LENGTH DRILLS

118° Standard Point (Type 600).....	122-123
135° Split Point (Type 601).....	122-123
118° Standard Point (Type 690).....	124-125
135° Split Point (Type 691).....	124-125

MASONRY DRILLS (Types 681/682/683/684).....

REDUCED SHANK DIAMETER DRILLS

Hard Steel Die (Types 670/672).....	136
Jobbers Length (Types 600/601).....	136
Stub Length (Types 640/641).....	136
Silver & Deming 118° Std. Pt. (Type 616).....	137
Silver & Deming 135° Split Pt. (Type 618).....	137

SPOTTING/CENTERING (CNC) DRILLS

90° Short or Regular Length (Types 647/677).....	137
120° Short or Regular Length (Types 648/678).....	137
140° Short or Regular Length (Types 649/679).....	137

STUB LENGTH (CNC) DRILLS

118° Standard Point (Type 640).....	120-121
135° Split Point (Type 641).....	120-121

TAPER LENGTH DRILLS

118° Standard Point (Type 630).....	128-129
135° Split Point (Type 631).....	128-129

TAPER SHANK DRILLS

118° Standard Point (Type 660).....	130-131
135° Split Point (Type 661).....	130-131



CATALOG INDEX (CONTINUED)

ALPHABETICAL BY PRODUCT SECTION

Smaller Taper Shank, 118° Standard Point (Type 668).....	131
8" Extra Long Flute, 118° Standard Point (Type 664).....	132
11" Extra Long Flute, 118° Standard Point (Type 665).....	132

DRILLS - SOLID CARBIDE

JOBBER LENGTH DRILLS

118° Standard Point (Type 860).....	126-127
-------------------------------------	---------

DIE DRILLS

Solid Carbide, 140° Pt. (Type 893).....	135
---	-----

DRILLS - COBALT

JOBBER LENGTH DRILLS

135° Point (Type 699).....	138
----------------------------	-----

CENTERS

Brown & Sharpe - Half or Full (Types 593/596).....	139
Jarno - Half or Full (Types 594/597).....	139
Morse - Half or Full (Types 592/595).....	139

COUNTERBORES & PILOTS

AIRCRAFT COUNTERBORES

3 Flutes - Similar to Craig 850 Series (Type 522).....	147
--	-----

CAPSCREW COUNTERBORES

For Non-Ferrous & Cast Irons (Type 513).....	157
For Steels (Type 515).....	157

PILOTS

Short Shank (Type 500).....	158
-----------------------------	-----

STRAIGHT SHANK COUNTERBORES

4 Flutes (Type 512).....	148-149
3-4 Flutes (Type 514).....	148-149
3-4 Flutes - For Steels (Type 510).....	152-153

TAPER SHANK COUNTERBORES

4 Flutes (Type 518).....	150-151
3-4 Flutes (Type 516).....	150-151
3-4 Flutes - For Steels (Type 511).....	152-153

STUB LENGTH COUNTERBORES

Pin Drive - For Non-Ferrous & Cast Irons (Type 573).....	155
Pin Drive - For Steels (Type 574).....	155
Stub Taper - For Non-Ferrous & Cast Irons (Type 575).....	154
Stub Taper - For Steels (Type 576).....	154
Radial Drive - For Non-Ferrous & Cast Irons (Type 577).....	156
Radial Drive - For Steels (Type 578).....	156

MILLING CUTTERS

ARBOR HOLE TYPES

DOUBLE ANGLE CUTTERS

45° Included for Non-Ferrous & Cast Irons (Type 750).....	174
60° Included for Non-Ferrous & Cast Irons (Type 752).....	174
90° Included for Non-Ferrous & Cast Irons (Type 754).....	174

SHELL END MILLS

For Non-Ferrous (Type 530).....	174
For Cast Irons (Type 531).....	174
For Steels (Type 532).....	174

SIDE MILLING CUTTERS

For Non-Ferrous (Type 540).....	163
For Cast Irons (Type 541).....	163
For Steels (Type 542).....	163
For High Temp Alloys (Type 543).....	163

SIDE MILLING CUTTERS - STAGGERED TOOTH

For Most Materials (Type 547).....	162
------------------------------------	-----

SINGLE ANGLE CUTTERS

45° Right for Non-Ferrous & Cast Irons (Type 714).....	174
45° Left for Non-Ferrous & Cast Irons (Type 716).....	174
60° Right for Non-Ferrous & Cast Irons (Type 724).....	174
60° Left for Non-Ferrous & Cast Irons (Type 726).....	174

