HANNIBAL

Carbide Tool, Inc

ISO 9001 Certified

CARBIDE TIPPED & SOLID CARBIDE CUTTING TOOLS

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

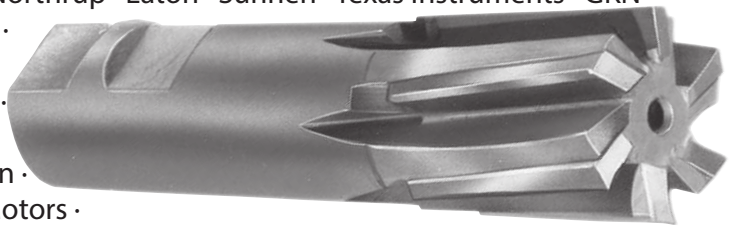
STABILITY — FOR TODAY & TOMORROW

- 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

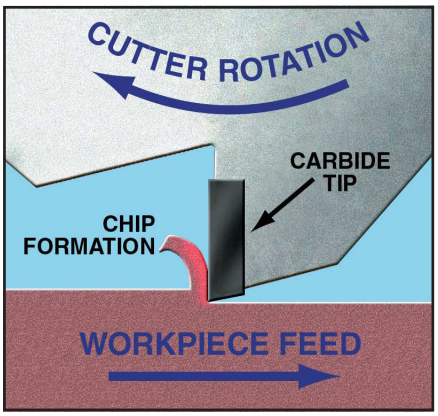
Paul Enander

HANNIBAL

ALL ABOUT CARBIDE TECHNICAL INFORMATION

THE CUTTING PROCESS

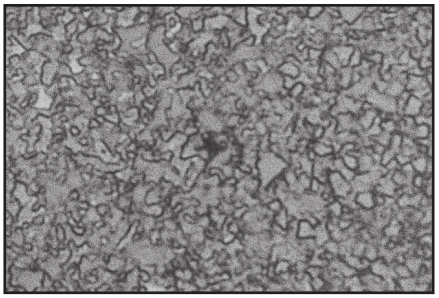
- Intense concentrated force at the cutting edge separates the metal's individual crystals
- Continuous flowing chip is separated from the workpiece
- Chip moves up cutting tool face until chip's internal stresses cause a chip fracture and chip breaks away as a segmented or discontinuous chip
- Large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



CHIP FORMATION

CARBIDE PRODUCTION

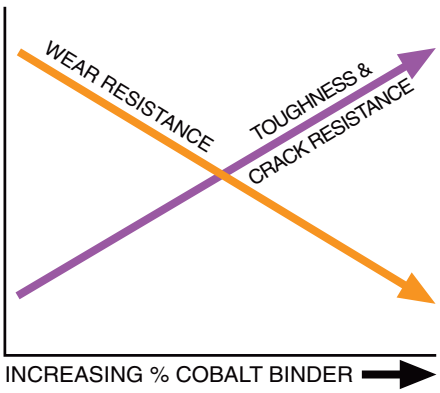
- Carbide powders are created by heating metal powders, usually tungsten, and carbon to a very high temperature – over 2800°F
- Resultant tungsten carbide powder grains are extremely hard and stable at elevated temperatures
- These carbide powders are sorted by grain size and recombined in appropriate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

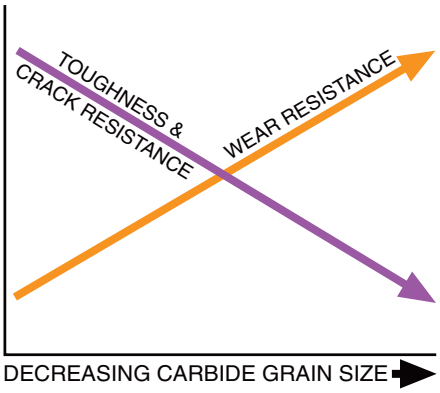

C-2 TUNGSTEN CARBIDE
HIGH MAGNIFICATION (1000X)

CARBIDE TECHNICAL

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

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





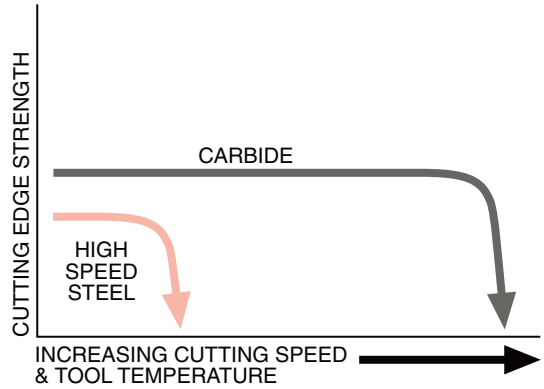
THE HANNIBAL CARBIDE TIPPED END USER ADVANTAGE

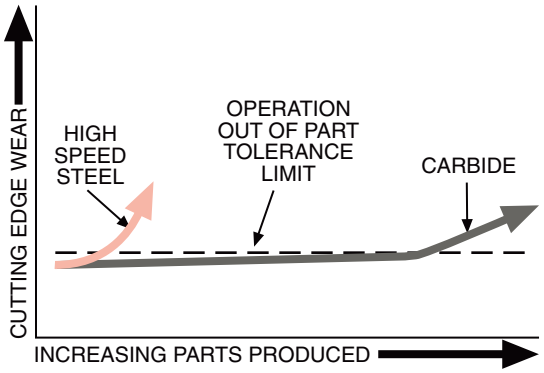
CARBIDE TIPPED VS. HIGH SPEED STEEL

ADVANTAGE #1
- Higher feeds & speeds
- Retains cutting edge at very high machining temperature (see upper right graph)
- More aggressive machining reduces cycle time

ADVANTAGE #2
- Exceptional wear resistance at cutting edge
- Holds size far longer (see lower right graph)

ADVANTAGE #3
- Far longer runs before resharpening
- 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**

CARBIDE TIPPED VS. CARBIDE INSERT

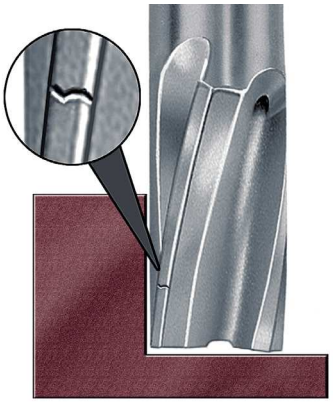
ADVANTAGE #1
- Initial tooling costs far lower for carbide tipped tools

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

CRACKED **CARBIDE TIPPED** TOOL **KEEPS CUTTING**

TOUGH ALLOY STEEL BODY STOPS CRACK



TOOL SELECTION USING CHIP CLASSIFICATIONS

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, 1Sb-9Sb 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-S-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

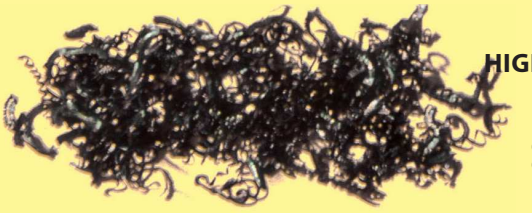
CHIP CLASS **80**

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

TOOL SELECTOR

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")

WORLD CLASS HC HT MADE IN USA

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

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																			
			⅛		¼		⅜		½		⅝		¾		1		1¼		1½	
	GENERAL PURPOSE	COOLANT 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	GEN. PUR-POSE	COOL-ANT FED
DRILL	250-350	375-550	.003	–	.005	.004	.007	.005	.008	.006	.010	.006	.011	.007	.014	.009	.017	–	.019	–
REAM	150-250	200-300	.004	–	.006	.008	.008	.010	.011	.013	.012	.015	.013	.017	.016	.021	.019	.022	.020	.024
DRILL	125-190	225-300	.002	–	.005	.004	.007	.005	.008	.006	.009	.007	.010	.008	.012	.010	.014	–	.016	–
REAM	50-90	70-105	.005	–	.006	.008	.008	.010	.010	.013	.011	.014	.012	.016	.014	.018	.016	.019	.017	.020
DRILL	350-450	400-500	.003	–	.005	.004	.006	.006	.007	.007	.008	.008	.009	.009	.013	.013	.015	–	.017	–
REAM	150-250	200-300	.002	–	.006	.008	.008	.010	.012	016	.014	.017	.015	.018	.018	.022	.021	.024	.022	.026
DRILL	175-450	–	.002	–	.004	–	.005	–	.005	–	.006	–	.008	–	.009	–	.010	–	.012	–
REAM	90-250	125-300	.004	–	.005	.006	.007	.008	.008	.009	.009	.010	.012	.014	.014	.016	.016	.018	.018	.020
DRILL	300-400	400-500	.003	–	.005	.004	.007	.005	.009	.006	.011	.008	.012	.009	.014	.010	.016	–	.018	–
REAM	140-210	170-240	.005	–	.007	.009	.008	.011	.010	.013	.011	.014	.012	.016	.015	.020	.018	.022	.020	.025
DRILL	125-190	200-300	.002	–	.005	.004	.007	.005	.008	.006	.009	.007	.010	.008	.012	.010	.014	–	.016	–
REAM	50-90	70-105	.004	–	.006	.008	.010	.013	.012	.015	.014	.016	.016	.018	.018	.021	.020	.024	.022	.028
DRILL	225-400	300-450	.003	–	.005	.004	.007	.005	.008	.006	.009	.007	.010	.008	.012	.010	.014	–	.016	–
REAM	100-250	125-300	.005	–	.008	.010	.011	.014	.015	.020	.017	.022	.018	.024	.020	.026	.022	.028	.025	.032
DRILL	300-400	450-550	.003	–	.005	.005	.006	.006	.007	.007	.008	.008	.009	.009	.013	.013	.015	–	.016	–
REAM	130-190	150-250	.005	–	.010	.012	.012	.015	.015	.018	.016	.019	.017	.020	.020	.024	.022	.026	.025	.028
DRILL	125-190	225-300	.002	–	.005	.004	.007	.005	.008	.006	.009	.007	.010	.008	.012	.010	.014	–	.016	–
REAM	50-90	70-190	.004	–	.006	.007	.008	.010	.010	.012	.011	.013	.012	.014	.014	.017	.015	.018	.016	.018
DRILL	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
REAM	45-70	65-100	.004	–	.006	.008	.007	.009	.008	.011	.010	.014	.013	.016	.015	.018	.018	.020	.020	.025
DRILL	150-225	200-250	.002	–	.004	.004	.006	.005	.008	.006	.010	.007	.012	.008	.014	.010	.016	–	.018	–
REAM	50-90	70-105	.004	–	.005	.007	.008	.010	.010	.012	.012	.015	.014	.017	.017	.022	.020	.024	.023	.027
DRILL	–	200-250	–	–	–	.004	–	.005	–	.006	–	.007	–	.008	–	.010	–	–	–	–
REAM	35-60	50-85	.004	–	.006	.008	.007	.009	.008	.010	.009	.011	.010	.013	.012	.014	.014	.017	.016	.019
DRILL	175-300	250-400	.002	–	.005	.004	.007	.006	.009	.008	.011	.010	.014	.012	.017	.015	.018	–	.019	–
REAM	65-135	95-190	.005	–	.008	.010	.010	.013	.011	.014	.013	.017	.016	.020	.020	.024	.022	.028	.025	.030
DRILL	130-225	225-325	.002	–	.004	.004	.006	.006	.007	.008	.009	.010	.010	.012	.013	.015	.016	–	.018	–
REAM	45-70	55-100	.004	–	.006	.008	.008	.010	.009	.012	.010	.014	.012	.015	.014	.018	.018	.020	.020	.026
DRILL	125-190	200-250	.002	–	.005	.004	.008	.006	.009	.008	.010	.008	.011	.008	.012	.010	.014	–	.016	–
REAM	60-120	70-105	.004	–	.006	.007	.010	.012	.011	.014	.012	.014	.013	.014	.014	.017	.016	.020	.018	.022
DRILL	100-150	200-250	.002	–	.004	.004	.006	.005	.007	.006	.008	.007	.010	.008	.012	.010	.014	–	.016	–
REAM	45-70	65-100	.004	–	.006	.008	.008	.010	.010	.012	.012	.014	.013	.015	.015	.020	.018	.023	.025	.030
DRILL	125-175	150-250	.003	–	.004	.005	.008	.006	.010	.008	.012	.009	.014	.010	.017	.012	.018	–	.019	–
REAM	70-100	100-150	.005	–	.008	.012	.010	.014	.012	.016	.014	.018	.015	.020	.020	.025	.025	.030	.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	–	100-220	–	–	–	.005	–	.006	–	.007	–	.008	–	.010	–	.012	–	–	–	–
REAM	65-100	90-135	.005	–	.008	.010	.010	.012	.015	.018	.017	.020	.018	.022	.022	.025	.025	.027	.027	.030
DRILL	–	100-150	–	–	–	.005	–	.006	–	.007	–	.008	–	.010	–	.012	–	–	–	–
REAM	40-85	65-100	.005	–	.010	.012	.012	.015	.015	.018	.018	.022	.020	.024	.025	.028	.027	.030	.030	.033
DRILL	–	110-150	–	–	–	.004	–	.005	–	.006	–	.007	–	.008	–	.010	–	–	–	–
REAM	40-90	50-100	.003	–	.005	.007	.006	.007	.007	.008	.008	.009	.008	.009	.010	.012	.011	.014	.012	.015
DRILL	100-150	125-190	.002	–	.004	.004	.005	.005	.006	.006	.007	.007	.008	.007	.010	.008	.012	–	.014	–
REAM	65-100	90-135	.004	–	.006	.008	.007	.009	.008	.010	.009	.011	.009	.012	.010	.013	.011	.013	.012	.014
DRILL	–	100-150	–	–	–	.004	–	.006	–	.007	–	.008	–	.010	–	.012	–	–	–	–
REAM	35-70	50-100	.004	–	.006	.007	.007	.008	.008	.009	.009	.011	.010	.012	.011	.014	.012	.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

GENERAL PURPOSE | MATERIAL SPECIFIC | COOLANT FED

BENEFITS OF USING COATED TOOLS

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

COATING SELECTOR GUIDE

CHIP CLASS	MATERIAL MACHINED	DRILLING	REAMING	COUNTERBORING		MILLING	
		WET	WET	WET	DRY	WET	DRY
20	NON-FERRROUS 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

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.
- Resharpening policy to only resharpen 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.

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_aµm)	.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

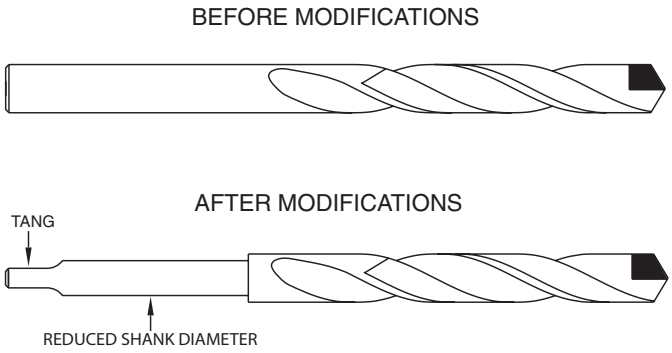
Over 20% of standard tools ordered specify one or more modifications

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

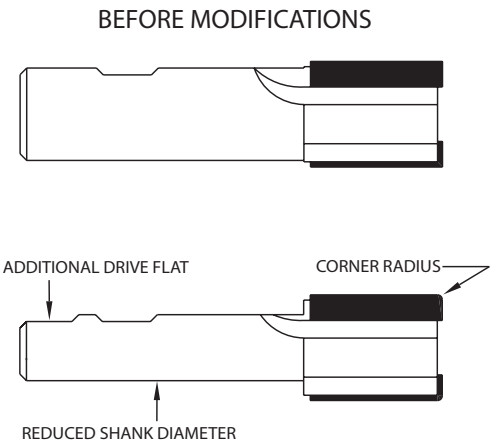
DRILLS

- 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



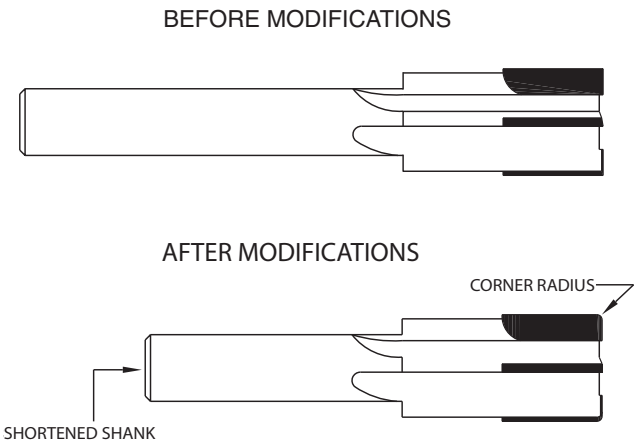
END MILLS

- 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



COUNTERBORES

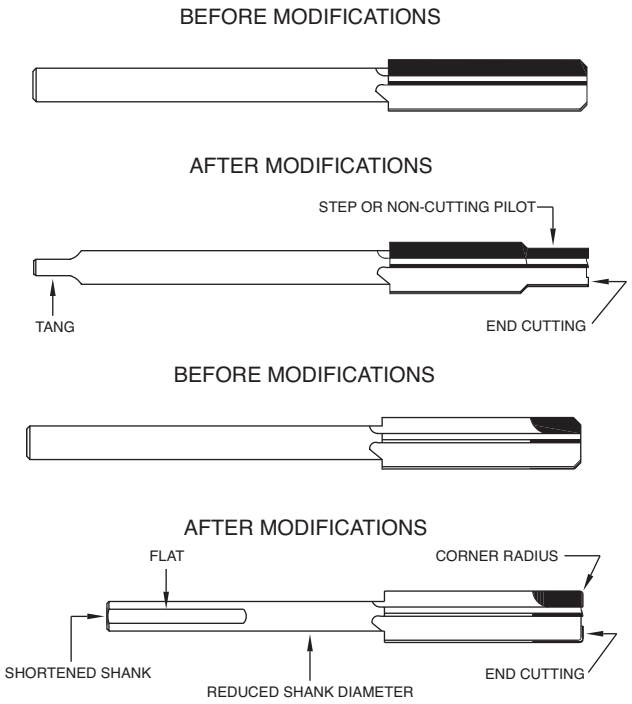
- Modified tool diameter
- Non-stocked metric tool diameter
- Cutting diameter reduced for step
- Corner chamfer or corner radius
- Shortened shank
- Reduced shank diameter
- Flat(s) on shank
- Tanged shank
- Shank whistle notch for set screw
- Smaller taper shank
- Coatings available:
  - TITANIUM NITRIDE – TiN
  - TITANIUM CARBONITRIDE – TiCN
  - ZIRCONIUM NITRIDE – ZrN
  - AL TITANIUM NITRIDE – AlTiN



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:

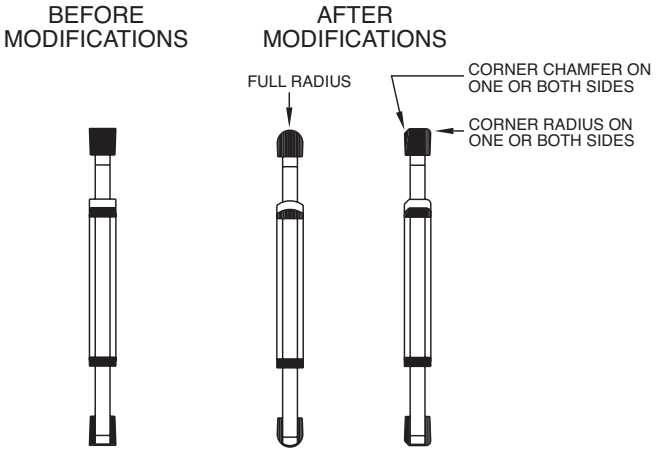
TITANIUM NITRIDE – TiN
TITANIUM CARBONITRIDE – TiCN
ZIRCONIUM NITRIDE – ZrN
AL TITANIUM NITRIDE – AlTiN



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:

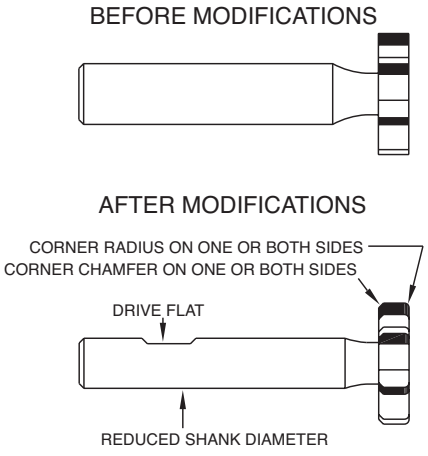
TITANIUM NITRIDE – TiN
TITANIUM CARBONITRIDE – TiCN
ZIRCONIUM NITRIDE – ZrN
AL TITANIUM NITRIDE – AlTiN



KEYSEAT CUTTERS & MISCELLANEOUS CUTTERS

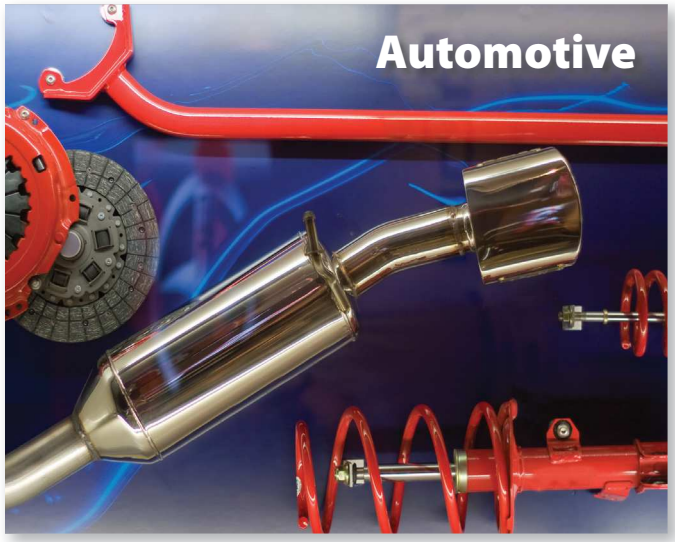
- Modified tool diameter
- Metric tool diameter
- Modified face width
- Metric face width
- Corner chamfer or corner radius on one side
- Corner chamfer or corner radius on both sides
- Reduced neck diameter
- Shortened shank
- Reduced shank diameter
- Shank drive flat(s)
- Coatings available:

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



SPECIAL ENGINEERED TOOLS TO PRINT

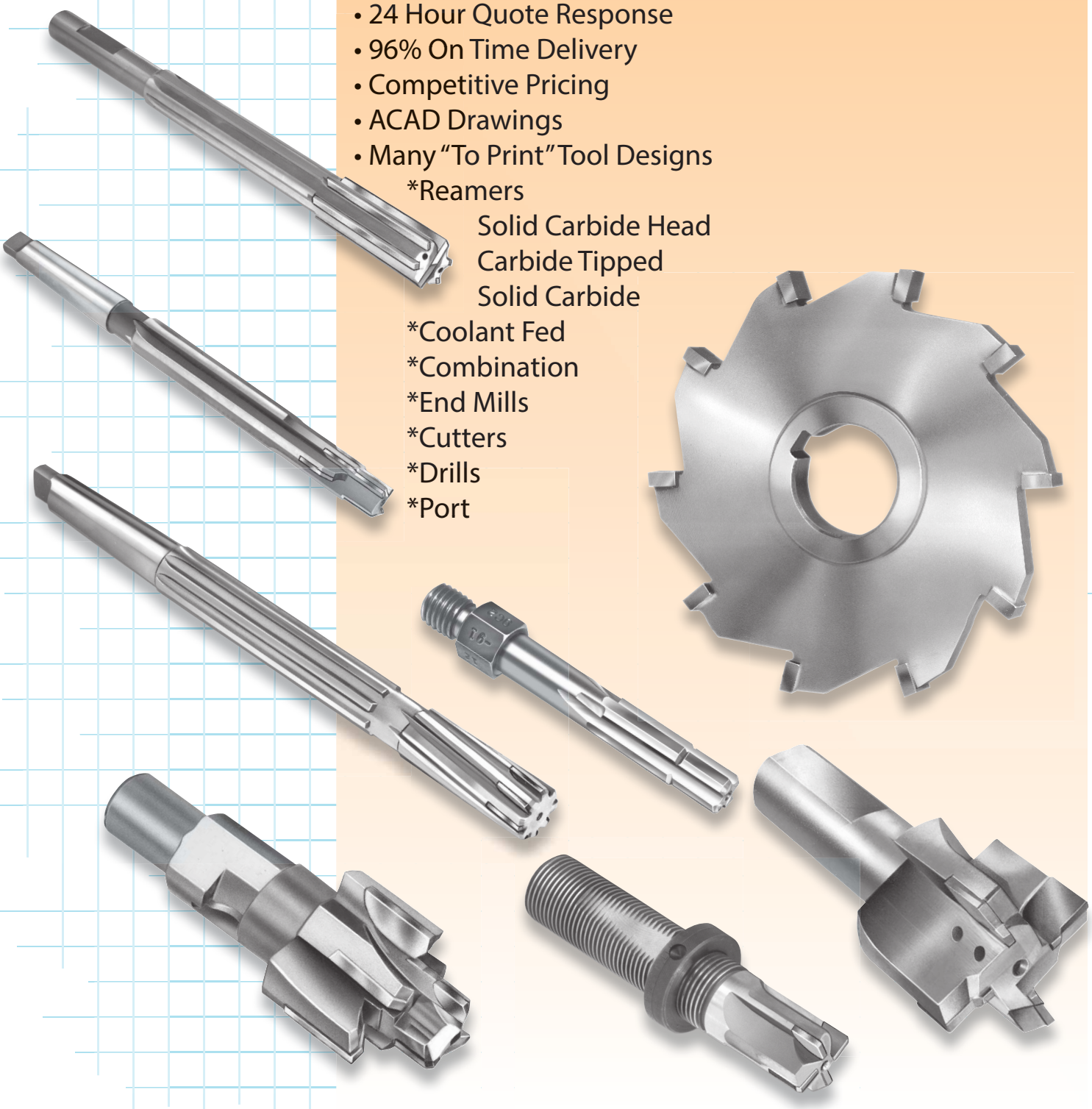
QUALITY "MADE TO PRINT" TOOLS FOR ALL MANUFACTURING SECTORS



SPECIAL ENGINEERED TOOLS TO PRINT

ENGINEERED TOOLS TO YOUR SPECIFICATIONS

- 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



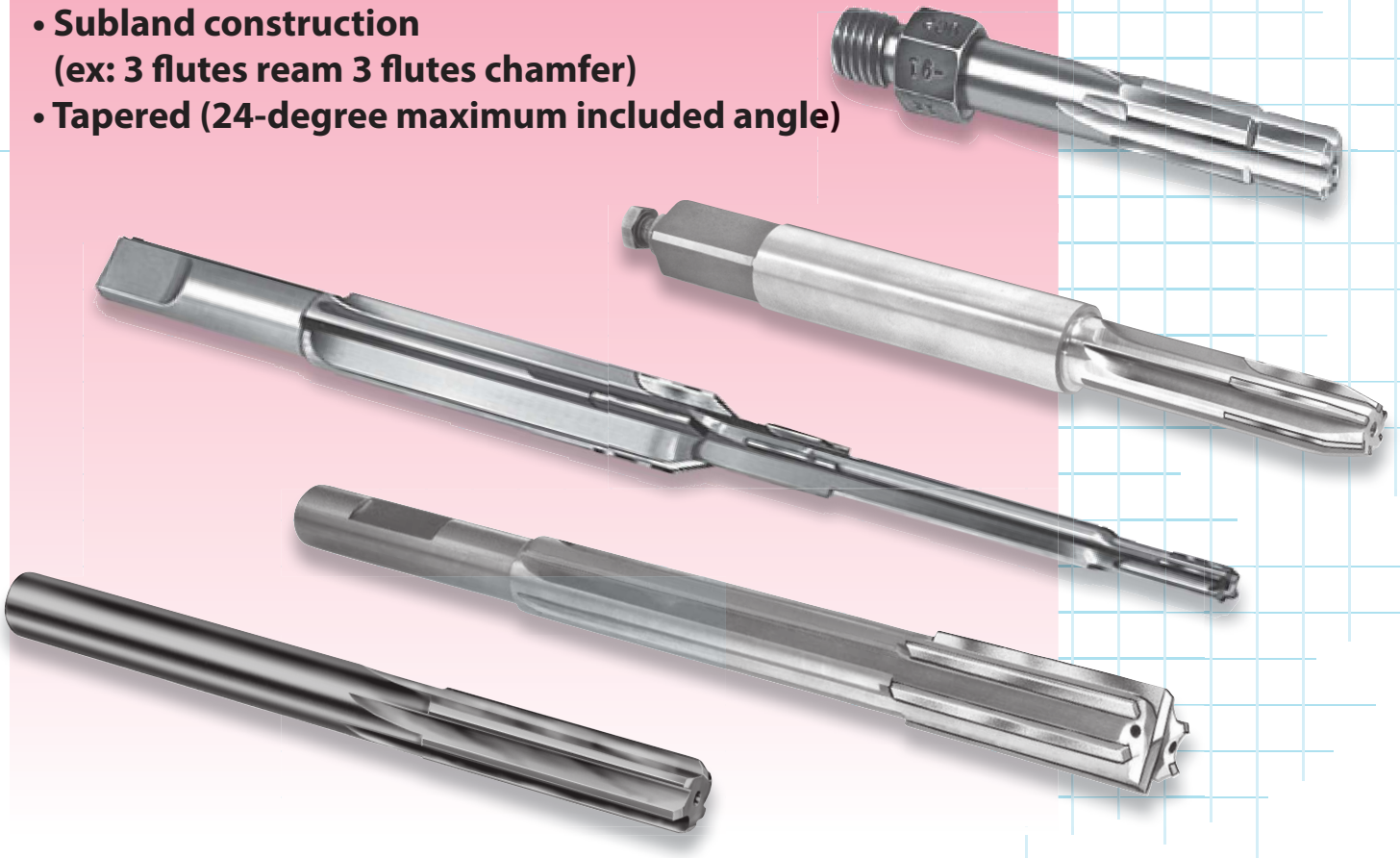
SPECIAL ENGINEERED TOOLS TO PRINT

QUALITY "MADE TO PRINT" TOOLS FOR ALL MANUFACTURING SECTORS

REAMERS

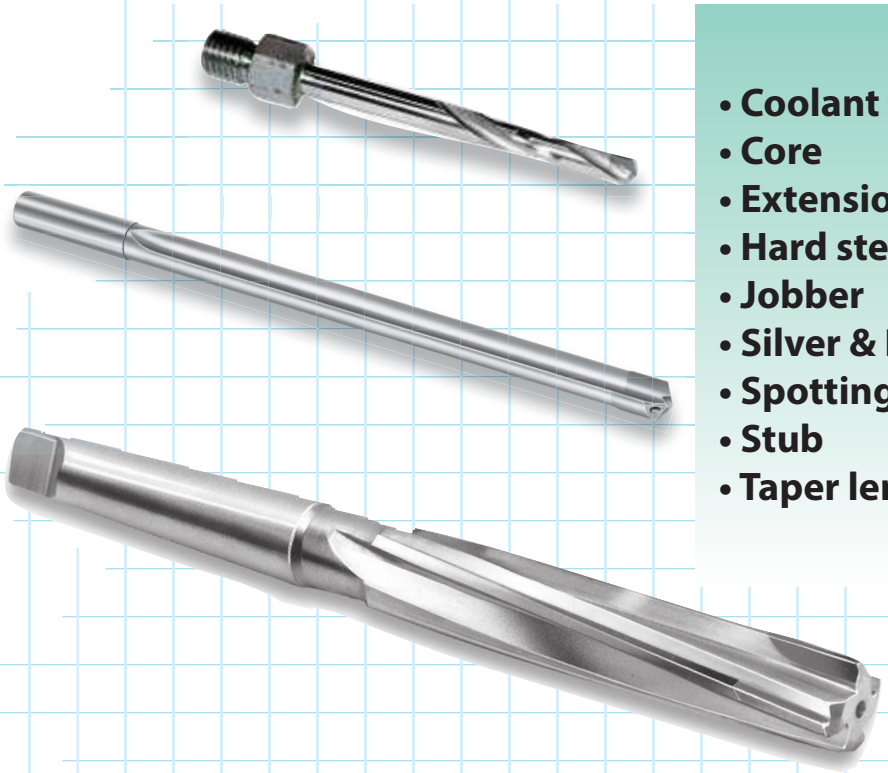
Carbide Tipped – Solid Carbide – Solid Carbide Head

- **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)**



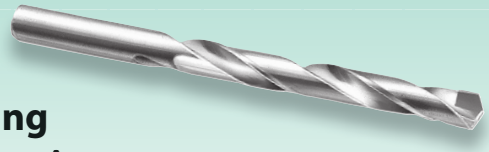
SPECIAL ENGINEERED TOOLS TO PRINT

ENGINEERED TOOLS TO YOUR SPECIFICATIONS



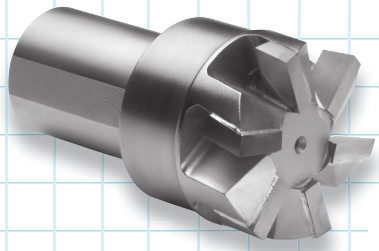
DRILLS

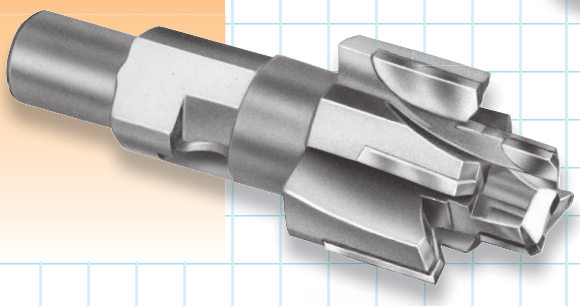
- Coolant fed — straight and spiral flutes
- Core
- Extension
- Hard steel
- Jobber
- Silver & Deming
- Spotting/Centering
- Stub
- Taper length

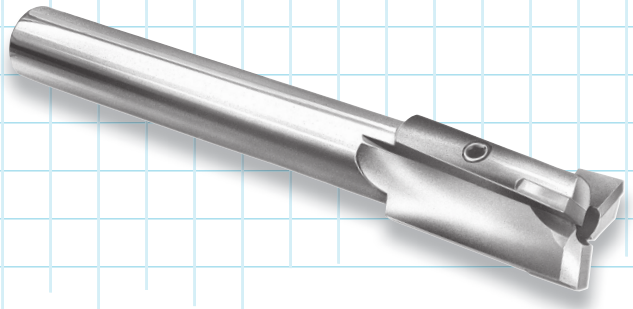


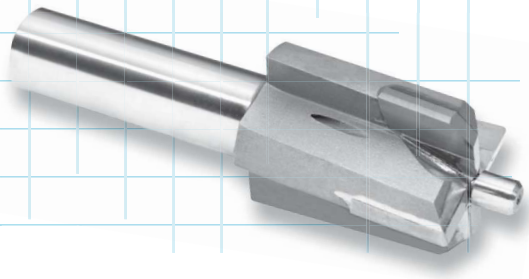
COUNTERBORES & SPOT FACE

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



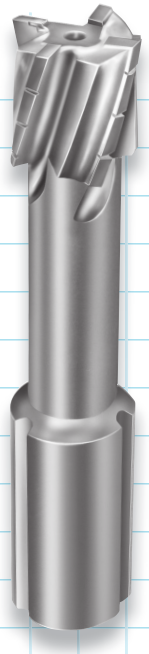






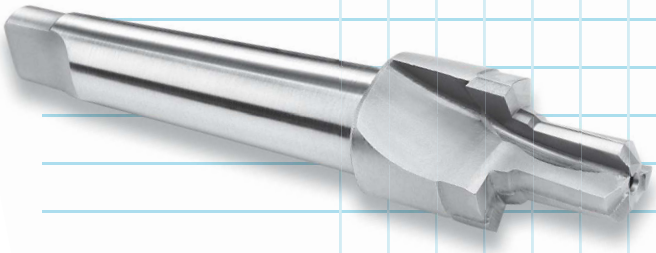
SPECIAL ENGINEERED TOOLS TO PRINT

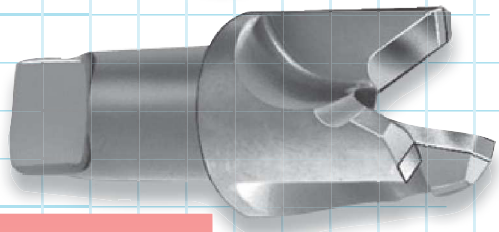
ENGINEERED TOOLS TO YOUR SPECIFICATIONS



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)

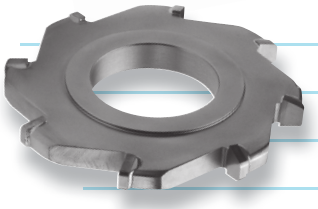


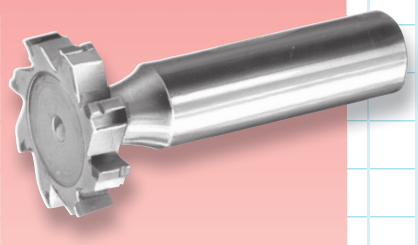


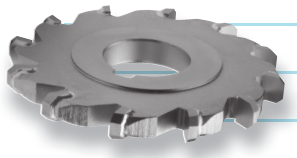
CUTTERS

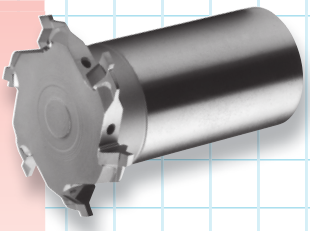
SHANK TYPE

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



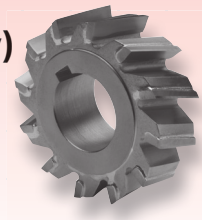






ARBOR MOUNTED TYPE

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

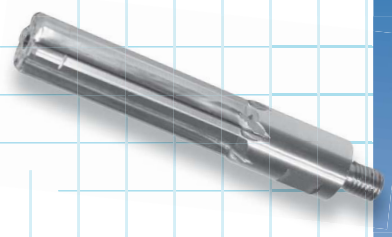


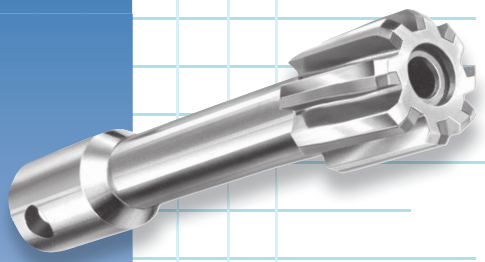
SPECIAL ENGINEERED TOOLS TO PRINT

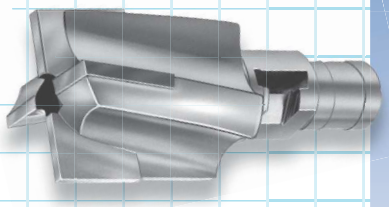
QUALITY "MADE TO PRINT" TOOLS FOR ALL MANUFACTURING SECTORS

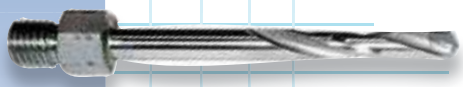
SHANK CONFIGURATIONS

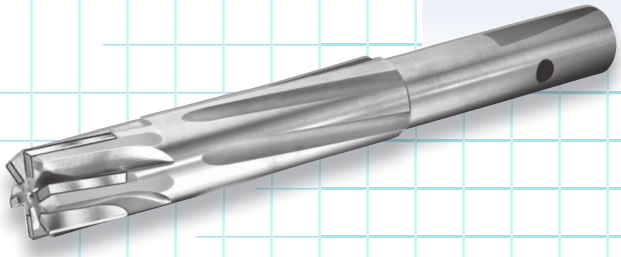
- Acme thread with nut
- End adjusting screw (for length pre-setting)
- Hex adapter
- Pin drive
- Quick-change adapters
- Radial drive
- Square drive
- Straight
- Tanged
- Taper
- Threaded
- Weldon flats
- Whistle notch

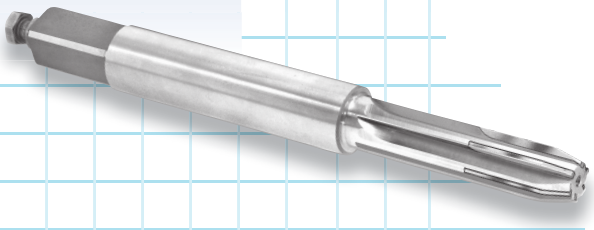


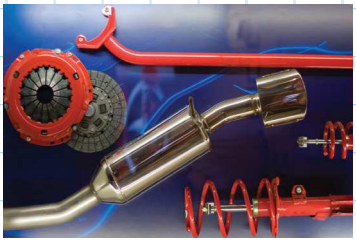








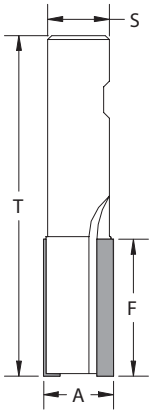




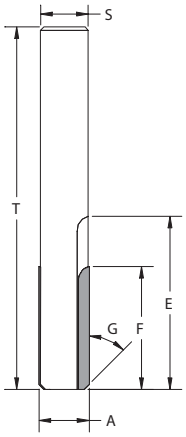
CARBIDE TIPPED SPECIALS QUOTE FORM

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

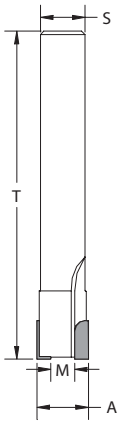
CARBIDE TIPPED - SHANK TYPE TOOLS



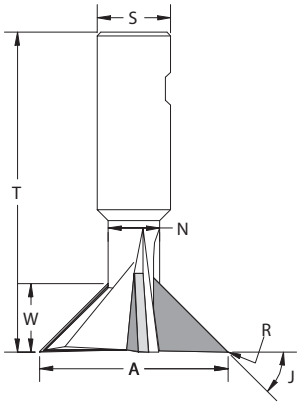
❑ **END MILL**



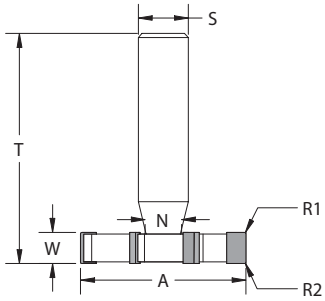
❑ **REAMER**



❑ **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
G= _____° Chamfer Angle

FLUTES

E= _____ Flute Length F= _____ Carbide Length

❑ 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
N= _____ Neck Diameter

❑ Straight Tooth
❑ Staggered Tooth

R1= _____ Radius/Chamfer
R2= _____ Radius/Chamfer

IF DOVETAIL

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

ADDITIONAL APPLICATION NOTES: _____

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

CARBIDE TIPPED SPECIALS QUOTE FORM

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

CARBIDE TIPPED - ARBOR TYPE TOOLS

D= _____ **Cutter Diameter**

W= _____ **Cutter Width**

A= _____ **Arbor Hole Diam.**

N= _____ **# of Teeth**

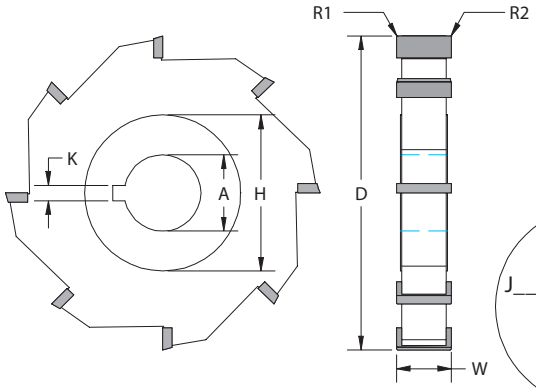
H= _____ **Hub Diameter**

K= _____ **Keyway Size**

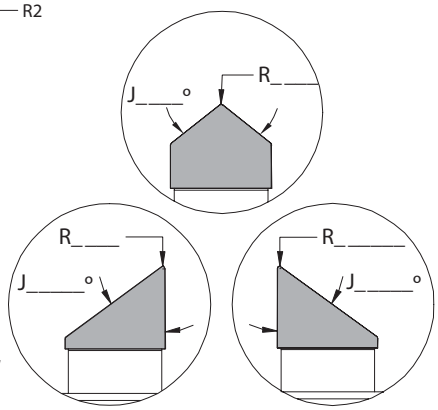
R1= _____ **Radius/Chamfer**

R2= _____ **Radius/Chamfer**

❑ **Straight Tooth**
❑ **Straight Stagger**
❑ **Herringbone Stagger**



❑ **MILLING CUTTER**
❑ **SLITTING SAW**



❑ **ANGLE CUTTER**
(Fill in "J" & "R")

QUOTE REQUEST FORM:

INDIVIDUAL: _____

COMPANY: _____

CITY/STATE: _____

FAX #: _____ **PHONE #:** _____

QUANTITY BREAKS: _____ **pcs** _____ **pcs** _____ **pcs** _____ **pcs**

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

❑ **20** ❑ **40** ❑ **60** ❑ **80** ❑ **100** ❑ **120** ❑ **140** ❑ **Other Material** _____

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

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

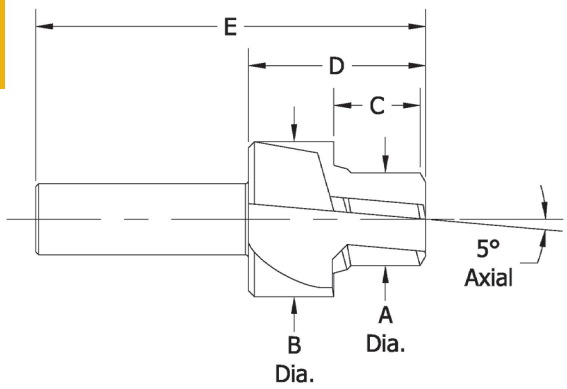
LIMITED WARRANTY

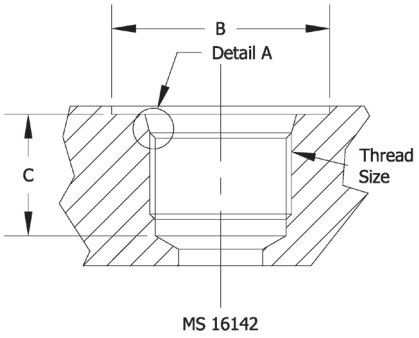
Hannibal Carbide Tool, Inc. does not give any warranty on its products except as follows: Hannibal Carbide Tool, Inc. warrants to original equipment manufacturers, distributors and industrial and commercial users of its products that each new product manufactured or supplied by Hannibal Carbide Tool,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

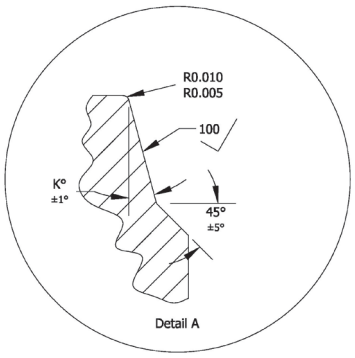
THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Hannibal Carbide Tool, Inc. shall have no liability or responsibility on any claim of any kind, whether in contract, tort or otherwise, for any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

SPECIAL PORT CONTOUR TOOLS CARBIDE TIPPED

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







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

B = _____ SPOTFACE DIAMETER

C = _____ REAMER LENGTH

D = _____ HEAD LENGTH

E = _____ OVERALL 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

FLUTE STYLES

Straight:

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

Right Hand Spiral:

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

Left Hand Spiral:

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

Expansion Reamers:

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

COOLANT OPTIONS

Center Fed Coolant (axial):

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

Flute Fed Coolant (radial):

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

REAMER GUIDE

BASIC TECHNICAL INFORMATION FOR REAMERS

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

OPTIMUM OPERATING CONDITIONS

Stock Removal:

2%-3% of the reamer diameter will normally be appropriate stock removal when reaming.
Example: a .500" diameter tool would remove .010"-.015" of stock.
Example: a 1.0" diameter tool would remove .020"-.030" of stock.
These examples cover finish reaming.
When your application calls for a rough ream, stock removal can be up to 5%
See "Pre-Ream Drill Size Chart" on page 26.

Runout (TIR) Concerns:

One of the most overlooked areas in reaming.
It is critical to the function of the tool to be running concentric with the machine spindle.
Some of the most important areas to consider include:

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

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

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

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

Coolant feeding reamers:

Coolant induced thru the reamer should be utilitized 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

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

GENERAL PURPOSE | MATERIAL SPECIFIC | COOLANT FED

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
	STRAIGHT	480 - pg. 74	–	480 - pg. 74	–	480 - pg. 74	–	480 - pg. 74	–
	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

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

REAMER SELECTOR

CHIP CLASS	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**
		ABRASIVE - OVER 10% SILICON	HSS	Cobalt	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**
40	**NON-FERROUS** SHORT CHIPS	SOFT - FREE MACHINING	HSS	HSS	HSS	HSS	**CT**	**CT**	**CT**	**CT**	**CT**
		HARD - HIGH TENSILE	HSS	Cobalt	Cobalt	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**
60	**CAST IRONS**	SOFT - 120 TO 220 Bhn	HSS	HSS	HSS	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**
		MEDIUM - 220 to 300 Bhn	HSS	Cobalt	Cobalt	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**
		HARD - OVER 300 Bhn	HSS	Cobalt	**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**
		MEDIUM - 176 TO 275 Bhn	HSS	Cobalt	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**
		HARD - OVER 275 Bhn	Cobalt	Cobalt	**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**
		MEDIUM - 276 TO 425 Bhn	HSS	Cobalt	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**
		HARD - OVER 45 Rc	Cobalt	**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**
		MEDIUM - 276 TO 425 Bhn	Cobalt	Cobalt	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**
		HARD - OVER 45 Rc	Cobalt	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**	**CT**
140	**HIGH TEMP ALLOYS**	ALL CONDITIONS	**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	Regrind reamer with equal chamfer height
	Incorrect margins	Regrind reamer with narrower margins for reaming higher tensile materials
	Excessive spindle runout	Use bushing — .0002"/.0003" over reamer diameter
	Chatter	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
	Insufficient cutting action	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	Check fixturing & setup for possible causes; use floating holder if necessary Consider using precision bushings or piloted reamers
	Incorrect feed and/or speed	Verify feeds & speeds (see pages 8 & 9)
3. EXCESSIVE TOOL WEAR	Improper stock removal	Change pre-ream hole size to leave 2 to 3% of tool diameter
	Excessive reaming pressure	Decrease feed rate (see "Feeds & Speeds" Chart on pages 8 & 9)
		See solution for "improper stock removal" in #3
	Misalignment	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	See solution for "excessive reaming pressure" in #3
	Misalignment	See solution for "misalignment" in #2

CARBIDE TIPPED REAMERS TECHNICAL INFORMATION

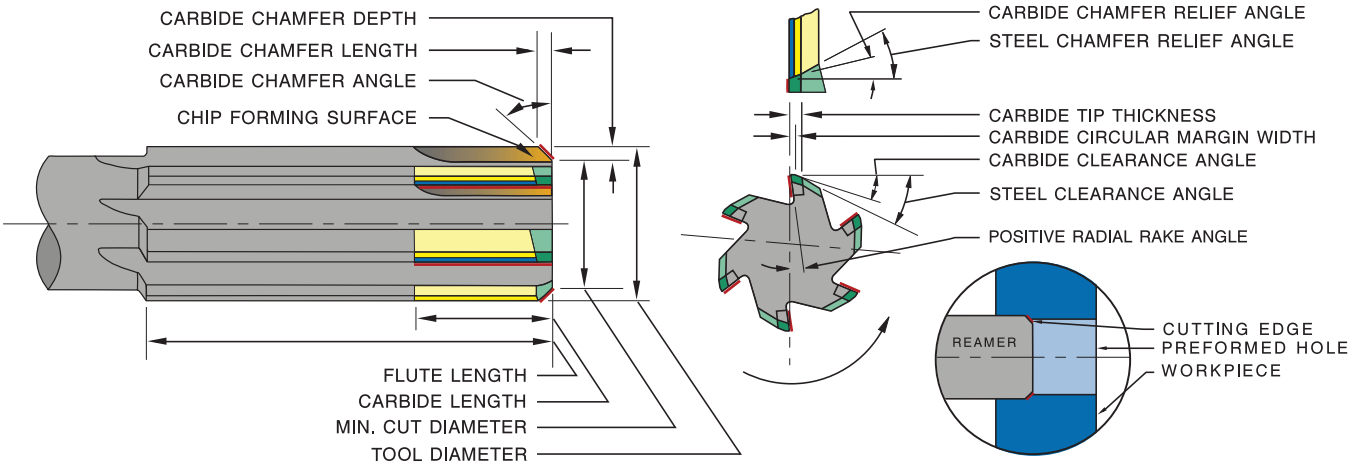
REAMER BASICS

- 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 recieved 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 9/16" - 2 1/2"	.015"

REAMER TOLERANCES

- Tool diameter tolerance:
  General purpose & **Coolant fed**
  Thru 1½" tool diameter: plus .0003", minus .0000"
  Over 1½" tool diameter: plus .0004", minus .0000"
  Material specific (excluding coolant fed)
  Thru ½" tool diameter: plus .0002", minus .0000"
  Over ½" tool diameter thru ¾": plus .0003", minus .0000"
  Over ¾" tool diameter: plus .0004", minus .0000"
- Closer tool diameter tolerance pricing per tool:

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

- Shank diameter tolerance:
  General purpose
  minus .0005", minus .0015"
  Material specific (NAS) & Coolant fed
  Thru 23/32" tool diameter: plus .0000", minus .0010"
  Over 23/32" tool diameter: plus .0000", minus .0015"

REAMERS INDEX AND COMPARISON CHART

DESCRIPTION	HANNIBAL FRAC. PAGE	HANNIBAL METRIC PAGE	HANNIBAL TOOL TYPE	CJT	CLEVELAND	FULLERTON	IMCO	MORSE	MAFORD
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

MATERIAL SPECIFIC COOLANT FED

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 MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH OVER-ALL	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
0.3471 - 0.3780	41412h6	42412h6	43412h6	.3125	4	1 ¾	5	$238.10	$212.40	$203.90	$199.75	$195.30	$191.95
0.3781 - 0.4090	41413h6	42413h6	43413h6	.3125	4	1 ¾	5	238.60	213.10	204.55	200.40	196.05	192.45
0.4091 - 0.4410	41414h6	42414h6	43414h6	.3750	6	1 ¾	5	240.65	214.95	206.35	202.35	197.80	194.45
0.4411 - 0.4720	41415h6	42415h6	43415h6	.3750	6	1 ¾	5	242.25	216.60	208.00	203.95	199.50	196.10
0.4721 - 0.5030	41416h6	42416h6	43416h6	.4375	6	2	6	244.45	218.80	210.25	206.20	201.75	198.30
0.5031 - 0.5340	41417h6	42417h6	43417h6	.4375	6	2	6	248.65	223.00	214.50	210.45	206.10	202.60
0.5341 - 0.5660	41418h6	42418h6	43418h6	.4375	6	2	6	251.60	225.95	217.35	213.30	208.95	205.40
0.5661 - 0.5970	41419h6	42419h6	43419h6	.4375	6	2	6	255.75	230.05	221.45	217.45	213.10	209.65
0.5971 - 0.6280	41420h6	42420h6	43420h6	.5625	6	2 ¼	6	259.60	234.00	225.40	221.30	216.95	213.45
0.6281 - 0.6590	41421h6	42421h6	43421h6	.5625	6	2 ¼	6	281.90	256.30	247.65	243.70	239.25	235.80
0.6591 - 0.6910	41422h6	42422h6	43422h6	.5625	6	2 ¼	6	286.60	261.00	252.45	248.40	243.85	240.45
0.6911 - 0.7220	41423h6	42423h6	43423h6	.5625	6	2 ¼	6	296.70	271.20	262.60	258.45	254.10	250.60
0.7221 - 0.7530	41424h6	42424h6	43424h6	.6250	6	2 ½	6	296.70	271.20	262.60	258.45	254.10	250.60
0.7531 - 0.7840	41425h6	42425h6	43425h6	.6250	6	2 ½	6	304.05	278.45	269.80	265.75	261.40	257.85
0.7841 - 0.8160	41426h6	42426h6	43426h6	.6250	6	2 ½	6	304.05	278.45	269.80	265.75	261.40	257.85
0.8161 - 0.8470	41427h6	42427h6	43427h6	.6250	6	2 ½	6	312.70	287.00	278.50	274.35	269.90	266.40
0.8471 - 0.8780	41428h6	42428h6	43428h6	.7500	6	2 ⅝	6	322.80	297.15	288.55	284.50	280.10	276.60
0.8781 - 0.9090	41429h6	42429h6	43429h6	.7500	6	2 ⅝	6	352.80	327.20	318.60	314.55	310.15	306.65
0.9091 - 0.9410	41430h6	42430h6	43430h6	.7500	8	2 ⅝	6	352.80	327.20	318.60	314.55	310.15	306.65
0.9411 - 0.9720	41431h6	42431h6	43431h6	.7500	8	2 ⅝	6	353.95	328.25	319.75	315.65	311.20	307.75
0.9721 - 1.0030	41432h6	42432h6	43432h6	.8750	8	2 ¾	6	353.95	328.25	319.75	315.65	311.20	307.75

CENTER FED FOR BLIND HOLES STRAIGHT FLUTES & SHANK

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

MODIFICATIONS

MATERIAL SPECIFIC COOLANT FED

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

TOOL DIAMETER RANGE	TYPE 414h6 NON FERROUS EDP NO.	TYPE 424h6 CAST IRON EDP NO.	TYPE 434h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS MAX. SHANK DIAM. (mm)	NO. OF FLTS	LENGTH FLT (mm)	LENGTH OVER-ALL (mm)	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
8.815 - 9.601	414095h6	424095h6	434095h6	8	4	45	127	$242.40	$216.80	$208.20	$204.00	$199.75	$196.15
9.602 - 10.389	414100h6	424100h6	434100h6	8	4	45	127	243.00	217.45	208.95	204.70	200.40	196.75
10.390 - 11.201	414110h6	424110h6	434110h6	10	6	45	127	244.80	219.40	210.80	206.65	202.35	198.75
11.202 - 12.000	414120h6	424120h6	434120h6	10	6	45	127	246.55	221.05	212.40	208.20	203.95	200.40
12.001 - 12.875	414125h6	424125h6	434125h6	10	6	51	153	248.65	223.35	214.55	210.45	206.20	202.60
12.876 - 13.565	414135h6	424135h6	434135h6	12	6	51	153	253.00	227.60	218.90	214.80	210.45	206.85
13.566 - 14.376	414140h6	424140h6	434140h6	12	6	51	153	255.85	230.30	221.75	217.50	213.30	209.70
14.377 - 15.164	414150h6	424150h6	434150h6	12	6	51	153	260.05	234.45	225.95	221.75	217.45	213.85
15.165 - 16.100	414160h6	424160h6	434160h6	14	6	57	153	263.90	238.45	229.80	225.55	221.30	217.75
16.101 - 16.740	414165h6	424165h6	434165h6	14	6	57	153	286.20	260.60	252.05	247.90	243.70	240.10
16.741 - 17.551	414175h6	424175h6	434175h6	14	6	57	153	290.90	265.45	256.90	252.65	248.40	244.75
17.552 - 18.340	414180h6	424180h6	434180h6	14	6	57	153	301.00	275.60	266.95	262.85	258.45	254.90
18.341 - 19.250	414190h6	424190h6	434190h6	16	6	64	153	301.00	275.60	266.95	262.85	258.45	254.90
19.251 - 20.126	414200h6	424200h6	434200h6	16	6	64	153	303.55	277.80	269.25	265.15	260.75	257.20
20.127 - 21.127	414210h6	424210h6	434210h6	16	6	64	153	312.10	286.45	277.85	273.75	269.35	265.90
21.128 - 22.127	414220h6	424220h6	434220h6	20	6	64	153	312.10	286.45	277.85	273.75	269.35	265.90
22.128 - 23.127	414230h6	424230h6	434230h6	20	6	67	153	352.10	326.40	317.90	313.70	309.40	305.90
23.128 - 24.127	414240h6	424240h6	434240h6	20	8	67	153	353.25	327.60	319.05	314.90	310.55	307.05
24.128 - 25.127	414250h6	424250h6	434250h6	20	8	70	153	353.25	327.60	319.05	314.90	310.55	307.05

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

PRECISION h6 SHANK REAMERS CARBIDE TIPPED TYPES 416h6, 426h6, 435h6 FRACTIONAL & METRIC

MATERIAL SPECIFIC · COOLANT FED

FLUTE FED FOR THRU HOLES STRAIGHT FLUTES & SHANK

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

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

TOOL DIAMETER RANGE	TYPE 416h6 NON FERROUS EDP NO.	TYPE 426h6 CAST IRON EDP NO.	TYPE 435h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH OVER-ALL	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
0.3471 - 0.3780	41612h6	42612h6	43512h6	.3125	4	1 ¾	5	$239.70	$214.15	$205.55	$201.50	$197.15	$193.55
0.3781 - 0.4090	41613h6	42613h6	43513h6	.3125	4	1 ¾	5	244.45	218.80	210.25	206.20	201.75	198.30
0.4091 - 0.4410	41614h6	42614h6	43514h6	.3750	6	1 ¾	5	249.05	223.50	214.95	210.85	206.50	203.00
0.4411 - 0.4720	41615h6	42615h6	43515h6	.3750	6	1 ¾	5	249.05	223.50	214.95	210.85	206.50	203.00
0.4721 - 0.5030	41616h6	42616h6	43516h6	.4375	6	2	6	249.05	223.50	214.95	210.85	206.50	203.00
0.5031 - 0.5340	41617h6	42617h6	43517h6	.4375	6	2	6	260.50	234.95	226.40	222.35	217.90	214.45
0.5341 - 0.5660	41618h6	42618h6	43518h6	.4375	6	2	6	263.45	237.95	229.25	225.20	220.80	217.35
0.5661 - 0.5970	41619h6	42619h6	43519h6	.4375	6	2	6	265.50	239.80	231.25	227.10	222.70	219.40
0.5971 - 0.6280	41620h6	42620h6	43520h6	.5625	6	2 ¼	6	265.50	239.80	231.25	227.10	222.70	219.40
0.6281 - 0.6590	41621h6	42621h6	43521h6	.5625	6	2 ¼	6	288.75	263.15	254.40	250.45	246.00	242.55
0.6591 - 0.6910	41622h6	42622h6	43522h6	.5625	6	2 ¼	6	288.75	263.15	254.40	250.45	246.00	242.55
0.6911 - 0.7220	41623h6	42623h6	43523h6	.5625	6	2 ¼	6	305.05	279.35	270.80	266.80	262.25	258.90
0.7221 - 0.7530	41624h6	42624h6	43524h6	.6250	6	2 ½	6	305.05	279.35	270.80	266.80	262.25	258.90
0.7531 - 0.7840	41625h6	42625h6	43525h6	.6250	6	2 ½	6	306.10	280.35	271.90	267.75	263.35	259.90
0.7841 - 0.8160	41626h6	42626h6	43526h6	.6250	6	2 ½	6	306.10	280.35	271.90	267.75	263.35	259.90
0.8161 - 0.8470	41627h6	42627h6	43527h6	.6250	6	2 ½	6	313.65	288.10	279.50	275.45	271.00	267.50
0.8471 - 0.8780	41628h6	42628h6	43528h6	.7500	6	2 ⅝	6	323.85	298.15	289.65	285.50	281.15	277.70
0.8781 - 0.9090	41629h6	42629h6	43529h6	.7500	6	2 ⅝	6	357.45	331.80	323.20	319.10	314.70	311.20
0.9091 - 0.9410	41630h6	42630h6	43530h6	.7500	8	2 ⅝	6	364.45	338.75	330.25	326.15	321.70	318.30
0.9411 - 0.9720	41631h6	42631h6	43531h6	.7500	8	2 ⅝	6	364.45	338.75	330.25	326.15	321.70	318.30
0.9721 - 1.0030	41632h6	42632h6	43532h6	.8750	8	2 ¾	6	364.45	338.75	330.25	326.15	321.70	318.30

FLUTE FED FOR THRU HOLES STRAIGHT FLUTES & SHANK

TYPE 416h6 - FOR NON-FERROUS MATERIALS - METRIC
TYPE 426h6 - FOR CAST IRONS & MULTI-PURPOSE - METRIC
TYPE 435h6 - FOR STEELS & HIGH TEMP ALLOYS - METRIC

• Coolant outlets in each flute • Polished flutes • Flute long carbide

MODIFICATIONS

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

MATERIAL SPECIFIC · COOLANT FED

TOOL DIAMETER RANGE	TYPE 416h6 NON FERROUS EDP NO.	TYPE 426h6 CAST IRON EDP NO.	TYPE 435h6 STEEL/ HI-TEMP EDP NO.	DIMENSIONS MAX. SHANK DIAM. (mm)	NO. OF FLTS	LENGTH FLT (mm)	LENGTH OVER-ALL (mm)	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
8.815 - 9.601	416095h6	426095h6	435095h6	8	4	45	127	$244.00	$218.50	$209.85	$205.70	$201.50	$197.80
9.602 - 10.389	416100h6	426100h6	435100h6	8	4	45	127	248.65	223.35	214.55	210.45	206.20	202.60
10.390 - 11.201	416110h6	426110h6	435110h6	10	6	45	127	253.40	227.90	219.40	215.10	210.85	207.30
11.202 - 12.000	416120h6	426120h6	435120h6	10	6	45	127	253.40	227.90	219.40	215.10	210.85	207.30
12.001 - 12.875	416125h6	426125h6	435125h6	10	6	51	153	253.40	227.90	219.40	215.10	210.85	207.30
12.876 - 13.565	416135h6	426135h6	435135h6	12	6	51	153	264.75	239.30	230.70	226.60	222.35	218.65
13.566 - 14.376	416140h6	426140h6	435140h6	12	6	51	153	267.75	242.25	233.75	229.55	225.20	221.70
14.377 - 15.164	416150h6	426150h6	435150h6	12	6	51	153	269.80	244.25	235.65	231.45	227.10	223.65
15.165 - 16.100	416160h6	426160h6	435160h6	14	6	57	153	269.80	244.25	235.65	231.45	227.10	223.65
16.101 - 16.740	416165h6	426165h6	435165h6	14	6	57	153	293.15	267.45	258.90	254.75	250.45	246.85
16.741 - 17.551	416175h6	426175h6	435175h6	14	6	57	153	293.15	267.45	258.90	254.75	250.45	246.85
17.552 - 18.340	416180h6	426180h6	435180h6	14	6	57	153	309.30	283.75	275.10	271.00	266.80	263.20
18.341 - 19.250	416190h6	426190h6	435190h6	16	6	64	153	309.30	283.75	275.10	271.00	266.80	263.20
19.251 - 20.126	416200h6	426200h6	435200h6	16	6	64	153	305.55	279.95	271.35	267.30	262.90	259.35
20.127 - 21.127	416210h6	426210h6	435210h6	16	6	64	153	313.15	287.45	278.90	274.85	270.40	266.95
21.128 - 22.127	416220h6	426220h6	435220h6	20	6	64	153	313.15	287.45	278.90	274.85	270.40	266.95
22.128 - 23.127	416230h6	426230h6	435230h6	20	6	67	153	356.80	331.15	322.55	318.50	314.10	310.55
23.128 - 24.127	416240h6	426240h6	435240h6	20	8	67	153	363.80	338.25	329.65	325.55	321.10	317.65
24.128 - 25.127	416250h6	426250h6	435250h6	20	8	70	153	363.80	338.25	329.65	325.55	321.10	317.65

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

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

MATERIAL SPECIFIC · COOLANT FED

CENTER FED FOR BLIND HOLES RIGHT SPIRAL FLUTES

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

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

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 PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH OVER-ALL	1	2	3	4	5-7	8-14*
0.3471 0.3780	41112h6	41312h6	41512h6	.3125	4	1 ¾	5	$242.75	$217.20	$208.60	$204.55	$200.15	$196.60
0.3781 0.4090	41113h6	41313h6	41513h6	.3125	4	1 ¾	5	243.35	217.65	209.15	205.05	200.60	197.20
0.4091 0.4410	41114h6	41314h6	41514h6	.3750	6	1 ¾	5	245.35	219.65	211.10	207.00	202.65	199.15
0.4411 0.4720	41115h6	41315h6	41515h6	.3750	6	1 ¾	5	247.15	221.45	212.90	208.85	204.45	200.95
0.4721 0.5030	41116h6	41316h6	41516h6	.4375	6	2	6	254.85	229.15	220.60	216.50	212.10	208.60
0.5031 0.5340	41117h6	41317h6	41517h6	.4375	6	2	6	262.25	236.65	228.00	223.95	219.55	216.05
0.5341 0.5660	41118h6	41318h6	41518h6	.4375	6	2	6	262.25	236.65	228.00	223.95	219.55	216.05
0.5661 0.5970	41119h6	41319h6	41519h6	.4375	6	2	6	270.65	244.90	236.40	232.25	227.85	224.40
0.5971 0.6280	41120h6	41320h6	41520h6	.5625	6	2 ¼	6	270.65	244.90	236.40	232.25	227.85	224.40
0.6281 0.6590	41121h6	41321h6	41521h6	.5625	6	2 ¼	6	299.10	273.50	264.90	260.85	256.40	252.90
0.6591 0.6910	41122h6	41322h6	41522h6	.5625	6	2 ¼	6	299.10	273.50	264.90	260.85	256.40	252.90
0.6911 0.7220	41123h6	41323h6	41523h6	.5625	6	2 ¼	6	309.85	284.15	275.60	271.50	267.15	263.60
0.7221 0.7530	41124h6	41324h6	41524h6	.6250	6	2 ½	6	293.85	268.20	259.60	255.55	251.15	247.65
0.7531 0.7840	41125h6	41325h6	41525h6	.6250	6	2 ½	6	329.90	304.25	295.70	291.65	287.20	283.75
0.7841 0.8160	41126h6	41326h6	41526h6	.6250	6	2 ½	6	333.45	307.80	299.20	295.15	290.70	287.25
0.8161 0.8470	41127h6	41327h6	41527h6	.6250	6	2 ½	6	338.70	313.10	304.45	300.40	296.00	292.55
0.8471 0.8780	41128h6	41328h6	41528h6	.7500	6	2 ⅝	6	354.45	328.85	320.25	316.20	311.75	308.25
0.8781 0.9090	41129h6	41329h6	41529h6	.7500	6	2 ⅝	6	372.50	346.85	338.30	334.20	329.80	326.25
0.9091 0.9410	41130h6	41330h6	41530h6	.7500	8	2 ⅝	6	387.80	362.10	353.50	349.50	345.05	341.60
0.9411 0.9720	41131h6	41331h6	41531h6	.7500	8	2 ⅝	6	388.80	363.15	354.55	350.50	346.05	342.65
0.9721 1.0030	41132h6	41332h6	41532h6	.8750	8	2 ¾	6	389.40	363.65	355.10	351.05	346.60	343.15

CENTER FED FOR BLIND HOLES RIGHT SPIRAL FLUTES STRAIGHT SHANK

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

MODIFICATIONS

MATERIAL SPECIFIC · COOLANT FED

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

TOOL DIAMETER RANGE	TYPE 411h6 NON FERROUS EDP NO.	TYPE 413h6 CAST IRON EDP NO.	TYPE 415h6 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 FLT (mm)	LENGTH OVER-ALL (mm)	1	2	3	4	5-7	8-14*
8.815 - 9.601	411095h6	413095h6	415095h6	8	4	45	127	$242.75	$217.20	$208.60	$204.55	$200.15	$196.60
9.602 - 10.389	411100h6	413100h6	415100h6	8	4	45	127	243.35	217.65	209.15	205.05	200.60	197.20
10.390 - 11.201	411110h6	413110h6	415110h6	10	6	45	127	245.35	219.65	211.10	207.00	202.65	199.15
11.202 - 12.000	411120h6	413120h6	415120h6	10	6	45	127	254.85	229.15	220.60	216.50	212.10	208.60
12.001 - 12.875	411125h6	413125h6	415125h6	10	6	51	153	262.25	236.65	228.00	223.95	219.55	216.05
12.876 - 13.565	411135h6	413135h6	415135h6	12	6	51	153	262.25	236.65	228.00	223.95	219.55	216.05
13.566 - 14.376	411140h6	413140h6	415140h6	12	6	51	153	262.25	236.65	228.00	223.95	219.55	216.05
14.377 - 15.164	411150h6	413150h6	415150h6	12	6	51	153	270.65	244.90	236.40	232.25	227.85	224.40
15.165 - 16.100	411160h6	413160h6	415160h6	14	6	57	153	299.10	273.50	264.90	260.85	256.40	252.90
16.101 - 16.740	411165h6	413165h6	415165h6	14	6	57	153	299.10	273.50	264.90	260.85	256.40	252.90
16.741 - 17.551	411175h6	413175h6	415175h6	14	6	57	153	299.10	273.50	264.90	260.85	256.40	252.90
17.552 - 18.340	411180h6	413180h6	415180h6	14	6	57	153	309.85	284.15	275.60	271.50	267.15	263.60
18.341 - 19.250	411190h6	413190h6	415190h6	16	6	64	153	329.90	304.25	295.70	291.65	287.20	283.75
19.251 - 20.126	411200h6	413200h6	415200h6	16	6	64	153	333.45	307.80	299.20	295.15	290.70	287.25
20.127 - 21.127	411210h6	413210h6	415210h6	16	6	64	153	338.70	313.10	304.45	300.40	296.00	292.55
21.128 - 22.127	411220h6	413220h6	415220h6	20	6	64	153	354.45	328.85	320.25	316.20	311.75	308.25
22.128 - 23.127	411230h6	413230h6	415230h6	20	6	67	153	387.80	362.10	353.50	349.50	345.05	341.60
23.128 - 24.127	411240h6	413240h6	415240h6	20	8	67	153	388.80	363.15	354.55	350.50	346.05	342.65
24.128 - 25.127	411250h6	413250h6	415250h6	20	8	70	153	389.40	363.65	355.10	351.05	346.60	343.15

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

PRECISION h6 SHANK REAMERS CARBIDE TIPPED TYPES 427h6, 428h6, 429h6 FRACTIONAL & METRIC

MATERIAL SPECIFIC COOLANT FED

FLUTE FED FOR THRU HOLES LEFT SPIRAL FLUTES

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

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

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 PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH OVER-ALL	1	2	3	4	5-7	8-14*
0.3471 - 0.3780	42712h6	42812h6	42912h6	.3125	4	1 ¾	5	$288.95	$263.25	$254.75	$250.60	$246.20	$242.65
0.3781 - 0.4090	42713h6	42813h6	42913h6	.3125	4	1 ¾	5	289.85	264.30	255.70	251.60	247.20	243.70
0.4091 - 0.4410	42714h6	42814h6	42914h6	.3750	6	1 ¾	5	292.10	266.35	257.85	253.75	249.35	245.90
0.4411 - 0.4720	42715h6	42815h6	42915h6	.3750	6	1 ¾	5	294.30	268.55	260.05	255.90	251.50	248.00
0.4721 - 0.5030	42716h6	42816h6	42916h6	.4375	6	2	6	297.35	271.65	263.15	259.00	254.60	251.15
0.5031 - 0.5340	42717h6	42817h6	42917h6	.4375	6	2	6	302.50	276.75	268.30	264.15	259.75	256.30
0.5341 - 0.5660	42718h6	42818h6	42918h6	.4375	6	2	6	306.15	280.55	271.95	267.85	263.40	260.00
0.5661 - 0.5970	42719h6	42819h6	42919h6	.4375	6	2	6	311.45	285.85	277.25	273.25	268.75	265.30
0.5971 - 0.6280	42720h6	42820h6	42920h6	.5625	6	2 ¼	6	316.30	290.60	282.05	277.95	273.60	270.10
0.6281 - 0.6590	42721h6	42821h6	42921h6	.5625	6	2 ¼	6	344.70	319.05	310.50	306.45	302.00	298.55
0.6591 - 0.6910	42722h6	42822h6	42922h6	.5625	6	2 ¼	6	350.80	325.10	316.50	312.45	308.10	304.55
0.6911 - 0.7220	42723h6	42823h6	42923h6	.5625	6	2 ¼	6	357.10	331.40	322.85	318.75	314.35	310.95
0.7221 - 0.7530	42724h6	42824h6	42924h6	.6250	6	2 ½	6	363.60	337.95	329.40	325.25	320.90	317.40
0.7531 - 0.7840	42725h6	42825h6	42925h6	.6250	6	2 ½	6	368.90	343.30	334.70	330.65	326.20	322.75
0.7841 - 0.8160	42726h6	42826h6	42926h6	.6250	6	2 ½	6	372.80	347.15	338.55	334.50	330.15	326.65
0.8161 - 0.8470	42727h6	42827h6	42927h6	.6250	6	2 ½	6	378.60	352.95	344.45	340.35	335.90	332.45
0.8471 - 0.8780	42728h6	42828h6	42928h6	.7500	6	2 ⅝	6	396.60	370.95	362.35	358.30	353.90	350.35
0.8781 - 0.9090	42729h6	42829h6	42929h6	.7500	6	2 ⅝	6	417.00	391.30	382.75	378.70	374.20	370.80
0.9091 - 0.9410	42730h6	42830h6	42930h6	.7500	8	2 ⅝	6	434.70	409.15	400.50	396.40	392.00	388.55
0.9411 - 0.9720	42731h6	42831h6	42931h6	.7500	8	2 ⅝	6	435.65	410.10	401.45	397.40	393.00	389.50
0.9721 - 1.0030	42732h6	42832h6	42932h6	.8750	8	2 ¾	6	436.20	410.50	401.95	397.85	393.50	390.00

FLUTE FED FOR THRU HOLES LEFT SPIRAL FLUTES STRAIGHT SHANK

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

MODIFICATIONS

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

MATERIAL SPECIFIC COOLANT FED

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 PRICE EACH - BASED ON QUANTITY ORDERED					
				MAX. SHANK DIAM. (mm)	NO. OF FLTS	LENGTH FLT (mm)	LENGTH OVER-ALL (mm)	1	2	3	4	5-7	8-14*
8.815 - 9.601	427095h6	428095h6	429095h6	8	4	45	127	$288.95	$263.25	$254.75	$250.60	$246.20	$242.65
9.602 - 10.389	427100h6	428100h6	429100h6	8	4	45	127	289.85	264.30	255.70	251.60	247.20	243.70
10.390 - 11.201	427110h6	428110h6	429110h6	10	6	45	127	292.10	266.35	257.85	253.75	249.35	245.90
11.202 - 12.000	427120h6	428120h6	429120h6	10	6	45	127	297.35	271.65	263.15	259.00	254.60	251.15
12.001 - 12.875	427125h6	428125h6	429125h6	10	6	51	153	302.50	276.75	268.30	264.15	259.75	256.30
12.876 - 13.565	427135h6	428135h6	429135h6	12	6	51	153	306.15	280.55	271.95	267.85	263.40	260.00
13.566 - 14.376	427140h6	428140h6	429140h6	12	6	51	153	306.15	280.55	271.95	267.85	263.40	260.00
14.377 - 15.164	427150h6	428150h6	429150h6	12	6	51	153	311.45	285.85	277.25	273.25	268.75	265.30
15.165 - 16.100	427160h6	428160h6	429160h6	14	6	57	153	344.70	319.05	310.50	306.45	302.00	298.55
16.101 - 16.740	427165h6	428165h6	429165h6	14	6	57	153	350.80	325.10	316.50	312.45	308.10	304.55
16.741 - 17.551	427175h6	428175h6	429175h6	14	6	57	153	350.80	325.10	316.50	312.45	308.10	304.55
17.552 - 18.340	427180h6	428180h6	429180h6	14	6	57	153	357.10	331.40	322.85	318.75	314.35	310.95
18.341 - 19.250	427190h6	428190h6	429190h6	16	6	64	153	368.90	343.30	334.70	330.65	326.20	322.75
19.251 - 20.126	427200h6	428200h6	429200h6	16	6	64	153	372.80	347.15	338.55	334.50	330.15	326.65
20.127 - 21.127	427210h6	428210h6	429210h6	16	6	64	153	378.60	352.95	344.45	340.35	335.90	332.45
21.128 - 22.127	427220h6	428220h6	429220h6	20	6	64	153	396.60	370.95	362.35	358.30	353.90	350.35
22.128 - 23.127	427230h6	428230h6	429230h6	20	6	67	153	434.70	409.15	400.50	396.40	392.00	388.55
23.128 - 24.127	427240h6	428240h6	429240h6	20	8	67	153	435.65	410.10	401.45	397.40	393.00	389.50
24.128 - 25.127	427250h6	428250h6	429250h6	20	8	70	153	436.20	410.50	401.95	397.85	393.50	390.00

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

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

MATERIAL SPECIFIC

STRAIGHT FLUTE LONG CARBIDE

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

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)

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 457EL NON FERROUS EDP NO.	TYPE 458EL CAST IRON EDP NO.	TYPE 459EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH OVERALL RANGE	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14**
* 0.1121-0.1280	45704EL	45804EL	45904EL	.1099	4	1 ½	2 9/32 -6	$275.05	$240.90	$229.40	$224.00	$218.20	$213.50
* 0.1281-0.1435	457045EL	458045EL	459045EL	.1255	4	1 ½	2 17/32 -6 ½	276.00	241.90	230.45	224.90	219.05	214.50
* 0.1436-0.1590	45705EL	45805EL	45905EL	.1411	4	1 ½	2 17/32 -7	280.60	246.40	234.95	229.45	223.65	219.00
* 0.1591-0.1750	457055EL	458055EL	459055EL	.1567	4	1 ½	2 25/32 -8	285.90	251.65	240.30	234.80	228.95	224.35
* 0.1751-0.1910	45706EL	45806EL	45906EL	.1724	4	1 ½	4 17/32 -9	293.45	259.30	247.80	242.45	236.50	231.90
* 0.1911-0.2210	45707EL	45807EL	45907EL	.1880	4	1 ½	5 1/32 -10	303.30	269.25	257.80	252.35	246.45	241.90
* 0.2211-0.2530	45708EL	45808EL	45908EL	.2193	4	1 ½	6 1/32 -12	322.95	288.75	277.40	271.95	266.10	261.50
* 0.2531-0.2840	45709EL	45809EL	45909EL	.2505	4	1 ½	6 1/32 -12	339.80	305.65	294.25	288.70	282.90	278.20
0.2841-0.3150	45710EL	45810EL	45910EL	.2792	4	1 ½	6 1/32 -12	241.10	206.95	195.55	190.05	184.20	179.65
0.3151-0.3470	45711EL	45811EL	45911EL	.2792	4	1 ½	6 1/32 -12	241.10	206.95	195.55	190.05	184.20	179.65
0.3471-0.3780	45712EL	45812EL	45912EL	.3105	4	1 ¾	7 1/32 -14	249.00	214.90	203.45	197.90	192.10	187.45
0.3781-0.4090	45713EL	45813EL	45913EL	.3105	4	1 ¾	7 1/32 -14	249.00	214.90	203.45	197.90	192.10	187.45
0.4091-0.4410	45714EL	45814EL	45914EL	.3730	6	1 ¾	7 1/32 -14	256.95	222.70	211.35	205.80	200.00	195.35
0.4411-0.4720	45715EL	45815EL	45915EL	.3730	6	1 ¾	7 1/32 -14	256.95	222.70	211.35	205.80	200.00	195.35
0.4721-0.5030	45716EL	45816EL	45916EL	.4355	6	2	8 1/32 -16	262.25	228.00	216.60	211.15	205.35	200.70
0.5031-0.5340	45717EL	45817EL	45917EL	.4355	6	2	8 1/32 -16	262.25	228.00	216.60	211.15	205.35	200.70
0.5341-0.5660	45718EL	45818EL	45918EL	.4355	6	2	8 1/32 -16	267.15	232.90	221.50	216.05	210.20	205.60
0.5661-0.5970	45719EL	45819EL	45919EL	.4355	6	2	8 1/32 -16	267.15	232.90	221.50	216.05	210.20	205.60
0.5971-0.6280	45720EL	45820EL	45920EL	.5615	6	2 ¼	9 1/32 -18	272.75	238.55	227.10	221.70	215.90	211.25
0.6281-0.6590	45721EL	45821EL	45921EL	.5615	6	2 ¼	9 1/32 -18	272.75	238.55	227.10	221.70	215.90	211.25
0.6591-0.6910	45722EL	45822EL	45922EL	.5615	6	2 ¼	9 1/32 -18	273.55	239.35	227.85	222.45	216.60	212.00
0.6911-0.7220	45723EL	45823EL	45923EL	.5615	6	2 ¼	9 1/32 -18	273.55	239.35	227.85	222.45	216.60	212.00
0.7221-0.7530	45724EL	45824EL	45924EL	.6245	6	2 ½	9 17/32 -18	293.60	259.40	247.90	242.55	236.75	232.10
0.7531-0.7840	45725EL	45825EL	45925EL	.6245	6	2 ½	9 17/32 -18	356.30	323.75	312.80	307.70	302.10	297.75
0.7841-0.8160	45726EL	45826EL	45926EL	.6245	6	2 ½	9 17/32 -18	367.65	335.05	324.15	319.05	313.45	309.05
0.8161-0.8470	45727EL	45827EL	45927EL	.6245	6	2 ½	9 17/32 -18	371.90	339.35	328.40	323.25	317.70	313.35
0.8471-0.8780	45728EL	45828EL	45928EL	.7495	6	2 ⅝	10 1/32 -18	379.80	347.15	336.25	331.15	325.55	321.10
0.8781-0.9090	45729EL	45829EL	45929EL	.7495	6	2 ⅝	10 1/32 -18	395.75	363.15	352.25	347.10	341.55	337.15
0.9091-0.9410	45730EL	45830EL	45930EL	.7495	8	2 ⅝	10 1/32 -18	399.75	367.10	356.20	351.05	345.45	341.15
0.9411-0.9720	45731EL	45831EL	45931EL	.7495	8	2 ⅝	10 1/32 -18	403.50	370.95	360.05	354.90	349.30	344.90
0.9721-1.0030	45732EL	45832EL	45932EL	.8745	8	2 ¾	10 17/32 -18	412.90	380.35	369.45	364.30	358.65	354.30

*Solid Carbide

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

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

MATERIAL SPECIFIC COOLANT FED

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	LENGTH OVERALL RANGE	1	2	3	4	5-7	8-14**
* 0.1751 - 0.1910	41606EL	42606EL	43506EL	.1724	4	1 ½	4 17/32 - 9	$351.10	$316.95	$305.45	$300.05	$294.25	$289.55
* 0.1911 - 0.2210	41607EL	42607EL	43507EL	.1880	4	1 ½	5 1/32 - 10	364.65	330.40	318.95	313.55	307.75	303.10
* 0.2211 - 0.2530	41608EL	42608EL	43508EL	.2193	4	1 ½	6 1/32 - 12	405.10	370.95	359.45	354.05	348.10	343.55
* 0.2531 - 0.2840	41609EL	42609EL	43509EL	.2505	4	1 ½	6 1/32 - 12	424.75	390.55	379.10	373.65	367.75	363.15
0.2841 - 0.3150	41610EL	42610EL	43510EL	.2792	4	1 ½	6 1/32 - 12	314.10	279.95	268.45	263.00	257.10	252.55
0.3151 - 0.3470	41611EL	42611EL	43511EL	.2792	4	1 ½	6 1/32 - 12	314.10	279.95	268.45	263.00	257.10	252.55
0.3471 - 0.3780	41612EL	42612EL	43512EL	.3105	4	1 ¾	7 1/32 - 14	320.25	286.05	274.70	269.25	263.35	258.80
0.3781 - 0.4090	41613EL	42613EL	43513EL	.3105	4	1 ¾	7 1/32 - 14	320.25	286.05	274.70	269.25	263.35	258.80
0.4091 - 0.4410	41614EL	42614EL	43514EL	.3730	6	1 ¾	7 1/32 - 14	321.60	287.40	275.95	270.55	264.65	260.10
0.4411 - 0.4720	41615EL	42615EL	43515EL	.3730	6	1 ¾	7 1/32 - 14	321.60	287.40	275.95	270.55	264.65	260.10
0.4721 - 0.5030	41616EL	42616EL	43516EL	.4355	6	2	8 1/32 - 16	349.85	315.65	304.25	298.75	292.90	288.30
0.5031 - 0.5340	41617EL	42617EL	43517EL	.4355	6	2	8 1/32 - 16	349.85	315.65	304.25	298.75	292.90	288.30
0.5341 - 0.5660	41618EL	42618EL	43518EL	.4355	6	2	8 1/32 - 16	352.30	318.15	306.70	301.25	295.40	290.70
0.5661 - 0.5970	41619EL	42619EL	43519EL	.4355	6	2	8 1/32 - 16	352.30	318.15	306.70	301.25	295.40	290.70
0.5971 - 0.6280	41620EL	42620EL	43520EL	.5615	6	2 ¼	9 1/32 - 18	359.25	325.10	313.60	308.20	302.35	297.75
0.6281 - 0.6590	41621EL	42621EL	43521EL	.5615	6	2 ¼	9 1/32 - 18	359.25	325.10	313.60	308.20	302.35	297.75
0.6591 - 0.6910	41622EL	42622EL	43522EL	.5615	6	2 ¼	9 1/32 - 18	363.15	329.00	317.55	312.10	306.20	301.60
0.6911 - 0.7220	41623EL	42623EL	43523EL	.5615	6	2 ¼	9 1/32 - 18	363.15	329.00	317.55	312.10	306.20	301.60
0.7221 - 0.7530	41624EL	42624EL	43524EL	.6245	6	2 ½	9 17/32 - 18	378.10	343.90	332.50	326.95	321.10	316.50
0.7531 - 0.7840	41625EL	42625EL	43525EL	.6245	6	2 ½	9 17/32 18	430.95	398.35	387.45	382.25	376.75	372.30
0.7841 - 0.8160	41626EL	42626EL	43526EL	.6245	6	2 ½	9 17/32 18	446.40	413.85	402.95	397.75	392.15	387.80
0.8161 - 0.8470	41627EL	42627EL	43527EL	.6245	6	2 ½	9 17/32 18	450.55	418.00	407.10	401.90	396.30	391.90
0.8471 - 0.8780	41628EL	42628EL	43528EL	.7495	6	2 ⅝	10 1/32 18	453.35	420.80	409.90	404.70	399.15	394.75
0.8781 - 0.9090	41629EL	42629EL	43529EL	.7495	6	2 ⅝	10 1/32 18	470.95	438.45	427.50	422.30	416.75	412.40
0.9091 - 0.9410	41630EL	42630EL	43530EL	.7495	8	2 ⅝	10 1/32 18	479.05	446.50	435.60	430.40	424.85	420.45
0.9411 - 0.9720	41631EL	42631EL	43531EL	.7495	8	2 ⅝	10 1/32 18	481.70	449.15	438.25	433.05	427.45	423.05
0.9721 - 1.0030	41632EL	42632EL	43532EL	.8745	8	2 ¾	10 17/32 18	495.50	462.95	452.15	446.90	441.30	436.90

*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

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

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)