SLITTING SAWS - COARSE TOOTH

For Non-Ferrous (Type 550).....	164
For Cast Irons (Type 552).....	164
For Steels (Type 554).....	164
For High Temp Alloys (Type 558).....	164

SLITTING SAWS - STANDARD TOOTH

For Non-Ferrous (Type 551).....	165
For Cast Irons (Type 553).....	165
For Steels (Type 556).....	165, 166-169
For High Temp Alloys (Type 559).....	165, 170-173

SHANK TYPES

CHAMFER MILLING CUTTERS

45° for Non-Ferrous & Cast Irons/Steels (Types 730/731).....	183
60° for Non-Ferrous & Cast Irons/Steels (Types 732/733).....	183

CORNER ROUNDING END MILLS

For Non-Ferrous & Cast Irons/Steels (Types 740/741).....	182
--	-----

COUNTERSINKS

Single Flute - 60°/82°/90°/100° (Types 561/581/584/591).....	175
Three Flutes - 60°/82°/90°/100° (Types 563/583/585/590).....	175

DOUBLE ANGLE CUTTERS

60° for Non-Ferrous & Cast Irons/Steels (Types 746/747).....	184
90° for Non-Ferrous & Cast Irons/Steels (Types 748/749).....	184

DOVETAIL CUTTERS

45° for Non-Ferrous & Cast Irons/Steels (Types 734/735).....	183
60° for Non-Ferrous & Cast Irons/Steels (Types 736/737).....	183

KEYSEAT CUTTERS

Straight Tooth for Non-Ferrous & Cast Irons/Steels (Types 700/702).....	178, 180
Staggered Tooth for Non-Ferrous & Cast Irons/Steels (Types 701/703).....	179, 181
Straight Tooth for Aluminum (Type 704).....	177

RADIUS CUTTERS - For Non-Ferrous & Cast Irons/Steels (Types 718/719).....

T-SLOT CUTTERS - For Non-Ferrous & Cast Irons/Steels (Types 720/721).....

PORT CONTOUR CUTTERS

ISO 6149-1 METRIC PORT W/O I.D. GROOVE

Straight Shank for Non-Ferrous & Cast Irons (Type 786).....	187
Straight Shank for Steels (Type 787).....	187

MS33649 INTEGRAL REAMER PILOT

Straight Shank for Non-Ferrous & Cast Irons (Type 792).....	187
Straight Shank for Steels (Type 793).....	187

S.A.E. - MS16142 - J514F - J1926

Straight Shank for Non-Ferrous & Cast Irons (Type 780).....	186
Straight Shank for Steels (Type 781).....	186

END MILLS

CENTER CUTTING END MILLS

Straight Flutes	
For Non-Ferrous & Cast Irons (Type 314).....	189
For Steels (Type 312).....	189
25° Right Spiral Flutes	
For Non-Ferrous (Type 318).....	189

HIGH SPIRAL SHEAR CUTTING END MILLS

15° Right Spiral Flutes	
For Non-Ferrous & Cast Irons (Type 375).....	191
For Cast Irons & High Temp Alloys (Type 320).....	191
For Steels (Type 350).....	192
25° Right Spiral Flutes	
For Non-Ferrous - Sharp Edged (Type 327).....	191
For Non-Ferrous (Type 325).....	191

SLOW SPIRAL END MILLS

6° Right Spiral Flutes	
For Non-Ferrous - Sharp Edged (Type 307).....	190
For Non-Ferrous & Cast Irons (Type 306).....	190
For Steels (Type 308).....	192
6° Left Spiral Flutes	
For Steels - (Type 310).....	192

STRAIGHT FLUTES END MILLS

Sharp Edged	
For Non-Ferrous - 4 Flutes (Type 305).....	190
Radial Edged	
For Non-Ferrous & Cast Irons 2 Flutes (Type 302).....	190
For Non-Ferrous & Cast Irons 4 or 6 Flutes (Type 304).....	190
For Steels - 2 Flutes (Type 300).....	192

BRAZED SINGLE POINT TOOLS

CUT-OFF TOOLS

Standard Cut-Off (CT/CTL) (Types 101, 102, 104, 105).....	195
Swiss Automatic (SA-C/SA-T) (Type 199).....	195

END CUTTING OFFSET TOOLS (FL/FR) (Types 164, 165, 161, 162).....

POINTED NOSE TOOL (D) (Types 147, 148).....

SIDE CUTTING TOOLS (GL/GR) (Types 174, 175, 171, 172).....

SQUARE NOSE TOOL (C) (Types 137, 138).....