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 442EL NON FERROUS EDP NO.	TYPE 443EL CAST IRON EDP NO.	TYPE 444EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH OVERALL RANGE	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14**
*0.2211 - 0.2530	44208EL	44308EL	44408EL	.2193	4	1 ½	6 1/32 - 12	$387.50	$346.55	$332.85	$326.35	$319.35	$313.70
*0.2531 - 0.2840	44209EL	44309EL	44409EL	.2505	4	1 ½	6 1/32 - 12	407.80	366.70	353.05	346.50	339.45	334.00
0.2841 - 0.3150	44210EL	44310EL	44410EL	.2792	4	1 ½	6 1/32 - 12	289.40	248.40	234.70	228.10	221.10	215.55
0.3151 - 0.3470	44211EL	44311EL	44411EL	.2792	4	1 ½	6 1/32 - 12	289.40	248.40	234.70	228.10	221.10	215.55
0.3471 - 0.3780	44212EL	44312EL	44412EL	.3105	4	1 ¾	7 1/32 - 14	298.85	257.85	244.10	237.50	230.55	225.00
0.3781 - 0.4090	44213EL	44313EL	44413EL	.3105	4	1 ¾	7 1/32 - 14	298.85	257.85	244.10	237.50	230.55	225.00
0.4091 - 0.4410	44214EL	44314EL	44414EL	.3730	6	1 ¾	7 1/32 - 14	308.30	267.35	253.60	247.00	239.95	234.45
0.4411 - 0.4720	44215EL	44315EL	44415EL	.3730	6	1 ¾	7 1/32 - 14	308.30	267.35	253.60	247.00	239.95	234.45
0.4721 - 0.5030	44216EL	44316EL	44416EL	.4355	6	2	8 1/32 - 16	314.70	273.65	260.00	253.40	246.40	240.85
0.5031 - 0.5340	44217EL	44317EL	44417EL	.4355	6	2	8 1/32 - 16	314.70	273.65	260.00	253.40	246.40	240.85
0.5341 - 0.5660	44218EL	44318EL	44418EL	.4355	6	2	8 1/32 - 16	320.60	279.50	265.80	259.25	252.25	246.65
0.5661 - 0.5970	44219EL	44319EL	44419EL	.4355	6	2	8 1/32 - 16	320.60	279.50	265.80	259.25	252.25	246.65
0.5971 - 0.6280	44220EL	44320EL	44420EL	.5615	6	2 ¼	9 1/32 - 18	327.35	286.30	272.55	266.10	259.00	253.55
0.6281 - 0.6590	44221EL	44321EL	44421EL	.5615	6	2 ¼	9 1/32 - 18	327.35	286.30	272.55	266.10	259.00	253.55
0.6591 - 0.6910	44222EL	44322EL	44422EL	.5615	6	2 ¼	9 1/32 - 18	328.15	287.20	273.50	267.00	260.00	254.40
0.6911 - 0.7220	44223EL	44323EL	44423EL	.5615	6	2 ¼	9 1/32 - 18	328.15	287.20	273.50	267.00	260.00	254.40
0.7221 - 0.7530	44224EL	44324EL	44424EL	.6245	6	2 ½	9 17/32 - 18	352.35	311.35	297.60	291.05	284.05	278.55
0.7531 0.7840	44225EL	44325EL	44425EL	.6245	6	2 ½	9 17/32 18	406.20	367.10	354.00	347.90	341.20	335.90
0.7841 0.8160	44226EL	44326EL	44426EL	.6245	6	2 ½	9 17/32 18	417.85	378.85	365.75	359.55	352.85	347.60
0.8161 0.8470	44227EL	44327EL	44427EL	.6245	6	2 ½	9 17/32 18	422.05	383.05	369.90	363.75	357.10	351.80
0.8471 0.8780	44228EL	44328EL	44428EL	.7495	6	2 5/8	10 1/32 18	423.70	384.60	371.60	365.40	358.65	353.40
0.8781 0.9090	44229EL	44329EL	44429EL	.7495	6	2 5/8	10 1/32 18	437.85	398.85	385.70	379.60	372.85	367.60
0.9091 0.9410	44230EL	44330EL	44430EL	.7495	8	2 5/8	10 1/32 18	452.55	413.60	400.45	394.25	387.60	382.30
0.9411 0.9720	44231EL	44331EL	44431EL	.7495	8	2 5/8	10 1/32 18	455.30	416.20	403.10	397.00	390.30	385.05
0.9721 1.0030	44232EL	44332EL	44432EL	.8745	8	2 ¾	10 17/32 18	471.90	432.85	419.75	413.65	406.95	401.60

*Solid Carbide

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

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

MATERIAL SPECIFIC COOLANT FED

CENTER FED FOR BLIND HOLES
RIGHT SPIRAL FLUTES

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

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

TOOL SELECTOR

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

MODIFICATIONS (Prompt delivery)

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

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

TOOL DIAMETER RANGE	TYPE 411EL NON FERROUS EDP NO.	TYPE 413EL CAST IRON EDP NO.	TYPE 415EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH OVERALL RANGE	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14**
* 0.2211 - 0.2530	41108EL	41308EL	41508EL	.2193	4	1 ½	6 1/32 - 12	$486.05	$445.05	$431.45	$424.85	$417.75	$412.30
* 0.2531 - 0.2840	41109EL	41309EL	41509EL	.2505	4	1 ½	6 1/32 - 12	509.65	468.65	454.85	448.40	441.30	435.80
0.2841 - 0.3150	41110EL	41310EL	41510EL	.2792	4	1 ½	6 1/32 - 12	376.85	335.80	322.15	315.60	308.45	303.05
0.3151 - 0.3470	41111EL	41311EL	41511EL	.2792	4	1 ½	6 1/32 - 12	376.85	335.80	322.15	315.60	308.45	303.05
0.3471 - 0.3780	41112EL	41312EL	41512EL	.3105	4	1 ¾	7 1/32 - 14	384.35	343.30	329.50	323.00	316.05	310.50
0.3781 - 0.4090	41113EL	41313EL	41513EL	.3105	4	1 ¾	7 1/32 - 14	384.35	343.30	329.50	323.00	316.05	310.50
0.4091 - 0.4410	41114EL	41314EL	41514EL	.3730	6	1 ¾	7 1/32 - 14	385.90	344.90	331.20	324.65	317.60	312.10
0.4411 - 0.4720	41115EL	41315EL	41515EL	.3730	6	1 ¾	7 1/32 - 14	385.90	344.90	331.20	324.65	317.60	312.10
0.4721 - 0.5030	41116EL	41316EL	41516EL	.4355	6	2	8 1/32 - 16	419.80	378.85	365.00	358.50	351.50	346.00
0.5031 - 0.5340	41117EL	41317EL	41517EL	.4355	6	2	8 1/32 - 16	419.80	378.85	365.00	358.50	351.50	346.00
0.5341 - 0.5660	41118EL	41318EL	41518EL	.4355	6	2	8 1/32 - 16	422.80	381.65	368.05	361.50	354.45	348.90
0.5661 - 0.5970	41119EL	41319EL	41519EL	.4355	6	2	8 1/32 - 16	422.80	381.65	368.05	361.50	354.45	348.90
0.5971 - 0.6280	41120EL	41320EL	41520EL	.5615	6	2 ¼	9 1/32 - 18	431.15	390.10	376.35	369.85	362.85	357.25
0.6281 - 0.6590	41121EL	41321EL	41521EL	.5615	6	2 ¼	9 1/32 - 18	431.15	390.10	376.35	369.85	362.85	357.25
0.6591 - 0.6910	41122EL	41322EL	41522EL	.5615	6	2 ¼	9 1/32 - 18	435.80	394.80	381.10	374.60	367.50	362.00
0.6911 - 0.7220	41123EL	41323EL	41523EL	.5615	6	2 ¼	9 1/32 - 18	435.80	394.80	381.10	374.60	367.50	362.00
0.7221 - 0.7530	41124EL	41324EL	41524EL	.6245	6	2 ½	9 17/32 - 18	453.70	412.70	398.95	392.50	385.40	379.95
0.7531 - 0.7840	41125EL	41325EL	41525EL	.6245	6	2 ½	9 17/32 - 18	458.05	419.00	405.95	399.75	393.00	387.80
0.7841 - 0.8160	41126EL	41326EL	41526EL	.6245	6	2 ½	9 17/32 - 18	473.05	433.95	420.95	414.70	408.00	402.80
0.8161 - 0.8470	41127EL	41327EL	41527EL	.6245	6	2 ½	9 17/32 - 18	477.30	438.25	425.20	418.95	412.25	407.05
0.8471 - 0.8780	41128EL	41328EL	41528EL	.7495	6	2 ⅝	10 1/32 - 18	478.85	439.80	426.80	420.55	413.80	408.60
0.8781 - 0.9090	41129EL	41329EL	41529EL	.7495	6	2 ⅝	10 1/32 - 18	496.00	456.90	443.90	437.60	430.95	425.75
0.9091 - 0.9410	41130EL	41330EL	41530EL	.7495	8	2 ⅝	10 1/32 - 18	511.15	472.10	459.00	452.80	446.10	440.85
0.9411 - 0.9720	41131EL	41331EL	41531EL	.7495	8	2 ⅝	10 1/32 - 18	513.85	474.80	461.75	455.45	448.80	443.60
0.9721 - 1.0030	41132EL	41332EL	41532EL	.8745	8	2 ¾	10 17/32 - 18	534.10	495.05	481.95	475.70	469.05	463.85

*Solid Carbide

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

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

MATERIAL SPECIFIC

LEFT SPIRAL FLUTES
FLUTE LONG CARBIDE

TYPE 482EL - FOR NON-FERROUS MATERIALS
TYPE 483EL - FOR CAST IRONS & NAS MULTI-PURPOSE
TYPE 484EL - FOR STEELS & HIGH TEMP ALLOYS

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

TOOL SELECTOR

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

MODIFICATIONS (Prompt delivery)

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

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

TOOL DIAMETER RANGE	TYPE 482EL NON FERROUS EDP NO.	TYPE 483EL CAST IRON EDP NO.	TYPE 484EL STEEL/ HI-TEMP EDP NO.	DIMENSIONS MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH OVERALL	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14**
*0.2211 - 0.2530	48208EL	48308EL	48408EL	.2193	4	1 ½	6 1/32 - 12	$387.50	$346.55	$332.85	$326.35	$319.35	$313.70
*0.2531 - 0.2840	48209EL	48309EL	48409EL	.2505	4	1 ½	6 1/32 - 12	407.80	366.70	353.05	346.50	339.45	334.00
0.2841 - 0.3150	48210EL	48310EL	48410EL	.2792	4	1 ½	6 1/32 - 12	289.40	248.40	234.70	228.10	221.10	215.55
0.3151 - 0.3470	48211EL	48311EL	48411EL	.2792	4	1 ½	6 1/32 - 12	289.40	248.40	234.70	228.10	221.10	215.55
0.3471 - 0.3780	48212EL	48312EL	48412EL	.3105	4	1 ¾	7 1/32 - 14	298.85	257.85	244.10	237.50	230.55	225.00
0.3781 - 0.4090	48213EL	48313EL	48413EL	.3105	4	1 ¾	7 1/32 - 14	298.85	257.85	244.10	237.50	230.55	225.00
0.4091 - 0.4410	48214EL	48314EL	48414EL	.3730	6	1 ¾	7 1/32 - 14	308.30	267.35	253.60	247.00	239.95	234.45
0.4411 - 0.4720	48215EL	48315EL	48415EL	.3730	6	1 ¾	7 1/32 - 14	308.30	267.35	253.60	247.00	239.95	234.45
0.4721 - 0.5030	48216EL	48316EL	48416EL	.4355	6	2	8 1/32 - 16	314.70	273.65	260.00	253.40	246.40	240.85
0.5031 - 0.5340	48217EL	48317EL	48417EL	.4355	6	2	8 1/32 - 16	314.70	273.65	260.00	253.40	246.40	240.85
0.5341 - 0.5660	48218EL	48318EL	48418EL	.4355	6	2	8 1/32 - 16	320.60	279.50	265.80	259.25	252.25	246.65
0.5661 - 0.5970	48219EL	48319EL	48419EL	.4355	6	2	8 1/32 - 16	320.60	279.50	265.80	259.25	252.25	246.65
0.5971 - 0.6280	48220EL	48320EL	48420EL	.5615	6	2 ¼	9 1/32 - 18	327.35	286.30	272.55	266.10	259.00	253.55
0.6281 - 0.6590	48221EL	48321EL	48421EL	.5615	6	2 ¼	9 1/32 - 18	327.35	286.30	272.55	266.10	259.00	253.55
0.6591 - 0.6910	48222EL	48322EL	48422EL	.5615	6	2 ¼	9 1/32 - 18	328.15	287.20	273.50	267.00	260.00	254.40
0.6911 - 0.7220	48223EL	48323EL	48423EL	.5615	6	2 ¼	9 1/32 - 18	328.15	287.20	273.50	267.00	260.00	254.40
0.7221 - 0.7530	48224EL	48324EL	48424EL	.6245	6	2 ½	9 17/32 - 18	352.35	311.35	297.60	291.05	284.05	278.55
0.7531 - 0.7840	48225EL	48325EL	48425EL	.6245	6	2 ½	9 17/32 - 18	406.20	367.10	354.00	347.90	341.20	335.90
0.7841 - 0.8160	48226EL	48326EL	48426EL	.6245	6	2 ½	9 17/32 - 18	417.85	378.85	365.75	359.55	352.85	347.60
0.8161 - 0.8470	48227EL	48327EL	48427EL	.6245	6	2 ½	9 17/32 - 18	422.05	383.05	369.90	363.75	357.10	351.80
0.8471 - 0.8780	48228EL	48328EL	48428EL	.7495	6	2 ⅝	10 1/32 - 18	423.70	384.60	371.60	365.40	358.65	353.40
0.8781 - 0.9090	48229EL	48329EL	48429EL	.7495	6	2 ⅝	10 1/32 - 18	437.85	398.85	385.70	379.60	372.85	367.60
0.9091 - 0.9410	48230EL	48330EL	48430EL	.7495	8	2 ⅝	10 1/32 - 18	452.55	413.60	400.45	394.25	387.60	382.30
0.9411 - 0.9720	48231EL	48331EL	48431EL	.7495	8	2 ⅝	10 1/32 - 18	455.30	416.20	403.10	397.00	390.30	385.05
0.9721 - 1.0030	48232EL	48332EL	48432EL	.8745	8	2 ¾	10 17/32 - 18	471.90	432.85	419.75	413.65	406.95	401.60

*Solid Carbide

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

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

MATERIAL SPECIFIC · COOLANT FED

FLUTE FED FOR THRU HOLES
LEFT SPIRAL FLUTES

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

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)

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 MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH OVERALL RANGE	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14**
*0.2211-0.2530	42708EL	42808EL	42908EL	.2193	4	1 ½	6 1/32 -12	$486.05	$445.05	$431.45	$424.85	$417.75	$412.30
*0.2531-0.2840	42709EL	42809EL	42909EL	.2505	4	1 ½	6 1/32 -12	509.65	468.65	454.85	448.40	441.30	435.80
0.2841-0.3150	42710EL	42810EL	42910EL	.2792	4	1 ½	6 1/32 -12	376.85	335.80	322.15	315.60	308.45	303.05
0.3151-0.3470	42711EL	42811EL	42911EL	.2792	4	1 ½	6 1/32 -12	376.85	335.80	322.15	315.60	308.45	303.05
0.3471-0.3780	42712EL	42812EL	42912EL	.3105	4	1 ¾	7 1/32 -14	384.35	343.30	329.50	323.00	316.05	310.50
0.3781-0.4090	42713EL	42813EL	42913EL	.3105	4	1 ¾	7 1/32 -14	384.35	343.30	329.50	323.00	316.05	310.50
0.4091-0.4410	42714EL	42814EL	42914EL	.3730	6	1 ¾	7 1/32 -14	385.90	344.90	331.20	324.65	317.60	312.10
0.4411-0.4720	42715EL	42815EL	42915EL	.3730	6	1 ¾	7 1/32 -14	385.90	344.90	331.20	324.65	317.60	312.10
0.4721-0.5030	42716EL	42816EL	42916EL	.4355	6	2	8 1/32 -16	419.80	378.85	365.00	358.50	351.50	346.00
0.5031-0.5340	42717EL	42817EL	42917EL	.4355	6	2	8 1/32 -16	419.80	378.85	365.00	358.50	351.50	346.00
0.5341-0.5660	42718EL	42818EL	42918EL	.4355	6	2	8 1/32 -16	422.80	381.65	368.05	361.50	354.45	348.90
0.5661-0.5970	42719EL	42819EL	42919EL	.4355	6	2	8 1/32 -16	422.80	381.65	368.05	361.50	354.45	348.90
0.5971-0.6280	42720EL	42820EL	42920EL	.5615	6	2 ¼	9 1/32 -18	431.15	390.10	376.35	369.85	362.85	357.25
0.6281-0.6590	42721EL	42821EL	42921EL	.5615	6	2 ¼	9 1/32 -18	431.15	390.10	376.35	369.85	362.85	357.25
0.6591-0.6910	42722EL	42822EL	42922EL	.5615	6	2 ¼	9 1/32 -18	435.80	394.80	381.10	374.60	367.50	362.00
0.6911-0.7220	42723EL	42823EL	42923EL	.5615	6	2 ¼	9 1/32 -18	435.80	394.80	381.10	374.60	367.50	362.00
0.7221-0.7530	42724EL	42824EL	42924EL	.6245	6	2 ½	9 17/32 -18	453.70	412.70	398.95	392.50	385.40	379.95
0.7531-0.7840	42725EL	42825EL	42925EL	.6245	6	2 ½	9 17/32 -18	479.05	439.95	427.00	420.70	413.95	408.75
0.7841-0.8160	42726EL	42826EL	42926EL	.6245	6	2 ½	9 17/32 -18	495.15	456.10	443.05	436.80	430.10	424.90
0.8161-0.8470	42727EL	42827EL	42927EL	.6245	6	2 ½	9 17/32 -18	499.35	460.35	447.25	441.00	434.35	429.15
0.8471-0.8780	42728EL	42828EL	42928EL	.7495	6	2 ⅝	10 1/32 -18	500.85	461.80	448.80	442.55	435.80	430.60
0.8781-0.9090	42729EL	42829EL	42929EL	.7495	6	2 ⅝	10 1/32 -18	519.40	480.40	467.30	461.05	454.35	449.15
0.9091-0.9410	42730EL	42830EL	42930EL	.7495	8	2 ⅝	10 1/32 -18	534.65	495.55	482.55	476.25	469.60	464.40
0.9411-0.9720	42731EL	42831EL	42931EL	.7495	8	2 ⅝	10 1/32 -18	537.25	498.20	485.15	478.90	472.20	467.00
0.9721-1.0030	42732EL	42832EL	42932EL	.8745	8	2 ¾	10 17/32 -18	558.80	519.75	506.70	500.40	493.75	488.55

*Solid Carbide

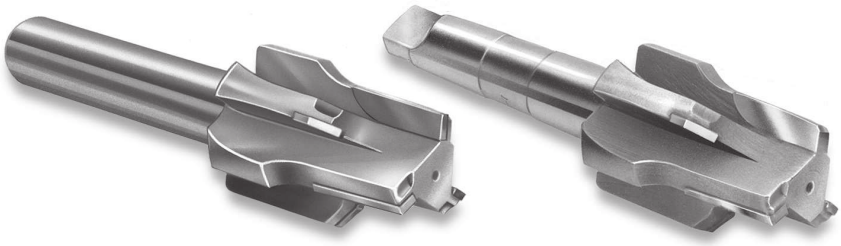
**Quantities of 15 or more — Contact Hannibal Specials Dept.

PIPE TAP REAMERS CARBIDE TIPPED TYPES 446 & 447 FRACTIONAL

GENERAL PURPOSE

STRAIGHT OR TAPER SHANK

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



TYPE 446 - STRAIGHT SHANK

TYPE 447 - TAPER SHANK

MODIFICATIONS (Prompt delivery)

- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

BOTH TYPES:

- Three flutes on pipe tap sizes through ½-14
- Six alternate cutting flutes on pipe tap sizes ¾-14 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

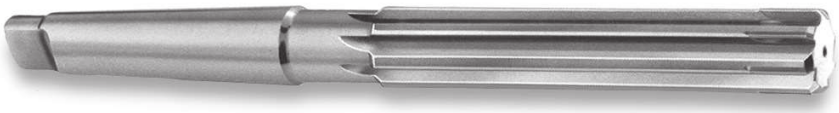
PIPE TAP SIZE	TOOL DIAM.	DIMENSIONS			STRAIGHT SHANK - TYPE 446					TAPER SHANK - TYPE 447			
		LARGE DIAM. TAPER	SMALL DIAM. TAPER	REAMER TAPER LENGTH	SHANK DIAM.	SHANK LENGTH	OVERALL LENGTH	TYPE 446 EDP NO.	PRICE	TAPER SHANK NO.	OVERALL LENGTH	TYPE 447 EDP NO.	PRICE
1/8-27	5/8	.347	.318	15/32	1/2	1 1/2	2 19/32	44601	$160.90	2	4 11/32	44701	$179.75
1/4-18	3/4	.450	.409	21/32	1/2	1 1/2	2 29/32	44602	166.05	2	4 21/32	44702	185.80
3/8-18	7/8	.586	.543	11/16	1/2	2	3 7/16	44603	190.40	2	4 11/16	44703	212.75
1/2-14	1	.725	.670	7/8	1/2	2	3 7/8	44604	202.25	2	5 1/8	44704	226.60
3/4-14	1 1/4	.937	.882	7/8	1	2 1/2	4 5/8	44606	273.20	3	6 1/8	44706	305.50
1 -11 1/2	1 1/2	1.173	1.107	1 1/16	1	2 1/2	5 1/16	44608	317.65	3	6 9/16	44708	355.65
1 -11 1/2	1 1/2	1.173	1.107	1 1/16	-	-	-	-	-	4	7 9/16	44709	364.90
1 1/4-11 1/2	1 7/8	1.518	1.448	1 1/8	1 1/2	3	5 5/8	44610	379.30	3	6 5/8	44710	423.65
1 1/4-11 1/2	1 7/8	1.518	1.448	1 1/8	-	-	-	-	-	4	7 5/8	44711	454.75
1 1/2-11 1/2	2 1/8	1.757	1.687	1 1/8	1 1/2	3	5 7/8	44612	522.05	3	6 7/8	44712	585.20
1 1/2-11 1/2	2 1/8	1.757	1.687	1 1/8	-	-	-	-	-	4	7 7/8	44713	601.15
2 -11 1/2	2 5/8	2.230	2.154	1 7/32	1 1/2	3	6 7/32	44616	591.45	3	7 3/32	44716	662.30
2 -11 1/2	2 5/8	2.230	2.154	1 7/32	-	-	-	-	-	4	8 7/32	44717	680.10
2 1/2- 8	3 1/8	2.670	2.561	1 3/4	1 1/2	3	6 3/4	44620	795.45	3	7 3/4	44720	890.75
2 1/2- 8	3 1/8	2.670	2.561	1 3/4	-	-	-	-	-	4	8 3/4	44721	914.70
3 - 8	3 3/4	3.296	3.180	1 7/8	1 1/2	3	6 7/8	44624	820.35	3	7 7/8	44724	918.85

JOBBERS REAMERS - CARBIDE TIPPED TYPE 403 FRACTIONAL

GENERAL PURPOSE

TYPE 403

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



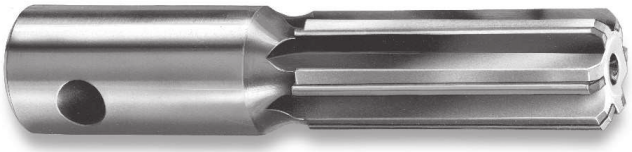
TOOL DIAMETER		TYPE 403 EDP NO.	PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
				TAPER SHANK NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLUTE	CARBIDE	OVERALL		1	2	3	4	5-7	8-14*
3/8	.3750	40312	$151.10	1	4	2 1/2	5/8	5 13/16	0.3471 - 0.3780	$189.35	$170.10	$163.80	$160.70	$157.45	$154.90
7/16	.4375	40314	158.15	1	4	2 3/4	5/8	6 1/8	0.4091 - 0.4410	196.45	177.30	170.85	167.85	164.65	161.95
1/2	.5000	40316	165.40	1	6	3	5/8	6 7/16	0.4721 - 0.5030	203.65	184.50	178.00	175.10	171.70	169.10
5/8	.6250	40320	181.10	2	6	3 1/2	5/8	7 9/16	0.5971 - 0.6280	219.40	200.15	193.80	190.75	187.40	184.85
11/16	.6875	40322	189.20	2	6	3 7/8	5/8	8	0.6591 - 0.6910	227.45	208.20	201.80	198.75	195.40	192.95
3/4	.7500	40324	196.85	2	6	4 3/16	3/4	8 3/8	0.7221 - 0.7530	235.10	216.00	209.60	206.50	203.25	200.60
13/16	.8125	40326	204.35	2	6	4 9/16	3/4	8 13/16	0.7841 - 0.8160	242.50	223.40	217.05	214.00	210.70	208.10
7/8	.8750	40328	220.10	2	6	4 7/8	3/4	9 3/16	0.8471 - 0.8780	259.70	239.80	233.15	230.00	226.60	223.85
15/16	.9375	40330	231.55	3	8	5 1/8	3/4	10	0.9091 - 0.9410	263.75	251.30	244.60	241.40	238.05	235.30
1	1.0000	40332	236.30	3	8	5 7/16	3/4	10 3/8	0.9721 - 1.0030	275.90	256.05	249.50	246.20	242.70	240.15

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

CNC STUB REAMERS CARBIDE TIPPED TYPES 430 & 440 FRACTIONAL

GENERAL PURPOSE

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

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

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

TOOL DIAMETER		TYPE 430 STRAIGHT EDP NO.	TYPE 440 LEFT EDP NO.	BOTH TYPES PRICE	DIMENSIONS						FINISHED TO MODIFIED TOOL DIAMETER						
					SHANK DIAM.	NO. OF FLTS	LENGTH			PIN HOLE DIAM.	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.						FLT	CAR-BIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/16	.1875	43006	44006	$52.00	1/4	4	1	1/2	2 1/4	3/32	0.1770-0.2040	$90.10	$71.00	$64.60	$61.60	$58.30	$55.70
7/32	.2188	43007	44007	52.00	1/4	4	1	1/2	2 1/4	3/32	0.2041-0.2210	90.10	71.00	64.60	61.60	58.30	55.70
15/64	.2344	4302344	4402344	52.00	1/4	4	1	1/2	2 1/4	3/32	0.2211-0.2380	90.10	71.00	64.60	61.60	58.30	55.70
1/4	.2500	43008	44008	52.00	1/4	4	1	1/2	2 1/4	3/32	0.2381-0.2530	90.10	71.00	64.60	61.60	58.30	55.70
9/32	.2812	43009	44009	52.00	3/8	4	1	1/2	2 1/4	1/8	0.2531-0.2840	90.10	71.00	64.60	61.60	58.30	55.70
5/16	.3125	43010	44010	60.45	3/8	4	1	1	2 1/4	1/8	0.2841-0.3150	98.55	79.40	73.10	70.05	66.70	64.15
11/32	.3438	43011	44011	60.90	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3151-0.3470	99.10	80.05	73.60	70.65	67.25	64.70
3/8	.3750	43012	44012	66.10	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3471-0.3780	104.30	85.20	78.80	75.65	72.40	69.80
13/32	.4062	43013	44013	67.05	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.3781-0.4090	105.30	86.00	79.70	76.65	73.35	70.85
7/16	.4375	43014	44014	79.35	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4091-0.4410	117.60	98.45	92.00	89.00	85.75	83.20
15/32	.4688	43015	44015	79.35	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4411-0.4720	117.60	98.45	92.00	89.00	85.75	83.20
1/2	.5000	43016	44016	86.90	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4721-0.5030	126.15	106.50	99.90	96.80	93.35	90.80
17/32	.5312	43017	44017	86.90	5/8	6	1 1/2	1 1/2	3	1/4	0.5031-0.5340	126.15	106.50	99.90	96.80	93.35	90.80
9/16	.5625	43018	44018	91.60	5/8	6	1 1/2	1 1/2	3	1/4	0.5341-0.5660	130.70	111.10	104.45	101.40	98.00	95.30
19/32	.5938	43019	44019	91.60	5/8	6	1 1/2	1 1/2	3	1/4	0.5661-0.5970	130.70	111.10	104.45	101.40	98.00	95.30
5/8	.6250	43020	44020	94.00	5/8	6	1 1/2	1 1/2	3	1/4	0.5971-0.6280	133.25	113.60	107.00	103.80	100.45	97.85
21/32	.6562	43021	44021	94.00	5/8	6	1 1/2	1 1/2	3	1/4	0.6281-0.6590	133.25	113.60	107.00	103.80	100.45	97.85
11/16	.6875	43022	44022	98.40	5/8	6	1 1/2	1 1/2	3	1/4	0.6591-0.6910	137.55	117.95	111.40	108.20	104.85	102.20
23/32	.7188	43023	44023	98.40	3/4	6	1 1/2	1 1/2	3	5/16	0.6911-0.7220	137.55	117.95	111.40	108.20	104.85	102.20
3/4	.7500	43024	44024	100.95	3/4	6	1 1/2	1 1/2	3	5/16	0.7221-0.7530	140.00	120.45	113.85	110.70	107.35	104.75
25/32	.7812	43025	44025	100.95	3/4	6	1 1/2	1 1/2	3	5/16	0.7531-0.7840	140.00	120.45	113.85	110.70	107.35	104.75
13/16	.8125	43026	44026	109.55	3/4	6	1 1/2	1 1/2	3	5/16	0.7841-0.8160	148.75	129.20	122.55	119.45	116.05	113.50
27/32	.8438	43027	44027	109.55	3/4	6	1 1/2	1 1/2	3	5/16	0.8161-0.8470	148.75	129.20	122.55	119.45	116.05	113.50
7/8	.8750	43028	44028	119.75	3/4	6	1 1/2	1 1/2	3	5/16	0.8471-0.8780	160.45	139.95	133.15	129.90	126.45	123.70
29/32	.9062	43029	44029	119.75	3/4	6	1 1/2	1 1/2	3	5/16	0.8781-0.9090	160.45	139.95	133.15	129.90	126.45	123.70
15/16	.9375	43030	44030	131.85	3/4	6	1 1/2	1 1/2	3	5/16	0.9091-0.9410	172.50	152.20	145.35	142.10	138.65	135.90
31/32	.9688	43031	44031	131.85	3/4	8	1 1/2	1 1/2	3	5/16	0.9411-0.9720	172.50	152.20	145.35	142.10	138.65	135.90
1	1.0000	43032	44032	138.30	3/4	8	1 1/2	1 1/2	3	5/16	0.9721-1.0030	179.05	158.70	151.80	148.60	145.05	142.35
1 1/16	1.0625	43034	44034	138.30	3/4	8	1 1/2	1 1/2	3	5/16	1.0031-1.0660	179.05	158.70	151.80	148.60	145.05	142.35
1 1/8	1.1250	43036	44036	161.95	3/4	8	1 1/2	1 1/2	3	5/16	1.0661-1.1280	202.65	182.15	175.35	172.20	168.65	165.90
1 3/16	1.1875	43038	44038	168.80	3/4	8	1 1/2	1 1/2	3	5/16	1.1281-1.1905	209.60	189.15	182.25	179.05	175.60	172.80
1 1/4	1.2500	43040	44040	197.75	3/4	8	1 1/2	1 1/2	3	5/16	1.1906-1.2530	238.50	218.10	211.35	208.00	204.60	201.80
1 5/16	1.3125	43042	44042	197.75	3/4	8	1 1/2	1 1/2	3	5/16	1.2531-1.3155	238.50	218.10	211.35	208.00	204.60	201.80
1 3/8	1.3750	43044	44044	200.60	3/4	8	1 1/2	1 1/2	3	5/16	1.3156-1.3780	241.30	220.90	214.20	210.85	207.50	204.70
1 7/16	1.4375	43046	44046	233.85	3/4	8	1 1/2	1 1/2	3	5/16	1.3781-1.4405	274.65	254.15	247.40	244.10	240.65	237.95
1 1/2	1.5000	43048	44048	280.85	3/4	8	1 1/2	1 1/2	3	5/16	1.4406-1.5030	321.55	301.25	294.40	291.15	287.55	284.80

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

CNC STUB REAMERS
CARBIDE TIPPED TYPES 430 & 440 METRIC

GENERAL PURPOSE

STRAIGHT OR LEFT SPIRAL FLUTES
FLUTE LONG CARBIDE
STRAIGHT SHANK

NOTE: Tool diameter in millimeters (mm); all other dimensions in inches. Also, modifications available (see list on page 42).

TOOL DIAMETER		TYPE 430 STRAIGHT	TYPE 440 LEFT	BOTH TYPES	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
							LENGTH				PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH	METRIC EDP NO.	METRIC EDP NO.	METRIC PRICE	SHANK DIAM.	NO. OF FLTS	FLT & CARBIDE	OVER-ALL	PIN HOLE DIAM.	MODIFIED DIAMETER RANGE (mm)	1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	430045	440045	$64.60	¼	4	*1	2 ¼	3⁄32	4.494 - 5.182	$93.30	$74.25	$67.90	$64.75	$61.60	$58.90	$55.30
5.0	.1969	430050	440050	64.60	¼	4	*1	2 ¼	3⁄32	-	-	-	-	-	-	-	-
5.5	.2165	430055	440055	64.60	¼	4	*1	2 ¼	3⁄32	5.183 - 5.613	93.30	74.25	67.90	64.75	61.60	58.90	55.30
6.0	.2362	430060	440060	64.60	¼	4	*1	2 ¼	3⁄32	5.614 - 6.045	93.30	74.25	67.90	64.75	61.60	58.90	55.30
-	-	430063	440063	-	¼	4	*1	2 ¼	3⁄32	6.046 - 6.426	93.30	74.25	67.90	64.75	61.60	58.90	55.30
6.5	.2559	430065	440065	64.60	⅜	4	*1	2 ¼	⅛	6.427 - 7.214	93.30	74.25	67.90	64.75	61.60	58.90	55.30
7.0	.2756	430070	440070	64.60	⅜	4	*1	2 ¼	⅛	-	-	-	-	-	-	-	-
7.5	.2953	430075	440075	73.10	⅜	4	1	2 ¼	⅛	7.215 - 8.001	101.80	82.75	76.30	73.20	70.05	67.30	63.65
8.0	.3150	430080	440080	73.10	⅜	4	1	2 ¼	⅛	-	-	-	-	-	-	-	-
8.5	.3346	430085	440085	73.60	⅜	4	1 ¼	2 ½	⅛	8.002 - 8.814	102.35	83.35	76.85	73.75	70.65	67.90	64.20
9.0	.3543	430090	440090	78.80	⅜	4	1 ¼	2 ½	⅛	8.815 - 9.601	107.45	88.50	82.05	78.95	75.65	73.10	69.40
9.5	.3740	430095	440095	78.80	⅜	4	1 ¼	2 ½	⅛	-	-	-	-	-	-	-	-
10.0	.3937	430100	440100	79.70	½	4	1 ¼	2 ½	3⁄16	9.602 - 10.389	108.45	89.40	82.90	79.95	76.65	74.00	70.25
10.5	.4134	430105	440105	92.00	½	4	1 ¼	2 ½	3⁄16	10.390 - 11.201	120.90	101.65	95.25	92.20	89.00	86.40	82.65
11.0	.4331	430110	440110	92.00	½	4	1 ¼	2 ½	3⁄16	-	-	-	-	-	-	-	-
11.5	.4528	430115	440115	92.00	½	4	1 ¼	2 ½	3⁄16	11.202 - 11.989	120.90	101.65	95.25	92.20	89.00	86.40	82.65
12.0	.4724	430120	440120	99.90	½	4	1 ¼	2 ½	3⁄16	11.990 - 12.776	129.35	109.70	103.25	100.05	96.80	94.00	90.30
12.5	.4921	430125	440125	99.90	½	4	1 ¼	2 ½	3⁄16	-	-	-	-	-	-	-	-
13.0	.5118	430130	440130	99.90	⅝	6	1 ½	3	¼	12.777 - 13.564	129.35	109.70	103.25	100.05	96.80	94.00	90.30
13.5	.5315	430135	440135	99.90	⅝	6	1 ½	3	¼	-	-	-	-	-	-	-	-
14.0	.5512	430140	440140	104.45	⅝	6	1 ½	3	¼	13.565 - 14.376	134.05	114.50	107.90	104.75	101.40	98.60	94.90
14.5	.5709	430145	440145	104.45	⅝	6	1 ½	3	¼	14.377 - 15.164	134.05	114.50	107.90	104.75	101.40	98.60	94.90
15.0	.5906	430150	440150	104.45	⅝	6	1 ½	3	¼	-	-	-	-	-	-	-	-
15.5	.6102	430155	440155	107.00	⅝	6	1 ½	3	¼	15.165 - 15.951	136.55	117.00	110.40	107.15	103.80	101.20	97.40
16.0	.6299	430160	440160	107.00	⅝	6	1 ½	3	¼	15.952 - 16.739	136.55	117.00	110.40	107.15	103.80	101.20	97.40
16.5	.6496	430165	440165	107.00	⅝	6	1 ½	3	¼	-	-	-	-	-	-	-	-
17.0	.6693	430170	440170	111.40	⅝	6	1 ½	3	¼	16.740 - 17.551	140.85	121.25	114.70	111.55	108.20	105.50	101.65
17.5	.6890	430175	440175	111.40	⅝	6	1 ½	3	¼	-	-	-	-	-	-	-	-
18.0	.7087	430180	440180	111.40	¾	6	1 ½	3	5⁄16	17.552 - 18.339	140.85	121.25	114.70	111.55	108.20	105.50	101.65
18.5	.7283	430185	440185	113.85	¾	6	1 ½	3	5⁄16	18.340 - 19.126	143.35	123.70	117.20	114.00	110.70	107.95	104.25
19.0	.7480	430190	440190	113.85	¾	6	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
19.5	.7677	430195	440195	113.85	¾	6	1 ½	3	5⁄16	19.127 - 19.914	143.35	123.70	117.20	114.00	110.70	107.95	104.25
20.0	.7874	430200	440200	122.55	¾	6	1 ½	3	5⁄16	19.915 - 20.726	152.15	132.55	126.00	122.80	119.45	116.75	112.95
20.5	.8071	430205	440205	122.55	¾	6	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
21.0	.8268	430210	440210	122.55	¾	6	1 ½	3	5⁄16	20.727 - 21.514	152.15	132.55	126.00	122.80	119.45	116.75	112.95
21.5	.8465	430215	440215	122.55	¾	6	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
22.0	.8661	430220	440220	128.40	¾	6	1 ½	3	5⁄16	21.515 - 22.301	157.90	138.30	131.65	128.55	125.20	122.50	118.75
22.5	.8858	430225	440225	133.15	¾	6	1 ½	3	5⁄16	22.302 - 23.089	163.80	143.50	136.70	133.30	129.90	127.20	123.25
23.0	.9055	430230	440230	133.15	¾	6	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
23.5	.9252	430235	440235	145.35	¾	6	1 ½	3	5⁄16	23.090 - 23.901	175.95	155.65	148.85	145.55	142.10	139.25	135.40
24.0	.9449	430240	440240	145.35	¾	8	1 ½	3	5⁄16	23.902 - 24.689	175.95	155.65	148.85	145.55	142.10	139.25	135.40
24.5	.9646	430245	440245	145.35	¾	8	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
25.0	.9843	430250	440250	151.80	¾	8	1 ½	3	5⁄16	24.690 - 25.476	182.55	162.10	155.40	152.10	148.60	145.80	141.90
25.5	1.0039	430255	440255	151.80	¾	8	1 ½	3	5⁄16	25.477 - 27.076	182.55	162.10	155.40	152.10	148.60	145.80	141.90
26.0	1.0236	430260	440260	151.80	¾	8	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
27.0	1.0630	430270	440270	151.80	¾	8	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
28.0	1.1024	430280	440280	175.35	¾	8	1 ½	3	5⁄16	27.077 - 28.651	206.10	185.75	178.85	175.60	172.20	169.35	165.45
29.0	1.1417	430290	440290	182.25	¾	8	1 ½	3	5⁄16	28.652 - 30.239	206.10	185.75	178.85	175.60	172.20	169.35	165.45
30.0	1.1811	430300	440300	182.25	¾	8	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
31.0	1.2205	430310	440310	211.35	¾	8	1 ½	3	5⁄16	30.240 - 31.826	241.95	221.55	214.85	211.45	208.00	205.20	201.30
32.0	1.2598	430320	440320	211.35	¾	8	1 ½	3	5⁄16	31.827 - 33.414	241.95	221.55	214.85	211.45	208.00	205.20	201.30
33.0	1.2992	430330	440330	211.35	¾	8	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
34.0	1.3386	430340	440340	214.20	¾	8	1 ½	3	5⁄16	33.415 - 35.001	244.75	224.40	217.60	214.30	210.85	208.00	204.10
35.0	1.3780	430350	440350	214.20	¾	8	1 ½	3	5⁄16	-	-	-	-	-	-	-	-
36.0	1.4173	430360	440360	247.40	¾	8	1 ½	3	5⁄16	35.002 - 36.589	277.95	257.70	250.85	247.50	244.10	241.25	237.35
37.0	1.4567	430370	440370	294.40	¾	8	1 ½	3	5⁄16	36.590 - 38.176	325.05	304.75	297.85	294.60	291.15	288.25	284.35
38.0	1.4961	430380	440380	294.40	¾	8	1 ½	3	5⁄16	-	-	-	-	-	-	-	-

*½" carbide length

JOBBERS DRILL LENGTH REAMERS CARBIDE TIPPED TYPE 401 FRACTIONAL

GENERAL PURPOSE

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						
				SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
5/32	.1562	40105	$64.05	.151	4	1	1/2	3 1/8	0.1560 - 0.1769	$102.25	$83.20	$76.70	$73.70	$70.40	$67.85
11/64	.1719	4011719	64.05	.151	4	1	1/2	3 1/4	-	-	-	-	-	-	-
3/16	.1875	40106	61.90	11/64	4	1 1/8	1/2	3 1/2	0.1770 - 0.2040	99.10	80.50	74.25	71.25	68.15	65.65
13/64	.2031	4012031	62.35	11/64	4	1 1/8	1/2	3 5/8	-	-	-	-	-	-	-
7/32	.2188	40107	61.90	13/64	4	1 1/4	1/2	3 3/4	0.2041 - 0.2210	99.10	80.50	74.25	71.25	68.15	65.65
15/64	.2344	4012344	62.35	7/32	4	1 1/2	1/2	3 7/8	0.2211 - 0.2380	99.60	81.05	74.60	71.70	68.55	65.95
1/4	.2500	40108	61.90	15/64	4	1 1/2	1/2	4	0.2381 - 0.2530	99.10	80.50	74.25	71.25	68.15	65.65
17/64	.2656	4012656	63.15	15/64	4	1 1/2	1/2	4 1/8	-	-	-	-	-	-	-
9/32	.2812	40109	62.80	15/64	4	1 1/2	1/2	4 1/4	0.2531 - 0.2840	99.95	81.35	75.15	72.15	68.95	66.45
19/64	.2969	4012969	63.15	9/32	4	1 1/2	1/2	4 3/8	-	-	-	-	-	-	-
5/16	.3125	40110	62.80	9/32	4	1 1/2	1/2	4 1/2	0.2841 - 0.3150	99.95	81.35	75.15	72.15	68.95	66.45
21/64	.3281	4013281	65.05	9/32	4	1 1/2	5/8	4 5/8	-	-	-	-	-	-	-
11/32	.3438	40111	64.35	9/32	4	1 1/2	5/8	4 3/4	0.3151 - 0.3470	101.45	82.85	76.65	73.70	70.45	67.95
23/64	.3594	4013594	65.05	5/16	4	1 3/4	5/8	4 7/8	-	-	-	-	-	-	-
3/8	.3750	40112	59.10	5/16	4	1 3/4	5/8	5	0.3471 - 0.3780	93.15	76.05	70.25	67.55	64.70	62.35
25/64	.3906	4013906	67.50	5/16	4	1 3/4	5/8	5 1/8	-	-	-	-	-	-	-
13/32	.4062	40113	66.40	5/16	4	1 3/4	5/8	5 1/4	0.3781 - 0.4090	103.60	84.95	78.70	75.85	72.50	70.05
27/64	.4219	4014219	67.50	3/8	4	1 3/4	5/8	5 3/8	-	-	-	-	-	-	-
7/16	.4375	40114	69.30	3/8	4	1 3/4	5/8	5 1/2	0.4091 - 0.4410	106.50	87.85	81.60	78.60	75.40	72.95
29/64	.4531	4014531	72.00	3/8	4	1 3/4	5/8	5 5/8	-	-	-	-	-	-	-
15/32	.4688	40115	72.40	3/8	4	1 3/4	5/8	5 3/4	0.4411 - 0.4720	109.55	90.95	84.70	81.75	78.55	76.05
31/64	.4844	4014844	76.70	7/16	6	2	5/8	5 7/8	-	-	-	-	-	-	-
1/2	.5000	40116	81.30	7/16	6	2	5/8	6	0.4721 - 0.5030	122.20	101.65	94.90	91.65	88.05	85.30
33/64	.5156	4015156	86.40	7/16	6	2	5/8	6 5/8	-	-	-	-	-	-	-
17/32	.5312	40117	86.40	7/16	6	2	5/8	6 5/8	0.5031 - 0.5340	127.30	106.75	99.95	96.70	93.20	90.45
35/64	.5469	4015469	86.40	7/16	6	2	5/8	6 5/8	-	-	-	-	-	-	-
9/16	.5625	40118	86.40	7/16	6	2	5/8	6 5/8	0.5341 - 0.5660	127.30	106.75	99.95	96.70	93.20	90.45
37/64	.5781	4015781	88.75	7/16	6	2	5/8	6 5/8	-	-	-	-	-	-	-
19/32	.5938	40119	88.75	7/16	6	2	5/8	7 1/8	0.5661 - 0.5970	129.80	109.30	102.45	99.10	95.55	92.90
39/64	.6094	4016094	88.75	9/16	6	2 1/4	5/8	7 1/8	-	-	-	-	-	-	-
5/8	.6250	40120	88.75	9/16	6	2 1/4	5/8	7 1/8	0.5971 - 0.6280	129.80	109.30	102.45	99.10	95.55	92.90
41/64	.6406	4016406	89.90	9/16	6	2 1/4	5/8	7 1/8	-	-	-	-	-	-	-
21/32	.6562	40121	89.90	9/16	6	2 1/4	5/8	7 1/8	0.6281 - 0.6590	130.85	110.40	103.50	100.20	96.70	93.90
43/64	.6719	4016719	89.90	9/16	6	2 1/4	5/8	7 5/8	-	-	-	-	-	-	-
11/16	.6875	40122	89.90	9/16	6	2 1/4	5/8	7 5/8	0.6591 - 0.6910	130.85	110.40	103.50	100.20	96.70	93.90
45/64	.7031	4017031	93.00	9/16	6	2 1/4	5/8	7 5/8	-	-	-	-	-	-	-
23/32	.7188	40123	93.00	9/16	6	2 1/4	5/8	7 5/8	0.6911 - 0.7220	133.90	113.50	106.60	103.30	99.80	97.00
47/64	.7344	4017344	93.00	5/8	6	2 1/2	3/4	7 5/8	-	-	-	-	-	-	-
3/4	.7500	40124	93.00	5/8	6	2 1/2	3/4	8	0.7221 - 0.7530	133.90	113.50	106.60	103.30	99.80	97.00

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

JOBBERS DRILL LENGTH REAMERS CARBIDE TIPPED TYPES 477 & 479 FRACTIONAL

GENERAL PURPOSE

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	LENGTH CARBIDE	LENGTH OVERALL
.1865	47918	$62.35	11/64	4	1 1/8	1/2	3 1/2
.1885	47919	62.35	11/64	4	1 1/8	1/2	3 1/2
.2490	47924	62.35	15/64	4	1 1/2	1/2	4
.2510	47925	62.35	15/64	4	1 1/2	1/2	4
.3115	47931	63.15	9/32	4	1 1/2	1/2	4 1/2
.3135	47932	63.15	9/32	4	1 1/2	1/2	4 1/2
.3740	47937	65.05	5/16	4	1 3/4	5/8	5
.3760	47938	65.05	5/16	4	1 3/4	5/8	5
.4365	47943	72.00	3/8	4	1 3/4	5/8	5 1/2
.4385	47944	72.00	3/8	4	1 3/4	5/8	5 1/2
.4990	47949	76.70	7/16	6	2	5/8	6
.5010	47950	76.70	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	LENGTH CARBIDE	LENGTH OVERALL
.1855	47717	$62.35	11/64	4	1 1/8	1/2	3 1/2
.1870	47718	62.35	11/64	4	1 1/8	1/2	3 1/2
.2480	47723	62.35	15/64	4	1 1/2	1/2	4
.2495	47724	62.35	15/64	4	1 1/2	1/2	4
.3105	47730	63.15	9/32	4	1 1/2	1/2	4 1/2
.3120	47731	63.15	9/32	4	1 1/2	1/2	4 1/2
.3730	47736	65.05	5/16	4	1 3/4	5/8	5
.3745	47737	65.05	5/16	4	1 3/4	5/8	5
.4355	47742	72.00	3/8	4	1 3/4	5/8	5 1/2
.4370	47743	72.00	3/8	4	1 3/4	5/8	5 1/2
.4980	47748	76.70	7/16	6	2	5/8	6
.4995	47749	76.70	7/16	6	2	5/8	6

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

GENERAL PURPOSE

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	LENGTH CARBIDE	LENGTH OVERALL
22	.1570	4001570	$56.10	.151	4	1	1/2	4
21	.1590	4001590	56.10	.151	4	1	1/2	4
20	.1610	4001610	56.10	.151	4	1	1/2	4
19	.1660	4001660	56.10	.151	4	1	1/2	4
18	.1695	4001695	56.10	.151	4	1	1/2	4
17	.1730	4001730	56.10	.151	4	1	1/2	4
16	.1770	4001770	52.25	11/64	4	1 1/8	1/2	4 1/2
15	.1800	4001800	52.25	11/64	4	1 1/8	1/2	4 1/2
14	.1820	4001820	52.25	11/64	4	1 1/8	1/2	4 1/2
13	.1850	400047	52.25	11/64	4	1 1/8	1/2	4 1/2
12	.1890	400048	52.25	11/64	4	1 1/8	1/2	4 1/2
11	.1910	4001910	52.25	11/64	4	1 1/8	1/2	4 1/2
10	.1935	4001935	52.25	11/64	4	1 1/8	1/2	4 1/2
9	.1960	4001960	52.25	11/64	4	1 1/8	1/2	4 1/2
8	.1990	4001990	52.25	11/64	4	1 1/8	1/2	4 1/2
7	.2010	4002010	52.25	11/64	4	1 1/8	1/2	4 1/2
6	.2040	4002040	52.25	11/64	4	1 1/8	1/2	4 1/2
5	.2055	4002055	52.25	13/64	4	1 1/4	1/2	5
4	.2090	4002090	52.25	13/64	4	1 1/4	1/2	5
3	.2130	4002130	52.25	13/64	4	1 1/4	1/2	5
2	.2210	4002210	52.25	13/64	4	1 1/4	1/2	5
1	.2280	4002280	54.65	7/32	4	1 1/2	1/2	6
A	.2340	4002340	54.65	7/32	4	1 1/2	1/2	6
B	.2380	4002380	54.65	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	LENGTH CARBIDE	LENGTH OVERALL
C	.2420	4002420	$52.25	15/64	4	1 1/2	1/2	6
D	.2460	4002460	52.25	15/64	4	1 1/2	1/2	6
E	.2500	40008	39.80	15/64	4	1 1/2	1/2	6
F	.2570	4002570	53.05	15/64	4	1 1/2	1/2	6
G	.2610	4002610	53.05	15/64	4	1 1/2	1/2	6
H	.2660	4002660	53.05	15/64	4	1 1/2	1/2	6
I	.2720	4002720	53.05	15/64	4	1 1/2	1/2	6
J	.2770	4002770	53.05	15/64	4	1 1/2	1/2	6
K	.2810	4002810	53.05	15/64	4	1 1/2	1/2	6
L	.2900	4002900	53.05	9/32	4	1 1/2	1/2	6
M	.2950	4002950	53.05	9/32	4	1 1/2	1/2	6
N	.3020	4003020	53.05	9/32	4	1 1/2	1/2	6
O	.3160	4003160	54.40	9/32	4	1 1/2	1/2	6
P	.3230	4003230	54.40	9/32	4	1 1/2	1/2	6
Q	.3320	4003320	54.40	9/32	4	1 1/2	1/2	6
R	.3390	4003390	54.40	9/32	4	1 1/2	1/2	6
S	.3480	4003480	54.40	5/16	4	1 3/4	5/8	7
T	.3580	4003580	54.40	5/16	4	1 3/4	5/8	7
U	.3680	4003680	54.40	5/16	4	1 3/4	5/8	7
V	.3770	4003770	54.40	5/16	4	1 3/4	5/8	7
W	.3860	4003860	56.50	5/16	4	1 3/4	5/8	7
X	.3970	4003970	56.50	5/16	4	1 3/4	5/8	7
Y	.4040	4004040	56.50	5/16	4	1 3/4	5/8	7
Z	.4130	4004130	59.40	3/8	4	1 3/4	5/8	7

CHUCKING REAMERS CARBIDE TIPPED TYPE 400 FRACTIONAL

GENERAL PURPOSE

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						
				SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
5/32	.1562	40005	$43.40	.151	4	1	1/2	4	0.1560 - 0.1769	$82.05	$62.40	$56.10	$53.00	$49.70	$47.15
11/64	.1719	4001719	43.40	.151	4	1	1/2	4	-	-	-	-	-	-	-
3/16	.1875	40006	39.80	11/64	4	1 1/8	1/2	4 1/2	0.1770 - 0.2040	77.00	58.35	52.25	49.10	46.00	43.45
3/16	.1875	40086	42.15	11/64	4	1 1/4	1/2	5	0.1770 - 0.2040	79.35	60.70	54.65	51.50	48.35	45.85
13/64	.2031	4002031	42.15	11/64	4	1 1/8	1/2	4 1/2	-	-	-	-	-	-	-
7/32	.2188	40007	39.80	13/64	4	1 1/4	1/2	5	0.2041 - 0.2210	77.00	58.35	52.25	49.10	46.00	43.45
15/64	.2344	4002344	42.15	7/32	4	1 1/2	1/2	6	0.2211 - 0.2380	79.35	60.70	54.65	51.50	48.35	45.85
1/4	.2500	40008	39.80	15/64	4	1 1/2	1/2	6	0.2381 - 0.2530	77.00	58.35	52.25	49.10	46.00	43.45
17/64	.2656	4002656	43.10	15/64	4	1 1/2	1/2	6	-	-	-	-	-	-	-
9/32	.2812	40009	40.70	15/64	4	1 1/2	1/2	6	0.2531 - 0.2840	77.85	59.25	53.05	50.05	46.80	44.30
19/64	.2969	4002969	43.10	9/32	4	1 1/2	1/2	6	-	-	-	-	-	-	-
5/16	.3125	40010	40.70	9/32	4	1 1/2	1/2	6	0.2841 - 0.3150	77.85	59.25	53.05	50.05	46.80	44.30
21/64	.3281	4003281	44.70	9/32	4	1 1/2	5/8	6	-	-	-	-	-	-	-
11/32	.3438	40011	42.10	9/32	4	1 1/2	5/8	6	0.3151 - 0.3470	79.30	60.65	54.40	51.45	48.30	45.75
23/64	.3594	4003594	44.70	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-
3/8	.3750	40012	42.10	5/16	4	1 3/4	5/8	7	0.3471 - 0.3780	79.30	60.65	54.40	51.45	48.30	45.75
25/64	.3906	4003906	47.00	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-
13/32	.4062	40013	44.20	5/16	4	1 3/4	5/8	7	0.3781 - 0.4090	81.35	62.75	56.50	53.50	50.30	47.85
27/64	.4219	4004219	50.00	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-
7/16	.4375	40014	47.20	3/8	4	1 3/4	5/8	7	0.4091 - 0.4410	84.35	65.75	59.40	56.50	53.25	50.85
29/64	.4531	4004531	50.80	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-
15/32	.4688	40015	47.85	3/8	4	1 3/4	5/8	7	0.4411 - 0.4720	85.05	66.40	60.15	57.15	54.00	51.45
31/64	.4844	4004844	54.85	7/16	6	2	5/8	8	-	-	-	-	-	-	-
1/2	.5000	40016	56.90	7/16	6	2	5/8	8	0.4721 - 0.5030	97.85	77.40	70.45	67.25	63.65	60.90
33/64	.5156	4005156	61.90	7/16	6	2	5/8	8	-	-	-	-	-	-	-
17/32	.5312	40017	61.90	7/16	6	2	5/8	8	0.5031 - 0.5340	102.95	82.45	75.55	72.25	68.70	65.95
35/64	.5469	4005469	61.90	7/16	6	2	5/8	8	-	-	-	-	-	-	-
9/16	.5625	40018	61.90	7/16	6	2	5/8	8	0.5341 - 0.5660	102.95	82.45	75.55	72.25	68.70	65.95
37/64	.5781	4005781	64.45	7/16	6	2	5/8	8	-	-	-	-	-	-	-
19/32	.5938	40019	64.45	7/16	6	2	5/8	8	0.5661 - 0.5970	105.45	84.85	78.00	74.80	71.20	68.55
39/64	.6094	4006094	64.45	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
5/8	.6250	40020	64.45	9/16	6	2 1/4	5/8	9	0.5971 - 0.6280	105.45	84.85	78.00	74.80	71.20	68.55
41/64	.6406	4006406	65.60	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
21/32	.6562	40021	65.60	9/16	6	2 1/4	5/8	9	0.6281 - 0.6590	106.50	85.90	79.10	75.90	72.30	69.60
43/64	.6719	4006719	65.60	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
11/16	.6875	40022	65.60	9/16	6	2 1/4	5/8	9	0.6591 - 0.6910	106.50	85.90	79.10	75.90	72.30	69.60
45/64	.7031	4007031	68.65	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-
23/32	.7188	40023	68.65	9/16	6	2 1/4	5/8	9	0.6911 - 0.7220	109.55	89.15	82.20	79.00	75.40	72.70
47/64	.7344	4007344	68.65	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
3/4	.7500	40024	68.65	5/8	6	2 1/2	3/4	9 1/2	0.7221 - 0.7530	109.55	89.15	82.20	79.00	75.40	72.70

CONTINUED ON NEXT PAGE

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

CONTINUED FROM PAGE 46 - TYPE 400 FRACTIONAL

TOOL DIAMETER		TYPE 400 EDP NO.	PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
				SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
49/64	.7656	4007656	$70.90	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
25/32	.7812	40025	70.90	5/8	6	2 1/2	3/4	9 1/2	0.7531 - 0.7840	$111.80	$91.30	$84.50	$81.25	$77.70	$74.90
51/64	.7969	4007969	70.90	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
13/16	.8125	40026	70.90	5/8	6	2 1/2	3/4	9 1/2	0.7841 - 0.8160	111.80	91.30	84.50	81.25	77.70	74.90
53/64	.8281	4008281	73.75	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-
27/32	.8438	40027	73.75	5/8	6	2 1/2	3/4	9 1/2	0.8161 - 0.8470	114.70	94.15	87.35	84.05	80.50	77.75
55/64	.8594	4008594	73.75	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-
7/8	.8750	40028	76.55	3/4	6	2 5/8	3/4	10	0.8471 - 0.8780	118.95	97.75	90.65	87.25	83.50	80.65
57/64	.8906	4008906	89.15	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-
29/32	.9062	40029	89.15	3/4	6	2 5/8	3/4	10	0.8781 - 0.9090	131.60	110.30	103.25	99.85	96.15	93.30
59/64	.9219	4009219	89.15	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-
15/16	.9375	40030	89.15	3/4	8	2 5/8	3/4	10	0.9091 - 0.9410	131.60	110.30	103.25	99.85	96.15	93.30
61/64	.9531	4009531	93.40	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-
31/32	.9688	40031	93.40	3/4	8	2 5/8	3/4	10	0.9411 - 0.9720	135.95	114.65	107.65	104.20	100.45	97.60
63/64	.9844	4009844	93.40	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-
1	1.0000	40032	93.40	7/8	8	2 3/4	3/4	10 1/2	0.9721 - 1.0030	135.95	114.65	107.65	104.20	100.45	97.60
1 1/16	1.0625	40034	96.60	7/8	8	2 3/4	3/4	10 1/2	1.0031 - 1.0660	137.40	117.00	110.10	106.95	103.40	100.60
1 1/8	1.1250	40036	104.40	7/8	8	2 7/8	7/8	11	1.0661 - 1.1280	145.20	124.80	118.05	114.75	111.15	108.45
1 3/16	1.1875	40038	109.85	1	8	2 7/8	7/8	11	1.1281 - 1.1905	150.50	130.15	123.30	120.00	116.60	113.75
1 1/4	1.2500	40040	116.05	1	8	3	7/8	11 1/2	1.1906 - 1.2530	156.85	136.55	129.60	126.40	122.85	120.05
1 5/16	1.3125	40042	122.15	1	8	3	7/8	11 1/2	1.2531 - 1.3155	162.85	142.45	135.55	132.40	128.85	126.15
1 3/8	1.3750	40044	129.60	1	8	3 1/4	7/8	12	1.3156 - 1.3780	170.25	149.95	143.15	139.85	136.45	133.70
1 7/16	1.4375	40046	144.40	1 1/4	8	3 1/4	7/8	12	1.3781 - 1.4405	185.20	164.80	157.95	154.70	151.20	148.45
1 1/2	1.5000	40048	152.70	1 1/4	8	3 1/2	7/8	12 1/2	1.4406 - 1.5030	193.40	173.00	166.10	162.95	159.45	156.65
1 9/16	1.5625	40050	226.75	1 1/4	8	3 1/2	7/8	12 1/2	1.5031 - 1.5660	267.45	247.10	240.30	237.00	233.55	230.75
1 5/8	1.6250	40052	234.55	1 1/4	8	3 3/4	7/8	13	1.5661 - 1.6280	275.15	254.85	248.00	244.75	241.25	238.50
1 11/16	1.6875	40054	263.75	1 1/4	8	3 3/4	7/8	13	1.6281 - 1.6910	304.55	284.15	277.30	274.10	270.65	267.85
1 3/4	1.7500	40056	263.75	1 1/4	10	4	7/8	13 1/2	1.6911 - 1.7530	304.55	284.15	277.30	274.10	270.65	267.85
1 13/16	1.8125	40058	263.75	1 1/2	10	4	7/8	13 1/2	1.7531 - 1.8160	304.55	284.15	277.30	274.10	270.65	267.85
1 7/8	1.8750	40060	276.45	1 1/2	10	4 1/4	7/8	14	1.8161 - 1.8780	317.10	296.70	289.80	286.60	283.10	280.30
1 15/16	1.9375	40062	276.45	1 1/2	10	4 1/4	7/8	14	1.8781 - 1.9410	317.10	296.70	289.80	286.60	283.10	280.30
2	2.0000	40064	276.45	1 1/2	12	4 1/4	7/8	14	1.9411 - 2.0030	317.10	296.70	289.80	286.60	283.10	280.30

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

OVER & UNDER SIZE REAMERS CARBIDE TIPPED

GENERAL PURPOSE

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	$50.10	11/64	4	1 1/8	1/2	4 1/2
.1885	47819	50.10	11/64	4	1 1/8	1/2	4 1/2
.2490	47824	50.10	15/64	4	1 1/2	1/2	6
.2510	47825	50.10	15/64	4	1 1/2	1/2	6
.3115	47831	51.20	9/32	4	1 1/2	1/2	6
.3135	47832	51.20	9/32	4	1 1/2	1/2	6
.3740	47837	53.10	5/16	4	1 3/4	5/8	7
.3760	47838	53.10	5/16	4	1 3/4	5/8	7
.4365	47843	59.35	3/8	4	1 3/4	5/8	7
.4385	47844	59.35	3/8	4	1 3/4	5/8	7
.4990	47849	65.05	7/16	6	2	5/8	8
.5010	47850	65.05	7/16	6	2	5/8	8
.6240	47862	78.00	9/16	6	2 1/4	5/8	9
.6260	47863	78.00	9/16	6	2 1/4	5/8	9
.7490	47874	82.20	5/8	6	2 1/2	3/4	9 1/2
.7510	47875	82.20	5/8	6	2 1/2	3/4	9 1/2
.8740	47886	87.35	3/4	6	2 5/8	3/4	10
.8760	47887	90.65	3/4	6	2 5/8	3/4	10
.9990	47898	107.70	7/8	8	2 3/4	3/4	10 1/2
1.0010	47899	103.20	7/8	8	2 3/4	3/4	10 1/2

DOWEL PIN SIZE REAMERS CARBIDE TIPPED

GENERAL PURPOSE

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	$50.10	11/64	4	1 1/8	1/2	4 1/2
.1870	47618	50.10	11/64	4	1 1/8	1/2	4 1/2
.2480	47623	50.10	15/64	4	1 1/2	1/2	6
.2495	47624	50.10	15/64	4	1 1/2	1/2	6
.3105	47630	51.20	9/32	4	1 1/2	1/2	6
.3120	47631	51.20	9/32	4	1 1/2	1/2	6
.3730	47636	53.10	5/16	4	1 3/4	5/8	7
.3745	47637	53.10	5/16	4	1 3/4	5/8	7
.4355	47642	59.35	3/8	4	1 3/4	5/8	7
.4370	47643	59.35	3/8	4	1 3/4	5/8	7
.4980	47648	65.05	7/16	6	2	5/8	8
.4995	47649	65.05	7/16	6	2	5/8	8
	47600	$625.05 - CASED SET OF ABOVE 12 REAMERS					

CHUCKING REAMERS CARBIDE TIPPED TYPE 400 .0005 INCREMENTS

GENERAL PURPOSE

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
.1560	4001560	$56.10
.1565	4001565	56.10
.1570	4001570	56.10
.1575	400040	56.10
.1580	4001580	56.10
.1585	4001585	56.10
.1590	4001590	56.10
.1595	4001595	56.10
.1600	4001600	56.10
.1605	4001605	56.10
.1610	4001610	56.10
.1615	4001615	56.10
.1620	4001620	56.10
.1625	4001625	56.10
.1630	4001630	56.10
.1635	4001635	56.10
.1640	4001640	56.10
.1645	4001645	56.10
.1650	4001650	56.10
.1655	4001655	56.10
.1660	4001660	56.10
.1665	4001665	56.10
.1670	4001670	56.10
.1675	4001675	56.10
.1680	4001680	56.10
.1685	4001685	56.10
.1690	4001690	56.10
.1695	4001695	56.10
.1700	4001700	56.10
.1705	4001705	56.10
.1710	4001710	56.10
.1715	4001715	56.10
.1720	4001720	56.10
.1725	4001725	56.10
.1730	4001730	56.10
.1735	4001735	56.10
.1740	4001740	56.10
.1745	4001745	56.10
.1750	4001750	56.10
.1755	4001755	56.10
.1760	4001760	56.10
.1765	4001765	56.10
.1770	4001770	52.25
.1775	4001775	52.25
.1780	4001780	52.25
.1785	4001785	52.25
.1790	4001790	52.25
.1795	4001795	52.25
.1800	4001800	52.25
.1805	4001805	52.25
.1810	4001810	52.25
.1815	4001815	52.25
.1820	4001820	52.25
.1825	4001825	52.25
.1830	4001830	52.25
.1835	4001835	52.25
.1840	4001840	52.25
.1845	4001845	52.25
.1850	400047	52.25
.1855	4001855	52.25

TOOL DIAM.	EDP NO.	PRICE
.1860	4001860	$52.25
.1865	47818	50.10
.1870	4001870	52.25
.1875	40006	39.80
.1880	4001880	52.25
.1885	47819	50.10
.1890	400048	52.25
.1895	4001895	52.25
.1900	4001900	52.25
.1905	4001905	52.25
.1910	4001910	52.25
.1915	4001915	52.25
.1920	4001920	52.25
.1925	4001925	52.25
.1930	4001930	52.25
.1935	4001935	52.25
.1940	4001940	52.25
.1945	4001945	52.25
.1950	4001950	52.25
.1955	4001955	52.25
.1960	4001960	52.25
.1965	4001965	52.25
.1970	4001970	52.25
.1975	4001975	52.25
.1980	4001980	52.25
.1985	4001985	52.25
.1990	4001990	52.25
.1995	4001995	52.25
.2000	4002000	52.25
.2005	4002005	52.25
.2010	4002010	52.25
.2015	4002015	52.25
.2020	4002020	52.25
.2025	4002025	52.25
.2030	4002030	52.25
.2035	4002035	52.25
.2040	4002040	52.25
.2045	4002045	52.25
.2050	4002050	52.25
.2055	4002055	52.25
.2060	4002060	52.25
.2065	4002065	52.25
.2070	4002070	52.25
.2075	4002075	52.25
.2080	4002080	52.25
.2085	4002085	52.25
.2090	4002090	52.25
.2095	4002095	52.25
.2100	4002100	52.25
.2105	4002105	52.25
.2110	4002110	52.25
.2115	4002115	52.25
.2120	4002120	52.25
.2125	4002125	52.25
.2130	4002130	52.25
.2135	4002135	52.25
.2140	4002140	52.25
.2145	4002145	52.25
.2150	4002150	52.25
.2155	4002155	52.25

TOOL DIAM.	EDP NO.	PRICE
.2160	4002160	$52.25
.2165	400055	52.25
.2170	4002170	52.25
.2175	4002175	52.25
.2180	4002180	52.25
.2185	4002185	52.25
.2190	4002190	52.25
.2195	4002195	52.25
.2200	4002200	52.25
.2205	400056	52.25
.2210	4002210	52.25
.2215	4002215	54.65
.2220	4002220	54.65
.2225	4002225	54.65
.2230	4002230	54.65
.2235	4002235	54.65
.2240	4002240	54.65
.2245	4002245	54.65
.2250	4002250	54.65
.2255	4002255	54.65
.2260	4002260	54.65
.2265	4002265	54.65
.2270	4002270	54.65
.2275	4002275	54.65
.2280	4002280	54.65
.2285	4002285	54.65
.2290	4002290	54.65
.2295	4002295	54.65
.2300	4002300	54.65
.2305	4002305	54.65
.2310	4002310	54.65
.2315	4002315	54.65
.2320	4002320	54.65
.2325	4002325	54.65
.2330	4002330	54.65
.2335	4002335	54.65
.2340	4002340	54.65
.2345	4002345	54.65
.2350	4002350	54.65
.2355	4002355	54.65
.2360	4002360	54.65
.2365	4002365	54.65
.2370	4002370	54.65
.2375	4002375	54.65
.2380	4002380	54.65
.2385	4002385	52.25
.2390	4002390	52.25
.2395	4002395	52.25
.2400	4002400	52.25
.2405	4002405	52.25
.2410	4002410	52.25
.2415	4002415	52.25
.2420	4002420	52.25
.2425	4002425	52.25
.2430	4002430	52.25
.2435	4002435	52.25
.2440	4002440	52.25
.2445	4002445	52.25
.2450	4002450	52.25
.2455	4002455	52.25

TOOL DIAM.	EDP NO.	PRICE
.2460	4002460	$52.25
.2465	4002465	52.25
.2470	4002470	52.25
.2475	4002475	52.25
.2480	400063	52.25
.2485	4002485	52.25
.2490	47824	50.10
.2495	4002495	52.25
.2500	40008	39.80
.2505	4002505	52.25
.2510	47825	50.10
.2515	4002515	52.25
.2520	400064	52.25
.2525	4002525	52.25
.2530	4002530	52.25
.2535	4002535	53.05
.2540	4002540	53.05
.2545	4002545	53.05
.2550	4002550	53.05
.2555	4002555	53.05
.2560	4002560	53.05
.2565	4002565	53.05
.2570	4002570	53.05
.2575	4002575	53.05
.2580	4002580	53.05
.2585	4002585	53.05
.2590	4002590	53.05
.2595	4002595	53.05
.2600	4002600	53.05
.2605	4002605	53.05
.2610	4002610	53.05
.2615	4002615	53.05
.2620	4002620	53.05
.2625	4002625	53.05
.2630	4002630	53.05
.2635	4002635	53.05
.2640	4002640	53.05
.2645	4002645	53.05
.2650	4002650	53.05
.2655	4002655	53.05
.2660	4002660	53.05
.2665	4002665	53.05
.2670	4002670	53.05
.2675	4002675	53.05
.2680	4002680	53.05
.2685	4002685	53.05
.2690	4002690	53.05
.2695	4002695	53.05
.2700	4002700	53.05
.2705	4002705	53.05
.2710	4002710	53.05
.2715	4002715	53.05
.2720	4002720	53.05
.2725	4002725	53.05
.2730	4002730	53.05
.2735	4002735	53.05
.2740	4002740	53.05
.2745	4002745	53.05
.2750	4002750	53.05
.2755	4002755	53.05

TOOL DIAM.	EDP NO.	PRICE
.2760	4002760	$53.05
.2765	4002765	53.05
.2770	4002770	53.05
.2775	4002775	53.05
.2780	4002780	53.05
.2785	4002785	53.05
.2790	4002790	53.05
.2795	400071	53.05
.2800	4002800	53.05
.2805	4002805	53.05
.2810	4002810	53.05
.2815	4002815	53.05
.2820	4002820	53.05
.2825	4002825	53.05
.2830	4002830	53.05
.2835	400072	53.05
.2840	4002840	53.05
.2845	4002845	53.05
.2850	4002850	53.05
.2855	4002855	53.05
.2860	4002860	53.05
.2865	4002865	53.05
.2870	4002870	53.05
.2875	4002875	53.05
.2880	4002880	53.05
.2885	4002885	53.05
.2890	4002890	53.05
.2895	4002895	53.05
.2900	4002900	53.05
.2905	4002905	53.05
.2910	4002910	53.05
.2915	4002915	53.05
.2920	4002920	53.05
.2925	4002925	53.05
.2930	4002930	53.05
.2935	4002935	53.05
.2940	4002940	53.05
.2945	4002945	53.05
.2950	4002950	53.05
.2955	4002955	53.05
.2960	4002960	53.05
.2965	4002965	53.05
.2970	4002970	53.05
.2975	4002975	53.05
.2980	4002980	53.05
.2985	4002985	53.05
.2990	4002990	53.05
.2995	4002995	53.05
.3000	4003000	53.05
.3005	4003005	53.05
.3010	4003010	53.05
.3015	4003015	53.05
.3020	4003020	53.05
.3025	4003025	53.05
.3030	4003030	53.05
.3035	4003035	53.05
.3040	4003040	53.05
.3045	4003045	53.05
.3050	4003050	53.05
.3055	4003055	53.05

CHUCKING REAMERS
CARBIDE TIPPED TYPE 400 .0005 INCREMENTS

GENERAL PURPOSE

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
.3060	4003060	$53.05
.3065	4003065	53.05
.3070	4003070	53.05
.3075	4003075	53.05
.3080	4003080	53.05
.3085	4003085	53.05
.3090	4003090	53.05
.3095	4003095	53.05
.3100	4003100	53.05
.3105	4003105	53.05
.3110	400079	53.05
.3115	47831	51.20
.3120	4003120	53.05
.3125	40010	40.70
.3130	4003130	53.05
.3135	47832	51.20
.3140	4003140	53.05
.3145	4003145	53.05
.3150	400080	53.05
.3155	4003155	54.40
.3160	4003160	54.40
.3165	4003165	54.40
.3170	4003170	54.40
.3175	4003175	54.40
.3180	4003180	54.40
.3185	4003185	54.40
.3190	4003190	54.40
.3195	4003195	54.40
.3200	4003200	54.40
.3205	4003205	54.40
.3210	4003210	54.40
.3215	4003215	54.40
.3220	4003220	54.40
.3225	4003225	54.40
.3230	4003230	54.40
.3235	4003235	54.40
.3240	4003240	54.40
.3245	4003245	54.40
.3250	4003250	54.40
.3255	4003255	54.40
.3260	4003260	54.40
.3265	4003265	54.40
.3270	4003270	54.40
.3275	4003275	54.40
.3280	4003280	54.40
.3285	4003285	54.40
.3290	4003290	54.40
.3295	4003295	54.40
.3300	4003300	54.40
.3305	4003305	54.40
.3310	4003310	54.40
.3315	4003315	54.40
.3320	4003320	54.40
.3325	4003325	54.40
.3330	4003330	54.40
.3335	4003335	54.40
.3340	4003340	54.40
.3345	4003345	54.40
.3350	4003350	54.40
.3355	4003355	54.40

TOOL DIAM.	EDP NO.	PRICE
.3360	4003360	$54.40
.3365	4003365	54.40
.3370	4003370	54.40
.3375	4003375	54.40
.3380	4003380	54.40
.3385	4003385	54.40
.3390	4003390	54.40
.3395	4003395	54.40
.3400	4003400	54.40
.3405	4003405	54.40
.3410	4003410	54.40
.3415	4003415	54.40
.3420	4003420	54.40
.3425	400087	54.40
.3430	4003430	54.40
.3435	4003435	54.40
.3440	4003440	54.40
.3445	4003445	54.40
.3450	4003450	54.40
.3455	4003455	54.40
.3460	4003460	54.40
.3465	400088	54.40
.3470	4003470	54.40
.3475	4003475	54.40
.3480	4003480	54.40
.3485	4003485	54.40
.3490	4003490	54.40
.3495	4003495	54.40
.3500	4003500	54.40
.3505	4003505	54.40
.3510	4003510	54.40
.3515	4003515	54.40
.3520	4003520	54.40
.3525	4003525	54.40
.3530	4003530	54.40
.3535	4003535	54.40
.3540	4003540	54.40
.3545	4003545	54.40
.3550	4003550	54.40
.3555	4003555	54.40
.3560	4003560	54.40
.3565	4003565	54.40
.3570	4003570	54.40
.3575	4003575	54.40
.3580	4003580	54.40
.3585	4003585	54.40
.3590	4003590	54.40
.3595	4003595	54.40
.3600	4003600	54.40
.3605	4003605	54.40
.3610	4003610	54.40
.3615	4003615	54.40
.3620	4003620	54.40
.3625	4003625	54.40
.3630	4003630	54.40
.3635	4003635	54.40
.3640	4003640	54.40
.3645	4003645	54.40
.3650	4003650	54.40
.3655	4003655	54.40

TOOL DIAM.	EDP NO.	PRICE
.3660	4003660	$54.40
.3665	4003665	54.40
.3670	4003670	54.40
.3675	4003675	54.40
.3680	4003680	54.40
.3685	4003685	54.40
.3690	4003690	54.40
.3695	4003695	54.40
.3700	4003700	54.40
.3705	4003705	54.40
.3710	4003710	54.40
.3715	4003715	54.40
.3720	4003720	54.40
.3725	4003725	54.40
.3730	4003730	54.40
.3735	4003735	54.40
.3740	47837	53.10
.3745	4003745	54.40
.3750	40012	42.10
.3755	4003755	54.40
.3760	47838	53.10
.3765	4003765	54.40
.3770	4003770	54.40
.3775	4003775	54.40
.3780	400096	54.40
.3785	4003785	56.50
.3790	4003790	56.50
.3795	4003795	56.50
.3800	4003800	56.50
.3805	4003805	56.50
.3810	4003810	56.50
.3815	4003815	56.50
.3820	4003820	56.50
.3825	4003825	56.50
.3830	4003830	56.50
.3835	4003835	56.50
.3840	4003840	56.50
.3845	4003845	56.50
.3850	4003850	56.50
.3855	4003855	56.50
.3860	4003860	56.50
.3865	4003865	56.50
.3870	4003870	56.50
.3875	4003875	56.50
.3880	4003880	56.50
.3885	4003885	56.50
.3890	4003890	56.50
.3895	4003895	56.50
.3900	4003900	56.50
.3905	4003905	56.50
.3910	4003910	56.50
.3915	4003915	56.50
.3920	4003920	56.50
.3925	4003925	56.50
.3930	4003930	56.50
.3935	4003935	56.50
.3940	4003940	56.50
.3945	4003945	56.50
.3950	4003950	56.50
.3955	4003955	56.50

TOOL DIAM.	EDP NO.	PRICE
.3960	4003960	$56.50
.3965	4003965	56.50
.3970	4003970	56.50
.3975	4003975	56.50
.3980	4003980	56.50
.3985	4003985	56.50
.3990	4003990	56.50
.3995	4003995	56.50
.4000	4004000	56.50
.4005	4004005	56.50
.4010	4004010	56.50
.4015	4004015	56.50
.4020	4004020	56.50
.4025	4004025	56.50
.4030	4004030	56.50
.4035	4004035	56.50
.4040	4004040	56.50
.4045	4004045	56.50
.4050	4004050	56.50
.4055	400103	56.50
.4060	4004060	56.50
.4065	4004065	56.50
.4070	4004070	56.50
.4075	4004075	56.50
.4080	4004080	56.50
.4085	4004085	56.50
.4090	4004090	56.50
.4095	4004095	59.40
.4100	4004100	59.40
.4105	4004105	59.40
.4110	4004110	59.40
.4115	4004115	59.40
.4120	4004120	59.40
.4125	4004125	59.40
.4130	4004130	59.40
.4135	4004135	59.40
.4140	4004140	59.40
.4145	4004145	59.40
.4150	4004150	59.40
.4155	4004155	59.40
.4160	4004160	59.40
.4165	4004165	59.40
.4170	4004170	59.40
.4175	4004175	59.40
.4180	4004180	59.40
.4185	4004185	59.40
.4190	4004190	59.40
.4195	4004195	59.40
.4200	4004200	59.40
.4205	4004205	59.40
.4210	4004210	59.40
.4215	4004215	59.40
.4220	4004220	59.40
.4225	4004225	59.40
.4230	4004230	59.40
.4235	4004235	59.40
.4240	4004240	59.40
.4245	4004245	59.40
.4250	4004250	59.40
.4255	4004255	59.40

TOOL DIAM.	EDP NO.	PRICE
.4260	4004260	$59.40
.4265	4004265	59.40
.4270	4004270	59.40
.4275	4004275	59.40
.4280	4004280	59.40
.4285	4004285	59.40
.4290	4004290	59.40
.4295	4004295	59.40
.4300	4004300	59.40
.4305	4004305	59.40
.4310	4004310	59.40
.4315	4004315	59.40
.4320	4004320	59.40
.4325	4004325	59.40
.4330	4004330	59.40
.4335	4004335	59.40
.4340	4004340	59.40
.4345	4004345	59.40
.4350	4004350	59.40
.4355	4004355	59.40
.4360	4004360	59.40
.4365	47843	59.35
.4370	400111	59.40
.4375	40014	47.20
.4380	4004380	59.40
.4385	47844	59.35
.4390	4004390	59.40
.4395	4004395	59.40
.4400	4004400	59.40
.4405	4004405	59.40
.4410	4004410	59.40
.4415	4004415	60.15
.4420	4004420	60.15
.4425	4004425	60.15
.4430	4004430	60.15
.4435	4004435	60.15
.4440	4004440	60.15
.4445	4004445	60.15
.4450	4004450	60.15
.4455	4004455	60.15
.4460	4004460	60.15
.4465	4004465	60.15
.4470	4004470	60.15
.4475	4004475	60.15
.4480	4004480	60.15
.4485	4004485	60.15
.4490	4004490	60.15
.4495	4004495	60.15
.4500	4004500	60.15
.4505	4004505	60.15
.4510	4004510	60.15
.4515	4004515	60.15
.4520	4004520	60.15
.4525	4004525	60.15
.4530	4004530	60.15
.4535	4004535	60.15
.4540	4004540	60.15
.4545	4004545	60.15
.4550	4004550	60.15
.4555	4004555	60.15

CHUCKING REAMERS CARBIDE TIPPED TYPE 400 .0005 INCREMENTS

GENERAL PURPOSE

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
.4560	4004560	$60.15
.4565	4004565	60.15
.4570	4004570	60.15
.4575	4004575	60.15
.4580	4004580	60.15
.4585	4004585	60.15
.4590	4004590	60.15
.4595	4004595	60.15
.4600	4004600	60.15
.4605	4004605	60.15
.4610	4004610	60.15
.4615	4004615	60.15
.4620	4004620	60.15
.4625	4004625	60.15
.4630	4004630	60.15
.4635	4004635	60.15
.4640	4004640	60.15
.4645	4004645	60.15
.4650	4004650	60.15
.4655	4004655	60.15
.4660	4004660	60.15
.4665	4004665	60.15
.4670	4004670	60.15
.4675	4004675	60.15
.4680	4004680	60.15
.4685	400119	60.15
.4690	4004690	60.15
.4695	4004695	60.15
.4700	4004700	60.15
.4705	4004705	60.15
.4710	4004710	60.15
.4715	4004715	60.15
.4720	4004720	60.15
.4725	4004725	70.45
.4730	4004730	70.45
.4735	4004735	70.45
.4740	4004740	70.45
.4745	4004745	70.45
.4750	4004750	70.45
.4755	4004755	70.45
.4760	4004760	70.45
.4765	4004765	70.45
.4770	4004770	70.45
.4775	4004775	70.45
.4780	4004780	70.45
.4785	4004785	70.45
.4790	4004790	70.45
.4795	4004795	70.45
.4800	4004800	70.45
.4805	4004805	70.45
.4810	4004810	70.45
.4815	4004815	70.45
.4820	4004820	70.45
.4825	4004825	70.45
.4830	4004830	70.45
.4835	4004835	70.45
.4840	4004840	70.45
.4845	4004845	70.45
.4850	4004850	70.45
.4855	4004855	70.45
.4860	4004860	$70.45
.4865	4004865	70.45
.4870	4004870	70.45
.4875	4004875	70.45
.4880	4004880	70.45
.4885	4004885	70.45
.4890	4004890	70.45
.4895	4004895	70.45
.4900	4004900	70.45
.4905	4004905	70.45
.4910	4004910	70.45
.4915	4004915	70.45
.4920	4004920	70.45
.4925	4004925	70.45
.4930	4004930	70.45
.4935	4004935	70.45
.4940	4004940	70.45
.4945	4004945	70.45
.4950	4004950	70.45
.4955	4004955	70.45
.4960	4004960	70.45
.4965	4004965	70.45
.4970	4004970	70.45
.4975	4004975	70.45
.4980	4004980	70.45
.4985	4004985	70.45
.4990	47849	65.05
.4995	4004995	70.45
.5000	40016	56.90
.5005	4005005	70.45
.5010	47850	65.05
.5015	4005015	70.45
.5020	4005020	70.45
.5025	4005025	70.45
.5030	4005030	70.45
.5035	4005035	75.55
.5040	4005040	75.55
.5045	4005045	75.55
.5050	4005050	75.55
.5055	4005055	75.55
.5060	4005060	75.55
.5065	4005065	75.55
.5070	4005070	75.55
.5075	4005075	75.55
.5080	4005080	75.55
.5085	4005085	75.55
.5090	4005090	75.55
.5095	4005095	75.55
.5100	4005100	75.55
.5105	4005105	75.55
.5110	4005110	75.55
.5115	4005115	75.55
.5120	4005120	75.55
.5125	4005125	75.55
.5130	4005130	75.55
.5135	4005135	75.55
.5140	4005140	75.55
.5145	4005145	75.55
.5150	4005150	75.55
.5155	4005155	75.55
.5160	4005160	$75.55
.5165	4005165	75.55
.5170	4005170	75.55
.5175	4005175	75.55
.5180	4005180	75.55
.5185	4005185	75.55
.5190	4005190	75.55
.5195	4005195	75.55
.5200	4005200	75.55
.5205	4005205	75.55
.5210	4005210	75.55
.5215	4005215	75.55
.5220	4005220	75.55
.5225	4005225	75.55
.5230	4005230	75.55
.5235	4005235	75.55
.5240	4005240	75.55
.5245	4005245	75.55
.5250	4005250	75.55
.5255	4005255	75.55
.5260	4005260	75.55
.5265	4005265	75.55
.5270	4005270	75.55
.5275	4005275	75.55
.5280	4005280	75.55
.5285	4005285	75.55
.5290	4005290	75.55
.5295	4005295	75.55
.5300	4005300	75.55
.5305	4005305	75.55
.5310	4005310	75.55
.5315	400135	75.55
.5320	4005320	75.55
.5325	4005325	75.55
.5330	4005330	75.55
.5335	4005335	75.55
.5340	4005340	75.55
.5345	4005345	75.55
.5350	4005350	75.55
.5355	4005355	75.55
.5360	4005360	75.55
.5365	4005365	75.55
.5370	4005370	75.55
.5375	4005375	75.55
.5380	4005380	75.55
.5385	4005385	75.55
.5390	4005390	75.55
.5395	4005395	75.55
.5400	4005400	75.55
.5405	4005405	75.55
.5410	4005410	75.55
.5415	4005415	75.55
.5420	4005420	75.55
.5425	4005425	75.55
.5430	4005430	75.55
.5435	4005435	75.55
.5440	4005440	75.55
.5445	4005445	75.55
.5450	4005450	75.55
.5455	4005455	75.55
.5460	4005460	$75.55
.5465	4005465	75.55
.5470	4005470	75.55
.5475	4005475	75.55
.5480	4005480	75.55
.5485	4005485	75.55
.5490	4005490	75.55
.5495	4005495	75.55
.5500	4005500	75.55
.5505	4005505	75.55
.5510	4005510	75.55
.5515	4005515	75.55
.5520	4005520	75.55
.5525	4005525	75.55
.5530	4005530	75.55
.5535	4005535	75.55
.5540	4005540	75.55
.5545	4005545	75.55
.5550	4005550	75.55
.5555	4005555	75.55
.5560	4005560	75.55
.5565	4005565	75.55
.5570	4005570	75.55
.5575	4005575	75.55
.5580	4005580	75.55
.5585	4005585	75.55
.5590	4005590	75.55
.5595	4005595	75.55
.5600	4005600	75.55
.5605	4005605	75.55
.5610	4005610	75.55
.5615	4005615	75.55
.5620	4005620	75.55
.5625	40018	61.90
.5630	400143	75.55
.5635	4005635	75.55
.5640	4005640	75.55
.5645	4005645	75.55
.5650	4005650	75.55
.5655	4005655	75.55
.5660	4005660	75.55
.5665	4005665	78.00
.5670	4005670	78.00
.5675	4005675	78.00
.5680	4005680	78.00
.5685	4005685	78.00
.5690	4005690	78.00
.5695	4005695	78.00
.5700	4005700	78.00
.5705	4005705	78.00
.5710	4005710	78.00
.5715	4005715	78.00
.5720	4005720	78.00
.5725	4005725	78.00
.5730	4005730	78.00
.5735	4005735	78.00
.5740	4005740	78.00
.5745	4005745	78.00
.5750	4005750	78.00
.5755	4005755	78.00
.5760	4005760	$78.00
.5765	4005765	78.00
.5770	4005770	78.00
.5775	4005775	78.00
.5780	4005780	78.00
.5785	4005785	78.00
.5790	4005790	78.00
.5795	4005795	78.00
.5800	4005800	78.00
.5805	4005805	78.00
.5810	4005810	78.00
.5815	4005815	78.00
.5820	4005820	78.00
.5825	4005825	78.00
.5830	4005830	78.00
.5835	4005835	78.00
.5840	4005840	78.00
.5845	4005845	78.00
.5850	4005850	78.00
.5855	4005855	78.00
.5860	4005860	78.00
.5865	4005865	78.00
.5870	4005870	78.00
.5875	4005875	78.00
.5880	4005880	78.00
.5885	4005885	78.00
.5890	4005890	78.00
.5895	4005895	78.00
.5900	4005900	78.00
.5905	4005905	78.00
.5910	4005910	78.00
.5915	4005915	78.00
.5920	4005920	78.00
.5925	4005925	78.00
.5930	4005930	78.00
.5935	4005935	78.00
.5940	4005940	78.00
.5945	400151	78.00
.5950	4005950	78.00
.5955	4005955	78.00
.5960	4005960	78.00
.5965	4005965	78.00
.5970	4005970	78.00
.5975	4005975	78.00
.5980	4005980	78.00
.5985	4005985	78.00
.5990	4005990	78.00
.5995	4005995	78.00
.6000	4006000	78.00
.6005	4006005	78.00
.6010	4006010	78.00
.6015	4006015	78.00
.6020	4006020	78.00
.6025	4006025	78.00
.6030	4006030	78.00
.6035	4006035	78.00
.6040	4006040	78.00
.6045	4006045	78.00
.6050	4006050	78.00
.6055	4006055	78.00

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
.6060	4006060	$78.00
.6065	4006065	78.00
.6070	4006070	78.00
.6075	4006075	78.00
.6080	4006080	78.00
.6085	4006085	78.00
.6090	4006090	78.00
.6095	4006095	78.00
.6100	4006100	78.00
.6105	4006105	78.00
.6110	4006110	78.00
.6115	4006115	78.00
.6120	4006120	78.00
.6125	4006125	78.00
.6130	4006130	78.00
.6135	4006135	78.00
.6140	4006140	78.00
.6145	4006145	78.00
.6150	4006150	78.00
.6155	4006155	78.00
.6160	4006160	78.00
.6165	4006165	78.00
.6170	4006170	78.00
.6175	4006175	78.00
.6180	4006180	78.00
.6185	4006185	78.00
.6190	4006190	78.00
.6195	4006195	78.00
.6200	4006200	78.00
.6205	4006205	78.00
.6210	4006210	78.00
.6215	4006215	78.00
.6220	400158	78.00
.6225	4006225	78.00
.6230	4006230	78.00
.6235	4006235	78.00
.6240	47862	78.00
.6245	4006245	78.00
.6250	40020	64.45
.6255	4006255	78.00
.6260	47863	78.00
.6265	4006265	78.00
.6270	4006270	78.00
.6275	4006275	78.00
.6280	4006280	78.00
.6285	4006285	79.10
.6290	4006290	79.10
.6295	4006295	79.10
.6300	4006300	79.10
.6305	4006305	79.10
.6310	4006310	79.10
.6315	4006315	79.10
.6320	4006320	79.10
.6325	4006325	79.10
.6330	4006330	79.10
.6335	4006335	79.10
.6340	4006340	79.10
.6345	4006345	79.10
.6350	4006350	79.10
.6355	4006355	79.10

TOOL DIAM.	EDP NO.	PRICE
.6360	4006360	$79.10
.6365	4006365	79.10
.6370	4006370	79.10
.6375	4006375	79.10
.6380	4006380	79.10
.6385	4006385	79.10
.6390	4006390	79.10
.6395	4006395	79.10
.6400	4006400	79.10
.6405	4006405	79.10
.6410	4006410	79.10
.6415	4006415	79.10
.6420	4006420	79.10
.6425	4006425	79.10
.6430	4006430	79.10
.6435	4006435	79.10
.6440	4006440	79.10
.6445	4006445	79.10
.6450	4006450	79.10
.6455	4006455	79.10
.6460	4006460	79.10
.6465	4006465	79.10
.6470	4006470	79.10
.6475	4006475	79.10
.6480	4006480	79.10
.6485	4006485	79.10
.6490	4006490	79.10
.6495	4006495	79.10
.6500	4006500	79.10
.6505	4006505	79.10
.6510	4006510	79.10
.6515	4006515	79.10
.6520	4006520	79.10
.6525	4006525	79.10
.6530	4006530	79.10
.6535	400166	79.10
.6540	4006540	79.10
.6545	4006545	79.10
.6550	4006550	79.10
.6555	4006555	79.10
.6560	4006560	79.10
.6565	4006565	79.10
.6570	4006570	79.10
.6575	400167	79.10
.6580	4006580	79.10
.6585	4006585	79.10
.6590	4006590	79.10
.6595	4006595	79.10
.6600	4006600	79.10
.6605	4006605	79.10
.6610	4006610	79.10
.6615	4006615	79.10
.6620	4006620	79.10
.6625	4006625	79.10
.6630	4006630	79.10
.6635	4006635	79.10
.6640	4006640	79.10
.6645	4006645	79.10
.6650	4006650	79.10
.6655	4006655	79.10

TOOL DIAM.	EDP NO.	PRICE
.6660	4006660	$79.10
.6665	4006665	79.10
.6670	4006670	79.10
.6675	4006675	79.10
.6680	4006680	79.10
.6685	4006685	79.10
.6690	4006690	79.10
.6695	4006695	79.10
.6700	4006700	79.10
.6705	4006705	79.10
.6710	4006710	79.10
.6715	4006715	79.10
.6720	4006720	79.10
.6725	4006725	79.10
.6730	4006730	79.10
.6735	4006735	79.10
.6740	4006740	79.10
.6745	4006745	79.10
.6750	4006750	79.10
.6755	4006755	79.10
.6760	4006760	79.10
.6765	4006765	79.10
.6770	4006770	79.10
.6775	4006775	79.10
.6780	4006780	79.10
.6785	4006785	79.10
.6790	4006790	79.10
.6795	4006795	79.10
.6800	4006800	79.10
.6805	4006805	79.10
.6810	4006810	79.10
.6815	4006815	79.10
.6820	4006820	79.10
.6825	4006825	79.10
.6830	4006830	79.10
.6835	4006835	79.10
.6840	4006840	79.10
.6845	4006845	79.10
.6850	400174	79.10
.6855	4006855	79.10
.6860	4006860	79.10
.6865	4006865	79.10
.6870	4006870	79.10
.6875	40022	65.60
.6880	4006880	79.10
.6885	4006885	79.10
.6890	400175	79.10
.6895	4006895	79.10
.6900	4006900	79.10
.6905	4006905	79.10
.6910	4006910	79.10
.6915	4006915	82.20
.6920	4006920	82.20
.6925	4006925	82.20
.6930	4006930	82.20
.6935	4006935	82.20
.6940	4006940	82.20
.6945	4006945	82.20
.6950	4006950	82.20
.6955	4006955	82.20

TOOL DIAM.	EDP NO.	PRICE
.6960	4006960	$82.20
.6965	4006965	82.20
.6970	4006970	82.20
.6975	4006975	82.20
.6980	4006980	82.20
.6985	4006985	82.20
.6990	4006990	82.20
.6995	4006995	82.20
.7000	4007000	82.20
.7005	4007005	82.20
.7010	4007010	82.20
.7015	4007015	82.20
.7020	4007020	82.20
.7025	4007025	82.20
.7030	4007030	82.20
.7035	4007035	82.20
.7040	4007040	82.20
.7045	4007045	82.20
.7050	4007050	82.20
.7055	4007055	82.20
.7060	4007060	82.20
.7065	4007065	82.20
.7070	4007070	82.20
.7075	4007075	82.20
.7080	4007080	82.20
.7085	4007085	82.20
.7090	4007090	82.20
.7095	4007095	82.20
.7100	4007100	82.20
.7105	4007105	82.20
.7110	4007110	82.20
.7115	4007115	82.20
.7120	4007120	82.20
.7125	4007125	82.20
.7130	4007130	82.20
.7135	4007135	82.20
.7140	4007140	82.20
.7145	4007145	82.20
.7150	4007150	82.20
.7155	4007155	82.20
.7160	4007160	82.20
.7165	400182	82.20
.7170	4007170	82.20
.7175	4007175	82.20
.7180	4007180	82.20
.7185	4007185	82.20
.7190	4007190	82.20
.7195	4007195	82.20
.7200	4007200	82.20
.7205	400183	82.20
.7210	4007210	82.20
.7215	4007215	82.20
.7220	4007220	82.20
.7225	4007225	82.20
.7230	4007230	82.20
.7235	4007235	82.20
.7240	4007240	82.20
.7245	4007245	82.20
.7250	4007250	82.20
.7255	4007255	82.20

TOOL DIAM.	EDP NO.	PRICE
.7260	4007260	$82.20
.7265	4007265	82.20
.7270	4007270	82.20
.7275	4007275	82.20
.7280	4007280	82.20
.7285	4007285	82.20
.7290	4007290	82.20
.7295	4007295	82.20
.7300	4007300	82.20
.7305	4007305	82.20
.7310	4007310	82.20
.7315	4007315	82.20
.7320	4007320	82.20
.7325	4007325	82.20
.7330	4007330	82.20
.7335	4007335	82.20
.7340	4007340	82.20
.7345	4007345	82.20
.7350	4007350	82.20
.7355	4007355	82.20
.7360	4007360	82.20
.7365	4007365	82.20
.7370	4007370	82.20
.7375	4007375	82.20
.7380	4007380	82.20
.7385	4007385	82.20
.7390	4007390	82.20
.7395	4007395	82.20
.7400	4007400	82.20
.7405	4007405	82.20
.7410	4007410	82.20
.7415	4007415	82.20
.7420	4007420	82.20
.7425	4007425	82.20
.7430	4007430	82.20
.7435	4007435	82.20
.7440	4007440	82.20
.7445	4007445	82.20
.7450	4007450	82.20
.7455	4007455	82.20
.7460	4007460	82.20
.7465	4007465	82.20
.7470	4007470	82.20
.7475	4007475	82.20
.7480	400190	82.20
.7485	4007485	82.20
.7490	47874	82.20
.7495	4007495	82.20
.7500	40024	68.65
.7505	4007505	82.20
.7510	47875	82.20
.7515	4007515	82.20
.7520	400191	82.20
.7525	4007525	82.20
.7530	4007530	82.20
.7535	4007535	84.50
.7540	4007540	84.50
.7545	4007545	84.50
.7550	4007550	84.50
.7555	4007555	84.50

CHUCKING REAMERS CARBIDE TIPPED TYPE 400 METRIC

GENERAL PURPOSE

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							
				SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH					FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.0	.1575	400040	$56.10	.151	4	1	½	4	3.962 - 4.493	$84.75	$65.75	$59.30	$56.15	$53.00	$50.25	$46.65
4.5	.1772	400045	52.25	11/64	4	1 ⅛	½	4 ½	4.494 - 5.182	80.15	61.60	55.40	52.35	49.10	46.60	43.05
5.0	.1969	400050	52.25	11/64	4	1 ⅛	½	4 ½	-	-	-	-	-	-	-	-
5.5	.2165	400055	52.25	13/64	4	1 ¼	½	5	5.183 - 5.613	80.15	61.60	55.40	52.35	49.10	46.60	43.05
6.0	.2362	400060	54.65	7/32	4	1 ½	½	6	5.614 - 6.045	82.55	64.00	57.70	54.70	51.50	48.95	45.35
6.3	.2480	400063	52.25	15/64	4	1 ½	½	6	6.046 - 6.426	80.15	61.60	55.40	52.35	49.10	46.60	43.05
6.5	.2559	400065	53.05	15/64	4	1 ½	½	6	6.427 - 7.214	81.10	62.40	56.25	53.15	50.05	47.40	43.85
7.0	.2756	400070	53.05	15/64	4	1 ½	½	6	-	-	-	-	-	-	-	-
7.5	.2953	400075	53.05	9/32	4	1 ½	½	6	7.215 - 8.001	81.10	62.40	56.25	53.15	50.05	47.40	43.85
8.0	.3150	400080	53.05	9/32	4	1 ½	½	6	-	-	-	-	-	-	-	-
8.5	.3346	400085	54.40	9/32	4	1 ½	⅝	6	8.002 - 8.814	82.50	63.90	57.65	54.65	51.45	48.90	45.30
9.0	.3543	400090	54.40	5/16	4	1 ¾	⅝	7	8.815 - 9.601	82.50	63.90	57.65	54.65	51.45	48.90	45.30
9.5	.3740	400095	54.40	5/16	4	1 ¾	⅝	7	-	-	-	-	-	-	-	-
10.0	.3937	400100	56.50	5/16	4	1 ¾	⅝	7	9.602 - 10.389	84.50	65.90	59.70	56.65	53.50	50.95	47.35
10.5	.4134	400105	59.40	⅜	4	1 ¾	⅝	7	10.390 - 11.201	87.45	68.90	62.70	59.60	56.50	53.95	50.30
11.0	.4331	400110	59.40	⅜	4	1 ¾	⅝	7	-	-	-	-	-	-	-	-
11.5	.4528	400115	60.15	⅜	4	1 ¾	⅝	7	11.202 - 11.989	88.10	69.60	63.35	60.35	57.15	54.65	51.05
12.0	.4724	400120	70.45	7/16	6	2	⅝	8	11.990 - 12.776	101.30	80.80	74.00	70.75	67.25	64.40	60.45
12.5	.4921	400125	70.45	7/16	6	2	⅝	8	-	-	-	-	-	-	-	-
13.0	.5118	400130	75.55	7/16	6	2	⅝	8	12.777 - 13.564	106.30	85.85	79.05	75.65	72.25	69.40	65.50
13.5	.5315	400135	75.55	7/16	6	2	⅝	8	-	-	-	-	-	-	-	-
14.0	.5512	400140	75.55	7/16	6	2	⅝	8	13.565 - 14.376	106.30	85.85	79.05	75.65	72.25	69.40	65.50
14.5	.5709	400145	78.00	7/16	6	2	⅝	8	14.377 - 15.164	108.85	88.40	81.50	78.20	74.80	71.95	67.95
15.0	.5906	400150	78.00	7/16	6	2	⅝	8	-	-	-	-	-	-	-	-
15.5	.6102	400155	78.00	9/16	6	2 ¼	⅝	9	15.165 - 15.951	108.85	88.40	81.50	78.20	74.80	71.95	67.95
16.0	.6299	400160	79.10	9/16	6	2 ¼	⅝	9	15.952 - 16.739	110.00	89.50	82.60	79.20	75.90	73.00	69.00
16.5	.6496	400165	79.10	9/16	6	2 ¼	⅝	9	-	-	-	-	-	-	-	-
17.0	.6693	400170	79.10	9/16	6	2 ¼	⅝	9	16.740 - 17.551	110.00	89.50	82.60	79.20	75.90	73.00	69.00
17.5	.6890	400175	79.10	9/16	6	2 ¼	⅝	9	-	-	-	-	-	-	-	-
18.0	.7087	400180	82.20	9/16	6	2 ¼	⅝	9	17.552 - 18.339	113.00	92.60	85.75	82.45	79.00	76.10	72.15
18.5	.7283	400185	82.20	⅝	6	2 ½	¾	9 ½	18.340 - 19.126	113.00	92.60	85.75	82.45	79.00	76.10	72.15
19.0	.7480	400190	82.20	⅝	6	2 ½	¾	9 ½	-	-	-	-	-	-	-	-
19.5	.7677	400195	84.50	⅝	6	2 ½	¾	9 ½	19.127 - 19.914	115.25	94.90	88.00	84.60	81.25	78.35	74.45
20.0	.7874	400200	84.50	⅝	6	2 ½	¾	9 ½	19.915 - 20.726	115.25	94.90	88.00	84.60	81.25	78.35	74.45
20.5	.8071	400205	84.50	⅝	6	2 ½	¾	9 ½	-	-	-	-	-	-	-	-
21.0	.8268	400210	87.35	⅝	6	2 ½	¾	9 ½	20.727 - 21.514	118.15	97.60	90.85	87.45	84.05	81.25	77.30
21.5	.8465	400215	87.35	⅝	6	2 ½	¾	9 ½	-	-	-	-	-	-	-	-
22.0	.8661	400220	87.35	¾	6	2 ⅝	¾	10	21.515 - 22.301	118.15	97.60	90.85	87.45	84.05	81.25	77.30
22.5	.8858	400225	103.25	¾	6	2 ⅝	¾	10	22.302 - 23.089	135.20	113.95	106.85	103.40	99.85	96.90	92.80
23.0	.9055	400230	103.25	¾	6	2 ⅝	¾	10	-	-	-	-	-	-	-	-
23.5	.9252	400235	103.25	¾	8	2 ⅝	¾	10	23.090 - 23.901	135.20	113.95	106.85	103.40	99.85	96.90	92.80
24.0	.9449	400240	107.65	¾	8	2 ⅝	¾	10	23.902 - 24.689	139.55	118.25	111.15	107.75	104.20	101.25	97.15
24.5	.9646	400245	107.65	¾	8	2 ⅝	¾	10	-	-	-	-	-	-	-	-
25.0	.9843	400250	107.65	⅞	8	2 ¾	¾	10 ½	24.690 - 25.476	139.55	118.25	111.15	107.75	104.20	101.25	97.15
25.5	1.0039	400255	110.10	⅞	8	2 ¾	¾	10 ½	25.477 - 27.076	140.85	120.45	113.65	110.30	106.95	104.15	100.10
26.0	1.0236	400260	110.10	⅞	8	2 ¾	¾	10 ½	-	-	-	-	-	-	-	-
27.0	1.0630	400270	110.10	⅞	8	2 ¾	¾	10 ½	-	-	-	-	-	-	-	-
28.0	1.1024	400280	118.05	⅞	8	2 ⅞	⅞	11	27.077 - 28.651	148.60	128.30	121.45	118.15	114.75	111.90	107.95
29.0	1.1417	400290	123.30	1	8	2 ⅞	⅞	11	28.652 - 30.239	153.90	133.70	126.70	123.45	120.00	117.20	113.30
30.0	1.1811	400300	123.30	1	8	2 ⅞	⅞	11	-	-	-	-	-	-	-	-
31.0	1.2205	400310	129.60	1	8	3	⅞	11 ½	30.240 - 31.826	160.25	139.90	133.10	129.80	126.40	123.55	119.70
32.0	1.2598	400320	135.55	1	8	3	⅞	11 ½	31.827 - 33.414	166.30	146.00	139.10	135.85	132.40	129.50	125.55
33.0	1.2992	400330	135.55	1	8	3	⅞	11 ½	-	-	-	-	-	-	-	-
34.0	1.3386	400340	143.15	1	8	3 ¼	⅞	12	33.415 - 35.001	173.70	153.45	146.55	143.30	139.85	137.00	133.10
35.0	1.3780	400350	143.15	1	8	3 ¼	⅞	12	-	-	-	-	-	-	-	-
36.0	1.4173	400360	157.95	1 ¼	8	3 ¼	⅞	12	35.002 - 36.589	188.60	168.25	161.45	158.05	154.70	151.80	147.95
37.0	1.4567	400370	166.10	1 ¼	8	3 ½	⅞	12 ½	36.590 - 38.176	196.85	176.50	169.65	166.35	162.95	160.10	156.20

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

GENERAL PURPOSE

FINISH GRINDING OPERATIONS REQUIRED BEFORE USE


TYPE 400


TYPE 430


TYPE 440


TYPE 402


TYPE 450


TYPE 410


TYPE 465

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	$33.90	-	-	41006SF	$47.75	43006SF	44006SF	$44.20	45006SF	$40.55	-	-
0.2041-0.2210	40007SF	33.90	-	-	41007SF	47.75	43007SF	44007SF	44.20	45007SF	40.55	-	-
0.2211-0.2380	4002344SF	35.80	-	-	4102344SF	47.75	4302344SF	4402344SF	44.20	4502344SF	40.55	-	-
0.2381-0.2530	40008SF	33.90	40208SF	$39.10	41008SF	47.75	43008SF	44008SF	44.20	45008SF	40.55	-	-
0.2531-0.2840	40009SF	34.55	40209SF	39.70	41009SF	47.85	43009SF	44009SF	44.20	45009SF	41.50	-	-
0.2841-0.3150	40010SF	34.55	40210SF	39.70	41010SF	47.85	43010SF	44010SF	51.30	45010SF	41.50	46510SF	$62.60
0.3151-0.3470	40011SF	35.75	40211SF	41.15	41011SF	52.60	43011SF	44011SF	51.85	45011SF	42.90	46511SF	62.60
0.3471-0.3780	40012SF	32.80	40212SF	37.85	41012SF	53.10	43012SF	44012SF	56.15	45012SF	42.90	46512SF	58.55
0.3781-0.4090	40013SF	37.50	40213SF	43.15	41013SF	55.50	43013SF	44013SF	56.90	45013SF	45.00	46513SF	62.10
0.4091-0.4410	40014SF	39.95	40214SF	46.00	41014SF	57.70	43014SF	44014SF	67.50	45014SF	48.75	46514SF	62.10
0.4411-0.4720	40015SF	40.70	40215SF	47.30	41015SF	61.30	43015SF	44015SF	67.50	45015SF	52.60	46515SF	65.85
0.4721-0.5030	40016SF	48.45	40216SF	55.65	41016SF	63.60	43016SF	44016SF	73.80	45016SF	56.45	46516SF	65.85
0.5031-0.5340	40017SF	52.60	40217SF	60.15	41017SF	65.60	43017SF	44017SF	73.80	45017SF	57.85	46517SF	67.50
0.5341-0.5660	40018SF	52.60	40218SF	60.15	41018SF	65.60	43018SF	44018SF	77.85	45018SF	57.85	46518SF	67.50
0.5661-0.5970	40019SF	54.75	40219SF	62.90	41019SF	67.50	43019SF	44019SF	77.85	45019SF	60.30	46519SF	70.45
0.5971-0.6280	40020SF	54.75	40220SF	62.90	41020SF	67.50	43020SF	44020SF	79.95	45020SF	60.30	46520SF	70.45
0.6281-0.6590	40021SF	55.70	40221SF	64.10	41021SF	69.40	43021SF	44021SF	79.95	45021SF	61.30	46521SF	77.10
0.6591-0.6910	40022SF	55.70	40222SF	64.10	41022SF	73.95	43022SF	44022SF	83.60	45022SF	61.30	46522SF	77.10
0.6911-0.7220	40023SF	58.30	40223SF	67.05	41023SF	74.95	43023SF	44023SF	83.60	45023SF	64.10	46523SF	80.05
0.7221-0.7530	40024SF	58.30	40224SF	67.05	41024SF	76.15	43024SF	44024SF	85.75	45024SF	64.10	46524SF	80.05
0.7531-0.7840	40025SF	60.35	40225SF	69.05	41025SF	78.05	43025SF	44025SF	85.75	45025SF	66.25	46525SF	86.30
0.7841-0.8160	40026SF	60.35	40226SF	69.05	41026SF	78.05	43026SF	44026SF	93.15	45026SF	66.25	46526SF	86.30
0.8161-0.8470	40027SF	62.75	40227SF	72.10	41027SF	82.30	43027SF	44027SF	93.15	45027SF	68.95	46527SF	89.55
0.8471-0.8780	40028SF	65.05	40228SF	74.80	41028SF	85.45	43028SF	44028SF	101.80	45028SF	71.60	46528SF	92.95
0.8781-0.9090	40029SF	75.95	40229SF	87.75	41029SF	99.60	43029SF	44029SF	101.80	45029SF	83.35	46529SF	98.95
0.9091-0.9410	40030SF	75.95	40230SF	87.75	41030SF	99.60	43030SF	44030SF	112.05	45030SF	83.35	46530SF	98.95
0.9411-0.9720	40031SF	79.50	40231SF	91.30	41031SF	104.35	43031SF	44031SF	112.05	45031SF	87.35	46531SF	102.75
0.9721-1.0030	40032SF	79.50	40232SF	91.30	41032SF	104.35	43032SF	44032SF	117.65	45032SF	87.35	46532SF	102.75
1.0031-1.0660	40034SF	82.10	40234SF	125.55	41034SF	112.00	43034SF	44034SF	117.65	45034SF	90.40	46534SF	112.70
1.0661-1.1280	40036SF	88.85	40236SF	133.75	41036SF	115.45	43036SF	44036SF	137.65	45036SF	97.75	46536SF	112.70
1.1281-1.1905	40038SF	93.30	40238SF	141.75	41038SF	121.25	43038SF	44038SF	143.50	45038SF	102.20	46538SF	122.90
1.1906-1.2530	40040SF	98.60	40240SF	157.45	41040SF	128.45	43040SF	44040SF	168.20	45040SF	119.40	46540SF	122.90
1.2531-1.3155	40042SF	103.75	40242SF	169.85	41042SF	142.00	43042SF	44042SF	168.20	45042SF	119.40	46542SF	136.35
1.3156-1.3780	40044SF	110.10	40244SF	176.60	41044SF	155.70	43044SF	44044SF	170.50	45044SF	121.10	46544SF	142.70
1.3781-1.4405	40046SF	122.80	40246SF	180.35	41046SF	164.90	43046SF	44046SF	198.80	45046SF	133.80	46546SF	168.50
1.4406-1.5030	40048SF	129.80	40248SF	189.25	41048SF	174.20	43048SF	44048SF	238.75	45048SF	160.70	46548SF	173.55

CHUCKING REAMERS CARBIDE TIPPED TYPE 402 FRACTIONAL

GENERAL PURPOSE

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						
				TAPER SHANK NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLUTE	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
1/4	.2500	40208	$45.90	1	4	1 1/2	1/2	6	0.2381 - 0.2530	$83.00	$64.45	$58.25	$55.30	$52.20	$49.65
9/32	.2812	40209	46.75	1	4	1 1/2	1/2	6	0.2531 - 0.2840	83.95	65.30	59.15	56.10	53.00	50.35
5/16	.3125	40210	46.75	1	4	1 1/2	1/2	6	0.2841 - 0.3150	83.95	65.30	59.15	56.10	53.00	50.35
11/32	.3438	40211	48.50	1	4	1 1/2	5/8	6	0.3151 - 0.3470	85.70	67.05	60.75	57.80	54.70	52.25
3/8	.3750	40212	44.50	1	4	1 3/4	5/8	7	0.3471 - 0.3780	78.60	61.55	55.75	53.10	50.15	47.85
13/32	.4062	40213	50.90	1	4	1 3/4	5/8	7	0.3781 - 0.4090	88.05	69.40	63.15	60.30	57.05	54.55
7/16	.4375	40214	54.15	1	4	1 3/4	5/8	7	0.4091 - 0.4410	91.30	72.70	66.45	63.50	60.35	57.75
15/32	.4688	40215	55.55	1	4	1 3/4	5/8	7	0.4411 - 0.4720	92.80	74.15	67.90	64.95	61.75	59.25
1/2	.5000	40216	65.50	1	6	2	5/8	8	0.4721 - 0.5030	106.40	85.85	79.05	75.85	72.25	69.55
17/32	.5312	40217	70.75	1	6	2	5/8	8	0.5031 - 0.5340	111.65	91.05	84.20	81.05	77.45	74.60
9/16	.5625	40218	70.75	1	6	2	5/8	8	0.5341 - 0.5660	111.65	91.05	84.20	81.05	77.45	74.60
19/32	.5938	40219	74.10	1	6	2	5/8	8	0.5661 - 0.5970	115.05	94.50	87.65	84.40	80.80	78.15
5/8	.6250	40220	74.10	2	6	2 1/4	5/8	9	0.5971 - 0.6280	115.05	94.50	87.65	84.40	80.80	78.15
21/32	.6562	40221	75.40	2	6	2 1/4	5/8	9	0.6281 - 0.6590	116.30	95.85	89.00	85.75	82.20	79.40
11/16	.6875	40222	75.40	2	6	2 1/4	5/8	9	0.6591 - 0.6910	116.30	95.85	89.00	85.75	82.20	79.40
23/32	.7188	40223	78.85	2	6	2 1/4	5/8	9	0.6911 - 0.7220	119.80	99.20	92.35	89.20	85.70	82.85
3/4	.7500	40224	78.85	2	6	2 1/2	3/4	9 1/2	0.7221 - 0.7530	119.80	99.20	92.35	89.20	85.70	82.85
25/32	.7812	40225	81.30	2	6	2 1/2	3/4	9 1/2	0.7531 - 0.7840	122.20	101.65	94.90	91.65	88.05	85.30
13/16	.8125	40226	81.30	2	6	2 1/2	3/4	9 1/2	0.7841 - 0.8160	122.20	101.65	94.90	91.65	88.05	85.30
27/32	.8438	40227	84.80	2	6	2 1/2	3/4	9 1/2	0.8161 - 0.8470	125.70	105.15	98.40	95.10	91.65	88.75
7/8	.8750	40228	88.05	2	6	2 5/8	3/4	10	0.8471 - 0.8780	130.40	109.25	102.10	98.60	95.05	92.15
29/32	.9062	40229	103.25	2	6	2 5/8	3/4	10	0.8781 - 0.9090	145.65	124.35	117.25	113.85	110.25	107.35
15/16	.9375	40230	103.25	3	8	2 5/8	3/4	10	0.9091 - 0.9410	145.65	124.35	117.25	113.85	110.25	107.35
31/32	.9688	40231	107.65	3	8	2 5/8	3/4	10	0.9411 - 0.9720	150.00	128.70	121.55	118.20	114.60	111.70
1	1.0000	40232	107.65	3	8	2 3/4	3/4	10 1/2	0.9721 - 1.0030	150.00	128.70	121.55	118.20	114.60	111.70
1 1/16	1.0625	40234	147.70	3	8	2 3/4	3/4	10 1/2	1.0031 - 1.0660	188.45	168.10	161.30	158.00	154.45	151.70
1 1/8	1.1250	40236	157.40	3	8	2 7/8	7/8	11	1.0661 - 1.1280	198.10	177.60	170.85	167.55	164.15	161.40
1 3/16	1.1875	40238	166.70	3	8	2 7/8	7/8	11	1.1281 - 1.1905	207.50	186.95	180.25	176.85	173.40	170.70
1 1/4	1.2500	40240	185.25	4	8	3	7/8	11 1/2	1.1906 - 1.2530	225.95	205.55	198.75	195.40	192.00	189.20
1 5/16	1.3125	40242	199.75	4	8	3	7/8	11 1/2	1.2531 - 1.3155	240.40	220.05	213.20	209.95	206.45	203.70
1 3/8	1.3750	40244	207.80	4	8	3 1/4	7/8	12	1.3156 - 1.3780	248.50	228.10	221.30	218.05	214.50	211.90
1 7/16	1.4375	40246	212.10	4	8	3 1/4	7/8	12	1.3781 - 1.4405	252.85	232.50	225.55	222.40	218.80	216.10
1 1/2	1.5000	40248	222.65	4	8	3 1/2	7/8	12 1/2	1.4406 - 1.5030	263.40	243.10	236.20	232.95	229.40	226.65
1 9/16	1.5625	40250	240.35	4	8	3 1/2	7/8	12 1/2	1.5031 - 1.5660	281.05	260.70	253.80	250.60	247.10	244.35
1 5/8	1.6250	40252	248.60	4	8	3 3/4	7/8	13	1.5661 - 1.6280	289.40	269.05	262.15	258.90	255.45	252.65
1 11/16	1.6875	40254	279.60	4	8	3 3/4	7/8	13	1.6281 - 1.6910	320.35	299.90	293.20	289.80	286.45	283.70
1 3/4	1.7500	40256	279.60	4	10	4	7/8	13 1/2	1.6911 - 1.7530	320.35	299.90	293.20	289.80	286.45	283.70
1 13/16	1.8125	40258	279.60	4	10	4	7/8	13 1/2	1.7531 - 1.8160	320.35	299.90	293.20	289.80	286.45	283.70
1 7/8	1.8750	40260	293.00	4	10	4 1/4	7/8	14	1.8161 - 1.8780	333.65	313.30	306.45	303.15	299.75	296.95
1 15/16	1.9375	40262	293.00	4	10	4 1/4	7/8	14	1.8781 - 1.9410	333.65	313.30	306.45	303.15	299.75	296.95
2	2.0000	40264	293.00	4	12	4 1/4	7/8	14	1.9411 - 2.0030	333.65	313.30	306.45	303.15	299.75	296.95

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

CHUCKING REAMERS CARBIDE TIPPED TYPE 402 METRIC

GENERAL PURPOSE

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							
				TAPER SHANK NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH					FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
6.0	.2362	402060	$58.25	1	4	1 ½	½	6	6.000-6.426	$86.30	$67.65	$61.50	$58.35	$55.30	$52.60	$49.05
6.5	.2559	402065	59.15	1	4	1 ½	½	6	6.427-7.214	87.05	68.55	62.30	59.25	56.10	53.50	50.00
7.0	.2756	402070	59.15	1	4	1 ½	½	6	-	-	-	-	-	-	-	-
7.5	.2953	402075	59.15	1	4	1 ½	½	6	7.215-8.001	87.05	68.55	62.30	59.25	56.10	53.50	50.00
8.0	.3150	402080	59.15	1	4	1 ½	½	6	-	-	-	-	-	-	-	-
8.5	.3346	402085	60.75	1	4	1 ½	⅝	6	8.002-8.814	88.75	70.20	64.05	60.90	57.80	55.30	51.65
9.0	.3543	402090	55.75	1	4	1 ¾	⅝	7	8.815-9.601	81.45	64.45	58.80	55.95	53.10	50.80	47.40
9.5	.3740	402095	55.75	1	4	1 ¾	⅝	7	-	-	-	-	-	-	-	-
10.0	.3937	402100	63.15	1	4	1 ¾	⅝	7	9.602-10.389	91.10	72.55	66.40	63.35	60.30	57.65	54.10
10.5	.4134	402105	66.45	1	4	1 ¾	⅝	7	10.390-11.201	94.45	75.95	69.65	66.65	63.50	60.85	57.40
11.0	.4331	402110	66.45	1	4	1 ¾	⅝	7	-	-	-	-	-	-	-	-
11.5	.4528	402115	67.90	1	4	1 ¾	⅝	7	11.202-11.989	95.85	77.40	71.05	68.10	64.95	62.35	58.85
12.0	.4724	402120	79.05	1	6	2	⅝	8	11.990-12.776	109.70	89.45	82.55	79.15	75.85	72.95	68.95
12.5	.4921	402125	79.05	1	6	2	⅝	8	-	-	-	-	-	-	-	-
13.0	.5118	402130	84.20	1	6	2	⅝	8	12.777-13.564	115.05	94.60	87.75	84.40	81.05	78.15	74.15
13.5	.5315	402135	84.20	1	6	2	⅝	8	-	-	-	-	-	-	-	-
14.0	.5512	402140	84.20	1	6	2	⅝	8	13.565-14.376	115.05	94.60	87.75	84.40	81.05	78.15	74.15
14.5	.5709	402145	87.65	1	6	2	⅝	8	14.377-15.164	118.40	98.00	91.10	87.85	84.40	81.50	77.60
15.0	.5906	402150	87.65	1	6	2	⅝	8	-	-	-	-	-	-	-	-
15.5	.6102	402155	87.65	2	6	2 ¼	⅝	9	15.165-15.951	118.40	98.00	91.10	87.85	84.40	81.50	77.60
16.0	.6299	402160	89.00	2	6	2 ¼	⅝	9	15.952-16.739	119.80	99.25	92.55	89.20	85.75	82.85	79.00
16.5	.6496	402165	89.00	2	6	2 ¼	⅝	9	-	-	-	-	-	-	-	-
17.0	.6693	402170	89.00	2	6	2 ¼	⅝	9	16.740-17.551	119.80	99.25	92.55	89.20	85.75	82.85	79.00
17.5	.6890	402175	89.00	2	6	2 ¼	⅝	9	-	-	-	-	-	-	-	-
18.0	.7087	402180	92.35	2	6	2 ¼	⅝	9	17.552-18.339	123.25	102.75	96.00	92.60	89.20	86.35	82.45
18.5	.7283	402185	92.35	2	6	2 ½	¾	9 ½	18.340-19.126	123.25	102.75	96.00	92.60	89.20	86.35	82.45
19.0	.7480	402190	92.35	2	6	2 ½	¾	9 ½	-	-	-	-	-	-	-	-
19.5	.7677	402195	94.90	2	6	2 ½	¾	9 ½	19.127-19.914	125.60	105.15	98.40	95.05	91.65	88.70	84.80
20.0	.7874	402200	94.90	2	6	2 ½	¾	9 ½	19.915-20.726	125.60	105.15	98.40	95.05	91.65	88.70	84.80
20.5	.8071	402205	94.90	2	6	2 ½	¾	9 ½	-	-	-	-	-	-	-	-
21.0	.8268	402210	98.40	2	6	2 ½	¾	9 ½	20.727-21.514	129.20	108.80	101.85	98.50	95.10	92.20	88.35
21.5	.8465	402215	98.40	2	6	2 ½	¾	9 ½	-	-	-	-	-	-	-	-
22.0	.8661	402220	98.40	2	6	2 ⅝	¾	10	21.515-22.301	129.20	108.80	101.85	98.50	95.10	92.20	88.35
22.5	.8858	402225	117.25	2	6	2 ⅝	¾	10	22.302-23.089	149.25	128.05	120.95	117.40	113.85	110.85	106.85
23.0	.9055	402230	117.25	2	6	2 ⅝	¾	10	-	-	-	-	-	-	-	-
23.5	.9252	402235	117.25	3	8	2 ⅝	¾	10	23.090-23.901	149.25	128.05	120.95	117.40	113.85	110.85	106.85
24.0	.9449	402240	121.55	3	8	2 ⅝	¾	10	23.902-24.689	153.65	132.45	125.20	121.75	118.20	115.25	111.15
24.5	.9646	402245	121.55	3	8	2 ⅝	¾	10	-	-	-	-	-	-	-	-
25.0	.9843	402250	121.55	3	8	2 ¾	¾	10 ½	24.690-25.476	153.65	132.45	125.20	121.75	118.20	115.25	111.15
25.5	1.0039	402255	161.30	3	8	2 ¾	¾	10 ½	25.477-27.076	191.95	171.55	164.80	161.45	158.00	155.20	151.35
26.0	1.0236	402260	161.30	3	8	2 ¾	¾	10 ½	-	-	-	-	-	-	-	-
27.0	1.0630	402270	161.30	3	8	2 ¾	¾	10 ½	-	-	-	-	-	-	-	-
28.0	1.1024	402280	170.85	3	8	2 ⅞	⅞	11	27.077-28.651	201.50	181.10	174.30	171.00	167.55	164.80	160.85
29.0	1.1417	402290	180.25	3	8	2 ⅞	⅞	11	28.652-30.239	210.80	190.50	183.75	180.35	176.85	174.15	170.15
30.0	1.1811	402300	180.25	3	8	2 ⅞	⅞	11	-	-	-	-	-	-	-	-
31.0	1.2205	402310	198.75	4	8	3	⅞	11 ½	30.240-31.826	229.35	209.10	202.25	198.85	195.40	192.60	188.70
32.0	1.2598	402320	213.20	4	8	3	⅞	11 ½	31.827-33.414	243.80	223.55	216.65	213.35	209.95	207.05	203.25
33.0	1.2992	402330	213.20	4	8	3	⅞	11 ½	-	-	-	-	-	-	-	-
34.0	1.3386	402340	221.30	4	8	3 ¼	⅞	12	33.415-35.001	251.90	231.60	224.80	221.45	218.05	215.20	211.35
35.0	1.3780	402350	221.30	4	8	3 ¼	⅞	12	-	-	-	-	-	-	-	-
36.0	1.4173	402360	225.55	4	8	3 ¼	⅞	12	35.002-36.589	256.30	235.90	229.15	225.85	222.40	219.55	215.60
37.0	1.4567	402370	236.20	4	8	3 ½	⅞	12 ½	36.590-38.176	266.85	246.55	239.65	236.40	232.95	230.10	226.30
38.0	1.4961	402380	236.20	4	8	3 ½	⅞	12 ½	-	-	-	-	-	-	-	-
39.0	1.5354	402390	253.80	4	8	3 ½	⅞	12 ½	38.177-39.776	284.50	264.15	257.30	254.05	250.60	247.70	243.80
40.0	1.5748	402400	262.15	4	8	3 ¾	⅞	13	39.777-41.351	292.80	272.50	265.65	262.30	258.90	256.05	252.10
41.0	1.6142	402410	262.15	4	8	3 ¾	⅞	13	-	-	-	-	-	-	-	-

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

CHUCKING REAMERS CARBIDE TIPPED TYPE 450 FRACTIONAL

GENERAL PURPOSE

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

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

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						
				SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
3/16	.1875	45006	$47.65	11/64	4	1 1/2	6	0.1770 - 0.2040	$85.85	$66.70	$60.45	$57.30	$54.00	$51.40
7/32	.2188	45007	47.65	13/64	4	1 1/2	6	0.2041 - 0.2210	85.85	66.70	60.45	57.30	54.00	51.40
15/64	.2344	4502344	47.65	7/32	4	1 1/2	6	0.2211 - 0.2380	85.85	66.70	60.45	57.30	54.00	51.40
1/4	.2500	45008	47.65	15/64	4	1 1/2	6	0.2381 - 0.2530	85.85	66.70	60.45	57.30	54.00	51.40
9/32	.2812	45009	48.75	15/64	4	1 1/2	6	0.2531 - 0.2840	86.90	67.75	61.35	58.30	54.95	52.45
5/16	.3125	45010	48.75	9/32	4	1 1/2	6	0.2841 - 0.3150	86.90	67.75	61.35	58.30	54.95	52.45
11/32	.3438	45011	50.40	9/32	4	1 1/2	6	0.3151 - 0.3470	88.65	69.60	63.05	60.10	56.80	54.20
3/8	.3750	45012	50.40	5/16	4	1 3/4	7	0.3471 - 0.3780	88.65	69.60	63.05	60.10	56.80	54.20
13/32	.4062	45013	53.00	5/16	4	1 3/4	7	0.3781 - 0.4090	91.10	72.10	65.65	62.65	59.30	56.70
7/16	.4375	45014	57.30	3/8	4	1 3/4	7	0.4091 - 0.4410	95.50	76.30	69.90	66.95	63.60	61.05
15/32	.4688	45015	61.85	3/8	4	1 3/4	7	0.4411 - 0.4720	100.10	81.05	74.50	71.45	68.20	65.65
1/2	.5000	45016	66.25	7/16	6	2	8	0.4721 - 0.5030	107.20	86.70	79.95	76.60	73.15	70.25
17/32	.5312	45017	68.15	7/16	6	2	8	0.5031 - 0.5340	109.10	88.60	81.75	78.40	74.90	72.15
9/16	.5625	45018	68.15	7/16	6	2	8	0.5341 - 0.5660	109.10	88.60	81.75	78.40	74.90	72.15
19/32	.5938	45019	70.85	7/16	6	2	8	0.5661 - 0.5970	111.75	91.15	84.40	81.20	77.60	74.85
5/8	.6250	45020	70.85	9/16	6	2	9	0.5971 - 0.6280	111.75	91.15	84.40	81.20	77.60	74.85
21/32	.6562	45021	72.10	9/16	6	2	9	0.6281 - 0.6590	113.00	92.55	85.70	82.45	78.85	76.10
11/16	.6875	45022	72.10	9/16	6	2	9	0.6591 - 0.6910	113.00	92.55	85.70	82.45	78.85	76.10
23/32	.7188	45023	75.40	9/16	6	2	9	0.6911 - 0.7220	116.30	95.85	89.00	85.75	82.20	79.40
3/4	.7500	45024	75.40	5/8	6	2	9 1/2	0.7221 - 0.7530	116.30	95.85	89.00	85.75	82.20	79.40
25/32	.7812	45025	78.00	5/8	6	2	9 1/2	0.7531 - 0.7840	118.90	98.45	91.65	88.35	84.80	82.05
13/16	.8125	45026	78.00	5/8	6	2	9 1/2	0.7841 - 0.8160	118.90	98.45	91.65	88.35	84.80	82.05
27/32	.8438	45027	81.20	5/8	6	2	9 1/2	0.8161 - 0.8470	122.10	101.50	94.65	91.40	87.95	85.10
7/8	.8750	45028	84.20	3/4	6	2 1/4	10	0.8471 - 0.8780	126.65	105.45	98.30	94.85	91.15	88.35
29/32	.9062	45029	98.00	3/4	6	2 1/4	10	0.8781 - 0.9090	140.45	119.20	112.05	108.70	105.05	102.15
15/16	.9375	45030	98.00	3/4	8	2 1/4	10	0.9091 - 0.9410	140.45	119.20	112.05	108.70	105.05	102.15
31/32	.9688	45031	102.65	3/4	8	2 1/4	10	0.9411 - 0.9720	145.15	123.90	116.80	113.40	109.70	106.85
1	1.0000	45032	102.65	7/8	8	2 1/4	10 1/2	0.9721 - 1.0030	145.15	123.90	116.80	113.40	109.70	106.85
1 1/16	1.0625	45034	106.25	7/8	8	2 1/4	10 1/2	1.0031 - 1.0660	147.00	126.55	119.75	116.45	113.00	110.25
1 1/8	1.1250	45036	115.00	7/8	8	2 1/4	11	1.0661 - 1.1280	155.65	135.35	128.45	125.20	121.65	118.90
1 3/16	1.1875	45038	120.30	1	8	2 1/4	11	1.1281 - 1.1905	160.95	140.60	133.80	130.50	127.00	124.30
1 1/4	1.2500	45040	140.45	1	8	2 1/2	11 1/2	1.1906 - 1.2530	181.10	160.80	153.90	150.65	147.15	144.40
1 5/16	1.3125	45042	140.45	1	8	2 1/2	11 1/2	1.2531 - 1.3155	181.10	160.80	153.90	150.65	147.15	144.40
1 3/8	1.3750	45044	142.50	1	8	2 1/2	12	1.3156 - 1.3780	183.20	162.85	155.95	152.75	149.25	146.45
1 7/16	1.4375	45046	157.45	1 1/4	8	2 1/2	12	1.3781 - 1.4405	198.20	177.65	170.95	167.70	164.20	161.45
1 1/2	1.5000	45048	189.00	1 1/4	8	2 1/2	12 1/2	1.4406 - 1.5030	229.70	209.25	202.50	199.25	195.75	193.05
1 9/16	1.5625	45050	249.50	1 1/4	8	2 1/2	12 1/2	1.5031 - 1.5660	290.20	269.75	262.95	259.70	256.25	253.50
1 5/8	1.6250	45052	258.00	1 1/4	8	2 3/4	13	1.5661 - 1.6280	298.70	278.20	271.45	268.30	264.70	262.00
1 11/16	1.6875	45054	283.20	1 1/4	8	2 3/4	13	1.6281 - 1.6910	324.00	303.65	296.85	293.50	290.05	287.35
1 3/4	1.7500	45056	283.20	1 1/4	10	3	13 1/2	1.6911 - 1.7530	324.00	303.65	296.85	293.50	290.05	287.35
1 13/16	1.8125	45058	289.80	1 1/2	10	3	13 1/2	1.7531 - 1.8160	330.65	310.25	303.30	300.15	296.60	293.90
1 7/8	1.8750	45060	303.95	1 1/2	10	3 1/4	14	1.8161 - 1.8780	344.65	324.25	317.50	314.20	310.65	307.95
1 15/16	1.9375	45062	322.30	1 1/2	10	3 1/4	14	1.8781 - 1.9410	362.95	342.50	335.75	332.50	329.05	326.25
2	2.0000	45064	322.30	1 1/2	12	3 1/4	14	1.9411 - 2.0030	362.95	342.50	335.75	332.50	329.05	326.25

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

CHUCKING REAMERS CARBIDE TIPPED TYPE 450 METRIC

GENERAL PURPOSE

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							
				SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH					FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	450045	$60.45	11/64	4	1 ½	6	4.494 - 5.182	$89.15	$70.05	$63.60	$60.50	$57.30	$54.65	$50.95
5.0	.1969	450050	60.45	11/64	4	1 ½	6	-	-	-	-	-	-	-	-
5.5	.2165	450055	60.45	13/64	4	1 ½	6	5.183 - 5.613	89.15	70.05	63.60	60.50	57.30	54.65	50.95
6.0	.2362	450060	60.45	7/32	4	1 ½	6	5.614 - 6.045	89.15	70.05	63.60	60.50	57.30	54.65	50.95
6.3	.2480	450063	60.45	15/64	4	1 ½	6	6.046 - 6.426	89.15	70.05	63.60	60.50	57.30	54.65	50.95
6.5	.2559	450065	61.35	15/64	4	1 ½	6	6.427 - 7.214	90.00	71.00	64.60	61.50	58.30	55.55	52.00
7.0	.2756	450070	61.35	15/64	4	1 ½	6	-	-	-	-	-	-	-	-
7.5	.2953	450075	61.35	9/32	4	1 ½	6	7.215 - 8.001	90.00	71.00	64.60	61.50	58.30	55.55	52.00
8.0	.3150	450080	61.35	9/32	4	1 ½	6	-	-	-	-	-	-	-	-
8.5	.3346	450085	63.05	9/32	4	1 ½	6	8.002 - 8.814	91.85	72.85	66.40	63.30	60.10	57.45	53.75
9.0	.3543	450090	63.05	5/16	4	1 ¾	7	8.815 - 9.601	91.85	72.85	66.40	63.30	60.10	57.45	53.75
9.5	.3740	450095	63.05	5/16	4	1 ¾	7	-	-	-	-	-	-	-	-
10.0	.3937	450100	65.65	5/16	4	1 ¾	7	9.602 - 10.389	94.40	75.35	68.90	65.80	62.65	59.95	56.25
10.5	.4134	450105	69.90	3/8	4	1 ¾	7	10.390 - 11.201	98.75	79.55	73.20	70.10	66.95	64.20	60.55
11.0	.4331	450110	69.90	3/8	4	1 ¾	7	-	-	-	-	-	-	-	-
11.5	.4528	450115	74.50	3/8	4	1 ¾	7	11.202 - 11.989	103.30	84.20	77.85	74.75	71.45	68.80	65.15
12.0	.4724	450120	79.95	7/16	6	2	8	11.990 - 12.776	110.65	90.30	83.40	80.05	76.60	73.75	69.80
12.5	.4921	450125	79.95	7/16	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	450130	81.75	7/16	6	2	8	12.777 - 13.564	112.55	92.10	85.25	81.85	78.40	75.55	71.65
13.5	.5315	450135	81.75	7/16	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	450140	81.75	7/16	6	2	8	13.565 - 14.376	112.55	92.10	85.25	81.85	78.40	75.55	71.65
14.5	.5709	450145	84.40	7/16	6	2	8	14.377 - 15.164	115.20	94.70	87.95	84.55	81.20	78.25	74.35
15.0	.5906	450150	84.40	7/16	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	450155	84.40	9/16	6	2	9	15.165 - 15.951	115.20	94.70	87.95	84.55	81.20	78.25	74.35
16.0	.6299	450160	85.70	9/16	6	2	9	15.952 - 16.739	116.35	96.05	89.20	85.80	82.45	79.50	75.55
16.5	.6496	450165	85.70	9/16	6	2	9	-	-	-	-	-	-	-	-
17.0	.6693	450170	85.70	9/16	6	2	9	16.740 - 17.551	116.35	96.05	89.20	85.80	82.45	79.50	75.55
17.5	.6890	450175	85.70	9/16	6	2	9	-	-	-	-	-	-	-	-
18.0	.7087	450180	89.00	9/16	6	2	9	17.552 - 18.339	119.80	99.25	92.55	89.20	85.75	82.85	79.00
18.5	.7283	450185	89.00	5/8	6	2	9 ½	18.340 - 19.126	119.80	99.25	92.55	89.20	85.75	82.85	79.00
19.0	.7480	450190	89.00	5/8	6	2	9 ½	-	-	-	-	-	-	-	-
19.5	.7677	450195	91.65	5/8	6	2	9 ½	19.127 - 19.914	122.35	102.05	95.10	91.75	88.35	85.45	81.50
20.0	.7874	450200	91.65	5/8	6	2	9 ½	19.915 - 20.726	122.35	102.05	95.10	91.75	88.35	85.45	81.50
20.5	.8071	450205	91.65	5/8	6	2	9 ½	-	-	-	-	-	-	-	-
21.0	.8268	450210	94.65	5/8	6	2	9 ½	20.727 - 21.514	125.50	105.05	98.20	94.90	91.40	88.60	84.60
21.5	.8465	450215	94.65	5/8	6	2	9 ½	-	-	-	-	-	-	-	-
22.0	.8661	450220	94.65	¾	6	2 ¼	10	21.515 - 22.301	125.50	105.05	98.20	94.90	91.40	88.60	84.60
22.5	.8858	450225	112.05	¾	6	2 ¼	10	22.302 - 23.089	144.05	122.85	115.75	112.20	108.70	105.65	101.55
23.0	.9055	450230	112.05	¾	6	2 ¼	10	-	-	-	-	-	-	-	-
23.5	.9252	450235	112.05	¾	8	2 ¼	10	23.090 - 23.901	144.05	122.85	115.75	112.20	108.70	105.65	101.55
24.0	.9449	450240	116.80	¾	8	2 ¼	10	23.902 - 24.689	148.65	127.55	120.35	116.90	113.40	110.45	106.40
24.5	.9646	450245	116.80	¾	8	2 ¼	10	-	-	-	-	-	-	-	-
25.0	.9843	450250	116.80	⅞	8	2 ¼	10 ½	24.690 - 25.476	148.65	127.55	120.35	116.90	113.40	110.45	106.40
25.5	1.0039	450255	119.75	⅞	8	2 ¼	10 ½	25.477 - 27.076	150.35	130.10	123.25	119.90	116.45	113.65	109.70
26.0	1.0236	450260	119.75	⅞	8	2 ¼	10 ½	-	-	-	-	-	-	-	-
27.0	1.0630	450270	119.75	⅞	8	2 ¼	10 ½	-	-	-	-	-	-	-	-
28.0	1.1024	450280	128.45	⅞	8	2 ¼	11	27.077 - 28.651	159.10	138.80	131.90	128.65	125.20	122.35	118.40
29.0	1.1417	450290	133.80	1	8	2 ¼	11	28.652 - 30.239	164.35	144.15	137.25	133.90	130.50	127.70	123.85
30.0	1.1811	450300	133.80	1	8	2 ¼	11	-	-	-	-	-	-	-	-
31.0	1.2205	450310	153.90	1	8	2 ½	11 ½	30.240 - 31.826	184.60	164.25	157.45	154.20	150.65	147.75	143.95
32.0	1.2598	450320	153.90	1	8	2 ½	11 ½	31.827 - 33.414	184.60	164.25	157.45	154.20	150.65	147.75	143.95
33.0	1.2992	450330	153.90	1	8	2 ½	11 ½	-	-	-	-	-	-	-	-
34.0	1.3386	450340	155.95	1	8	2 ½	12	33.415 - 35.001	186.70	166.35	159.50	156.20	152.75	149.95	146.05
35.0	1.3780	450350	155.95	1	8	2 ½	12	-	-	-	-	-	-	-	-
36.0	1.4173	450360	170.95	1 ¼	8	2 ½	12	35.002 - 36.589	201.55	181.30	174.40	171.05	167.70	164.85	160.90
37.0	1.4567	450370	202.50	1 ¼	8	2 ½	12 ½	36.590 - 38.176	233.05	212.80	205.95	202.65	199.25	196.40	192.45
38.0	1.4961	450380	202.50	1 ¼	8	2 ½	12 ½	-	-	-	-	-	-	-	-

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

CHUCKING REAMERS
SOLID CARBIDE TYPE 804 .0005 INCREMENTS

GENERAL PURPOSE

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	$25.50	.0580	8040580	$26.25	.0880	8040880	$26.45	.1180	8041180	$29.85	.1480	8041480	$32.85
.0285	8040285	26.95	.0585	8040585	26.25	.0885	8040885	26.45	.1185	8041185	29.95	.1485	8041485	32.85
.0290	8040290	26.95	.0590	8040590	22.85	.0890	8040890	25.60	.1190	8041190	29.95	.1490	8041490	32.85
.0295	8040295	25.50	.0595	8040595	24.10	.0895	8040895	27.10	.1195	8041195	29.95	.1495	8041495	31.25
.0300	8040300	26.95	.0600	8040600	26.10	.0900	8040900	27.10	.1200	8041200	28.45	.1500	8041500	32.85
.0305	8040305	26.95	.0605	8040605	26.10	.0905	8040905	27.10	.1205	8041205	29.95	.1505	8041505	32.85
.0310	8040310	25.50	.0610	8040610	24.70	.0910	8040910	27.20	.1210	8041210	29.95	.1510	8041510	32.85
.0315	804008	25.50	.0615	8040615	26.10	.0915	8040915	27.20	.1215	8041215	29.95	.1515	8041515	32.85
.0320	8040320	25.50	.0620	8040620	26.10	.0920	8040920	27.20	.1220	804031	28.45	.1520	8041520	31.25
.0325	8040325	26.95	.0625	80404	22.75	.0925	8040925	25.70	.1225	8041225	29.95	.1525	8041525	34.30
.0330	8040330	25.50	.0630	804016	24.70	.0930	8040930	27.20	.1230	8041230	29.95	.1530	8041530	34.30
.0335	8040335	25.50	.0635	8040635	24.70	.0935	8040935	25.70	.1235	8041235	29.95	.1535	804039	32.60
.0340	8040340	26.00	.0640	8040640	26.10	.0940	8040940	27.20	.1240	8041240	29.95	.1540	8041540	32.60
.0345	8040345	26.00	.0645	8040645	26.10	.0945	804024	25.70	.1245	8041245	29.95	.1545	8041545	34.30
.0350	8040350	24.75	.0650	8040650	26.25	.0950	8040950	27.50	.1250	80408	26.25	.1550	8041550	34.30
.0355	8040355	26.00	.0655	8040655	26.25	.0955	8040955	27.50	.1255	8041255	29.95	.1555	8041555	32.60
.0360	8040360	24.75	.0660	8040660	26.25	.0960	8040960	26.25	.1260	804032	28.45	.1560	8041560	34.30
.0365	8040365	26.00	.0665	8040665	26.25	.0965	8040965	26.25	.1265	8041265	30.05	.1565	8041565	35.50
.0370	8040370	24.75	.0670	8040670	25.00	.0970	8040970	27.50	.1270	8041270	30.05	.1570	8041570	33.70
.0375	8040375	26.00	.0675	8040675	26.25	.0975	8040975	27.50	.1275	8041275	30.05	.1575	804040	30.80
.0380	8040380	24.75	.0680	8040680	26.25	.0980	8040980	26.25	.1280	8041280	28.50	.1580	8041580	36.25
.0385	8040385	26.00	.0685	8040685	26.25	.0985	8040985	27.75	.1285	8041285	28.50	.1585	8041585	36.25
.0390	8040390	24.75	.0690	8040690	26.25	.0990	8040990	27.75	.1290	8041290	30.05	.1590	8041590	34.55
.0395	8040395	26.00	.0695	8040695	26.25	.0995	8040995	26.45	.1295	8041295	30.05	.1595	8041595	36.85
.0400	8040400	24.75	.0700	8040700	25.00	.1000	8041000	27.75	.1300	8041300	30.05	.1600	8041600	36.85
.0405	8040405	26.00	.0705	8040705	26.25	.1005	8041005	27.75	.1305	8041305	30.05	.1605	8041605	36.85
.0410	8040410	24.75	.0710	8040710	26.25	.1010	8041010	27.75	.1310	8041310	30.05	.1610	8041610	35.00
.0415	8040415	26.00	.0715	8040715	26.25	.1015	8041015	26.45	.1315	8041315	30.05	.1615	8041615	36.85
.0420	8040420	24.75	.0720	8040720	26.25	.1020	8041020	28.00	.1320	8041320	30.05	.1620	8041620	36.85
.0425	8040425	26.00	.0725	8040725	26.25	.1025	8041025	28.10	.1325	8041325	30.05	.1625	8041625	36.85
.0430	8040430	24.75	.0730	8040730	25.00	.1030	8041030	28.10	.1330	8041330	30.05	.1630	8041630	36.85
.0435	8040435	26.25	.0735	8040735	26.25	.1035	8041035	28.10	.1335	8041335	30.05	.1635	8041635	36.95
.0440	8040440	26.25	.0740	8040740	26.25	.1040	8041040	28.10	.1340	8041340	30.05	.1640	8041640	36.85
.0445	8040445	26.25	.0745	8040745	26.25	.1045	8041045	28.10	.1345	8041345	30.05	.1645	8041645	36.85
.0450	8040450	26.25	.0750	8040750	26.25	.1050	8041050	28.10	.1350	8041350	30.05	.1650	8041650	36.85
.0455	8040455	26.25	.0755	8040755	26.25	.1055	8041055	28.10	.1355	8041355	30.05	.1655	8041655	36.85
.0460	8040460	26.25	.0760	8040760	25.00	.1060	8041060	28.10	.1360	8041360	28.50	.1660	8041660	35.20
.0465	8040465	24.90	.0765	8040765	26.25	.1065	8041065	26.70	.1365	8041365	30.05	.1665	8041665	37.30
.0470	8040470	26.25	.0770	8040770	26.25	.1070	8041070	28.50	.1370	8041370	30.05	.1670	8041670	37.30
.0475	8040475	26.25	.0775	8040775	26.25	.1075	8041075	28.50	.1375	8041375	30.05	.1675	8041675	37.30
.0480	8040480	26.25	.0780	8040780	26.25	.1080	8041080	28.50	.1380	8041380	30.60	.1680	8041680	37.30
.0485	8040485	26.25	.0785	8040785	25.05	.1085	8041085	28.90	.1385	8041385	30.60	.1685	8041685	37.30
.0490	8040490	26.25	.0790	8040790	26.35	.1090	8041090	28.90	.1390	8041390	30.60	.1690	8041690	37.30
.0495	8040495	26.25	.0795	8040795	26.35	.1095	8041095	28.90	.1395	8041395	30.60	.1695	8041695	35.55
.0500	8040500	26.25	.0800	8040800	26.35	.1100	8041100	27.50	.1400	8041400	30.60	.1700	8041700	38.10
.0505	8040505	26.25	.0805	8040805	26.35	.1105	8041105	29.30	.1405	8041405	28.90	.1705	8041705	38.10
.0510	8040510	26.25	.0810	8040810	25.05	.1110	8041110	28.00	.1410	8041410	31.75	.1710	8041710	38.10
.0515	8040515	26.25	.0815	8040815	26.45	.1115	8041115	29.85	.1415	8041415	31.75	.1715	8041715	38.10
.0520	8040520	24.90	.0820	8040820	25.20	.1120	8041120	29.85	.1420	8041420	31.75	.1720	8041720	38.10
.0525	8040525	26.25	.0825	8040825	26.45	.1125	8041125	29.85	.1425	8041425	31.75	.1725	8041725	38.10
.0530	8040530	26.25	.0830	8040830	26.45	.1130	8041130	28.35	.1430	8041430	31.75	.1730	8041730	36.25
.0535	8040535	26.25	.0835	8040835	26.45	.1135	8041135	29.85	.1435	8041435	31.75	.1735	8041735	38.65
.0540	8040540	26.25	.0840	8040840	26.45	.1140	8041140	29.85	.1440	8041440	30.20	.1740	8041740	38.65
.0545	8040545	26.25	.0845	8040845	26.45	.1145	8041145	29.85	.1445	8041445	31.90	.1745	8041745	38.65
.0550	8040550	24.90	.0850	8040850	26.45	.1150	8041150	29.85	.1450	8041450	31.95	.1750	8041750	38.65
.0555	8040555	26.25	.0855	8040855	26.45	.1155	8041155	29.85	.1455	8041455	31.95	.1755	8041755	39.05
.0560	8040560	26.25	.0860	8040860	25.20	.1160	8041160	28.35	.1460	8041460	32.80	.1760	8041760	39.05
.0565	8040565	26.25	.0865	8040865	26.45	.1165	8041165	29.85	.1465	8041465	32.80	.1765	8041765	39.05
.0570	8040570	26.25	.0870	8040870	26.45	.1170	8041170	29.85	.1470	8041470	31.10	-	-	-
.0575	8040575	26.25	.0875	8040875	26.45	.1175	8041175	29.85	.1475	8041475	32.80	-	-	-

CHUCKING REAMERS
CARBIDE TIPPED TYPE 450 .0005 INCREMENTS

GENERAL PURPOSE

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	$60.45	.2070	4502070	$60.45	.2370	4502370	$60.45	.2670	4502670	$61.35	.2970	4502970	$61.35
.1775	4501775	60.45	.2075	4502075	60.45	.2375	4502375	60.45	.2675	4502675	61.35	.2975	4502975	61.35
.1780	4501780	60.45	.2080	4502080	60.45	.2380	4502380	60.45	.2680	4502680	61.35	.2980	4502980	61.35
.1785	4501785	60.45	.2085	4502085	60.45	.2385	4502385	60.45	.2685	4502685	61.35	.2985	4502985	61.35
.1790	4501790	60.45	.2090	4502090	60.45	.2390	4502390	60.45	.2690	4502690	61.35	.2990	4502990	61.35
.1795	4501795	60.45	.2095	4502095	60.45	.2395	4502395	60.45	.2695	4502695	61.35	.2995	4502995	61.35
.1800	4501800	60.45	.2100	4502100	60.45	.2400	4502400	60.45	.2700	4502700	61.35	.3000	4503000	61.35
.1805	4501805	60.45	.2105	4502105	60.45	.2405	4502405	60.45	.2705	4502705	61.35	.3005	4503005	61.35
.1810	4501810	60.45	.2110	4502110	60.45	.2410	4502410	60.45	.2710	4502710	61.35	.3010	4503010	61.35
.1815	4501815	60.45	.2115	4502115	60.45	.2415	4502415	60.45	.2715	4502715	61.35	.3015	4503015	61.35
.1820	4501820	60.45	.2120	4502120	60.45	.2420	4502420	60.45	.2720	4502720	61.35	.3020	4503020	61.35
.1825	4501825	60.45	.2125	4502125	60.45	.2425	4502425	60.45	.2725	4502725	61.35	.3025	4503025	61.35
.1830	4501830	60.45	.2130	4502130	60.45	.2430	4502430	60.45	.2730	4502730	61.35	.3030	4503030	61.35
.1835	4501835	60.45	.2135	4502135	60.45	.2435	4502435	60.45	.2735	4502735	61.35	.3035	4503035	61.35
.1840	4501840	60.45	.2140	4502140	60.45	.2440	4502440	60.45	.2740	4502740	61.35	.3040	4503040	61.35
.1845	4501845	60.45	.2145	4502145	60.45	.2445	4502445	60.45	.2745	4502745	61.35	.3045	4503045	61.35
.1850	450047	60.45	.2150	4502150	60.45	.2450	4502450	60.45	.2750	4502750	61.35	.3050	4503050	61.35
.1855	4501855	60.45	.2155	4502155	60.45	.2455	4502455	60.45	.2755	4502755	61.35	.3055	4503055	61.35
.1860	4501860	60.45	.2160	4502160	60.45	.2460	4502460	60.45	.2760	4502760	61.35	.3060	4503060	61.35
.1865	4501865	60.45	.2165	450055	60.45	.2465	4502465	60.45	.2765	4502765	61.35	.3065	4503065	61.35
.1870	4501870	60.45	.2170	4502170	60.45	.2470	4502470	60.45	.2770	4502770	61.35	.3070	4503070	61.35
.1875	45006	47.65	.2175	4502175	60.45	.2475	4502475	60.45	.2775	4502775	61.35	.3075	4503075	61.35
.1880	4501880	60.45	.2180	4502180	60.45	.2480	450063	60.45	.2780	4502780	61.35	.3080	4503080	61.35
.1885	4501885	60.45	.2185	4502185	60.45	.2485	4502485	60.45	.2785	4502785	61.35	.3085	4503085	61.35
.1890	450048	60.45	.2190	4502190	60.45	.2490	4502490	60.45	.2790	4502790	61.35	.3090	4503090	61.35
.1895	4501895	60.45	.2195	4502195	60.45	.2495	4502495	60.45	.2795	450071	61.35	.3095	4503095	61.35
.1900	4501900	60.45	.2200	4502200	60.45	.2500	45008	47.65	.2800	4502800	61.35	.3100	4503100	61.35
.1905	4501905	60.45	.2205	450056	60.45	.2505	4502505	60.45	.2805	4502805	61.35	.3105	4503105	61.35
.1910	4501910	60.45	.2210	4502210	60.45	.2510	4502510	60.45	.2810	4502810	61.35	.3110	450079	61.35
.1915	4501915	60.45	.2215	4502215	60.45	.2515	4502515	60.45	.2815	4502815	61.35	.3115	4503115	61.35
.1920	4501920	60.45	.2220	4502220	60.45	.2520	450064	60.45	.2820	4502820	61.35	.3120	4503120	61.35
.1925	4501925	60.45	.2225	4502225	60.45	.2525	4502525	60.45	.2825	4502825	61.35	.3125	45010	48.75
.1930	4501930	60.45	.2230	4502230	60.45	.2530	4502530	60.45	.2830	4502830	61.35	.3130	4503130	61.35
.1935	4501935	60.45	.2235	4502235	60.45	.2535	4502535	61.35	.2835	450072	61.35	.3135	4503135	61.35
.1940	4501940	60.45	.2240	4502240	60.45	.2540	4502540	61.35	.2840	4502840	61.35	.3140	4503140	61.35
.1945	4501945	60.45	.2245	4502245	60.45	.2545	4502545	61.35	.2845	4502845	61.35	.3145	4503145	61.35
.1950	4501950	60.45	.2250	4502250	60.45	.2550	4502550	61.35	.2850	4502850	61.35	.3150	450080	61.35
.1955	4501955	60.45	.2255	4502255	60.45	.2555	4502555	61.35	.2855	4502855	61.35	.3155	4503155	63.05
.1960	4501960	60.45	.2260	4502260	60.45	.2560	4502560	61.35	.2860	4502860	61.35	.3160	4503160	63.05
.1965	4501965	60.45	.2265	4502265	60.45	.2565	4502565	61.35	.2865	4502865	61.35	.3165	4503165	63.05
.1970	4501970	60.45	.2270	4502270	60.45	.2570	4502570	61.35	.2870	4502870	61.35	.3170	4503170	63.05
.1975	4501975	60.45	.2275	4502275	60.45	.2575	4502575	61.35	.2875	4502875	61.35	.3175	4503175	63.05
.1980	4501980	60.45	.2280	4502280	60.45	.2580	4502580	61.35	.2880	4502880	61.35	.3180	4503180	63.05
.1985	4501985	60.45	.2285	4502285	60.45	.2585	4502585	61.35	.2885	4502885	61.35	.3185	4503185	63.05
.1990	4501990	60.45	.2290	4502290	60.45	.2590	4502590	61.35	.2890	4502890	61.35	.3190	4503190	63.05
.1995	4501995	60.45	.2295	4502295	60.45	.2595	4502595	61.35	.2895	4502895	61.35	.3195	4503195	63.05
.2000	4502000	60.45	.2300	4502300	60.45	.2600	4502600	61.35	.2900	4502900	61.35	.3200	4503200	63.05
.2005	4502005	60.45	.2305	4502305	60.45	.2605	4502605	61.35	.2905	4502905	61.35	.3205	4503205	63.05
.2010	4502010	60.45	.2310	4502310	60.45	.2610	4502610	61.35	.2910	4502910	61.35	.3210	4503210	63.05
.2015	4502015	60.45	.2315	4502315	60.45	.2615	4502615	61.35	.2915	4502915	61.35	.3215	4503215	63.05
.2020	4502020	60.45	.2320	4502320	60.45	.2620	4502620	61.35	.2920	4502920	61.35	.3220	4503220	63.05
.2025	4502025	60.45	.2325	4502325	60.45	.2625	4502625	61.35	.2925	4502925	61.35	.3225	4503225	63.05
.2030	4502030	60.45	.2330	4502330	60.45	.2630	4502630	61.35	.2930	4502930	61.35	.3230	4503230	63.05
.2035	4502035	60.45	.2335	4502335	60.45	.2635	4502635	61.35	.2935	4502935	61.35	.3235	4503235	63.05
.2040	4502040	60.45	.2340	4502340	60.45	.2640	4502640	61.35	.2940	4502940	61.35	.3240	4503240	63.05
.2045	4502045	60.45	.2345	4502345	60.45	.2645	4502645	61.35	.2945	4502945	61.35	.3245	4503245	63.05
.2050	4502050	60.45	.2350	4502350	60.45	.2650	4502650	61.35	.2950	4502950	61.35	.3250	4503250	63.05
.2055	4502055	60.45	.2355	4502355	60.45	.2655	4502655	61.35	.2955	4502955	61.35	.3255	4503255	63.05
.2060	4502060	60.45	.2360	4502360	60.45	.2660	4502660	61.35	.2960	4502960	61.35	.3260	4503260	63.05
.2065	4502065	60.45	.2365	4502365	60.45	.2665	4502665	61.35	.2965	4502965	61.35	.3265	4503265	63.05

CHUCKING REAMERS CARBIDE TIPPED TYPE 450 .0005 INCREMENTS

GENERAL PURPOSE

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
.3270	4503270	$63.05
.3275	4503275	63.05
.3280	4503280	63.05
.3285	4503285	63.05
.3290	4503290	63.05
.3295	4503295	63.05
.3300	4503300	63.05
.3305	4503305	63.05
.3310	4503310	63.05
.3315	4503315	63.05
.3320	4503320	63.05
.3325	4503325	63.05
.3330	4503330	63.05
.3335	4503335	63.05
.3340	4503340	63.05
.3345	4503345	63.05
.3350	4503350	63.05
.3355	4503355	63.05
.3360	4503360	63.05
.3365	4503365	63.05
.3370	4503370	63.05
.3375	4503375	63.05
.3380	4503380	63.05
.3385	4503385	63.05
.3390	4503390	63.05
.3395	4503395	63.05
.3400	4503400	63.05
.3405	4503405	63.05
.3410	4503410	63.05
.3415	4503415	63.05
.3420	4503420	63.05
.3425	450087	63.05
.3430	4503430	63.05
.3435	4503435	63.05
.3440	4503440	63.05
.3445	4503445	63.05
.3450	4503450	63.05
.3455	4503455	63.05
.3460	4503460	63.05
.3465	450088	63.05
.3470	4503470	63.05
.3475	4503475	63.05
.3480	4503480	63.05
.3485	4503485	63.05
.3490	4503490	63.05
.3495	4503495	63.05
.3500	4503500	63.05
.3505	4503505	63.05
.3510	4503510	63.05
.3515	4503515	63.05
.3520	4503520	63.05
.3525	4503525	63.05
.3530	4503530	63.05
.3535	4503535	63.05
.3540	4503540	63.05
.3545	4503545	63.05
.3550	4503550	63.05
.3555	4503555	63.05
.3560	4503560	63.05
.3565	4503565	63.05

TOOL DIAM.	EDP NO.	PRICE
.3570	4503570	$63.05
.3575	4503575	63.05
.3580	4503580	63.05
.3585	4503585	63.05
.3590	4503590	63.05
.3595	4503595	63.05
.3600	4503600	63.05
.3605	4503605	63.05
.3610	4503610	63.05
.3615	4503615	63.05
.3620	4503620	63.05
.3625	4503625	63.05
.3630	4503630	63.05
.3635	4503635	63.05
.3640	4503640	63.05
.3645	4503645	63.05
.3650	4503650	63.05
.3655	4503655	63.05
.3660	4503660	63.05
.3665	4503665	63.05
.3670	4503670	63.05
.3675	4503675	63.05
.3680	4503680	63.05
.3685	4503685	63.05
.3690	4503690	63.05
.3695	4503695	63.05
.3700	4503700	63.05
.3705	4503705	63.05
.3710	4503710	63.05
.3715	4503715	63.05
.3720	4503720	63.05
.3725	4503725	63.05
.3730	4503730	63.05
.3735	4503735	63.05
.3740	450095	63.05
.3745	4503745	63.05
.3750	45012	50.40
.3755	4503755	63.05
.3760	4503760	63.05
.3765	4503765	63.05
.3770	4503770	63.05
.3775	4503775	63.05
.3780	450096	63.05
.3785	4503785	65.65
.3790	4503790	65.65
.3795	4503795	65.65
.3800	4503800	65.65
.3805	4503805	65.65
.3810	4503810	65.65
.3815	4503815	65.65
.3820	4503820	65.65
.3825	4503825	65.65
.3830	4503830	65.65
.3835	4503835	65.65
.3840	4503840	65.65
.3845	4503845	65.65
.3850	4503850	65.65
.3855	4503855	65.65
.3860	4503860	65.65
.3865	4503865	65.65

TOOL DIAM.	EDP NO.	PRICE
.3870	4503870	$65.65
.3875	4503875	65.65
.3880	4503880	65.65
.3885	4503885	65.65
.3890	4503890	65.65
.3895	4503895	65.65
.3900	4503900	65.65
.3905	4503905	65.65
.3910	4503910	65.65
.3915	4503915	65.65
.3920	4503920	65.65
.3925	4503925	65.65
.3930	4503930	65.65
.3935	4503935	65.65
.3940	4503940	65.65
.3945	4503945	65.65
.3950	4503950	65.65
.3955	4503955	65.65
.3960	4503960	65.65
.3965	4503965	65.65
.3970	4503970	65.65
.3975	4503975	65.65
.3980	4503980	65.65
.3985	4503985	65.65
.3990	4503990	65.65
.3995	4503995	65.65
.4000	4504000	65.65
.4005	4504005	65.65
.4010	4504010	65.65
.4015	4504015	65.65
.4020	4504020	65.65
.4025	4504025	65.65
.4030	4504030	65.65
.4035	4504035	65.65
.4040	4504040	65.65
.4045	4504045	65.65
.4050	4504050	65.65
.4055	450103	65.65
.4060	4504060	65.65
.4065	4504065	65.65
.4070	4504070	65.65
.4075	4504075	65.65
.4080	4504080	65.65
.4085	4504085	65.65
.4090	4504090	65.65
.4095	4504095	69.90
.4100	4504100	69.90
.4105	4504105	69.90
.4110	4504110	69.90
.4115	4504115	69.90
.4120	4504120	69.90
.4125	4504125	69.90
.4130	4504130	69.90
.4135	4504135	69.90
.4140	4504140	69.90
.4145	4504145	69.90
.4150	4504150	69.90
.4155	4504155	69.90
.4160	4504160	69.90
.4165	4504165	69.90

TOOL DIAM.	EDP NO.	PRICE
.4170	4504170	$69.90
.4175	4504175	69.90
.4180	4504180	69.90
.4185	4504185	69.90
.4190	4504190	69.90
.4195	4504195	69.90
.4200	4504200	69.90
.4205	4504205	69.90
.4210	4504210	69.90
.4215	4504215	69.90
.4220	4504220	69.90
.4225	4504225	69.90
.4230	4504230	69.90
.4235	4504235	69.90
.4240	4504240	69.90
.4245	4504245	69.90
.4250	4504250	69.90
.4255	4504255	69.90
.4260	4504260	69.90
.4265	4504265	69.90
.4270	4504270	69.90
.4275	4504275	69.90
.4280	4504280	69.90
.4285	4504285	69.90
.4290	4504290	69.90
.4295	4504295	69.90
.4300	4504300	69.90
.4305	4504305	69.90
.4310	4504310	69.90
.4315	4504315	69.90
.4320	4504320	69.90
.4325	4504325	69.90
.4330	4504330	69.90
.4335	4504335	69.90
.4340	4504340	69.90
.4345	4504345	69.90
.4350	4504350	69.90
.4355	4504355	69.90
.4360	4504360	69.90
.4365	4504365	69.90
.4370	450111	69.90
.4375	45014	57.30
.4380	4504380	69.90
.4385	4504385	69.90
.4390	4504390	69.90
.4395	4504395	69.90
.4400	4504400	69.90
.4405	4504405	69.90
.4410	4504410	69.90
.4415	4504415	74.60
.4420	4504420	74.60
.4425	4504425	74.60
.4430	4504430	74.60
.4435	4504435	74.60
.4440	4504440	74.60
.4445	4504445	74.60
.4450	4504450	74.60
.4455	4504455	74.60
.4460	4504460	74.60
.4465	4504465	74.60

TOOL DIAM.	EDP NO.	PRICE
.4470	4504470	$74.60
.4475	4504475	74.60
.4480	4504480	74.60
.4485	4504485	74.60
.4490	4504490	74.60
.4495	4504495	74.60
.4500	4504500	74.60
.4505	4504505	74.60
.4510	4504510	74.60
.4515	4504515	74.60
.4520	4504520	74.60
.4525	4504525	74.60
.4530	4504530	74.60
.4535	4504535	74.60
.4540	4504540	74.60
.4545	4504545	74.60
.4550	4504550	74.60
.4555	4504555	74.60
.4560	4504560	74.60
.4565	4504565	74.60
.4570	4504570	74.60
.4575	4504575	74.60
.4580	4504580	74.60
.4585	4504585	74.60
.4590	4504590	74.60
.4595	4504595	74.60
.4600	4504600	74.60
.4605	4504605	74.60
.4610	4504610	74.60
.4615	4504615	74.60
.4620	4504620	74.60
.4625	4504625	74.60
.4630	4504630	74.60
.4635	4504635	74.60
.4640	4504640	74.60
.4645	4504645	74.60
.4650	4504650	74.60
.4655	4504655	74.60
.4660	4504660	74.60
.4665	4504665	74.60
.4670	4504670	74.60
.4675	4504675	74.60
.4680	4504680	74.60
.4685	450119	74.60
.4690	4504690	74.60
.4695	4504695	74.60
.4700	4504700	74.60
.4705	4504705	74.60
.4710	4504710	74.60
.4715	4504715	74.60
.4720	4504720	74.60
.4725	4504725	80.00
.4730	4504730	80.00
.4735	4504735	80.00
.4740	4504740	80.00
.4745	4504745	80.00
.4750	4504750	80.00
.4755	4504755	80.00
.4760	4504760	80.00
.4765	4504765	80.00

CHUCKING REAMERS
CARBIDE TIPPED TYPE 450 .0005 INCREMENTS

GENERAL PURPOSE

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
.4770	4504770	$80.00
.4775	4504775	80.00
.4780	4504780	80.00
.4785	4504785	80.00
.4790	4504790	80.00
.4795	4504795	80.00
.4800	4504800	80.00
.4805	4504805	80.00
.4810	4504810	80.00
.4815	4504815	80.00
.4820	4504820	80.00
.4825	4504825	80.00
.4830	4504830	80.00
.4835	4504835	80.00
.4840	4504840	80.00
.4845	4504845	80.00
.4850	4504850	80.00
.4855	4504855	80.00
.4860	4504860	80.00
.4865	4504865	80.00
.4870	4504870	80.00
.4875	4504875	80.00
.4880	4504880	80.00
.4885	4504885	80.00
.4890	4504890	80.00
.4895	4504895	80.00
.4900	4504900	80.00
.4905	4504905	80.00
.4910	4504910	80.00
.4915	4504915	80.00
.4920	4504920	80.00
.4925	4504925	80.00
.4930	4504930	80.00
.4935	4504935	80.00
.4940	4504940	80.00
.4945	4504945	80.00
.4950	4504950	80.00
.4955	4504955	80.00
.4960	4504960	80.00
.4965	4504965	80.00
.4970	4504970	80.00
.4975	4504975	80.00
.4980	4504980	80.00
.4985	4504985	80.00
.4990	4504990	80.00
.4995	4504995	80.00
.5000	45016	66.25
.5005	4505005	80.00
.5010	4505010	80.00
.5015	4505015	80.00
.5020	4505020	80.00
.5025	4505025	80.00
.5030	4505030	80.00
.5035	4505035	81.75
.5040	4505040	81.75
.5045	4505045	81.75
.5050	4505050	81.75
.5055	4505055	81.75
.5060	4505060	81.75
.5065	4505065	81.75
.5070	4505070	$81.75
.5075	4505075	81.75
.5080	4505080	81.75
.5085	4505085	81.75
.5090	4505090	81.75
.5095	4505095	81.75
.5100	4505100	81.75
.5105	4505105	81.75
.5110	4505110	81.75
.5115	4505115	81.75
.5120	4505120	81.75
.5125	4505125	81.75
.5130	4505130	81.75
.5135	4505135	81.75
.5140	4505140	81.75
.5145	4505145	81.75
.5150	4505150	81.75
.5155	4505155	81.75
.5160	4505160	81.75
.5165	4505165	81.75
.5170	4505170	81.75
.5175	4505175	81.75
.5180	4505180	81.75
.5185	4505185	81.75
.5190	4505190	81.75
.5195	4505195	81.75
.5200	4505200	81.75
.5205	4505205	81.75
.5210	4505210	81.75
.5215	4505215	81.75
.5220	4505220	81.75
.5225	4505225	81.75
.5230	4505230	81.75
.5235	4505235	81.75
.5240	4505240	81.75
.5245	4505245	81.75
.5250	4505250	81.75
.5255	4505255	81.75
.5260	4505260	81.75
.5265	4505265	81.75
.5270	4505270	81.75
.5275	4505275	81.75
.5280	4505280	81.75
.5285	4505285	81.75
.5290	4505290	81.75
.5295	4505295	81.75
.5300	4505300	81.75
.5305	4505305	81.75
.5310	4505310	81.75
.5315	450135	81.75
.5320	4505320	81.75
.5325	4505325	81.75
.5330	4505330	81.75
.5335	4505335	81.75
.5340	4505340	81.75
.5345	4505345	81.75
.5350	4505350	81.75
.5355	4505355	81.75
.5360	4505360	81.75
.5365	4505365	81.75
.5370	4505370	$81.75
.5375	4505375	81.75
.5380	4505380	81.75
.5385	4505385	81.75
.5390	4505390	81.75
.5395	4505395	81.75
.5400	4505400	81.75
.5405	4505405	81.75
.5410	4505410	81.75
.5415	4505415	81.75
.5420	4505420	81.75
.5425	4505425	81.75
.5430	4505430	81.75
.5435	4505435	81.75
.5440	4505440	81.75
.5445	4505445	81.75
.5450	4505450	81.75
.5455	4505455	81.75
.5460	4505460	81.75
.5465	4505465	81.75
.5470	4505470	81.75
.5475	4505475	81.75
.5480	4505480	81.75
.5485	4505485	81.75
.5490	4505490	81.75
.5495	4505495	81.75
.5500	4505500	81.75
.5505	4505505	81.75
.5510	4505510	81.75
.5515	4505515	81.75
.5520	4505520	81.75
.5525	4505525	81.75
.5530	4505530	81.75
.5535	4505535	81.75
.5540	4505540	81.75
.5545	4505545	81.75
.5550	4505550	81.75
.5555	4505555	81.75
.5560	4505560	81.75
.5565	4505565	81.75
.5570	4505570	81.75
.5575	4505575	81.75
.5580	4505580	81.75
.5585	4505585	81.75
.5590	4505590	81.75
.5595	4505595	81.75
.5600	4505600	81.75
.5605	4505605	81.75
.5610	4505610	81.75
.5615	4505615	81.75
.5620	4505620	81.75
.5625	45018	68.15
.5630	450143	81.75
.5635	4505635	81.75
.5640	4505640	81.75
.5645	4505645	81.75
.5650	4505650	81.75
.5655	4505655	81.75
.5660	4505660	81.75
.5665	4505665	84.40
.5670	4505670	$84.40
.5675	4505675	84.40
.5680	4505680	84.40
.5685	4505685	84.40
.5690	4505690	84.40
.5695	4505695	84.40
.5700	4505700	84.40
.5705	4505705	84.40
.5710	4505710	84.40
.5715	4505715	84.40
.5720	4505720	84.40
.5725	4505725	84.40
.5730	4505730	84.40
.5735	4505735	84.40
.5740	4505740	84.40
.5745	4505745	84.40
.5750	4505750	84.40
.5755	4505755	84.40
.5760	4505760	84.40
.5765	4505765	84.40
.5770	4505770	84.40
.5775	4505775	84.40
.5780	4505780	84.40
.5785	4505785	84.40
.5790	4505790	84.40
.5795	4505795	84.40
.5800	4505800	84.40
.5805	4505805	84.40
.5810	4505810	84.40
.5815	4505815	84.40
.5820	4505820	84.40
.5825	4505825	84.40
.5830	4505830	84.40
.5835	4505835	84.40
.5840	4505840	84.40
.5845	4505845	84.40
.5850	4505850	84.40
.5855	4505855	84.40
.5860	4505860	84.40
.5865	4505865	84.40
.5870	4505870	84.40
.5875	4505875	84.40
.5880	4505880	84.40
.5885	4505885	84.40
.5890	4505890	84.40
.5895	4505895	84.40
.5900	4505900	84.40
.5905	4505905	84.40
.5910	4505910	84.40
.5915	4505915	84.40
.5920	4505920	84.40
.5925	4505925	84.40
.5930	4505930	84.40
.5935	4505935	84.40
.5940	4505940	84.40
.5945	450151	84.40
.5950	4505950	84.40
.5955	4505955	84.40
.5960	4505960	84.40
.5965	4505965	84.40
.5970	4505970	$84.40
.5975	4505975	84.40
.5980	4505980	84.40
.5985	4505985	84.40
.5990	4505990	84.40
.5995	4505995	84.40
.6000	4506000	84.40
.6005	4506005	84.40
.6010	4506010	84.40
.6015	4506015	84.40
.6020	4506020	84.40
.6025	4506025	84.40
.6030	4506030	84.40
.6035	4506035	84.40
.6040	4506040	84.40
.6045	4506045	84.40
.6050	4506050	84.40
.6055	4506055	84.40
.6060	4506060	84.40
.6065	4506065	84.40
.6070	4506070	84.40
.6075	4506075	84.40
.6080	4506080	84.40
.6085	4506085	84.40
.6090	4506090	84.40
.6095	4506095	84.40
.6100	4506100	84.40
.6105	4506105	84.40
.6110	4506110	84.40
.6115	4506115	84.40
.6120	4506120	84.40
.6125	4506125	84.40
.6130	4506130	84.40
.6135	4506135	84.40
.6140	4506140	84.40
.6145	4506145	84.40
.6150	4506150	84.40
.6155	4506155	84.40
.6160	4506160	84.40
.6165	4506165	84.40
.6170	4506170	84.40
.6175	4506175	84.40
.6180	4506180	84.40
.6185	4506185	84.40
.6190	4506190	84.40
.6195	4506195	84.40
.6200	4506200	84.40
.6205	4506205	84.40
.6210	4506210	84.40
.6215	4506215	84.40
.6220	450158	84.40
.6225	4506225	84.40
.6230	4506230	84.40
.6235	4506235	84.40
.6240	4506240	84.40
.6245	4506245	84.40
.6250	45020	70.85
.6255	4506255	84.40
.6260	450159	84.40
.6265	4506265	84.40