THREADING TOOLS

30° Offset (ER & EL) (Types 151, 152, 154, 155).....	194
60° Included Angle (E) (Types 157, 158).....	194

TURNING TOOLS

Straight (AL/AR) (Types 114, 115, 111, 112).....	193
15° Side (BL/BR) (Types 124, 125, 121, 122).....	193



CATALOG INDEX NUMERICAL BY TOOL TYPE

TOOL TYPE	PAGE(S)
300	192
302	190
304	190
305	190
306	190
307	190
308	192
310	192
312	189
314	189
318	189
320	191
325	191
327	191
350	192
375	191
400	45-53
401	44
402	53-55
403	41
407	76-77
408	76-77
409	76-77
410	68-69, 53
411 EL	38
411 h6	33
411	94
412	70
413 EL	38
413 h6	33
413	94
414	90-91
414 h6	31
415 EL	38
415 h6	33
415	94
416 EL	36
416 h6	32
416	92-93
417	95
418	95
419	95
420	68-69
422	70
424	90-91
424 h6	31
426 EL	36
426 h6	32
426	92-93
427 EL	40
427 h6	34
427	96
428 EL	40
428 h6	34
428	96
429 EL	40
429 h6	34
429	96
430	42-43, 53
431	71
432	84
433	86
434	90-91
434 h6	31
435 EL	36
435 h6	32

TOOL TYPE	PAGE(S)
435	92-93
436	84
437	86
438	84
439	86
440	42-43, 53
441	72
442 EL	37
442 ST	99
442	85
443 EL	37
443 ST	99
443	85
444 EL	37
444 ST	99
444	85
446	41
447	41
450	56-57, 59-61, 53
452	62-63
453	81
454	81
455	81
457 EL	35
457 ST	98
457	78-79
458 EL	35
458 ST	98
458	78-79
459 EL	35
459 ST	98
459	78-79
461	83
462	83
463	83
464	82
465	64-65, 53
466	82
467	66-67
468	82
470	88
471	88
472	80
473	80
474	80
475	88
476	47
477	45
478	47
479	45
480	73-75
481	72
482 EL	39
482 ST	100
482	87
483 EL	39
483 ST	100
483	87
484 EL	39
484 ST	100
484	87
486	75
488	75
490	97
500	158
501	158

TOOL TYPE	PAGE(S)
502	158
503	158
504	158
505	158
506	158
507	158
508	158
509	158
510	152-153
511	152-153
512	148-149
513	157
514	148-149
515	157
516	150-151
518	150-151
522	147
530	174
531	174
532	174
536	175
537	175
538	175
540	163
541	163
542	163
543	163
547	162
550	164
551	165
552	164
553	165
554	164
556	165-169
558	164
559	165, 170-173
561	175
563	175
573	155
574	155
575	154
576	154
577	156
578	156
581	175
583	175
584	175
585	175
590	175
591	175
592	139
593	139
594	139
595	139
596	139
597	139
600	122-123, 136
601	122-123, 136
602	122
603	122
604	122
605	122
610	133
611	133
612	133
613	133

TOOL TYPE	PAGE(S)
614	133
615	133
616	137
618	137
620	140-141
621	142-143
622	140-141
623	142-143
630	128-129
631	128-129
632	128
633	128
634	128
635	128
640	120-121, 136
641	120-121, 136
642	120
643	120
644	120
645	120
647	137
648	137
649	137
650	117
652	116
654	118
655	118
656	119
657	119
658	115
660	130-131
661	130-131
664	132
665	132
668	131
670	134, 136
671	134
672	134, 136
673	134
674	135
675	135
677	137
678	137
679	137
680	144
681	144
682	144
683	144
684	144
690	124-125
691	124-125
692	124
693	124
694	124
695	124
699	138
700	178
701	179
702	180
703	181
704	177
714	174
716	174
718	184
719	184
720	182

TOOL TYPE	PAGE(S)
721	182
724	174
726	174
730	183
731	183
732	183
733	183
734	183
735	183
736	183
737	183
740	182
741	182
746	184
747	184
748	184
749	184
750	174
752	174
754	174
780	186
781	186
786	187
787	187
792	187
793	187
800	110
801	110
802	104
803	104
804	58, 105-109
806	102
807	102
808	102
809	102
810	111
811	111
812	104
813	104
816	103
817	103
820	111
821	111
822	104
823	104
828	103
829	103
860	126-127
893	135
AL	193
AR	193
BL	193
BR	193
C	193
CT	195
CTL	195
D	193
E	194
EL	194
ER	194
FL	194
FR	194
GL	194
GR	194
SA-C	195
SA-T	195



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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."

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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.

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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.

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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

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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.

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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.

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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.

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