CHUCKING REAMERS CARBIDE TIPPED TYPE 452 FRACTIONAL

GENERAL PURPOSE

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

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

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

TOOL DIAMETER		TYPE 452 EDP NO.	PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
				TAPER SHANK NO.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
1/4	.2500	45208	$54.85	1	4	1 1/2	6	0.2381 - 0.2530	$93.10	$73.95	$67.50	$64.45	$61.20	$58.55
9/32	.2812	45209	55.55	1	4	1 1/2	6	0.2531 - 0.2840	93.85	74.75	68.25	65.20	61.90	59.35
5/16	.3125	45210	55.55	1	4	1 1/2	6	0.2841 - 0.3150	93.85	74.75	68.25	65.20	61.90	59.35
11/32	.3438	45211	56.85	1	4	1 1/2	6	0.3151 - 0.3470	95.10	76.00	69.60	66.45	63.15	60.60
3/8	.3750	45212	57.50	1	4	1 3/4	7	0.3471 - 0.3780	95.75	76.60	70.15	67.10	63.80	61.30
13/32	.4062	45213	60.55	1	4	1 3/4	7	0.3781 - 0.4090	98.80	79.55	73.20	70.15	66.95	64.35
7/16	.4375	45214	64.50	1	4	1 3/4	7	0.4091 - 0.4410	102.70	83.60	77.20	74.15	70.90	68.25
15/32	.4688	45215	65.85	1	4	1 3/4	7	0.4411 - 0.4720	104.15	84.85	78.55	75.45	72.20	69.65
1/2	.5000	45216	71.00	1	6	2	8	0.4721 - 0.5030	111.85	91.40	84.55	81.30	77.75	75.05
17/32	.5312	45217	77.75	1	6	2	8	0.5031 - 0.5340	118.75	98.20	91.30	88.05	84.55	81.75
9/16	.5625	45218	77.75	1	6	2	8	0.5341 - 0.5660	118.75	98.20	91.30	88.05	84.55	81.75
19/32	.5938	45219	81.35	1	6	2	8	0.5661 - 0.5970	122.25	101.80	94.95	91.70	88.15	85.40
5/8	.6250	45220	81.35	2	6	2	9	0.5971 - 0.6280	122.25	101.80	94.95	91.70	88.15	85.40
21/32	.6562	45221	82.85	2	6	2	9	0.6281 - 0.6590	123.90	103.30	96.35	93.20	89.65	86.95
11/16	.6875	45222	82.85	2	6	2	9	0.6591 - 0.6910	123.90	103.30	96.35	93.20	89.65	86.95
23/32	.7188	45223	84.05	2	6	2	9	0.6911 - 0.7220	125.05	104.45	97.55	94.35	90.85	88.05
3/4	.7500	45224	86.70	2	6	2	9 1/2	0.7221 - 0.7530	127.70	107.15	100.30	97.00	93.40	90.80
25/32	.7812	45225	87.40	2	6	2	9 1/2	0.7531 - 0.7840	128.40	107.85	101.00	97.60	94.15	91.40
13/16	.8125	45226	89.45	2	6	2	9 1/2	0.7841 - 0.8160	130.30	109.70	103.00	99.70	96.20	93.35
27/32	.8438	45227	93.30	2	6	2	9 1/2	0.8161 - 0.8470	134.30	113.75	106.85	103.65	100.10	97.40
7/8	.8750	45228	96.90	2	6	2 1/4	10	0.8471 - 0.8780	139.40	118.10	110.85	107.65	103.80	101.10
29/32	.9062	45229	109.10	2	6	2 1/4	10	0.8781 - 0.9090	151.55	130.30	123.25	119.80	116.05	113.30
15/16	.9375	45230	113.50	3	8	2 1/4	10	0.9091 - 0.9410	155.85	134.65	127.55	124.10	120.45	117.65
31/32	.9688	45231	118.15	3	8	2 1/4	10	0.9411 - 0.9720	160.65	139.40	132.20	128.85	125.15	122.35
1	1.0000	45232	118.15	3	8	2 1/4	10 1/2	0.9721 - 1.0030	160.65	139.40	132.20	128.85	125.15	122.35
1 1/16	1.0625	45234	161.95	3	8	2 1/4	10 1/2	1.0031 - 1.0660	202.65	182.15	175.35	172.20	168.65	165.90
1 1/8	1.1250	45236	174.40	3	8	2 1/4	11	1.0661 - 1.1280	215.10	194.70	187.95	184.65	181.10	178.40
1 3/16	1.1875	45238	187.40	3	8	2 1/4	11	1.1281 - 1.1905	228.10	207.70	200.90	197.60	194.20	191.35
1 1/4	1.2500	45240	199.15	4	8	2 1/2	11 1/2	1.1906 - 1.2530	239.80	219.45	212.70	209.30	205.80	203.10
1 5/16	1.3125	45242	224.85	4	8	2 1/2	11 1/2	1.2531 - 1.3155	265.55	245.25	238.25	235.15	231.60	228.85
1 3/8	1.3750	45244	256.95	4	8	2 1/2	12	1.3156 - 1.3780	297.60	277.25	270.35	267.15	263.60	260.90
1 7/16	1.4375	45246	268.15	4	8	2 1/2	12	1.3781 - 1.4405	308.90	288.50	281.65	278.50	274.90	272.15
1 1/2	1.5000	45248	279.35	4	8	2 1/2	12 1/2	1.4406 - 1.5030	320.05	299.75	292.90	289.65	286.10	283.35

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

CHUCKING REAMERS CARBIDE TIPPED TYPE 452 METRIC

GENERAL PURPOSE

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							
				TAPER SHANK NO.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH					FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
6.0	.2362	452060	$67.50	1	4	1 ½	6	6.000 - 6.426	$96.25	$77.20	$70.85	$67.65	$64.45	$61.80	$58.15
6.5	.2559	452065	68.25	1	4	1 ½	6	6.427 - 7.214	97.00	78.00	71.60	68.50	65.20	62.65	58.90
7.0	.2756	452070	68.25	1	4	1 ½	6	-	-	-	-	-	-	-	-
7.5	.2953	452075	68.25	1	4	1 ½	6	7.215 - 8.001	97.00	78.00	71.60	68.50	65.20	62.65	58.90
8.0	.3150	452080	68.25	1	4	1 ½	6	-	-	-	-	-	-	-	-
8.5	.3346	452085	69.60	1	4	1 ½	6	8.002 - 8.814	98.35	79.20	72.85	69.70	66.45	63.80	60.15
9.0	.3543	452090	70.15	1	4	1 ¾	7	8.815 - 9.601	98.95	79.95	73.40	70.25	67.10	64.45	60.70
9.5	.3740	452095	70.15	1	4	1 ¾	7	-	-	-	-	-	-	-	-
10.0	.3937	452100	73.20	1	4	1 ¾	7	9.602 - 10.389	102.05	82.85	76.45	73.35	70.15	67.50	63.80
10.5	.4134	452105	77.20	1	4	1 ¾	7	10.390 - 11.201	105.90	86.90	80.50	77.40	74.15	71.45	67.85
11.0	.4331	452110	77.20	1	4	1 ¾	7	-	-	-	-	-	-	-	-
11.5	.4528	452115	78.55	1	4	1 ¾	7	11.202 - 11.989	107.30	88.15	81.80	78.70	75.45	72.85	69.05
12.0	.4724	452120	84.55	1	6	2	8	11.990 - 12.776	115.35	94.95	88.05	84.70	81.30	78.40	74.50
12.5	.4921	452125	84.55	1	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	452130	91.30	1	6	2	8	12.777 - 13.564	122.15	101.65	94.90	91.60	88.05	85.25	81.30
13.5	.5315	452135	91.30	1	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	452140	91.30	1	6	2	8	13.565 - 14.376	122.15	101.65	94.90	91.60	88.05	85.25	81.30
14.5	.5709	452145	94.95	1	6	2	8	14.377 - 15.164	125.70	105.40	98.45	95.10	91.70	88.75	84.85
15.0	.5906	452150	94.95	1	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	452155	94.95	2	6	2	9	15.165 - 15.951	125.70	105.40	98.45	95.10	91.70	88.75	84.85
16.0	.6299	452160	96.35	2	6	2	9	15.952 - 16.739	127.25	106.75	99.95	96.60	93.20	90.40	86.40
16.5	.6496	452165	96.35	2	6	2	9	-	-	-	-	-	-	-	-
17.0	.6693	452170	96.35	2	6	2	9	16.740 - 17.551	127.25	106.75	99.95	96.60	93.20	90.40	86.40
17.5	.6890	452175	96.35	2	6	2	9	-	-	-	-	-	-	-	-
18.0	.7087	452180	97.55	2	6	2	9	17.552 - 18.339	128.45	107.95	101.20	97.80	94.35	91.60	87.50
18.5	.7283	452185	100.30	2	6	2	9 ½	18.340 - 19.126	131.15	110.65	103.75	100.40	97.00	94.15	90.30
19.0	.7480	452190	100.30	2	6	2	9 ½	-	-	-	-	-	-	-	-
19.5	.7677	452195	101.00	2	6	2	9 ½	19.127 - 19.914	131.75	111.40	104.45	101.20	97.60	94.90	90.90
20.0	.7874	452200	103.00	2	6	2	9 ½	19.915 - 20.726	133.80	113.30	106.50	103.15	99.70	96.85	92.95
20.5	.8071	452205	103.00	2	6	2	9 ½	-	-	-	-	-	-	-	-
21.0	.8268	452210	106.85	2	6	2	9 ½	20.727 - 21.514	137.70	117.25	110.45	107.05	103.65	100.85	96.85
21.5	.8465	452215	106.85	2	6	2	9 ½	-	-	-	-	-	-	-	-
22.0	.8661	452220	106.85	2	6	2 ¼	10	21.515 - 22.301	137.70	117.25	110.45	107.05	103.65	100.85	96.85
22.5	.8858	452225	123.25	2	6	2 ¼	10	22.302 - 23.089	155.15	133.90	126.80	123.35	119.80	116.85	112.85
23.0	.9055	452230	123.25	2	6	2 ¼	10	-	-	-	-	-	-	-	-
23.5	.9252	452235	127.55	3	8	2 ¼	10	23.090 - 23.901	159.50	138.25	131.25	127.70	124.10	121.15	117.10
24.0	.9449	452240	132.20	3	8	2 ¼	10	23.902 - 24.689	164.20	142.95	135.90	132.45	128.85	125.90	121.75
24.5	.9646	452245	132.20	3	8	2 ¼	10	-	-	-	-	-	-	-	-
25.0	.9843	452250	132.20	3	8	2 ¼	10 ½	24.690 - 25.476	164.20	142.95	135.90	132.45	128.85	125.90	121.75
25.5	1.0039	452255	175.35	3	8	2 ¼	10 ½	25.477 - 27.076	206.10	185.75	178.85	175.60	172.20	169.35	165.45
26.0	1.0236	452260	175.35	3	8	2 ¼	10 ½	-	-	-	-	-	-	-	-
27.0	1.0630	452270	175.35	3	8	2 ¼	10 ½	-	-	-	-	-	-	-	-
28.0	1.1024	452280	187.95	3	8	2 ¼	11	27.077 - 28.651	218.55	198.25	191.35	188.05	184.65	181.80	177.95
29.0	1.1417	452290	200.90	3	8	2 ¼	11	28.652 - 30.239	231.55	211.25	204.35	201.05	197.60	194.80	190.90
30.0	1.1811	452300	200.90	3	8	2 ¼	11	-	-	-	-	-	-	-	-
31.0	1.2205	452310	212.70	4	8	2 ½	11 ½	30.240 - 31.826	243.25	222.95	216.10	212.80	209.30	206.50	202.65
32.0	1.2598	452320	238.25	4	8	2 ½	11 ½	31.827 - 33.414	269.05	248.60	241.90	238.50	235.15	232.20	228.30
33.0	1.2992	452330	238.25	4	8	2 ½	11 ½	-	-	-	-	-	-	-	-
34.0	1.3386	452340	270.35	4	8	2 ½	12	33.415 - 35.001	301.00	280.75	273.90	270.65	267.15	264.35	260.40
35.0	1.3780	452350	270.35	4	8	2 ½	12	-	-	-	-	-	-	-	-
36.0	1.4173	452360	281.65	4	8	2 ½	12	35.002 - 36.589	312.25	291.95	285.20	281.80	278.50	275.55	271.55
37.0	1.4567	452370	292.90	4	8	2 ½	12 ½	36.590 - 38.176	323.55	303.15	296.35	293.15	289.65	286.85	282.95
38.0	1.4961	452380	292.90	4	8	2 ½	12 ½	-	-	-	-	-	-	-	-

CHUCKING REAMERS CARBIDE TIPPED TYPE 465 FRACTIONAL

GENERAL PURPOSE

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						
				SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
5/16	.3125	46510	$73.45	9/32	4	1	6	0.2841 - 0.3150	$111.75	$92.60	$86.05	$83.20	$79.95	$77.30
11/32	.3438	46511	73.45	9/32	4	1	6	0.3151 - 0.3470	111.75	92.60	86.05	83.20	79.95	77.30
3/8	.3750	46512	68.90	5/16	4	1	7	0.3471 - 0.3780	104.80	86.80	80.70	77.90	74.85	72.40
13/32	.4062	46513	73.15	5/16	4	1	7	0.3781 - 0.4090	108.90	90.95	84.95	82.10	79.05	76.60
7/16	.4375	46514	73.15	3/8	4	1	7	0.4091 - 0.4410	108.90	90.95	84.95	82.10	79.05	76.60
15/32	.4688	46515	77.55	3/8	4	1	7	0.4411 - 0.4720	113.20	95.30	89.40	86.50	83.45	81.10
1/2	.5000	46516	77.55	7/16	6	1	8	0.4721 - 0.5030	113.20	95.30	89.40	86.50	83.45	81.10
17/32	.5312	46517	79.40	7/16	6	1	8	0.5031 - 0.5340	115.30	97.35	91.30	88.50	85.40	82.95
9/16	.5625	46518	79.40	7/16	6	1 1/8	8	0.5341 - 0.5660	115.30	97.35	91.30	88.50	85.40	82.95
19/32	.5938	46519	82.90	7/16	6	1 1/8	8	0.5661 - 0.5970	118.75	100.85	94.85	91.95	88.85	86.45
5/8	.6250	46520	82.90	9/16	6	1 1/4	9	0.5971 - 0.6280	118.75	100.85	94.85	91.95	88.85	86.45
21/32	.6562	46521	90.70	9/16	6	1 1/4	9	0.6281 - 0.6590	126.45	108.50	102.55	99.70	96.60	94.15
11/16	.6875	46522	90.70	9/16	6	1 1/4	9	0.6591 - 0.6910	126.45	108.50	102.55	99.70	96.60	94.15
23/32	.7188	46523	94.00	9/16	6	1 1/4	9	0.6911 - 0.7220	129.90	111.85	105.85	103.05	99.95	97.55
3/4	.7500	46524	94.00	5/8	6	1 3/8	9 1/2	0.7221 - 0.7530	129.90	111.85	105.85	103.05	99.95	97.55
25/32	.7812	46525	101.35	5/8	6	1 3/8	9 1/2	0.7531 - 0.7840	137.20	119.25	113.15	110.40	107.30	104.90
13/16	.8125	46526	101.35	5/8	6	1 3/8	9 1/2	0.7841 - 0.8160	137.20	119.25	113.15	110.40	107.30	104.90
27/32	.8438	46527	105.40	5/8	6	1 3/8	9 1/2	0.8161 - 0.8470	141.10	123.25	117.20	114.30	111.35	108.85
7/8	.8750	46528	109.35	3/4	6	1 1/2	10	0.8471 - 0.8780	146.40	127.85	121.55	118.70	115.45	112.95
29/32	.9062	46529	116.35	3/4	6	1 1/2	10	0.8781 - 0.9090	153.55	134.85	128.70	125.75	122.55	120.00
15/16	.9375	46530	116.35	3/4	8	1 1/2	10	0.9091 - 0.9410	153.55	134.85	128.70	125.75	122.55	120.00
31/32	.9688	46531	120.95	3/4	8	1 1/2	10	0.9411 - 0.9720	158.00	139.45	133.15	130.25	127.00	124.50
1	1.0000	46532	120.95	7/8	8	1 5/8	10 1/2	0.9721 - 1.0030	158.00	139.45	133.15	130.25	127.00	124.50
1 1/32	1.0312	46533	132.50	7/8	8	1 5/8	10 1/2	-	-	-	-	-	-	-
1 1/16	1.0625	46534	132.50	7/8	8	1 5/8	10 1/2	1.0031 - 1.0660	169.65	151.05	144.80	141.85	138.65	136.10
1 3/32	1.0938	46535	132.50	7/8	8	1 3/4	11	-	-	-	-	-	-	-
1 1/8	1.1250	46536	132.50	7/8	8	1 3/4	11	1.0661 - 1.1280	169.65	151.05	144.80	141.85	138.65	136.10
1 3/16	1.1875	46538	144.60	1	8	1 3/4	11	1.1281 - 1.1905	181.75	163.10	156.85	153.90	150.65	148.30
1 1/4	1.2500	46540	144.60	1	8	1 7/8	11 1/2	1.1906 - 1.2530	181.75	163.10	156.85	153.90	150.65	148.30
1 5/16	1.3125	46542	160.25	1	8	1 7/8	11 1/2	1.2531 - 1.3155	197.50	178.85	172.70	169.65	166.45	164.05
1 3/8	1.3750	46544	167.85	1	8	2	12	1.3156 - 1.3780	205.00	186.35	180.15	177.30	173.95	171.50
1 7/16	1.4375	46546	198.35	1 1/4	8	2	12	1.3781 - 1.4405	238.00	218.10	211.45	208.25	204.85	202.25
1 1/2	1.5000	46548	204.10	1 1/4	8	2 1/8	12 1/2	1.4406 - 1.5030	243.80	223.85	217.30	214.20	210.75	208.00
1 9/16	1.5625	46550	268.10	1 1/4	8	2 1/8	12 1/2	1.5031 - 1.5660	307.70	287.95	281.15	277.95	274.65	271.95
1 5/8	1.6250	46552	268.10	1 1/4	8	2 1/4	13	1.5661 - 1.6280	307.70	287.95	281.15	277.95	274.65	271.95
1 11/16	1.6875	46554	296.90	1 1/4	8	2 1/4	13	1.6281 - 1.6910	336.55	316.65	310.10	306.85	303.55	300.75
1 3/4	1.7500	46556	296.90	1 1/4	10	2 3/8	13 1/2	1.6911 - 1.7530	336.55	316.65	310.10	306.85	303.55	300.75
1 13/16	1.8125	46558	351.60	1 1/2	10	2 3/8	13 1/2	1.7531 - 1.8160	391.15	371.30	364.70	361.50	358.15	355.45
1 7/8	1.8750	46560	351.60	1 1/2	10	2 1/2	14	1.8161 - 1.8780	391.15	371.30	364.70	361.50	358.15	355.45
1 15/16	1.9375	46562	384.15	1 1/2	10	2 1/2	14	1.8781 - 1.9410	423.70	403.90	397.20	394.00	390.70	387.95
2	2.0000	46564	384.15	1 1/2	12	2 1/2	14	1.9411 - 2.0030	423.70	403.90	397.20	394.00	390.70	387.95
2 1/8	2.1250	46568	623.90	1 1/2	12	2 3/4	14 1/2	2.0031 - 2.1280	663.55	643.70	637.05	633.95	630.50	627.75
2 1/4	2.2500	46572	670.10	1 3/4	12	2 3/4	14 1/2	2.1281 - 2.2530	709.60	689.80	683.15	680.00	676.60	673.90
2 3/8	2.3750	46576	693.40	1 3/4	12	3	15	2.2531 - 2.3780	733.10	713.25	706.55	703.35	700.00	697.25
2 1/2	2.5000	46580	693.40	1 3/4	12	3	15	2.3781 - 2.5030	733.10	713.25	706.55	703.35	700.00	697.25

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

CHUCKING REAMERS
CARBIDE TIPPED TYPE 465 METRIC

GENERAL PURPOSE

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							
				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
mm	INCH														
7.5	.2953	465075	$86.05	9/32	4	1	6	7.215-8.001	$115.00	$95.85	$89.45	$86.40	$83.20	$80.50	$76.75
8.0	.3150	465080	86.05	9/32	4	1	6	-	-	-	-	-	-	-	-
8.5	.3346	465085	86.05	9/32	4	1	6	8.002-8.814	115.00	95.85	89.45	86.40	83.20	80.50	76.75
9.0	.3543	465090	80.70	5/16	4	1	7	8.815-9.601	107.80	89.85	83.80	81.05	77.90	75.45	72.00
9.5	.3740	465095	80.70	5/16	4	1	7	-	-	-	-	-	-	-	-
10.0	.3937	465100	84.95	5/16	4	1	7	9.602-10.389	111.85	94.00	88.05	85.10	82.10	79.55	76.20
10.5	.4134	465105	84.95	3/8	4	1	7	10.390-11.201	111.85	94.00	88.05	85.10	82.10	79.55	76.20
11.0	.4331	465110	84.95	3/8	4	1	7	-	-	-	-	-	-	-	-
11.5	.4528	465115	89.40	3/8	4	1	7	11.202-11.989	116.25	98.45	92.35	89.50	86.50	84.00	80.55
12.0	.4724	465120	89.40	7/16	6	1	8	11.990-12.776	116.25	98.45	92.35	89.50	86.50	84.00	80.55
12.5	.4921	465125	89.40	7/16	6	1	8	-	-	-	-	-	-	-	-
13.0	.5118	465130	91.30	7/16	6	1	8	12.777-13.564	118.30	100.40	94.40	91.55	88.50	85.95	82.55
13.5	.5315	465135	91.30	7/16	6	1	8	-	-	-	-	-	-	-	-
14.0	.5512	465140	91.30	7/16	6	1 1/8	8	13.565-14.376	118.30	100.40	94.40	91.55	88.50	85.95	82.55
14.5	.5709	465145	94.85	7/16	6	1 1/8	8	14.377-15.164	121.75	103.80	97.85	94.95	91.95	89.45	85.95
15.0	.5906	465150	94.85	7/16	6	1 1/8	8	-	-	-	-	-	-	-	-
15.5	.6102	465155	94.85	9/16	6	1 1/4	9	15.165-15.951	121.75	103.80	97.85	94.95	91.95	89.45	85.95
16.0	.6299	465160	102.55	9/16	6	1 1/4	9	15.952-16.739	129.45	111.65	105.60	102.65	99.70	97.25	93.80
16.5	.6496	465165	102.55	9/16	6	1 1/4	9	-	-	-	-	-	-	-	-
17.0	.6693	465170	102.55	9/16	6	1 1/4	9	16.740-17.551	129.45	111.65	105.60	102.65	99.70	97.25	93.80
17.5	.6890	465175	102.55	9/16	6	1 1/4	9	-	-	-	-	-	-	-	-
18.0	.7087	465180	105.85	9/16	6	1 1/4	9	17.552-18.339	132.90	115.00	108.95	106.10	103.05	100.60	97.15
18.5	.7283	465185	105.85	5/8	6	1 3/8	9 1/2	18.340-19.126	132.90	115.00	108.95	106.10	103.05	100.60	97.15
19.0	.7480	465190	105.85	5/8	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	465195	113.15	5/8	6	1 3/8	9 1/2	19.127-19.914	140.25	122.35	116.25	113.30	110.40	107.90	104.40
20.0	.7874	465200	113.15	5/8	6	1 3/8	9 1/2	19.915-20.726	140.25	122.35	116.25	113.30	110.40	107.90	104.40
20.5	.8071	465205	113.15	5/8	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	465210	117.20	5/8	6	1 3/8	9 1/2	20.727-21.514	144.15	126.30	120.25	117.35	114.30	111.80	108.40
21.5	.8465	465215	117.20	5/8	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	465220	117.20	3/4	6	1 1/2	10	21.515-22.301	144.15	126.30	120.25	117.35	114.30	111.80	108.40
22.5	.8858	465225	128.70	3/4	6	1 1/2	10	22.302-23.089	156.65	138.15	131.85	128.85	125.75	123.20	119.55
23.0	.9055	465230	128.70	3/4	6	1 1/2	10	-	-	-	-	-	-	-	-
23.5	.9252	465235	128.70	3/4	8	1 1/2	10	23.090-23.901	156.65	138.15	131.85	128.85	125.75	123.20	119.55
24.0	.9449	465240	133.15	3/4	8	1 1/2	10	23.902-24.689	161.15	142.60	136.45	133.30	130.25	127.60	124.05
24.5	.9646	465245	133.15	3/4	8	1 1/2	10	-	-	-	-	-	-	-	-
25.0	.9843	465250	133.15	7/8	8	1 5/8	10 1/2	24.690-25.476	161.15	142.60	136.45	133.30	130.25	127.60	124.05
25.5	1.0039	465255	144.80	7/8	8	1 5/8	10 1/2	25.477-27.076	172.80	154.25	147.95	144.90	141.85	139.25	135.65
26.0	1.0236	465260	144.80	7/8	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	465270	144.80	7/8	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	465280	144.80	7/8	8	1 3/4	11	27.077-28.651	172.80	154.25	147.95	144.90	141.85	139.25	135.65
29.0	1.1417	465290	156.85	1	8	1 3/4	11	28.652-30.239	184.85	166.30	160.10	156.95	153.90	151.40	147.70
30.0	1.1811	465300	156.85	1	8	1 3/4	11	-	-	-	-	-	-	-	-
31.0	1.2205	465310	156.85	1	8	1 7/8	11 1/2	30.240-31.826	184.85	166.30	160.10	156.95	153.90	151.40	147.70
32.0	1.2598	465320	172.70	1	8	1 7/8	11 1/2	31.827-33.414	200.55	182.00	175.85	172.80	169.65	167.10	163.55
33.0	1.2992	465330	172.70	1	8	1 7/8	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	465340	180.15	1	8	2	12	33.415-35.001	208.10	189.55	183.30	180.35	177.30	174.60	171.00
35.0	1.3780	465350	180.15	1	8	2	12	-	-	-	-	-	-	-	-
36.0	1.4173	465360	211.45	1 1/4	8	2	12	35.002-36.589	241.25	221.50	214.90	211.60	208.25	205.55	201.75
37.0	1.4567	465370	217.30	1 1/4	8	2 1/8	12 1/2	36.590-38.176	247.15	227.40	220.75	217.40	214.20	211.40	207.60
38.0	1.4961	465380	217.30	1 1/4	8	2 1/8	12 1/2	-	-	-	-	-	-	-	-
39.0	1.5354	465390	281.15	1 1/4	8	2 1/8	12 1/2	38.177-39.776	311.05	291.20	284.55	281.35	277.95	275.15	271.45
40.0	1.5748	465400	281.15	1 1/4	8	2 1/4	13	39.777-41.351	311.05	291.20	284.55	281.35	277.95	275.15	271.45
41.0	1.6142	465410	281.15	1 1/4	8	2 1/4	13	-	-	-	-	-	-	-	-
42.0	1.6535	465420	310.10	1 1/4	8	2 1/4	13	41.352-42.951	339.85	320.05	313.45	310.25	306.85	304.10	300.25
43.0	1.6929	465430	310.10	1 1/4	10	2 3/8	13 1/2	42.952-44.526	339.85	320.05	313.45	310.25	306.85	304.10	300.25
44.0	1.7323	465440	310.10	1 1/4	10	2 3/8	13 1/2	-	-	-	-	-	-	-	-

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

CHUCKING REAMERS CARBIDE TIPPED TYPE 467 FRACTIONAL

GENERAL PURPOSE

EXPANSION REAMERS STRAIGHT FLUTE LONG CARBIDE TAPER SHANK

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

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 DIAMETER		TYPE 467 EDP NO.	PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
				TAPER SHANK NO.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
5/16	.3125	46710	$82.80	1	4	1	6	0.2841 - 0.3150	$121.05	$101.85	$95.50	$92.35	$89.20	$86.55
11/32	.3438	46711	82.80	1	4	1	6	0.3151 - 0.3470	121.05	101.85	95.50	92.35	89.20	86.55
3/8	.3750	46712	77.65	1	4	1	7	0.3471 - 0.3780	113.50	95.50	89.50	86.65	83.60	81.20
13/32	.4062	46713	80.05	1	4	1	7	0.3781 - 0.4090	115.85	97.85	91.85	89.00	85.90	83.50
7/16	.4375	46714	80.05	1	4	1	7	0.4091 - 0.4410	115.85	97.85	91.85	89.00	85.90	83.50
15/32	.4688	46715	83.95	1	4	1	7	0.4411 - 0.4720	119.80	101.85	95.80	92.95	89.85	87.45
1/2	.5000	46716	83.95	1	6	1	8	0.4721 - 0.5030	119.80	101.85	95.80	92.95	89.85	87.45
17/32	.5312	46717	86.50	1	6	1	8	0.5031 - 0.5340	122.35	104.35	98.40	95.50	92.35	89.95
9/16	.5625	46718	86.50	1	6	1 1/8	8	0.5341 - 0.5660	122.35	104.35	98.40	95.50	92.35	89.95
19/32	.5938	46719	89.95	1	6	1 1/8	8	0.5661 - 0.5970	125.80	107.90	101.95	99.05	96.05	93.55
5/8	.6250	46720	89.95	2	6	1 1/4	9	0.5971 - 0.6280	125.80	107.90	101.95	99.05	96.05	93.55
21/32	.6562	46721	101.30	2	6	1 1/4	9	0.6281 - 0.6590	137.15	119.10	113.10	110.30	107.20	104.85
11/16	.6875	46722	101.30	2	6	1 1/4	9	0.6591 - 0.6910	137.15	119.10	113.10	110.30	107.20	104.85
23/32	.7188	46723	101.50	2	6	1 1/4	9	0.6911 - 0.7220	137.40	119.50	113.50	110.65	107.45	105.10
3/4	.7500	46724	101.50	2	6	1 3/8	9 1/2	0.7221 - 0.7530	137.40	119.50	113.50	110.65	107.45	105.10
25/32	.7812	46725	109.05	2	6	1 3/8	9 1/2	0.7531 - 0.7840	144.90	126.90	121.00	118.15	115.00	112.60
13/16	.8125	46726	109.05	2	6	1 3/8	9 1/2	0.7841 - 0.8160	144.90	126.90	121.00	118.15	115.00	112.60
27/32	.8438	46727	113.65	2	6	1 3/8	9 1/2	0.8161 - 0.8470	149.45	131.50	125.50	122.60	119.55	117.10
7/8	.8750	46728	118.00	2	6	1 1/2	10	0.8471 - 0.8780	155.05	136.55	130.25	127.30	124.05	121.50
29/32	.9062	46729	124.70	2	6	1 1/2	10	0.8781 - 0.9090	161.90	143.30	137.00	134.05	130.85	128.40
15/16	.9375	46730	124.70	3	8	1 1/2	10	0.9091 - 0.9410	161.90	143.30	137.00	134.05	130.85	128.40
31/32	.9688	46731	129.25	3	8	1 1/2	10	0.9411 - 0.9720	166.35	147.70	141.45	138.50	135.40	132.80
1	1.0000	46732	129.25	3	8	1 5/8	10 1/2	0.9721 - 1.0030	166.35	147.70	141.45	138.50	135.40	132.80
1 1/32	1.0312	46733	141.35	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-
1 1/16	1.0625	46734	141.35	3	8	1 5/8	10 1/2	1.0031 - 1.0660	178.70	160.00	153.75	150.80	147.60	145.05
1 3/32	1.0938	46735	141.35	3	8	1 3/4	11	-	-	-	-	-	-	-
1 1/8	1.1250	46736	141.35	3	8	1 3/4	11	1.0661 - 1.1280	178.70	160.00	153.75	150.80	147.60	145.05
1 3/16	1.1875	46738	159.05	3	8	1 3/4	11	1.1281 - 1.1905	196.15	177.55	171.35	168.40	165.25	162.70
1 1/4	1.2500	46740	161.20	4	8	1 7/8	11 1/2	1.1906 - 1.2530	198.35	179.75	173.55	170.60	167.30	164.85
1 5/16	1.3125	46742	176.20	4	8	1 7/8	11 1/2	1.2531 - 1.3155	213.35	194.70	188.45	185.55	182.45	179.80
1 3/8	1.3750	46744	193.05	4	8	2	12	1.3156 - 1.3780	230.10	211.55	205.35	202.35	199.15	196.60
1 7/16	1.4375	46746	216.65	4	8	2	12	1.3781 - 1.4405	256.30	236.45	229.80	226.60	223.20	220.55
1 1/2	1.5000	46748	224.35	4	8	2 1/8	12 1/2	1.4406 - 1.5030	264.05	244.10	237.40	234.35	230.90	228.20
1 9/16	1.5625	46750	308.25	4	8	2 1/8	12 1/2	1.5031 - 1.5660	347.95	328.05	321.45	318.30	314.80	312.15
1 5/8	1.6250	46752	308.25	4	8	2 1/4	13	1.5661 - 1.6280	347.95	328.05	321.45	318.30	314.80	312.15
1 11/16	1.6875	46754	341.40	4	8	2 1/4	13	1.6281 - 1.6910	381.10	361.25	354.55	351.35	348.00	345.30
1 3/4	1.7500	46756	341.40	4	10	2 3/8	13 1/2	1.6911 - 1.7530	381.10	361.25	354.55	351.35	348.00	345.30
1 13/16	1.8125	46758	404.20	4	10	2 3/8	13 1/2	1.7531 - 1.8160	443.90	424.10	417.45	414.25	410.80	408.15
1 7/8	1.8750	46760	404.20	4	10	2 1/2	14	1.8161 - 1.8780	443.90	424.10	417.45	414.25	410.80	408.15
1 15/16	1.9375	46762	441.80	4	10	2 1/2	14	1.8781 - 1.9410	481.35	461.50	454.80	451.70	448.25	445.70
2	2.0000	46764	441.80	4	12	2 1/2	14	1.9411 - 2.0030	481.35	461.50	454.80	451.70	448.25	445.70
2 1/8	2.1250	46768	661.40	5	12	2 3/4	14 1/2	2.0031 - 2.1280	701.00	681.20	674.50	671.35	668.00	665.25
2 1/4	2.2500	46772	710.25	5	12	2 3/4	14 1/2	2.1281 - 2.2530	749.95	730.05	723.45	720.20	716.85	714.20
2 3/8	2.3750	46776	734.95	5	12	3	15	2.2531 - 2.3780	774.55	754.80	748.05	745.00	741.55	738.90
2 1/2	2.5000	46780	734.95	5	12	3	15	2.3781 - 2.5030	774.55	754.80	748.05	745.00	741.55	738.90

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

CHUCKING REAMERS CARBIDE TIPPED TYPE 467 METRIC

GENERAL PURPOSE

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							
				TAPER SHANK NO.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH					FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
7.5	.2953	467075	$95.50	1	4	1	6	7.215 - 8.001	$124.25	$105.15	$98.80	$95.65	$92.35	$89.75	$86.00
8.0	.3150	467080	95.50	1	4	1	6	-	-	-	-	-	-	-	-
8.5	.3346	467085	95.50	1	4	1	6	8.002 - 8.814	124.25	105.15	98.80	95.65	92.35	89.75	86.00
9.0	.3543	467090	89.50	1	4	1	7	8.815 - 9.601	116.45	98.55	92.60	89.65	86.65	84.15	80.65
9.5	.3740	467095	89.50	1	4	1	7	-	-	-	-	-	-	-	-
10.0	.3937	467100	91.85	1	4	1	7	9.602 - 10.389	118.80	101.00	94.95	92.00	89.00	86.50	83.00
10.5	.4134	467105	91.85	1	4	1	7	10.390 - 11.201	118.80	101.00	94.95	92.00	89.00	86.50	83.00
11.0	.4331	467110	91.85	1	4	1	7	-	-	-	-	-	-	-	-
11.5	.4528	467115	95.80	1	4	1	7	11.202 - 11.989	122.80	104.90	98.95	96.05	92.95	90.50	87.00
12.0	.4724	467120	95.80	1	6	1	8	11.990 - 12.776	122.80	104.90	98.95	96.05	92.95	90.50	87.00
12.5	.4921	467125	95.80	1	6	1	8	-	-	-	-	-	-	-	-
13.0	.5118	467130	98.40	1	6	1	8	12.777 - 13.564	125.40	107.40	101.40	98.50	95.50	93.10	89.55
13.5	.5315	467135	98.40	1	6	1	8	-	-	-	-	-	-	-	-
14.0	.5512	467140	98.40	1	6	1 1/8	8	13.565 - 14.376	125.40	107.40	101.40	98.50	95.50	93.10	89.55
14.5	.5709	467145	101.95	1	6	1 1/8	8	14.377 - 15.164	128.85	110.90	105.00	102.10	99.05	96.50	93.15
15.0	.5906	467150	101.95	1	6	1 1/8	8	-	-	-	-	-	-	-	-
15.5	.6102	467155	101.95	2	6	1 1/4	9	15.165 - 15.951	128.85	110.90	105.00	102.10	99.05	96.50	93.15
16.0	.6299	467160	113.10	2	6	1 1/4	9	15.952 - 16.739	140.15	122.20	116.20	113.20	110.30	107.85	104.35
16.5	.6496	467165	113.10	2	6	1 1/4	9	-	-	-	-	-	-	-	-
17.0	.6693	467170	113.10	2	6	1 1/4	9	16.740 - 17.551	140.15	122.20	116.20	113.20	110.30	107.85	104.35
17.5	.6890	467175	113.10	2	6	1 1/4	9	-	-	-	-	-	-	-	-
18.0	.7087	467180	113.50	2	6	1 1/4	9	17.552 - 18.339	140.45	122.55	116.60	113.65	110.65	108.10	104.70
18.5	.7283	467185	113.50	2	6	1 3/8	9 1/2	18.340 - 19.126	140.45	122.55	116.60	113.65	110.65	108.10	104.70
19.0	.7480	467190	113.50	2	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	467195	121.00	2	6	1 3/8	9 1/2	19.127 - 19.914	147.90	130.10	124.05	121.10	118.15	115.60	112.15
20.0	.7874	467200	121.00	2	6	1 3/8	9 1/2	19.915 - 20.726	147.90	130.10	124.05	121.10	118.15	115.60	112.15
20.5	.8071	467205	121.00	2	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	467210	125.50	2	6	1 3/8	9 1/2	20.727 - 21.514	152.40	134.60	128.60	125.60	122.60	120.05	116.75
21.5	.8465	467215	125.50	2	6	1 3/8	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	467220	125.50	2	6	1 1/2	10	21.515 - 22.301	152.40	134.60	128.60	125.60	122.60	120.05	116.75
22.5	.8858	467225	137.00	2	6	1 1/2	10	22.302 - 23.089	165.00	146.40	140.25	137.15	134.05	131.50	127.90
23.0	.9055	467230	137.00	2	6	1 1/2	10	-	-	-	-	-	-	-	-
23.5	.9252	467235	137.00	3	8	1 1/2	10	23.090 - 23.901	165.00	146.40	140.25	137.15	134.05	131.50	127.90
24.0	.9449	467240	141.45	3	8	1 1/2	10	23.902 - 24.689	169.50	151.00	144.75	141.75	138.50	135.95	132.45
24.5	.9646	467245	141.45	3	8	1 1/2	10	-	-	-	-	-	-	-	-
25.0	.9843	467250	141.45	3	8	1 5/8	10 1/2	24.690 - 25.476	169.50	151.00	144.75	141.75	138.50	135.95	132.45
25.5	1.0039	467255	153.75	3	8	1 5/8	10 1/2	25.477 - 27.076	181.75	163.15	156.90	153.90	150.80	148.30	144.65
26.0	1.0236	467260	153.75	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	467270	153.75	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	467280	153.75	3	8	1 3/4	11	27.077 - 28.651	181.75	163.15	156.90	153.90	150.80	148.30	144.65
29.0	1.1417	467290	171.35	3	8	1 3/4	11	28.652 - 30.239	199.30	180.80	174.55	171.50	168.40	165.80	162.15
30.0	1.1811	467300	171.35	3	8	1 3/4	11	-	-	-	-	-	-	-	-
31.0	1.2205	467310	173.55	4	8	1 7/8	11 1/2	30.240 - 31.826	201.55	182.95	176.70	173.65	170.60	167.95	164.35
32.0	1.2598	467320	188.45	4	8	1 7/8	11 1/2	31.827 - 33.414	216.45	197.85	191.75	188.65	185.55	182.95	179.40
33.0	1.2992	467330	188.45	4	8	1 7/8	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	467340	205.35	4	8	2	12	33.415 - 35.001	233.25	214.80	208.50	205.50	202.35	199.75	196.15
35.0	1.3780	467350	205.35	4	8	2	12	-	-	-	-	-	-	-	-
36.0	1.4173	467360	229.80	4	8	2	12	35.002 - 36.589	259.60	239.80	233.15	229.95	226.60	223.80	220.10
37.0	1.4567	467370	237.40	4	8	2 1/8	12 1/2	36.590 - 38.176	267.35	247.50	240.95	237.70	234.35	231.60	227.75
38.0	1.4961	467380	237.40	4	8	2 1/8	12 1/2	-	-	-	-	-	-	-	-
39.0	1.5354	467390	321.45	4	8	2 1/8	12 1/2	38.177 - 39.776	351.20	331.45	324.90	321.55	318.30	315.50	311.70
40.0	1.5748	467400	321.45	4	8	2 1/4	13	39.777 - 41.351	351.20	331.45	324.90	321.55	318.30	315.50	311.70
41.0	1.6142	467410	321.45	4	8	2 1/4	13	-	-	-	-	-	-	-	-
42.0	1.6535	467420	354.55	4	8	2 1/4	13	41.352 - 42.951	384.40	364.65	358.00	354.80	351.35	348.70	344.75
43.0	1.6929	467430	354.55	4	10	2 3/8	13 1/2	42.952 - 44.526	384.40	364.65	358.00	354.80	351.35	348.70	344.75
44.0	1.7323	467440	354.55	4	10	2 3/8	13 1/2	-	-	-	-	-	-	-	-

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

CHUCKING REAMERS CARBIDE TIPPED TYPE 410 & 420 FRACTIONAL

GENERAL PURPOSE

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
- 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 shallow holes only (see page 27)

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

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

TOOL DIAMETER FRAC.	TOOL DIAMETER DECIMAL	TYPE 410 RIGHT EDP NO.	TYPE 420 LEFT EDP NO.	PRICE	DIMENSIONS SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH CAR-BIDE	LENGTH OVER-ALL	FINISHED TO MODIFIED TOOL DIAMETER MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
3/16	.1875	41006	42006	$56.10	11/64	4	1 1/8	1/2	4 1/2	0.1770 - 0.2040	$92.55	$74.25	$68.15	$65.20	$62.10	$59.70
7/32	.2188	41007	42007	56.10	13/64	4	1 1/4	1/2	5	0.2041 - 0.2210	92.55	74.25	68.15	65.20	62.10	59.70
15/64	.2344	4102344	4202344	56.10	7/32	4	1 1/2	1/2	6	0.2211 0.2380	92.55	74.25	68.15	65.20	62.10	59.70
1/4	.2500	41008	42008	56.10	15/64	4	1 1/2	1/2	6	0.2381 0.2530	92.55	74.25	68.15	65.20	62.10	59.70
9/32	.2812	41009	42009	56.30	15/64	4	1 1/2	1/2	6	0.2531 0.2840	92.65	74.40	68.25	65.35	62.25	59.80
5/16	.3125	41010	42010	56.30	9/32	4	1 1/2	1/2	6	0.2841 0.3150	92.65	74.40	68.25	65.35	62.25	59.80
11/32	.3438	41011	42011	61.90	9/32	4	1 1/2	5/8	6	0.3151 0.3470	98.35	80.05	73.95	71.05	67.95	65.55
3/8	.3750	41012	42012	62.50	5/16	4	1 3/4	5/8	7	0.3471 0.3780	98.90	80.65	74.50	71.70	68.60	66.10
13/32	.4062	41013	42013	65.30	5/16	4	1 3/4	5/8	7	0.3781 0.4090	101.75	83.50	77.40	74.45	71.30	68.90
7/16	.4375	41014	42014	67.95	3/8	4	1 3/4	5/8	7	0.4091 0.4410	104.30	86.05	80.00	77.10	73.95	71.50
15/32	.4688	41015	42015	72.10	3/8	4	1 3/4	5/8	7	0.4411 0.4720	108.50	90.30	84.20	81.25	78.20	75.60
1/2	.5000	41016	42016	74.85	7/16	6	2	5/8	8	0.4721 0.5030	112.15	93.35	87.15	84.20	81.05	78.45
17/32	.5312	41017	42017	77.10	7/16	6	2	5/8	8	0.5031 0.5340	114.50	95.75	89.50	86.50	83.35	80.75
9/16	.5625	41018	42018	77.10	7/16	6	2	5/8	8	0.5341 0.5660	114.50	95.75	89.50	86.50	83.35	80.75
19/32	.5938	41019	42019	79.40	7/16	6	2	5/8	8	0.5661 0.5970	116.75	98.05	91.75	88.75	85.55	83.00
5/8	.6250	41020	42020	79.40	9/16	6	2 1/4	5/8	9	0.5971 0.6280	116.75	98.05	91.75	88.75	85.55	83.00
21/32	.6562	41021	42021	81.65	9/16	6	2 1/4	5/8	9	0.6281 0.6590	119.10	100.35	94.05	91.05	87.80	85.40
11/16	.6875	41022	42022	87.00	9/16	6	2 1/4	5/8	9	0.6591 0.6910	124.30	105.55	99.30	96.30	93.15	90.65
23/32	.7188	41023	42023	88.15	9/16	6	2 1/4	5/8	9	0.6911 0.7220	125.50	106.75	100.50	97.55	94.35	91.80
3/4	.7500	41024	42024	89.55	5/8	6	2 1/2	3/4	9 1/2	0.7221 - 0.7530	126.90	108.20	101.95	98.95	95.75	93.20
25/32	.7812	41025	42025	91.80	5/8	6	2 1/2	3/4	9 1/2	0.7531 - 0.7840	129.25	110.55	104.25	101.25	98.05	95.50
13/16	.8125	41026	42026	91.80	5/8	6	2 1/2	3/4	9 1/2	0.7841 - 0.8160	129.25	110.55	104.25	101.25	98.05	95.50
27/32	.8438	41027	42027	96.85	5/8	6	2 1/2	3/4	9 1/2	0.8161 - 0.8470	134.30	115.50	109.30	106.30	103.05	100.50
7/8	.8750	41028	42028	100.50	3/4	6	2 5/8	3/4	10	0.8471 - 0.8780	139.30	119.90	113.30	110.30	106.95	104.30
29/32	.9062	41029	42029	117.10	3/4	6	2 5/8	3/4	10	0.8781 - 0.9090	155.85	136.50	130.00	126.85	123.50	120.95
15/16	.9375	41030	42030	117.10	3/4	8	2 5/8	3/4	10	0.9091 - 0.9410	155.85	136.50	130.00	126.85	123.50	120.95
31/32	.9688	41031	42031	122.80	3/4	8	2 5/8	3/4	10	0.9411 - 0.9720	161.60	142.15	135.75	132.55	129.20	126.65
1	1.0000	41032	42032	122.80	7/8	8	2 3/4	3/4	10 1/2	0.9721 - 1.0030	161.60	142.15	135.75	132.55	129.20	126.65
1 1/16	1.0625	41034	42034	131.75	7/8	8	2 3/4	3/4	10 1/2	1.0031 - 1.0660	170.55	151.10	144.65	141.45	138.15	135.55
1 1/8	1.1250	41036	42036	135.85	7/8	8	2 7/8	7/8	11	1.0661 - 1.1280	174.55	155.20	148.65	145.55	142.20	139.65
1 3/16	1.1875	41038	42038	142.75	1	8	2 7/8	7/8	11	1.1281 - 1.1905	181.50	162.05	155.55	152.40	149.15	146.50
1 1/4	1.2500	41040	42040	151.05	1	8	3	7/8	11 1/2	1.1906 - 1.2530	189.80	170.35	163.90	160.80	157.45	154.90
1 5/16	1.3125	41042	42042	167.10	1	8	3	7/8	11 1/2	1.2531 - 1.3155	205.95	186.55	179.90	176.90	173.55	170.95
1 3/8	1.3750	41044	42044	183.15	1	8	3 1/4	7/8	12	1.3156 - 1.3780	221.90	202.50	196.00	192.95	189.55	186.95
1 7/16	1.4375	41046	42046	194.00	1 1/4	8	3 1/4	7/8	12	1.3781 - 1.4405	232.80	213.35	206.85	203.85	200.45	197.80
1 1/2	1.5000	41048	42048	204.95	1 1/4	8	3 1/2	7/8	12 1/2	1.4406 - 1.5030	243.70	224.25	217.85	214.60	211.40	208.75

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

CHUCKING REAMERS
CARBIDE TIPPED TYPE 410 & 420 METRIC

GENERAL PURPOSE

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 RIGHT METRIC EDP NO.	TYPE 420 LEFT METRIC EDP NO.	METRIC PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER							
					SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH						FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	410045	420045	$68.15	11/64	4	1 1/8	1/2	4 1/2	4.494 - 5.182	$95.50	$77.40	$71.25	$68.25	$65.20	$62.75	$59.30
5.0	.1969	410050	420050	68.15	11/64	4	1 1/8	1/2	4 1/2	-	-	-	-	-	-	-	-
5.5	.2165	410055	420055	68.15	13/64	4	1 1/4	1/2	5	5.183 - 5.613	95.50	77.40	71.25	68.25	65.20	62.75	59.30
6.0	.2362	410060	420060	68.15	7/32	4	1 1/2	1/2	6	5.614 - 6.045	95.50	77.40	71.25	68.25	65.20	62.75	59.30
-	-	410063	420063	-	15/64	4	1 1/2	1/2	6	6.046 - 6.426	95.50	77.40	71.25	68.25	65.20	62.75	59.30
6.5	.2559	410065	420065	68.25	15/64	4	1 1/2	1/2	6	6.427 - 7.214	95.65	77.55	71.45	68.50	65.35	62.85	59.40
7.0	.2756	410070	420070	68.25	15/64	4	1 1/2	1/2	6	-	-	-	-	-	-	-	-
7.5	.2953	410075	420075	68.25	9/32	4	1 1/2	1/2	6	7.215 - 8.001	95.65	77.55	71.45	68.50	65.35	62.85	59.40
8.0	.3150	410080	420080	68.25	9/32	4	1 1/2	1/2	6	-	-	-	-	-	-	-	-
8.5	.3346	410085	420085	73.95	9/32	4	1 1/2	5/8	6	8.002 - 8.814	101.30	83.20	77.10	74.15	71.05	68.60	65.05
9.0	.3543	410090	420090	74.50	5/16	4	1 3/4	5/8	7	8.815 - 9.601	101.95	83.75	77.65	74.60	71.70	69.05	65.65
9.5	.3740	410095	420095	74.50	5/16	4	1 3/4	5/8	7	-	-	-	-	-	-	-	-
10.0	.3937	410100	420100	77.40	5/16	4	1 3/4	5/8	7	9.602 - 10.389	104.80	86.60	80.55	77.55	74.45	71.95	68.50
10.5	.4134	410105	420105	80.00	3/8	4	1 3/4	5/8	7	10.390 - 11.201	107.35	89.25	83.10	80.10	77.10	74.50	71.05
11.0	.4331	410110	420110	80.00	3/8	4	1 3/4	5/8	7	-	-	-	-	-	-	-	-
11.5	.4528	410115	420115	84.20	3/8	4	1 3/4	5/8	7	11.202 - 11.989	111.60	93.35	87.35	84.30	81.25	78.70	75.25
12.0	.4724	410120	420120	87.15	7/16	6	2	5/8	8	11.990 - 12.776	115.25	96.70	90.40	87.35	84.20	81.60	78.00
12.5	.4921	410125	420125	87.15	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
13.0	.5118	410130	420130	89.50	7/16	6	2	5/8	8	12.777 - 13.564	117.60	98.95	92.70	89.65	86.50	83.95	80.35
13.5	.5315	410135	420135	89.50	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
14.0	.5512	410140	420140	89.50	7/16	6	2	5/8	8	13.565 - 14.376	117.60	98.95	92.70	89.65	86.50	83.95	80.35
14.5	.5709	410145	420145	91.75	7/16	6	2	5/8	8	14.377 - 15.164	119.85	101.25	94.95	91.85	88.75	86.25	82.60
15.0	.5906	410150	420150	91.75	7/16	6	2	5/8	8	-	-	-	-	-	-	-	-
15.5	.6102	410155	420155	91.75	9/16	6	2 1/4	5/8	9	15.165 - 15.951	119.85	101.25	94.95	91.85	88.75	86.25	82.60
16.0	.6299	410160	420160	94.05	9/16	6	2 1/4	5/8	9	15.952 - 16.739	122.15	103.50	97.30	94.15	91.05	88.55	84.90
16.5	.6496	410165	420165	94.05	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-	-
17.0	.6693	410170	420170	99.30	9/16	6	2 1/4	5/8	9	16.740 - 17.551	127.40	108.80	102.55	99.50	96.30	93.80	90.10
17.5	.6890	410175	420175	99.30	9/16	6	2 1/4	5/8	9	-	-	-	-	-	-	-	-
18.0	.7087	410180	420180	100.50	9/16	6	2 1/4	5/8	9	17.552 - 18.339	128.65	110.00	103.75	100.70	97.55	94.95	91.40
18.5	.7283	410185	420185	101.95	5/8	6	2 1/2	3/4	9 1/2	18.340 - 19.126	130.00	111.45	105.10	102.05	98.95	96.30	92.80
19.0	.7480	410190	420190	101.95	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	-
19.5	.7677	410195	420195	104.25	5/8	6	2 1/2	3/4	9 1/2	19.127 - 19.914	132.40	113.70	107.40	104.35	101.25	98.60	95.10
20.0	.7874	410200	420200	104.25	5/8	6	2 1/2	3/4	9 1/2	19.915 - 20.726	132.40	113.70	107.40	104.35	101.25	98.60	95.10
20.5	.8071	410205	420205	104.25	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	-
21.0	.8268	410210	420210	109.30	5/8	6	2 1/2	3/4	9 1/2	20.727 - 21.514	137.40	118.75	112.50	109.45	106.30	103.70	100.05
21.5	.8465	410215	420215	109.30	5/8	6	2 1/2	3/4	9 1/2	-	-	-	-	-	-	-	-
22.0	.8661	410220	420220	109.30	3/4	6	2 5/8	3/4	10	21.515 - 22.301	137.40	118.75	112.50	109.45	106.30	103.70	100.05
22.5	.8858	410225	420225	130.00	3/4	6	2 5/8	3/4	10	22.302 - 23.089	159.10	139.80	133.25	130.15	126.85	124.15	120.45
23.0	.9055	410230	420230	130.00	3/4	6	2 5/8	3/4	10	-	-	-	-	-	-	-	-
23.5	.9252	410235	420235	130.00	3/4	8	2 5/8	3/4	10	23.090 - 23.901	159.10	139.80	133.25	130.15	126.85	124.15	120.45
24.0	.9449	410240	420240	135.75	3/4	8	2 5/8	3/4	10	23.902 - 24.689	164.85	145.45	139.00	135.85	132.55	129.85	126.20
24.5	.9646	410245	420245	135.75	3/4	8	2 5/8	3/4	10	-	-	-	-	-	-	-	-
25.0	.9843	410250	420250	135.75	7/8	8	2 3/4	3/4	10 1/2	24.690 - 25.476	164.85	145.45	139.00	135.85	132.55	129.85	126.20
25.5	1.0039	410255	420255	144.65	7/8	8	2 3/4	3/4	10 1/2	25.477 - 27.076	173.80	154.45	148.00	144.80	141.45	138.85	135.10
26.0	1.0236	410260	420260	144.65	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	-
27.0	1.0630	410270	420270	144.65	7/8	8	2 3/4	3/4	10 1/2	-	-	-	-	-	-	-	-
28.0	1.1024	410280	420280	148.65	7/8	8	2 7/8	7/8	11	27.077 - 28.651	177.85	158.50	152.10	148.85	145.55	142.85	139.10
29.0	1.1417	410290	420290	155.55	1	8	2 7/8	7/8	11	28.652 - 30.239	184.80	165.40	158.95	155.75	152.40	149.75	146.05
30.0	1.1811	410300	420300	155.55	1	8	2 7/8	7/8	11	-	-	-	-	-	-	-	-
31.0	1.2205	410310	420310	163.90	1	8	3	7/8	11 1/2	30.240 - 31.826	193.05	173.70	167.20	164.05	160.80	158.05	154.40
32.0	1.2598	410320	420320	179.90	1	8	3	7/8	11 1/2	31.827 - 33.414	209.15	189.80	183.30	180.15	176.90	174.25	170.45
33.0	1.2992	410330	420330	179.90	1	8	3	7/8	11 1/2	-	-	-	-	-	-	-	-
34.0	1.3386	410340	420340	196.00	1	8	3 1/4	7/8	12	33.415 - 35.001	225.25	205.80	199.35	196.15	192.95	190.20	186.55
35.0	1.3780	410350	420350	196.00	1	8	3 1/4	7/8	12	-	-	-	-	-	-	-	-
36.0	1.4173	410360	420360	206.85	1 1/4	8	3 1/4	7/8	12	35.002 - 36.589	236.05	216.65	210.20	207.00	203.85	201.05	197.30
37.0	1.4567	410370	420370	217.85	1 1/4	8	3 1/2	7/8	12 1/2	36.590 - 38.176	246.90	227.65	221.15	217.95	214.60	212.00	208.25
38.0	1.4961	410380	420380	217.85	1 1/4	8	3 1/2	7/8	12 1/2	-	-	-	-	-	-	-	-

CHUCKING REAMERS CARBIDE TIPPED TYPES 412 & 422 FRACTIONAL

GENERAL PURPOSE

RIGHT OR LEFT SPIRAL FLUTES TAPER SHANK

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

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

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

For shallow holes only (see page 27)

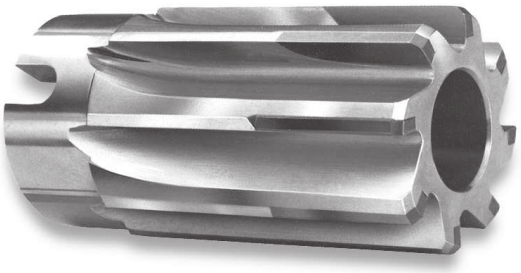
TOOL DIAMETER FRAC.	TOOL DIAMETER DEC.	TYPE 412 RIGHT EDP NO.	TYPE 422 LEFT EDP NO.	BOTH TYPES PRICE	DIMENSIONS TAPER SHANK NO.	NO. OF FLTS	LENGTH FLT	LENGTH CAR-BIDE	LENGTH OVER-ALL	FINISHED TO MODIFIED TOOL DIAMETER MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
1/4	.2500	41208	42208	$58.85	1	4	1 1/2	1/2	6	0.2381 - 0.2530	$94.65	$76.65	$70.75	$67.85	$64.75	$62.35
9/32	.2812	41209	42209	58.85	1	4	1 1/2	1/2	6	0.2531 - 0.2840	94.65	76.65	70.75	67.85	64.75	62.35
5/16	.3125	41210	42210	60.15	1	4	1 1/2	1/2	6	0.2841 - 0.3150	96.05	78.00	72.00	69.05	66.05	63.60
11/32	.3438	41211	42211	61.20	1	4	1 1/2	5/8	6	0.3151 - 0.3470	96.95	79.05	73.10	70.15	67.10	64.70
3/8	.3750	41212	42212	62.05	1	4	1 3/4	5/8	7	0.3471 - 0.3780	97.90	80.05	73.95	71.10	68.05	65.65
13/32	.4062	41213	42213	65.05	1	4	1 3/4	5/8	7	0.3781 - 0.4090	101.00	82.95	77.00	74.15	71.00	68.65
7/16	.4375	41214	42214	67.90	1	4	1 3/4	5/8	7	0.4091 - 0.4410	103.70	85.80	79.75	76.85	73.80	71.40
15/32	.4688	41215	42215	70.65	1	4	1 3/4	5/8	7	0.4411 - 0.4720	106.40	88.40	82.45	79.50	76.45	74.10
1/2	.5000	41216	42216	81.30	1	6	2	5/8	8	0.4721 - 0.5030	119.45	100.30	93.90	90.90	87.65	85.05
17/32	.5312	41217	42217	83.45	1	6	2	5/8	8	0.5031 - 0.5340	121.65	102.50	96.15	93.10	89.75	87.15
9/16	.5625	41218	42218	83.45	1	6	2	5/8	8	0.5341 - 0.5660	121.65	102.50	96.15	93.10	89.75	87.15
19/32	.5938	41219	42219	86.70	1	6	2	5/8	8	0.5661 - 0.5970	124.95	105.70	99.35	96.30	93.10	90.50
5/8	.6250	41220	42220	86.70	2	6	2 1/4	5/8	9	0.5971 - 0.6280	124.95	105.70	99.35	96.30	93.10	90.50
11/16	.6875	41222	42222	95.15	2	6	2 1/4	5/8	9	0.6591 - 0.6910	133.35	114.15	107.85	104.80	101.45	98.95
3/4	.7500	41224	42224	100.65	2	6	2 1/2	3/4	9 1/2	0.7221 - 0.7530	138.80	119.75	113.20	110.25	106.95	104.35
13/16	.8125	41226	42226	104.85	2	6	2 1/2	3/4	9 1/2	0.7841 - 0.8160	143.10	123.95	117.45	114.50	111.15	108.55
7/8	.8750	41228	42228	112.90	2	6	2 5/8	3/4	10	0.8471 - 0.8780	152.55	132.60	126.00	122.85	119.45	116.80
15/16	.9375	41230	42230	131.30	3	8	2 5/8	3/4	10	0.9091 - 0.9410	170.95	151.10	144.40	141.20	137.80	135.20
1	1.0000	41232	42232	135.85	3	8	2 3/4	3/4	10 1/2	0.9721 - 1.0030	175.40	155.55	148.95	145.80	142.40	139.70

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

SHELL REAMERS CARBIDE TIPPED TYPE 431 FRACTIONAL

GENERAL PURPOSE

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 ⅛" 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

REAMERS

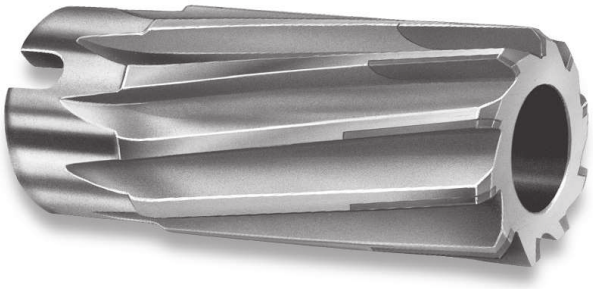
TOOL DIAMETER		TYPE 431 EDP NO.	PRICE	DIMENSIONS						FINISHED TO MODIFIED TOOL DIAMETER						
				HOLE DIAM LG. END	FITS ARBOR NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL						FLUTE	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
¾	.7500	43124	$189.45	⅜	4	6	1 ¾	1	2 ¼	0.7221 - 0.7530	$268.00	$228.70	$215.50	$209.20	$202.50	$197.25
25/32	.7812	43125	193.15	⅜	4	6	1 ¾	1	2 ¼	0.7531 - 0.7840	271.65	232.25	219.25	212.90	206.20	200.95
13/16	.8125	43126	193.15	½	5	6	1 15/16	1	2 ½	0.7841 - 0.8160	271.65	232.25	219.25	212.90	206.20	200.95
⅞	.8750	43128	215.90	½	5	6	1 15/16	1	2 ½	0.8161 - 0.8780	297.35	256.50	242.75	236.40	229.35	223.80
15/16	.9375	43130	215.90	½	5	8	1 15/16	1	2 ½	0.8781 - 0.9410	297.35	256.50	242.75	236.40	229.35	223.80
1	1.0000	43132	219.75	½	5	8	1 15/16	1	2 ½	0.9411 - 1.0030	301.25	260.40	246.80	240.30	233.25	227.75
1 1/16	1.0625	43134	227.50	⅝	6	8	2 ⅛	1	2 ¾	1.0031 - 1.0660	308.90	268.10	254.30	247.90	240.95	235.35
1 ⅛	1.1250	43136	231.25	⅝	6	8	2 ⅛	1	2 ¾	1.0661 - 1.1280	312.70	271.95	258.20	251.80	244.75	239.30
1 3/16	1.1875	43138	235.20	⅝	6	8	2 ⅛	1 ⅛	2 ¾	1.1281 - 1.1905	316.50	275.85	262.15	255.70	248.60	243.20
1 ¼	1.2500	43140	250.60	⅝	6	8	2 ⅛	1 ⅛	2 ¾	1.1906 - 1.2530	332.00	291.20	277.60	271.00	264.10	258.55
1 5/16	1.3125	43142	254.30	¾	7	8	2 ¼	1 ⅛	3	1.2531 - 1.3155	335.80	295.05	281.40	274.90	268.00	262.40
1 ⅜	1.3750	43144	262.10	¾	7	8	2 ¼	1 ⅛	3	1.3156 - 1.3780	343.55	302.70	289.10	282.50	275.55	270.10
1 7/16	1.4375	43146	269.80	¾	7	8	2 ¼	1 ⅛	3	1.3781 - 1.4405	351.20	310.45	296.85	290.35	283.20	277.85
1 ½	1.5000	43148	281.40	¾	7	8	2 ¼	1 ⅛	3	1.4406 - 1.5030	362.85	322.05	308.35	301.85	294.85	289.40
1 9/16	1.5625	43150	325.80	¾	7	10	2 ¼	1 ⅛	3	1.5031 - 1.5660	410.75	368.25	353.95	347.10	339.80	334.10
1 ⅝	1.6250	43152	341.80	¾	7	10	2 ¼	1 ⅛	3	1.5661 - 1.6280	426.90	384.30	370.00	363.20	355.95	350.20
1 11/16	1.6875	43154	370.05	1	8	10	2 ¾	1 ⅛	3 ½	1.6281 - 1.6910	455.15	412.50	398.25	391.45	384.20	378.45
1 ¾	1.7500	43156	370.05	1	8	10	2 ¾	1 ⅛	3 ½	1.6911 - 1.7530	455.15	412.50	398.25	391.45	384.20	378.45
1 13/16	1.8125	43158	398.15	1	8	10	2 ¾	1 ⅛	3 ½	1.7531 - 1.8160	483.05	440.55	426.30	419.55	412.20	406.45
1 ⅞	1.8750	43160	398.15	1	8	10	2 ¾	1 ⅛	3 ½	1.8161 - 1.8780	483.05	440.55	426.30	419.55	412.20	406.45
1 15/16	1.9375	43162	426.40	1	8	10	2 ¾	1 ⅛	3 ½	1.8781 - 1.9410	511.25	468.70	454.50	447.80	440.45	434.70
2	2.0000	43164	426.40	1	8	10	2 ¾	1 ⅛	3 ½	1.9411 - 2.0030	511.25	468.70	454.50	447.80	440.45	434.70
2 1/16	2.0625	43166	458.50	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.0031 - 2.0660	543.45	500.95	486.60	479.90	472.55	466.90
2 ⅛	2.1250	43168	458.50	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.0661 - 2.1280	543.45	500.95	486.60	479.90	472.55	466.90
2 3/16	2.1875	43170	498.70	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.1281 - 2.1905	583.70	541.10	526.85	520.05	512.85	507.00
2 ¼	2.2500	43172	498.70	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.1906 - 2.2530	583.70	541.10	526.85	520.05	512.85	507.00
2 5/16	2.3125	43174	526.85	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.2531 - 2.3155	611.90	569.25	555.05	548.20	540.95	535.20
2 ⅜	2.3750	43176	526.85	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.3156 - 2.3780	611.90	569.25	555.05	548.20	540.95	535.20
2 7/16	2.4375	43178	555.10	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.3781 - 2.4405	640.10	597.50	583.25	576.45	569.15	563.40
2 ½	2.5000	43180	555.10	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.4406 - 2.5030	640.10	597.50	583.25	576.45	569.15	563.40
2 9/16	2.5625	43182	609.30	1 ½	10	14	3 ⅛	1 ⅛	4	2.5031 - 2.5660	694.25	651.70	637.45	630.65	623.40	617.65
2 ⅝	2.6250	43184	631.90	1 ½	10	14	3 ⅛	1 ⅛	4	2.5661 - 2.6280	716.85	674.20	660.10	653.20	645.95	640.20
2 11/16	2.6875	43186	656.45	1 ½	10	14	3 ⅛	1 ⅛	4	2.6281 - 2.6910	741.40	698.90	684.60	677.85	670.50	664.75
2 ¾	2.7500	43188	679.25	1 ½	10	14	3 ⅛	1 ⅛	4	2.6911 - 2.7530	764.25	721.60	707.35	700.65	693.35	687.55
2 13/16	2.8125	43190	703.10	1 ½	10	14	3 ⅛	1 ⅛	4	2.7531 - 2.8160	788.05	745.55	731.30	724.50	717.20	711.55
2 ⅞	2.8750	43192	731.30	1 ½	10	14	3 ⅛	1 ⅛	4	2.8161 - 2.8780	816.15	773.75	759.40	752.70	745.35	739.65
2 15/16	2.9375	43194	759.55	1 ½	10	14	3 ⅛	1 ⅛	4	2.8781 - 2.9410	844.50	801.90	787.65	780.95	773.65	767.85
3	3.0000	43196	787.75	1 ½	10	14	3 ⅛	1 ⅛	4	2.9411 - 3.0030	872.65	830.15	815.90	809.20	801.85	796.10

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

SHELL REAMERS AND ARBORS CARBIDE TIPPED TYPES 441 FRACTIONAL & 481

GENERAL PURPOSE

LEFT SPIRAL FLUTES



TYPE 441

- Left spiral polished flutes
- Arbor hole tapered ⅛" 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						
				HOLE DIAM. LG. END	FITS ARBOR NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL						FLUTE	CARBIDE	OVERALL		1	2	3	4	5-7	8-14*
¾	.7500	44124	$246.25	⅜	4	6	1 ¾	1	2 ¼	0.7221 - 0.7530	$324.70	$285.45	$272.25	$266.05	$259.30	$254.00
25/32	.7812	44125	251.05	⅜	4	6	1 ¾	1	2 ¼	0.7531 - 0.7840	329.45	290.25	277.00	270.75	264.05	258.80
13/16	.8125	44126	251.05	½	5	6	1 15/16	1	2 ½	0.7841 - 0.8160	329.45	290.25	277.00	270.75	264.05	258.80
⅞	.8750	44128	280.70	½	5	6	1 15/16	1	2 ½	0.8161 - 0.8780	362.05	321.35	307.60	301.10	294.10	288.60
15/16	.9375	44130	280.70	½	5	8	1 15/16	1	2 ½	0.8781 - 0.9410	362.05	321.35	307.60	301.10	294.10	288.60
1	1.0000	44132	285.65	½	5	8	1 15/16	1	2 ½	0.9411 - 1.0030	367.05	326.25	312.60	306.15	299.10	293.60
1 1/16	1.0625	44134	294.60	⅝	6	8	2 ⅛	1	2 ¾	1.0031 - 1.0660	375.95	335.25	321.50	315.05	308.00	302.55
1 ⅛	1.1250	44136	300.70	⅝	6	8	2 ⅛	1	2 ¾	1.0661 - 1.1280	382.10	341.30	327.70	321.20	314.20	308.65
1 3/16	1.1875	44138	305.70	⅝	6	8	2 ⅛	1 ⅛	2 ¾	1.1281 - 1.1905	387.20	346.25	332.60	326.20	319.20	313.60
1 ¼	1.2500	44140	325.70	⅝	6	8	2 ⅛	1 ⅛	2 ¾	1.1906 - 1.2530	407.10	366.35	352.65	346.15	339.25	333.65
1 5/16	1.3125	44142	330.80	¾	7	8	2 ¼	1 ⅛	3	1.2531 - 1.3155	412.20	371.30	357.75	351.20	344.25	338.70
1 ⅜	1.3750	44144	340.75	¾	7	8	2 ¼	1 ⅛	3	1.3156 - 1.3780	422.20	381.40	367.75	361.25	354.20	348.75
1 7/16	1.4375	44146	350.80	¾	7	8	2 ¼	1 ⅛	3	1.3781 - 1.4405	432.20	391.40	377.80	371.20	364.25	358.60
1 ½	1.5000	44148	365.80	¾	7	8	2 ¼	1 ⅛	3	1.4406 - 1.5030	447.25	406.40	392.80	386.35	379.25	373.85
1 9/16	1.5625	44150	423.55	¾	7	10	2 ¼	1 ⅛	3	1.5031 - 1.5660	508.55	466.00	451.70	444.95	437.75	431.85
1 ⅝	1.6250	44152	444.40	¾	7	10	2 ¼	1 ⅛	3	1.5661 - 1.6280	529.40	486.90	472.55	465.75	458.50	452.65
1 11/16	1.6875	44154	480.90	1	8	10	2 ¾	1 ⅛	3 ½	1.6281 - 1.6910	566.00	523.40	509.10	502.45	495.10	489.35
1 ¾	1.7500	44156	480.90	1	8	10	2 ¾	1 ⅛	3 ½	1.6911 - 1.7530	566.00	523.40	509.10	502.45	495.10	489.35
1 13/16	1.8125	44158	517.30	1	8	10	2 ¾	1 ⅛	3 ½	1.7531 - 1.8160	602.20	559.60	545.35	538.65	531.35	525.55
1 ⅞	1.8750	44160	517.30	1	8	10	2 ¾	1 ⅛	3 ½	1.8161 - 1.8780	602.20	559.60	545.35	538.65	531.35	525.55
1 15/16	1.9375	44162	554.30	1	8	10	2 ¾	1 ⅛	3 ½	1.8781 - 1.9410	639.25	596.60	582.45	575.60	568.30	562.55
2	2.0000	44164	554.30	1	8	10	2 ¾	1 ⅛	3 ½	1.9411 - 2.0030	639.25	596.60	582.45	575.60	568.30	562.55
2 1/16	2.0625	44166	596.00	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.0031 - 2.0660	681.00	638.45	624.10	617.35	610.20	604.40
2 ⅛	2.1250	44168	596.00	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.0661 - 2.1280	681.00	638.45	624.10	617.35	610.20	604.40
2 3/16	2.1875	44170	648.40	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.1281 - 2.1905	733.25	690.65	676.45	669.70	662.35	656.65
2 ¼	2.2500	44172	648.40	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.1906 - 2.2530	733.25	690.65	676.45	669.70	662.35	656.65
2 5/16	2.3125	44174	685.00	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.2531 - 2.3155	770.00	727.40	713.15	706.40	699.05	693.35
2 ⅜	2.3750	44176	685.00	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.3156 - 2.3780	770.00	727.40	713.15	706.40	699.05	693.35
2 7/16	2.4375	44178	721.55	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.3781 - 2.4405	806.50	763.95	749.75	742.85	735.60	729.80
2 ½	2.5000	44180	721.55	1 ¼	9	12	2 ⅞	1 ⅛	3 ¾	2.4406 - 2.5030	806.50	763.95	749.75	742.85	735.60	729.80
2 9/16	2.5625	44182	792.10	1 ½	10	14	3 ⅛	1 ⅛	4	2.5031 - 2.5660	877.05	834.50	820.20	813.55	806.20	800.45
2 ⅝	2.6250	44184	821.45	1 ½	10	14	3 ⅛	1 ⅛	4	2.5661 - 2.6280	906.50	863.90	849.70	842.90	835.65	829.85

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

SHELL REAMER ARBORS TYPE 481

ARBOR NO.	FITS REAMER TOOL DIAM.	OVERALL 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	$120.30	2	48114	$143.45
5	0.7841 - 1.0030	9 ½	.625	48105	134.20	2	48115	171.25
6	1.0031 - 1.2530	10	.750	48106	148.15	3	48116	185.10
7	1.2531 - 1.6280	11	.875	48107	162.00	3	48117	203.70
8	1.6281 - 2.0030	12	1.125	48108	180.50	4	48118	226.85
9	2.0031 - 2.5030	13	1.375	48109	217.50	4	48119	254.60
10	2.5031 - 3.0030	14	1.625	48110	282.85	5	48120	322.95

STRAIGHT SHANK

TAPER SHANK

Both types hardened and ground

CHUCKING REAMERS - FOR STEELS
CARBIDE TIPPED TYPE 480 METRIC

MATERIAL SPECIFIC

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							
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH					FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	480045	$69.80	.1704	4	1 ⅛	4 ½	4.494 - 4.696	$98.55	$79.50	$73.15	$70.05	$66.80	$64.15	$60.50
5.0	.1969	480050	69.80	.1805	4	1 ⅛	4 ½	4.697 - 5.182	98.55	79.50	73.15	70.05	66.80	64.15	60.50
5.5	.2165	480055	69.80	.2075	4	1 ¼	5	5.183 - 5.613	98.55	79.50	73.15	70.05	66.80	64.15	60.50
6.0	.2362	480060	69.80	.2265	4	1 ½	6	5.614 - 6.045	98.55	79.50	73.15	70.05	66.80	64.15	60.50
-	-	480063	-	.2405	4	1 ½	6	6.046 - 6.426	98.55	79.50	73.15	70.05	66.80	64.15	60.50
6.5	.2559	480065	71.05	.2485	4	1 ½	6	6.427 - 7.214	99.85	80.70	74.35	71.20	68.10	65.35	61.75
7.0	.2756	480070	71.05	.2485	4	1 ½	6	-	-	-	-	-	-	-	-
7.5	.2953	480075	71.05	.2792	4	1 ½	6	7.215 - 8.001	99.85	80.70	74.35	71.20	68.10	65.35	61.75
8.0	.3150	480080	71.05	.2792	4	1 ½	6	-	-	-	-	-	-	-	-
8.5	.3346	480085	73.20	.2792	4	1 ½	6	8.002 - 8.814	102.05	82.85	76.45	73.35	70.15	67.50	63.80
9.0	.3543	480090	73.20	.3105	4	1 ¾	7	8.815 - 9.601	102.05	82.85	76.45	73.35	70.15	67.50	63.80
9.5	.3740	480095	73.20	.3105	4	1 ¾	7	-	-	-	-	-	-	-	-
10.0	.3937	480100	76.20	.3105	4	1 ¾	7	9.602 - 10.389	104.90	85.85	79.40	76.30	73.15	70.45	66.80
10.5	.4134	480105	86.30	.3730	6	1 ¾	7	10.390 - 11.201	115.05	96.00	89.55	86.45	83.25	80.55	76.85
11.0	.4331	480110	86.30	.3730	6	1 ¾	7	-	-	-	-	-	-	-	-
11.5	.4528	480115	87.00	.3730	6	1 ¾	7	11.202 - 11.989	115.80	96.60	90.30	87.10	83.95	81.30	77.60
12.0	.4724	480120	93.20	.4355	6	2	8	11.990 - 12.776	124.00	103.55	96.70	93.30	89.90	87.05	83.20
12.5	.4921	480125	93.20	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	480130	95.35	.4355	6	2	8	12.777 - 13.564	126.30	105.80	98.95	95.55	92.15	89.30	85.40
13.5	.5315	480135	95.35	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	480140	95.35	.4355	6	2	8	13.565 - 14.376	126.30	105.80	98.95	95.55	92.15	89.30	85.40
14.5	.5709	480145	98.50	.4355	6	2	8	14.377 - 15.164	129.30	108.90	102.10	98.75	95.25	92.35	88.50
15.0	.5906	480150	98.50	.4355	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	480155	98.50	.5615	6	2 ¼	9	15.165 - 15.951	129.30	108.90	102.10	98.75	95.25	92.35	88.50
16.0	.6299	480160	100.10	.5615	6	2 ¼	9	15.952 - 16.739	130.95	110.55	103.65	100.30	96.85	94.00	90.00
16.5	.6496	480165	100.10	.5615	6	2 ¼	9	-	-	-	-	-	-	-	-
17.0	.6693	480170	100.10	.5615	6	2 ¼	9	16.740 - 17.551	130.95	110.55	103.65	100.30	96.85	94.00	90.00
17.5	.6890	480175	100.10	.5615	6	2 ¼	9	-	-	-	-	-	-	-	-
18.0	.7087	480180	104.15	.5615	6	2 ¼	9	17.552 - 18.339	134.80	114.35	107.65	104.25	100.85	97.90	94.00
18.5	.7283	480185	104.15	.6245	6	2 ½	9 ½	18.340 - 19.126	134.80	114.35	107.65	104.25	100.85	97.90	94.00
19.0	.7480	480190	104.15	.6245	6	2 ½	9 ½	-	-	-	-	-	-	-	-
19.5	.7677	480195	107.15	.6245	6	2 ½	9 ½	19.127 - 19.914	138.00	117.55	110.65	107.30	103.80	101.05	97.15
20.0	.7874	480200	107.15	.6245	6	2 ½	9 ½	19.915 - 20.726	138.00	117.55	110.65	107.30	103.80	101.05	97.15
20.5	.8071	480205	107.15	.6245	6	2 ½	9 ½	-	-	-	-	-	-	-	-
21.0	.8268	480210	110.85	.6245	6	2 ½	9 ½	20.727 - 21.514	141.80	121.25	114.35	111.05	107.70	104.80	100.95
21.5	.8465	480215	110.85	.6245	6	2 ½	9 ½	-	-	-	-	-	-	-	-
22.0	.8661	480220	110.85	.7495	6	2 ⅝	10	21.515 - 22.301	141.80	121.25	114.35	111.05	107.70	104.80	100.95
22.5	.8858	480225	131.65	.7495	6	2 ⅝	10	22.302 - 23.089	163.65	142.45	135.40	131.85	128.30	125.40	121.20
23.0	.9055	480230	131.65	.7495	6	2 ⅝	10	-	-	-	-	-	-	-	-
23.5	.9252	480235	131.65	.7495	8	2 ⅝	10	23.090 - 23.901	163.65	142.45	135.40	131.85	128.30	125.40	121.20
24.0	.9449	480240	137.30	.7495	8	2 ⅝	10	23.902 - 24.689	169.35	148.15	141.05	137.55	133.90	131.00	126.85
24.5	.9646	480245	137.30	.7495	8	2 ⅝	10	-	-	-	-	-	-	-	-
25.0	.9843	480250	137.30	.8745	8	2 ¾	10 ½	24.690 - 25.476	169.35	148.15	141.05	137.55	133.90	131.00	126.85
25.5	1.0039	480255	141.00	.8745	8	2 ¾	10 ½	25.477 - 27.076	171.55	151.35	144.40	141.10	137.70	134.80	130.95
26.0	1.0236	480260	141.00	.8745	8	2 ¾	10 ½	-	-	-	-	-	-	-	-
27.0	1.0630	480270	141.00	.8745	8	2 ¾	10 ½	-	-	-	-	-	-	-	-
28.0	1.1024	480280	151.50	.8745	8	2 ⅞	11	27.077 - 28.651	182.10	161.90	155.00	151.60	148.30	145.40	141.45
29.0	1.1417	480290	164.70	.9995	8	2 ⅞	11	28.652 - 30.239	195.30	175.05	168.20	164.85	161.45	158.60	154.70
30.0	1.1811	480300	164.70	.9995	8	2 ⅞	11	-	-	-	-	-	-	-	-
31.0	1.2205	480310	181.95	.9995	8	3	11 ½	30.240 - 31.826	212.70	192.30	185.50	182.10	178.75	175.90	172.10
32.0	1.2598	480320	181.95	.9995	8	3	11 ½	31.827 - 33.414	212.70	192.30	185.50	182.10	178.75	175.90	172.10
33.0	1.2992	480330	181.95	.9995	8	3	11 ½	-	-	-	-	-	-	-	-
34.0	1.3386	480340	184.50	.9995	8	3 ¼	12	33.415 - 35.001	215.10	194.80	188.00	184.65	181.30	178.40	174.50
35.0	1.3780	480350	184.50	.9995	8	3 ¼	12	-	-	-	-	-	-	-	-
36.0	1.4173	480360	202.45	.9995	8	3 ¼	12	35.002 - 36.589	233.00	212.75	205.80	202.60	199.15	196.35	192.40
37.0	1.4567	480370	240.35	1.2495	8	3 ½	12 ½	36.590 - 38.176	270.95	250.65	243.80	240.45	237.05	234.30	230.40
38.0	1.4961	480380	240.35	1.2495	8	3 ½	12 ½	-	-	-	-	-	-	-	-

CHUCKING REAMERS - FOR STEELS
CARBIDE TIPPED TYPE 480 FRACTIONAL

MATERIAL SPECIFIC

STRAIGHT FLUTE LONG CARBIDE STRAIGHT SHANK

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

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

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						
				MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
3/16	.1875	48006	$57.15	.1805	4	1 1/8	4 1/2	0.1770 - 0.2040	$95.35	$76.25	$69.80	$66.80	$63.55	$60.90
13/64	.2031	4802031	57.15	.1805	4	1 1/8	4 1/2	-	-	-	-	-	-	-
7/32	.2188	48007	57.15	.2075	4	1 1/4	5	0.2041 - 0.2210	95.35	76.25	69.80	66.80	63.55	60.90
15/64	.2344	4802344	57.15	.2265	4	1 1/2	6	0.2211 - 0.2380	95.35	76.25	69.80	66.80	63.55	60.90
1/4	.2500	48008	57.15	.2405	4	1 1/2	6	0.2381 - 0.2530	95.35	76.25	69.80	66.80	63.55	60.90
17/64	.2656	4802656	58.40	.2485	4	1 1/2	6	-	-	-	-	-	-	-
9/32	.2812	48009	58.40	.2485	4	1 1/2	6	0.2531 - 0.2840	96.60	77.55	71.05	68.10	64.75	62.25
19/64	.2969	4802969	58.40	.2792	4	1 1/2	6	-	-	-	-	-	-	-
5/16	.3125	48010	58.40	.2792	4	1 1/2	6	0.2841 - 0.3150	96.60	77.55	71.05	68.10	64.75	62.25
21/64	.3281	4803281	60.55	.2792	4	1 1/2	6	-	-	-	-	-	-	-
11/32	.3438	48011	60.55	.2792	4	1 1/2	6	0.3151 - 0.3470	98.80	79.55	73.20	70.15	66.95	64.35
23/64	.3594	4803594	60.55	.3105	4	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	48012	60.55	.3105	4	1 3/4	7	0.3471 - 0.3780	98.80	79.55	73.20	70.15	66.95	64.35
25/64	.3906	4803906	63.55	.3105	4	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	48013	63.55	.3105	4	1 3/4	7	0.3781 - 0.4090	101.65	82.60	76.20	73.15	69.80	67.25
27/64	.4219	4804219	73.60	.3730	6	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	48014	73.60	.3730	6	1 3/4	7	0.4091 - 0.4410	111.80	92.65	86.30	83.25	80.00	77.40
29/64	.4531	4804531	74.25	.3730	6	1 3/4	7	-	-	-	-	-	-	-
15/32	.4688	48015	74.25	.3730	6	1 3/4	7	0.4411 - 0.4720	112.55	93.30	87.00	83.95	80.60	78.05
31/64	.4844	4804844	79.55	.4355	6	2	8	-	-	-	-	-	-	-
1/2	.5000	48016	79.55	.4355	6	2	8	0.4721 - 0.5030	120.55	100.05	93.20	89.90	86.40	83.65
33/64	.5156	4805156	81.85	.4355	6	2	8	-	-	-	-	-	-	-
17/32	.5312	48017	81.85	.4355	6	2	8	0.5031 - 0.5340	122.80	102.25	95.35	92.15	88.65	85.85
35/64	.5469	4805469	81.85	.4355	6	2	8	-	-	-	-	-	-	-
9/16	.5625	48018	81.85	.4355	6	2	8	0.5341 - 0.5660	122.80	102.25	95.35	92.15	88.65	85.85
37/64	.5781	4805781	84.95	.4355	6	2	8	-	-	-	-	-	-	-
19/32	.5938	48019	84.95	.4355	6	2	8	0.5661 - 0.5970	125.90	105.45	98.50	95.25	91.75	89.00
39/64	.6094	4806094	84.95	.5615	6	2 1/4	9	-	-	-	-	-	-	-

CONTINUED ON NEXT PAGE

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

CONTINUED FROM PAGE 74 - TYPE 480 FRACTIONAL

TOOL DIAMETER FRAC.	TOOL DIAMETER DECIMAL	TYPE 480 STEEL EDP NO.	PRICE	DIMENSIONS MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLUTE & CARBIDE	LENGTH OVER-ALL	FINISHED TO MODIFIED TOOL DIAMETER MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
5/8	.6250	48020	$84.95	.5615	6	2 1/4	9	0.5971 - 0.6280	$125.90	$105.45	$98.50	$95.25	$91.75	$89.00
41/64	.6406	4806406	86.55	.5615	6	2 1/4	9	-	-	-	-	-	-	-
21/32	.6562	48021	86.55	.5615	6	2 1/4	9	0.6281 - 0.6590	127.55	107.00	100.10	96.85	93.30	90.60
43/64	.6719	4806719	86.55	.5615	6	2 1/4	9	-	-	-	-	-	-	-
11/16	.6875	48022	86.55	.5615	6	2 1/4	9	0.6591 - 0.6910	127.55	107.00	100.10	96.85	93.30	90.60
45/64	.7031	4807031	90.50	.5615	6	2 1/4	9	-	-	-	-	-	-	-
23/32	.7188	48023	90.50	.5615	6	2 1/4	9	0.6911 - 0.7220	131.45	110.85	104.15	100.85	97.30	94.50
47/64	.7344	4807344	90.50	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-
3/4	.7500	48024	90.50	.6245	6	2 1/2	9 1/2	0.7221 - 0.7530	131.45	110.85	104.15	100.85	97.30	94.50
49/64	.7656	4807656	93.70	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-
25/32	.7812	48025	93.70	.6245	6	2 1/2	9 1/2	0.7531 - 0.7840	134.50	114.00	107.15	103.80	100.35	97.55
51/64	.7969	4807969	93.70	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-
13/16	.8125	48026	93.70	.6245	6	2 1/2	9 1/2	0.7841 - 0.8160	134.50	114.00	107.15	103.80	100.35	97.55
53/64	.8281	4808281	97.40	.6245	6	2 1/2	9 1/2	-	-	-	-	-	-	-
27/32	.8438	48027	97.40	.6245	6	2 1/2	9 1/2	0.8161 - 0.8470	138.25	117.70	110.85	107.70	104.20	101.35
55/64	.8594	4808594	97.40	.7495	6	2 5/8	10	-	-	-	-	-	-	-
7/8	.8750	48028	101.10	.7495	6	2 5/8	10	0.8471 - 0.8780	143.45	122.20	115.10	111.70	108.00	105.15
57/64	.8906	4808906	117.65	.7495	6	2 5/8	10	-	-	-	-	-	-	-
29/32	.9062	48029	117.65	.7495	6	2 5/8	10	0.8781 - 0.9090	160.15	138.90	131.65	128.30	124.65	121.75
59/64	.9219	4809219	117.65	.7495	8	2 5/8	10	-	-	-	-	-	-	-
15/16	.9375	48030	117.65	.7495	8	2 5/8	10	0.9091 - 0.9410	160.15	138.90	131.65	128.30	124.65	121.75
61/64	.9531	4809531	123.30	.7495	8	2 5/8	10	-	-	-	-	-	-	-
31/32	.9688	48031	123.30	.7495	8	2 5/8	10	0.9411 - 0.9720	165.80	144.55	137.30	133.90	130.30	127.40
63/64	.9844	4809844	123.30	.8745	8	2 3/4	10 1/2	-	-	-	-	-	-	-
1	1.0000	48032	123.30	.8745	8	2 3/4	10 1/2	0.9721 - 1.0030	165.80	144.55	137.30	133.90	130.30	127.40
1 1/16	1.0625	48034	127.45	.8745	8	2 3/4	10 1/2	1.0031 - 1.0660	168.20	147.70	141.00	137.70	134.20	131.50
1 1/8	1.1250	48036	138.10	.8745	8	2 7/8	11	1.0661 - 1.1280	178.75	158.35	151.50	148.30	144.80	142.00
1 3/16	1.1875	48038	151.20	.9995	8	2 7/8	11	1.1281 - 1.1905	191.95	171.50	164.70	161.45	157.95	155.20
1 1/4	1.2500	48040	168.50	.9995	8	3	11 1/2	1.1906 - 1.2530	209.20	188.80	181.95	178.75	175.25	172.45
1 5/16	1.3125	48042	168.50	.9995	8	3	11 1/2	1.2531 - 1.3155	209.20	188.80	181.95	178.75	175.25	172.45
1 3/8	1.3750	48044	171.00	.9995	8	3 1/4	12	1.3156 - 1.3780	211.65	191.30	184.50	181.30	177.65	175.05
1 7/16	1.4375	48046	188.95	.9995	8	3 1/4	12	1.3781 - 1.4405	229.60	209.20	202.45	199.15	195.60	193.00
1 1/2	1.5000	48048	226.85	1.2495	8	3 1/2	12 1/2	1.4406 - 1.5030	267.55	247.15	240.35	237.05	233.65	230.85

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

OVER & UNDER SIZE REAMERS CARBIDE TIPPED - FOR STEELS

MATERIAL SPECIFIC

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	LENGTH OVER-ALL
.1865	48818	$71.45	.1805	4	1 1/8	4 1/2
.1885	48819	71.45	.1805	4	1 1/8	4 1/2
.2490	48824	71.45	.2405	4	1 1/2	6
.2510	48825	71.45	.2405	4	1 1/2	6
.3115	48831	72.75	.2792	4	1 1/2	6
.3135	48832	72.75	.2792	4	1 1/2	6
.3740	48837	74.85	.3105	4	1 3/4	7
.3760	48838	74.85	.3105	4	1 3/4	7
.4365	48843	87.95	.3730	6	1 3/4	7
.4385	48844	87.95	.3730	6	1 3/4	7
.4990	48849	94.95	.4355	6	2	8
.5010	48850	94.95	.4355	6	2	8
	48800	$899.55 - CASED SET OF ABOVE 12 REAMERS				

DOWEL PIN SIZE REAMERS CARBIDE TIPPED - FOR STEELS

MATERIAL SPECIFIC

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	LENGTH OVER-ALL
.1855	48617	$71.45	.1805	4	1 1/8	4 1/2
.1870	48618	71.45	.1805	4	1 1/8	4 1/2
.2480	48623	71.45	.2405	4	1 1/2	6
.2495	48624	71.45	.2405	4	1 1/2	6
.3105	48630	72.75	.2792	4	1 1/2	6
.3120	48631	72.75	.2792	4	1 1/2	6
.3730	48636	74.85	.3105	4	1 3/4	7
.3745	48637	74.85	.3105	4	1 3/4	7
.4355	48642	87.95	.3730	6	1 3/4	7
.4370	48643	87.95	.3730	6	1 3/4	7
.4980	48648	94.95	.4355	6	2	8
.4995	48649	94.95	.4355	6	2	8
	48600	$899.55 - CASED SET OF ABOVE 12 REAMERS				

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

STRAIGHT FLUTES
STRAIGHT SHANK

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

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.

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						
						MAX SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
5/32	.1562	40705	40805	40905	$52.20	.1510	4	1	½	4	0.1560-0.1769	$90.40	$71.10	$64.75	$61.75	$58.40	$55.85
3/16	.1875	40706	40806	40906	47.85	.1805	4	1 ⅛	½	4 ½	0.1770-0.2040	85.05	66.40	60.15	57.15	54.00	51.45
7/32	.2188	40707	40807	40907	47.85	.2075	4	1 ¼	½	5	0.2041-0.2210	85.05	66.40	60.15	57.15	54.00	51.45
15/64	.2344	4072344	4082344	4092344	50.80	.2265	4	1 ½	½	6	0.2211-0.2380	87.95	69.30	63.00	60.10	56.85	54.35
¼	.2500	40708	40808	40908	48.15	.2405	4	1 ½	½	6	0.2381-0.2530	85.30	66.70	60.50	57.50	54.25	51.80
9/32	.2812	40709	40809	40909	49.05	.2485	4	1 ½	½	6	0.2531-0.2840	86.35	67.65	61.50	58.40	55.30	52.65
5/16	.3125	40710	40810	40910	49.05	.2792	4	1 ½	½	6	0.2841-0.3150	86.35	67.65	61.50	58.40	55.30	52.65
5/16	.3125	40790	40890	40990	54.00	.2792	6	1 ½	½	6	0.2841-0.3150	91.10	72.50	66.25	63.35	60.15	57.65
11/32	.3438	40711	40811	40911	50.95	.2792	4	1 ½	⅝	6	0.3151-0.3470	88.10	69.55	63.30	60.35	57.10	54.65
11/32	.3438	40791	40891	40991	55.95	.2792	6	1 ½	⅝	6	0.3151-0.3470	93.15	74.50	68.25	65.30	62.10	59.60
3/8	.3750	40712	40812	40912	46.75	.3105	4	1 ¾	⅝	7	0.3471-0.3780	80.80	63.75	58.10	55.35	52.40	50.10
3/8	.3750	40792	40892	40992	51.30	.3105	6	1 ¾	⅝	7	0.3471-0.3780	85.45	68.35	62.70	59.95	57.00	54.70
13/32	.4062	40713	40813	40913	53.40	.3105	4	1 ¾	⅝	7	0.3781-0.4090	90.60	71.95	65.75	62.75	59.45	57.05
13/32	.4062	40793	40893	40993	56.90	.3105	6	1 ¾	⅝	7	0.3781-0.4090	94.10	75.45	69.30	66.25	63.05	60.60
7/16	.4375	40714	40814	40914	56.90	.3730	6	1 ¾	⅝	7	0.4091-0.4410	94.10	75.45	69.30	66.25	63.05	60.60
15/32	.4688	40715	40815	40915	57.75	.3730	6	1 ¾	⅝	7	0.4411-0.4720	94.95	76.30	70.10	67.10	64.00	61.50
½	.5000	40716	40816	40916	68.25	.4355	6	2	⅝	8	0.4721-0.5030	109.30	88.70	81.85	78.60	75.10	72.30
17/32	.5312	40717	40817	40917	74.35	.4355	6	2	⅝	8	0.5031-0.5340	115.25	94.70	87.95	84.60	81.20	78.35
9/16	.5625	40718	40818	40918	74.35	.4355	6	2	⅝	8	0.5341-0.5660	115.25	94.70	87.95	84.60	81.20	78.35
19/32	.5938	40719	40819	40919	77.40	.4355	6	2	⅝	8	0.5661-0.5970	118.30	97.80	90.90	87.65	84.15	81.35
⅝	.6250	40720	40820	40920	77.40	.5615	6	2 ¼	⅝	9	0.5971-0.6280	118.30	97.80	90.90	87.65	84.15	81.35
21/32	.6562	40721	40821	40921	78.70	.5615	6	2 ¼	⅝	9	0.6281-0.6590	119.70	99.10	92.20	89.00	85.45	82.75
11/16	.6875	40722	40822	40922	78.70	.5615	6	2 ¼	⅝	9	0.6591-0.6910	119.70	99.10	92.20	89.00	85.45	82.75
23/32	.7188	40723	40823	40923	82.45	.5615	6	2 ¼	⅝	9	0.6911-0.7220	123.35	102.75	96.00	92.65	89.20	86.40
¾	.7500	40724	40824	40924	82.45	.6245	6	2 ½	¾	9 ½	0.7221-0.7530	123.35	102.75	96.00	92.65	89.20	86.40
25/32	.7812	40725	40825	40925	85.05	.6245	6	2 ½	¾	9 ½	0.7531-0.7840	126.00	105.50	98.60	95.30	91.80	89.15
13/16	.8125	40726	40826	40926	85.05	.6245	6	2 ½	¾	9 ½	0.7841-0.8160	126.00	105.50	98.60	95.30	91.80	89.15
27/32	.8438	40727	40827	40927	88.50	.6245	6	2 ½	¾	9 ½	0.8161-0.8470	129.35	108.90	102.10	98.80	95.25	92.55
⅞	.8750	40728	40828	40928	91.80	.7495	6	2 ⅝	¾	10	0.8471-0.8780	134.30	113.00	105.85	102.55	98.95	96.05
29/32	.9062	40729	40829	40929	106.95	.7495	6	2 ⅝	¾	10	0.8781-0.9090	149.40	128.10	121.05	117.65	113.95	111.05
15/16	.9375	40730	40830	40930	106.95	.7495	8	2 ⅝	¾	10	0.9091-0.9410	149.40	128.10	121.05	117.65	113.95	111.05
31/32	.9688	40731	40831	40931	112.00	.7495	8	2 ⅝	¾	10	0.9411-0.9720	154.45	133.15	126.10	122.60	118.95	116.05
1	1.0000	40732	40832	40932	112.00	.8745	8	2 ¾	¾	10 ½	0.9721-1.0030	154.45	133.15	126.10	122.60	118.95	116.05
1 1/16	1.0625	40734	40834	40934	115.95	.8745	8	2 ¾	¾	10 ½	1.0031-1.0660	156.65	136.35	129.45	126.20	122.65	119.95
1 1/8	1.1250	40736	40836	40936	125.40	.8745	8	2 ⅞	⅞	11	1.0661-1.1280	166.05	145.65	138.90	135.55	132.10	129.35
1 3/16	1.1875	40738	40838	40938	131.75	.9995	8	2 ⅞	⅞	11	1.1281-1.1905	172.45	152.15	145.30	142.00	138.50	135.85
1 ¼	1.2500	40740	40840	40940	139.25	.9995	8	3	⅞	11 ½	1.1906-1.2530	180.00	159.65	152.75	149.50	146.05	143.30
1 5/16	1.3125	40742	40842	40942	146.55	.9995	8	3	⅞	11 ½	1.2531-1.3155	187.30	167.00	160.10	156.85	153.30	150.55
1 3/8	1.3750	40744	40844	40944	155.50	.9995	8	3 ¼	⅞	12	1.3156-1.3780	196.30	175.85	168.95	165.80	162.15	159.50
1 7/16	1.4375	40746	40846	40946	173.30	.9995	8	3 ¼	⅞	12	1.3781-1.4405	214.15	193.60	186.85	183.65	180.05	177.40
1 ½	1.5000	40748	40848	40948	183.20	1.2495	8	3 ½	⅞	12 ½	1.4406-1.5030	223.95	203.55	196.65	193.50	189.95	187.20

*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							
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.0	.1575	407040	408040	409040	$64.75	.1510	4	1	½	4	3.962-4.493	$93.55	$74.45	$68.10	$64.95	$61.75	$59.15	$55.40
4.5	.1772	407045	408045	409045	60.15	.1704	4	1 ⅛	½	4 ½	4.494-4.696	88.10	69.60	63.35	60.35	57.15	54.65	51.05
5.0	.1969	407050	408050	409050	60.15	.1805	4	1 ⅛	½	4 ½	4.697-5.182	88.10	69.60	63.35	60.35	57.15	54.65	51.05
5.5	.2165	407055	408055	409055	60.15	.2075	4	1 ¼	½	5	5.183-5.613	88.10	69.60	63.35	60.35	57.15	54.65	51.05
6.0	.2362	407060	408060	409060	63.00	.2265	4	1 ½	½	6	5.614-6.045	91.00	72.45	66.20	63.15	60.10	57.50	53.95
-	-	407063	408063	409063	-	.2405	4	1 ½	½	6	6.046-6.426	88.50	69.90	63.60	60.60	57.50	54.90	51.30
6.5	.2559	407065	408065	409065	61.50	.2485	4	1 ½	½	6	6.427-7.214	89.45	70.90	64.60	61.60	58.40	55.85	52.35
7.0	.2756	407070	408070	409070	61.50	.2485	4	1 ½	½	6	-	-	-	-	-	-	-	-
7.5	.2953	407075	408075	409075	61.50	.2792	4	1 ½	½	6	7.215-8.001	89.45	70.90	64.60	61.60	58.40	55.85	52.35
7.5	.2953	407078	408078	409078	66.25	.2792	6	1 ½	½	6	7.215-8.001	94.35	75.85	69.55	66.45	63.35	60.70	57.15
8.0	.3150	407080	408080	409080	61.50	.2792	4	1 ½	½	6	-	-	-	-	-	-	-	-
8.0	.3150	407083	408083	409083	66.25	.2792	6	1 ½	½	6	-	-	-	-	-	-	-	-
8.5	.3346	407085	408085	409085	63.30	.2792	4	1 ½	⅝	6	8.002-8.814	91.15	72.70	66.45	63.45	60.35	57.70	54.15
8.5	.3346	407088	408088	409088	68.25	.2792	6	1 ½	⅝	6	8.002-8.814	96.25	77.70	71.45	68.50	65.30	62.75	59.20
9.0	.3543	407090	408090	409090	58.10	.3105	4	1 ¾	⅝	7	8.815-9.601	83.70	66.70	60.90	58.20	55.35	53.00	49.70
9.0	.3543	407093	408093	409093	62.70	.3105	6	1 ¾	⅝	7	8.815-9.601	88.35	71.25	65.60	62.80	59.95	57.55	54.25
9.5	.3740	407095	408095	409095	58.10	.3105	4	1 ¾	⅝	7	-	-	-	-	-	-	-	-
9.5	.3740	407098	408098	409098	62.70	.3105	6	1 ¾	⅝	7	-	-	-	-	-	-	-	-
10.0	.3937	407100	408100	409100	65.75	.3105	4	1 ¾	⅝	7	9.602-10.389	93.75	75.15	68.90	65.85	62.75	60.15	56.60
10.0	.3937	407103	408103	409103	69.30	.3105	6	1 ¾	⅝	7	9.602-10.389	97.30	78.70	72.45	69.40	66.25	63.65	60.15
10.5	.4134	407105	408105	409105	69.30	.3730	6	1 ¾	⅝	7	10.390-11.201	97.30	78.70	72.45	69.40	66.25	63.65	60.15
11.0	.4331	407110	408110	409110	69.30	.3730	6	1 ¾	⅝	7	-	-	-	-	-	-	-	-
11.5	.4528	407115	408115	409115	70.10	.3730	6	1 ¾	⅝	7	11.202-11.989	98.05	79.50	73.30	70.20	67.10	64.50	60.90
12.0	.4724	407120	408120	409120	81.85	.4355	6	2	⅝	8	11.990-12.776	112.70	92.20	85.40	82.05	78.60	75.85	71.90
12.5	.4921	407125	408125	409125	81.85	.4355	6	2	⅝	8	-	-	-	-	-	-	-	-
13.0	.5118	407130	408130	409130	87.95	.4355	6	2	⅝	8	12.777-13.564	118.75	98.35	91.40	88.05	84.60	81.75	77.85
13.5	.5315	407135	408135	409135	87.95	.4355	6	2	⅝	8	-	-	-	-	-	-	-	-
14.0	.5512	407140	408140	409140	87.95	.4355	6	2	⅝	8	13.565-14.376	118.75	98.35	91.40	88.05	84.60	81.75	77.85
14.5	.5709	407145	408145	409145	90.90	.4355	6	2	⅝	8	14.377-15.164	121.75	101.30	94.45	91.05	87.65	84.80	80.80
15.0	.5906	407150	408150	409150	90.90	.4355	6	2	⅝	8	-	-	-	-	-	-	-	-
15.5	.6102	407155	408155	409155	90.90	.5615	6	2 ¼	⅝	9	15.165-15.951	121.75	101.30	94.45	91.05	87.65	84.80	80.80
16.0	.6299	407160	408160	409160	92.20	.5615	6	2 ¼	⅝	9	15.952-16.739	123.15	102.60	95.80	92.35	89.00	86.05	82.20
16.5	.6496	407165	408165	409165	92.20	.5615	6	2 ¼	⅝	9	-	-	-	-	-	-	-	-
17.0	.6693	407170	408170	409170	92.20	.5615	6	2 ¼	⅝	9	16.740-17.551	123.15	102.60	95.80	92.35	89.00	86.05	82.20
17.5	.6890	407175	408175	409175	92.20	.5615	6	2 ¼	⅝	9	-	-	-	-	-	-	-	-
18.0	.7087	407180	408180	409180	96.00	.5615	6	2 ¼	⅝	9	17.552-18.339	126.70	106.30	99.55	96.15	92.65	89.85	85.85
19.0	.7480	407190	408190	409190	96.00	.6245	6	2 ½	¾	9 ½	18.340-19.126	126.70	106.30	99.55	96.15	92.65	89.85	85.85
19.5	.7677	407195	408195	409195	98.60	.6245	6	2 ½	¾	9 ½	19.127-19.914	129.35	108.95	102.15	98.80	95.30	92.55	88.60
20.0	.7874	407200	408200	409200	98.60	.6245	6	2 ½	¾	9 ½	19.915-20.726	129.35	108.95	102.15	98.80	95.30	92.55	88.60
21.0	.8268	407210	408210	409210	102.10	.6245	6	2 ½	¾	9 ½	20.727-21.514	132.80	112.45	105.55	102.20	98.80	96.00	92.00
22.0	.8661	407220	408220	409220	102.10	.7495	6	2 ⅝	¾	10	21.515-22.301	132.80	112.45	105.55	102.20	98.80	96.00	92.00
23.0	.9055	407230	408230	409230	121.05	.7495	6	2 ⅝	¾	10	22.302-23.089	152.90	131.75	124.65	121.15	117.65	114.65	110.65
23.5	.9252	407235	408235	409235	121.05	.7495	8	2 ⅝	¾	10	23.090-23.901	152.90	131.75	124.65	121.15	117.65	114.65	110.65
24.0	.9449	407240	408240	409240	126.10	.7495	8	2 ⅝	¾	10	23.902-24.689	158.00	136.80	129.75	126.25	122.60	119.75	115.65
25.0	.9843	407250	408250	409250	126.10	.8745	8	2 ¾	¾	10 ½	24.690-25.476	158.00	136.80	129.75	126.25	122.60	119.75	115.65
26.0	1.0236	407260	408260	409260	129.45	.8745	8	2 ¾	¾	10 ½	25.477-27.076	160.10	139.80	133.00	129.60	126.20	123.35	119.45
27.0	1.0630	407270	408270	409270	129.45	.8745	8	2 ¾	¾	10 ½	-	-	-	-	-	-	-	-
28.0	1.1024	407280	408280	409280	138.90	.8745	8	2 ⅞	⅞	11	27.077-28.651	169.45	149.20	142.35	139.00	135.55	132.75	128.85
29.0	1.1417	407290	408290	409290	145.30	.9995	8	2 ⅞	⅞	11	28.652-30.239	175.90	155.55	148.70	145.40	142.00	139.15	135.35
30.0	1.1811	407300	408300	409300	145.30	.9995	8	2 ⅞	⅞	11	-	-	-	-	-	-	-	-
31.0	1.2205	407310	408310	409310	152.75	.9995	8	3	⅞	11 ½	30.240-31.826	183.30	163.10	156.35	152.90	149.50	146.60	142.75
32.0	1.2598	407320	408320	409320	160.10	.9995	8	3	⅞	11 ½	31.827-33.414	190.75	170.35	163.60	160.25	156.85	154.00	150.05
33.0	1.2992	407330	408330	409330	160.10	.9995	8	3	⅞	11 ½	-	-	-	-	-	-	-	-
34.0	1.3386	407340	408340	409340	168.95	.9995	8	3 ¼	⅞	12	33.415-35.001	199.65	179.35	172.45	169.25	165.80	162.95	159.00
35.0	1.3780	407350	408350	409350	168.95	.9995	8	3 ¼	⅞	12	-	-	-	-	-	-	-	-
36.0	1.4173	407360	408360	409360	186.85	.9995	8	3 ¼	⅞	12	35.002-36.589	217.40	197.15	190.35	186.95	183.65	180.80	176.80
37.0	1.4567	407370	408370	409370	196.65	1.2495	8	3 ½	⅞	12 ½	36.590-38.176	227.45	207.00	200.30	196.95	193.50	190.70	186.75

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						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
3/16	.1875	45706	45806	45906	$57.15	.1805	4	1 1/8	4 1/2	0.1770 - 0.2040	$95.35	$76.25	$69.80	$66.80	$63.55	$60.90
7/32	.2188	45707	45807	45907	57.15	.2075	4	1 1/4	5	0.2041 - 0.2210	95.35	76.25	69.80	66.80	63.55	60.90
15/64	.2344	4572344	4582344	4592344	57.15	.2265	4	1 1/2	6	0.2211 - 0.2380	95.35	76.25	69.80	66.80	63.55	60.90
1/4	.2500	45708	45808	45908	57.15	.2405	4	1 1/2	6	0.2381 - 0.2530	95.35	76.25	69.80	66.80	63.55	60.90
9/32	.2812	45709	45809	45909	58.40	.2485	4	1 1/2	6	0.2531 - 0.2840	96.60	77.55	71.05	68.10	64.75	62.25
5/16	.3125	45710	45810	45910	58.40	.2792	4	1 1/2	6	0.2841 - 0.3150	96.60	77.55	71.05	68.10	64.75	62.25
11/32	.3438	45711	45811	45911	60.55	.2792	4	1 1/2	6	0.3151 - 0.3470	98.80	79.55	73.20	70.15	66.95	64.35
3/8	.3750	45712	45812	45912	60.55	.3105	4	1 3/4	7	0.3471 - 0.3780	98.80	79.55	73.20	70.15	66.95	64.35
13/32	.4062	45713	45813	45913	63.55	.3105	4	1 3/4	7	0.3781 - 0.4090	101.65	82.60	76.20	73.15	69.80	67.25
7/16	.4375	45714	45814	45914	68.75	.3730	6	1 3/4	7	0.4091 - 0.4410	106.95	87.85	81.40	78.35	75.10	72.45
15/32	.4688	45715	45815	45915	74.25	.3730	6	1 3/4	7	0.4411 - 0.4720	112.55	93.30	87.00	83.95	80.60	78.05
1/2	.5000	45716	45816	45916	79.55	.4355	6	2	8	0.4721 - 0.5030	120.55	100.05	93.20	89.90	86.40	83.65
17/32	.5312	45717	45817	45917	81.85	.4355	6	2	8	0.5031 - 0.5340	122.80	102.25	95.35	92.15	88.65	85.85
9/16	.5625	45718	45818	45918	81.85	.4355	6	2	8	0.5341 - 0.5660	122.80	102.25	95.35	92.15	88.65	85.85
19/32	.5938	45719	45819	45919	84.95	.4355	6	2	8	0.5661 - 0.5970	125.90	105.45	98.50	95.25	91.75	89.00
5/8	.6250	45720	45820	45920	84.95	.5615	6	2 1/4	9	0.5971 - 0.6280	125.90	105.45	98.50	95.25	91.75	89.00
21/32	.6562	45721	45821	45921	86.55	.5615	6	2 1/4	9	0.6281 - 0.6590	127.55	107.00	100.10	96.85	93.30	90.60
11/16	.6875	45722	45822	45922	86.55	.5615	6	2 1/4	9	0.6591 - 0.6910	127.55	107.00	100.10	96.85	93.30	90.60
23/32	.7188	45723	45823	45923	90.50	.5615	6	2 1/4	9	0.6911 - 0.7220	131.45	110.85	104.15	100.85	97.30	94.50
3/4	.7500	45724	45824	45924	90.50	.6245	6	2 1/2	9 1/2	0.7221 - 0.7530	131.45	110.85	104.15	100.85	97.30	94.50
25/32	.7812	45725	45825	45925	93.70	.6245	6	2 1/2	9 1/2	0.7531 - 0.7840	134.50	114.00	107.15	103.80	100.35	97.55
13/16	.8125	45726	45826	45926	93.70	.6245	6	2 1/2	9 1/2	0.7841 - 0.8160	134.50	114.00	107.15	103.80	100.35	97.55
27/32	.8438	45727	45827	45927	97.40	.6245	6	2 1/2	9 1/2	0.8161 - 0.8470	138.25	117.70	110.85	107.70	104.20	101.35
7/8	.8750	45728	45828	45928	101.10	.7495	6	2 5/8	10	0.8471 - 0.8780	143.45	122.20	115.10	111.70	108.00	105.15
29/32	.9062	45729	45829	45929	117.65	.7495	6	2 5/8	10	0.8781 - 0.9090	160.15	138.90	131.65	128.30	124.65	121.75
15/16	.9375	45730	45830	45930	117.65	.7495	8	2 5/8	10	0.9091 - 0.9410	160.15	138.90	131.65	128.30	124.65	121.75
31/32	.9688	45731	45831	45931	123.30	.7495	8	2 5/8	10	0.9411 - 0.9720	165.80	144.55	137.30	133.90	130.30	127.40
1	1.0000	45732	45832	45932	123.30	.8745	8	2 3/4	10 1/2	0.9721 - 1.0030	165.80	144.55	137.30	133.90	130.30	127.40
1 1/16	1.0625	45734	45834	45934	127.45	.8745	8	2 3/4	10 1/2	1.0031 - 1.0660	168.20	147.70	141.00	137.70	134.20	131.50
1 1/8	1.1250	45736	45836	45936	138.10	.8745	8	2 7/8	11	1.0661 - 1.1280	178.75	158.35	151.50	148.30	144.80	142.00
1 3/16	1.1875	45738	45838	45938	144.30	.9995	8	2 7/8	11	1.1281 - 1.1905	185.05	164.70	157.85	154.65	151.10	148.35
1 1/4	1.2500	45740	45840	45940	155.95	.9995	8	3	11 1/2	1.1906 - 1.2530	196.65	176.40	169.45	166.30	162.75	160.00
1 5/16	1.3125	45742	45842	45942	160.30	.9995	8	3	11 1/2	1.2531 - 1.3155	201.05	180.70	173.80	170.60	167.10	164.30
1 3/8	1.3750	45744	45844	45944	171.00	.9995	8	3 1/4	12	1.3156 - 1.3780	211.65	191.30	184.50	181.30	177.65	175.05
1 7/16	1.4375	45746	45846	45946	185.20	.9995	8	3 1/4	12	1.3781 - 1.4405	225.90	205.50	198.65	195.35	191.95	189.15
1 1/2	1.5000	45748	45848	45948	190.55	1.2495	8	3 1/2	12 1/2	1.4406 - 1.5030	231.25	210.85	204.05	200.80	197.35	194.60
1 9/16	1.5625	45750	45850	45950	299.30	1.2495	8	3 1/2	12 1/2	1.5031 - 1.5660	340.10	319.75	312.90	309.60	306.10	303.30
1 5/8	1.6250	45752	45852	45952	309.55	1.2495	8	3 1/2	13	1.5661 - 1.6280	350.35	330.00	323.15	319.90	316.35	313.60
1 11/16	1.6875	45754	45854	45954	339.90	1.2495	8	3 1/2	13	1.6281 - 1.6910	380.70	360.35	353.45	350.25	346.70	343.95
1 3/4	1.7500	45756	45856	45956	339.90	1.2495	10	3 1/2	13 1/2	1.6911 - 1.7530	380.70	360.35	353.45	350.25	346.70	343.95
1 13/16	1.8125	45758	45858	45958	347.85	1.4995	10	3 1/2	13 1/2	1.7531 - 1.8160	388.60	368.25	361.40	358.15	354.55	351.90
1 7/8	1.8750	45760	45860	45960	364.80	1.4995	10	3 1/2	14	1.8161 - 1.8780	405.60	385.20	378.30	375.15	371.60	368.85
1 15/16	1.9375	45762	45862	45962	386.70	1.4995	10	3 1/2	14	1.8781 - 1.9410	427.50	407.10	400.30	397.05	393.50	390.80
2	2.0000	45764	45864	45964	386.15	1.4995	12	3 1/2	14	1.9411 - 2.0030	427.00	406.55	399.80	396.50	393.00	390.25
2 1/8	2.1250	45768	45868	45968	717.50	1.4995	12	3 1/2	14 1/2	2.0031 - 2.1280	758.30	737.85	731.00	727.85	724.25	721.55
2 1/4	2.2500	45772	45872	45972	770.60	1.7495	12	3 1/2	14 1/2	2.1281 - 2.2530	811.40	790.95	784.20	780.95	777.40	774.70
2 3/8	2.3750	45776	45876	45976	797.40	1.7495	12	3 1/2	15	2.2531 - 2.3780	838.15	817.75	810.90	807.75	804.15	801.45
2 1/2	2.5000	45780	45880	45980	797.40	1.7495	12	3 1/2	15	2.3781 - 2.5030	838.15	817.75	810.90	807.75	804.15	801.45

*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							
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH							FLT & CARB	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	457045	458045	459045	$69.80	.1704	4	1 ⅛	4 ½	4.494-4.696	$98.55	$79.50	$73.15	$70.05	$66.80	$64.15	$60.50
5.0	.1969	457050	458050	459050	69.80	.1805	4	1 ⅛	4 ½	4.697-5.182	98.55	79.50	73.15	70.05	66.80	64.15	60.50
5.5	.2165	457055	458055	459055	69.80	.2075	4	1 ¼	5	5.183-5.613	98.55	79.50	73.15	70.05	66.80	64.15	60.50
6.0	.2362	457060	458060	459060	69.80	.2265	4	1 ½	6	5.614-6.045	98.55	79.50	73.15	70.05	66.80	64.15	60.50
-	-	457063	458063	459063	-	.2405	4	1 ½	6	6.046-6.426	98.55	79.50	73.15	70.05	66.80	64.15	60.50
6.5	.2559	457065	458065	459065	71.05	.2485	4	1 ½	6	6.427-7.214	99.85	80.70	74.35	71.20	68.10	65.35	61.75
7.0	.2756	457070	458070	459070	71.05	.2485	4	1 ½	6	-	-	-	-	-	-	-	-
7.5	.2953	457075	458075	459075	71.05	.2792	4	1 ½	6	7.215-8.001	99.85	80.70	74.35	71.20	68.10	65.35	61.75
8.0	.3150	457080	458080	459080	71.05	.2792	4	1 ½	6	-	-	-	-	-	-	-	-
8.5	.3346	457085	458085	459085	73.20	.2792	4	1 ½	6	8.002-8.814	102.05	82.85	76.45	73.35	70.15	67.50	63.80
9.0	.3543	457090	458090	459090	73.20	.3105	4	1 ¾	7	8.815-9.601	102.05	82.85	76.45	73.35	70.15	67.50	63.80
9.5	.3740	457095	458095	459095	73.20	.3105	4	1 ¾	7	-	-	-	-	-	-	-	-
10.0	.3937	457100	458100	459100	76.20	.3105	4	1 ¾	7	9.602-10.389	104.90	85.85	79.40	76.30	73.15	70.45	66.80
10.5	.4134	457105	458105	459105	81.40	.3730	6	1 ¾	7	10.390-11.201	110.15	91.05	84.70	81.50	78.35	75.65	72.10
11.0	.4331	457110	458110	459110	81.40	.3730	6	1 ¾	7	-	-	-	-	-	-	-	-
11.5	.4528	457115	458115	459115	87.00	.3730	6	1 ¾	7	11.202-11.989	115.80	96.60	90.30	87.10	83.95	81.30	77.60
12.0	.4724	457120	458120	459120	93.20	.4355	6	2	8	11.990-12.776	124.00	103.55	96.70	93.30	89.90	87.05	83.20
12.5	.4921	457125	458125	459125	93.20	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	457130	458130	459130	95.35	.4355	6	2	8	12.777-13.564	126.30	105.80	98.95	95.55	92.15	89.30	85.40
13.5	.5315	457135	458135	459135	95.35	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	457140	458140	459140	95.35	.4355	6	2	8	13.565-14.376	126.30	105.80	98.95	95.55	92.15	89.30	85.40
14.5	.5709	457145	458145	459145	98.50	.4355	6	2	8	14.377-15.164	129.30	108.90	102.10	98.75	95.25	92.35	88.50
15.0	.5906	457150	458150	459150	98.50	.4355	6	2	8	-	-	-	-	-	-	-	-
15.5	.6102	457155	458155	459155	98.50	.5615	6	2 ¼	9	15.165-15.951	129.30	108.90	102.10	98.75	95.25	92.35	88.50
16.0	.6299	457160	458160	459160	100.10	.5615	6	2 ¼	9	15.952-16.739	130.95	110.55	103.65	100.30	96.85	94.00	90.00
16.5	.6496	457165	458165	459165	100.10	.5615	6	2 ¼	9	-	-	-	-	-	-	-	-
17.0	.6693	457170	458170	459170	100.10	.5615	6	2 ¼	9	16.740-17.551	130.95	110.55	103.65	100.30	96.85	94.00	90.00
17.5	.6890	457175	458175	459175	100.10	.5615	6	2 ¼	9	-	-	-	-	-	-	-	-
18.0	.7087	457180	458180	459180	104.15	.5615	6	2 ¼	9	17.552-18.339	134.80	114.35	107.65	104.25	100.85	97.90	94.00
18.5	.7283	457185	458185	459185	104.15	.6245	6	2 ½	9 ½	18.340-19.126	134.80	114.35	107.65	104.25	100.85	97.90	94.00
19.0	.7480	457190	458190	459190	104.15	.6245	6	2 ½	9 ½	-	-	-	-	-	-	-	-
19.5	.7677	457195	458195	459195	107.15	.6245	6	2 ½	9 ½	19.127-19.914	138.00	117.55	110.65	107.30	103.80	101.05	97.15
20.0	.7874	457200	458200	459200	107.15	.6245	6	2 ½	9 ½	19.915-20.726	138.00	117.55	110.65	107.30	103.80	101.05	97.15
20.5	.8071	457205	458205	459205	107.15	.6245	6	2 ½	9 ½	-	-	-	-	-	-	-	-
21.0	.8268	457210	458210	459210	110.85	.6245	6	2 ½	9 ½	20.727-21.514	141.80	121.25	114.35	111.05	107.70	104.80	100.95
21.5	.8465	457215	458215	459215	110.85	.6245	6	2 ½	9 ½	-	-	-	-	-	-	-	-
22.0	.8661	457220	458220	459220	110.85	.7495	6	2 ⅝	10	21.515-22.301	141.80	121.25	114.35	111.05	107.70	104.80	100.95
22.5	.8858	457225	458225	459225	131.65	.7495	6	2 ⅝	10	22.302-23.089	163.65	142.45	135.40	131.85	128.30	125.40	121.20
23.0	.9055	457230	458230	459230	131.65	.7495	6	2 ⅝	10	-	-	-	-	-	-	-	-
23.5	.9252	457235	458235	459235	131.65	.7495	8	2 ⅝	10	23.090-23.901	163.65	142.45	135.40	131.85	128.30	125.40	121.20
24.0	.9449	457240	458240	459240	137.30	.7495	8	2 ⅝	10	23.902-24.689	169.35	148.15	141.05	137.55	133.90	131.00	126.85
24.5	.9646	457245	458245	459245	137.30	.7495	8	2 ⅝	10	-	-	-	-	-	-	-	-
25.0	.9843	457250	458250	459250	137.30	.8745	8	2 ¾	10 ½	24.690-25.476	169.35	148.15	141.05	137.55	133.90	131.00	126.85
25.5	1.0039	457255	458255	459255	141.00	.8745	8	2 ¾	10 ½	25.477-27.076	171.55	151.35	144.40	141.10	137.70	134.80	130.95
26.0	1.0236	457260	458260	459260	141.00	.8745	8	2 ¾	10 ½	-	-	-	-	-	-	-	-
27.0	1.0630	457270	458270	459270	141.00	.8745	8	2 ¾	10 ½	-	-	-	-	-	-	-	-
28.0	1.1024	457280	458280	459280	151.50	.8745	8	2 ⅞	11	27.077-28.651	182.10	161.90	155.00	151.60	148.30	145.40	141.45
29.0	1.1417	457290	458290	459290	157.85	.9995	8	2 ⅞	11	28.652-30.239	188.45	168.20	161.40	158.00	154.65	151.70	147.75
30.0	1.1811	457300	458300	459300	157.85	.9995	8	2 ⅞	11	-	-	-	-	-	-	-	-
31.0	1.2205	457310	458310	459310	169.45	.9995	8	3	11 ½	30.240-31.826	200.20	179.80	173.00	169.65	166.30	163.35	159.50
32.0	1.2598	457320	458320	459320	173.80	.9995	8	3	11 ½	31.827-33.414	204.45	184.10	177.40	174.00	170.60	167.75	163.80
33.0	1.2992	457330	458330	459330	173.80	.9995	8	3	11 ½	-	-	-	-	-	-	-	-
34.0	1.3386	457340	458340	459340	184.50	.9995	8	3 ¼	12	33.415-35.001	215.10	194.80	188.00	184.65	181.30	178.40	174.50
35.0	1.3780	457350	458350	459350	184.50	.9995	8	3 ¼	12	-	-	-	-	-	-	-	-
36.0	1.4173	457360	458360	459360	198.65	.9995	8	3 ¼	12	35.002-36.589	229.25	209.00	202.10	198.80	195.35	192.50	188.65
37.0	1.4567	457370	458370	459370	204.05	1.2495	8	3 ½	12 ½	36.590-38.176	234.70	214.35	207.60	204.15	200.80	197.90	194.10
38.0	1.4961	457380	458380	459380	204.05	1.2495	8	3 ½	12 ½	-	-	-	-	-	-	-	-

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						
						TAPER SHANK NO.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
1/4	.2500	47208	47308	47408	$55.15	1	4	1 1/2	1/2	6	0.2381-0.2530	$92.25	$73.70	$67.45	$64.45	$61.35	$58.85
9/32	.2812	47209	47309	47409	56.05	1	4	1 1/2	1/2	6	0.2531-0.2840	93.20	74.55	68.35	65.35	62.25	59.70
5/16	.3125	47210	47310	47410	56.05	1	4	1 1/2	1/2	6	0.2841-0.3150	93.20	74.55	68.35	65.35	62.25	59.70
11/32	.3438	47211	47311	47411	57.75	1	4	1 1/2	5/8	6	0.3151-0.3470	94.95	76.30	70.10	67.10	64.00	61.50
3/8	.3750	47212	47312	47412	53.40	1	4	1 3/4	5/8	7	0.3471-0.3780	87.45	70.40	64.70	61.90	59.10	56.70
13/32	.4062	47213	47313	47413	61.05	1	4	1 3/4	5/8	7	0.3781-0.4090	98.20	79.55	73.35	70.40	67.25	64.75
7/16	.4375	47214	47314	47414	65.00	1	6	1 3/4	5/8	7	0.4091-0.4410	102.20	83.60	77.40	74.35	71.10	68.65
15/32	.4688	47215	47315	47415	66.75	1	6	1 3/4	5/8	7	0.4411-0.4720	103.90	85.30	79.10	76.10	72.95	70.40
1/2	.5000	47216	47316	47416	76.45	1	6	2	5/8	8	0.4721-0.5030	117.35	96.85	89.95	86.70	83.25	80.45
17/32	.5312	47217	47317	47417	81.25	1	6	2	5/8	8	0.5031-0.5340	122.15	101.55	94.70	91.60	88.00	85.25
9/16	.5625	47218	47318	47418	81.25	1	6	2	5/8	8	0.5341-0.5660	122.15	101.55	94.70	91.60	88.00	85.25
19/32	.5938	47219	47319	47419	86.40	1	6	2	5/8	8	0.5661-0.5970	127.30	106.75	99.95	96.70	93.20	90.45
5/8	.6250	47220	47320	47420	86.40	2	6	2 1/4	5/8	9	0.5971-0.6280	127.30	106.75	99.95	96.70	93.20	90.45
21/32	.6562	47221	47321	47421	87.85	2	6	2 1/4	5/8	9	0.6281-0.6590	128.75	108.25	101.35	98.05	94.60	91.80
11/16	.6875	47222	47322	47422	87.85	2	6	2 1/4	5/8	9	0.6591-0.6910	128.75	108.25	101.35	98.05	94.60	91.80
23/32	.7188	47223	47323	47423	91.30	2	6	2 1/4	5/8	9	0.6911-0.7220	132.30	111.75	104.90	101.55	98.05	95.30
3/4	.7500	47224	47324	47424	91.30	2	6	2 1/2	3/4	9 1/2	0.7221-0.7530	132.30	111.75	104.90	101.55	98.05	95.30
25/32	.7812	47225	47325	47425	93.40	2	6	2 1/2	3/4	9 1/2	0.7531-0.7840	134.45	113.95	107.05	103.75	100.30	97.50
13/16	.8125	47226	47326	47426	93.40	2	6	2 1/2	3/4	9 1/2	0.7841-0.8160	134.45	113.95	107.05	103.75	100.30	97.50
27/32	.8438	47227	47327	47427	98.00	2	6	2 1/2	3/4	9 1/2	0.8161-0.8470	139.00	118.40	111.65	108.35	104.80	102.10
7/8	.8750	47228	47328	47428	101.75	2	6	2 5/8	3/4	10	0.8471-0.8780	144.20	122.90	115.85	112.40	108.75	105.85
29/32	.9062	47229	47329	47429	123.85	2	6	2 5/8	3/4	10	0.8781-0.9090	166.30	145.00	137.80	134.50	130.80	128.00
15/16	.9375	47230	47330	47430	123.85	3	8	2 5/8	3/4	10	0.9091-0.9410	166.30	145.00	137.80	134.50	130.80	128.00
31/32	.9688	47231	47331	47431	127.40	3	8	2 5/8	3/4	10	0.9411-0.9720	169.95	148.60	141.45	138.15	134.50	131.60
1	1.0000	47232	47332	47432	127.40	3	8	2 3/4	3/4	10 1/2	0.9721-1.0030	169.95	148.60	141.45	138.15	134.50	131.60
1 1/16	1.0625	47234	47334	47434	157.40	3	8	2 3/4	3/4	10 1/2	1.0031-1.0660	198.10	177.60	170.85	167.55	164.15	161.40
1 1/8	1.1250	47236	47336	47436	167.10	3	8	2 7/8	7/8	11	1.0661-1.1280	207.80	187.40	180.50	177.40	173.80	171.05
1 3/16	1.1875	47238	47338	47438	182.65	3	8	2 7/8	7/8	11	1.1281-1.1905	223.40	202.95	196.10	193.00	189.40	186.70
1 1/4	1.2500	47240	47340	47440	198.35	4	8	3	7/8	11 1/2	1.1906-1.2530	239.15	218.65	211.95	208.60	205.15	202.45
1 5/16	1.3125	47242	47342	47442	209.60	4	8	3	7/8	11 1/2	1.2531-1.3155	250.30	229.85	223.00	219.75	216.30	213.50
1 3/8	1.3750	47244	47344	47444	220.75	4	8	3 1/4	7/8	12	1.3156-1.3780	261.45	241.00	234.15	230.90	227.50	224.70
1 7/16	1.4375	47246	47346	47446	233.30	4	8	3 1/4	7/8	12	1.3781-1.4405	274.10	253.65	246.85	243.65	240.15	237.35
1 1/2	1.5000	47248	47348	47448	245.90	4	8	3 1/2	7/8	12 1/2	1.4406-1.5030	286.55	266.20	259.30	256.05	252.60	249.80
1 9/16	1.5625	47250	47350	47450	288.35	4	8	3 1/2	7/8	12 1/2	1.5031-1.5660	329.10	308.65	301.85	298.65	295.15	292.40
1 5/8	1.6250	47252	47352	47452	298.45	4	8	3 3/4	7/8	13	1.5661-1.6280	339.10	318.65	311.90	308.50	305.10	302.40
1 11/16	1.6875	47254	47354	47454	335.60	4	8	3 3/4	7/8	13	1.6281-1.6910	376.30	355.95	349.05	345.85	342.35	339.55
1 3/4	1.7500	47256	47356	47456	335.60	4	10	4	7/8	13 1/2	1.6911-1.7530	376.30	355.95	349.05	345.85	342.35	339.55
1 13/16	1.8125	47258	47358	47458	335.60	4	10	4	7/8	13 1/2	1.7531-1.8160	376.30	355.95	349.05	345.85	342.35	339.55
1 7/8	1.8750	47260	47360	47460	351.60	4	10	4 1/4	7/8	14	1.8161-1.8780	392.35	371.90	365.00	361.85	358.35	355.55
1 15/16	1.9375	47262	47362	47462	351.60	4	10	4 1/4	7/8	14	1.8781-1.9410	392.35	371.90	365.00	361.85	358.35	355.55
2	2.0000	47264	47364	47464	351.60	4	12	4 1/4	7/8	14	1.9411-2.0030	392.35	371.90	365.00	361.85	358.35	355.55

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

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

REAMERS

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 FRAC.	TOOL DIAMETER DEC.	TYPE 453 NON-FERROUS EDP NO.	TYPE 454 NAS/ CAST IRON EDP NO.	TYPE 455 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS TAPER SHANK NO.	NO. OF FLTS	LENGTH FLUTE & CARBIDE	LENGTH OVER-ALL	FINISHED TO MODIFIED TOOL DIAMETER MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
1/4	.2500	45308	45408	45508	$65.80	1	4	1 1/2	6	0.2381-0.2530	$104.00	$84.80	$78.40	$75.40	$72.15	$69.60
9/32	.2812	45309	45409	45509	66.80	1	4	1 1/2	6	0.2531-0.2840	105.00	85.85	79.40	76.40	73.15	70.65
5/16	.3125	45310	45410	45510	66.80	1	4	1 1/2	6	0.2841-0.3150	105.00	85.85	79.40	76.40	73.15	70.65
11/32	.3438	45311	45411	45511	68.25	1	4	1 1/2	6	0.3151-0.3470	106.55	87.35	81.05	77.90	74.60	72.10
3/8	.3750	45312	45412	45512	69.00	1	4	1 3/4	7	0.3471-0.3780	107.30	88.10	81.75	78.70	75.40	72.85
13/32	.4062	45313	45413	45513	72.70	1	4	1 3/4	7	0.3781-0.4090	110.80	91.75	85.30	82.25	79.00	76.40
7/16	.4375	45314	45414	45514	77.45	1	6	1 3/4	7	0.4091-0.4410	115.65	96.40	90.00	87.05	83.75	81.25
15/32	.4688	45315	45415	45515	79.05	1	6	1 3/4	7	0.4411-0.4720	117.25	98.15	91.75	88.65	85.40	82.80
1/2	.5000	45316	45416	45516	85.10	1	6	2	8	0.4721-0.5030	126.10	105.55	98.75	95.35	91.95	89.20
17/32	.5312	45317	45417	45517	93.30	1	6	2	8	0.5031-0.5340	134.30	113.75	106.85	103.65	100.10	97.40
9/16	.5625	45318	45418	45518	93.30	1	6	2	8	0.5341-0.5660	134.30	113.75	106.85	103.65	100.10	97.40
19/32	.5938	45319	45419	45519	97.60	1	6	2	8	0.5661-0.5970	138.65	118.15	111.35	107.95	104.45	101.65
5/8	.6250	45320	45420	45520	97.60	2	6	2 1/4	9	0.5971-0.6280	138.65	118.15	111.35	107.95	104.45	101.65
21/32	.6562	45321	45421	45521	99.55	2	6	2 1/4	9	0.6281-0.6590	140.40	119.85	113.00	109.65	106.25	103.50
11/16	.6875	45322	45422	45522	99.55	2	6	2 1/4	9	0.6591-0.6910	140.40	119.85	113.00	109.65	106.25	103.50
23/32	.7188	45323	45423	45523	100.85	2	6	2 1/4	9	0.6911-0.7220	141.80	121.20	114.30	111.05	107.65	104.80
3/4	.7500	45324	45424	45524	104.15	2	6	2 1/2	9 1/2	0.7221-0.7530	145.00	124.45	117.60	114.30	110.80	108.00
25/32	.7812	45325	45425	45525	104.90	2	6	2 1/2	9 1/2	0.7531-0.7840	145.80	125.30	118.40	115.20	111.70	108.90
13/16	.8125	45326	45426	45526	107.20	2	6	2 1/2	9 1/2	0.7841-0.8160	148.15	127.70	120.90	117.55	114.00	111.35
27/32	.8438	45327	45427	45527	111.85	2	6	2 1/2	9 1/2	0.8161-0.8470	152.80	132.40	125.50	122.20	118.75	115.95
7/8	.8750	45328	45428	45528	116.05	2	6	2 5/8	10	0.8471-0.8780	158.60	137.30	130.25	126.80	123.25	120.30
29/32	.9062	45329	45429	45529	136.45	2	6	2 5/8	10	0.8781-0.9090	178.85	157.65	150.45	147.10	143.40	140.60
15/16	.9375	45330	45430	45530	136.45	3	8	2 5/8	10	0.9091-0.9410	178.85	157.65	150.45	147.10	143.40	140.60
31/32	.9688	45331	45431	45531	141.90	3	8	2 5/8	10	0.9411-0.9720	184.30	163.05	155.85	152.55	148.95	146.05
1	1.0000	45332	45432	45532	141.90	3	8	2 3/4	10 1/2	0.9721-1.0030	184.30	163.05	155.85	152.55	148.95	146.05
1 1/16	1.0625	45334	45434	45534	180.90	3	8	2 3/4	10 1/2	1.0031-1.0660	221.55	201.25	194.40	191.15	187.70	184.85
1 1/8	1.1250	45336	45436	45536	192.15	3	8	2 7/8	11	1.0661-1.1280	232.95	212.65	205.70	202.50	198.90	196.30
1 3/16	1.1875	45338	45438	45538	210.15	3	8	2 7/8	11	1.1281-1.1905	250.85	230.45	223.65	220.30	216.95	214.20
1 1/4	1.2500	45340	45440	45540	228.00	4	8	3	11 1/2	1.1906-1.2530	268.70	248.35	241.55	238.20	234.75	232.05
1 5/16	1.3125	45342	45442	45542	240.95	4	8	3	11 1/2	1.2531-1.3155	281.65	261.20	254.30	251.20	247.65	244.85
1 3/8	1.3750	45344	45444	45544	254.85	4	8	3 1/4	12	1.3156-1.3780	295.50	275.10	268.35	265.10	261.55	258.80
1 7/16	1.4375	45346	45446	45546	268.30	4	8	3 1/4	12	1.3781-1.4405	309.00	288.55	281.75	278.55	274.95	272.20
1 1/2	1.5000	45348	45448	45548	282.80	4	8	3 1/2	12 1/2	1.4406-1.5030	323.50	303.05	296.25	293.00	289.50	286.80

*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						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
5/16	.3125	46410	46610	46810	$88.15	.2792	4	1	6	0.2841 - 0.3150	$126.40	$107.30	$100.95	$97.80	$94.50	$91.95
11/32	.3438	46411	46611	46811	88.15	.2792	4	1	6	0.3151 - 0.3470	126.40	107.30	100.95	97.80	94.50	91.95
3/8	.3750	46412	46612	46812	83.35	.3105	4	1	7	0.3471 - 0.3780	119.05	101.20	95.15	92.25	89.25	86.80
13/32	.4062	46413	46613	46813	87.75	.3105	4	1	7	0.3781 - 0.4090	123.50	105.60	99.65	96.80	93.75	91.15
7/16	.4375	46414	46614	46814	87.75	.3730	6	1	7	0.4091 - 0.4410	123.50	105.60	99.65	96.80	93.75	91.15
15/32	.4688	46415	46615	46815	92.95	.3730	6	1	7	0.4411 - 0.4720	128.75	110.80	104.85	102.05	98.95	96.40
1/2	.5000	46416	46616	46816	92.95	.4355	6	1	8	0.4721 - 0.5030	128.75	110.80	104.85	102.05	98.95	96.40
17/32	.5312	46417	46617	46817	95.30	.4355	6	1	8	0.5031 - 0.5340	131.30	113.15	107.20	104.35	101.30	98.95
9/16	.5625	46418	46618	46818	95.30	.4355	6	1 1/8	8	0.5341 - 0.5660	131.30	113.15	107.20	104.35	101.30	98.95
19/32	.5938	46419	46619	46819	99.55	.4355	6	1 1/8	8	0.5661 - 0.5970	135.25	117.35	111.40	108.45	105.45	103.00
5/8	.6250	46420	46620	46820	99.55	.5615	6	1 1/4	9	0.5971 - 0.6280	135.25	117.35	111.40	108.45	105.45	103.00
21/32	.6562	46421	46621	46821	108.80	.5615	6	1 1/4	9	0.6281 - 0.6590	144.60	126.60	120.60	117.70	114.70	112.35
11/16	.6875	46422	46622	46822	108.80	.5615	6	1 1/4	9	0.6591 - 0.6910	144.60	126.60	120.60	117.70	114.70	112.35
23/32	.7188	46423	46623	46823	112.90	.5615	6	1 1/4	9	0.6911 - 0.7220	148.70	130.70	124.70	121.95	118.80	116.30
3/4	.7500	46424	46624	46824	112.90	.6245	6	1 3/8	9 1/2	0.7221 - 0.7530	148.70	130.70	124.70	121.95	118.80	116.30
25/32	.7812	46425	46625	46825	121.65	.6245	6	1 3/8	9 1/2	0.7531 - 0.7840	157.50	139.55	133.55	130.65	127.60	125.15
13/16	.8125	46426	46626	46826	121.65	.6245	6	1 3/8	9 1/2	0.7841 - 0.8160	157.50	139.55	133.55	130.65	127.60	125.15
27/32	.8438	46427	46627	46827	126.40	.6245	6	1 3/8	9 1/2	0.8161 - 0.8470	162.30	144.25	138.25	135.40	132.40	130.00
7/8	.8750	46428	46628	46828	131.25	.7495	6	1 1/2	10	0.8471 - 0.8780	168.40	149.75	143.45	140.55	137.30	134.80
29/32	.9062	46429	46629	46829	139.65	.7495	6	1 1/2	10	0.8781 - 0.9090	176.75	158.15	151.95	149.05	145.80	143.30
15/16	.9375	46430	46630	46830	139.65	.7495	8	1 1/2	10	0.9091 - 0.9410	176.75	158.15	151.95	149.05	145.80	143.30
31/32	.9688	46431	46631	46831	145.00	.7495	8	1 1/2	10	0.9411 - 0.9720	182.15	163.60	157.40	154.40	151.20	148.65
1	1.0000	46432	46632	46832	145.00	.8745	8	1 5/8	10 1/2	0.9721 - 1.0030	182.15	163.60	157.40	154.40	151.20	148.65
1 1/32	1.0312	46433	46633	46833	159.00	.8745	8	1 5/8	10 1/2	-	-	-	-	-	-	-
1 1/16	1.0625	46434	46634	46834	159.00	.8745	8	1 5/8	10 1/2	1.0031 - 1.0660	196.10	177.50	171.30	168.35	165.05	162.65
1 3/32	1.0938	46435	46635	46835	159.00	.8745	8	1 3/4	11	-	-	-	-	-	-	-
1 1/8	1.1250	46436	46636	46836	159.00	.8745	8	1 3/4	11	1.0661 - 1.1280	196.10	177.50	171.30	168.35	165.05	162.65
1 3/16	1.1875	46438	46638	46838	173.55	.9995	8	1 3/4	11	1.1281 - 1.1905	210.75	192.05	185.80	182.85	179.65	177.30
1 1/4	1.2500	46440	46640	46840	173.55	.9995	8	1 7/8	11 1/2	1.1906 - 1.2530	210.75	192.05	185.80	182.85	179.65	177.30
1 5/16	1.3125	46442	46642	46842	191.60	.9995	8	1 7/8	11 1/2	1.2531 - 1.3155	228.80	210.15	203.95	201.00	197.75	195.25
1 3/8	1.3750	46444	46644	46844	201.35	.9995	8	2	12	1.3156 - 1.3780	238.60	220.05	213.75	210.80	207.65	205.05
1 7/16	1.4375	46446	46646	46846	237.30	.9995	8	2	12	1.3781 - 1.4405	277.00	257.10	250.50	247.35	243.85	241.15
1 1/2	1.5000	46448	46648	46848	244.00	1.2495	8	2 1/8	12 1/2	1.4406 - 1.5030	283.75	263.75	257.15	254.05	250.60	247.90
1 9/16	1.5625	46450	46650	46850	320.60	1.2495	8	2 1/8	12 1/2	1.5031 - 1.5660	360.25	340.45	333.75	330.55	327.20	324.45
1 5/8	1.6250	46452	46652	46852	320.60	1.2495	8	2 1/4	13	1.5661 - 1.6280	360.25	340.45	333.75	330.55	327.20	324.45
1 11/16	1.6875	46454	46654	46854	355.00	1.2495	8	2 1/4	13	1.6281 - 1.6910	394.70	374.85	368.25	364.95	361.55	359.00
1 3/4	1.7500	46456	46656	46856	355.00	1.2495	10	2 3/8	13 1/2	1.6911 - 1.7530	394.70	374.85	368.25	364.95	361.55	359.00
1 13/16	1.8125	46458	46658	46858	420.35	1.4995	10	2 3/8	13 1/2	1.7531 - 1.8160	460.00	440.10	433.55	430.40	427.00	424.25
1 7/8	1.8750	46460	46660	46860	420.35	1.4995	10	2 1/2	14	1.8161 - 1.8780	460.00	440.10	433.55	430.40	427.00	424.25
1 15/16	1.9375	46462	46662	46862	459.40	1.4995	10	2 1/2	14	1.8781 - 1.9410	498.95	479.10	472.45	469.30	465.90	463.25
2	2.0000	46464	46664	46864	459.40	1.4995	12	2 1/2	14	1.9411 - 2.0030	498.95	479.10	472.45	469.30	465.90	463.25

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

MATERIAL SPECIFIC REAMERS
CARBIDE TIPPED TYPES 461, 462, 463 FRACTIONAL

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 FRAC.	TOOL DIAMETER DEC.	TYPE 461 NON-FERROUS EDP NO.	TYPE 462 NAS/ CAST IRON EDP NO.	TYPE 463 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS TAPER SHANK NO.	NO. OF FLTS	LENGTH FLUTE & CARBIDE	LENGTH OVER-ALL	FINISHED TO MODIFIED TOOL DIAMETER MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
3/8	.3750	46112	46212	46312	$93.20	1	4	1	7	0.3471-0.3780	$128.95	$111.05	$105.05	$102.20	$99.10	$96.70
13/32	.4062	46113	46213	46313	94.60	1	4	1	7	0.3781-0.4090	130.35	112.45	106.50	103.60	100.45	98.05
7/16	.4375	46114	46214	46314	96.05	1	6	1	7	0.4091-0.4410	131.75	113.85	107.85	105.00	101.95	99.55
15/32	.4688	46115	46215	46315	100.10	1	6	1	7	0.4411-0.4720	135.95	118.10	111.90	109.10	106.10	103.65
1/2	.5000	46116	46216	46316	100.75	1	6	1	8	0.4721-0.5030	136.55	118.60	112.60	109.65	106.65	104.25
17/32	.5312	46117	46217	46317	103.80	1	6	1	8	0.5031-0.5340	139.65	121.75	115.80	112.90	109.70	107.35
9/16	.5625	46118	46218	46318	103.80	1	6	1 1/8	8	0.5341-0.5660	139.65	121.75	115.80	112.90	109.70	107.35
19/32	.5938	46119	46219	46319	107.80	1	6	1 1/8	8	0.5661-0.5970	143.50	125.60	119.70	116.80	113.70	111.35
5/8	.6250	46120	46220	46320	108.00	2	6	1 1/4	9	0.5971-0.6280	143.90	125.90	119.90	117.05	114.00	111.60
21/32	.6562	46121	46221	46321	117.35	2	6	1 1/4	9	0.6281-0.6590	153.20	135.20	129.20	126.35	123.30	120.90
11/16	.6875	46122	46222	46322	117.65	2	6	1 1/4	9	0.6591-0.6910	153.55	135.65	129.50	126.65	123.55	121.20
23/32	.7188	46123	46223	46323	122.00	2	6	1 1/4	9	0.6911-0.7220	157.85	139.80	133.80	130.95	127.85	125.50
3/4	.7500	46124	46224	46324	122.00	2	6	1 3/8	9 1/2	0.7221-0.7530	157.85	139.80	133.80	130.95	127.85	125.50
25/32	.7812	46125	46225	46325	130.85	2	6	1 3/8	9 1/2	0.7531-0.7840	166.75	148.75	142.75	139.90	136.80	134.45
13/16	.8125	46126	46226	46326	130.85	2	6	1 3/8	9 1/2	0.7841-0.8160	166.75	148.75	142.75	139.90	136.80	134.45
27/32	.8438	46127	46227	46327	136.35	2	6	1 3/8	9 1/2	0.8161-0.8470	172.20	154.25	148.15	145.30	142.20	139.80
7/8	.8750	46128	46228	46328	141.35	2	6	1 1/2	10	0.8471-0.8780	178.70	160.00	153.75	150.80	147.60	145.05
29/32	.9062	46129	46229	46329	149.05	2	6	1 1/2	10	0.8781-0.9090	186.10	167.50	161.30	158.35	155.15	152.60
15/16	.9375	46130	46230	46330	149.75	3	8	1 1/2	10	0.9091-0.9410	186.90	168.35	162.05	159.10	155.85	153.45
31/32	.9688	46131	46231	46331	155.05	3	8	1 1/2	10	0.9411-0.9720	192.15	173.60	167.30	164.35	161.20	158.70
1	1.0000	46132	46232	46332	155.05	3	8	1 5/8	10 1/2	0.9721-1.0030	192.15	173.60	167.30	164.35	161.20	158.70
1 1/32	1.0312	46133	46233	46333	164.90	3	8	1 5/8	10 1/2	-	-	-	-	-	-	-
1 1/16	1.0625	46134	46234	46334	164.90	3	8	1 5/8	10 1/2	1.0031-1.0660	202.10	183.45	177.35	174.30	171.15	168.60
1 3/32	1.0938	46135	46235	46335	169.85	3	8	1 3/4	11	-	-	-	-	-	-	-
1 1/8	1.1250	46136	46236	46336	169.85	3	8	1 3/4	11	1.0661-1.1280	206.90	188.30	182.00	179.05	175.90	173.40
1 3/16	1.1875	46138	46238	46338	181.10	3	8	1 3/4	11	1.1281-1.1905	218.35	199.65	193.45	190.50	187.25	184.80
1 1/4	1.2500	46140	46240	46340	193.45	4	8	1 7/8	11 1/2	1.1906-1.2530	230.65	212.00	205.70	202.75	199.60	197.15
1 5/16	1.3125	46142	46242	46342	200.70	4	8	1 7/8	11 1/2	1.2531-1.3155	237.95	219.35	213.05	210.10	206.90	204.35
1 3/8	1.3750	46144	46244	46344	222.55	4	8	2	12	1.3156-1.3780	259.85	241.15	235.05	232.05	228.80	226.35
1 7/16	1.4375	46146	46246	46346	246.70	4	8	2	12	1.3781-1.4405	286.45	266.40	259.90	256.70	253.25	250.60
1 1/2	1.5000	46148	46248	46348	254.15	4	8	2 1/8	12 1/2	1.4406-1.5030	293.85	273.90	267.35	264.15	260.75	258.10
1 9/16	1.5625	46150	46250	46350	356.15	4	8	2 1/8	12 1/2	1.5031-1.5660	395.85	375.90	369.10	366.05	362.70	360.05
1 5/8	1.6250	46152	46252	46352	356.15	4	8	2 1/4	13	1.5661-1.6280	395.85	375.90	369.10	366.05	362.70	360.05
1 11/16	1.6875	46154	46254	46354	394.60	4	8	2 1/4	13	1.6281-1.6910	434.30	414.35	407.65	404.50	401.15	398.40
1 3/4	1.7500	46156	46256	46356	394.60	4	10	2 3/8	13 1/2	1.6911-1.7530	434.30	414.35	407.65	404.50	401.15	398.40
1 13/16	1.8125	46158	46258	46358	467.15	4	10	2 3/8	13 1/2	1.7531-1.8160	506.80	487.00	480.30	477.15	473.70	471.05
1 7/8	1.8750	46160	46260	46360	467.15	4	10	2 1/2	14	1.8161-1.8780	506.80	487.00	480.30	477.15	473.70	471.05
1 15/16	1.9375	46162	46262	46362	510.15	4	10	2 1/2	14	1.8781-1.9410	549.80	529.95	523.30	520.20	516.80	514.10
2	2.0000	46164	46264	46364	510.15	4	12	2 1/2	14	1.9411-2.0030	549.80	529.95	523.30	520.20	516.80	514.10

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

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

RIGHT SPIRAL FLUTES
STRAIGHT SHANK

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

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

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

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						
						MAX SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
3/16	.1875	43206	43606	43806	$60.50	.1805	4	1 1/8	1/2	4 1/2	0.1770-0.2040	$96.30	$78.40	$72.30	$69.55	$66.40	$64.05
7/32	.2188	43207	43607	43807	60.50	.2075	4	1 1/4	1/2	5	0.2041-0.2210	96.30	78.40	72.30	69.55	66.40	64.05
15/64	.2344	4322344	4362344	4382344	60.50	.2265	4	1 1/2	1/2	6	0.2211-0.2380	96.30	78.40	72.30	69.55	66.40	64.05
1/4	.2500	43208	43608	43808	60.50	.2405	4	1 1/2	1/2	6	0.2381-0.2530	96.30	78.40	72.30	69.55	66.40	64.05
9/32	.2812	43209	43609	43809	60.60	.2485	4	1 1/2	1/2	6	0.2531-0.2840	96.40	78.55	72.50	69.70	66.60	64.15
5/16	.3125	43210	43610	43810	60.60	.2792	4	1 1/2	1/2	6	0.2841-0.3150	96.40	78.55	72.50	69.70	66.60	64.15
11/32	.3438	43211	43611	43811	66.80	.2792	4	1 1/2	5/8	6	0.3151-0.3470	102.60	84.70	78.70	75.90	72.75	70.25
3/8	.3750	43212	43612	43812	67.40	.3105	4	1 3/4	5/8	7	0.3471-0.3780	103.20	85.25	79.20	76.40	73.30	70.90
13/32	.4062	43213	43613	43813	70.40	.3105	4	1 3/4	5/8	7	0.3781-0.4090	106.20	88.20	82.25	79.35	76.30	73.90
7/16	.4375	43214	43614	43814	73.15	.3730	6	1 3/4	5/8	7	0.4091-0.4410	108.90	90.95	84.95	82.10	79.05	76.60
15/32	.4688	43215	43615	43815	77.75	.3730	6	1 3/4	5/8	7	0.4411-0.4720	113.65	95.65	89.65	86.80	83.70	81.35
1/2	.5000	43216	43616	43816	83.75	.4355	6	2	5/8	8	0.4721-0.5030	122.00	102.75	96.35	93.30	90.00	87.45
17/32	.5312	43217	43617	43817	86.30	.4355	6	2	5/8	8	0.5031-0.5340	124.45	105.40	98.95	95.85	92.60	89.95
9/16	.5625	43218	43618	43818	86.30	.4355	6	2	5/8	8	0.5341-0.5660	124.45	105.40	98.95	95.85	92.60	89.95
19/32	.5938	43219	43619	43819	88.95	.4355	6	2	5/8	8	0.5661-0.5970	127.15	107.95	101.50	98.50	95.20	92.65
5/8	.6250	43220	43620	43820	88.95	.5615	6	2 1/4	5/8	9	0.5971-0.6280	127.15	107.95	101.50	98.50	95.20	92.65
21/32	.6562	43221	43621	43821	91.65	.5615	6	2 1/4	5/8	9	0.6281-0.6590	129.80	110.65	104.25	101.20	97.85	95.25
11/16	.6875	43222	43622	43822	97.40	.5615	6	2 1/4	5/8	9	0.6591-0.6910	135.55	116.35	110.05	106.95	103.65	101.10
23/32	.7188	43223	43623	43823	98.90	.5615	6	2 1/4	5/8	9	0.6911-0.7220	137.00	117.95	111.55	108.45	105.15	102.60
3/4	.7500	43224	43624	43824	100.25	.6245	6	2 1/2	3/4	9 1/2	0.7221-0.7530	138.45	119.30	112.90	109.95	106.60	104.00
25/32	.7812	43225	43625	43825	103.00	.6245	6	2 1/2	3/4	9 1/2	0.7531-0.7840	141.15	122.05	115.65	112.60	109.35	106.70
13/16	.8125	43226	43626	43826	103.00	.6245	6	2 1/2	3/4	9 1/2	0.7841-0.8160	141.15	122.05	115.65	112.60	109.35	106.70
27/32	.8438	43227	43627	43827	108.45	.6245	6	2 1/2	3/4	9 1/2	0.8161-0.8470	146.55	127.55	121.10	118.10	114.75	112.15
7/8	.8750	43228	43628	43828	112.55	.7495	6	2 5/8	3/4	10	0.8471-0.8780	152.20	132.40	125.70	122.50	119.10	116.35
29/32	.9062	43229	43629	43829	131.15	.7495	6	2 5/8	3/4	10	0.8781-0.9090	170.75	150.85	144.20	141.10	137.70	135.05
15/16	.9375	43230	43630	43830	131.15	.7495	8	2 5/8	3/4	10	0.9091-0.9410	170.75	150.85	144.20	141.10	137.70	135.05
31/32	.9688	43231	43631	43831	137.55	.7495	8	2 5/8	3/4	10	0.9411-0.9720	177.25	157.35	150.60	147.50	144.05	141.30
1	1.0000	43232	43632	43832	137.55	.8745	8	2 3/4	3/4	10 1/2	0.9721-1.0030	177.25	157.35	150.60	147.50	144.05	141.30
1 1/16	1.0625	43234	43634	43834	147.55	.8745	8	2 3/4	3/4	10 1/2	1.0031-1.0660	187.20	167.30	160.70	157.55	154.20	151.45
1 1/8	1.1250	43236	43636	43836	152.15	.8745	8	2 7/8	7/8	11	1.0661-1.1280	191.85	171.90	165.30	162.05	158.70	155.95
1 3/16	1.1875	43238	43638	43838	159.80	.9995	8	2 7/8	7/8	11	1.1281-1.1905	199.45	179.60	172.95	169.85	166.35	163.65
1 1/4	1.2500	43240	43640	43840	169.25	.9995	8	3	7/8	11 1/2	1.1906-1.2530	208.95	189.05	182.45	179.10	175.80	173.10
1 5/16	1.3125	43242	43642	43842	187.20	.9995	8	3	7/8	11 1/2	1.2531-1.3155	226.85	206.95	200.40	197.20	193.80	191.15
1 3/8	1.3750	43244	43644	43844	205.00	.9995	8	3 1/4	7/8	12	1.3156-1.3780	244.70	224.85	218.20	215.00	211.60	209.00
1 7/16	1.4375	43246	43646	43846	217.30	.9995	8	3 1/4	7/8	12	1.3781-1.4405	256.95	237.05	230.45	227.30	223.80	221.15
1 1/2	1.5000	43248	43648	43848	229.55	1.2495	8	3 1/2	7/8	12 1/2	1.4406-1.5030	269.15	249.30	242.60	239.50	236.05	233.35

*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

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

REAMERS

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

MODIFICATIONS (Prompt delivery)

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

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

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

TOOL DIAMETER		TYPE 442 NON-FERROUS EDP NO.	TYPE 443 NAS/ CAST IRON EDP NO.	TYPE 444 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
5/16	.3125	44210	44310	44410	$72.75	.2792	4	1 1/2	6	0.2841 - 0.3150	$108.50	$90.65	$84.60	$81.75	$78.70	$76.25
11/32	.3438	44211	44311	44411	80.15	.2792	4	1 1/2	6	0.3151 - 0.3470	115.95	98.00	92.00	89.20	86.00	83.65
3/8	.3750	44212	44312	44412	80.80	.3105	4	1 3/4	7	0.3471 - 0.3780	116.75	98.75	92.70	89.85	86.80	84.40
13/32	.4062	44213	44313	44413	84.50	.3105	4	1 3/4	7	0.3781 - 0.4090	120.25	102.35	96.30	93.40	90.45	88.00
7/16	.4375	44214	44314	44414	87.75	.3730	6	1 3/4	7	0.4091 - 0.4410	123.50	105.60	99.65	96.80	93.75	91.15
15/32	.4688	44215	44315	44415	93.30	.3730	6	1 3/4	7	0.4411 - 0.4720	129.15	111.15	105.15	102.35	99.20	96.85
1/2	.5000	44216	44316	44416	100.65	.4355	6	2	8	0.4721 - 0.5030	138.80	119.75	113.20	110.25	106.95	104.35
17/32	.5312	44217	44317	44417	103.55	.4355	6	2	8	0.5031 - 0.5340	141.80	122.55	116.10	113.10	109.95	107.30
9/16	.5625	44218	44318	44418	103.55	.4355	6	2	8	0.5341 - 0.5660	141.80	122.55	116.10	113.10	109.95	107.30
19/32	.5938	44219	44319	44419	106.60	.4355	6	2	8	0.5661 - 0.5970	144.80	125.60	119.25	116.10	112.90	110.30
5/8	.6250	44220	44320	44420	106.60	.5615	6	2 1/4	9	0.5971 - 0.6280	144.80	125.60	119.25	116.10	112.90	110.30
21/32	.6562	44221	44321	44421	110.00	.5615	6	2 1/4	9	0.6281 - 0.6590	148.15	128.95	122.55	119.55	116.25	113.70
11/16	.6875	44222	44322	44422	116.75	.5615	6	2 1/4	9	0.6591 - 0.6910	154.95	135.85	129.35	126.35	123.15	120.50
23/32	.7188	44223	44323	44423	118.50	.5615	6	2 1/4	9	0.6911 - 0.7220	156.75	137.55	131.25	128.10	124.90	122.25
3/4	.7500	44224	44324	44424	120.30	.6245	6	2 1/2	9 1/2	0.7221 - 0.7530	158.45	139.40	132.95	130.00	126.65	124.10
25/32	.7812	44225	44325	44425	123.50	.6245	6	2 1/2	9 1/2	0.7531 - 0.7840	161.75	142.60	136.10	133.05	129.85	127.25
13/16	.8125	44226	44326	44426	123.50	.6245	6	2 1/2	9 1/2	0.7841 - 0.8160	161.75	142.60	136.10	133.05	129.85	127.25
27/32	.8438	44227	44327	44427	130.20	.6245	6	2 1/2	9 1/2	0.8161 - 0.8470	168.40	149.20	142.80	139.80	136.55	133.90
7/8	.8750	44228	44328	44428	135.10	.7495	6	2 5/8	10	0.8471 - 0.8780	174.70	154.90	148.25	145.05	141.75	139.00
29/32	.9062	44229	44329	44429	157.40	.7495	6	2 5/8	10	0.8781 - 0.9090	197.10	177.25	170.50	167.30	164.05	161.30
15/16	.9375	44230	44330	44430	157.40	.7495	8	2 5/8	10	0.9091 - 0.9410	197.10	177.25	170.50	167.30	164.05	161.30
31/32	.9688	44231	44331	44431	165.00	.7495	8	2 5/8	10	0.9411 - 0.9720	204.75	184.85	178.20	175.10	171.60	168.95
1	1.0000	44232	44332	44432	165.00	.8745	8	2 3/4	10 1/2	0.9721 - 1.0030	204.75	184.85	178.20	175.10	171.60	168.95
1 1/16	1.0625	44234	44334	44434	194.00	.8745	8	2 3/4	10 1/2	1.0031 - 1.0660	233.75	213.75	207.10	204.00	200.55	197.85
1 1/8	1.1250	44236	44336	44436	200.00	.8745	8	2 7/8	11	1.0661 - 1.1280	239.65	219.75	213.10	210.00	206.65	203.95
1 3/16	1.1875	44238	44338	44438	210.20	.9995	8	2 7/8	11	1.1281 - 1.1905	249.90	230.00	223.45	220.20	216.80	214.20
1 1/4	1.2500	44240	44340	44440	222.45	.9995	8	3	11 1/2	1.1906 - 1.2530	262.15	242.30	235.65	232.50	229.00	226.40
1 5/16	1.3125	44242	44342	44442	246.15	.9995	8	3	11 1/2	1.2531 - 1.3155	285.85	266.00	259.30	256.20	252.75	250.00
1 3/8	1.3750	44244	44344	44444	269.70	.9995	8	3 1/4	12	1.3156 - 1.3780	309.30	289.45	282.90	279.60	276.25	273.60
1 7/16	1.4375	44246	44346	44446	285.80	.9995	8	3 1/4	12	1.3781 - 1.4405	325.30	305.45	298.85	295.75	292.35	289.65
1 1/2	1.5000	44248	44348	44448	301.85	1.2495	8	3 1/2	12 1/2	1.4406 - 1.5030	341.50	321.60	314.90	311.90	308.35	305.80

*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

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

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

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						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
3/16	.1875	43306	43706	43906	$64.50	.1805	4	1 1/8	1/2	4 1/2	0.1770-0.2040	$102.70	$83.60	$77.20	$74.15	$70.90	$68.25
7/32	.2188	43307	43707	43907	64.50	.2075	4	1 1/4	1/2	5	0.2041-0.2210	102.70	83.60	77.20	74.15	70.90	68.25
15/64	.2344	4332344	4372344	4392344	64.50	.2265	4	1 1/2	1/2	6	0.2211-0.2380	102.70	83.60	77.20	74.15	70.90	68.25
1/4	.2500	43308	43708	43908	64.50	.2405	4	1 1/2	1/2	6	0.2381-0.2530	102.70	83.60	77.20	74.15	70.90	68.25
9/32	.2812	43309	43709	43909	64.70	.2485	4	1 1/2	1/2	6	0.2531-0.2840	102.95	83.75	77.40	74.25	71.00	68.50
5/16	.3125	43310	43710	43910	64.70	.2792	4	1 1/2	1/2	6	0.2841-0.3150	102.95	83.75	77.40	74.25	71.00	68.50
11/32	.3438	43311	43711	43911	71.20	.2792	4	1 1/2	5/8	6	0.3151-0.3470	109.45	90.40	83.95	80.80	77.60	75.05
3/8	.3750	43312	43712	43912	71.90	.3105	4	1 3/4	5/8	7	0.3471-0.3780	110.10	90.95	84.55	81.45	78.20	75.55
13/32	.4062	43313	43713	43913	75.10	.3105	4	1 3/4	5/8	7	0.3781-0.4090	113.20	94.15	87.75	84.70	81.40	78.85
7/16	.4375	43314	43714	43914	78.00	.3730	6	1 3/4	5/8	7	0.4091-0.4410	116.10	97.00	90.65	87.65	84.25	81.75
15/32	.4688	43315	43715	43915	82.90	.3730	6	1 3/4	5/8	7	0.4411-0.4720	121.15	102.10	95.65	92.60	89.30	86.70
1/2	.5000	43316	43716	43916	85.95	.4355	6	2	5/8	8	0.4721-0.5030	125.20	105.55	99.00	95.85	92.55	89.85
17/32	.5312	43317	43717	43917	88.60	.4355	6	2	5/8	8	0.5031-0.5340	127.80	108.10	101.50	98.45	95.10	92.35
9/16	.5625	43318	43718	43918	88.60	.4355	6	2	5/8	8	0.5341-0.5660	127.80	108.10	101.50	98.45	95.10	92.35
19/32	.5938	43319	43719	43919	91.30	.4355	6	2	5/8	8	0.5661-0.5970	130.50	110.80	104.30	101.20	97.80	95.15
5/8	.6250	43320	43720	43920	91.30	.5615	6	2 1/4	5/8	9	0.5971-0.6280	130.50	110.80	104.30	101.20	97.80	95.15
21/32	.6562	43321	43721	43921	94.00	.5615	6	2 1/4	5/8	9	0.6281-0.6590	133.25	113.60	107.00	103.80	100.45	97.85
11/16	.6875	43322	43722	43922	99.95	.5615	6	2 1/4	5/8	9	0.6591-0.6910	139.15	119.55	112.95	109.70	106.50	103.75
23/32	.7188	43323	43723	43923	101.45	.5615	6	2 1/4	5/8	9	0.6911-0.7220	140.70	121.05	114.50	111.40	107.95	105.40
3/4	.7500	43324	43724	43924	102.95	.6245	6	2 1/2	3/4	9 1/2	0.7221-0.7530	142.15	122.50	115.95	112.85	109.45	106.75
25/32	.7812	43325	43725	43925	105.70	.6245	6	2 1/2	3/4	9 1/2	0.7531-0.7840	145.00	125.30	118.75	115.60	112.25	109.55
13/16	.8125	43326	43726	43926	105.70	.6245	6	2 1/2	3/4	9 1/2	0.7841-0.8160	145.00	125.30	118.75	115.60	112.25	109.55
27/32	.8438	43327	43727	43927	111.40	.6245	6	2 1/2	3/4	9 1/2	0.8161-0.8470	150.60	130.95	124.30	121.20	117.80	115.20
7/8	.8750	43328	43728	43928	115.60	.7495	6	2 5/8	3/4	10	0.8471-0.8780	156.35	135.90	128.95	125.80	122.25	119.50
29/32	.9062	43329	43729	43929	134.65	.7495	6	2 5/8	3/4	10	0.8781-0.9090	175.30	154.95	148.15	144.85	141.30	138.65
15/16	.9375	43330	43730	43930	134.65	.7495	8	2 5/8	3/4	10	0.9091-0.9410	175.30	154.95	148.15	144.85	141.30	138.65
31/32	.9688	43331	43731	43931	141.15	.7495	8	2 5/8	3/4	10	0.9411-0.9720	181.90	161.55	154.70	151.45	147.95	145.20
1	1.0000	43332	43732	43932	141.15	.8745	8	2 3/4	3/4	10 1/2	0.9721-1.0030	181.90	161.55	154.70	151.45	147.95	145.20
1 1/16	1.0625	43334	43734	43934	151.50	.8745	8	2 3/4	3/4	10 1/2	1.0031-1.0660	192.15	171.90	164.95	161.75	158.25	155.50
1 1/8	1.1250	43336	43736	43936	156.20	.8745	8	2 7/8	7/8	11	1.0661-1.1280	196.95	176.50	169.65	166.40	162.95	160.20
1 3/16	1.1875	43338	43738	43938	164.15	.9995	8	2 7/8	7/8	11	1.1281-1.1905	204.80	184.45	177.55	174.30	170.85	168.10
1 1/4	1.2500	43340	43740	43940	173.70	.9995	8	3	7/8	11 1/2	1.1906-1.2530	214.40	194.10	187.20	184.00	180.45	177.65
1 5/16	1.3125	43342	43742	43942	192.15	.9995	8	3	7/8	11 1/2	1.2531-1.3155	232.95	212.65	205.70	202.50	198.90	196.30
1 3/8	1.3750	43344	43744	43944	210.55	.9995	8	3 1/4	7/8	12	1.3156-1.3780	251.30	230.85	224.00	220.80	217.30	214.50
1 7/16	1.4375	43346	43746	43946	223.15	.9995	8	3 1/4	7/8	12	1.3781-1.4405	263.75	243.40	236.65	233.30	229.85	227.10
1 1/2	1.5000	43348	43748	43948	235.75	1.2495	8	3 1/2	7/8	12 1/2	1.4406-1.5030	276.45	255.95	249.15	245.95	242.45	239.65

*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

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

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

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

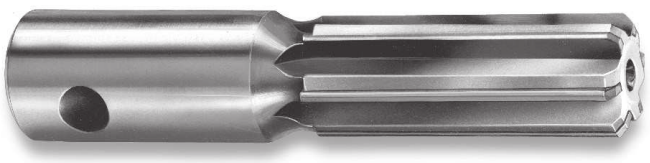
NOTE: For step reamers, see page 100. For smaller tool diameter, see solid carbide reamers on pages 104 & 111.

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						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
5/16	.3125	48210	48310	48410	$77.60	.2792	4	1 ½	6	0.2841 - 0.3150	$115.85	$96.60	$90.30	$87.15	$83.95	$81.35
11/32	.3438	48211	48311	48411	85.45	.2792	4	1 ½	6	0.3151 - 0.3470	123.65	104.50	98.15	95.10	91.80	89.25
3/8	.3750	48212	48312	48412	86.30	.3105	4	1 ¾	7	0.3471 - 0.3780	124.45	105.40	98.95	95.85	92.60	89.95
13/32	.4062	48213	48313	48413	90.00	.3105	4	1 ¾	7	0.3781 - 0.4090	128.30	109.25	102.70	99.70	96.35	93.85
7/16	.4375	48214	48314	48414	93.70	.3730	6	1 ¾	7	0.4091 - 0.4410	131.75	112.70	106.25	103.25	99.90	97.40
15/32	.4688	48215	48315	48415	99.60	.3730	6	1 ¾	7	0.4411 - 0.4720	137.80	118.60	112.15	109.25	105.85	103.30
1/2	.5000	48216	48316	48416	103.30	.4355	6	2	8	0.4721 - 0.5030	142.60	122.90	116.30	113.15	109.70	107.15
17/32	.5312	48217	48317	48417	106.30	.4355	6	2	8	0.5031 - 0.5340	145.55	125.80	119.30	116.10	112.85	110.15
9/16	.5625	48218	48318	48418	106.30	.4355	6	2	8	0.5341 - 0.5660	145.55	125.80	119.30	116.10	112.85	110.15
19/32	.5938	48219	48319	48419	109.45	.4355	6	2	8	0.5661 - 0.5970	148.65	128.95	122.40	119.30	115.95	113.20
5/8	.6250	48220	48320	48420	109.45	.5615	6	2 ¼	9	0.5971 - 0.6280	148.65	128.95	122.40	119.30	115.95	113.20
21/32	.6562	48221	48321	48421	112.90	.5615	6	2 ¼	9	0.6281 - 0.6590	152.15	132.50	125.80	122.80	119.40	116.75
11/16	.6875	48222	48322	48422	119.85	.5615	6	2 ¼	9	0.6591 - 0.6910	159.05	139.45	132.80	129.80	126.35	123.65
23/32	.7188	48223	48323	48423	121.75	.5615	6	2 ¼	9	0.6911 - 0.7220	160.90	141.20	134.70	131.55	128.15	125.55
3/4	.7500	48224	48324	48424	123.50	.6245	6	2 ½	9 ½	0.7221 - 0.7530	162.75	143.15	136.55	133.35	130.10	127.40
25/32	.7812	48225	48325	48425	126.80	.6245	6	2 ½	9 ½	0.7531 - 0.7840	166.05	146.40	139.80	136.75	133.30	130.65
13/16	.8125	48226	48326	48426	126.80	.6245	6	2 ½	9 ½	0.7841 - 0.8160	166.05	146.40	139.80	136.75	133.30	130.65
27/32	.8438	48227	48327	48427	133.70	.6245	6	2 ½	9 ½	0.8161 - 0.8470	172.85	153.20	146.55	143.45	140.15	137.50
7/8	.8750	48228	48328	48428	138.75	.7495	6	2 ⅝	10	0.8471 - 0.8780	179.40	159.00	152.20	148.95	145.40	142.70
29/32	.9062	48229	48329	48429	161.60	.7495	6	2 ⅝	10	0.8781 - 0.9090	202.30	181.90	175.10	171.90	168.35	165.60
15/16	.9375	48230	48330	48430	161.60	.7495	8	2 ⅝	10	0.9091 - 0.9410	202.30	181.90	175.10	171.90	168.35	165.60
31/32	.9688	48231	48331	48431	169.45	.7495	8	2 ⅝	10	0.9411 - 0.9720	210.20	189.80	183.05	179.75	176.25	173.55
1	1.0000	48232	48332	48432	169.45	.8745	8	2 ¾	10 ½	0.9721 - 1.0030	210.20	189.80	183.05	179.75	176.25	173.55
1 1/16	1.0625	48234	48334	48434	199.25	.8745	8	2 ¾	10 ½	1.0031 - 1.0660	239.90	219.55	212.75	209.35	205.95	203.25
1 1/8	1.1250	48236	48336	48436	205.40	.8745	8	2 ⅞	11	1.0661 - 1.1280	246.10	225.75	218.80	215.60	212.10	209.30
1 3/16	1.1875	48238	48338	48438	215.90	.9995	8	2 ⅞	11	1.1281 - 1.1905	256.55	236.20	229.35	226.05	222.55	219.80
1 1/4	1.2500	48240	48340	48440	228.55	.9995	8	3	11 ½	1.1906 - 1.2530	269.15	248.80	241.95	238.65	235.20	232.50
1 5/16	1.3125	48242	48342	48442	252.75	.9995	8	3	11 ½	1.2531 - 1.3155	293.45	273.00	266.25	263.00	259.50	256.80
1 3/8	1.3750	48244	48344	48444	276.95	.9995	8	3 ¼	12	1.3156 - 1.3780	317.60	297.30	290.40	287.10	283.70	280.85
1 7/16	1.4375	48246	48346	48446	293.40	.9995	8	3 ¼	12	1.3781 - 1.4405	334.10	313.60	306.85	303.65	300.15	297.40
1 1/2	1.5000	48248	48348	48448	309.90	1.2495	8	3 ½	12 ½	1.4406 - 1.5030	350.60	330.25	323.50	320.10	316.65	314.05

*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

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

MODIFICATIONS (Prompt delivery)

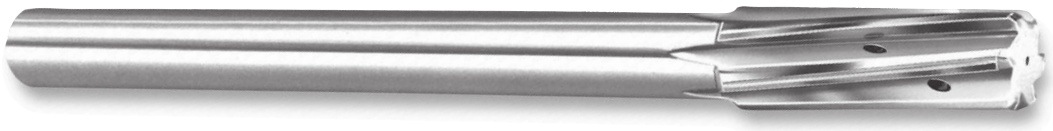
- Modified tool diameter - priced below
- Metric tool diameter
- Closer tool diameter tolerance - pg. 29
- Cutting diameter reduced for step or pilot
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diam. back taper
- Reduced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

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						
						SHANK DIAM.	NO. OF FLTS	LENGTH			PIN HOLE DIAM.	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL			1	2	3	4	5-7	8-14*
3/16	.1875	47006	47106	47506	$62.35	1/4	4	1	1/2	2 1/4	3/32	0.1770-0.2040	$100.45	$81.40	$75.05	$72.00	$68.65	$66.10
7/32	.2188	47007	47107	47507	62.35	1/4	4	1	1/2	2 1/4	3/32	0.2041-0.2210	100.45	81.40	75.05	72.00	68.65	66.10
15/64	.2344	4702344	4712344	4752344	62.35	1/4	4	1	1/2	2 1/4	3/32	0.2211-0.2380	100.45	81.40	75.05	72.00	68.65	66.10
1/4	.2500	47008	47108	47508	62.35	1/4	4	1	1/2	2 1/4	3/32	0.2381-0.2530	100.45	81.40	75.05	72.00	68.65	66.10
9/32	.2812	47009	47109	47509	62.35	3/8	4	1	1/2	2 1/4	1/8	0.2531-0.2840	100.45	81.40	75.05	72.00	68.65	66.10
5/16	.3125	47010	47110	47510	72.45	3/8	4	1	1	2 1/4	1/8	0.2841-0.3150	110.70	91.65	85.20	82.10	78.85	76.25
11/32	.3438	47011	47111	47511	73.15	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3151-0.3470	111.40	92.20	85.80	82.75	79.40	76.85
3/8	.3750	47012	47112	47512	79.30	3/8	4	1 1/4	1 1/4	2 1/2	1/8	0.3471-0.3780	117.45	98.40	91.95	88.95	85.70	83.00
13/32	.4062	47013	47113	47513	80.50	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.3781-0.4090	118.70	99.60	93.15	90.00	86.80	84.20
7/16	.4375	47014	47114	47514	95.20	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4091-0.4410	133.50	114.30	107.90	104.85	101.50	99.00
15/32	.4688	47015	47115	47515	95.20	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4411-0.4720	133.50	114.30	107.90	104.85	101.50	99.00
1/2	.5000	47016	47116	47516	108.80	1/2	4	1 1/4	1 1/4	2 1/2	3/16	0.4721-0.5030	149.75	129.20	122.25	118.95	115.50	112.80
17/32	.5312	47017	47117	47517	108.80	5/8	6	1 1/2	1 1/2	3	1/4	0.5031-0.5340	149.75	129.20	122.25	118.95	115.50	112.80
9/16	.5625	47018	47118	47518	114.65	5/8	6	1 1/2	1 1/2	3	1/4	0.5341-0.5660	155.55	135.05	128.10	124.90	121.35	118.60
19/32	.5938	47019	47119	47519	114.65	5/8	6	1 1/2	1 1/2	3	1/4	0.5661-0.5970	155.55	135.05	128.10	124.90	121.35	118.60
5/8	.6250	47020	47120	47520	117.65	5/8	6	1 1/2	1 1/2	3	1/4	0.5971-0.6280	158.60	138.15	131.35	128.00	124.45	121.75
21/32	.6562	47021	47121	47521	117.65	5/8	6	1 1/2	1 1/2	3	1/4	0.6281-0.6590	158.60	138.15	131.35	128.00	124.45	121.75
11/16	.6875	47022	47122	47522	123.25	5/8	6	1 1/2	1 1/2	3	1/4	0.6591-0.6910	164.15	143.65	136.80	133.55	130.10	127.25
23/32	.7188	47023	47123	47523	123.25	3/4	6	1 1/2	1 1/2	3	5/16	0.6911-0.7220	164.15	143.65	136.80	133.55	130.10	127.25
3/4	.7500	47024	47124	47524	126.35	3/4	6	1 1/2	1 1/2	3	5/16	0.7221-0.7530	167.25	146.85	139.85	136.60	133.05	130.30
25/32	.7812	47025	47125	47525	126.35	3/4	6	1 1/2	1 1/2	3	5/16	0.7531-0.7840	167.25	146.85	139.85	136.60	133.05	130.30
13/16	.8125	47026	47126	47526	137.20	3/4	6	1 1/2	1 1/2	3	5/16	0.7841-0.8160	178.15	157.70	150.80	147.50	144.00	141.15
27/32	.8438	47027	47127	47527	137.20	3/4	6	1 1/2	1 1/2	3	5/16	0.8161-0.8470	178.15	157.70	150.80	147.50	144.00	141.15
7/8	.8750	47028	47128	47528	149.95	3/4	6	1 1/2	1 1/2	3	5/16	0.8471-0.8780	192.40	171.15	164.10	160.65	156.90	154.20
29/32	.9062	47029	47129	47529	149.95	3/4	6	1 1/2	1 1/2	3	5/16	0.8781-0.9090	192.40	171.15	164.10	160.65	156.90	154.20
15/16	.9375	47030	47130	47530	165.05	3/4	6	1 1/2	1 1/2	3	5/16	0.9091-0.9410	207.65	186.30	179.30	175.85	172.20	169.35
31/32	.9688	47031	47131	47531	165.05	3/4	8	1 1/2	1 1/2	3	5/16	0.9411-0.9720	207.65	186.30	179.30	175.85	172.20	169.35
1	1.0000	47032	47132	47532	173.30	3/4	8	1 1/2	1 1/2	3	5/16	0.9721-1.0030	215.80	194.55	187.30	184.00	180.35	177.50
1 1/16	1.0625	47034	47134	47534	166.05	3/4	8	1 1/2	1 1/2	3	5/16	1.0031-1.0660	206.85	186.35	179.60	176.40	172.80	170.05
1 1/8	1.1250	47036	47136	47536	194.30	3/4	8	1 1/2	1 1/2	3	5/16	1.0661-1.1280	235.05	214.60	207.80	204.60	201.05	198.30
1 3/16	1.1875	47038	47138	47538	202.65	3/4	8	1 1/2	1 1/2	3	5/16	1.1281-1.1905	243.30	222.95	216.10	212.90	209.30	206.65
1 1/4	1.2500	47040	47140	47540	237.40	3/4	8	1 1/2	1 1/2	3	5/16	1.1906-1.2530	278.10	257.75	250.95	247.65	244.20	241.40
1 5/16	1.3125	47042	47142	47542	237.40	3/4	8	1 1/2	1 1/2	3	5/16	1.2531-1.3155	278.10	257.75	250.95	247.65	244.20	241.40
1 3/8	1.3750	47044	47144	47544	240.75	3/4	8	1 1/2	1 1/2	3	5/16	1.3156-1.3780	281.40	261.00	254.15	250.95	247.45	244.70
1 7/16	1.4375	47046	47146	47546	280.70	3/4	8	1 1/2	1 1/2	3	5/16	1.3781-1.4405	321.40	300.95	294.10	290.90	287.40	284.60
1 1/2	1.5000	47048	47148	47548	337.10	3/4	8	1 1/2	1 1/2	3	5/16	1.4406-1.5030	377.85	357.45	350.55	347.40	343.85	341.15

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

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

ADVANTAGES & APPLICATION RECOMMENDATIONS



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

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

MAXIMUM TOOL LIFE
- Use of premium carbide grades based on material specific application

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

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

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

STEP REAMERS
CUTTING OR NON-CUTTING PILOT

LOW COST & PROMPT DELIVERY

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

STEP REAMER MODIFICATIONS
- Modified tool diameter
- Metric tool diameter
- Closer tool diameter tolerance
- End chamfer other than 45°
- End cutting or corner radius
- Increased/decreased circular margin
- Increased/decreased tool diameter back taper
- Shortened shank or reduced shank diameter
- Flat(s) or tang on shank
- Coatings available:
  - TITANIUM NITRIDE – TiN
  - TITANIUM CARBONITRIDE – TiCN
  - ZIRCONIUM NITRIDE – ZrN
  - AL TITANIUM NITRIDE – AlTiN

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

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

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

MATERIAL SPECIFIC COOLANT FED

CENTER FED FOR BLIND HOLES
STRAIGHT FLUTES & SHANK

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

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

MODIFICATIONS (See list on page 94)

TOOL DIAMETER		TYPE 414 NON-FERROUS EDP NO.	TYPE 424 CAST IRON EDP NO.	TYPE 434 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS					FINISHED TO MODIFIED TOOL DIAMETER						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
3/16	.1875	41406	42406	43406	$131.00	.1805	4	1 1/4	1/2	5	0.1770 - 0.2040	$172.00	$151.45	$144.55	$141.30	$137.80	$135.05
13/64	.2031	4142031	4242031	4342031	131.00	.1805	4	1 1/4	1/2	5	-	-	-	-	-	-	-
7/32	.2188	41407	42407	43407	131.00	.2075	4	1 1/4	1/2	5	0.2041 - 0.2210	172.00	151.45	144.55	141.30	137.80	135.05
15/64	.2344	4142344	4242344	4342344	131.00	.2265	4	1 1/2	1/2	6	0.2211 - 0.2380	172.00	151.45	144.55	141.30	137.80	135.05
1/4	.2500	41408	42408	43408	131.00	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	172.00	151.45	144.55	141.30	137.80	135.05
17/64	.2656	4142656	4242656	4342656	139.05	.2485	4	1 1/2	1/2	6	-	-	-	-	-	-	-
9/32	.2812	41409	42409	43409	139.05	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	180.00	159.50	152.60	149.30	145.80	143.10
19/64	.2969	4142969	4242969	4342969	146.90	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
5/16	.3125	41410	42410	43410	146.90	.2792	4	1 1/2	1 1/2	6	0.2841 - 0.3150	187.85	167.25	160.40	157.00	153.65	150.85
21/64	.3281	4143281	4243281	4343281	148.00	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
11/32	.3438	41411	42411	43411	148.00	.2792	4	1 1/2	1 1/2	6	0.3151 - 0.3470	188.95	168.40	161.60	158.25	154.80	152.10
23/64	.3594	4143594	4243594	4343594	149.50	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	41412	42412	43412	149.50	.3105	4	1 3/4	1 3/4	7	0.3471 - 0.3780	190.50	169.95	163.10	159.75	156.25	153.55
25/64	.3906	4143906	4243906	4343906	150.00	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	41413	42413	43413	150.00	.3105	4	1 3/4	1 3/4	7	0.3781 - 0.4090	190.90	170.50	163.60	160.30	156.80	153.95
27/64	.4219	4144219	4244219	4344219	151.50	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	41414	42414	43414	151.50	.3730	6	1 3/4	1 3/4	7	0.4091 - 0.4410	192.45	172.00	165.00	161.85	158.25	155.55
29/64	.4531	4144531	4244531	4344531	152.80	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
15/32	.4688	41415	42415	43415	152.80	.3730	6	1 3/4	1 3/4	7	0.4411 - 0.4720	193.80	173.30	166.40	163.15	159.60	156.85
31/64	.4844	4144844	4244844	4344844	154.55	.4355	6	2	2	8	-	-	-	-	-	-	-
1/2	.5000	41416	42416	43416	154.55	.4355	6	2	2	8	0.4721 - 0.5030	195.55	175.10	168.25	164.90	161.45	158.60
33/64	.5156	4145156	4245156	4345156	158.05	.4355	6	2	2	8	-	-	-	-	-	-	-
17/32	.5312	41417	42417	43417	158.05	.4355	6	2	2	8	0.5031 - 0.5340	198.90	178.45	171.60	168.35	164.85	162.00
9/16	.5625	41418	42418	43418	160.30	.4355	6	2	2	8	0.5341 - 0.5660	201.25	180.70	173.85	170.65	167.10	164.30
19/32	.5938	41419	42419	43419	163.65	.4355	6	2	2	8	0.5661 - 0.5970	204.60	184.05	177.25	174.00	170.50	167.70
5/8	.6250	41420	42420	43420	166.75	.5615	6	2 1/4	2 1/4	9	0.5971 - 0.6280	207.70	187.15	180.35	176.95	173.55	170.75
21/32	.6562	41421	42421	43421	184.60	.5615	6	2 1/4	2 1/4	9	0.6281 - 0.6590	225.50	205.00	198.10	194.95	191.35	188.60
11/16	.6875	41422	42422	43422	188.35	.5615	6	2 1/4	2 1/4	9	0.6591 - 0.6910	229.25	208.85	201.85	198.70	195.15	192.35
23/32	.7188	41423	42423	43423	196.45	.5615	6	2 1/4	2 1/4	9	0.6911 - 0.7220	237.35	216.95	210.10	206.80	203.30	200.45
3/4	.7500	41424	42424	43424	196.45	.6245	6	2 1/2	2 1/2	9 1/2	0.7221 - 0.7530	237.35	216.95	210.10	206.80	203.30	200.45
25/32	.7812	41425	42425	43425	202.30	.6245	6	2 1/2	2 1/2	9 1/2	0.7531 - 0.7840	243.20	222.65	215.90	212.65	209.05	206.25
13/16	.8125	41426	42426	43426	202.30	.6245	6	2 1/2	2 1/2	9 1/2	0.7841 - 0.8160	243.20	222.65	215.90	212.65	209.05	206.25
27/32	.8438	41427	42427	43427	209.20	.6245	6	2 1/2	2 1/2	9 1/2	0.8161 - 0.8470	250.10	229.70	222.70	219.50	216.00	213.15
7/8	.8750	41428	42428	43428	217.15	.7495	6	2 5/8	2 5/8	10	0.8471 - 0.8780	259.60	238.25	231.15	227.75	224.15	221.25
29/32	.9062	41429	42429	43429	241.05	.7495	6	2 5/8	2 5/8	10	0.8781 - 0.9090	283.55	262.25	255.10	251.80	248.05	245.30
15/16	.9375	41430	42430	43430	241.05	.7495	8	2 5/8	2 5/8	10	0.9091 - 0.9410	283.55	262.25	255.10	251.80	248.05	245.30
31/32	.9688	41431	42431	43431	242.00	.7495	8	2 5/8	2 5/8	10	0.9411 - 0.9720	284.50	263.25	256.20	252.75	249.00	246.20
1	1.0000	41432	42432	43432	242.00	.8745	8	2 3/4	2 3/4	10 1/2	0.9721 - 1.0030	284.50	263.25	256.20	252.75	249.00	246.20
1 1/16	1.0625	41434	42434	43434	248.90	.8745	8	2 3/4	2 3/4	10 1/2	1.0031 - 1.0660	291.40	270.10	262.95	259.60	255.85	253.05
1 1/8	1.1250	41436	42436	43436	257.55	.8745	8	2 7/8	2 7/8	11	1.0661 - 1.1280	300.00	278.75	271.50	268.15	264.50	261.60
1 3/16	1.1875	41438	42438	43438	275.85	.9995	8	2 7/8	2 7/8	11	1.1281 - 1.1905	318.35	297.00	289.80	286.55	282.90	280.05
1 1/4	1.2500	41440	42440	43440	279.40	.9995	8	3	3	11 1/2	1.1906 - 1.2530	322.00	300.65	293.50	290.20	286.55	283.70
1 5/16	1.3125	41442	42442	43442	287.45	.9995	8	3	3	11 1/2	1.2531 - 1.3155	330.00	308.65	301.55	298.05	294.50	291.65
1 3/8	1.3750	41444	42444	43444	299.10	.9995	8	3 1/4	3 1/4	12	1.3156 - 1.3780	341.60	320.25	313.20	309.80	306.15	303.20
1 7/16	1.4375	41446	42446	43446	308.40	.9995	8	3 1/4	3 1/4	12	1.3781 - 1.4405	351.00	329.65	322.60	319.20	315.50	312.70
1 1/2	1.5000	41448	42448	43448	318.75	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406 - 1.5030	361.30	340.00	332.90	329.50	325.85	322.95

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

CONTINUED FROM PAGE 90 - TYPE 414, 424, 434 FRACTIONAL

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						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
1 9⁄16	1.5625	41450	42450	43450	$339.40	1.2495	8	3 ½	3 ½	12 ½	1.5031 - 1.5660	$379.90	$359.65	$352.85	$349.65	$346.05	$343.45
1 5⁄8	1.6250	41452	42452	43452	371.60	1.2495	8	3 ½	3 ½	13	1.5661 - 1.6280	412.00	391.80	385.05	381.70	378.25	375.60
1 11⁄16	1.6875	41454	42454	43454	379.40	1.2495	8	3 ½	3 ½	13	1.6281 - 1.6910	419.95	399.75	392.95	389.65	386.15	383.45
1 ¾	1.7500	41456	42456	43456	415.55	1.2495	10	3 ½	3 ½	13 ½	1.6911 - 1.7530	456.05	435.80	429.00	425.80	422.25	419.60
1 13⁄16	1.8125	41458	42458	43458	432.50	1.4995	10	3 ½	3 ½	13 ½	1.7531 - 1.8160	473.05	452.80	446.00	442.75	439.20	436.60
1 7⁄8	1.8750	41460	42460	43460	456.60	1.4995	10	3 ½	3 ½	14	1.8161 - 1.8780	497.15	476.80	470.10	466.85	463.35	460.60
1 15⁄16	1.9375	41462	42462	43462	484.10	1.4995	10	3 ½	3 ½	14	1.8781 - 1.9410	524.60	504.35	497.55	494.35	490.85	488.10
2	2.0000	41464	42464	43464	502.70	1.4995	12	3 ½	3 ½	14	1.9411 - 2.0030	543.25	523.05	516.20	512.95	509.45	506.75

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

MATERIAL SPECIFIC COOLANT FED

CENTER FED FOR BLIND HOLES
STRAIGHT FLUTES & SHANK

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 METRIC 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							
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH							FLT & CARB	OVER-ALL		1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	414045	424045	434045	$144.55	.1704	4	*1 ¼	5	4.494-4.696	$175.35	$154.95	$148.05	$144.80	$141.30	$138.45	$134.50
5.0	.1969	414050	424050	434050	144.55	.1805	4	*1 ¼	5	4.697-5.182	175.35	154.95	148.05	144.80	141.30	138.45	134.50
5.5	.2165	414055	424055	434055	144.55	.2075	4	*1 ¼	5	5.183-5.613	175.35	154.95	148.05	144.80	141.30	138.45	134.50
6.0	.2362	414060	424060	434060	144.55	.2265	4	*1 ½	6	5.614-6.045	175.35	154.95	148.05	144.80	141.30	138.45	134.50
-	-	414063	424063	434063	-	.2405	4	*1 ½	6	6.046-6.426	175.35	154.95	148.05	144.80	141.30	138.45	134.50
6.5	.2559	414065	424065	434065	152.60	.2485	4	*1 ½	6	6.427-7.214	183.40	162.95	156.10	152.75	149.30	146.45	142.60
7.0	.2756	414070	424070	434070	152.60	.2485	4	*1 ½	6	-	-	-	-	-	-	-	-
7.5	.2953	414075	424075	434075	160.40	.2792	4	1 ½	6	7.215-8.001	191.20	170.75	164.00	160.60	157.00	154.35	150.30
8.0	.3150	414080	424080	434080	160.40	.2792	4	1 ½	6	-	-	-	-	-	-	-	-
8.5	.3346	414085	424085	434085	161.60	.2792	4	1 ½	6	8.002-8.814	192.35	172.00	165.00	161.75	158.25	155.45	151.50
9.0	.3543	414090	424090	434090	163.10	.3105	4	1 ¾	7	8.815-9.601	193.85	173.45	166.55	163.20	159.75	156.90	153.10
9.5	.3740	414095	424095	434095	163.10	.3105	4	1 ¾	7	-	-	-	-	-	-	-	-
10.0	.3937	414100	424100	434100	163.60	.3105	4	1 ¾	7	9.602-10.389	194.35	174.00	167.10	163.75	160.30	157.45	153.55
10.5	.4134	414105	424105	434105	165.00	.3730	6	1 ¾	7	10.390-11.201	195.85	175.40	168.60	165.30	161.85	159.00	155.00
11.0	.4331	414110	424110	434110	165.00	.3730	6	1 ¾	7	-	-	-	-	-	-	-	-
11.5	.4528	414115	424115	434115	166.40	.3730	6	1 ¾	7	11.202-11.989	197.25	176.75	169.95	166.55	163.15	160.30	156.50
12.0	.4724	414120	424120	434120	168.25	.4355	6	2	8	11.990-12.776	198.90	178.65	171.65	168.35	164.90	162.00	158.10
12.5	.4921	414125	424125	434125	168.25	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	414130	424130	434130	171.60	.4355	6	2	8	12.777-13.564	202.45	182.00	175.15	171.70	168.35	165.45	161.60
13.5	.5315	414135	424135	434135	171.60	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	414140	424140	434140	173.85	.4355	6	2	8	13.565-14.376	204.70	184.20	177.45	174.10	170.65	167.75	163.80
14.5	.5709	414145	424145	434145	177.25	.4355	6	2	8	14.377-15.164	208.00	187.55	180.70	177.45	174.00	171.15	167.15
15.5	.6102	414155	424155	434155	180.35	.5615	6	2 ¼	9	15.165-15.951	211.10	190.75	183.85	180.45	176.95	174.20	170.20
16.0	.6299	414160	424160	434160	198.10	.5615	6	2 ¼	9	15.952-16.739	228.95	208.50	201.65	198.35	194.95	192.05	188.05
17.0	.6693	414170	424170	434170	201.85	.5615	6	2 ¼	9	16.740-17.551	232.75	212.25	205.50	202.10	198.70	195.80	191.90
18.0	.7087	414180	424180	434180	210.10	.5615	6	2 ¼	9	17.552-18.339	240.85	220.50	213.50	210.20	206.80	203.90	200.00
18.5	.7283	414185	424185	434185	210.10	.6245	6	2 ½	9 ½	18.340-19.126	240.85	220.50	213.50	210.20	206.80	203.90	200.00
19.5	.7677	414195	424195	434195	215.90	.6245	6	2 ½	9 ½	19.127-19.914	246.60	226.25	219.40	216.00	212.65	209.70	205.75
20.0	.7874	414200	424200	434200	215.90	.6245	6	2 ½	9 ½	19.915-20.726	246.60	226.25	219.40	216.00	212.65	209.70	205.75
21.0	.8268	414210	424210	434210	222.70	.6245	6	2 ½	9 ½	20.727-21.514	253.60	233.15	226.35	222.95	219.50	216.65	212.75
22.0	.8661	414220	424220	434220	222.70	.7495	6	2 ⅝	10	21.515-22.301	253.60	233.15	226.35	222.95	219.50	216.65	212.75
22.5	.8858	414225	424225	434225	255.10	.7495	6	2 ⅝	10	22.302-23.089	287.10	265.90	258.80	255.30	251.80	248.85	244.70
23.5	.9252	414235	424235	434235	255.10	.7495	8	2 ⅝	10	23.090-23.901	287.10	265.90	258.80	255.30	251.80	248.85	244.70
24.0	.9449	414240	424240	434240	256.20	.7495	8	2 ⅝	10	23.902-24.689	288.10	266.85	259.75	256.30	252.75	249.75	245.65
25.0	.9843	414250	424250	434250	256.20	.8745	8	2 ¾	10 ½	24.690-25.476	288.10	266.85	259.75	256.30	252.75	249.75	245.65
25.5	1.0039	414255	424255	434255	262.95	.8745	8	2 ¾	10 ½	25.477-27.076	294.90	273.70	266.65	263.15	259.60	256.65	252.55
28.0	1.1024	414280	424280	434280	271.50	.8745	8	2 ⅞	11	27.077-28.651	303.60	282.30	275.15	271.70	268.15	265.25	261.10
29.0	1.1417	414290	424290	434290	289.80	.9995	8	2 ⅞	11	28.652-30.239	321.95	300.65	293.50	290.05	286.55	283.55	279.40
31.0	1.2205	414310	424310	434310	293.50	.9995	8	3	11 ½	30.240-31.826	325.50	304.30	297.25	293.70	290.20	287.20	283.10
32.0	1.2598	414320	424320	434320	301.55	.9995	8	3	11 ½	31.827-33.414	333.50	312.25	305.25	301.75	298.05	295.20	291.10
34.0	1.3386	414340	424340	434340	313.20	.9995	8	3 ¼	12	33.415-35.001	345.15	323.90	316.85	313.35	309.80	306.80	302.75
36.0	1.4173	414360	424360	434360	322.60	.9995	8	3 ¼	12	35.002-36.589	354.50	333.25	326.20	322.75	319.20	316.25	312.15
37.0	1.4567	414370	424370	434370	332.90	1.2495	8	3 ½	12 ½	36.590-38.176	364.85	343.65	336.55	333.10	329.50	326.60	322.40

*½" carbide length

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

MATERIAL SPECIFIC COOLANT FED

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

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						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
3/16	.1875	41606	42606	43506	$135.95	.1805	4	1 1/4	1/2	5	0.1770 - 0.2040	$176.85	$156.50	$149.50	$146.25	$142.75	$139.90
13/64	.2031	4162031	4262031	4352031	135.95	.1805	4	1 1/4	1/2	5	-	-	-	-	-	-	-
7/32	.2188	41607	42607	43507	135.95	.2075	4	1 1/4	1/2	5	0.2041 - 0.2210	176.85	156.50	149.50	146.25	142.75	139.90
15/64	.2344	4162344	4262344	4352344	135.95	.2265	4	1 1/2	1/2	6	0.2211 - 0.2380	176.85	156.50	149.50	146.25	142.75	139.90
1/4	.2500	41608	42608	43508	135.95	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	176.85	156.50	149.50	146.25	142.75	139.90
17/64	.2656	4162656	4262656	4352656	139.05	.2485	4	1 1/2	1/2	6	-	-	-	-	-	-	-
9/32	.2812	41609	42609	43509	139.05	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	180.00	159.50	152.60	149.30	145.80	143.10
19/64	.2969	4162969	4262969	4352969	150.85	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
5/16	.3125	41610	42610	43510	150.85	.2792	4	1 1/2	1 1/2	6	0.2841 - 0.3150	191.85	171.25	164.35	161.15	157.70	154.90
21/64	.3281	4163281	4263281	4353281	150.85	.2792	4	1 1/2	1 1/2	6	-	-	-	-	-	-	-
11/32	.3438	41611	42611	43511	150.85	.2792	4	1 1/2	1 1/2	6	0.3151 - 0.3470	191.85	171.25	164.35	161.15	157.70	154.90
23/64	.3594	4163594	4263594	4353594	150.85	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	41612	42612	43512	150.85	.3105	4	1 3/4	1 3/4	7	0.3471 - 0.3780	191.85	171.25	164.35	161.15	157.70	154.90
25/64	.3906	4163906	4263906	4353906	154.55	.3105	4	1 3/4	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	41613	42613	43513	154.55	.3105	4	1 3/4	1 3/4	7	0.3781 - 0.4090	195.55	175.10	168.25	164.90	161.45	158.60
27/64	.4219	4164219	4264219	4354219	158.35	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	41614	42614	43514	158.35	.3730	6	1 3/4	1 3/4	7	0.4091 - 0.4410	199.30	178.80	172.00	168.65	165.25	162.40
29/64	.4531	4164531	4264531	4354531	158.35	.3730	6	1 3/4	1 3/4	7	-	-	-	-	-	-	-
15/32	.4688	41615	42615	43515	158.35	.3730	6	1 3/4	1 3/4	7	0.4411 - 0.4720	199.30	178.80	172.00	168.65	165.25	162.40
31/64	.4844	4164844	4264844	4354844	158.35	.4355	6	2	2	8	-	-	-	-	-	-	-
1/2	.5000	41616	42616	43516	158.35	.4355	6	2	2	8	0.4721 - 0.5030	199.30	178.80	172.00	168.65	165.25	162.40
33/64	.5156	4165156	4265156	4355156	167.50	.4355	6	2	2	8	-	-	-	-	-	-	-
17/32	.5312	41617	42617	43517	167.50	.4355	6	2	2	8	0.5031 - 0.5340	208.40	187.95	181.10	177.85	174.25	171.55
9/16	.5625	41618	42618	43518	169.90	.4355	6	2	2	8	0.5341 - 0.5660	210.80	190.35	183.40	180.15	176.60	173.85
19/32	.5938	41619	42619	43519	171.40	.4355	6	2	2	8	0.5661 - 0.5970	212.30	191.90	185.00	181.70	178.20	175.40
5/8	.6250	41620	42620	43520	171.40	.5615	6	2 1/4	2 1/4	9	0.5971 - 0.6280	212.30	191.90	185.00	181.70	178.20	175.40
21/32	.6562	41621	42621	43521	190.00	.5615	6	2 1/4	2 1/4	9	0.6281 - 0.6590	231.05	210.45	203.55	200.35	196.75	194.10
11/16	.6875	41622	42622	43522	190.00	.5615	6	2 1/4	2 1/4	9	0.6591 - 0.6910	231.05	210.45	203.55	200.35	196.75	194.10
23/32	.7188	41623	42623	43523	203.05	.5615	6	2 1/4	2 1/4	9	0.6911 - 0.7220	244.00	223.50	216.65	213.40	209.80	207.05
3/4	.7500	41624	42624	43524	203.05	.6245	6	2 1/2	2 1/2	9 1/2	0.7221 - 0.7530	244.00	223.50	216.65	213.40	209.80	207.05
25/32	.7812	41625	42625	43525	203.05	.6245	6	2 1/2	2 1/2	9 1/2	0.7531 - 0.7840	244.00	223.50	216.65	213.40	209.80	207.05
13/16	.8125	41626	42626	43526	203.05	.6245	6	2 1/2	2 1/2	9 1/2	0.7841 - 0.8160	244.00	223.50	216.65	213.40	209.80	207.05
27/32	.8438	41627	42627	43527	209.20	.6245	6	2 1/2	2 1/2	9 1/2	0.8161 - 0.8470	250.10	229.70	222.70	219.50	216.00	213.15
7/8	.8750	41628	42628	43528	217.15	.7495	6	2 5/8	2 5/8	10	0.8471 - 0.8780	259.60	238.25	231.15	227.75	224.15	221.25
29/32	.9062	41629	42629	43529	243.75	.7495	6	2 5/8	2 5/8	10	0.8781 - 0.9090	286.20	264.95	257.85	254.40	250.70	247.90
15/16	.9375	41630	42630	43530	249.50	.7495	8	2 5/8	2 5/8	10	0.9091 - 0.9410	291.85	270.65	263.45	260.10	256.40	253.60
31/32	.9688	41631	42631	43531	249.50	.7495	8	2 5/8	2 5/8	10	0.9411 - 0.9720	291.85	270.65	263.45	260.10	256.40	253.60
1	1.0000	41632	42632	43532	249.50	.8745	8	2 3/4	2 3/4	10 1/2	0.9721 - 1.0030	291.85	270.65	263.45	260.10	256.40	253.60
1 1/16	1.0625	41634	42634	43534	263.75	.8745	8	2 3/4	2 3/4	10 1/2	1.0031 - 1.0660	306.25	285.10	277.90	274.50	270.85	268.05
1 1/8	1.1250	41636	42636	43536	264.90	.8745	8	2 7/8	2 7/8	11	1.0661 - 1.1280	307.40	286.05	278.90	275.55	271.95	269.05
1 3/16	1.1875	41638	42638	43538	275.85	.9995	8	2 7/8	2 7/8	11	1.1281 - 1.1905	318.35	297.00	289.80	286.55	282.90	280.05
1 1/4	1.2500	41640	42640	43540	279.40	.9995	8	3	3	11 1/2	1.1906 - 1.2530	322.00	300.65	293.50	290.20	286.55	283.70
1 5/16	1.3125	41642	42642	43542	287.45	.9995	8	3	3	11 1/2	1.2531 - 1.3155	330.00	308.65	301.55	298.05	294.50	291.65
1 3/8	1.3750	41644	42644	43544	299.10	.9995	8	3 1/4	3 1/4	12	1.3156 - 1.3780	341.60	320.25	313.20	309.80	306.15	303.20
1 7/16	1.4375	41646	42646	43546	308.40	.9995	8	3 1/4	3 1/4	12	1.3781 - 1.4405	351.00	329.65	322.60	319.20	315.50	312.70
1 1/2	1.5000	41648	42648	43548	318.75	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406 - 1.5030	361.30	340.00	332.90	329.50	325.85	322.95

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

CONTINUED FROM PAGE 92 - TYPE 416, 426, 435 FRACTIONAL

TOOL DIAMETER FRAC.	TOOL DIAMETER DEC.	TYPE 416 NON-FERROUS EDP NO.	TYPE 426 CAST IRON EDP NO.	TYPE 435 STEEL/ HI-TEMP EDP NO.	ALL TYPES PRICE	DIMENSIONS MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT	LENGTH CAR-BIDE	LENGTH OVER-ALL	FINISHED TO MODIFIED TOOL DIAMETER MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14*
1 9/16	1.5625	41650	42650	43550	$358.40	1.2495	8	3 ½	3 ½	12 ½	1.5031 - 1.5660	$398.90	$378.60	$371.80	$368.65	$365.05	$362.40
1 5/8	1.6250	41652	42652	43552	394.05	1.2495	8	3 ½	3 ½	13	1.5661 - 1.6280	434.55	414.35	407.45	404.25	400.75	398.10
1 11/16	1.6875	41654	42654	43554	400.90	1.2495	8	3 ½	3 ½	13	1.6281 - 1.6910	441.40	421.15	414.35	411.10	407.55	404.95
1 ¾	1.7500	41656	42656	43556	438.10	1.2495	10	3 ½	3 ½	13 ½	1.6911 - 1.7530	478.60	458.35	451.50	448.35	444.85	442.10
1 13/16	1.8125	41658	42658	43558	456.20	1.4995	10	3 ½	3 ½	13 ½	1.7531 - 1.8160	496.65	476.45	469.60	466.35	462.85	460.25
1 7/8	1.8750	41660	42660	43560	480.30	1.4995	10	3 ½	3 ½	14	1.8161 - 1.8780	520.85	500.50	493.75	490.55	487.00	484.30
1 15/16	1.9375	41662	42662	43562	510.95	1.4995	10	3 ½	3 ½	14	1.8781 - 1.9410	551.45	531.25	524.35	521.15	517.65	515.00
2	2.0000	41664	42664	43564	529.50	1.4995	12	3 ½	3 ½	14	1.9411 - 2.0030	570.00	549.75	542.95	539.75	536.15	533.55

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

MATERIAL SPECIFIC COOLANT FED

FLUTE FED FOR THRU HOLES
STRAIGHT FLUTES & SHANK

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

TOOL DIAMETER mm	TOOL DIAMETER INCH	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 MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT & CARB.	LENGTH OVER-ALL	FINISHED TO MODIFIED TOOL DIAMETER MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED 1	2	3	4	5-7	8-14	OVER 14
4.5	.1772	416045	426045	435045	$149.50	.1704	4	*1 ¼	5	4.494-4.696	$180.35	$159.90	$153.10	$149.75	$146.25	$143.40	$139.45
5.0	.1969	416050	426050	435050	149.50	.1805	4	*1 ¼	5	4.697-5.182	180.35	159.90	153.10	149.75	146.25	143.40	139.45
5.5	.2165	416055	426055	435055	149.50	.2075	4	*1 ¼	5	5.183-5.613	180.35	159.90	153.10	149.75	146.25	143.40	139.45
6.0	.2362	416060	426060	435060	149.50	.2265	4	*1 ½	6	5.614-6.045	180.35	159.90	153.10	149.75	146.25	143.40	139.45
-	-	416063	426063	435063	-	.2405	4	*1 ½	6	6.046-6.426	180.35	159.90	153.10	149.75	146.25	143.40	139.45
6.5	.2559	416065	426065	435065	152.60	.2485	4	*1 ½	6	6.427-7.214	183.40	162.95	156.10	152.75	149.30	146.45	142.60
7.0	.2756	416070	426070	435070	152.60	.2485	4	*1 ½	6	-	-	-	-	-	-	-	-
7.5	.2953	416075	426075	435075	164.35	.2792	4	1 ½	6	7.215-8.001	195.20	174.75	167.90	164.65	161.15	158.25	154.40
8.0	.3150	416080	426080	435080	164.35	.2792	4	1 ½	6	-	-	-	-	-	-	-	-
8.5	.3346	416085	426085	435085	164.35	.2792	4	1 ½	6	8.002-8.814	195.20	174.75	167.90	164.65	161.15	158.25	154.40
9.0	.3543	416090	426090	435090	164.35	.3105	4	1 ¾	7	8.815-9.601	195.20	174.75	167.90	164.65	161.15	158.25	154.40
9.5	.3740	416095	426095	435095	164.35	.3105	4	1 ¾	7	-	-	-	-	-	-	-	-
10.0	.3937	416100	426100	435100	168.25	.3105	4	1 ¾	7	9.602-10.389	198.90	178.65	171.65	168.35	164.90	162.00	158.10
10.5	.4134	416105	426105	435105	172.00	.3730	6	1 ¾	7	10.390-11.201	202.70	182.45	175.40	172.15	168.65	165.85	161.90
11.0	.4331	416110	426110	435110	172.00	.3730	6	1 ¾	7	-	-	-	-	-	-	-	-
11.5	.4528	416115	426115	435115	172.00	.3730	6	1 ¾	7	11.202-11.989	202.70	182.45	175.40	172.15	168.65	165.85	161.90
12.0	.4724	416120	426120	435120	172.00	.4355	6	2	8	11.990-12.776	202.70	182.45	175.40	172.15	168.65	165.85	161.90
12.5	.4921	416125	426125	435125	172.00	.4355	6	2	8	-	-	-	-	-	-	-	-
13.0	.5118	416130	426130	435130	181.10	.4355	6	2	8	12.777-13.564	211.90	191.40	184.60	181.30	177.85	174.95	171.05
13.5	.5315	416135	426135	435135	181.10	.4355	6	2	8	-	-	-	-	-	-	-	-
14.0	.5512	416140	426140	435140	183.40	.4355	6	2	8	13.565-14.376	214.25	193.80	186.95	183.65	180.15	177.40	173.40
14.5	.5709	416145	426145	435145	185.00	.4355	6	2	8	14.377-15.164	215.90	195.35	188.45	185.10	181.70	178.85	174.95
15.5	.6102	416155	426155	435155	185.00	.5615	6	2 ¼	9	15.165-15.951	215.90	195.35	188.45	185.10	181.70	178.85	174.95
16.0	.6299	416160	426160	435160	203.55	.5615	6	2 ¼	9	15.952-16.739	234.40	214.00	207.05	203.80	200.35	197.50	193.50
17.0	.6693	416170	426170	435170	203.55	.5615	6	2 ¼	9	16.740-17.551	234.40	214.00	207.05	203.80	200.35	197.50	193.50
18.0	.7087	416180	426180	435180	216.65	.5615	6	2 ¼	9	17.552-18.339	247.45	226.95	220.15	216.80	213.40	210.55	206.70
18.5	.7283	416185	426185	435185	216.65	.6245	6	2 ½	9 ½	18.340-19.126	247.45	226.95	220.15	216.80	213.40	210.55	206.70
19.5	.7677	416195	426195	435195	216.65	.6245	6	2 ½	9 ½	19.127-19.914	247.45	226.95	220.15	216.80	213.40	210.55	206.70
20.0	.7874	416200	426200	435200	216.65	.6245	6	2 ½	9 ½	19.915-20.726	247.45	226.95	220.15	216.80	213.40	210.55	206.70
21.0	.8268	416210	426210	435210	222.70	.6245	6	2 ½	9 ½	20.727-21.514	253.60	233.15	226.35	222.95	219.50	216.65	212.75
22.0	.8661	416220	426220	435220	222.70	.7495	6	2 ⅝	10	21.515-22.301	253.60	233.15	226.35	222.95	219.50	216.65	212.75
22.5	.8858	416225	426225	435225	257.85	.7495	6	2 ⅝	10	22.302-23.089	289.75	268.55	261.50	258.00	254.40	251.45	247.45
23.5	.9252	416235	426235	435235	263.45	.7495	8	2 ⅝	10	23.090-23.901	295.45	274.25	267.15	263.60	260.10	257.10	253.05
24.0	.9449	416240	426240	435240	263.45	.7495	8	2 ⅝	10	23.902-24.689	295.45	274.25	267.15	263.60	260.10	257.10	253.05
25.0	.9843	416250	426250	435250	263.45	.8745	8	2 ¾	10 ½	24.690-25.476	295.45	274.25	267.15	263.60	260.10	257.10	253.05
25.5	1.0039	416255	426255	435255	277.90	.8745	8	2 ¾	10 ½	25.477-27.076	309.85	288.70	281.60	278.00	274.50	271.50	267.45
28.0	1.1024	416280	426280	435280	278.95	.8745	8	2 ⅞	11	27.077-28.651	310.95	289.70	282.60	279.15	275.55	272.65	268.50
29.0	1.1417	416290	426290	435290	289.80	.9995	8	2 ⅞	11	28.652-30.239	321.95	300.65	293.50	290.05	286.55	283.55	279.40
31.0	1.2205	416310	426310	435310	293.50	.9995	8	3	11 ½	30.240-31.826	325.50	304.30	297.25	293.70	290.20	287.20	283.10
32.0	1.2598	416320	426320	435320	301.55	.9995	8	3	11 ½	31.827-33.414	333.50	312.25	305.25	301.75	298.05	295.20	291.10
34.0	1.3386	416340	426340	435340	313.20	.9995	8	3 ¼	12	33.415-35.001	345.15	323.90	316.85	313.35	309.80	306.80	302.75
36.0	1.4173	416360	426360	435360	322.60	.9995	8	3 ¼	12	35.002-36.589	354.50	333.25	326.20	322.75	319.20	316.25	312.15
37.0	1.4567	416370	426370	435370	332.90	1.2495	8	3 ½	12 ½	36.590-38.176	364.85	343.65	336.55	333.10	329.50	326.60	322.40

*½" carbide length

COOLANT FED REAMERS
CARBIDE TIPPED TYPES 411 413, 415 FRACTIONAL

MATERIAL SPECIFIC COOLANT FED

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

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

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 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						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
¼	.2500	41108	41308	41508	$134.60	.2405	4	1 ½	½	6	0.2381 - 0.2530	$172.75	$153.65	$147.20	$144.15	$140.85	$138.25
9/32	.2812	41109	41309	41509	137.65	.2485	4	1 ½	½	6	0.2531 - 0.2840	174.50	156.05	149.85	146.95	143.85	141.20
5/16	.3125	41110	41310	41510	150.85	.2792	4	1 ½	1 ½	6	0.2841 - 0.3150	189.05	169.90	163.45	160.40	157.00	154.50
11/32	.3438	41111	41311	41511	151.95	.2792	4	1 ½	1 ½	6	0.3151 - 0.3470	190.15	171.05	164.70	161.60	158.25	155.70
⅜	.3750	41112	41312	41512	153.55	.3105	4	1 ¾	1 ¾	7	0.3471 - 0.3780	191.75	172.50	166.15	163.15	159.90	157.35
13/32	.4062	41113	41313	41513	153.95	.3105	4	1 ¾	1 ¾	7	0.3781 - 0.4090	192.15	173.10	166.70	163.60	160.30	157.75
7/16	.4375	41114	41314	41514	155.55	.3730	6	1 ¾	1 ¾	7	0.4091 - 0.4410	193.80	174.60	168.25	165.25	161.90	159.40
15/32	.4688	41115	41315	41515	156.90	.3730	6	1 ¾	1 ¾	7	0.4411 - 0.4720	195.20	175.95	169.65	166.55	163.25	160.70
½	.5000	41116	41316	41516	163.05	.4355	6	2	2	8	0.4721 - 0.5030	202.30	182.60	175.95	172.85	169.50	166.95
17/32	.5312	41117	41317	41517	168.95	.4355	6	2	2	8	0.5031 - 0.5340	208.15	188.45	181.90	178.80	175.40	172.80
9/16	.5625	41118	41318	41518	168.95	.4355	6	2	2	8	0.5341 - 0.5660	208.15	188.45	181.90	178.80	175.40	172.80
19/32	.5938	41119	41319	41519	175.65	.4355	6	2	2	8	0.5661 - 0.5970	214.95	195.25	188.65	185.60	182.15	179.55
⅝	.6250	41120	41320	41520	175.65	.5615	6	2 ¼	2 ¼	9	0.5971 - 0.6280	214.95	195.25	188.65	185.60	182.15	179.55
21/32	.6562	41121	41321	41521	198.50	.5615	6	2 ¼	2 ¼	9	0.6281 - 0.6590	237.70	218.10	211.45	208.30	204.95	202.35
11/16	.6875	41122	41322	41522	198.50	.5615	6	2 ¼	2 ¼	9	0.6591 - 0.6910	237.70	218.10	211.45	208.30	204.95	202.35
23/32	.7188	41123	41323	41523	207.05	.5615	6	2 ¼	2 ¼	9	0.6911 - 0.7220	246.40	226.70	220.15	217.10	213.60	210.90
¾	.7500	41124	41324	41524	194.55	.6245	6	2 ½	2 ½	9 ½	0.7221 - 0.7530	231.45	212.90	206.80	203.80	200.60	198.10
25/32	.7812	41125	41325	41525	223.20	.6245	6	2 ½	2 ½	9 ½	0.7531 - 0.7840	262.40	242.70	236.20	233.00	229.70	226.95
13/16	.8125	41126	41326	41526	225.90	.6245	6	2 ½	2 ½	9 ½	0.7841 - 0.8160	265.15	245.45	238.95	235.80	232.50	229.85
27/32	.8438	41127	41327	41527	230.10	.6245	6	2 ½	2 ½	9 ½	0.8161 - 0.8470	269.50	249.75	243.20	240.00	236.70	234.05
⅞	.8750	41128	41328	41528	242.55	.7495	6	2 ⅝	2 ⅝	10	0.8471 - 0.8780	283.20	262.95	256.05	252.85	249.30	246.60
29/32	.9062	41129	41329	41529	257.00	.7495	6	2 ⅝	2 ⅝	10	0.8781 - 0.9090	297.70	277.30	270.50	267.30	263.70	261.00
15/16	.9375	41130	41330	41530	269.30	.7495	8	2 ⅝	2 ⅝	10	0.9091 - 0.9410	310.10	289.65	282.90	279.55	276.00	273.30
31/32	.9688	41131	41331	41531	270.10	.7495	8	2 ⅝	2 ⅝	10	0.9411 - 0.9720	310.70	290.40	283.55	280.25	276.75	274.10
1	1.0000	41132	41332	41532	270.50	.8745	8	2 ¾	2 ¾	10 ½	0.9721 - 1.0030	311.20	290.80	284.00	280.75	277.25	274.50
1 1/16	1.0625	41134	41334	41534	278.00	.8745	8	2 ¾	2 ¾	10 ½	1.0031 - 1.0660	318.70	298.45	291.55	288.25	284.75	282.05
1 ⅛	1.1250	41136	41336	41536	287.65	.8745	8	2 ⅞	2 ⅞	11	1.0661 - 1.1280	328.45	308.00	301.25	297.95	294.50	291.75
1 3/16	1.1875	41138	41338	41538	308.20	.9995	8	2 ⅞	2 ⅞	11	1.1281 - 1.1905	348.90	328.60	321.65	318.50	314.85	312.15
1 ¼	1.2500	41140	41340	41540	312.15	.9995	8	3	3	11 ½	1.1906 - 1.2530	352.85	332.50	325.70	322.40	318.95	316.25
1 5/16	1.3125	41142	41342	41542	321.20	.9995	8	3	3	11 ½	1.2531 - 1.3155	361.90	341.50	334.65	331.40	327.95	325.15
1 ⅜	1.3750	41144	41344	41544	334.25	.9995	8	3 ¼	3 ¼	12	1.3156 - 1.3780	375.00	354.55	347.70	344.55	340.95	338.25
1 7/16	1.4375	41146	41346	41546	344.65	.9995	8	3 ¼	3 ¼	12	1.3781 - 1.4405	385.35	364.95	358.15	354.90	351.35	348.70
1 ½	1.5000	41148	41348	41548	356.30	1.2495	8	3 ½	3 ½	12 ½	1.4406 - 1.5030	397.00	376.70	369.80	366.50	363.05	360.35

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

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

MATERIAL SPECIFIC COOLANT FED

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

REAMERS

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						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CAR-BIDE	OVER-ALL		1	2	3	4	5-7	8-14*
1/4	.2500	41708	41808	41908	$144.15	.2405	4	1 1/2	1/2	6	0.2381 - 0.2530	$185.05	$164.65	$157.75	$154.45	$151.00	$148.15
9/32	.2812	41709	41809	41909	152.90	.2485	4	1 1/2	1/2	6	0.2531 - 0.2840	193.85	173.40	166.45	163.20	159.70	156.90
5/16	.3125	41710	41810	41910	161.60	.2792	4	1 1/2	1 1/2	6	0.2841 - 0.3150	202.50	182.00	175.15	171.95	168.35	165.60
11/32	.3438	41711	41811	41911	162.85	.2792	4	1 1/2	1 1/2	6	0.3151 - 0.3470	203.80	183.25	176.40	173.15	169.55	166.95
3/8	.3750	41712	41812	41912	164.40	.3105	4	1 3/4	1 3/4	7	0.3471 - 0.3780	205.50	184.90	178.00	174.75	171.25	168.50
13/32	.4062	41713	41813	41913	164.95	.3105	4	1 3/4	1 3/4	7	0.3781 - 0.4090	205.90	185.40	178.65	175.30	171.70	169.00
7/16	.4375	41714	41814	41914	166.70	.3730	6	1 3/4	1 3/4	7	0.4091 - 0.4410	207.65	187.10	180.30	176.90	173.45	170.70
15/32	.4688	41715	41815	41915	168.25	.3730	6	1 3/4	1 3/4	7	0.4411 - 0.4720	209.15	188.60	181.70	178.45	174.95	172.20
1/2	.5000	41716	41816	41916	170.05	.4355	6	2	2	8	0.4721 - 0.5030	210.95	190.55	183.75	180.40	176.85	174.15
17/32	.5312	41717	41817	41917	176.35	.4355	6	2	2	8	0.5031 - 0.5340	217.25	196.65	189.85	186.70	183.05	180.35
9/16	.5625	41718	41818	41918	176.35	.4355	6	2	2	8	0.5341 - 0.5660	217.25	196.65	189.85	186.70	183.05	180.35
19/32	.5938	41719	41819	41919	183.30	.4355	6	2	2	8	0.5661 - 0.5970	224.25	203.80	196.85	193.65	190.05	187.30
5/8	.6250	41720	41820	41920	183.30	.5615	6	2 1/4	2 1/4	9	0.5971 - 0.6280	224.25	203.80	196.85	193.65	190.05	187.30
21/32	.6562	41721	41821	41921	207.05	.5615	6	2 1/4	2 1/4	9	0.6281 - 0.6590	248.00	227.60	220.70	217.35	213.85	211.10
11/16	.6875	41722	41822	41922	207.05	.5615	6	2 1/4	2 1/4	9	0.6591 - 0.6910	248.00	227.60	220.70	217.35	213.85	211.10
23/32	.7188	41723	41823	41923	216.10	.5615	6	2 1/4	2 1/4	9	0.6911 - 0.7220	257.05	236.50	229.80	226.45	222.95	220.15
3/4	.7500	41724	41824	41924	216.10	.6245	6	2 1/2	2 1/2	9 1/2	0.7221 - 0.7530	257.05	236.50	229.80	226.45	222.95	220.15
25/32	.7812	41725	41825	41925	232.85	.6245	6	2 1/2	2 1/2	9 1/2	0.7531 - 0.7840	273.75	253.25	246.45	243.20	239.65	236.95
13/16	.8125	41726	41826	41926	235.75	.6245	6	2 1/2	2 1/2	9 1/2	0.7841 - 0.8160	276.65	256.20	249.30	246.10	242.50	239.70
27/32	.8438	41727	41827	41927	240.20	.6245	6	2 1/2	2 1/2	9 1/2	0.8161 - 0.8470	281.15	260.60	253.70	250.45	246.90	244.20
7/8	.8750	41728	41828	41928	253.10	.7495	6	2 5/8	2 5/8	10	0.8471 - 0.8780	295.65	274.35	267.25	263.75	260.15	257.20
29/32	.9062	41729	41829	41929	268.15	.7495	6	2 5/8	2 5/8	10	0.8781 - 0.9090	310.60	289.40	282.25	278.85	275.15	272.35
15/16	.9375	41730	41830	41930	281.05	.7495	8	2 5/8	2 5/8	10	0.9091 - 0.9410	323.55	302.20	295.05	291.75	288.10	285.25
31/32	.9688	41731	41831	41931	281.80	.7495	8	2 5/8	2 5/8	10	0.9411 - 0.9720	324.30	303.05	295.85	292.45	288.80	285.95
1	1.0000	41732	41832	41932	282.25	.8745	8	2 3/4	2 3/4	10 1/2	0.9721 - 1.0030	324.80	303.55	296.30	292.90	289.30	286.45
1 1/16	1.0625	41734	41834	41934	325.50	.8745	8	2 3/4	2 3/4	10 1/2	1.0031 - 1.0660	367.95	346.70	339.55	336.15	332.55	329.65
1 1/8	1.1250	41736	41836	41936	326.90	.8745	8	2 7/8	2 7/8	11	1.0661 - 1.1280	369.40	348.05	340.95	337.55	334.00	331.05
1 3/16	1.1875	41738	41838	41938	340.45	.9995	8	2 7/8	2 7/8	11	1.1281 - 1.1905	382.80	361.50	354.45	351.05	347.45	344.55
1 1/4	1.2500	41740	41840	41940	344.85	.9995	8	3	3	11 1/2	1.1906 - 1.2530	387.35	366.05	359.00	355.55	351.90	349.05
1 5/16	1.3125	41742	41842	41942	354.85	.9995	8	3	3	11 1/2	1.2531 - 1.3155	397.30	376.00	368.80	365.45	361.85	359.00
1 3/8	1.3750	41744	41844	41944	369.05	.9995	8	3 1/4	3 1/4	12	1.3156 - 1.3780	411.65	390.35	383.15	379.85	376.20	373.30
1 7/16	1.4375	41746	41846	41946	380.60	.9995	8	3 1/4	3 1/4	12	1.3781 - 1.4405	423.20	401.85	394.75	391.40	387.80	384.85
1 1/2	1.5000	41748	41848	41948	393.45	1.2495	8	3 1/2	3 1/2	12 1/2	1.4406 - 1.5030	435.90	414.70	407.50	404.10	400.45	397.60

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

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

MATERIAL SPECIFIC COOLANT FED

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

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

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 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						
						MAX. SHANK DIAM.	NO. OF FLTS	LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.							FLT	CARBIDE	OVERALL		1	2	3	4	5-7	8-14*
¼	.2500	42708	42808	42908	$166.70	.2405	4	1 ½	½	6	0.2381 - 0.2530	$207.65	$187.10	$180.30	$176.90	$173.45	$170.70
9/32	.2812	42709	42809	42909	176.75	.2485	4	1 ½	½	6	0.2531 - 0.2840	217.65	197.25	190.40	187.10	183.65	180.85
5/16	.3125	42710	42810	42910	186.80	.2792	4	1 ½	1 ½	6	0.2841 - 0.3150	227.70	207.10	200.35	197.10	193.50	190.80
11/32	.3438	42711	42811	42911	188.25	.2792	4	1 ½	1 ½	6	0.3151 - 0.3470	229.05	208.55	201.75	198.50	195.00	192.15
⅜	.3750	42712	42812	42912	190.05	.3105	4	1 ¾	1 ¾	7	0.3471 - 0.3780	231.10	210.55	203.70	200.40	196.85	194.20
13/32	.4062	42713	42813	42913	190.85	.3105	4	1 ¾	1 ¾	7	0.3781 - 0.4090	231.80	211.35	204.45	201.20	197.60	194.95
7/16	.4375	42714	42814	42914	192.65	.3730	6	1 ¾	1 ¾	7	0.4091 - 0.4410	233.65	213.10	206.25	203.00	199.55	196.65
15/32	.4688	42715	42815	42915	194.35	.3730	6	1 ¾	1 ¾	7	0.4411 - 0.4720	235.25	214.85	207.95	204.70	201.20	198.40
½	.5000	42716	42816	42916	196.85	.4355	6	2	2	8	0.4721 - 0.5030	237.90	217.30	210.45	207.10	203.70	200.95
17/32	.5312	42717	42817	42917	201.00	.4355	6	2	2	8	0.5031 - 0.5340	241.95	221.40	214.55	211.35	207.80	205.00
9/16	.5625	42718	42818	42918	203.90	.4355	6	2	2	8	0.5341 - 0.5660	244.85	224.35	217.45	214.25	210.70	207.95
19/32	.5938	42719	42819	42919	208.15	.4355	6	2	2	8	0.5661 - 0.5970	249.05	228.65	221.75	218.50	215.00	212.20
⅝	.6250	42720	42820	42920	212.05	.5615	6	2 ¼	2 ¼	9	0.5971 - 0.6280	252.95	232.50	225.55	222.35	218.80	216.05
21/32	.6562	42721	42821	42921	234.80	.5615	6	2 ¼	2 ¼	9	0.6281 - 0.6590	275.80	255.25	248.40	245.15	241.60	238.80
11/16	.6875	42722	42822	42922	239.55	.5615	6	2 ¼	2 ¼	9	0.6591 - 0.6910	280.55	260.05	253.10	249.90	246.40	243.65
23/32	.7188	42723	42823	42923	244.70	.5615	6	2 ¼	2 ¼	9	0.6911 - 0.7220	285.60	265.10	258.20	254.95	251.45	248.65
¾	.7500	42724	42824	42924	249.90	.6245	6	2 ½	2 ½	9 ½	0.7221 - 0.7530	290.80	270.35	263.40	260.25	256.65	253.95
25/32	.7812	42725	42825	42925	254.15	.6245	6	2 ½	2 ½	9 ½	0.7531 - 0.7840	295.05	274.65	267.65	264.45	260.90	258.15
13/16	.8125	42726	42826	42926	257.20	.6245	6	2 ½	2 ½	9 ½	0.7841 - 0.8160	298.05	277.70	270.80	267.50	264.05	261.20
27/32	.8438	42727	42827	42927	261.90	.6245	6	2 ½	2 ½	9 ½	0.8161 - 0.8470	302.95	282.40	275.50	272.20	268.70	266.00
⅞	.8750	42728	42828	42928	276.15	.7495	6	2 ⅝	2 ⅝	10	0.8471 - 0.8780	318.65	297.40	290.25	286.85	283.15	280.25
29/32	.9062	42729	42829	42929	292.40	.7495	6	2 ⅝	2 ⅝	10	0.8781 - 0.9090	334.90	313.55	306.50	303.10	299.50	296.60
15/16	.9375	42730	42830	42930	306.70	.7495	8	2 ⅝	2 ⅝	10	0.9091 - 0.9410	349.10	327.90	320.75	317.35	313.60	310.85
31/32	.9688	42731	42831	42931	307.50	.7495	8	2 ⅝	2 ⅝	10	0.9411 - 0.9720	349.90	328.70	321.50	318.10	314.45	311.60
1	1.0000	42732	42832	42932	307.90	.8745	8	2 ¾	2 ¾	10 ½	0.9721 - 1.0030	350.35	329.10	322.00	318.55	314.85	312.00
1 1/16	1.0625	42734	42834	42934	325.50	.8745	8	2 ¾	2 ¾	10 ½	1.0031 - 1.0660	367.95	346.70	339.55	336.15	332.55	329.65
1 ⅛	1.1250	42736	42836	42936	326.90	.8745	8	2 ⅞	2 ⅞	11	1.0661 - 1.1280	369.40	348.05	340.95	337.55	334.00	331.05
1 3/16	1.1875	42738	42838	42938	340.45	.9995	8	2 ⅞	2 ⅞	11	1.1281 - 1.1905	382.80	361.50	354.45	351.05	347.45	344.55
1 ¼	1.2500	42740	42840	42940	344.85	.9995	8	3	3	11 ½	1.1906 - 1.2530	387.35	366.05	359.00	355.55	351.90	349.05
1 5/16	1.3125	42742	42842	42942	354.85	.9995	8	3	3	11 ½	1.2531 - 1.3155	397.30	376.00	368.80	365.45	361.85	359.00
1 ⅜	1.3750	42744	42844	42944	369.05	.9995	8	3 ¼	3 ¼	12	1.3156 - 1.3780	411.65	390.35	383.15	379.85	376.20	373.30
1 7/16	1.4375	42746	42846	42946	380.60	.9995	8	3 ¼	3 ¼	12	1.3781 - 1.4405	423.20	401.85	394.75	391.40	387.80	384.85
1 ½	1.5000	42748	42848	42948	393.45	1.2495	8	3 ½	3 ½	12 ½	1.4406 - 1.5030	435.90	414.70	407.50	404.10	400.45	397.60

*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						
				SHANK DIAM.	SHANK LENGTH	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.						FLUTE & CARBIDE	OVER-ALL		1	2	3	4	5-7	8-14*
3/8	.3750	49012	$127.30	3/8	3/4	6	1/2	2 1/2	0.3181 - 0.3800	$205.75	$166.40	$153.30	$147.05	$140.30	$135.00
13/32	.4062	49013	129.20	3/8	3/4	6	1/2	2 5/8	0.3801 - 0.4090	207.65	168.35	155.15	148.85	142.15	136.90
7/16	.4375	49014	129.20	3/8	3/4	6	1/2	2 5/8	0.4091 - 0.4410	207.65	168.35	155.15	148.85	142.15	136.90
15/32	.4688	49015	132.70	5/8	1	6	5/8	3 1/2	0.4411 - 0.4720	211.15	171.90	158.80	152.40	145.65	140.40
1/2	.5000	49016	132.70	5/8	1	6	5/8	3 1/2	0.4721 - 0.5050	211.15	171.90	158.80	152.40	145.65	140.40
9/16	.5625	49018	145.05	5/8	1	6	3/4	3 3/4	0.5051 - 0.5660	223.50	184.10	171.05	164.80	158.05	152.75
5/8	.6250	49020	145.05	5/8	1	6	3/4	3 3/4	0.5661 - 0.6300	223.50	184.10	171.05	164.80	158.05	152.75
11/16	.6875	49022	160.90	5/8	1	6	3/4	4 1/4	0.6301 - 0.6910	239.40	200.10	186.95	180.60	173.95	168.60
3/4	.7500	49024	160.90	5/8	1	6	3/4	4 1/4	0.6911 - 0.7550	239.40	200.10	186.95	180.60	173.95	168.60
13/16	.8125	49026	169.70	5/8	1	6	7/8	4 3/4	0.7551 - 0.8160	248.25	209.00	195.75	189.45	182.75	177.50
7/8	.8750	49028	176.15	5/8	1	6	7/8	4 3/4	0.8161 - 0.8800	257.65	216.80	203.10	196.60	189.70	184.10
15/16	.9375	49030	211.10	1	1 1/2	8	1	5 1/2	0.8801 - 0.9410	292.55	251.80	238.10	231.60	224.65	219.10
1	1.0000	49032	211.10	1	1 1/2	8	1	5 1/2	0.9411 - 1.0050	292.55	251.80	238.10	231.60	224.65	219.10
1 1/16	1.0625	49034	233.65	1	1 1/2	8	1 1/4	6	1.0051 - 1.0660	318.55	275.95	261.80	254.95	247.65	241.95
1 1/8	1.1250	49036	233.65	1	1 1/2	8	1 1/4	6	1.0661 - 1.1300	318.55	275.95	261.80	254.95	247.65	241.95
1 3/16	1.1875	49038	239.40	1	1 1/2	8	1 1/4	6	1.1301 - 1.1900	324.40	281.80	267.55	260.75	253.55	247.70
1 1/4	1.2500	49040	239.40	1	1 1/2	8	1 1/4	6	1.1901 - 1.2550	324.40	281.80	267.55	260.75	253.55	247.70
1 5/16	1.3125	49042	256.70	1	1 1/2	8	1 1/4	6	1.2551 - 1.3155	341.70	299.10	284.80	278.00	270.75	265.05
1 3/8	1.3750	49044	256.70	1	1 1/2	8	1 1/4	6	1.3156 - 1.3800	341.70	299.10	284.80	278.00	270.75	265.05
1 7/16	1.4375	49046	273.90	1	1 1/2	8	1 1/4	6	1.3801 - 1.4405	358.95	316.30	302.00	295.30	288.05	282.25
1 1/2	1.5000	49048	273.90	1	1 1/2	8	1 1/4	6	1.4406 - 1.5050	358.95	316.30	302.00	295.30	288.05	282.25
1 9/16	1.5625	49050	287.25	1	1 1/2	10	1 1/4	6	1.5051 - 1.5660	372.25	329.65	315.45	308.65	301.35	295.65
1 5/8	1.6250	49052	287.25	1	1 1/2	10	1 1/4	6	1.5661 - 1.6300	372.25	329.65	315.45	308.65	301.35	295.65
1 11/16	1.6875	49054	304.55	1	1 1/2	10	1 1/4	6	1.6301 - 1.6910	389.55	346.95	332.75	325.95	318.65	312.90
1 3/4	1.7500	49056	304.55	1	1 1/2	10	1 1/4	6	1.6911 - 1.7550	389.55	346.95	332.75	325.95	318.65	312.90
1 13/16	1.8125	49058	319.85	1	1 1/2	10	1 1/4	6	1.7551 - 1.8160	404.90	362.25	348.00	341.25	334.00	328.15
1 7/8	1.8750	49060	319.85	1	1 1/2	10	1 1/4	6	1.8161 - 1.8800	404.90	362.25	348.00	341.25	334.00	328.15
1 15/16	1.9375	49062	335.25	1	1 1/2	10	1 1/4	6	1.8801 - 1.9410	420.05	377.50	363.30	356.55	349.15	343.55
2	2.0000	49064	335.25	1	1 1/2	10	1 1/4	6	1.9411 - 2.0150	420.05	377.50	363.30	356.55	349.15	343.55

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

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

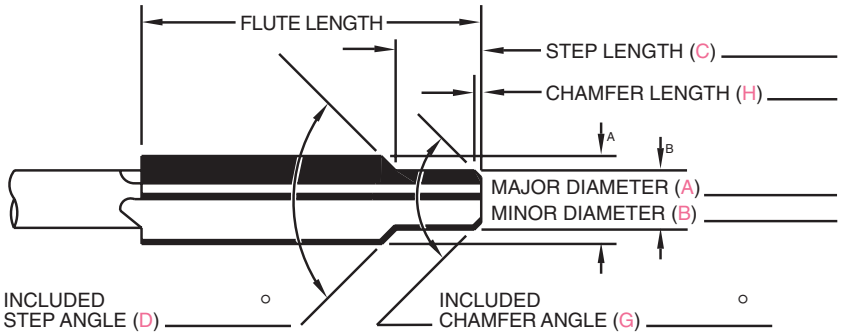
STRAIGHT FLUTES
FLUTE LONG CARBIDE
CUTTING OR NON-CUTTING PILOT

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 PRICE EACH - BASED ON QUANTITY ORDERED						
	NON-CUT PILOT MIN. DIAM.	MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLUTE & CARB.	LENGTH OVER-ALL				1	2	3	4	5-7	8-14	OVER 14
0.1770-0.2040	.1660	.1805	4	1 ⅛	4 ½	45706ST	45806ST	45906ST	$153.65	$115.30	$102.50	$96.35	$89.85	$84.70	$77.20
0.2041-0.2210	.1920	.2075	4	1 ¼	5	45707ST	45807ST	45907ST	153.65	115.30	102.50	96.35	89.85	84.70	77.20
0.2211-0.2380	.2080	.2265	4	1 ½	6	4572344ST	4582344ST	4592344ST	153.65	115.30	102.50	96.35	89.85	84.70	77.20
0.2381-0.2530	.2240	.2405	4	1 ½	6	45708ST	45808ST	45908ST	153.65	115.30	102.50	96.35	89.85	84.70	77.20
0.2531-0.2840	.2380	.2485	4	1 ½	6	45709ST	45809ST	45909ST	155.40	117.05	104.25	98.15	91.65	86.45	78.95
0.2841-0.3150	.2670	.2792	4	1 ½	6	45710ST	45810ST	45910ST	155.40	117.05	104.25	98.15	91.65	86.45	78.95
0.3151-0.3470	.2960	.2792	4	1 ½	6	45711ST	45811ST	45911ST	158.10	119.85	107.00	101.00	94.40	89.25	81.75
0.3471-0.3780	.3260	.3105	4	1 ¾	7	45712ST	45812ST	45912ST	158.10	119.85	107.00	101.00	94.40	89.25	81.75
0.3781-0.4090	.3550	.3105	4	1 ¾	7	45713ST	45813ST	45913ST	162.10	123.95	111.10	105.00	98.45	93.25	85.80
0.4091-0.4410	.3850	.3730	6	1 ¾	7	45714ST	45814ST	45914ST	169.30	130.95	118.15	112.00	105.50	100.30	92.90
0.4411-0.4720	.4150	.3730	6	1 ¾	7	45715ST	45815ST	45915ST	176.60	138.35	125.55	119.45	112.90	107.75	100.25
0.4721-0.5030	.4440	.4355	6	2	8	45716ST	45816ST	45916ST	189.25	148.25	134.50	128.00	121.00	115.45	107.40
0.5031-0.5340	.4730	.4355	6	2	8	45717ST	45817ST	45917ST	192.35	151.40	137.65	131.15	124.05	118.50	110.55
0.5341-0.5660	.5020	.4355	6	2	8	45718ST	45818ST	45918ST	192.35	151.40	137.65	131.15	124.05	118.50	110.55
0.5661-0.5970	.5320	.4355	6	2	8	45719ST	45819ST	45919ST	196.60	155.65	141.90	135.35	128.40	122.80	114.75
0.5971-0.6280	.5610	.5615	6	2 ¼	9	45720ST	45820ST	45920ST	196.60	155.65	141.90	135.35	128.40	122.80	114.75
0.6281-0.6590	.5900	.5615	6	2 ¼	9	45721ST	45821ST	45921ST	198.75	157.75	144.00	137.40	130.40	124.90	116.90
0.6591-0.6910	.6200	.5615	6	2 ¼	9	45722ST	45822ST	45922ST	198.75	157.75	144.00	137.40	130.40	124.90	116.90
0.6911-0.7220	.6500	.5615	6	2 ¼	9	45723ST	45823ST	45923ST	203.95	162.95	149.25	142.75	135.75	130.20	122.15
0.7221-0.7530	.6790	.6245	6	2 ½	9 ½	45724ST	45824ST	45924ST	203.95	162.95	149.25	142.75	135.75	130.20	122.15
0.7531-0.7840	.7080	.6245	6	2 ½	9 ½	45725ST	45825ST	45925ST	208.15	167.15	153.50	146.95	139.85	134.40	126.35
0.7841-0.8160	.7370	.6245	6	2 ½	9 ½	45726ST	45826ST	45926ST	208.15	167.15	153.50	146.95	139.85	134.40	126.35
0.8161-0.8470	.7670	.6245	6	2 ½	9 ½	45727ST	45827ST	45927ST	213.15	172.20	158.45	151.95	144.90	139.40	131.40
0.8471-0.8780	.7970	.7495	6	2 ⅝	10	45728ST	45828ST	45928ST	221.25	178.70	164.40	157.70	150.35	144.65	136.35
0.8781-0.9090	.8260	.7495	6	2 ⅝	10	45729ST	45829ST	45929ST	243.75	201.20	186.90	180.25	172.85	167.15	158.85
0.9091-0.9410	.8550	.7495	8	2 ⅝	10	45730ST	45830ST	45930ST	243.75	201.20	186.90	180.25	172.85	167.15	158.85
0.9411-0.9720	.8850	.7495	8	2 ⅝	10	45731ST	45831ST	45931ST	251.35	208.75	194.55	187.75	180.40	174.65	166.35
0.9721-1.0030	.9140	.8745	8	2 ¾	10 ½	45732ST	45832ST	45932ST	251.35	208.75	194.55	187.75	180.40	174.65	166.35
1.0031-1.0660	.9430	.8745	8	2 ¾	10 ½	45734ST	45834ST	45934ST	253.50	212.70	198.90	192.45	185.50	180.00	172.10
1.0661-1.1280	1.0020	.8745	8	2 ⅞	11	45736ST	45836ST	45936ST	267.65	226.90	213.30	206.85	199.80	194.30	186.30
1.1281-1.1905	1.0610	.9995	8	2 ⅞	11	45738ST	45838ST	45938ST	276.25	235.35	221.75	215.30	208.25	202.75	194.80
1.1906-1.2530	1.1200	.9995	8	3	11 ½	45740ST	45840ST	45940ST	292.05	251.30	237.50	231.10	224.15	218.60	210.70
1.2531-1.3155	1.1780	.9995	8	3	11 ½	45742ST	45842ST	45942ST	297.85	257.05	243.40	236.95	229.95	224.40	216.45
1.3156-1.3780	1.2370	.9995	8	3 ¼	12	45744ST	45844ST	45944ST	312.25	271.45	257.85	251.35	244.35	238.80	230.85
1.3781-1.4405	1.2960	.9995	8	3 ¼	12	45746ST	45846ST	45946ST	331.30	290.45	276.75	270.30	263.30	257.85	249.80
1.4406-1.5030	1.3550	1.2495	8	3 ½	12 ½	45748ST	45848ST	45948ST	338.65	297.85	284.25	277.75	270.75	265.25	257.20

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

MATERIAL SPECIFIC

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

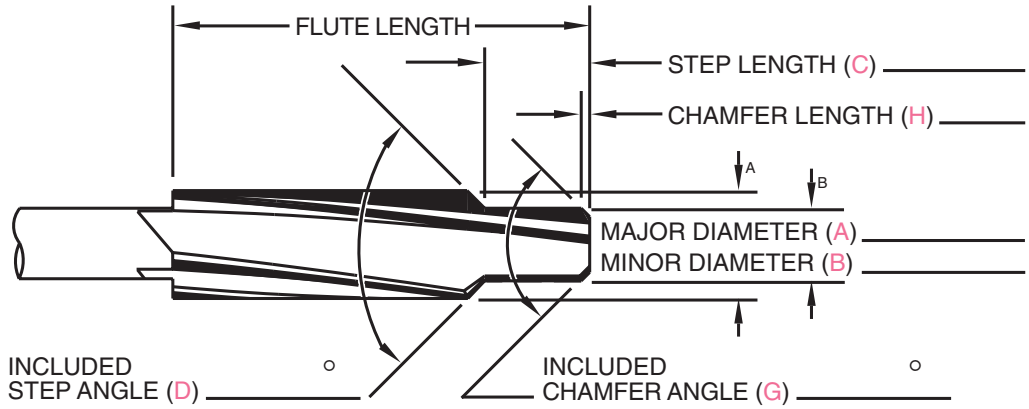
TYPE 442ST - FOR NON-FERROUS MATERIALS
TYPE 443ST - FOR CAST IRONS
TYPE 444ST - FOR STEELS & HIGH TEMP ALLOYS

- 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)



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 442ST NON-FERROUS EDP NO.	TYPE 443ST CAST IRON EDP NO.	TYPE 444ST STEEL/ HI-TEMP EDP NO.	FINISHED TO MODIFIED TOOL DIAMETER PRICE EACH - BASED ON QUANTITY ORDERED						
	NON-CUT PILOT MIN. DIAM.	MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT & CARB.	LENGTH OVER-ALL				1	2	3	4	5-7	8-14	OVER 14
0.2841 - 0.3150	.2670	.2792	4	1 ½	6	44210ST	44310ST	44410ST	$169.90	$133.90	$122.00	$116.20	$110.10	$105.30	$98.20
0.3151 - 0.3470	.2960	.2792	4	1 ½	6	44211ST	44311ST	44411ST	179.85	143.95	131.85	126.25	120.00	115.25	108.20
0.3471 - 0.3780	.3260	.3105	4	1 ¾	7	44212ST	44312ST	44412ST	180.85	145.00	132.95	127.25	121.10	116.20	109.30
0.3781 - 0.4090	.3550	.3105	4	1 ¾	7	44213ST	44313ST	44413ST	185.70	149.80	137.80	132.05	125.90	121.10	114.05
0.4091 - 0.4410	.3850	.3730	6	1 ¾	7	44214ST	44314ST	44414ST	190.05	154.25	142.15	136.50	130.30	125.50	118.40
0.4411 - 0.4720	.4150	.3730	6	1 ¾	7	44215ST	44315ST	44415ST	197.60	161.75	149.75	144.00	137.90	133.00	126.00
0.4721 - 0.5030	.4440	.4355	6	2	8	44216ST	44316ST	44416ST	212.20	173.95	161.05	155.00	148.50	143.30	135.85
0.5031 - 0.5340	.4730	.4355	6	2	8	44217ST	44317ST	44417ST	216.15	177.90	165.05	159.00	152.40	147.30	139.80
0.5341 - 0.5660	.5020	.4355	6	2	8	44218ST	44318ST	44418ST	216.15	177.90	165.05	159.00	152.40	147.30	139.80
0.5661 - 0.5970	.5320	.4355	6	2	8	44219ST	44319ST	44419ST	220.25	182.05	169.30	163.15	156.60	151.45	143.95
0.5971 - 0.6280	.5610	.5615	6	2 ¼	9	44220ST	44320ST	44420ST	220.25	182.05	169.30	163.15	156.60	151.45	143.95
0.6281 - 0.6590	.5900	.5615	6	2 ¼	9	44221ST	44321ST	44421ST	224.80	186.70	173.70	167.70	161.05	155.95	148.50
0.6591 - 0.6910	.6200	.5615	6	2 ¼	9	44222ST	44322ST	44422ST	234.10	195.80	182.95	176.85	170.35	165.25	157.70
0.6911 - 0.7220	.6500	.5615	6	2 ¼	9	44223ST	44323ST	44423ST	236.45	198.20	185.40	179.30	172.75	167.55	160.15
0.7221 - 0.7530	.6790	.6245	6	2 ½	9 ½	44224ST	44324ST	44424ST	238.80	200.55	187.75	181.65	175.15	169.95	162.40
0.7531 - 0.7840	.7080	.6245	6	2 ½	9 ½	44225ST	44325ST	44425ST	243.15	204.85	192.05	186.00	179.40	174.25	166.75
0.7841 - 0.8160	.7370	.6245	6	2 ½	9 ½	44226ST	44326ST	44426ST	243.15	204.85	192.05	186.00	179.40	174.25	166.75
0.8161 - 0.8470	.7670	.6245	6	2 ½	9 ½	44227ST	44327ST	44427ST	252.20	214.00	201.15	195.05	188.40	183.30	175.80
0.8471 - 0.8780	.7970	.7495	6	2 ⅝	10	44228ST	44328ST	44428ST	261.70	222.05	208.70	202.45	195.55	190.25	182.50
0.8781 - 0.9090	.8260	.7495	6	2 ⅝	10	44229ST	44329ST	44429ST	291.75	251.95	238.65	232.35	225.55	220.20	212.30
0.9091 - 0.9410	.8550	.7495	8	2 ⅝	10	44230ST	44330ST	44430ST	291.75	251.95	238.65	232.35	225.55	220.20	212.30
0.9411 - 0.9720	.8850	.7495	8	2 ⅝	10	44231ST	44331ST	44431ST	302.15	262.40	249.15	242.70	235.95	230.65	222.90
0.9721 - 1.0030	.9140	.8745	8	2 ¾	10 ½	44232ST	44332ST	44432ST	302.15	262.40	249.15	242.70	235.95	230.65	222.90
1.0031 - 1.0660	.9430	.8745	8	2 ¾	10 ½	44234ST	44334ST	44434ST	341.20	301.45	288.15	281.80	275.00	269.70	261.90
1.0661 - 1.1280	1.0020	.8745	8	2 ⅞	11	44236ST	44336ST	44436ST	349.30	309.55	296.25	289.95	283.10	277.80	269.95
1.1281 - 1.1905	1.0610	.9995	8	2 ⅞	11	44238ST	44338ST	44438ST	363.15	323.50	310.15	303.85	297.00	291.70	283.90
1.1906 - 1.2530	1.1200	.9995	8	3	11 ½	44240ST	44340ST	44440ST	379.45	339.80	326.55	320.10	313.40	308.00	300.20
1.2531 - 1.3155	1.1780	.9995	8	3	11 ½	44242ST	44342ST	44442ST	411.65	371.90	358.55	352.30	345.40	340.10	332.35
1.3156 - 1.3780	1.2370	.9995	8	3 ¼	12	44244ST	44344ST	44444ST	443.30	403.55	390.35	384.00	377.15	371.80	364.15
1.3781 - 1.4405	1.2960	.9995	8	3 ¼	12	44246ST	44346ST	44446ST	464.95	425.20	411.95	405.60	398.85	393.45	385.70
1.4406 - 1.5030	1.3550	1.2495	8	3 ½	12 ½	44248ST	44348ST	44448ST	486.80	447.15	433.80	427.50	420.70	415.40	407.50

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

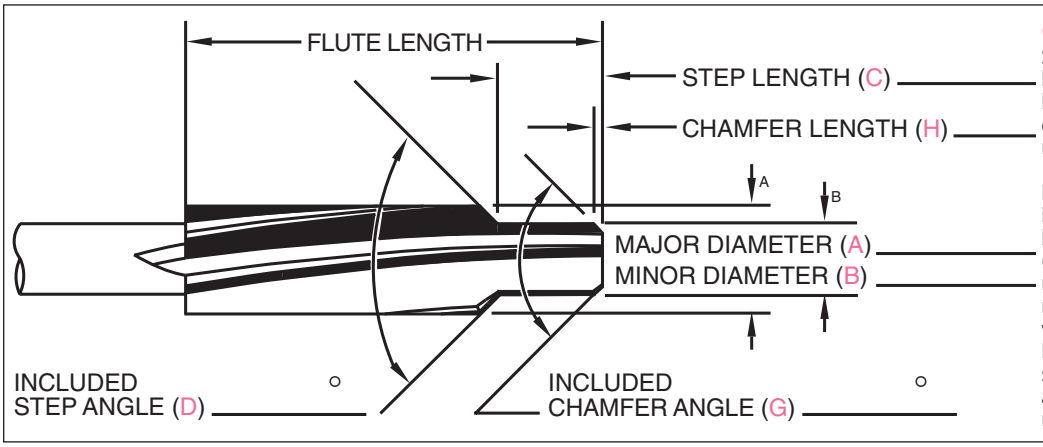
LEFT SPIRAL FLUTES
FLUTE LONG CARBIDE
CUTTING OR NON-CUTTING PILOT

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 PRICE EACH - BASED ON QUANTITY ORDERED						
	NON-CUT PILOT MIN. DIAM.	MAX. SHANK DIAM.	NO. OF FLTS	LENGTH FLT & CARB.	LENGTH OVER-ALL				1	2	3	4	5-7	8-14	OVER 14
0.2841 - 0.3150	.2670	.2792	4	1 ½	6	48210ST	48310ST	48410ST	$181.15	$142.90	$130.15	$124.00	$117.40	$112.25	$104.80
0.3151 - 0.3470	.2960	.2792	4	1 ½	6	48211ST	48311ST	48411ST	191.90	153.55	140.70	134.65	128.05	122.90	115.35
0.3471 - 0.3780	.3260	.3105	4	1 ¾	7	48212ST	48312ST	48412ST	192.95	154.55	141.85	135.75	129.15	124.00	116.45
0.3781 - 0.4090	.3550	.3105	4	1 ¾	7	48213ST	48313ST	48413ST	198.05	159.70	147.00	140.85	134.30	129.15	121.65
0.4091 - 0.4410	.3850	.3730	6	1 ¾	7	48214ST	48314ST	48414ST	202.70	164.40	151.60	145.60	139.00	133.85	126.35
0.4411 - 0.4720	.4150	.3730	6	1 ¾	7	48215ST	48315ST	48415ST	210.80	172.45	159.65	153.65	147.05	141.90	134.40
0.4721 - 0.5030	.4440	.4355	6	2	8	48216ST	48316ST	48416ST	217.90	178.65	165.40	159.15	152.40	147.15	139.45
0.5031 - 0.5340	.4730	.4355	6	2	8	48217ST	48317ST	48417ST	222.00	182.70	169.50	163.20	156.60	151.25	143.45
0.5341 - 0.5660	.5020	.4355	6	2	8	48218ST	48318ST	48418ST	222.00	182.70	169.50	163.20	156.60	151.25	143.45
0.5661 - 0.5970	.5320	.4355	6	2	8	48219ST	48319ST	48419ST	226.30	186.95	173.70	167.50	160.80	155.50	147.70
0.5971 - 0.6280	.5610	.5615	6	2 ¼	9	48220ST	48320ST	48420ST	226.30	186.95	173.70	167.50	160.80	155.50	147.70
0.6281 - 0.6590	.5900	.5615	6	2 ¼	9	48221ST	48321ST	48421ST	230.90	191.55	178.45	172.20	165.40	160.15	152.40
0.6591 - 0.6910	.6200	.5615	6	2 ¼	9	48222ST	48322ST	48422ST	240.35	201.05	187.90	181.65	174.85	169.55	161.90
0.6911 - 0.7220	.6500	.5615	6	2 ¼	9	48223ST	48323ST	48423ST	242.75	203.55	190.40	184.05	177.45	172.15	164.30
0.7221 - 0.7530	.6790	.6245	6	2 ½	9 ½	48224ST	48324ST	48424ST	245.30	205.90	192.75	186.55	179.80	174.50	166.80
0.7531 - 0.7840	.7080	.6245	6	2 ½	9 ½	48225ST	48325ST	48425ST	249.70	210.35	197.25	190.90	184.10	178.85	171.20
0.7841 - 0.8160	.7370	.6245	6	2 ½	9 ½	48226ST	48326ST	48426ST	249.70	210.35	197.25	190.90	184.10	178.85	171.20
0.8161 - 0.8470	.7670	.6245	6	2 ½	9 ½	48227ST	48327ST	48427ST	258.95	219.65	206.50	200.20	193.50	188.25	180.50
0.8471 - 0.8780	.7970	.7495	6	2 ⅝	10	48228ST	48328ST	48428ST	268.70	227.90	214.30	207.80	200.80	195.30	187.30
0.8781 - 0.9090	.8260	.7495	6	2 ⅝	10	48229ST	48329ST	48429ST	299.60	258.75	245.15	238.60	231.60	226.05	218.10
0.9091 - 0.9410	.8550	.7495	8	2 ⅝	10	48230ST	48330ST	48430ST	299.60	258.75	245.15	238.60	231.60	226.05	218.10
0.9411 - 0.9720	.8850	.7495	8	2 ⅝	10	48231ST	48331ST	48431ST	310.30	269.55	255.80	249.30	242.40	236.85	228.85
0.9721 - 1.0030	.9140	.8745	8	2 ¾	10 ½	48232ST	48332ST	48432ST	310.30	269.55	255.80	249.30	242.40	236.85	228.85
1.0031 - 1.0660	.9430	.8745	8	2 ¾	10 ½	48234ST	48334ST	48434ST	350.30	309.55	295.85	289.40	282.40	276.95	268.80
1.0661 - 1.1280	1.0020	.8745	8	2 ⅞	11	48236ST	48336ST	48436ST	358.55	317.90	304.20	297.70	290.70	285.25	277.25
1.1281 - 1.1905	1.0610	.9995	8	2 ⅞	11	48238ST	48338ST	48438ST	372.85	332.05	318.50	311.95	304.95	299.55	291.45
1.1906 - 1.2530	1.1200	.9995	8	3	11 ½	48240ST	48340ST	48440ST	389.65	348.90	335.30	328.75	321.75	316.30	308.25
1.2531 - 1.3155	1.1780	.9995	8	3	11 ½	48242ST	48342ST	48442ST	422.70	381.90	368.25	361.75	354.80	349.15	341.25
1.3156 - 1.3780	1.2370	.9995	8	3 ¼	12	48244ST	48344ST	48444ST	455.25	414.50	400.75	394.25	387.30	381.70	373.85
1.3781 - 1.4405	1.2960	.9995	8	3 ¼	12	48246ST	48346ST	48446ST	477.40	436.70	422.95	416.45	409.55	404.05	396.05
1.4406 - 1.5030	1.3550	1.2495	8	3 ½	12 ½	48248ST	48348ST	48448ST	499.90	459.00	445.30	438.90	431.85	426.40	418.45

SOLID CARBIDE REAMERS

MATERIAL SPECIFIC COOLANT FED

INDEX

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 recieved 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

MATERIAL SPECIFIC COOLANT FED

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	$144.75	$125.40	$118.90	$115.85	$112.40	$109.85	$106.00
.1281 - .1435	.1255	4	3/4	2 1/2	80709	80609	145.80	126.30	120.00	116.80	113.50	110.85	107.05
.1436 - .1590	.1411	4	3/4	2 1/2	80710	80610	146.35	127.00	120.55	117.45	114.05	111.45	107.70
.1591 - .1750	.1567	4	7/8	2 3/4	80711	80611	147.75	128.45	122.00	118.85	115.45	112.90	109.10
.1751 - .1910	.1724	4	7/8	2 3/4	80712	80612	153.75	134.25	127.90	124.70	121.45	118.80	115.05
.1911 - .2210	.1880	6	1	3	80714	80614	156.00	136.60	130.15	127.00	123.70	121.05	117.35
.2211 - .2530	.2193	6	1	3	80716	80616	158.80	139.40	132.95	129.80	126.35	123.90	120.05
.2531 - .2840	.2505	6	1 1/8	3 1/4	80718	80618	163.30	143.90	137.50	134.25	130.95	128.40	124.50
.2841 - .3150	.2817	6	1 1/8	3 1/4	80720	80620	167.05	147.65	141.20	138.10	134.75	132.20	128.40
.3151 - .3470	.3130	6	1 1/4	3 1/2	80722	80622	171.70	152.25	145.85	142.60	139.40	136.75	132.95
.3471 - .3780	.3443	6	1 1/4	3 1/2	80724	80624	176.90	157.45	151.05	147.95	144.60	141.95	138.20
.3781 - .4090	.3755	6	1 3/8	3 3/4	80726	80626	185.05	165.65	159.30	156.10	152.80	150.20	146.35

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	$204.80	$185.45	$179.00	$175.90	$172.45	$169.95	$166.15
.1281 - .1435	.1255	4	3/4	2 1/2	80909	80809	194.60	175.15	168.75	165.50	162.30	159.65	155.85
.1436 - .1590	.1411	4	3/4	2 1/2	80910	80810	206.85	187.40	181.05	177.85	174.55	171.90	168.10
.1591 - .1750	.1567	4	7/8	2 3/4	80911	80811	208.60	189.20	182.80	179.70	176.35	173.70	169.95
.1751 - .1910	.1724	4	7/8	2 3/4	80912	80812	209.90	190.55	184.05	180.95	177.55	175.00	171.20
.1911 - .2210	.1880	6	1	3	80914	80814	252.25	232.85	226.40	223.25	219.95	217.40	213.50
.2211 - .2530	.2193	6	1	3	80916	80816	255.40	235.90	229.60	226.35	223.05	220.40	216.60
.2531 - .2840	.2505	6	1 1/8	3 1/4	80918	80818	260.85	241.40	235.05	231.85	228.55	225.90	222.05
.2841 - .3150	.2817	6	1 1/8	3 1/4	80920	80820	265.15	245.85	239.35	236.20	232.85	230.15	226.40
.3151 - .3470	.3130	6	1 1/4	3 1/2	80922	80822	282.05	262.65	256.25	253.00	249.70	247.15	243.30
.3471 - .3780	.3443	6	1 1/4	3 1/2	80924	80824	288.05	268.60	262.25	259.00	255.75	253.05	249.30
.3781 - .4090	.3755	6	1 3/8	3 3/4	80926	80826	297.90	278.50	272.05	268.90	265.55	262.95	259.15

COOLANT FED MATERIAL SPECIFIC REAMERS
SOLID CARBIDE TYPES 816, 817, 828, & 829

MATERIAL SPECIFIC COOLANT FED

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	$148.45	$128.95	$122.60	$119.40	$116.05	$113.50	$109.60
.1281 - .1435	.1255	4	3/4	2 1/2	81709	81609	149.40	130.05	123.55	120.45	117.00	114.55	110.75
.1436 - .1590	.1411	4	3/4	2 1/2	81710	81610	150.05	130.60	124.30	121.05	117.70	115.15	111.30
.1591 - .1750	.1567	4	7/8	2 3/4	81711	81611	151.50	132.10	125.70	122.50	119.15	116.55	112.70
.1751 - .1910	.1724	4	7/8	2 3/4	81712	81612	157.35	137.95	131.50	128.40	125.00	122.40	118.70
.1911 - .2210	.1880	6	1	3	81714	81614	159.60	140.20	133.75	130.50	127.25	124.65	120.80
.2211 - .2530	.2193	6	1	3	81716	81616	162.35	142.95	136.55	133.25	130.05	127.40	123.55
.2531 - .2840	.2505	6	1 1/8	3 1/4	81718	81618	166.80	147.50	141.05	137.90	134.50	131.85	128.10
.2841 - .3150	.2817	6	1 1/8	3 1/4	81720	81620	170.60	151.25	144.80	141.70	138.30	135.65	131.85
.3151 - .3470	.3130	6	1 1/4	3 1/2	81722	81622	175.30	155.95	149.45	146.30	143.05	140.40	136.60
.3471 - .3780	.3443	6	1 1/4	3 1/2	81724	81624	181.60	162.10	155.70	152.60	149.20	146.60	142.90
.3781 - .4090	.3755	6	1 3/8	3 3/4	81726	81626	189.85	170.50	164.05	160.90	157.50	154.95	151.20

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	$234.30	$214.90	$208.50	$205.35	$201.95	$199.35	$195.55
.1281 - .1435	.1255	4	3/4	2 1/2	82909	82809	235.60	216.15	209.75	206.70	203.25	200.60	196.85
.1436 - .1590	.1411	4	3/4	2 1/2	82910	82810	236.30	216.85	210.50	207.25	204.00	201.35	197.55
.1591 - .1750	.1567	4	7/8	2 3/4	82911	82811	237.95	218.50	212.10	209.00	205.60	203.05	199.25
.1751 - .1910	.1724	4	7/8	2 3/4	82912	82812	239.05	219.65	213.30	210.00	206.80	204.10	200.35
.1911 - .2210	.1880	6	1	3	82914	82814	309.10	289.75	283.30	280.10	276.70	274.25	270.45
.2211 - .2530	.2193	6	1	3	82916	82816	308.85	289.50	283.05	279.95	276.55	273.90	270.20
.2531 - .2840	.2505	6	1 1/8	3 1/4	82918	82818	314.25	294.90	288.40	285.30	281.90	279.35	275.60
.2841 - .3150	.2817	6	1 1/8	3 1/4	82920	82820	318.65	299.30	292.85	289.75	286.45	283.75	280.00
.3151 - .3470	.3130	6	1 1/4	3 1/2	82922	82822	335.45	316.15	309.65	306.50	303.15	300.60	296.70
.3471 - .3780	.3443	6	1 1/4	3 1/2	82924	82824	341.55	322.20	315.75	312.55	309.25	306.65	302.90
.3781 - .4090	.3755	6	1 3/8	3 3/4	82926	82826	351.60	332.10	325.75	322.55	319.25	316.60	312.85

MATERIAL SPECIFIC REAMERS
SOLID CARBIDE TYPES 802, 803, 812, 813, 822, 823

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

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

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

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

MODIFICATIONS (See list on page 101)

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

TOOL DIAMETER RANGE	DIMENSIONS				EDP NO. - STRAIGHT		FINISHED TO MODIFIED TOOL DIAMETER						
	MAX. SHANK DIAM.	NO. OF FLUTES	LENGTH		TYPE 803 NON-FERROUS	TYPE 802 CAST IRON/ STEEL	PRICE EACH - BASED ON QUANTITY ORDERED						
			FLT	OVER-ALL			1	2	3	4	5-7	8-14	OVER 14
*0.0591 - 0.0660	.0580	4	3/8	1 1/2	-	80204	$76.25	$47.50	$37.85	$33.35	$28.40	$24.50	$18.85
*0.0661 - 0.0740	.0650	4	1/2	1 3/4	-	80245	76.55	47.70	38.10	33.50	28.60	24.70	19.10
*0.0741 - 0.0810	.0730	4	1/2	1 3/4	-	80205	76.65	47.80	38.15	33.70	28.65	24.90	19.15
*0.0811 - 0.0890	.0800	4	1/2	2	-	80255	77.05	48.35	38.70	34.15	29.25	25.35	19.70
*0.0891 - 0.0970	.0880	4	1/2	2	-	80206	77.60	48.75	39.15	34.60	29.75	25.70	20.20
*0.0971 - 0.1120	.0943	4	5/8	2 1/4	80307	80207	77.85	49.00	39.45	34.85	29.95	26.10	20.45
0.1121 - 0.1280	.1099	4	5/8	2 1/4	80308	80208	79.25	50.40	40.80	36.25	31.25	27.40	21.80
0.1281 - 0.1435	.1255	4	3/4	2 1/2	80309	80209	79.75	51.00	41.35	36.85	31.90	28.05	22.35
0.1436 - 0.1590	.1411	4	3/4	2 1/2	80310	80210	81.15	52.30	42.70	38.15	33.30	29.30	23.70
0.1591 - 0.1750	.1567	4	7/8	2 3/4	80311	80211	84.20	55.35	45.75	41.25	36.30	32.45	26.75
0.1751 - 0.1910	.1724	4	7/8	2 3/4	80312	80212	86.25	57.40	47.80	43.30	38.25	34.50	28.80
0.1911 - 0.2210	.1880	6	1	3	80314	80214	89.80	61.00	51.40	46.85	42.00	38.05	32.45
0.2211 - 0.2530	.2193	6	1	3	80316	80216	95.90	67.15	57.50	53.00	48.05	44.15	38.55
0.2531 - 0.2840	.2505	6	1 1/8	3 1/4	80318	80218	103.05	74.20	64.60	60.05	55.15	51.25	45.65
0.2841 - 0.3150	.2817	6	1 1/8	3 1/4	80320	80220	110.90	82.10	72.35	67.95	63.00	59.10	53.50
0.3151 - 0.3470	.3130	6	1 1/4	3 1/2	80322	80222	122.50	93.75	84.15	79.60	74.70	70.65	65.20
0.3471 - 0.3780	.3443	6	1 1/4	3 1/2	80324	80224	124.00	95.30	85.75	81.15	76.20	72.25	66.65
0.3781 - 0.4090	.3755	6	1 3/8	3 3/4	80326	80226	134.30	105.50	95.90	91.25	86.40	82.50	76.85
0.4091 - 0.4410	.4067	6	1 3/8	3 3/4	80328	80228	135.45	106.65	97.05	92.50	87.60	83.65	78.00
0.4411 - 0.4720	.4380	6	1 1/2	4	80330	80230	143.70	114.90	105.25	100.75	95.80	91.95	86.30
0.4721 - 0.5150	.4693	6	1 1/2	4	80332	80232	151.70	122.90	113.20	108.75	103.85	99.95	94.30

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	$80.80	$51.75	$42.00	$37.40	$32.35	$28.40	$22.70
0.1121 - 0.1280	.1099	4	5/8	2 1/4	81308	81208	82308	82208	82.35	53.20	43.45	38.95	33.85	29.90	24.25
0.1281 - 0.1435	.1255	4	3/4	2 1/2	81309	81209	82309	82209	87.15	56.65	46.45	41.55	36.35	32.20	26.15
0.1436 - 0.1590	.1411	4	3/4	2 1/2	81310	81210	82310	82210	88.80	58.20	47.95	43.15	37.90	33.75	27.85
0.1591 - 0.1750	.1567	4	7/8	2 3/4	81311	81211	82311	82211	92.35	61.80	51.55	46.65	41.50	37.30	31.30
0.1751 - 0.1910	.1724	4	7/8	2 3/4	81312	81212	82312	82212	94.65	64.15	53.85	49.00	43.75	39.65	33.65
0.1911 - 0.2210	.1880	6	1	3	81314	81214	82314	82214	103.55	71.55	60.85	55.75	50.25	45.90	39.65
0.2211 - 0.2530	.2193	6	1	3	81316	81216	82316	82216	111.15	79.00	68.25	63.30	57.75	53.50	47.25
0.2531 - 0.2840	.2505	6	1 1/8	3 1/4	81318	81218	82318	82218	119.85	87.80	77.10	72.10	66.50	62.25	55.95
0.2841 - 0.3150	.2817	6	1 1/8	3 1/4	81320	81220	82320	82220	129.30	97.30	86.55	81.50	76.05	71.65	65.35
0.3151 - 0.3470	.3130	6	1 1/4	3 1/2	81322	81222	82322	82222	143.60	111.60	100.85	95.80	90.30	85.90	79.65
0.3471 - 0.3780	.3443	6	1 1/4	3 1/2	81324	81224	82324	82224	145.55	113.50	102.80	97.65	92.25	87.85	81.60
0.3781 - 0.4090	.3755	6	1 3/8	3 3/4	81326	81226	82326	82226	149.60	117.50	106.75	101.65	96.20	91.85	85.65
0.4091 - 0.4410	.4067	6	1 3/8	3 3/4	81328	81228	82328	82228	150.85	118.70	107.95	102.95	97.45	93.10	86.90
0.4411 - 0.4720	.4380	6	1 1/2	4	81330	81230	82330	82230	160.00	127.90	117.20	112.20	106.70	102.35	96.05
0.4721 - 0.5150	.4693	6	1 1/2	4	81332	81232	82332	82232	168.85	136.80	126.10	121.10	115.50	111.20	104.95

*Designed with male centers

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

GENERAL PURPOSE

SHORT SERIES
STRAIGHT FLUTES & SHANK

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

TOOL DIAMETER					TOOL DIAMETER					TOOL DIAMETER					TOOL DIAMETER				
FRAC/ WIRE	(mm)	DEC.	TYPE 804 EDP NO.	PRICE	FRAC/ WIRE	(mm)	DEC.	TYPE 804 EDP NO.	PRICE	FRAC/ LETTER	(mm)	DEC.	TYPE 804 EDP NO.	PRICE	FRAC/ LETTER	(mm)	DEC.	TYPE 804 EDP NO.	PRICE
*1/32		.0312	80402	$23.50	9/64		.1406	80409	$29.85		6.0	.2362	804060	$47.70	23/64		.3594	80423	$87.10
	*1.0	.0394	804010	22.50		3.6	.1417	804036	30.20	B		.2380	8042380	52.45		9.2	.3622	804092	92.60
	*1.1	.0433	804011	24.75	27		.1440	8041440	30.20		6.1	.2402	804061	52.45		9.3	.3661	804093	92.60
*3/64		.0469	80403	24.90		3.7	.1457	804037	30.60	C		.2420	8042420	52.45	U		.3680	8043680	88.20
	*1.2	.0472	804012	24.90	26		.1470	8041470	31.10		6.2	.2441	804062	52.45		9.4	.3701	804094	93.05
	*1.3	.0512	804013	24.90	25		.1495	8041495	31.25	D		.2460	8042460	52.45		9.5	.3740	804095	88.70
	*1.4	.0551	804014	24.90		3.8	.1496	804038	32.85		6.3	.2480	804063	52.45	3/8		.3750	80424	81.20
	1.5	.0591	804015	22.10	24		.1520	8041520	31.25	1/4 , E		.2500	80416	47.70	V		.3770	8043770	105.35
1/16		.0625	80404	22.75		3.9	.1535	804039	32.60		6.4	.2520	804064	57.80		9.6	.3780	804096	110.75
	1.6	.0630	804016	24.70	23		.1540	8041540	32.60		6.5	.2559	804065	57.75		9.7	.3819	804097	110.75
	1.7	.0669	804017	25.00	5/32		.1562	80410	30.80	F		.2570	8042570	57.75		9.8	.3858	804098	110.75
51		.0670	8040670	25.00	22		.1570	8041570	33.70		6.6	.2598	804066	60.60	W		.3860	8043860	105.65
50		.0700	8040700	25.00		4.0	.1575	804040	30.80	G		.2610	8042610	57.75		9.9	.3898	804099	116.65
	1.8	.0709	804018	25.00	21		.1590	8041590	34.55		6.7	.2638	804067	60.60	25/64		.3906	80425	111.10
49		.0730	8040730	25.00	20		.1610	8041610	35.00	17/64		.2656	80417	57.75		10.0	.3937	804100	111.10
	1.9	.0748	804019	25.00		4.1	.1614	804041	35.00	H		.2660	8042660	57.75	X		.3970	8043970	111.10
48		.0760	8040760	25.00		4.2	.1654	804042	35.20		6.8	.2677	804068	60.60		10.1	.3976	804101	116.65
5/64		.0781	80405	25.00	19		.1660	8041660	35.20		6.9	.2717	804069	60.60		10.2	.4016	804102	116.65
47		.0785	8040785	25.05		4.3	.1693	804043	35.55	I		.2720	8042720	57.75	Y		.4040	8044040	111.10
	2.0	.0787	804020	23.05	18		.1695	8041695	35.55		7.0	.2756	804070	52.70		10.3	.4055	804103	116.65
46		.0810	8040810	25.05	11/64		.1719	80411	36.25	J		.2770	8042770	57.75	13/32		.4062	80426	111.10
45		.0820	8040820	25.20	17		.1730	8041730	36.25		7.1	.2795	804071	65.75		10.4	.4094	804104	116.65
	2.1	.0827	804021	25.20		4.4	.1732	804044	36.25	K		.2810	8042810	62.60	Z		.4130	8044130	111.10
44		.0860	8040860	25.20	16		.1770	8041770	37.15	9/32		.2812	80418	57.25		10.5	.4134	804105	111.10
	2.2	.0866	804022	25.20		4.5	.1772	804045	33.70		7.2	.2835	804072	71.05		10.6	.4173	804106	119.75
43		.0890	8040890	25.60	15		.1800	8041800	37.30		7.3	.2874	804073	71.05		10.7	.4213	804107	119.75
	2.3	.0906	804023	25.60		4.6	.1811	804046	37.80	L		.2900	8042900	67.80	27/64		.4219	80427	114.05
42		.0935	8040935	25.70	14		.1820	8041820	37.85		7.4	.2913	804074	71.05		10.8	.4252	804108	119.75
3/32		.0938	80406	23.70	13	4.7	.1850	804047	38.10	M		.2950	8042950	67.80		10.9	.4291	804109	119.75
	2.4	.0945	804024	25.70	3/16		.1875	80412	36.55		7.5	.2953	804075	67.80		11.0	.4331	804110	114.05
41		.0960	8040960	26.25	12	4.8	.1890	804048	40.15	19/64		.2969	80419	67.80		11.1	.4370	804111	119.80
40		.0980	8040980	26.25	11		.1910	8041910	40.65		7.6	.2992	804076	74.15	7/16		.4375	80428	114.05
	2.5	.0984	804025	23.95		4.9	.1929	804049	40.65	N		.3020	8043020	70.60		11.2	.4409	804112	130.05
39		.0995	8040995	26.45	10		.1935	8041935	40.90		7.7	.3031	804077	74.15		11.3	.4449	804113	130.05
38		.1015	8041015	26.45	9		.1960	8041960	42.35		7.8	.3071	804078	74.15		11.4	.4488	804114	130.05
	2.6	.1024	804026	26.55		5.0	.1969	804050	38.65		7.9	.3110	804079	74.15		11.5	.4528	804115	123.85
37		.1040	8041040	28.10	8		.1990	8041990	42.55	5/16		.3125	80420	64.55	29/64		.4531	80429	123.85
	2.7	.1063	804027	26.70		5.1	.2008	804051	43.95		8.0	.3150	804080	64.55		11.6	.4567	804116	130.05
36		.1065	8041065	26.70	7		.2010	8042010	43.95	O		.3160	8043160	74.15		11.7	.4606	804117	130.05
7/64		.1094	80407	27.50	13/64		.2031	80413	43.95		8.1	.3189	804081	78.90		11.8	.4646	804118	130.05
35		.1100	8041100	27.50	6		.2040	8042040	43.95		8.2	.3228	804082	78.90		11.9	.4685	804119	131.20
	2.8	.1102	804028	27.50		5.2	.2047	804052	43.95	P		.3230	8043230	75.05	15/32		.4688	80430	123.85
34		.1110	8041110	28.00	5		.2055	8042055	43.95		8.3	.3268	804083	90.25		12.0	.4724	804120	123.85
33		.1130	8041130	28.35		5.3	.2087	804053	43.95	21/64		.3281	80421	85.90		12.1	.4764	804121	141.80
	2.9	.1142	804029	28.35	4		.2090	8042090	46.15		8.4	.3307	804084	90.25		12.2	.4803	804122	141.80
32		.1160	8041160	28.35		5.4	.2126	804054	43.95	Q		.3320	8043320	85.90		12.3	.4843	804123	141.80
	3.0	.1181	804030	26.25	3		.2130	8042130	43.95		8.5	.3346	804085	85.90	31/64		.4844	80431	135.00
31		.1200	8041200	28.45		5.5	.2165	804055	40.15		8.6	.3386	804086	90.25		12.4	.4882	804124	141.80
	3.1	.1220	804031	28.45	7/32		.2188	80414	40.05	R		.3390	8043390	85.90		12.5	.4921	804125	135.00
1/8		.1250	80408	26.25		5.6	.2205	804056	48.95		8.7	.3425	804087	90.25		12.6	.4961	804126	141.80
	3.2	.1260	804032	28.45	2		.2210	8042210	48.95	11/32		.3438	80422	85.90	1/2		.5000	80432	135.00
30		.1285	8041285	28.50		5.7	.2244	804057	50.85		8.8	.3465	804088	90.65		12.8	.5039	804128	141.80
	3.3	.1299	804033	28.50	1		.2280	8042280	51.45	S		.3480	8043480	86.30		12.9	.5079	804129	141.80
	3.4	.1339	804034	28.50		5.8	.2283	804058	51.45		8.9	.3504	804089	90.65		13.0	.5118	804130	160.55
29		.1360	8041360	28.50		5.9	.2323	804059	51.45		9.0	.3543	804090	79.35					
	3.5	.1378	804035	26.55	A		.2340	8042340	51.45	T		.3580	8043580	86.65					
28		.1405	8041405	28.90	15/64		.2344	80415	51.45		9.1	.3583	804091	91.50					

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

CHUCKING REAMERS
SOLID CARBIDE TYPE 804 .0005 INCREMENTS

GENERAL PURPOSE

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

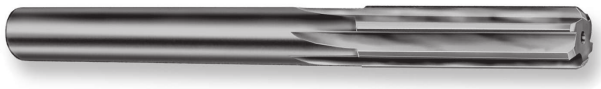
MODIFICATIONS (See list on page 101)

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	$25.50	.0520	8040520	$24.90	.0760	8040760	$25.00	.1000	8041000	$27.75	.1240	8041240	$29.95
.0285	8040285	26.95	.0525	8040525	26.25	.0765	8040765	26.25	.1005	8041005	27.75	.1245	8041245	29.95
.0290	8040290	26.95	.0530	8040530	26.25	.0770	8040770	26.25	.1010	8041010	27.75	.1250	80408	26.25
.0295	8040295	25.50	.0535	8040535	26.25	.0775	8040775	26.25	.1015	8041015	26.45	.1255	8041255	29.95
.0300	8040300	26.95	.0540	8040540	26.25	.0780	8040780	26.25	.1020	8041020	28.00	.1260	804032	28.45
.0305	8040305	26.95	.0545	8040545	26.25	.0785	8040785	25.05	.1025	8041025	28.10	.1265	8041265	30.05
.0310	8040310	25.50	.0550	8040550	24.90	.0790	8040790	26.35	.1030	8041030	28.10	.1270	8041270	30.05
.0315	804008	25.50	.0555	8040555	26.25	.0795	8040795	26.35	.1035	8041035	28.10	.1275	8041275	30.05
.0320	8040320	25.50	.0560	8040560	26.25	.0800	8040800	26.35	.1040	8041040	28.10	.1280	8041280	28.50
.0325	8040325	26.95	.0565	8040565	26.25	.0805	8040805	26.35	.1045	8041045	28.10	.1285	8041285	28.50
.0330	8040330	25.50	.0570	8040570	26.25	.0810	8040810	25.05	.1050	8041050	28.10	.1290	8041290	30.05
.0335	8040335	25.50	.0575	8040575	26.25	.0815	8040815	26.45	.1055	8041055	28.10	.1295	8041295	30.05
.0340	8040340	26.00	.0580	8040580	26.25	.0820	8040820	25.20	.1060	8041060	28.10	.1300	8041300	30.05
.0345	8040345	26.00	.0585	8040585	26.25	.0825	8040825	26.45	.1065	8041065	26.70	.1305	8041305	30.05
.0350	8040350	24.75	.0590	8040590	22.85	.0830	8040830	26.45	.1070	8041070	28.50	.1310	8041310	30.05
.0355	8040355	26.00	.0595	8040595	24.10	.0835	8040835	26.45	.1075	8041075	28.50	.1315	8041315	30.05
.0360	8040360	24.75	.0600	8040600	26.10	.0840	8040840	26.45	.1080	8041080	28.50	.1320	8041320	30.05
.0365	8040365	26.00	.0605	8040605	26.10	.0845	8040845	26.45	.1085	8041085	28.90	.1325	8041325	30.05
.0370	8040370	24.75	.0610	8040610	24.70	.0850	8040850	26.45	.1090	8041090	28.90	.1330	8041330	30.05
.0375	8040375	26.00	.0615	8040615	26.10	.0855	8040855	26.45	.1095	8041095	28.90	.1335	8041335	30.05
.0380	8040380	24.75	.0620	8040620	26.10	.0860	8040860	25.20	.1100	8041100	27.50	.1340	8041340	30.05
.0385	8040385	26.00	.0625	80404	22.75	.0865	8040865	26.45	.1105	8041105	29.30	.1345	8041345	30.05
.0390	8040390	24.75	.0630	804016	24.70	.0870	8040870	26.45	.1110	8041110	28.00	.1350	8041350	30.05
.0395	8040395	26.00	.0635	8040635	24.70	.0875	8040875	26.45	.1115	8041115	29.85	.1355	8041355	30.05
.0400	8040400	24.75	.0640	8040640	26.10	.0880	8040880	26.45	.1120	8041120	29.85	.1360	8041360	28.50
.0405	8040405	26.00	.0645	8040645	26.10	.0885	8040885	26.45	.1125	8041125	29.85	.1365	8041365	30.05
.0410	8040410	24.75	.0650	8040650	26.25	.0890	8040890	25.60	.1130	8041130	28.35	.1370	8041370	30.05
.0415	8040415	26.00	.0655	8040655	26.25	.0895	8040895	27.10	.1135	8041135	29.85	.1375	8041375	30.05
.0420	8040420	24.75	.0660	8040660	26.25	.0900	8040900	27.10	.1140	8041140	29.85	.1380	8041380	30.60
.0425	8040425	26.00	.0665	8040665	26.25	.0905	8040905	27.10	.1145	8041145	29.85	.1385	8041385	30.60
.0430	8040430	24.75	.0670	8040670	25.00	.0910	8040910	27.20	.1150	8041150	29.85	.1390	8041390	30.60
.0435	8040435	26.25	.0675	8040675	26.25	.0915	8040915	27.20	.1155	8041155	29.85	.1395	8041395	30.60
.0440	8040440	26.25	.0680	8040680	26.25	.0920	8040920	27.20	.1160	8041160	28.35	.1400	8041400	30.60
.0445	8040445	26.25	.0685	8040685	26.25	.0925	8040925	25.70	.1165	8041165	29.85	.1405	8041405	28.90
.0450	8040450	26.25	.0690	8040690	26.25	.0930	8040930	27.20	.1170	8041170	29.85	.1410	8041410	31.75
.0455	8040455	26.25	.0695	8040695	26.25	.0935	8040935	25.70	.1175	8041175	29.85	.1415	8041415	31.75
.0460	8040460	26.25	.0700	8040700	25.00	.0940	8040940	27.20	.1180	8041180	29.85	.1420	8041420	31.75
.0465	8040465	24.90	.0705	8040705	26.25	.0945	804024	25.70	.1185	8041185	29.95	.1425	8041425	31.75
.0470	8040470	26.25	.0710	8040710	26.25	.0950	8040950	27.50	.1190	8041190	29.95	.1430	8041430	31.75
.0475	8040475	26.25	.0715	8040715	26.25	.0955	8040955	27.50	.1195	8041195	29.95	.1435	8041435	31.75
.0480	8040480	26.25	.0720	8040720	26.25	.0960	8040960	26.25	.1200	8041200	28.45	.1440	8041440	30.20
.0485	8040485	26.25	.0725	8040725	26.25	.0965	8040965	26.25	.1205	8041205	29.95	.1445	8041445	31.90
.0490	8040490	26.25	.0730	8040730	25.00	.0970	8040970	27.50	.1210	8041210	29.95	.1450	8041450	31.95
.0495	8040495	26.25	.0735	8040735	26.25	.0975	8040975	27.50	.1215	8041215	29.95	.1455	8041455	31.95
.0500	8040500	26.25	.0740	8040740	26.25	.0980	8040980	26.25	.1220	804031	28.45	.1460	8041460	32.80
.0505	8040505	26.25	.0745	8040745	26.25	.0985	8040985	27.75	.1225	8041225	29.95	.1465	8041465	32.80
.0510	8040510	26.25	.0750	8040750	26.25	.0990	8040990	27.75	.1230	8041230	29.95	.1470	8041470	31.10
.0515	8040515	26.25	.0755	8040755	26.25	.0995	8040995	26.45	.1235	8041235	29.95	.1475	8041475	32.80

CHUCKING REAMERS
SOLID CARBIDE TYPE 804 .0005 INCREMENTS

GENERAL PURPOSE

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

MODIFICATIONS (See list on page 101)

REAMERS

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 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	$32.85	.1720	8041720	$38.10	.1960	8041960	$42.35	.2200	8042200	$51.60	.2440	8042440	$55.10
.1485	8041485	32.85	.1725	8041725	38.10	.1965	8041965	44.35	.2205	804056	48.95	.2445	8042445	55.10
.1490	8041490	32.85	.1730	8041730	36.25	.1970	8041970	44.85	.2210	8042210	48.95	.2450	8042450	55.10
.1495	8041495	31.25	.1735	8041735	38.65	.1975	8041975	44.85	.2215	8042215	53.65	.2455	8042455	55.10
.1500	8041500	32.85	.1740	8041740	38.65	.1980	8041980	44.85	.2220	8042220	53.65	.2460	8042460	52.45
.1505	8041505	32.85	.1745	8041745	38.65	.1985	8041985	44.85	.2225	8042225	53.65	.2465	8042465	55.10
.1510	8041510	32.85	.1750	8041750	38.65	.1990	8041990	42.55	.2230	8042230	53.65	.2470	8042470	55.10
.1515	8041515	32.85	.1755	8041755	39.05	.1995	8041995	46.15	.2235	8042235	53.65	.2475	8042475	55.10
.1520	8041520	31.25	.1760	8041760	39.05	.2000	8042000	46.15	.2240	8042240	53.65	.2480	804063	52.45
.1525	8041525	34.30	.1765	8041765	39.05	.2005	8042005	46.15	.2245	8042245	53.65	.2485	8042485	55.10
.1530	8041530	34.30	.1770	8041770	37.15	.2010	8042010	43.95	.2250	8042250	53.65	.2490	8042490	55.10
.1535	804039	32.60	.1775	8041775	39.15	.2015	8042015	46.15	.2255	8042255	53.65	.2495	8042495	55.10
.1540	8041540	32.60	.1780	8041780	39.15	.2020	8042020	46.15	.2260	8042260	53.65	.2500	80416	47.70
.1545	8041545	34.30	.1785	8041785	39.15	.2025	8042025	46.15	.2265	8042265	54.20	.2505	8042505	55.10
.1550	8041550	34.30	.1790	8041790	39.15	.2030	8042030	46.15	.2270	8042270	54.20	.2510	8042510	55.10
.1555	8041555	32.60	.1795	8041795	39.15	.2035	8042035	46.15	.2275	8042275	54.20	.2515	8042515	55.10
.1560	8041560	34.30	.1800	8041800	37.30	.2040	8042040	43.95	.2280	8042280	51.45	.2520	804064	57.80
.1565	8041565	35.50	.1805	8041805	39.45	.2045	8042045	46.15	.2285	8042285	54.20	.2525	8042525	57.80
.1570	8041570	33.70	.1810	8041810	39.50	.2050	8042050	46.15	.2290	8042290	54.20	.2530	8042530	55.10
.1575	804040	30.80	.1815	8041815	39.70	.2055	8042055	43.95	.2295	8042295	54.20	.2535	8042535	60.85
.1580	8041580	36.25	.1820	8041820	37.85	.2060	8042060	46.15	.2300	8042300	54.20	.2540	8042540	60.85
.1585	8041585	36.25	.1825	8041825	39.95	.2065	8042065	46.15	.2305	8042305	54.20	.2545	8042545	60.85
.1590	8041590	34.55	.1830	8041830	39.95	.2070	8042070	46.15	.2310	8042310	54.20	.2550	8042550	60.85
.1595	8041595	36.85	.1835	8041835	40.05	.2075	8042075	46.15	.2315	8042315	54.20	.2555	8042555	60.85
.1600	8041600	36.85	.1840	8041840	40.05	.2080	8042080	46.15	.2320	8042320	54.20	.2560	8042560	60.85
.1605	8041605	36.85	.1845	8041845	40.05	.2085	8042085	46.15	.2325	8042325	54.20	.2565	8042565	60.85
.1610	8041610	35.00	.1850	804047	38.10	.2090	8042090	46.15	.2330	8042330	54.20	.2570	8042570	57.75
.1615	8041615	36.85	.1855	8041855	42.15	.2095	8042095	46.15	.2335	8042335	54.20	.2575	8042575	60.85
.1620	8041620	36.85	.1860	8041860	42.15	.2100	8042100	46.15	.2340	8042340	51.45	.2580	8042580	60.85
.1625	8041625	36.85	.1865	8041865	42.15	.2105	8042105	46.15	.2345	8042345	54.20	.2585	8042585	60.85
.1630	8041630	36.85	.1870	8041870	40.15	.2110	8042110	46.15	.2350	8042350	54.20	.2590	8042590	60.85
.1635	8041635	36.95	.1875	80412	36.55	.2115	8042115	46.15	.2355	8042355	54.20	.2595	8042595	60.85
.1640	8041640	36.85	.1880	8041880	42.25	.2120	8042120	46.15	.2360	8042360	54.20	.2600	8042600	60.85
.1645	8041645	36.85	.1885	8041885	42.25	.2125	8042125	46.15	.2365	8042365	55.10	.2605	8042605	60.85
.1650	8041650	36.85	.1890	804048	40.15	.2130	8042130	43.95	.2370	8042370	55.10	.2610	8042610	57.75
.1655	8041655	36.85	.1895	8041895	42.70	.2135	8042135	46.15	.2375	8042375	55.10	.2615	8042615	60.85
.1660	8041660	35.20	.1900	8041900	42.70	.2140	8042140	46.15	.2380	8042380	52.45	.2620	8042620	60.85
.1665	8041665	37.30	.1905	8041905	42.70	.2145	8042145	46.15	.2385	8042385	55.10	.2625	8042625	60.85
.1670	8041670	37.30	.1910	8041910	40.65	.2150	8042150	46.15	.2390	8042390	55.10	.2630	8042630	60.85
.1675	8041675	37.30	.1915	8041915	42.80	.2155	8042155	46.15	.2395	8042395	55.10	.2635	8042635	60.85
.1680	8041680	37.30	.1920	8041920	42.80	.2160	8042160	46.15	.2400	8042400	55.10	.2640	8042640	60.85
.1685	8041685	37.30	.1925	8041925	42.80	.2165	804055	40.15	.2405	8042405	55.10	.2645	8042645	60.85
.1690	8041690	37.30	.1930	8041930	43.25	.2170	8042170	46.15	.2410	8042410	55.10	.2650	8042650	60.85
.1695	8041695	35.55	.1935	8041935	40.90	.2175	8042175	46.15	.2415	8042415	55.10	.2655	8042655	60.85
.1700	8041700	38.10	.1940	8041940	43.25	.2180	8042180	46.15	.2420	8042420	52.45	.2660	8042660	57.75
.1705	8041705	38.10	.1945	8041945	43.25	.2185	8042185	43.95	.2425	8042425	55.10	.2665	8042665	60.85
.1710	8041710	38.10	.1950	8041950	44.35	.2190	8042190	51.60	.2430	8042430	55.10	.2670	8042670	60.85
.1715	8041715	38.10	.1955	8041955	44.35	.2195	8042195	51.60	.2435	8042435	55.10	.2675	8042675	60.85

CHUCKING REAMERS
SOLID CARBIDE TYPE 804 .0005 INCREMENTS

GENERAL PURPOSE

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	$60.85	.2920	8042920	$71.30	.3160	8043160	$74.15	.3400	8043400	$90.45	.3640	8043640	$92.75
.2685	8042685	60.85	.2925	8042925	71.30	.3165	8043165	78.95	.3405	8043405	90.45	.3645	8043645	92.75
.2690	8042690	60.85	.2930	8042930	71.30	.3170	8043170	78.95	.3410	8043410	90.45	.3650	8043650	92.75
.2695	8042695	60.85	.2935	8042935	71.30	.3175	8043175	78.95	.3415	8043415	90.45	.3655	8043655	92.75
.2700	8042700	60.85	.2940	8042940	71.30	.3180	8043180	78.95	.3420	8043420	90.45	.3660	8043660	92.75
.2705	8042705	60.85	.2945	8042945	71.30	.3185	8043185	78.95	.3425	804087	90.25	.3665	8043665	92.75
.2710	8042710	60.85	.2950	8042950	67.80	.3190	8043190	78.95	.3430	8043430	90.45	.3670	8043670	92.75
.2715	8042715	60.85	.2955	8042955	71.30	.3195	8043195	78.95	.3435	8043435	90.45	.3675	8043675	92.75
.2720	8042720	57.75	.2960	8042960	71.30	.3200	8043200	78.95	.3440	8043440	90.65	.3680	8043680	88.20
.2725	8042725	60.85	.2965	8042965	71.30	.3205	8043205	78.95	.3445	8043445	90.65	.3685	8043685	93.65
.2730	8042730	60.85	.2970	8042970	74.15	.3210	8043210	78.95	.3450	8043450	90.65	.3690	8043690	93.85
.2735	8042735	60.85	.2975	8042975	74.15	.3215	8043215	78.95	.3455	8043455	90.65	.3695	8043695	93.65
.2740	8042740	60.85	.2980	8042980	74.15	.3220	8043220	78.95	.3460	8043460	90.65	.3700	8043700	93.65
.2745	8042745	60.85	.2985	8042985	74.15	.3225	8043225	78.95	.3465	804088	90.65	.3705	8043705	93.65
.2750	8042750	60.85	.2990	8042990	74.15	.3230	8043230	75.05	.3470	8043470	90.65	.3710	8043710	93.65
.2755	8042755	60.85	.2995	8042995	74.15	.3235	8043235	78.95	.3475	8043475	90.65	.3715	8043715	93.65
.2760	8042760	60.85	.3000	8043000	74.15	.3240	8043240	90.45	.3480	8043480	86.30	.3720	8043720	93.65
.2765	8042765	60.85	.3005	8043005	74.15	.3245	8043245	90.45	.3485	8043485	90.65	.3725	8043725	93.65
.2770	8042770	57.75	.3010	8043010	74.15	.3250	8043250	90.45	.3490	8043490	90.65	.3730	8043730	93.65
.2775	8042775	60.85	.3015	8043015	74.15	.3255	8043255	90.45	.3495	8043495	90.65	.3735	8043735	93.65
.2780	8042780	65.85	.3020	8043020	70.60	.3260	8043260	90.45	.3500	8043500	90.65	.3740	804095	88.70
.2785	8042785	65.85	.3025	8043025	74.15	.3265	8043265	90.45	.3505	8043505	90.65	.3745	8043745	93.65
.2790	8042790	65.85	.3030	8043030	74.15	.3270	8043270	90.45	.3510	8043510	90.65	.3750	80424	81.20
.2795	804071	65.75	.3035	8043035	74.15	.3275	8043275	90.45	.3515	8043515	90.65	.3755	8043755	111.00
.2800	8042800	65.85	.3040	8043040	74.15	.3280	8043280	90.45	.3520	8043520	90.65	.3760	8043760	111.10
.2805	8042805	65.85	.3045	8043045	74.15	.3285	8043285	90.45	.3525	8043525	90.65	.3765	8043765	111.00
.2810	8042810	62.60	.3050	8043050	74.15	.3290	8043290	90.45	.3530	8043530	90.65	.3770	8043770	105.35
.2815	8042815	65.85	.3055	8043055	74.15	.3295	8043295	90.45	.3535	8043535	90.65	.3775	8043775	111.00
.2820	8042820	71.30	.3060	8043060	74.15	.3300	8043300	90.45	.3540	8043540	90.65	.3780	804096	110.75
.2825	8042825	71.30	.3065	8043065	74.15	.3305	8043305	90.45	.3545	8043545	90.65	.3785	8043785	111.00
.2830	8042830	71.30	.3070	8043070	74.15	.3310	8043310	87.30	.3550	8043550	91.05	.3790	8043790	111.00
.2835	804072	71.05	.3075	8043075	74.15	.3315	8043315	90.45	.3555	8043555	91.05	.3795	8043795	111.00
.2840	8042840	71.30	.3080	8043080	74.15	.3320	8043320	85.90	.3560	8043560	91.05	.3800	8043800	111.00
.2845	8042845	71.30	.3085	8043085	74.15	.3325	8043325	90.45	.3565	8043565	91.05	.3805	8043805	111.00
.2850	8042850	71.30	.3090	8043090	74.15	.3330	8043330	90.45	.3570	8043570	91.05	.3810	8043810	111.00
.2855	8042855	71.30	.3095	8043095	74.15	.3335	8043335	90.45	.3575	8043575	91.05	.3815	8043815	111.00
.2860	8042860	71.30	.3100	8043100	74.15	.3340	8043340	90.45	.3580	8043580	86.65	.3820	8043820	111.00
.2865	8042865	71.30	.3105	8043105	74.15	.3345	8043345	90.45	.3585	8043585	91.05	.3825	8043825	111.00
.2870	8042870	71.30	.3110	804079	74.15	.3350	8043350	90.45	.3590	8043590	91.75	.3830	8043830	111.00
.2875	8042875	71.30	.3115	8043115	74.15	.3355	8043355	90.45	.3595	8043595	92.75	.3835	8043835	111.00
.2880	8042880	71.30	.3120	8043120	74.15	.3360	8043360	90.45	.3600	8043600	92.75	.3840	8043840	111.00
.2885	8042885	71.30	.3125	80420	64.55	.3365	8043365	90.45	.3605	8043605	92.75	.3845	8043845	111.00
.2890	8042890	71.30	.3130	8043130	74.15	.3370	8043370	90.45	.3610	8043610	92.75	.3850	8043850	111.00
.2895	8042895	71.30	.3135	8043135	74.15	.3375	8043375	90.45	.3615	8043615	92.75	.3855	8043855	111.00
.2900	8042900	67.80	.3140	8043140	74.15	.3380	8043380	90.45	.3620	8043620	92.75	.3860	8043860	105.65
.2905	8042905	71.30	.3145	8043145	74.15	.3385	8043385	90.45	.3625	8043625	92.75	.3865	8043865	116.65
.2910	8042910	71.30	.3150	804080	64.55	.3390	8043390	85.90	.3630	8043630	92.75	.3870	8043870	116.65
.2915	8042915	71.30	.3155	8043155	74.15	.3395	8043395	90.45	.3635	8043635	92.75	.3875	8043875	116.65

CHUCKING REAMERS
SOLID CARBIDE TYPE 804 .0005 INCREMENTS

GENERAL PURPOSE

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
.3880	8043880	$116.65
.3885	8043885	116.65
.3890	8043890	116.65
.3895	8043895	116.65
.3900	8043900	116.65
.3905	8043905	116.65
.3910	8043910	116.65
.3915	8043915	116.65
.3920	8043920	116.65
.3925	8043925	116.65
.3930	8043930	116.65
.3935	8043935	116.65
.3940	8043940	116.65
.3945	8043945	116.65
.3950	8043950	116.65
.3955	8043955	116.65
.3960	8043960	116.65
.3965	8043965	116.65
.3970	8043970	111.10
.3975	8043975	116.65
.3980	8043980	116.65
.3985	8043985	116.65
.3990	8043990	116.65
.3995	8043995	116.65
.4000	8044000	116.65
.4005	8044005	116.65
.4010	8044010	116.65
.4015	8044015	116.65
.4020	8044020	116.65
.4025	8044025	116.65
.4030	8044030	116.65
.4035	8044035	116.65
.4040	8044040	111.10
.4045	8044045	116.65
.4050	8044050	116.65
.4055	804103	116.65
.4060	8044060	116.65
.4065	8044065	116.65
.4070	8044070	116.65
.4075	8044075	116.65
.4080	8044080	116.65
.4085	8044085	116.65
.4090	8044090	116.65
.4095	8044095	116.65
.4100	8044100	116.65
.4105	8044105	116.65
.4110	8044110	116.65
.4115	8044115	116.65
.4120	8044120	116.65
.4125	8044125	116.65
.4130	8044130	111.10

TOOL DIAM.	EDP NO.	PRICE
.4135	8044135	$119.80
.4140	8044140	119.80
.4145	8044145	119.80
.4150	8044150	119.80
.4155	8044155	119.80
.4160	8044160	119.80
.4165	8044165	119.80
.4170	8044170	119.80
.4175	8044175	119.80
.4180	8044180	119.80
.4185	8044185	119.80
.4190	8044190	119.80
.4195	8044195	119.80
.4200	8044200	119.80
.4205	8044205	119.80
.4210	8044210	119.80
.4215	8044215	119.80
.4220	8044220	119.80
.4225	8044225	119.80
.4230	8044230	119.80
.4235	8044235	119.80
.4240	8044240	119.80
.4245	8044245	119.80
.4250	8044250	119.80
.4255	8044255	119.80
.4260	8044260	119.80
.4265	8044265	119.80
.4270	8044270	119.80
.4275	8044275	119.80
.4280	8044280	119.80
.4285	8044285	119.80
.4290	8044290	119.80
.4295	8044295	119.80
.4300	8044300	119.80
.4305	8044305	119.80
.4310	8044310	119.80
.4315	8044315	119.80
.4320	8044320	119.80
.4325	8044325	119.80
.4330	8044330	119.80
.4335	8044335	119.80
.4340	8044340	119.80
.4345	8044345	119.80
.4350	8044350	119.80
.4355	8044355	119.80
.4360	8044360	119.80
.4365	8044365	119.80
.4370	804111	119.80
.4375	80428	114.05
.4380	8044380	131.20
.4385	8044385	131.20

TOOL DIAM.	EDP NO.	PRICE
.4390	8044390	$131.20
.4395	8044395	131.20
.4400	8044400	131.20
.4405	8044405	131.20
.4410	8044410	131.20
.4415	8044415	131.20
.4420	8044420	131.20
.4425	8044425	131.20
.4430	8044430	131.20
.4435	8044435	131.20
.4440	8044440	131.20
.4445	8044445	131.20
.4450	8044450	131.20
.4455	8044455	131.20
.4460	8044460	131.20
.4465	8044465	131.20
.4470	8044470	131.20
.4475	8044475	131.20
.4480	8044480	131.20
.4485	8044485	131.20
.4490	8044490	131.20
.4495	8044495	131.20
.4500	8044500	131.20
.4505	8044505	131.20
.4510	8044510	131.20
.4515	8044515	131.20
.4520	8044520	131.20
.4525	8044525	131.20
.4530	8044530	131.20
.4535	8044535	131.20
.4540	8044540	131.20
.4545	8044545	131.20
.4550	8044550	131.20
.4555	8044555	131.20
.4560	8044560	131.20
.4565	8044565	131.20
.4570	8044570	131.20
.4575	8044575	131.20
.4580	8044580	131.20
.4585	8044585	131.20
.4590	8044590	131.20
.4595	8044595	131.20
.4600	8044600	131.20
.4605	8044605	131.20
.4610	8044610	131.20
.4615	8044615	131.20
.4620	8044620	131.20
.4625	8044625	131.20
.4630	8044630	131.20
.4635	8044635	131.20
.4640	8044640	131.20

TOOL DIAM.	EDP NO.	PRICE
.4645	8044645	$131.20
.4650	8044650	131.20
.4655	8044655	131.20
.4660	8044660	131.20
.4665	8044665	131.20
.4670	8044670	131.20
.4675	8044675	131.20
.4680	8044680	131.20
.4685	804119	131.20
.4690	8044690	131.20
.4695	8044695	131.20
.4700	8044700	131.20
.4705	8044705	131.20
.4710	8044710	131.20
.4715	8044715	131.20
.4720	8044720	131.20
.4725	8044725	142.75
.4730	8044730	142.75
.4735	8044735	142.75
.4740	8044740	142.75
.4745	8044745	142.75
.4750	8044750	142.75
.4755	8044755	142.75
.4760	8044760	142.75
.4765	8044765	142.75
.4770	8044770	142.75
.4775	8044775	142.75
.4780	8044780	142.75
.4785	8044785	142.75
.4790	8044790	142.75
.4795	8044795	142.75
.4800	8044800	142.75
.4805	8044805	142.75
.4810	8044810	142.75
.4815	8044815	142.75
.4820	8044820	142.75
.4825	8044825	142.75
.4830	8044830	142.75
.4835	8044835	142.75
.4840	8044840	142.75
.4845	8044845	142.75
.4850	8044850	142.75
.4855	8044855	142.75
.4860	8044860	142.75
.4865	8044865	142.75
.4870	8044870	142.75
.4875	8044875	142.75
.4880	8044880	142.75
.4885	8044885	142.75
.4890	8044890	142.75
.4895	8044895	142.75

TOOL DIAM.	EDP NO.	PRICE
.4900	8044900	$142.75
.4905	8044905	142.75
.4910	8044910	142.75
.4915	8044915	142.75
.4920	8044920	142.75
.4925	8044925	142.75
.4930	8044930	142.75
.4935	8044935	142.75
.4940	8044940	142.75
.4945	8044945	142.75
.4950	8044950	142.75
.4955	8044955	142.75
.4960	8044960	142.75
.4965	8044965	142.75
.4970	8044970	142.75
.4975	8044975	142.75
.4980	8044980	142.75
.4985	8044985	142.75
.4990	8044990	142.75
.4995	8044995	135.00
.5000	80432	135.00
.5005	8045005	169.45
.5010	8045010	169.45
.5015	8045015	169.45
.5020	8045020	169.45
.5025	8045025	169.45
.5030	8045030	169.45
.5035	8045035	169.45
.5040	8045040	169.45
.5045	8045045	169.45
.5050	8045050	169.45
.5055	8045055	169.45
.5060	8045060	169.45
.5065	8045065	169.45
.5070	8045070	169.45
.5075	8045075	169.45
.5080	8045080	169.45
.5085	8045085	169.45
.5090	8045090	169.45
.5095	8045095	169.45
.5100	8045100	169.45
.5105	8045105	169.45
.5110	8045110	169.45
.5115	8045115	169.45
.5120	8045120	169.45
.5125	8045125	169.45
.5130	8045130	169.45
.5135	8045135	169.45
.5140	8045140	169.45
.5145	8045145	169.45
.5150	8045150	169.45

MATERIAL SPECIFIC REAMERS
SOLID CARBIDE HEAD TYPES 800 & 801 FRACTIONAL

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						
					MAX. SHANK DIAM.	NO. OF FLTS	LENGTH		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL						FLUTE	OVER-ALL		1	2	3	4	5-7	8-14**
* -	-	-	80099	-	.0800	4	¾	3	0.0811 - 0.0890	$81.10	$59.95	$52.65	$49.40	$45.65	$42.90
* 3/32	.0938	-	80006	$38.75	.0880	4	¾	3	0.0891 - 0.0970	81.10	59.95	52.65	49.40	45.65	42.90
* 7/64	.1094	-	80007	38.75	.0943	4	⅞	3 ½	0.0971 - 0.1120	81.10	59.95	52.65	49.40	45.65	42.90
* ⅛	.1250	80108	80008	38.75	.1099	4	⅞	3 ½	0.1121 - 0.1280	81.10	59.95	52.65	49.40	45.65	42.90
* 9/64	.1406	80109	80009	44.30	.1255	4	⅞	3 ½	0.1281 - 0.1435	86.65	65.40	58.25	54.90	51.30	48.40
* 5/32	.1562	80110	80010	45.55	.1411	4	1	4	0.1436 - 0.1590	87.85	66.70	59.50	56.20	52.50	49.80
* 11/64	.1719	80111	80011	51.35	.1567	4	1	4	0.1591 - 0.1750	93.60	72.55	65.40	62.00	58.40	55.55
* 3/16	.1875	80112	80012	52.45	.1724	4	1 ⅛	4 ½	0.1751 - 0.1910	94.80	73.60	66.40	63.10	59.45	56.70
13/64	.2031	80113	80013	55.90	.1880	6	1 ¼	5	-	-	-	-	-	-	-
7/32	.2188	80114	80014	55.90	.1880	6	1 ¼	5	0.1911 - 0.2210	98.25	77.10	70.00	66.55	62.90	60.15
15/64	.2344	80115	80015	59.45	.2193	6	1 ½	6	-	-	-	-	-	-	-
¼	.2500	80116	80016	59.45	.2193	6	1 ½	6	0.2211 - 0.2530	101.80	80.55	73.50	70.20	66.40	63.65
17/64	.2656	80117	80017	63.95	.2505	6	1 ½	6	-	-	-	-	-	-	-
9/32	.2812	80118	80018	63.95	.2505	6	1 ½	6	0.2531 - 0.2840	106.20	85.10	77.95	74.65	71.00	68.15
19/64	.2969	80119	80019	66.55	.2817	6	1 ⅝	6	-	-	-	-	-	-	-
5/16	.3125	80120	80020	66.55	.2817	6	1 ⅝	6	0.2841 - 0.3150	108.85	87.70	80.55	77.20	73.60	70.70
21/64	.3281	80121	80021	71.25	.3130	6	1 ⅝	6	-	-	-	-	-	-	-
11/32	.3438	80122	80022	71.25	.3130	6	1 ⅝	6	0.3151 - 0.3470	113.50	92.30	85.15	81.75	78.20	75.40
23/64	.3594	80123	80023	76.60	.3443	6	1 ¾	7	-	-	-	-	-	-	-
⅜	.3750	80124	80024	76.60	.3443	6	1 ¾	7	0.3471 - 0.3780	118.85	97.65	90.55	87.25	83.60	80.80
25/64	.3906	80125	80025	87.50	.3755	6	1 ¾	7	-	-	-	-	-	-	-
13/32	.4062	80126	80026	87.50	.3755	6	1 ¾	7	0.3781 - 0.4090	129.80	108.60	101.60	98.20	94.55	91.65
27/64	.4219	80127	80027	93.00	.4067	6	1 ¾	7	-	-	-	-	-	-	-
7/16	.4375	80128	80028	93.00	.4067	6	1 ¾	7	0.4091 - 0.4410	135.25	114.00	107.00	103.65	99.95	97.05
29/64	.4531	80129	80029	98.55	.4380	6	1 ¾	8	-	-	-	-	-	-	-
15/32	.4688	80130	80030	98.55	.4380	6	1 ¾	8	0.4411 - 0.4720	140.90	119.65	112.60	109.25	105.65	102.70
31/64	.4844	80131	80031	105.80	.4693	6	1 ¾	8	-	-	-	-	-	-	-
½	.5000	80132	80032	105.80	.4693	6	1 ¾	8	0.4721 - 0.5030	148.20	126.95	119.75	116.45	112.80	110.00
33/64	.5156	80133	80033	136.50	.5005	6	1 ⅞	9	-	-	-	-	-	-	-
17/32	.5312	80134	80034	136.50	.5005	6	1 ⅞	9	0.5031 - 0.5340	178.75	157.55	150.55	147.15	143.45	140.60
35/64	.5469	80135	80035	161.10	.5005	6	1 ⅞	9	-	-	-	-	-	-	-
9/16	.5625	80136	80036	158.20	.5005	6	1 ⅞	9	0.5341 - 0.5660	199.70	178.80	171.85	168.60	165.00	162.25
37/64	.5781	80137	80037	179.50	.5630	6	1 ⅞	9	-	-	-	-	-	-	-
19/32	.5938	80138	80038	179.50	.5630	6	1 ⅞	9	0.5661 - 0.5970	221.05	200.25	193.25	189.90	186.40	183.55
39/64	.6094	80139	80039	181.55	.5630	6	1 ⅞	9	-	-	-	-	-	-	-
⅝	.6250	80140	80040	181.55	.5630	6	1 ⅞	9	0.5971 - 0.6280	223.00	202.15	195.35	192.00	188.45	185.55
21/32	.6562	80142	80042	262.60	.6255	6	2	9 ½	0.6281 - 0.6590	302.10	282.30	275.70	272.55	269.55	266.45
11/16	.6875	80144	80044	262.60	.6255	6	2	9 ½	0.6591 - 0.6910	302.10	282.30	275.70	272.55	269.55	266.45
23/32	.7188	80146	80046	295.50	.6880	6	2	9 ½	0.6911 - 0.7220	335.00	315.15	308.60	305.40	302.45	299.35
¾	.7500	80148	80048	295.50	.6880	6	2	9 ½	0.7221 - 0.7530	335.00	315.15	308.60	305.40	302.45	299.35
25/32	.7812	80150	80050	328.05	.7505	8	2	10	0.7531 - 0.7840	367.50	347.70	341.10	337.95	334.90	331.80
13/16	.8125	80152	80052	357.90	.7817	8	2	10	0.7841 - 0.8160	397.40	377.55	371.00	367.85	364.85	361.75
27/32	.8438	80154	80054	377.45	.8130	8	2	10	0.8161 - 0.8470	416.95	397.15	390.55	387.40	384.35	381.30
⅞	.8750	80156	80056	369.55	.8440	8	2	10	0.8471 - 0.8780	409.05	389.20	382.65	379.50	376.45	373.35
29/32	.9062	80158	80058	432.40	.8755	8	2	10	0.8781 - 0.9090	471.90	452.05	445.50	442.35	439.30	436.25
15/16	.9375	80160	80060	454.55	.9067	8	2	10	0.9091 - 0.9410	494.00	474.20	467.60	464.45	461.45	458.35
31/32	.9688	80162	80062	476.10	.9380	8	2	10	0.9411 - 0.9720	515.60	495.80	489.20	486.05	483.00	479.90
1	1.0000	80164	80064	494.05	.9693	8	2	10	0.9721 - 1.0030	533.55	513.75	507.15	504.00	501.00	497.90

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

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

HANNIBAL CARBIDE TOOL, INC. • TEL 800-451-9436 • FAX 800-633-7302 • sales@hannibalcarbide.com

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

- 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

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.

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.

TOOL DIAMETER		EDP NO. - R SPIRAL		EDP NO. - L SPIRAL		ALL TYPES PRICE	DIMENSIONS				FINISHED TO MODIFIED TOOL DIAMETER						
		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 FLT	LENGTH OVER-ALL	MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.											1	2	3	4	5-7	8-14**
* 1/8	.1250	81108	81008	82108	82008	$39.55	.1099	4	7/8	3 1/2	0.1121-0.1280	$75.05	$57.30	$51.25	$48.45	$45.35	$43.05
* 9/64	.1406	81109	81009	82109	82009	45.15	.1255	4	7/8	3 1/2	0.1281-0.1435	80.65	62.85	56.90	54.10	51.10	48.70
* 5/32	.1562	81110	81010	82110	82010	46.65	.1411	4	1	4	0.1436-0.1590	82.10	64.25	58.30	55.50	52.40	50.05
* 11/64	.1719	81111	81011	82111	82011	57.70	.1567	4	1	4	0.1591-0.1750	96.85	77.25	70.65	67.60	64.25	61.70
* 3/16	.1875	81112	81012	82112	82012	58.95	.1724	4	1 1/8	4 1/2	0.1751-0.1910	97.90	78.45	71.85	68.80	65.45	62.80
13/64	.2031	81113	81013	82113	82013	62.80	.1880	6	1 1/4	5	-	-	-	-	-	-	-
7/32	.2188	81114	81014	82114	82014	68.15	.1880	6	1 1/4	5	0.1911-0.2210	110.45	89.25	82.20	78.90	75.10	72.30
15/64	.2344	81115	81015	82115	82015	72.60	.2193	6	1 1/2	6	-	-	-	-	-	-	-
1/4	.2500	81116	81016	82116	82016	72.60	.2193	6	1 1/2	6	0.2211-0.2530	114.90	93.60	86.65	83.15	79.50	76.65
17/64	.2656	81117	81017	82117	82017	77.95	.2505	6	1 1/2	6	-	-	-	-	-	-	-
9/32	.2812	81118	81018	82118	82018	77.95	.2505	6	1 1/2	6	0.2531-0.2840	120.30	99.15	91.95	88.60	84.95	82.20
19/64	.2969	81119	81019	82119	82019	81.30	.2817	6	1 5/8	6	-	-	-	-	-	-	-
5/16	.3125	81120	81020	82120	82020	81.30	.2817	6	1 5/8	6	0.2841-0.3150	123.50	102.35	95.30	91.85	88.20	85.35
21/64	.3281	81121	81021	82121	82021	86.75	.3130	6	1 5/8	6	-	-	-	-	-	-	-
11/32	.3438	81122	81022	82122	82022	86.75	.3130	6	1 5/8	6	0.3151-0.3470	129.05	107.95	100.75	97.35	93.70	90.95
23/64	.3594	81123	81023	82123	82023	93.45	.3443	6	1 3/4	7	-	-	-	-	-	-	-
3/8	.3750	81124	81024	82124	82024	93.45	.3443	6	1 3/4	7	0.3471-0.3780	135.60	114.40	107.40	104.10	100.40	97.45
25/64	.3906	81125	81025	82125	82025	106.80	.3755	6	1 3/4	7	-	-	-	-	-	-	-
13/32	.4062	81126	81026	82126	82026	106.80	.3755	6	1 3/4	7	0.3781-0.4090	149.05	127.80	120.75	117.30	113.80	110.85
27/64	.4219	81127	81027	82127	82027	113.30	.4067	6	1 3/4	7	-	-	-	-	-	-	-
7/16	.4375	81128	81028	82128	82028	113.30	.4067	6	1 3/4	7	0.4091-0.4410	155.55	134.30	127.30	123.95	120.30	117.40
29/64	.4531	81129	81029	82129	82029	120.25	.4380	6	1 3/4	8	-	-	-	-	-	-	-
15/32	.4688	81130	81030	82130	82030	120.25	.4380	6	1 3/4	8	0.4411-0.4720	162.45	141.30	134.20	130.85	127.25	124.35
31/64	.4844	81131	81031	82131	82031	128.95	.4693	6	1 3/4	8	-	-	-	-	-	-	-
1/2	.5000	81132	81032	82132	82032	128.95	.4693	6	1 3/4	8	0.4721-0.5030	171.25	150.10	143.00	139.60	136.05	133.15
33/64	.5156	81133	81033	82133	82033	153.30	.5005	6	1 7/8	9	-	-	-	-	-	-	-
17/32	.5312	81134	81034	82134	82034	150.45	.5005	6	1 7/8	9	0.5031-0.5340	188.85	169.60	163.15	160.10	156.85	154.35
35/64	.5469	81135	81035	82135	82035	177.75	.5005	6	1 7/8	9	-	-	-	-	-	-	-
9/16	.5625	81136	81036	82136	82036	177.75	.5005	6	1 7/8	9	0.5341-0.5660	216.10	196.85	190.40	187.35	184.05	181.45
37/64	.5781	81137	81037	82137	82037	201.65	.5630	6	1 7/8	9	-	-	-	-	-	-	-
19/32	.5938	81138	81038	82138	82038	201.65	.5630	6	1 7/8	9	0.5661-0.5970	239.90	220.80	214.40	211.30	208.00	205.45
39/64	.6094	81139	81039	82139	82039	204.00	.5630	6	1 7/8	9	-	-	-	-	-	-	-
5/8	.6250	81140	81040	82140	82040	204.00	.5630	6	1 7/8	9	0.5971-0.6280	242.35	223.20	216.65	213.65	210.35	207.75
21/32	.6562	81142	81042	82142	82042	295.35	.6255	6	2	9 1/2	0.6281-0.6590	339.80	317.50	310.10	306.50	303.15	299.65
11/16	.6875	81144	81044	82144	82044	295.35	.6255	6	2	9 1/2	0.6591-0.6910	339.80	317.50	310.10	306.50	303.15	299.65
23/32	.7188	81146	81046	82146	82046	332.30	.6880	6	2	9 1/2	0.6911-0.7220	376.80	354.35	347.00	343.50	340.05	336.55
3/4	.7500	81148	81048	82148	82048	332.30	.6880	6	2	9 1/2	0.7221-0.7530	376.80	354.35	347.00	343.50	340.05	336.55
25/32	.7812	81150	81050	82150	82050	368.90	.7505	8	2	10	0.7531-0.7840	413.30	391.00	383.55	380.00	376.55	373.15
13/16	.8125	81152	81052	82152	82052	402.45	.7817	8	2	10	0.7841-0.8160	446.90	424.60	417.20	413.60	410.20	406.70
27/32	.8438	81154	81054	82154	82054	424.40	.8130	8	2	10	0.8161-0.8470	468.85	446.60	439.15	435.65	432.20	428.70
7/8	.8750	81156	81056	82156	82056	415.55	.8440	8	2	10	0.8471-0.8780	460.00	437.75	430.30	426.70	423.35	419.85
29/32	.9062	81158	81058	82158	82058	486.30	.8755	8	2	10	0.8781-0.9090	530.70	508.45	500.95	497.40	494.00	490.55
15/16	.9375	81160	81060	82160	82060	511.10	.9067	8	2	10	0.9091-0.9410	555.50	533.25	525.85	522.25	518.85	515.40
31/32	.9688	81162	81062	82162	82062	535.35	.9380	8	2	10	0.9411-0.9720	579.75	557.50	550.15	546.55	543.15	539.70
1	1.0000	81164	81064	82164	82064	555.55	.9693	8	2	10	0.9721-1.0030	600.00	577.70	570.35	566.85	563.35	559.95

*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 Plus	Diameter Minus	Included Angle Plus	Included Angle Minus	Lip Height T.I.V.
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

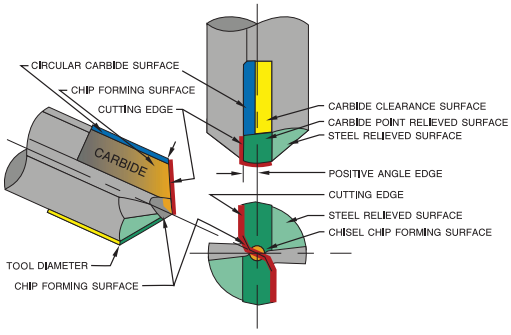
MACHINE CONDITION	❑ Tool holder in good condition and secure part holding fixture.
TOOL CONDITION	❑ Use cutting tool recommended for material being machined. Avoid excessive tool overhang.
FEEDS & SPEEDS	❑ Start with feeds and speeds recommended for material being machined (see page 8 & 9).
COOLANT	❑ 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

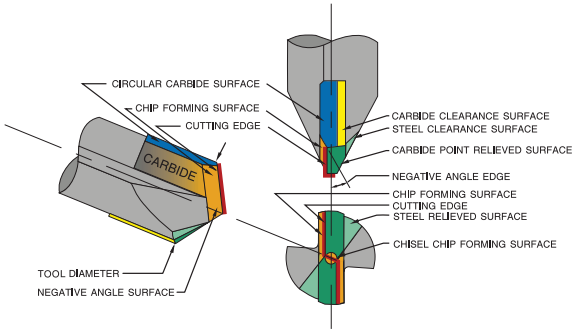
DRILL POINT SELECTION GUIDE
TWIST DRILLS, DIE DRILLS & COOLANT FED DRILLS

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

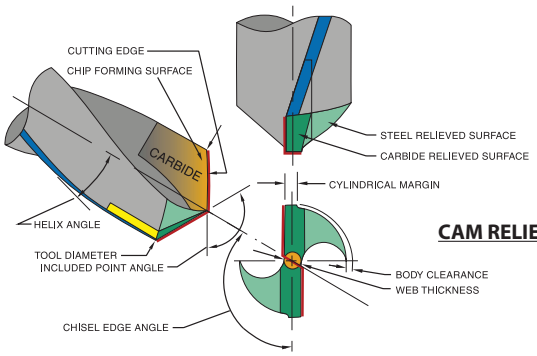
TWIST DRILLS (NON-COOLANT)	AVAILABILITY	POINT GEOMETRY & USE	ADVANTAGES
90° Included point (not spotting type)	Special Order	Cam relieved. Produces thinner chips for very ductile, soft materials (Chip Class 20 & 40)	High lip relief for faster penetration. Less abrasive wear at corners.
118° Standard 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. For cast irons and abrasive materials.	Reduces corner wear at point. Reduces breakthrough burrs.
135° Split point	Standard	Cam relieved and split to NAS 907 standard. Excellent web thinning point.	Self centering. Split point acts as chipbreaker.
135° x 45° Double angle point	Modified Standard	Both angles cam relieved. For cast irons and abrasive materials.	Reduces corner wear at point. 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.



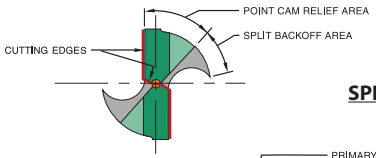
POSITIVE ANGLE CUTTING EDGE DIE DRILL (PG. 134)



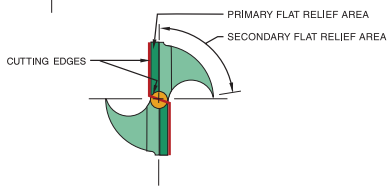
NEGATIVE ANGLE CUTTING EDGE DIE DRILL (PG. 134)



CAM RELIEVED POINT



SPLIT POINT, CAM RELIEVED



FOUR FACET POINT, FLAT RELIEVED

DRILLS INDEX AND COMPARISON CHART

DESCRIPTION	HANNIBAL FRAC. PAGE	HANNIBAL METRIC PAGE	HANNIBAL TOOL TYPE	CJT	CLEVELAND	FULLERTON	CHICAGO/ LATROBE	IMCO	MORSE	NYTD	PTD/DORMER
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	–	–	–
JOBBERS 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

COOLANT FED

125° FOUR FACET POINT

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

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

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*
FRAC.	DECIMAL	FLUTE	OVER-ALL			
5/16	.3125	8	10	65820	$277.10	0.3100 - 0.3160
11/32	.3438	8	10	65822	277.10	0.3281 - 0.3460
3/8	.3750	9	11	65824	292.85	0.3594 - 0.3770
13/32	.4062	9	11	65826	333.35	0.3906 - 0.4080
7/16	.4375	9	11	65828	333.35	0.4200 - 0.4390
15/32	.4688	9 3/4	12	65830	352.00	0.4531 - 0.4710
1/2	.5000	9 3/4	12	65832	352.00	0.4800 - 0.5030
17/32	.5312	9 3/4	12	65834	377.80	0.5118 - 0.5330
9/16	.5625	10 3/4	13	65836	406.90	0.5430 - 0.5650
5/8	.6250	10 3/4	13	65840	429.65	0.6070 - 0.6270
11/16	.6875	11 3/4	14	65844	447.40	0.6693 - 0.6900
23/32	.7188	11 3/4	14	65846	467.95	0.7031 - 0.7220
3/4	.7500	11 3/4	14	65848	473.60	0.7320 - 0.7530
13/16	.8125	12 3/4	15	65852	502.90	0.7953 - 0.8160
7/8	.8750	12 3/4	15	65856	541.90	0.8570 - 0.8780
15/16	.9375	13 3/4	16	65860	579.00	0.9180 - 0.9390
1	1.0000	13 3/4	16	65864	627.05	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**
		FLUTE		OVERALL				
mm	INCH	mm	INCH	mm	INCH			
8.0	.3150	203	8	254	10	658080	$369.30	-
8.5	.3346	203	8	254	10	658085	369.30	8.280 - 8.788
9.0	.3543	229	9	279	11	658090	390.20	8.992 - 9.576
9.5	.3740	229	9	279	11	658095	390.20	-
10.0	.3937	229	9	279	11	658100	428.75	9.779 - 10.363
10.5	.4134	229	9	279	11	658105	428.75	10.414 - 11.151
11.0	.4331	229	9	279	11	658110	428.75	-
11.5	.4528	248	9 3/4	305	12	658115	452.95	11.153 - 12.000
12.0	.4724	248	9 3/4	305	12	658120	452.95	-
12.5	.4921	248	9 3/4	305	12	658125	452.95	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

COOLANT FED

125° FOUR FACET POINT

DISCONTINUED - WHILE SUPPLIES LAST

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

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.

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 FRAC.	TOOL DIAMETER DEC.	LENGTH FLUTE	LENGTH OVER-ALL	TYPE 652 EDP NO.	PRICE	DECIMAL DIAMETER RANGE*
1/4	.2500	2 1/2	4 29/32	65216	$175.30	.2490 - .2530
17/64	.2656	2 3/4	5 5/32	65217	175.30	-
9/32	.2812	2 3/4	5 5/32	65218	175.30	.2640 - .2840
19/64	.2969	3 3/16	5 19/32	65219	175.30	-
5/16	.3125	3 3/16	5 19/32	65220	175.30	.2950 - .3160
21/64	.3281	3 7/16	5 27/32	65221	175.30	-
11/32	.3438	3 7/16	5 27/32	65222	175.30	.3260 - .3460
23/64	.3594	3 5/8	6 1/32	65223	177.20	-
3/8	.3750	3 5/8	6 1/32	65224	177.20	.3540 - .3770
25/64	.3906	3 7/8	6 9/32	65225	181.60	-
13/32	.4062	3 7/8	6 9/32	65226	181.60	.3850 - .4080
27/64	.4219	4 1/16	6 15/32	65227	187.75	-
7/16	.4375	4 1/16	6 15/32	65228	187.75	.4100 - .4390
29/64	.4531	4 5/16	6 23/32	65229	199.90	-
15/32	.4688	4 5/16	6 23/32	65230	199.90	.4391 - .4724
31/64	.4844	4 1/2	6 29/32	65231	205.75	-
1/2	.5000	4 1/2	6 29/32	65232	205.75	.4725 - .5030
33/64	.5156	4 13/16	7 7/32	65233	214.40	-
17/32	.5312	4 13/16	7 7/32	65234	218.00	.5031 - .5330
35/64	.5469	4 13/16	7 7/32	65235	226.15	-
9/16	.5625	4 13/16	7 7/32	65236	230.10	.5331 - .5650
37/64	.5781	5 3/16	7 19/32	65237	271.10	-
19/32	.5938	5 3/16	7 19/32	65238	275.60	.5651 - .5950
39/64	.6094	5 3/16	7 19/32	65239	271.10	-
5/8	.6250	5 3/16	7 19/32	65240	275.60	.5951 - .6270
41/64	.6406	5 3/16	7 19/32	65241	290.60	-
21/32	.6562	5 3/16	7 19/32	65242	290.60	.6271 - .6570
43/64	.6719	5 5/8	8 1/32	65243	314.40	-
11/16	.6875	5 5/8	8 1/32	65244	314.80	.6571 - .6900
45/64	.7031	5 5/8	8 1/32	65245	323.75	-
23/32	.7188	5 5/8	8 1/32	65246	323.75	.6901 - .7220
47/64	.7344	6 1/16	8 15/32	65247	327.00	-
3/4	.7500	6 1/16	8 15/32	65248	327.00	.7221 - .7530
49/64	.7656	6 1/16	8 9/16	65249	342.30	-
25/32	.7812	6 1/16	8 9/16	65250	348.20	.7531 - .7840
13/16	.8125	6 1/16	8 9/16	65252	354.00	.7841 - .8160
27/32	.8438	6 1/2	9	65254	375.35	.8161 - .8470
7/8	.8750	6 1/2	9	65256	384.40	.8471 - .8780
29/32	.9062	6 15/16	9 7/16	65258	411.35	.8781 - .9090
15/16	.9375	6 15/16	9 7/16	65260	441.90	.9091 - .9390
31/32	.9688	6 15/16	9 7/16	65262	460.00	.9391 - .9700
1	1.0000	7 3/8	9 7/8	65264	472.10	.9701 - 1.0030

*Contact us for decimal and metric diameter range prices

TOOL DIAMETER mm	TOOL DIAMETER INCH	LENGTH FLUTE mm	LENGTH FLUTE INCH	LENGTH OVERALL mm	LENGTH OVERALL INCH	TYPE 652 METRIC EDP NO.	METRIC PRICE	METRIC DIAMETER RANGE*
**6.5	.2559	64	2 1/2	125	4 29/32	652065	$226.50	-
7.0	.2756	70	2 3/4	131	5 5/32	652070	226.50	6.706 - 7.214
7.5	.2953	81	3 3/16	142	5 19/32	652075	226.50	7.493 - 8.026
8.0	.3150	81	3 3/16	142	5 19/32	652080	226.50	-
8.5	.3346	87	3 7/16	148	5 27/32	652085	218.70	8.280 - 8.788
9.0	.3543	92	3 5/8	153	6 1/32	652090	218.70	8.992 - 9.576
9.5	.3740	92	3 5/8	153	6 1/32	652095	218.70	-
10.0	.3937	98	3 7/8	159	6 9/32	652100	218.70	9.779 - 10.363
10.5	.4134	103	4 1/16	164	6 15/32	652105	226.50	10.414 - 11.151
11.0	.4331	103	4 1/16	164	6 15/32	652110	226.50	-
11.5	.4528	109	4 5/16	171	6 23/32	652115	244.80	11.153 - 12.000
12.0	.4724	109	4 5/16	171	6 23/32	652120	244.80	-
12.5	.4921	114	4 1/2	175	6 29/32	652125	250.00	12.002 - 12.776
13.0	.5118	122	4 13/16	183	7 7/32	652130	265.55	12.779 - 13.538
13.5	.5315	122	4 13/16	183	7 7/32	652135	265.55	-
14.0	.5512	122	4 13/16	183	7 7/32	652140	278.60	13.541 - 14.351
14.5	.5709	131	5 3/16	193	7 19/32	652145	338.45	14.354 - 15.113
15.0	.5906	131	5 3/16	193	7 19/32	652150	338.45	-
15.5	.6102	131	5 3/16	193	7 19/32	652155	338.45	15.116 - 15.926
16.0	.6299	131	5 3/16	193	7 19/32	652160	346.20	15.928 - 16.688
16.5	.6496	131	5 3/16	193	7 19/32	652165	346.20	-
17.0	.6693	143	5 5/8	204	8 1/32	652170	369.65	16.690 - 17.526
17.5	.6890	143	5 5/8	204	8 1/32	652175	369.65	-
18.0	.7087	143	5 5/8	204	8 1/32	652180	388.00	17.529 - 18.339
18.5	.7283	154	6 1/16	215	8 15/32	652185	390.50	18.341 - 19.126
19.0	.7480	154	6 1/16	215	8 15/32	652190	390.50	-
19.5	.7677	154	6 1/16	217	8 9/16	652195	414.05	19.129 - 19.914
20.0	.7874	154	6 1/16	217	8 9/16	652200	419.30	19.916 - 20.726
20.5	.8071	154	6 1/16	217	8 9/16	652205	419.30	-
21.0	.8268	165	6 1/2	229	9	652210	442.60	20.729 - 21.514
21.5	.8465	165	6 1/2	229	9	652215	442.60	-
22.0	.8661	165	6 1/2	229	9	652220	453.05	21.516 - 22.301
22.5	.8858	176	6 15/16	240	9 7/16	652225	499.90	22.304 - 23.089
23.0	.9055	176	6 15/16	240	9 7/16	652230	499.90	-
23.5	.9252	176	6 15/16	240	9 7/16	652235	518.15	23.091 - 23.851
24.0	.9449	176	6 15/16	240	9 7/16	652240	538.90	23.853 - 24.638
24.5	.9646	176	6 15/16	240	9 7/16	652245	534.40	-
25.0	.9843	187	7 3/8	251	9 7/8	652250	538.90	24.641 - 25.476

**6.5mm tool diameter has 6.35mm shank diameter

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

COOLANT FED

125° FOUR FACET POINT

DISCONTINUED - WHILE SUPPLIES LAST

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

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 DIAMETER		LENGTH		TYPE 650 EDP NO.	PRICE	DECIMAL DIAMETER RANGE*
FRAC.	DECIMAL	FLUTE	OVER-ALL			
1/4	.2500	4 5/8	6 1/8	65016	$192.00	0.2490 - 0.2530
17/64	.2656	4 3/4	6 1/4	65017	192.00	-
9/32	.2812	4 3/4	6 1/4	65018	192.00	0.2640 - 0.2840
19/64	.2969	4 7/8	6 3/8	65019	192.00	-
5/16	.3125	4 7/8	6 3/8	65020	192.00	0.2950 - 0.3160
21/64	.3281	5	6 1/2	65021	184.80	-
11/32	.3438	5	6 1/2	65022	184.80	0.3260 - 0.3460
23/64	.3594	5 1/4	6 3/4	65023	180.05	-
3/8	.3750	5 1/4	6 3/4	65024	187.00	0.3540 - 0.3770
25/64	.3906	5 1/2	7	65025	184.80	-
13/32	.4062	5 1/2	7	65026	184.80	0.3850 - 0.4080
27/64	.4219	5 3/4	7 1/4	65027	190.80	-
7/16	.4375	5 3/4	7 1/4	65028	190.80	0.4100 - 0.4390
29/64	.4531	5 3/4	7 1/2	65029	202.80	-
15/32	.4688	5 3/4	7 1/2	65030	202.80	0.4391 - 0.4724
31/64	.4844	5 3/4	7 3/4	65031	208.85	-
1/2	.5000	5 3/4	7 3/4	65032	208.85	0.4725 - 0.5030
33/64	.5156	6	8	65033	224.10	-
17/32	.5312	6	8	65034	224.10	0.5031 - 0.5330
35/64	.5469	6 1/4	8 1/4	65035	232.15	-
9/16	.5625	6 1/4	8 1/4	65036	236.05	0.5331 - 0.5650
37/64	.5781	6 3/4	8 3/4	65037	279.50	-
19/32	.5938	6 3/4	8 3/4	65038	284.20	0.5651 - 0.5950
39/64	.6094	6 3/4	8 3/4	65039	279.50	-
5/8	.6250	6 3/4	8 3/4	65040	284.20	0.5951 - 0.6270
41/64	.6406	7	9	65041	294.55	-
21/32	.6562	7	9	65042	299.65	0.6271 - 0.6570
43/64	.6719	7 1/4	9 1/4	65043	315.30	-
11/16	.6875	7 1/4	9 1/4	65044	320.90	0.6571 - 0.6900
45/64	.7031	7 1/2	9 1/2	65045	327.35	-
23/32	.7188	7 1/2	9 1/2	65046	332.90	0.6901 - 0.7220
47/64	.7344	7 3/4	9 3/4	65047	330.10	-
3/4	.7500	7 3/4	9 3/4	65048	335.90	0.7221 - 0.7530
49/64	.7656	7 7/8	9 7/8	65049	357.10	-
25/32	.7812	7 7/8	9 7/8	65050	357.10	0.7531 - 0.7840
13/16	.8125	8	10	65052	363.10	0.7841 - 0.8160
27/32	.8438	8	10	65054	384.40	0.8161 - 0.8470
7/8	.8750	8	10	65056	393.50	0.8471 - 0.8780
29/32	.9062	8	10	65058	435.90	0.8781 - 0.9090
15/16	.9375	8 3/4	10 3/4	65060	453.95	0.9091 - 0.9390
31/32	.9688	9	11	65062	458.35	0.9391 - 0.9700
1	1.0000	9	11	65064	458.35	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*
		FLUTE		OVERALL				
mm	INCH	mm	INCH	mm	INCH			
6.5	.2559	117	4 5/8	156	6 1/8	650065	$200.10	-
7.0	.2756	121	4 3/4	159	6 1/4	650070	200.10	6.706 - 7.214
7.5	.2953	124	4 7/8	162	6 3/8	650075	200.10	7.493 - 8.026
8.0	.3150	124	4 7/8	162	6 3/8	650080	200.10	-
8.5	.3346	127	5	165	6 1/2	650085	193.25	8.280 - 8.788
9.0	.3543	133	5 1/4	171	6 3/4	650090	193.25	8.992 - 9.576
9.5	.3740	133	5 1/4	171	6 3/4	650095	193.25	-
10.0	.3937	140	5 1/2	178	7	650100	193.25	9.779 - 10.363
10.5	.4134	146	5 3/4	184	7 1/4	650105	200.10	10.414 - 11.151
11.0	.4331	146	5 3/4	184	7 1/4	650110	200.10	-
11.5	.4528	146	5 3/4	191	7 1/2	650115	216.25	11.153 - 12.000
12.0	.4724	146	5 3/4	191	7 1/2	650120	216.25	-
12.5	.4921	146	5 3/4	197	7 3/4	650125	220.85	12.002 - 12.776
13.0	.5118	152	6	203	8	650130	234.60	12.779 - 13.538
13.5	.5315	152	6	203	8	650135	234.60	-
14.0	.5512	159	6 1/4	210	8 1/4	650140	246.10	13.541 - 14.351
14.5	.5709	171	6 3/4	222	8 3/4	650145	298.90	14.354 - 15.113
15.0	.5906	171	6 3/4	222	8 3/4	650150	298.90	-
15.5	.6102	171	6 3/4	222	8 3/4	650155	298.90	15.116 - 15.926
16.0	.6299	178	7	229	9	650160	305.90	15.928 - 16.688
16.5	.6496	178	7	229	9	650165	305.90	-
17.0	.6693	184	7 1/4	235	9 1/4	650170	326.50	16.690 - 17.526
17.5	.6890	184	7 1/4	235	9 1/4	650175	326.50	-
18.0	.7087	191	7 1/2	241	9 1/2	650180	342.70	17.529 - 18.339
18.5	.7283	197	7 3/4	248	9 3/4	650185	344.95	18.341 - 19.126
19.0	.7480	197	7 3/4	248	9 3/4	650190	344.95	-
19.5	.7677	200	7 7/8	251	9 7/8	650195	365.75	19.129 - 19.914
20.0	.7874	203	8	254	10	650200	370.40	19.916 - 20.726
20.5	.8071	203	8	254	10	650205	370.40	-
21.0	.8268	203	8	254	10	650210	391.00	20.729 - 21.514
21.5	.8465	203	8	254	10	650215	391.00	-
22.0	.8661	203	8	254	10	650220	400.20	21.516 - 22.301
22.5	.8858	203	8	254	10	650225	441.60	22.304 - 23.089
23.0	.9055	203	8	254	10	650230	441.60	-
23.5	.9252	222	8 3/4	273	10 3/4	650235	457.70	23.091 - 23.851
24.0	.9449	229	9	279	11	650240	476.10	23.853 - 24.638
24.5	.9646	229	9	279	11	650245	476.10	-
25.0	.9843	229	9	279	11	650250	476.10	24.641 - 25.476

**6.5mm tool diameter has 6.35mm shank diameter

DRILLS

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

COOLANT FED

125° FOUR FACET POINT OR 135° SPLIT POINT

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

DISCONTINUED - WHILE SUPPLIES LAST

TOOL DIAMETER		DIMENSIONS			TYPE 654 - 125° PT.		TYPE 655 - 135° PT.	
		SHANK & BODY DIAM.	LENGTH		EDP NO.	PRICE	EDP NO.	PRICE
FRAC.	DEC.		FLT	OVER-ALL				
1/4	.2500	.2344	1 17/32	3 15/16	65416	$178.70	65516	$219.65
17/64	.2656	.2500	1 19/32	4	65417	203.75	65517	234.60
9/32	.2812	.2656	1 19/32	4	65418	191.40	65518	231.90
19/64	.2969	.2812	1 3/4	4 5/32	65419	203.75	65519	234.60
5/16	.3125	.2969	1 3/4	4 5/32	65420	191.40	65520	231.90
21/64	.3281	.3125	1 15/16	4 11/32	65421	203.75	65521	234.60
11/32	.3438	.3281	1 15/16	4 11/32	65422	191.40	65522	231.90
23/64	.3594	.3438	2 1/8	4 17/32	65423	203.75	65523	244.00
3/8	.3750	.3594	2 1/8	4 17/32	65424	191.40	65524	231.90
25/64	.3906	.3750	2 9/32	4 11/16	65425	203.75	65525	258.30
13/32	.4062	.3906	2 9/32	4 11/16	65426	191.40	65526	248.65
27/64	.4219	.4062	2 1/2	4 29/32	65427	203.75	65527	258.30
7/16	.4375	.4219	2 1/2	4 29/32	65428	191.40	65528	248.65
29/64	.4531	.4375	2 21/32	5 1/16	65429	215.50	65529	258.30
15/32	.4688	.4531	2 21/32	5 1/16	65430	203.80	65530	248.65
31/64	.4844	.4688	2 13/16	5 7/32	65431	220.30	65531	258.30
1/2	.5000	.4844	2 13/16	5 7/32	65432	209.90	65532	248.65
33/64	.5156	.5000	3	5 13/32	65433	N/A	65533	N/A
17/32	.5312	.5156	3	5 13/32	65434	N/A	65534	N/A
35/64	.5469	.5312	3 1/8	5 17/32	65435	N/A	65535	N/A
9/16	.5625	.5469	3 1/8	5 17/32	65436	N/A	65536	N/A
37/64	.5781	.5625	3 9/32	5 11/16	65437	N/A	65537	N/A
19/32	.5938	.5781	3 9/32	5 11/16	65438	224.60	65538	263.35
39/64	.6094	.5938	3 7/16	5 27/32	65439	234.60	65539	270.00
5/8	.6250	.6094	3 7/16	5 27/32	65440	224.60	65540	263.35
41/64	.6406	.6250	3 21/32	6 1/16	65441	234.60	65541	270.00
21/32	.6562	.6406	3 21/32	6 1/16	65442	224.60	65542	263.35
43/64	.6719	.6562	3 13/16	6 7/32	65443	234.60	65543	270.00
11/16	.6875	.6719	3 13/16	6 7/32	65444	224.60	65544	263.35
45/64	.7031	.6875	3 15/16	6 11/32	65445	260.70	65545	298.55
23/32	.7188	.7031	3 15/16	6 11/32	65446	251.10	65546	289.80
47/64	.7344	.7188	4 1/8	6 17/32	65447	260.70	65547	298.55
3/4	.7500	.7344	4 1/8	6 17/32	65448	251.10	65548	289.80
49/64	.7656	.7500	4 9/32	6 25/32	65449	260.70	65549	298.55
25/32	.7812	.7656	4 9/32	6 25/32	65450	251.10	65550	289.80
51/64	.7969	.7812	4 7/16	6 15/16	65451	310.40	65551	345.90
13/16	.8125	.7969	4 7/16	6 15/16	65452	299.60	65552	338.00
53/64	.8281	.8125	4 19/32	7 3/32	65453	310.40	65553	345.90
27/32	.8438	.8281	4 19/32	7 3/32	65454	299.60	65554	338.00
55/64	.8594	.8438	4 11/16	7 3/16	65455	310.40	65555	345.90
7/8	.8750	.8594	4 11/16	7 3/16	65456	299.60	65556	338.00
57/64	.8906	.8750	4 7/8	7 3/8	65457	329.20	65557	367.25
29/32	.9062	.8906	4 7/8	7 3/8	65458	318.90	65558	357.40
59/64	.9219	.9062	5 1/32	7 17/32	65459	329.20	65559	367.25
15/16	.9375	.9219	5 1/32	7 17/32	65460	318.90	65560	357.40
61/64	.9531	.9375	5 3/16	7 11/16	65461	348.25	65561	386.15
31/32	.9688	.9531	5 3/16	7 11/16	65462	335.65	65562	374.20
63/64	.9844	.9688	5 5/16	7 13/16	65463	348.25	65563	386.15
1	1.0000	.9844	5 5/16	7 13/16	65464	335.65	65564	374.20
1 1/32	1.0312	1.0000	5 11/16	8 3/16	65466	362.20	65566	400.85
1 1/16	1.0625	1.0000	5 11/16	8 3/16	65468	374.20	65568	413.00
1 3/32	1.0938	1.0000	5 11/16	8 3/16	65470	383.95	65570	422.65
1 1/8	1.1250	1.0000	5 11/16	8 3/16	65472	398.45	65572	437.15

*Contact us for decimal diameter prices

MODIFICATIONS (See list on page 119)

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

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

USE:

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

TOOL DIAMETER		SHANK & BODY DIAM.		LENGTH				TYPE 654 - 125° PT.		TYPE 655 - 135° PT.	
				FLUTE		OVERALL		METRIC EDP NO.	METRIC PRICE	METRIC EDP NO.	METRIC PRICE
mm	INCH	mm	INCH	mm	INCH	mm	INCH				
6.5	.2559	6.0	.2362	39	1 17/32	100	3 15/16	654065	$192.00	655065	$225.05
7.0	.2756	6.5	.2559	40	1 19/32	102	4	654070	203.75	655070	234.60
7.5	.2953	7.0	.2756	40	1 19/32	102	4	654075	203.75	655075	234.60
8.0	.3150	7.5	.2953	44	1 3/4	106	4 5/32	654080	203.75	655080	234.60
8.5	.3346	8.0	.3150	49	1 15/16	110	4 11/32	654085	203.75	655085	244.00
9.0	.3543	8.5	.3346	49	1 15/16	110	4 11/32	654090	203.75	655090	244.00
9.5	.3740	9.0	.3543	54	2 1/8	115	4 17/32	654095	203.75	655095	244.00
10.0	.3937	9.5	.3740	58	2 9/32	119	4 11/16	654100	203.75	655100	258.30
10.5	.4134	10.0	.3937	58	2 9/32	119	4 11/16	654105	203.75	655105	258.30
11.0	.4331	10.5	.4134	64	2 1/2	125	4 29/32	654110	203.75	655110	258.30
11.5	.4528	11.0	.4331	67	2 21/32	129	5 1/16	654115	215.50	655115	258.30
12.0	.4724	11.5	.4528	67	2 21/32	129	5 1/16	654120	215.50	655120	258.30
12.5	.4921	12.0	.4724	71	2 13/16	133	5 7/32	654125	220.30	655125	258.30
13.0	.5118	12.5	.4921	76	3	137	5 13/32	654130	217.85	655130	258.30
13.5	.5315	13.0	.5118	76	3	137	5 13/32	654135	217.85	655135	258.30
14.0	.5512	13.5	.5315	79	3 1/8	140	5 17/32	654140	217.85	655140	258.30
14.5	.5709	14.0	.5512	83	3 9/32	144	5 11/16	654145	234.60	655145	270.00
15.0	.5906	14.5	.5709	83	3 9/32	144	5 11/16	654150	234.60	655150	270.00
15.5	.6102	15.0	.5906	87	3 7/16	148	5 27/32	654155	234.60	655155	270.00
16.0	.6299	15.5	.6102	87	3 7/16	148	5 27/32	654160	234.60	655160	270.00
16.5	.6496	16.0	.6299	93	3 21/32	154	6 1/16	654165	234.60	655165	270.00
17.0	.6693	16.5	.6496	93	3 21/32	154	6 1/16	654170	234.60	655170	270.00
17.5	.6890	17.0	.6693	97	3 13/16	158	6 7/32	654175	234.60	655175	298.55
18.0	.7087	17.5	.6890	100	3 15/16	161	6 11/32	654180	260.70	655180	298.55
18.5	.7283	18.0	.7087	100	3 15/16	161	6 11/32	654185	260.70	655185	298.55
19.0	.7480	18.5	.7283	105	4 1/8	166	6 17/32	654190	260.70	655190	298.55
19.5	.7677	19.0	.7480	109	4 9/32	172	6 25/32	654195	260.70	655195	298.55
20.0	.7874	19.5	.7677	109	4 9/32	172	6 25/32	654200	260.70	655200	345.90
20.5	.8071	20.0	.7874	113	4 7/16	176	6 15/16	654205	310.40	655205	345.90
21.0	.8268	20.5	.8071	117	4 19/32	180	7 3/32	654210	310.40	655210	345.90
21.5	.8465	21.0	.8268	117	4 19/32	180	7 3/32	654215	310.40	655215	345.90
22.0	.8661	21.5	.8465	119	4 11/16	183	7 3/16	654220	310.40	655220	345.90
22.5	.8858	22.0	.8661	124	4 7/8	187	7 3/8	654225	329.20	655225	367.25
23.0	.9055	22.5	.8858	124	4 7/8	187	7 3/8	654230	329.20	655230	367.25
23.5	.9252	23.0	.9055	128	5 1/32	191	7 17/32	654235	329.20	655235	367.25
24.0	.9449	23.5	.9252	132	5 3/16	195	7 11/16	654240	348.25	655240	386.15
24.5	.9646	24.0	.9449	132	5 3/16	195	7 11/16	654245	348.25	655245	386.15
25.0	.9843	24.5	.9646	135	5 5/16	198	7 13/16	654250	348.25	655250	386.15
26.0	1.0236	25.5	1.0039	144	5 11/16	208	8 3/16	654260	374.20	655260	412.30

Contact us for metric diameter ranges & prices

DRILLS

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

COOLANT FED

125° FOUR FACET POINT OR 135° SPLIT POINT

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

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

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

DRILLS

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	$192.60	65716	$241.10
9/32	.2812	3 7/8	6 1/4	65618	192.60	65718	237.25
5/16	.3125	4	6 3/8	65620	N/A	65720	N/A
11/32	.3438	4 1/8	6 1/2	65622	192.60	65722	237.25
3/8	.3750	4 1/4	6 3/4	65624	192.60	65724	237.25
13/32	.4062	4 3/8	7	65626	192.60	65726	254.60
7/16	.4375	4 5/8	7 1/4	65628	192.60	65728	254.60
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	284.30	65738	339.05
5/8	.6250	5 3/4	8 3/4	65640	284.30	65740	339.05
21/32	.6562	5 7/8	9	65642	302.40	65742	360.60
11/16	.6875	6	9 1/4	65644	324.00	65744	386.20
23/32	.7188	6 3/16	9 1/2	65646	337.55	65746	396.20
3/4	.7500	6 3/8	9 3/4	65648	339.30	65748	398.35

*Contact us for decimal and metric diameter prices

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

MATERIAL SPECIFIC

118° STANDARD OR 135° SPLIT POINT

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

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

MODIFICATIONS (See list on page 123)

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

DRILLS

TOOL DIAMETER			LENGTH		TYPE 640 - 118° PT.		TYPE 641 - 135° PT.	
FRAC.	WIRE/ LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
	32	.1160	7/8	1 7/8	64232	$24.30	64332	$27.00
	31	.1200	7/8	1 7/8	64231	24.30	64331	27.00
1/8		.1250	7/8	1 7/8	64008	18.25	64108	19.70
	30	.1285	15/16	1 15/16	64230	25.75	64330	28.40
	29	.1360	15/16	1 15/16	64229	25.75	64329	28.40
	28	.1405	15/16	1 15/16	64228	25.75	64328	28.40
9/64		.1406	15/16	1 15/16	64009	22.10	64109	26.00
	27	.1440	1	2 1/16	64227	25.75	64327	28.40
	26	.1470	1	2 1/16	64226	25.75	64326	28.40
	25	.1495	1	2 1/16	64225	25.75	64325	28.40
	24	.1520	1	2 1/16	64224	25.75	64324	28.40
	23	.1540	1	2 1/16	64223	25.75	64323	28.40
5/32		.1562	1	2 1/16	64010	19.30	64110	21.00
	22	.1570	1 1/16	2 1/8	64222	25.75	64322	28.40
	21	.1590	1 1/16	2 1/8	64221	25.75	64321	28.40
	20	.1610	1 1/16	2 1/8	64220	29.90	64320	33.30
	19	.1660	1 1/16	2 1/8	64219	29.90	64319	33.30
	18	.1695	1 1/16	2 1/8	64218	29.90	64318	33.30
11/64		.1719	1 1/16	2 1/8	64011	26.30	64111	28.25
	17	.1730	1 1/8	2 3/16	64217	30.50	64317	33.85
	16	.1770	1 1/8	2 3/16	64216	30.50	64316	33.85
	15	.1800	1 1/8	2 3/16	64215	30.50	64315	33.85
	14	.1820	1 1/8	2 3/16	64214	30.50	64314	33.85
	13	.1850	1 1/8	2 3/16	64213	30.50	64313	33.85
3/16		.1875	1 1/8	2 3/16	64012	20.30	64112	22.25
	12	.1890	1 3/16	2 1/4	64212	30.30	64312	33.60
	11	.1910	1 3/16	2 1/4	64211	30.30	64311	33.60
	10	.1935	1 3/16	2 1/4	64210	30.30	64310	33.60
	9	.1960	1 3/16	2 1/4	64209	30.30	64309	33.60
	8	.1990	1 3/16	2 1/4	64208	30.30	64308	33.60
	7	.2010	1 3/16	2 1/4	64207	26.60	64307	31.90
13/64		.2031	1 3/16	2 1/4	64013	26.30	64113	28.25
	6	.2040	1 1/4	2 3/8	64206	30.50	64306	33.85
	5	.2055	1 1/4	2 3/8	64205	30.50	64305	33.85
	4	.2090	1 1/4	2 3/8	64204	30.50	64304	33.85
	3	.2130	1 1/4	2 3/8	64203	26.60	64303	31.90
7/32		.2188	1 1/4	2 3/8	64014	21.85	64114	24.20
	2	.2210	1 5/16	2 7/16	64202	30.30	64302	33.60
	1	.2280	1 5/16	2 7/16	64201	26.60	64301	33.60
	A	.2340	1 5/16	2 7/16	64401	30.30	64501	33.60
15/64		.2344	1 5/16	2 7/16	64015	24.20	64115	28.90
	B	.2380	1 3/8	2 1/2	64402	30.30	64502	33.60
	C	.2420	1 3/8	2 1/2	64403	30.30	64503	33.60
	D	.2460	1 3/8	2 1/2	64404	26.60	64504	31.90
1/4	E	.2500	1 3/8	2 1/2	64016	22.20	64116	25.60
	F	.2570	1 7/16	2 5/8	64406	30.95	64506	37.20
	G	.2610	1 7/16	2 5/8	64407	30.95	64507	37.20
17/64		.2656	1 7/16	2 5/8	64017	27.00	64117	32.05
	H	.2660	1 1/2	2 11/16	64408	29.95	64508	38.90
	I	.2720	1 1/2	2 11/16	64409	30.95	64509	37.20
	J	.2770	1 1/2	2 11/16	64410	35.00	64510	38.90
	K	.2810	1 1/2	2 11/16	64411	35.00	64511	38.90

TOOL DIAMETER			LENGTH		TYPE 640 - 118° PT.		TYPE 641 - 135° PT.	
FRAC.	LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
9/32		.2812	1 1/2	2 11/16	64018	$25.55	64118	$29.75
	L	.2900	1 9/16	2 3/4	64412	36.10	64512	40.00
	M	.2950	1 9/16	2 3/4	64413	36.10	64513	40.00
19/64		.2969	1 9/16	2 3/4	64019	30.95	64119	36.65
	N	.3020	1 5/8	2 13/16	64414	41.40	64514	46.10
5/16		.3125	1 5/8	2 13/16	64020	27.20	64120	31.70
	O	.3160	1 11/16	2 15/16	64415	38.10	64515	45.95
	P	.3230	1 11/16	2 15/16	64416	43.30	64516	48.10
21/64		.3281	1 11/16	2 15/16	64021	33.60	64121	39.00
	Q	.3320	1 11/16	3	64417	38.10	64517	45.95
	R	.3390	1 11/16	3	64418	38.10	64518	45.95
11/32		.3438	1 11/16	3	64022	31.75	64122	36.65
	S	.3480	1 3/4	3 1/16	64419	43.75	64519	48.65
	T	.3580	1 3/4	3 1/16	64420	43.75	64520	48.65
23/64		.3594	1 3/4	3 1/16	64023	34.60	64123	40.25
	U	.3680	1 13/16	3 1/8	64421	39.20	64521	47.10
3/8		.3750	1 13/16	3 1/8	64024	32.50	64124	37.60
	V	.3770	1 7/8	3 1/4	64422	50.45	64522	56.00
	W	.3860	1 7/8	3 1/4	64423	44.50	64523	53.50
25/64		.3906	1 7/8	3 1/4	64025	38.50	64125	44.75
	X	.3970	1 15/16	3 5/16	64424	44.50	64524	56.00
	Y	.4040	1 15/16	3 5/16	64425	50.45	64525	56.00
13/32		.4062	1 15/16	3 5/16	64026	38.50	64126	44.75
	Z	.4130	2	3 3/8	64426	57.35	64526	63.80
27/64		.4219	2	3 3/8	64027	42.70	64127	48.65
7/16		.4375	2 1/16	3 7/16	64028	41.20	64128	45.70
29/64		.4531	2 1/8	3 9/16	64029	54.90	64129	70.55
15/32		.4688	2 1/8	3 5/8	64030	58.60	64130	68.15
31/64		.4844	2 3/16	3 11/16	64031	52.55	64131	67.55
1/2		.5000	2 1/4	3 3/4	64032	56.10	64132	65.20
33/64		.5156	2 3/8	3 7/8	64033	83.70	64133	93.20
17/32		.5312	2 3/8	3 7/8	64034	69.90	64134	78.90
35/64		.5469	2 1/2	4	64035	83.70	64135	93.20
9/16		.5625	2 1/2	4	64036	69.90	64136	78.90
37/64		.5781	2 5/8	4 1/8	64037	97.75	64137	108.70
19/32		.5938	2 5/8	4 1/8	64038	80.15	64138	90.40
39/64		.6094	2 3/4	4 1/4	64039	97.75	64139	108.70
5/8		.6250	2 3/4	4 1/4	64040	80.15	64140	90.40
41/64		.6406	2 7/8	4 1/2	64041	116.70	64141	129.85
21/32		.6562	2 7/8	4 1/2	64042	96.35	64142	108.80
43/64		.6719	2 7/8	4 5/8	64043	119.65	64143	133.00
11/16		.6875	2 7/8	4 5/8	64044	99.00	64144	111.60
45/64		.7031	3	4 3/4	64045	135.25	64145	150.25
23/32		.7188	3	4 3/4	64046	112.10	64146	130.20
47/64		.7344	3 1/8	5	64047	135.40	64147	150.65
3/4		.7500	3 1/8	5	64048	112.50	64148	126.65
49/64		.7656	3 1/4	5 1/8	64049	144.85	64149	161.20
25/32		.7812	3 1/4	5 1/8	64050	138.95	64150	161.30
51/64		.7969	3 3/8	5 1/4	64051	162.10	64151	180.35
13/16		.8125	3 3/8	5 1/4	64052	139.10	64152	156.85
53/64		.8281	3 1/2	5 3/8	64053	158.90	64153	176.60
27/32		.8438	3 1/2	5 3/8	64054	152.20	64154	176.80

CONTINUED ON NEXT PAGE

CNC STUB LENGTH DRILLS
CARBIDE TIPPED TYPES 640 & 641 METRIC

MATERIAL SPECIFIC

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	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
55/64	.8594	3 1/2	5 1/2	64055	$177.90	64155	$197.90
7/8	.8750	3 1/2	5 1/2	64056	152.60	64156	171.95
57/64	.8906	3 5/8	5 5/8	64057	170.65	64157	189.70
29/32	.9062	3 5/8	5 5/8	64058	163.60	64158	189.80
59/64	.9219	3 3/4	5 3/4	64059	190.90	64159	212.45
15/16	.9375	3 3/4	5 3/4	64060	163.80	64160	184.70
61/64	.9531	3 7/8	5 7/8	64061	190.90	64161	212.45
31/32	.9688	3 7/8	5 7/8	64062	172.80	64162	200.65
63/64	.9844	4	6	64063	201.85	64163	224.60
1	1.0000	4	6	64064	173.05	64164	195.25
*1 1/32	1.0312	4	6 1/4	64066	252.90	64166	281.20
*1 1/16	1.0625	4	6 1/4	64068	216.70	64168	244.55
*1 3/32	1.0938	4	6 3/8	64070	280.60	64170	312.20
*1 1/8	1.1250	4	6 3/8	64072	240.65	64172	271.25
*1 5/32	1.1562	4 1/4	6 5/8	64074	342.50	64174	381.10
*1 3/16	1.1875	4 1/4	6 5/8	64076	293.75	64176	329.20
*1 7/32	1.2188	4 3/8	6 3/4	64078	342.50	64178	381.10
*1 1/4	1.2500	4 3/8	6 3/4	64080	293.75	64180	329.20

*Shank: 1" diameter, 2¼" 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.	
		FLUTE		OVERALL		METRIC	METRIC	METRIC	METRIC
mm	INCH	mm	INCH	mm	INCH	EDP NO.	PRICE	EDP NO.	PRICE
3.0	.1181	22	7/8	48	1 7/8	640030	$24.20	641030	$26.65
3.1	.1220	22	7/8	48	1 7/8	640031	24.20	641031	26.65
3.2	.1260	24	15/16	49	1 15/16	640032	24.20	641032	26.65
3.3	.1299	24	15/16	49	1 15/16	640033	24.20	641033	26.65
3.4	.1339	24	15/16	49	1 15/16	640034	24.20	641034	26.65
3.5	.1378	24	15/16	49	1 15/16	640035	20.70	641035	23.70
3.6	.1417	25	1	52	2 1/16	640036	24.20	641036	26.65
3.7	.1457	25	1	52	2 1/16	640037	24.20	641037	26.65
3.8	.1496	25	1	52	2 1/16	640038	24.20	641038	26.65
3.9	.1535	25	1	52	2 1/16	640039	24.20	641039	26.65
4.0	.1575	27	1 1/16	54	2 1/8	640040	20.70	641040	23.75
4.1	.1614	27	1 1/16	54	2 1/8	640041	28.85	641041	31.75
4.2	.1654	27	1 1/16	54	2 1/8	640042	28.85	641042	31.75
4.3	.1693	27	1 1/16	54	2 1/8	640043	28.85	641043	31.75
4.4	.1732	29	1 1/8	56	2 3/16	640044	28.85	641044	31.75
4.5	.1772	29	1 1/8	56	2 3/16	640045	24.65	641045	28.30
4.6	.1811	29	1 1/8	56	2 3/16	640046	28.85	641046	31.75
4.7	.1850	29	1 1/8	56	2 3/16	64213	30.50	64313	33.85
4.8	.1890	30	1 3/16	57	2 1/4	64212	30.30	64312	33.60
4.9	.1929	30	1 3/16	57	2 1/4	640049	28.85	641049	31.75
5.0	.1969	30	1 3/16	57	2 1/4	640050	24.65	641050	28.30
5.1	.2008	30	1 3/16	57	2 1/4	640051	28.85	641051	31.75
5.2	.2047	32	1 1/4	60	2 3/8	640052	28.85	641052	31.75
5.3	.2087	32	1 1/4	60	2 3/8	640053	28.85	641053	31.75
5.4	.2126	32	1 1/4	60	2 3/8	640054	28.85	641054	31.75
5.5	.2165	32	1 1/4	60	2 3/8	640055	24.65	641055	28.30
5.6	.2205	33	1 5/16	62	2 7/16	640056	28.85	641056	31.75
5.7	.2244	33	1 5/16	62	2 7/16	640057	28.85	641057	31.75
5.8	.2283	33	1 5/16	62	2 7/16	640058	28.85	641058	31.75
5.9	.2323	33	1 5/16	62	2 7/16	640059	28.85	641059	31.75
6.0	.2362	35	1 3/8	64	2 1/2	640060	23.05	641060	26.40
6.1	.2402	35	1 3/8	64	2 1/2	640061	29.75	641061	33.00
6.2	.2441	35	1 3/8	64	2 1/2	640062	29.75	641062	33.00
6.3	.2480	35	1 3/8	64	2 1/2	640063	29.75	641063	33.00
6.4	.2520	37	1 7/16	67	2 5/8	640064	29.75	641064	33.00
6.5	.2559	37	1 7/16	67	2 5/8	640065	25.55	641065	29.30
6.6	.2598	37	1 7/16	67	2 5/8	640066	$29.75	641066	$33.00
6.7	.2638	37	1 7/16	67	2 5/8	640067	29.75	641067	33.00
6.8	.2677	38	1 1/2	68	2 11/16	640068	29.75	641068	33.00
6.9	.2717	38	1 1/2	68	2 11/16	640069	29.75	641069	33.00
7.0	.2756	38	1 1/2	68	2 11/16	640070	25.55	641070	29.30
7.1	.2795	38	1 1/2	68	2 11/16	640071	29.75	641071	33.00
7.2	.2835	40	1 9/16	70	2 3/4	640072	34.20	641072	37.75
7.3	.2874	40	1 9/16	70	2 3/4	640073	34.20	641073	37.75
7.4	.2913	40	1 9/16	70	2 3/4	640074	34.20	641074	37.75
7.5	.2953	40	1 9/16	70	2 3/4	640075	29.35	641075	33.50
7.6	.2992	41	1 5/8	71	2 13/16	640076	34.20	641076	37.75
7.7	.3031	41	1 5/8	71	2 13/16	640077	34.20	641077	37.75
7.8	.3071	41	1 5/8	71	2 13/16	640078	34.20	641078	37.75
7.9	.3110	41	1 5/8	71	2 13/16	640079	34.20	641079	37.75
8.0	.3150	43	1 11/16	75	2 15/16	640080	29.35	641080	33.50
8.1	.3189	43	1 11/16	75	2 15/16	640081	36.80	641081	40.30
8.2	.3228	43	1 11/16	75	2 15/16	640082	36.80	641082	40.30
8.3	.3268	43	1 11/16	75	2 15/16	640083	36.80	641083	40.30
8.4	.3307	43	1 11/16	76	3	640084	36.80	641084	40.30
8.5	.3346	43	1 11/16	76	3	640085	31.55	641085	35.65
8.6	.3386	43	1 11/16	76	3	640086	36.80	641086	40.30
8.7	.3425	43	1 11/16	76	3	640087	37.40	641087	41.20
8.8	.3465	44	1 3/4	78	3 1/16	640088	37.40	641088	41.20
8.9	.3504	44	1 3/4	78	3 1/16	640089	37.40	641089	41.20
9.0	.3543	44	1 3/4	78	3 1/16	640090	32.10	641090	36.80
9.1	.3583	44	1 3/4	78	3 1/16	640091	37.40	641091	41.20
9.2	.3622	46	1 13/16	79	3 1/8	640092	37.40	641092	41.20
9.3	.3661	46	1 13/16	79	3 1/8	640093	37.40	641093	41.20
9.4	.3701	46	1 13/16	79	3 1/8	640094	37.40	641094	41.20
9.5	.3740	46	1 13/16	79	3 1/8	640095	32.10	641095	36.80
9.6	.3780	48	1 7/8	83	3 1/4	640096	41.60	641096	45.90
9.7	.3819	48	1 7/8	83	3 1/4	640097	41.60	641097	45.90
9.8	.3858	48	1 7/8	83	3 1/4	640098	41.60	641098	45.90
9.9	.3898	48	1 7/8	83	3 1/4	640099	41.60	641099	45.90
10.0	.3937	49	1 15/16	84	3 5/16	640100	35.70	641100	40.85
10.5	.4134	51	2	86	3 3/8	640105	39.90	641105	44.45
11.0	.4331	52	2 1/16	87	3 7/16	640110	39.90	641110	44.45
11.5	.4528	54	2 1/8	90	3 9/16	640115	56.15	641115	62.20
12.0	.4724	56	2 3/16	94	3 11/16	640120	53.70	641120	59.60
12.5	.4921	57	2 1/4	95	3 3/4	640125	53.70	641125	59.60
13.0	.5118	60	2 3/8	98	3 7/8	640130	66.35	641130	72.05
13.5	.5315	60	2 3/8	98	3 7/8	640135	65.10	641135	72.05
14.0	.5512	64	2 1/2	102	4	640140	65.10	641140	72.05
14.5	.5709	67	2 5/8	105	4 1/8	640145	91.70	641145	101.05
15.0	.5906	67	2 5/8	105	4 1/8	640150	91.70	641150	101.05
15.5	.6102	70	2 3/4	108	4 1/4	640155	103.40	641155	114.00
16.0	.6299	73	2 7/8	114	4 1/2	640160	116.50	641160	128.45
16.5	.6496	73	2 7/8	114	4 1/2	640165	116.50	641165	128.45
17.0	.6693	73	2 7/8	117	4 5/8	640170	116.50	641170	128.45
17.5	.6890	76	3	121	4 3/4	640175	128.50	641175	141.60
18.0	.7087	76	3	121	4 3/4	640180	128.50	641180	141.60
18.5	.7283	79	3 1/8	127	5	640185	140.40	641185	154.75
19.0	.7480	79	3 1/8	127	5	640190	140.40	641190	154.75
19.5	.7677	83	3 1/4	130	5 1/8	640195	155.30	641195	171.20
20.0	.7874	86	3 3/8	133	5 1/4	640200	173.65	641200	191.20
20.5	.8071	86	3 3/8	133	5 1/4	640205	173.65	641205	191.20
21.0	.8268	89	3 1/2	137	5 3/8	640210	190.60	641210	209.95
21.5	.8465	89	3 1/2	140	5 1/2	640215	190.60	641215	209.95
22.0	.8661	89	3 1/2	140	5 1/2	640220	190.60	641220	209.95
22.5	.8858	92	3 5/8	143	5 5/8	640225	196.15	641225	216.05
23.0	.9055	92	3 5/8	143	5 5/8	640230	196.15	641230	216.05
23.5	.9252	95	3 3/4	146	5 3/4	640235	201.00	641235	221.35
24.0	.9449	98	3 7/8	149	5 7/8	640240	204.70	641240	225.65
24.5	.9646	98	3 7/8	149	5 7/8	640245	204.70	641245	225.65
25.0	.9843	102	4	152	6	640250	216.25	641250	238.00

JOBBERS LENGTH DRILLS CARBIDE TIPPED TYPES 600 & 601 FRACTIONAL

118° STANDARD OR 135° SPLIT POINT

MATERIAL SPECIFIC

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.	
FRAC.	WIRE/LTR.	DEC.	FLUTE	OAL	EDP NO.	PRICE	EDP NO.	PRICE
	*40	.0980	1	2	60240	$21.60	-	-
	*39	.0995	1 1/4	2 1/4	60239	21.60	-	-
	*38	.1015	1 1/4	2 1/4	60238	21.60	-	-
	*37	.1040	1 1/4	2 1/4	60237	21.60	-	-
	*36	.1065	1 1/4	2 1/4	60236	21.60	-	-
*7/64		.1094	1 1/4	2 1/4	60007	21.60	-	-
	*35	.1100	1 1/4	2 1/4	60235	21.60	-	-
	*34	.1110	1 1/4	2 1/4	60234	21.60	-	-
	*33	.1130	1 1/4	2 1/4	60233	21.60	-	-
	32	.1160	1 5/8	2 3/4	60232	17.45	60332	$20.45
	31	.1200	1 5/8	2 3/4	60231	15.80	60331	18.40
1/8		.1250	1 5/8	2 3/4	60008	16.15	60108	18.85
	30	.1285	1 5/8	2 3/4	60230	16.50	60330	19.15
	29	.1360	1 3/4	2 7/8	60229	17.10	60329	19.70
	28	.1405	1 3/4	2 7/8	60228	17.20	60328	20.10
9/64		.1406	1 3/4	2 7/8	60009	17.45	60109	20.35
	27	.1440	1 7/8	3	60227	17.70	60327	20.50
	26	.1470	1 7/8	3	60226	16.40	60326	19.15
	25	.1495	1 7/8	3	60225	16.40	60325	19.15
	24	.1520	2	3 1/8	60224	17.70	60324	20.50
	23	.1540	2	3 1/8	60223	17.20	60323	20.10
5/32		.1562	2	3 1/8	60010	17.15	60110	20.10
	22	.1570	2	3 1/8	60222	18.95	60322	22.20
	21	.1590	2 1/8	3 1/4	60221	18.25	60321	21.25
	20	.1610	2 1/8	3 1/4	60220	18.70	60320	21.60
	19	.1660	2 1/8	3 1/4	60219	18.70	60319	21.60
	18	.1695	2 1/8	3 1/4	60218	18.70	60318	21.60
11/64		.1719	2 1/8	3 1/4	60011	18.70	60111	21.60
	17	.1730	2 3/16	3 3/8	60217	18.70	60317	21.60
	16	.1770	2 3/16	3 3/8	60216	18.25	60316	21.25
	15	.1800	2 3/16	3 3/8	60215	18.95	60315	22.20
	14	.1820	2 3/16	3 3/8	60214	18.25	60314	21.25
	13	.1850	2 5/16	3 1/2	60213	20.10	60313	21.25
3/16		.1875	2 5/16	3 1/2	60012	18.25	60112	21.25
	12	.1890	2 5/16	3 1/2	60212	21.00	60312	22.20
	11	.1910	2 5/16	3 1/2	60211	19.40	60311	22.40
	10	.1935	2 7/16	3 5/8	60210	18.95	60310	22.20
	9	.1960	2 7/16	3 5/8	60209	19.40	60309	22.40
	8	.1990	2 7/16	3 5/8	60208	19.40	60308	22.40
	7	.2010	2 7/16	3 5/8	60207	19.40	60307	22.40
13/64		.2031	2 7/16	3 5/8	60013	20.05	60113	23.05
	6	.2040	2 1/2	3 3/4	60206	19.80	60306	23.00
	5	.2055	2 1/2	3 3/4	60205	20.05	60305	22.40
	4	.2090	2 1/2	3 3/4	60204	19.80	60304	23.00
	3	.2130	2 1/2	3 3/4	60203	20.05	60303	22.40
7/32		.2188	2 1/2	3 3/4	60014	20.05	60114	23.05
	2	.2210	2 5/8	3 7/8	60202	20.90	60302	24.10
	1	.2280	2 5/8	3 7/8	60201	20.45	60301	23.75
	A	.2340	2 5/8	3 7/8	60401	22.70	60501	26.30
15/64		.2344	2 5/8	3 7/8	60015	21.50	60115	25.00
	B	.2380	2 3/4	4	60402	22.70	60502	26.30
	C	.2420	2 3/4	4	60403	22.70	60503	26.30
	D	.2460	2 3/4	4	60404	22.15	60504	25.75
1/4	E	.2500	2 3/4	4	60016	21.50	60116	25.00

TOOL DIAMETER			LENGTH		TYPE 600 - 118° PT.		TYPE 601 - 135° PT.	
FRAC.	LTR.	DEC.	FLUTE	OAL	EDP NO.	PRICE	EDP NO.	PRICE
	F	.2570	2 7/8	4 1/8	60406	$25.45	60506	$29.50
	G	.2610	2 7/8	4 1/8	60407	26.10	60507	30.20
17/64		.2656	2 7/8	4 1/8	60017	23.95	60117	27.40
	H	.2660	2 7/8	4 1/8	60408	26.60	60508	30.90
	I	.2720	2 7/8	4 1/8	60409	26.10	60509	30.20
	J	.2770	2 7/8	4 1/8	60410	26.60	60510	30.90
	K	.2810	2 15/16	4 1/4	60411	26.60	60511	30.90
9/32		.2812	2 15/16	4 1/4	60018	25.40	60118	29.35
	L	.2900	2 15/16	4 1/4	60412	26.60	60512	30.90
	M	.2950	3 1/16	4 3/8	60413	29.30	60513	34.10
19/64		.2969	3 1/16	4 3/8	60019	28.10	60119	32.50
	N	.3020	3 1/16	4 3/8	60414	28.60	60514	33.35
5/16		.3125	3 3/16	4 1/2	60020	27.50	60120	31.85
	O	.3160	3 3/16	4 1/2	60415	28.25	60515	32.65
	P	.3230	3 5/16	4 5/8	60416	30.10	60516	34.80
21/64		.3281	3 5/16	4 5/8	60021	29.10	60121	33.85
	Q	.3320	3 7/16	4 3/4	60417	30.65	60517	35.75
	R	.3390	3 7/16	4 3/4	60418	30.10	60518	34.80
11/32		.3438	3 7/16	4 3/4	60022	29.10	60122	33.85
	S	.3480	3 1/2	4 7/8	60419	32.35	60519	37.55
	T	.3580	3 1/2	4 7/8	60420	33.00	60520	38.45
23/64		.3594	3 1/2	4 7/8	60023	31.00	60123	36.05
	U	.3680	3 5/8	5	60421	31.75	60521	36.85
3/8		.3750	3 5/8	5	60024	31.00	60124	36.05
	V	.3770	3 5/8	5	60422	32.35	60522	37.55
	W	.3860	3 3/4	5 1/8	60423	35.50	60523	41.10
25/64		.3906	3 3/4	5 1/8	60025	33.70	60125	39.25
	X	.3970	3 3/4	5 1/8	60424	34.00	60524	39.40
	Y	.4040	3 7/8	5 1/4	60425	35.50	60525	41.10
13/32		.4062	3 7/8	5 1/4	60026	33.70	60126	39.25
	Z	.4130	3 7/8	5 1/4	60426	39.30	60526	45.50
27/64		.4219	3 15/16	5 3/8	60027	36.65	60127	42.60
7/16		.4375	4 1/16	5 1/2	60028	36.65	60128	42.60
29/64		.4531	4 3/16	5 5/8	60029	42.20	60129	48.85
15/32		.4688	4 5/16	5 3/4	60030	41.20	60130	47.75
31/64		.4844	4 3/8	5 7/8	60031	46.15	60131	53.45
1/2		.5000	4 1/2	6	60032	50.65	60132	53.45
33/64		.5156	4 13/16	6 5/8	60033	66.00	60133	76.70
17/32		.5312	4 13/16	6 5/8	60034	66.00	60134	76.70
35/64		.5469	4 13/16	6 5/8	60035	66.60	60135	77.35
9/16		.5625	4 13/16	6 5/8	60036	66.60	60136	77.35
37/64		.5781	4 13/16	6 5/8	60037	73.55	60137	85.50
19/32		.5938	5 3/16	7 1/8	60038	71.50	60138	83.10
39/64		.6094	5 3/16	7 1/8	60039	84.55	60139	98.15
5/8		.6250	5 3/16	7 1/8	60040	81.05	60140	94.00
41/64		.6406	5 3/16	7 1/8	60041	93.50	60141	108.60
21/32		.6562	5 3/16	7 1/8	60042	82.45	60142	95.65
43/64		.6719	5 5/8	7 5/8	60043	107.30	60143	124.55
11/16		.6875	5 5/8	7 5/8	60044	84.05	60144	97.50
45/64		.7031	5 5/8	7 5/8	60045	98.15	60145	109.20
23/32		.7188	5 5/8	7 5/8	60046	99.20	60146	110.20
47/64		.7344	5 5/8	7 5/8	60047	99.70	60147	110.80
3/4		.7500	5 13/16	8	60048	101.20	60148	112.55
-	-	-	-	-	-	-	-	-

*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	METRIC	METRIC	METRIC
mm	INCH	mm	INCH	mm	INCH	EDP NO.	PRICE	EDP NO.	PRICE
3.0	.1181	41	1 5/8	70	2 3/4	600030	$21.65	601030	$22.20
3.1	.1220	41	1 5/8	70	2 3/4	600031	22.75	601031	23.00
3.2	.1260	41	1 5/8	70	2 3/4	600032	22.75	601032	23.00
3.3	.1299	44	1 3/4	73	2 7/8	600033	22.75	601033	23.00
3.4	.1339	44	1 3/4	73	2 7/8	600034	22.75	601034	23.00
3.5	.1378	44	1 3/4	73	2 7/8	600035	21.00	601035	21.65
3.6	.1417	48	1 7/8	76	3	600036	21.65	601036	22.20
3.7	.1457	48	1 7/8	76	3	600037	21.65	601037	22.20
3.8	.1496	48	1 7/8	76	3	600038	21.65	601038	22.20
3.9	.1535	51	2	79	3 1/8	600039	21.65	601039	22.20
4.0	.1575	54	2 1/8	83	3 1/4	600040	20.45	601040	21.00
4.1	.1614	54	2 1/8	83	3 1/4	600041	19.70	601041	22.40
4.2	.1654	54	2 1/8	83	3 1/4	600042	21.00	601042	22.40
4.3	.1693	54	2 1/8	83	3 1/4	600043	21.00	601043	22.40
4.4	.1732	56	2 3/16	86	3 3/8	600044	21.00	601044	22.40
4.5	.1772	56	2 3/16	86	3 3/8	600045	21.65	601045	22.40
4.6	.1811	56	2 3/16	86	3 3/8	600046	23.70	601046	24.00
4.7	.1850	59	2 5/16	89	3 1/2	60213	20.10	60313	21.25
4.8	.1890	59	2 5/16	89	3 1/2	60212	21.00	60312	22.20
4.9	.1929	62	2 7/16	92	3 5/8	600049	23.70	601049	24.00
5.0	.1969	62	2 7/16	92	3 5/8	600050	22.75	601050	23.40
5.1	.2008	62	2 7/16	92	3 5/8	600051	24.70	601051	25.00
5.2	.2047	64	2 1/2	95	3 3/4	600052	24.70	601052	25.00
5.3	.2087	64	2 1/2	95	3 3/4	600053	24.70	601053	25.00
5.4	.2126	64	2 1/2	95	3 3/4	600054	24.70	601054	25.00
5.5	.2165	64	2 1/2	95	3 3/4	600055	24.10	601055	24.30
5.6	.2205	67	2 5/8	98	3 7/8	600056	25.40	601056	25.80
5.7	.2244	67	2 5/8	98	3 7/8	600057	25.40	601057	25.80
5.8	.2283	67	2 5/8	98	3 7/8	600058	25.40	601058	25.80
5.9	.2323	67	2 5/8	98	3 7/8	600059	25.40	601059	25.80
6.0	.2362	70	2 3/4	102	4	600060	25.00	601060	26.45
6.1	.2402	70	2 3/4	102	4	600061	26.45	601061	27.20
6.2	.2441	70	2 3/4	102	4	600062	26.45	601062	27.20
6.3	.2480	70	2 3/4	102	4	600063	26.45	601063	27.20
6.4	.2520	73	2 7/8	105	4 1/8	600064	26.45	601064	27.20
6.5	.2559	73	2 7/8	105	4 1/8	600065	25.85	601065	26.45
6.6	.2598	73	2 7/8	105	4 1/8	600066	27.65	601066	31.00
6.7	.2638	73	2 7/8	105	4 1/8	600067	27.65	601067	31.00
6.8	.2677	73	2 7/8	105	4 1/8	600068	27.65	601068	31.00
6.9	.2717	73	2 7/8	105	4 1/8	600069	27.65	601069	31.00
7.0	.2756	73	2 7/8	105	4 1/8	600070	27.10	601070	31.00
7.1	.2795	75	2 15/16	108	4 1/4	600071	28.40	601071	31.00
7.2	.2835	75	2 15/16	108	4 1/4	600072	28.40	601072	31.00
7.3	.2874	75	2 15/16	108	4 1/4	600073	28.40	601073	31.00
7.4	.2913	78	3 1/16	111	4 3/8	600074	28.40	601074	33.60
7.5	.2953	78	3 1/16	111	4 3/8	600075	28.40	601075	33.60
7.6	.2992	78	3 1/16	111	4 3/8	600076	29.75	601076	33.60
7.7	.3031	81	3 3/16	114	4 1/2	600077	29.75	601077	33.60
7.8	.3071	81	3 3/16	114	4 1/2	600078	29.75	601078	33.60
7.9	.3110	81	3 3/16	114	4 1/2	600079	29.75	601079	33.60
8.0	.3150	81	3 3/16	114	4 1/2	600080	29.05	601080	33.60
8.1	.3189	84	3 5/16	117	4 5/8	600081	31.75	601081	35.75
8.2	.3228	84	3 5/16	117	4 5/8	600082	31.75	601082	35.75
8.3	.3268	84	3 5/16	117	4 5/8	600083	31.75	601083	35.75
8.4	.3307	87	3 7/16	121	4 3/4	600084	31.75	601084	35.75
8.5	.3346	87	3 7/16	121	4 3/4	600085	30.35	601085	35.75
8.6	.3386	87	3 7/16	121	4 3/4	600086	31.75	601086	35.75
8.7	.3425	87	3 7/16	121	4 3/4	600087	$31.75	601087	$35.75
8.8	.3465	89	3 1/2	124	4 7/8	600088	31.75	601088	35.75
8.9	.3504	89	3 1/2	124	4 7/8	600089	31.75	601089	38.05
9.0	.3543	89	3 1/2	124	4 7/8	600090	31.00	601090	38.05
9.1	.3583	89	3 1/2	124	4 7/8	600091	34.40	601091	38.05
9.2	.3622	92	3 5/8	127	5	600092	34.40	601092	38.05
9.3	.3661	92	3 5/8	127	5	600093	34.40	601093	38.05
9.4	.3701	92	3 5/8	127	5	600094	34.40	601094	38.05
9.5	.3740	92	3 5/8	127	5	600095	33.70	601095	38.05
9.6	.3780	95	3 3/4	130	5 1/8	600096	34.85	601096	41.45
9.7	.3819	95	3 3/4	130	5 1/8	600097	34.85	601097	41.45
9.8	.3858	95	3 3/4	130	5 1/8	600098	34.85	601098	41.45
9.9	.3898	95	3 3/4	130	5 1/8	600099	34.85	601099	41.45
10.0	.3937	95	3 3/4	130	5 1/8	600100	34.85	601100	41.45
10.1	.3976	98	3 7/8	133	5 1/4	600101	41.60	601101	42.70
10.2	.4016	98	3 7/8	133	5 1/4	600102	41.60	601102	42.70
10.3	.4055	98	3 7/8	133	5 1/4	600103	41.60	601103	42.70
10.4	.4094	98	3 7/8	133	5 1/4	600104	41.60	601104	44.90
10.5	.4134	98	3 7/8	133	5 1/4	600105	40.20	601105	44.90
10.6	.4173	100	3 15/16	137	5 3/8	600106	45.55	601106	46.40
10.7	.4213	100	3 15/16	137	5 3/8	600107	45.55	601107	46.40
10.8	.4252	103	4 1/16	140	5 1/2	600108	45.55	601108	46.40
10.9	.4291	103	4 1/16	140	5 1/2	600109	45.55	601109	46.40
11.0	.4331	103	4 1/16	140	5 1/2	600110	43.60	601110	44.90
11.1	.4370	103	4 1/16	140	5 1/2	600111	50.90	601111	51.65
11.2	.4409	106	4 3/16	143	5 5/8	600112	50.90	601112	52.10
11.3	.4449	106	4 3/16	143	5 5/8	600113	50.90	601113	52.10
11.4	.4488	106	4 3/16	143	5 5/8	600114	50.90	601114	50.50
11.5	.4528	106	4 3/16	143	5 5/8	600115	48.90	601115	50.50
11.6	.4567	110	4 5/16	146	5 3/4	600116	55.40	601116	56.20
11.7	.4606	110	4 5/16	146	5 3/4	600117	55.40	601117	56.20
11.8	.4646	110	4 5/16	146	5 3/4	600118	55.40	601118	56.20
11.9	.4685	110	4 5/16	146	5 3/4	600119	55.40	601119	56.20
12.0	.4724	111	4 3/8	149	5 7/8	600120	53.00	601120	56.60
12.1	.4764	111	4 3/8	149	5 7/8	600121	57.60	601121	58.50
12.2	.4803	111	4 3/8	149	5 7/8	600122	57.60	601122	58.50
12.3	.4843	111	4 3/8	149	5 7/8	600123	57.60	601123	58.50
12.4	.4882	114	4 1/2	152	6	600124	57.60	601124	58.50
12.5	.4921	114	4 1/2	152	6	600125	54.90	601125	56.60
12.6	.4961	114	4 1/2	152	6	600126	59.65	601126	60.35
12.7	.5000	114	4 1/2	152	6	60032	50.65	60132	53.45
12.8	.5039	114	4 1/2	152	6	600128	65.45	601128	83.30
12.9	.5079	114	4 1/2	152	6	600129	65.45	601129	83.30
13.0	.5118	114	4 1/2	152	6	600130	65.45	601130	83.30
13.5	.5315	122	4 13/16	168	6 5/8	600135	84.80	601135	91.40
14.0	.5512	122	4 13/16	168	6 5/8	600140	89.80	601140	96.85
14.5	.5709	122	4 13/16	168	6 5/8	600145	96.30	601145	104.05
15.0	.5906	132	5 3/16	181	7 1/8	600150	96.30	601150	104.05
15.5	.6102	132	5 3/16	181	7 1/8	600155	97.55	601155	105.35
16.0	.6299	132	5 3/16	181	7 1/8	600160	99.35	601160	107.30
16.5	.6496	132	5 3/16	181	7 1/8	600165	99.35	601165	107.30
17.0	.6693	143	5 5/8	194	7 5/8	600170	103.15	601170	111.50
17.5	.6890	143	5 5/8	194	7 5/8	600175	103.15	601175	111.50
18.0	.7087	143	5 5/8	194	7 5/8	600180	104.40	601180	112.55
18.5	.7283	143	5 5/8	194	7 5/8	600185	104.95	601185	113.30
19.0	.7480	148	5 13/16	203	8	600190	106.30	601190	114.90

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

MATERIAL SPECIFIC

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.	
FRAC.	WIRE/ LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
1/8		.1250	1 5/8	2 3/4	69008	$19.40	69108	$22.80
	30	.1285	1 5/8	2 3/4	69230	19.90	69330	23.10
	29	.1360	1 3/4	2 7/8	69229	20.60	69329	23.75
	28	.1405	1 3/4	2 7/8	69228	20.75	69328	24.25
9/64		.1406	1 3/4	2 7/8	69009	21.05	69109	24.70
	27	.1440	1 7/8	3	69227	21.35	69327	24.90
	26	.1470	1 7/8	3	69226	19.85	69326	23.10
	25	.1495	1 7/8	3	69225	19.85	69325	23.10
	24	.1520	2	3 1/8	69224	21.35	69324	24.90
	23	.1540	2	3 1/8	69223	20.75	69323	24.25
5/32		.1562	2	3 1/8	69010	20.70	69110	24.25
	22	.1570	2	3 1/8	69222	23.05	69322	26.75
	21	.1590	2 1/8	3 1/4	69221	22.00	69321	25.55
	20	.1610	2 1/8	3 1/4	69220	22.55	69320	26.30
	19	.1660	2 1/8	3 1/4	69219	22.55	69319	26.30
	18	.1695	2 1/8	3 1/4	69218	22.55	69318	26.30
11/64		.1719	2 1/8	3 1/4	69011	22.55	69111	26.30
	17	.1730	2 3/16	3 3/8	69217	22.55	69317	26.30
	16	.1770	2 3/16	3 3/8	69216	22.00	69316	25.55
	15	.1800	2 3/16	3 3/8	69215	23.05	69315	26.75
	14	.1820	2 3/16	3 3/8	69214	22.00	69314	25.55
	13	.1850	2 5/16	3 1/2	69213	24.25	69313	25.55
3/16		.1875	2 5/16	3 1/2	69012	22.00	69112	25.55
	12	.1890	2 5/16	3 1/2	69212	25.20	69312	26.75
	11	.1910	2 5/16	3 1/2	69211	23.40	69311	27.00
	10	.1935	2 7/16	3 5/8	69210	23.05	69310	26.75
	9	.1960	2 7/16	3 5/8	69209	23.40	69309	27.00
	8	.1990	2 7/16	3 5/8	69208	23.40	69308	27.00
	7	.2010	2 7/16	3 5/8	69207	23.40	69307	27.00
13/64		.2031	2 7/16	3 5/8	69013	24.10	69113	27.85
	6	.2040	2 1/2	3 3/4	69206	23.80	69306	27.80
	5	.2055	2 1/2	3 3/4	69205	24.20	69305	27.00
	4	.2090	2 1/2	3 3/4	69204	23.80	69304	27.80
	3	.2130	2 1/2	3 3/4	69203	24.20	69303	27.00
7/32		.2188	2 1/2	3 3/4	69014	24.10	69114	28.10
	2	.2210	2 5/8	3 7/8	69202	25.10	69302	29.10
	1	.2280	2 5/8	3 7/8	69201	24.85	69301	28.75
	A	.2340	2 5/8	3 7/8	69401	27.40	69501	31.70
15/64		.2344	2 5/8	3 7/8	69015	26.00	69115	30.25
	B	.2380	2 3/4	4	69402	27.40	69502	31.70
	C	.2420	2 3/4	4	69403	27.40	69503	31.70
	D	.2460	2 3/4	4	69404	26.70	69504	31.00
1/4	E	.2500	2 3/4	4	69016	26.00	69116	30.25
	F	.2570	2 7/8	4 1/8	69406	30.65	69506	35.80
	G	.2610	2 7/8	4 1/8	69407	31.55	69507	36.40
17/64		.2656	2 7/8	4 1/8	69017	28.90	69117	33.00
	H	.2660	2 7/8	4 1/8	69408	32.10	69508	37.30
	I	.2720	2 7/8	4 1/8	69409	31.55	69509	36.40

TOOL DIAMETER			LENGTH		TYPE 690 - 118° PT.		TYPE 691 - 135° PT.	
FRAC.	LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
	J	.2770	2 7/8	4 1/8	69410	$32.10	69510	$37.30
	K	.2810	2 15/16	4 1/4	69411	32.10	69511	37.30
9/32		.2812	2 15/16	4 1/4	69018	30.55	69118	35.40
	L	.2900	2 15/16	4 1/4	69412	32.10	69512	37.30
	M	.2950	3 1/16	4 3/8	69413	35.35	69513	41.20
19/64		.2969	3 1/16	4 3/8	69019	33.95	69119	39.25
	N	.3020	3 1/16	4 3/8	69414	34.60	69514	40.25
5/16		.3125	3 3/16	4 1/2	69020	33.10	69120	38.50
	O	.3160	3 3/16	4 1/2	69415	34.00	69515	39.30
	P	.3230	3 5/16	4 5/8	69416	36.35	69516	42.20
21/64		.3281	3 5/16	4 5/8	69021	35.15	69121	40.90
	Q	.3320	3 7/16	4 3/4	69417	37.20	69517	43.10
	R	.3390	3 7/16	4 3/4	69418	36.35	69518	42.20
11/32		.3438	3 7/16	4 3/4	69022	35.15	69122	40.90
	S	.3480	3 1/2	4 7/8	69419	39.10	69519	45.50
	T	.3580	3 1/2	4 7/8	69420	39.90	69520	46.30
23/64		.3594	3 1/2	4 7/8	69023	37.45	69123	43.55
	U	.3680	3 5/8	5	69421	38.45	69521	44.40
3/8		.3750	3 5/8	5	69024	37.45	69124	43.55
	V	.3770	3 5/8	5	69422	39.10	69522	45.50
	W	.3860	3 3/4	5 1/8	69423	42.90	69523	49.70
25/64		.3906	3 3/4	5 1/8	69025	40.70	69125	47.35
	X	.3970	3 3/4	5 1/8	69424	41.05	69524	47.65
	Y	.4040	3 7/8	5 1/4	69425	42.90	69525	49.70
13/32		.4062	3 7/8	5 1/4	69026	40.70	69126	47.35
	Z	.4130	3 7/8	5 1/4	69426	47.50	69526	55.00
27/64		.4219	3 15/16	5 3/8	69027	44.30	69127	51.40
7/16		.4375	4 1/16	5 1/2	69028	44.30	69128	51.40
29/64		.4531	4 3/16	5 5/8	69029	50.75	69129	58.85
15/32		.4688	4 5/16	5 3/4	69030	49.85	69130	57.60
31/64		.4844	4 3/8	5 7/8	69031	55.60	69131	64.60
1/2		.5000	4 1/2	6	69032	61.25	69132	64.60
33/64		.5156	4 13/16	6 5/8	69033	79.70	69133	92.60
17/32		.5312	4 13/16	6 5/8	69034	79.70	69134	92.60
35/64		.5469	4 13/16	6 5/8	69035	80.45	69135	93.50
9/16		.5625	4 13/16	6 5/8	69036	80.45	69136	93.50
37/64		.5781	4 13/16	6 5/8	69037	88.80	69137	103.20
19/32		.5938	5 3/16	7 1/8	69038	86.50	69138	100.30
39/64		.6094	5 3/16	7 1/8	69039	102.10	69139	118.55
5/8		.6250	5 3/16	7 1/8	69040	97.90	69140	113.50
41/64		.6406	5 3/16	7 1/8	69041	112.90	69141	131.15
21/32		.6562	5 3/16	7 1/8	69042	99.50	69142	115.50
43/64		.6719	5 5/8	7 5/8	69043	129.60	69143	150.50
11/16		.6875	5 5/8	7 5/8	69044	101.45	69144	117.65
45/64		.7031	5 5/8	7 5/8	69045	118.70	69145	131.95
23/32		.7188	5 5/8	7 5/8	69046	119.80	69146	133.00
47/64		.7344	5 5/8	7 5/8	69047	120.40	69147	134.00
3/4		.7500	5 13/16	8	69048	122.45	69148	135.85

JOBBERS LENGTH DRILLS – TANGED CARBIDE TIPPED TYPES 690 & 691 METRIC

MATERIAL SPECIFIC

118° STANDARD OR 135° SPLIT POINT

DISCONTINUED - WHILE SUPPLIES LAST

MODIFICATIONS (Prompt delivery)

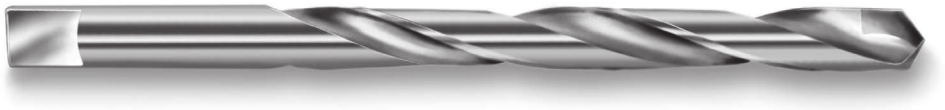
- Modified tool diameter
- Modified metric tool diameter
- Modified point and/or angle
- Reduced shank diameter
- Coatings available:

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	METRIC	METRIC	METRIC
mm	INCH	mm	INCH	mm	INCH	EDP NO.	PRICE	EDP NO.	PRICE
3.2	.1260	41	1 5/8	70	2 3/4	690032	$25.15	691032	$25.40
3.3	.1299	44	1 3/4	73	2 7/8	690033	25.15	691033	25.40
3.4	.1339	44	1 3/4	73	2 7/8	690034	25.15	691034	25.40
3.5	.1378	44	1 3/4	73	2 7/8	690035	23.05	691035	24.00
3.6	.1417	48	1 7/8	76	3	690036	24.05	691036	24.40
3.7	.1457	48	1 7/8	76	3	690037	24.05	691037	24.40
3.8	.1496	48	1 7/8	76	3	690038	24.05	691038	24.40
3.9	.1535	51	2	79	3 1/8	690039	24.05	691039	24.40
4.0	.1575	54	2 1/8	83	3 1/4	690040	22.70	691040	23.20
4.1	.1614	54	2 1/8	83	3 1/4	690041	21.70	691041	24.65
4.2	.1654	54	2 1/8	83	3 1/4	690042	23.05	691042	24.65
4.3	.1693	54	2 1/8	83	3 1/4	690043	23.05	691043	24.65
4.4	.1732	56	2 3/16	86	3 3/8	690044	23.05	691044	24.65
4.5	.1772	56	2 3/16	86	3 3/8	690045	24.05	691045	24.65
4.6	.1811	56	2 3/16	86	3 3/8	690046	26.15	691046	26.45
4.7	.1850	59	2 5/16	89	3 1/2	69213	24.25	69313	25.55
4.8	.1890	59	2 5/16	89	3 1/2	69212	25.20	69312	26.75
4.9	.1929	62	2 7/16	92	3 5/8	690049	26.15	691049	26.45
5.0	.1969	62	2 7/16	92	3 5/8	690050	25.10	691050	25.80
5.1	.2008	62	2 7/16	92	3 5/8	690051	27.20	691051	27.60
5.2	.2047	64	2 1/2	95	3 3/4	690052	27.20	691052	27.60
5.3	.2087	64	2 1/2	95	3 3/4	690053	27.20	691053	27.60
5.4	.2126	64	2 1/2	95	3 3/4	690054	27.20	691054	27.60
5.5	.2165	64	2 1/2	95	3 3/4	690055	26.50	691055	26.95
5.6	.2205	67	2 5/8	98	3 7/8	690056	27.90	691056	28.55
5.7	.2244	67	2 5/8	98	3 7/8	690057	27.90	691057	28.55
5.8	.2283	67	2 5/8	98	3 7/8	690058	27.90	691058	28.55
5.9	.2323	67	2 5/8	98	3 7/8	690059	27.90	691059	28.55
6.0	.2362	70	2 3/4	102	4	690060	27.60	691060	29.15
6.1	.2402	70	2 3/4	102	4	690061	29.15	691061	30.00
6.2	.2441	70	2 3/4	102	4	690062	29.15	691062	30.00
6.3	.2480	70	2 3/4	102	4	690063	29.15	691063	30.00
6.4	.2520	73	2 7/8	105	4 1/8	690064	29.15	691064	30.00
6.5	.2559	73	2 7/8	105	4 1/8	690065	28.70	691065	29.15
6.6	.2598	73	2 7/8	105	4 1/8	690066	30.55	691066	34.25
6.7	.2638	73	2 7/8	105	4 1/8	690067	30.55	691067	34.25
6.8	.2677	73	2 7/8	105	4 1/8	690068	30.55	691068	34.25
6.9	.2717	73	2 7/8	105	4 1/8	690069	30.55	691069	34.25
7.0	.2756	73	2 7/8	105	4 1/8	690070	29.90	691070	34.25
7.1	.2795	75	2 15/16	108	4 1/4	690071	31.30	691071	34.25
7.2	.2835	75	2 15/16	108	4 1/4	690072	31.30	691072	34.25
7.3	.2874	75	2 15/16	108	4 1/4	690073	31.30	691073	34.25
7.4	.2913	78	3 1/16	111	4 3/8	690074	31.30	691074	37.00
7.5	.2953	78	3 1/16	111	4 3/8	690075	31.30	691075	37.00
7.6	.2992	78	3 1/16	111	4 3/8	690076	32.90	691076	37.00
7.7	.3031	81	3 3/16	114	4 1/2	690077	32.90	691077	37.00
7.8	.3071	81	3 3/16	114	4 1/2	690078	32.90	691078	37.00
7.9	.3110	81	3 3/16	114	4 1/2	690079	32.90	691079	37.00
8.0	.3150	81	3 3/16	114	4 1/2	690080	32.10	691080	37.00
8.1	.3189	84	3 5/16	117	4 5/8	690081	35.00	691081	39.35
8.2	.3228	84	3 5/16	117	4 5/8	690082	35.00	691082	39.35
8.3	.3268	84	3 5/16	117	4 5/8	690083	35.00	691083	39.35

TOOL DIAMETER		LENGTH				TYPE 690 - 118° PT.		TYPE 691 - 135° PT.	
		FLUTE		OVERALL		METRIC	METRIC	METRIC	METRIC
mm	INCH	mm	INCH	mm	INCH	EDP NO.	PRICE	EDP NO.	PRICE
8.4	.3307	87	3 7/16	121	4 3/4	690084	$35.00	691084	$39.35
8.5	.3346	87	3 7/16	121	4 3/4	690085	33.40	691085	39.35
8.6	.3386	87	3 7/16	121	4 3/4	690086	35.00	691086	39.35
8.7	.3425	87	3 7/16	121	4 3/4	690087	35.00	691087	39.35
8.8	.3465	89	3 1/2	124	4 7/8	690088	35.00	691088	39.35
8.9	.3504	89	3 1/2	124	4 7/8	690089	35.00	691089	41.90
9.0	.3543	89	3 1/2	124	4 7/8	690090	34.20	691090	41.90
9.1	.3583	89	3 1/2	124	4 7/8	690091	37.90	691091	41.90
9.2	.3622	92	3 5/8	127	5	690092	37.90	691092	41.90
9.3	.3661	92	3 5/8	127	5	690093	37.90	691093	41.90
9.4	.3701	92	3 5/8	127	5	690094	37.90	691094	41.90
9.5	.3740	92	3 5/8	127	5	690095	37.15	691095	41.90
9.6	.3780	95	3 3/4	130	5 1/8	690096	38.60	691096	45.70
9.7	.3819	95	3 3/4	130	5 1/8	690097	38.60	691097	45.70
9.8	.3858	95	3 3/4	130	5 1/8	690098	38.60	691098	45.70
9.9	.3898	95	3 3/4	130	5 1/8	690099	38.60	691099	45.70
10.0	.3937	95	3 3/4	130	5 1/8	690100	38.60	691100	45.70
10.1	.3976	98	3 7/8	133	5 1/4	690101	45.85	691101	47.05
10.2	.4016	98	3 7/8	133	5 1/4	690102	45.85	691102	47.05
10.3	.4055	98	3 7/8	133	5 1/4	690103	45.85	691103	47.05
10.4	.4094	98	3 7/8	133	5 1/4	690104	45.90	691104	49.40
10.5	.4134	98	3 7/8	133	5 1/4	690105	44.45	691105	49.40
10.6	.4173	100	3 15/16	137	5 3/8	690106	50.40	691106	51.10
10.7	.4213	100	3 15/16	137	5 3/8	690107	50.40	691107	51.10
10.8	.4252	103	4 1/16	140	5 1/2	690108	50.40	691108	51.10
10.9	.4291	103	4 1/16	140	5 1/2	690109	50.40	691109	51.10
11.0	.4331	103	4 1/16	140	5 1/2	690110	48.05	691110	49.40
11.1	.4370	103	4 1/16	140	5 1/2	690111	56.05	691111	56.90
11.2	.4409	106	4 3/16	143	5 5/8	690112	56.10	691112	57.40
11.3	.4449	106	4 3/16	143	5 5/8	690113	56.10	691113	57.40
11.4	.4488	106	4 3/16	143	5 5/8	690114	56.05	691114	55.75
11.5	.4528	106	4 3/16	143	5 5/8	690115	53.80	691115	55.75
11.6	.4567	110	4 5/16	146	5 3/4	690116	60.90	691116	62.05
11.7	.4606	110	4 5/16	146	5 3/4	690117	60.90	691117	62.05
11.8	.4646	110	4 5/16	146	5 3/4	690118	60.90	691118	62.05
11.9	.4685	110	4 5/16	146	5 3/4	690119	60.90	691119	62.05
12.0	.4724	111	4 3/8	149	5 7/8	690120	58.40	691120	62.35
12.5	.4921	114	4 1/2	152	6	690125	60.60	691125	62.35
13.0	.5118	114	4 1/2	152	6	690130	72.20	691130	92.00
13.5	.5315	122	4 13/16	168	6 5/8	690135	93.35	691135	100.75
14.0	.5512	122	4 13/16	168	6 5/8	690140	99.05	691140	106.80
14.5	.5709	122	4 13/16	168	6 5/8	690145	106.20	691145	114.85
15.0	.5906	132	5 3/16	181	7 1/8	690150	106.20	691150	114.85
15.5	.6102	132	5 3/16	181	7 1/8	690155	107.65	691155	116.30
16.0	.6299	132	5 3/16	181	7 1/8	690160	109.55	691160	118.25
16.5	.6496	132	5 3/16	181	7 1/8	690165	109.55	691165	118.25
17.0	.6693	143	5 5/8	194	7 5/8	690170	113.70	691170	123.00
17.5	.6890	143	5 5/8	194	7 5/8	690175	113.70	691175	123.00
18.0	.7087	143	5 5/8	194	7 5/8	690180	114.95	691180	124.10
18.5	.7283	143	5 5/8	194	7 5/8	690185	115.70	691185	124.85
19.0	.7480	148	5 13/16	203	8	690190	117.20	691190	126.65

JOBBERS LENGTH DRILLS
SOLID CARBIDE TYPE 860 FRACTIONAL

GENERAL PURPOSE

118° SPLIT POINT

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

TYPE 860 – 118° SPLIT POINT

- Sold 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.

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"

DRILLS

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

TOOL DIAMETER			LENGTH		TYPE 860 - 118°	
FRAC.	WIRE	DEC. EQUIV.	FLT.	OVER-ALL	EDP NO.	PRICE
	60	.0400	¾	1 ½	8600400	$14.05
	59	.0410	¾	1 ½	8600410	14.05
	58	.0420	¾	1 ½	8600420	14.05
	57	.0430	¾	1 ½	8600430	14.05
	56	.0465	¾	1 ½	8600465	14.05
3/64		.0469	¾	1 ½	86003	14.05
	55	.0520	¾	1 ½	8600520	14.05
	54	.0550	¾	1 ½	8600550	14.05
	53	.0595	¾	1 ½	8600595	14.05
1/16		.0625	¾	1 ½	86004	13.30
	52	.0635	¾	1 ½	8600635	14.05
	51	.0670	¾	1 ½	8600670	14.05
	50	.0700	⅞	1 ¾	8600700	14.45
	49	.0730	⅞	1 ¾	8600730	14.80
	48	.0760	⅞	1 ¾	8600760	14.95
5/64		.0781	⅞	1 ¾	86005	14.75
	47	.0785	⅞	1 ¾	8600785	14.95
	46	.0810	⅞	1 ¾	8600810	14.95
	45	.0820	⅞	1 ¾	8600820	15.35
	44	.0860	1	2	8600860	15.80
	43	.0890	1	2	8600890	15.80
	42	.0935	1	2	8600935	15.95
3/32		.0938	1	2	86006	15.30
	41	.0960	1	2	8600960	16.00
	40	.0980	1	2	8600980	16.10
	39	.0995	1 ¼	2 ¼	8600995	16.30
	38	.1015	1 ¼	2 ¼	8601015	16.30
	37	.1040	1 ¼	2 ¼	8601040	16.30
	36	.1065	1 ¼	2 ¼	8601065	16.30
7/64		.1094	1 ¼	2 ¼	86007	16.70
	35	.1100	1 ¼	2 ¼	8601100	16.70
	34	.1110	1 ¼	2 ¼	8601110	17.10
	33	.1130	1 ¼	2 ¼	8601130	17.10
	32	.1160	1 ¼	2 ¼	8601160	17.50
	31	.1200	1 ¼	2 ¼	8601200	17.80
1/8		.1250	1 ¼	2 ¼	86008	17.30
	30	.1285	1 ¼	2 ¼	8601285	18.50
	29	.1360	1 ⅜	2 ½	8601360	18.65
	28	.1405	1 ⅜	2 ½	8601405	19.15
9/64		.1406	1 ⅜	2 ½	86009	20.60

TOOL DIAMETER			LENGTH		TYPE 860 - 118°	
FRAC.	WIRE LTR.	DEC. EQUIV.	FLT.	OVER-ALL	EDP NO.	PRICE
	27	.1440	1 ⅜	2 ½	8601440	$19.95
	26	.1470	1 ⅜	2 ½	8601470	20.25
	25	.1495	1 ⅜	2 ½	8601495	20.50
	24	.1520	1 ⅜	2 ½	8601520	20.95
	23	.1540	1 ⅜	2 ½	8601540	21.85
5/32		.1562	1 ⅜	2 ½	86010	21.50
	22	.1570	1 ⅜	2 ½	8601570	23.15
	21	.1590	1 ⅜	2 ½	8601590	23.45
	20	.1610	1 ⅜	2 ½	8601610	23.65
	19	.1660	1 ⅝	2 ¾	8601660	24.60
	18	.1695	1 ⅝	2 ¾	8601695	24.80
11/64		.1719	1 ⅝	2 ¾	86011	25.25
	17	.1730	1 ⅝	2 ¾	8601730	25.25
	16	.1770	1 ⅝	2 ¾	8601770	25.75
	15	.1800	1 ⅝	2 ¾	8601800	25.90
	14	.1820	1 ⅝	2 ¾	8601820	25.80
	13	.1850	1 ⅝	2 ¾	8601850	26.35
3/16		.1875	1 ⅝	2 ¾	86012	25.30
	12	.1890	1 ⅝	2 ¾	8601890	26.70
	11	.1910	1 ⅝	2 ¾	8601910	27.20
	10	.1935	1 ⅝	2 ¾	8601935	27.60
	9	.1960	1 ¾	3	8601960	28.20
	8	.1990	1 ¾	3	8601990	28.95
	7	.2010	1 ¾	3	8602010	29.30
13/64		.2031	1 ¾	3	86013	30.90
	6	.2040	1 ¾	3	8602040	30.45
	5	.2055	1 ¾	3	8602055	30.90
	4	.2090	1 ¾	3	8602090	31.65
	3	.2130	1 ¾	3	8602130	32.50
7/32		.2188	1 ¾	3	86014	31.90
	2	.2210	1 ¾	3	8602210	33.80
	1	.2280	1 ¾	3	8602280	35.55
	A	.2340	2	3 ¼	8602340	39.40
15/64		.2344	2	3 ¼	86015	35.40
	B	.2380	2	3 ¼	8602380	40.45
	C	.2420	2	3 ¼	8602420	40.55
	D	.2460	2	3 ¼	8602460	41.65
¼	E	.2500	2	3 ¼	86016	36.15
	F	.2570	2	3 ¼	8602570	44.25
	G	.2610	2 ⅛	3 ½	8602610	44.95

TOOL DIAMETER			LENGTH		TYPE 860 - 118°	
FRAC.	LTR.	DEC. EQUIV.	FLT.	OVER-ALL	EDP NO.	PRICE
17/64		.2656	2 ⅛	3 ½	86017	$39.45
	H	.2660	2 ⅛	3 ½	8602660	46.15
	I	.2720	2 ⅛	3 ½	8602720	47.15
	J	.2770	2 ⅛	3 ½	8602770	48.25
	K	.2810	2 ⅛	3 ½	8602810	48.65
9/32		.2812	2 ⅛	3 ½	86018	42.65
	L	.2900	2 ⅛	3 ½	8602900	51.05
	M	.2950	2 ⅜	3 ¾	8602950	52.80
19/64		.2969	2 ⅜	3 ¾	86019	48.50
	N	.3020	2 ⅜	3 ¾	8603020	55.95
5/16		.3125	2 ⅜	3 ¾	86020	51.50
	O	.3160	2 ⅜	3 ¾	8603160	59.25
	P	.3230	2 ⅜	3 ¾	8603230	61.15
21/64		.3281	2 ½	4	86021	56.15
	Q	.3320	2 ½	4	8603320	64.90
	R	.3390	2 ½	4	8603390	66.95
11/32		.3438	2 ½	4	86022	62.25
	S	.3480	2 ½	4	8603480	73.45
	T	.3580	2 ¾	4 ¼	8603580	76.15
23/64		.3594	2 ¾	4 ¼	86023	67.95
	U	.3680	2 ¾	4 ¼	8603680	77.65
3/8		.3750	2 ¾	4 ¼	86024	73.75
	V	.3770	2 ¾	4 ¼	8603770	85.70
	W	.3860	2 ⅞	4 ½	8603860	90.90
25/64		.3906	2 ⅞	4 ½	86025	83.40
	X	.3970	2 ⅞	4 ½	8603970	98.35
	Y	.4040	2 ⅞	4 ½	8604040	97.55
13/32		.4062	2 ⅞	4 ½	86026	92.45
	Z	.4130	2 ⅞	4 ½	8604130	107.75
27/64		.4219	2 ⅞	4 ½	86027	101.20
7/16		.4375	2 ⅞	4 ½	86028	109.55
29/64		.4531	3	4 ¾	86029	118.75
15/32		.4688	3	4 ¾	86030	127.80
31/64		.4844	3	4 ¾	86031	131.55
½		.5000	3	4 ¾	86032	134.85
9/16		.5625	3 ¼	5	86036	248.00
5/8		.6250	3 ¼	5	86040	299.65
¾		.7500	3 ¾	6	86048	363.60
-	-	-	-	-	-	-
-	-	-	-	-	-	-

*Smaller sizes available. Call for pricing.

JOBBERS LENGTH DRILLS
SOLID CARBIDE TYPE 860 METRIC

GENERAL PURPOSE

118° SPLIT POINT

MODIFICATIONS (Prompt delivery)

- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

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.

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.	
		FLT.	OAL	METRIC EDP NO.	METRIC PRICE
mm	INCH	mm	mm		
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.	
		FLT.	OAL	METRIC EDP NO.	METRIC PRICE
mm	INCH	mm	mm		
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.	
		FLT.	OAL	METRIC EDP NO.	METRIC PRICE
mm	INCH	mm	mm		
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
-	-	-	-	-	-

TAPER LENGTH DRILLS
CARBIDE TIPPED TYPES 630 & 631 FRACTIONAL

MATERIAL SPECIFIC

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.	
FRAC.	WIRE/ LTR.	DEC. EQUIV.	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
1/8		.1250	2 3/4	5 1/8	63008	$21.65	63108	$24.65
	30	.1285	3	5 3/8	63230	30.30	63330	29.90
	29	.1360	3	5 3/8	63229	30.30	63329	29.90
	28	.1405	3	5 3/8	63228	30.30	63328	29.90
9/64		.1406	3	5 3/8	63009	25.00	63109	26.05
	27	.1440	3	5 3/8	63227	30.30	63327	29.90
	26	.1470	3	5 3/8	63226	30.30	63326	29.90
	25	.1495	3	5 3/8	63225	30.30	63325	29.90
	24	.1520	3	5 3/8	63224	30.30	63324	29.90
	23	.1540	3	5 3/8	63223	30.30	63323	29.90
5/32		.1562	3	5 3/8	63010	23.00	63110	26.05
	22	.1570	3 3/8	5 3/4	63222	31.40	63322	31.00
	21	.1590	3 3/8	5 3/4	63221	31.40	63321	31.00
	20	.1610	3 3/8	5 3/4	63220	31.40	63320	31.00
	19	.1660	3 3/8	5 3/4	63219	31.40	63319	31.00
	18	.1695	3 3/8	5 3/4	63218	31.40	63318	31.00
11/64		.1719	3 3/8	5 3/4	63011	23.40	63111	27.00
	17	.1730	3 3/8	5 3/4	63217	31.40	63317	31.00
	16	.1770	3 3/8	5 3/4	63216	31.40	63316	31.00
	15	.1800	3 3/8	5 3/4	63215	31.40	63315	31.00
	14	.1820	3 3/8	5 3/4	63214	31.40	63314	31.00
	13	.1850	3 3/8	5 3/4	63213	31.40	63313	31.00
3/16		.1875	3 3/8	5 3/4	63012	23.40	63112	27.00
	12	.1890	3 5/8	6	63212	33.10	63312	32.70
	11	.1910	3 5/8	6	63211	33.10	63311	32.70
	10	.1935	3 5/8	6	63210	33.10	63310	32.70
	9	.1960	3 5/8	6	63209	33.10	63309	32.70
	8	.1990	3 5/8	6	63208	33.10	63308	32.70
	7	.2010	3 5/8	6	63207	33.10	63307	32.70
13/64		.2031	3 5/8	6	63013	24.80	63113	28.45
	6	.2040	3 5/8	6	63206	33.10	63306	32.70
	5	.2055	3 5/8	6	63205	33.10	63305	32.70
	4	.2090	3 5/8	6	63204	33.10	63304	32.70
	3	.2130	3 5/8	6	63203	33.10	63303	32.70
7/32		.2188	3 5/8	6	63014	24.80	63114	28.45
	2	.2210	3 3/4	6 1/8	63202	37.50	63302	37.10
	1	.2280	3 3/4	6 1/8	63201	37.50	63301	37.10
	A	.2340	3 3/4	6 1/8	63401	37.50	63501	37.10
15/64		.2344	3 3/4	6 1/8	63015	28.10	63115	32.15
	B	.2380	3 3/4	6 1/8	63402	37.50	63502	37.10
	C	.2420	3 3/4	6 1/8	63403	37.50	63503	37.10
	D	.2460	3 3/4	6 1/8	63404	37.50	63504	37.10
1/4	E	.2500	3 3/4	6 1/8	63016	28.10	63116	32.15
	F	.2570	3 7/8	6 1/4	63406	41.95	63506	41.45
	G	.2610	3 7/8	6 1/4	63407	41.95	63507	41.45
17/64		.2656	3 7/8	6 1/4	63017	31.40	63117	36.00
	H	.2660	3 7/8	6 1/4	63408	41.95	63508	41.45
	I	.2720	3 7/8	6 1/4	63409	41.95	63509	41.45
	J	.2770	3 7/8	6 1/4	63410	41.95	63510	41.45
	K	.2810	3 7/8	6 1/4	63411	41.95	63511	41.45
9/32		.2812	3 7/8	6 1/4	63018	31.40	63118	36.00
	L	.2900	4	6 3/8	63412	45.50	63512	44.75
	M	.2950	4	6 3/8	63413	45.50	63513	44.75
19/64		.2969	4	6 3/8	63019	33.85	63119	38.95
	N	.3020	4	6 3/8	63414	45.50	63514	44.75
5/16		.3125	4	6 3/8	63020	33.85	63120	38.95
	O	.3160	4 1/8	6 1/2	63415	51.60	63515	50.90
	P	.3230	4 1/8	6 1/2	63416	51.60	63516	50.90
21/64		.3281	4 1/8	6 1/2	63021	37.30	63121	44.35
	Q	.3320	4 1/8	6 1/2	63417	$51.60	63517	$50.90
	R	.3390	4 1/8	6 1/2	63418	51.60	63518	50.90
11/32		.3438	4 1/8	6 1/2	63022	37.30	63122	44.75
	S	.3480	4 1/4	6 3/4	63419	56.45	63519	55.75
	T	.3580	4 1/4	6 3/4	63420	56.45	63520	55.75
23/64		.3594	4 1/4	6 3/4	63023	42.05	63123	48.50
	U	.3680	4 1/4	6 3/4	63421	56.45	63521	55.75
3/8		.3750	4 1/4	6 3/4	63024	42.05	63124	48.50
	V	.3770	4 3/8	7	63422	60.40	63522	59.70
	W	.3860	4 3/8	7	63423	60.40	63523	59.70
25/64		.3906	4 3/8	7	63025	45.10	63125	51.95
	X	.3970	4 3/8	7	63424	60.40	63524	59.70
	Y	.4040	4 3/8	7	63425	60.40	63525	59.70
13/32		.4062	4 3/8	7	63026	45.10	63126	51.95
	Z	.4130	4 5/8	7 1/4	63426	69.70	63526	68.70
27/64		.4219	4 5/8	7 1/4	63027	52.10	63127	59.70
7/16		.4375	4 5/8	7 1/4	63028	52.10	63128	59.70
29/64		.4531	4 3/4	7 1/2	63029	57.85	63129	67.20
15/32		.4688	4 3/4	7 1/2	63030	57.85	63130	67.20
31/64		.4844	4 3/4	7 3/4	63031	60.65	63131	69.40
1/2		.5000	4 3/4	7 3/4	63032	66.60	63132	69.40
33/64		.5156	4 3/4	8	63033	86.90	63133	99.55
17/32		.5312	4 3/4	8	63034	86.90	63134	99.55
35/64		.5469	4 7/8	8 1/4	63035	87.60	63135	100.40
9/16		.5625	4 7/8	8 1/4	63036	87.60	63136	100.40
37/64		.5781	4 7/8	8 3/4	63037	96.70	63137	111.00
19/32		.5938	4 7/8	8 3/4	63038	94.00	63138	107.80
39/64		.6094	4 7/8	8 3/4	63039	111.20	63139	127.40
5/8		.6250	4 7/8	8 3/4	63040	106.60	63140	122.05
41/64		.6406	5 1/8	9	63041	122.95	63141	141.00
21/32		.6562	5 1/8	9	63042	108.40	63142	124.15
43/64		.6719	5 3/8	9 1/4	63043	141.05	63143	161.70
11/16		.6875	5 3/8	9 1/4	63044	110.45	63144	126.55
45/64		.7031	5 5/8	9 1/2	63045	128.95	63145	141.70
23/32		.7188	5 5/8	9 1/2	63046	130.45	63146	143.10
47/64		.7344	5 7/8	9 3/4	63047	131.15	63147	143.90
3/4		.7500	5 7/8	9 3/4	63048	133.10	63148	146.10
49/64		.7656	6	9 7/8	63049	135.85	63149	149.15
25/32		.7812	6	9 7/8	63050	138.60	63150	152.20
51/64		.7969	6 1/8	10	63051	141.35	63151	155.30
13/16		.8125	6 1/8	10	63052	144.10	63152	158.35
53/64		.8281	6 1/8	10	63053	146.90	63153	161.40
27/32		.8438	6 1/8	10	63054	149.65	63154	164.45
55/64		.8594	6 1/8	10	63055	152.40	63155	167.50
7/8		.8750	6 1/8	10	63056	155.15	63156	170.60
57/64		.8906	6 1/8	10	63057	157.90	63157	173.65
29/32		.9062	6 1/8	10	63058	160.70	63158	176.70
59/64		.9219	6 1/8	10 3/4	63059	163.45	63159	179.75
15/16		.9375	6 1/8	10 3/4	63060	166.20	63160	182.80
61/64		.9531	6 3/8	11	63061	168.95	63161	185.90
31/32		.9688	6 3/8	11	63062	171.70	63162	188.95
63/64		.9844	6 3/8	11	63063	174.50	63163	192.00
1		1.0000	6 3/8	11	63064	177.25	63164	195.05

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	$27.95	631032	$27.55
3.3	.1299	76	3	137	5 3/8	630033	27.95	631033	27.55
3.4	.1339	76	3	137	5 3/8	630034	27.95	631034	27.55
3.5	.1378	76	3	137	5 3/8	630035	27.10	631035	26.95
3.6	.1417	76	3	137	5 3/8	630036	27.10	631036	26.95
3.7	.1457	76	3	137	5 3/8	630037	27.10	631037	26.95
3.8	.1496	76	3	137	5 3/8	630038	27.10	631038	26.95
3.9	.1535	76	3	137	5 3/8	630039	27.10	631039	26.95
4.0	.1575	86	3 3/8	146	5 3/4	630040	26.50	631040	26.20
4.1	.1614	86	3 3/8	146	5 3/4	630041	27.95	631041	27.55
4.2	.1654	86	3 3/8	146	5 3/4	630042	27.95	631042	27.55
4.3	.1693	86	3 3/8	146	5 3/4	630043	27.95	631043	27.55
4.4	.1732	86	3 3/8	146	5 3/4	630044	29.50	631044	29.00
4.5	.1772	86	3 3/8	146	5 3/4	630045	29.50	631045	29.00
4.6	.1811	86	3 3/8	146	5 3/4	630046	29.50	631046	29.00
4.7	.1850	86	3 3/8	146	5 3/4	63213	31.40	63313	31.00
4.8	.1890	92	3 5/8	152	6	63212	33.10	63312	32.70
4.9	.1929	92	3 5/8	152	6	630049	29.50	631049	29.00
5.0	.1969	92	3 5/8	152	6	630050	29.35	631050	29.00
5.1	.2008	92	3 5/8	152	6	630051	30.55	631051	30.20
5.2	.2047	92	3 5/8	152	6	630052	26.30	631052	30.20
5.3	.2087	92	3 5/8	152	6	630053	30.55	631053	30.20
5.4	.2126	92	3 5/8	152	6	630054	30.55	631054	30.20
5.5	.2165	92	3 5/8	152	6	630055	31.30	631055	30.20
5.6	.2205	95	3 3/4	156	6 1/8	630056	30.55	631056	30.20
5.7	.2244	95	3 3/4	156	6 1/8	630057	30.55	631057	30.20
5.8	.2283	95	3 3/4	156	6 1/8	630058	30.55	631058	30.20
5.9	.2323	95	3 3/4	156	6 1/8	630059	31.85	631059	31.55
6.0	.2362	95	3 3/4	156	6 1/8	630060	32.50	631060	32.75
6.1	.2402	95	3 3/4	156	6 1/8	630061	33.95	631061	33.40
6.2	.2441	95	3 3/4	156	6 1/8	630062	33.95	631062	33.40
6.3	.2480	95	3 3/4	156	6 1/8	630063	33.95	631063	33.40
6.4	.2520	98	3 7/8	159	6 1/4	630064	37.30	631064	36.80
6.5	.2559	98	3 7/8	159	6 1/4	630065	33.70	631065	36.80
6.6	.2598	98	3 7/8	159	6 1/4	630066	38.45	631066	37.80
6.7	.2638	98	3 7/8	159	6 1/4	630067	38.45	631067	37.80
6.8	.2677	98	3 7/8	159	6 1/4	630068	38.45	631068	37.80
6.9	.2717	98	3 7/8	159	6 1/4	630069	38.45	631069	37.80
7.0	.2756	98	3 7/8	159	6 1/4	630070	35.15	631070	36.80
7.1	.2795	98	3 7/8	159	6 1/4	630071	38.45	631071	37.80
7.2	.2835	102	4	162	6 3/8	630072	38.45	631072	37.80
7.3	.2874	102	4	162	6 3/8	630073	38.45	631073	37.80
7.4	.2913	102	4	162	6 3/8	630074	38.45	631074	37.80
7.5	.2953	102	4	162	6 3/8	630075	37.25	631075	39.80
7.6	.2992	102	4	162	6 3/8	630076	40.25	631076	39.80
7.7	.3031	102	4	162	6 3/8	630077	40.25	631077	39.80
7.8	.3071	102	4	162	6 3/8	630078	40.25	631078	39.80
7.9	.3110	102	4	162	6 3/8	630079	40.25	631079	39.80
8.0	.3150	105	4 1/8	165	6 1/2	630080	37.80	631080	39.80
8.1	.3189	105	4 1/8	165	6 1/2	630081	40.25	631081	39.80
8.2	.3228	105	4 1/8	165	6 1/2	630082	42.90	631082	42.25
8.3	.3268	105	4 1/8	165	6 1/2	630083	42.90	631083	42.25
8.4	.3307	105	4 1/8	165	6 1/2	630084	42.90	631084	42.25
8.5	.3346	105	4 1/8	165	6 1/2	630085	39.60	631085	45.05
8.6	.3386	105	4 1/8	165	6 1/2	630086	45.70	631086	45.05
8.7	.3425	105	4 1/8	165	6 1/2	630087	45.70	631087	45.05

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	$45.70	631088	$45.05
8.9	.3504	108	4 1/4	171	6 3/4	630089	45.70	631089	45.05
9.0	.3543	108	4 1/4	171	6 3/4	630090	42.80	631090	49.45
9.1	.3583	108	4 1/4	171	6 3/4	630091	50.05	631091	49.45
9.2	.3622	108	4 1/4	171	6 3/4	630092	50.05	631092	49.45
9.3	.3661	108	4 1/4	171	6 3/4	630093	50.05	631093	49.45
9.4	.3701	108	4 1/4	171	6 3/4	630094	50.05	631094	49.45
9.5	.3740	108	4 1/4	171	6 3/4	630095	43.80	631095	49.45
9.6	.3780	111	4 3/8	178	7	630096	52.55	631096	51.85
9.7	.3819	111	4 3/8	178	7	630097	52.55	631097	51.85
9.8	.3858	111	4 3/8	178	7	630098	52.55	631098	51.85
9.9	.3898	111	4 3/8	178	7	630099	52.55	631099	51.85
10.0	.3937	111	4 3/8	178	7	630100	46.10	631100	53.10
10.1	.3976	111	4 3/8	178	7	630101	53.80	631101	53.10
10.2	.4016	111	4 3/8	178	7	630102	56.10	631102	55.30
10.3	.4055	111	4 3/8	178	7	630103	56.10	631103	55.30
10.4	.4094	117	4 5/8	184	7 1/4	630104	58.60	631104	57.65
10.5	.4134	117	4 5/8	184	7 1/4	630105	52.45	631105	57.65
10.6	.4173	117	4 5/8	184	7 1/4	630106	61.40	631106	60.60
10.7	.4213	117	4 5/8	184	7 1/4	630107	61.40	631107	60.60
10.8	.4252	117	4 5/8	184	7 1/4	630108	61.40	631108	60.60
10.9	.4291	117	4 5/8	184	7 1/4	630109	61.40	631109	60.60
11.0	.4331	117	4 5/8	184	7 1/4	630110	56.70	631110	60.85
11.5	.4528	121	4 3/4	190	7 1/2	630115	63.65	631115	67.30
12.0	.4724	121	4 3/4	197	7 3/4	630120	69.65	631120	70.80
12.5	.4921	121	4 3/4	197	7 3/4	630125	72.25	631125	70.80
13.0	.5118	121	4 3/4	203	8	630130	86.90	631130	99.55
13.5	.5315	121	4 3/4	203	8	630135	87.60	631135	100.40
14.0	.5512	124	4 7/8	210	8 1/4	630140	87.60	631140	100.40
14.5	.5709	124	4 7/8	222	8 3/4	630145	96.70	631145	111.00
15.0	.5906	124	4 7/8	222	8 3/4	630150	96.70	631150	111.00
15.5	.6102	124	4 7/8	222	8 3/4	630155	111.20	631155	127.40
16.0	.6299	130	5 1/8	229	9	630160	122.95	631160	141.00
16.5	.6496	130	5 1/8	229	9	630165	122.95	631165	141.00
17.0	.6693	137	5 3/8	235	9 1/4	630170	141.05	631170	161.70
17.5	.6890	143	5 5/8	241	9 1/2	630175	128.95	631175	141.70
18.0	.7087	143	5 5/8	241	9 1/2	630180	130.45	631180	143.10
18.5	.7283	149	5 7/8	248	9 3/4	630185	131.15	631185	143.90
19.0	.7480	149	5 7/8	248	9 3/4	630190	133.10	631190	146.10
19.5	.7677	152	6	251	9 7/8	630195	138.60	631195	152.20
20.0	.7874	156	6 1/8	254	10	630200	141.35	631200	155.30
20.5	.8071	156	6 1/8	254	10	630205	144.10	631205	158.35
21.0	.8268	156	6 1/8	254	10	630210	146.90	631210	161.40
21.5	.8465	156	6 1/8	254	10	630215	152.40	631215	167.50
22.0	.8661	156	6 1/8	254	10	630220	155.15	631220	170.60
22.5	.8858	156	6 1/8	254	10	630225	157.90	631225	173.65
23.0	.9055	156	6 1/8	254	10	630230	160.70	631230	176.70
23.5	.9252	156	6 1/8	273	10 3/4	630235	166.20	631235	182.80
24.0	.9449	162	6 3/8	279	11	630240	168.95	631240	185.90
24.5	.9646	162	6 3/8	279	11	630245	171.70	631245	188.95
25.0	.9843	162	6 3/8	279	11	630250	174.50	631250	192.00

TAPER SHANK DRILLS CARBIDE TIPPED TYPES 660 & 661 FRACTIONAL

118° STANDARD OR 135° SPLIT POINT

MATERIAL SPECIFIC

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

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

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

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.	
FRAC.	DEC.	FLUTE	OVER-ALL		EDP NO.	PRICE	EDP NO.	PRICE
1/4	.2500	2 7/8	6 1/8	1	66016	$49.90	66116	$56.60
17/64	.2656	3	6 1/4	1	66017	N/A	66117	N/A
9/32	.2812	3	6 1/4	1	66018	N/A	66118	N/A
19/64	.2969	3 1/8	6 3/8	1	66019	N/A	66119	N/A
5/16	.3125	3 1/8	6 3/8	1	66020	51.05	66120	57.85
21/64	.3281	3 1/4	6 1/2	1	66021	65.00	66121	73.45
11/32	.3438	3 1/4	6 1/2	1	66022	65.00	66122	73.45
23/64	.3594	3 1/2	6 3/4	1	66023	65.00	66123	73.45
3/8	.3750	3 1/2	6 3/4	1	66024	65.00	66124	73.45
25/64	.3906	3 5/8	7	1	66025	75.20	66125	85.20
13/32	.4062	3 5/8	7	1	66026	75.20	66126	85.20
27/64	.4219	3 7/8	7 1/4	1	66027	75.20	66127	85.20
7/16	.4375	3 7/8	7 1/4	1	66028	65.75	66128	74.60
29/64	.4531	4 1/8	7 1/2	1	66029	79.90	66129	90.60
15/32	.4688	4 1/8	7 1/2	1	66030	79.90	66130	90.60
31/64	.4844	4 3/8	8 1/4	2	66031	79.90	66131	90.60
1/2	.5000	4 3/8	8 1/4	2	66032	62.90	66132	83.75
33/64	.5156	4 5/8	8 1/2	2	66033	81.20	66133	97.45
17/32	.5312	4 5/8	8 1/2	2	66034	66.35	66134	86.15
35/64	.5469	4 7/8	8 3/4	2	66035	82.40	66135	98.80
9/16	.5625	4 7/8	8 3/4	2	66036	66.90	66136	87.35
37/64	.5781	4 7/8	8 3/4	2	66037	86.15	66137	103.50
19/32	.5938	4 7/8	8 3/4	2	66038	73.80	66138	96.65
39/64	.6094	4 7/8	8 3/4	2	66039	99.85	66139	119.90
5/8	.6250	4 7/8	8 3/4	2	66040	81.30	66140	105.85
41/64	.6406	5 1/8	9	2	66041	101.45	66141	121.75
21/32	.6562	5 1/8	9	2	66042	79.25	66142	107.65
43/64	.6719	5 3/8	9 1/4	2	66043	102.65	66143	123.30
11/16	.6875	5 3/8	9 1/4	2	66044	81.80	66144	108.90
45/64	.7031	5 5/8	9 1/2	2	66045	105.50	66145	126.55
23/32	.7188	5 5/8	9 1/2	2	66046	90.90	66146	121.40
47/64	.7344	5 7/8	9 3/4	2	66047	107.60	66147	129.10
3/4	.7500	5 7/8	9 3/4	2	66048	93.05	66148	117.40
49/64	.7656	6	9 7/8	2	66049	114.40	66149	137.40
25/32	.7812	6	9 7/8	2	66050	110.80	66150	137.35
51/64	.7969	6 1/8	10 3/4	3	66051	115.60	66151	138.70
13/16	.8125	6 1/8	10 3/4	3	66052	112.00	66152	138.80
53/64	.8281	6 1/8	10 3/4	3	66053	125.40	66153	150.55
27/32	.8438	6 1/8	10 3/4	3	66054	114.35	66154	138.80
55/64	.8594	6 1/8	10 3/4	3	66055	N/A	66155	N/A

TOOL DIAMETER		LENGTH		TAPER SHANK NO.	TYPE 660 118° PT.		TYPE 661 135° PT.	
FRAC.	DEC.	FLUTE	OVER-ALL		EDP NO.	PRICE	EDP NO.	PRICE
7/8	.8750	6 1/8	10 3/4	3	66056	$121.60	66156	$146.65
57/64	.8906	6 1/8	10 3/4	3	66057	131.00	66157	157.00
29/32	.9062	6 1/8	10 3/4	3	66058	131.90	66158	152.80
59/64	.9219	6 1/8	10 3/4	3	66059	133.40	66159	159.90
15/16	.9375	6 1/8	10 3/4	3	66060	133.80	66160	147.90
61/64	.9531	6 3/8	11	3	66061	N/A	66161	N/A
31/32	.9688	6 3/8	11	3	66062	139.60	66162	161.75
63/64	.9844	6 3/8	11	3	66063	146.10	66163	175.30
1	1.0000	6 3/8	11	3	66064	131.70	66164	159.10
1 1/64	1.0156	6 1/2	11 1/8	3	66065	N/A	66165	N/A
1 1/32	1.0312	6 1/2	11 1/8	3	66066	177.60	66166	201.40
1 3/64	1.0469	6 5/8	11 1/4	3	66067	N/A	66167	N/A
1 1/16	1.0625	6 5/8	11 1/4	3	66068	170.65	66168	216.25
1 5/64	1.0781	6 7/8	12 1/2	4	66069	N/A	66169	N/A
1 3/32	1.0938	6 7/8	12 1/2	4	66070	N/A	66170	N/A
1 7/64	1.1094	7 1/8	12 3/4	4	66071	N/A	66171	N/A
1 1/8	1.1250	7 1/8	12 3/4	4	66072	188.95	66172	239.80
1 9/64	1.1406	7 1/4	12 7/8	4	66073	N/A	66173	N/A
1 5/32	1.1562	7 1/4	12 7/8	4	66074	N/A	66174	N/A
1 11/64	1.1719	7 3/8	13	4	66075	N/A	66175	N/A
1 3/16	1.1875	7 3/8	13	4	66076	216.50	66176	274.45
1 13/64	1.2031	7 1/2	13 1/8	4	66077	N/A	66177	N/A
1 7/32	1.2188	7 1/2	13 1/8	4	66078	N/A	66178	N/A
1 15/64	1.2344	7 7/8	13 1/2	4	66079	N/A	66179	N/A
1 1/4	1.2500	7 7/8	13 1/2	4	66080	231.65	66180	294.00
1 9/32	1.2812	8 1/2	14 1/8	4	66082	N/A	66182	N/A
1 5/16	1.3125	8 5/8	14 1/4	4	66084	327.70	66184	371.15
1 11/32	1.3438	8 3/4	14 3/8	4	66086	N/A	66186	N/A
1 3/8	1.3750	8 7/8	14 1/2	4	66088	367.25	66188	416.05
1 13/32	1.4062	9	14 5/8	4	66090	N/A	66190	N/A
1 7/16	1.4375	9 1/8	14 3/4	4	66092	N/A	66192	N/A
1 15/32	1.4688	9 1/4	14 7/8	4	66094	N/A	66194	N/A
1 1/2	1.5000	9 3/8	15	4	66096	402.85	66196	456.55

TAPER SHANK DRILLS CARBIDE TIPPED TYPE 660 METRIC

MATERIAL SPECIFIC

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	$82.80
13.5	.5315	117	4 5/8	216	8 1/2	2	660135	76.70
14.0	.5512	124	4 7/8	222	8 3/4	2	660140	77.75
14.5	.5709	124	4 7/8	222	8 3/4	2	660145	87.85
15.0	.5906	124	4 7/8	222	8 3/4	2	660150	81.50
15.5	.6102	124	4 7/8	222	8 3/4	2	660155	101.90
16.0	.6299	130	5 1/8	229	9	2	660160	103.50
16.5	.6496	130	5 1/8	229	9	2	660165	95.95
17.0	.6693	137	5 3/8	235	9 1/4	2	660170	104.65
17.5	.6890	143	5 5/8	241	9 1/2	2	660175	107.60
18.0	.7087	143	5 5/8	241	9 1/2	2	660180	99.65
18.5	.7283	149	5 7/8	248	9 3/4	2	660185	109.70
19.0	.7480	149	5 7/8	248	9 3/4	2	660190	101.50
20.0	.7874	156	6 1/8	273	10 3/4	3	660200	117.80
21.0	.8268	156	6 1/8	273	10 3/4	3	660210	117.80
22.0	.8661	156	6 1/8	273	10 3/4	3	660220	115.30
23.0	.9055	156	6 1/8	273	10 3/4	3	660230	119.15
24.0	.9449	162	6 3/8	279	11	3	660240	137.50
25.0	.9843	162	6 3/8	279	11	3	660250	141.05
26.0	1.0236	165	6 1/2	283	11 1/8	3	660260	211.30
28.0	1.1024	181	7 1/8	324	12 3/4	4	660280	234.25
30.0	1.1811	187	7 3/8	330	13	4	660300	282.05
32.0	1.2598	216	8 1/2	359	14 1/8	4	660320	350.30
34.0	1.3386	222	8 3/4	365	14 3/8	4	660340	376.30
36.0	1.4173	232	9 1/8	375	14 3/4	4	660360	430.85
38.0	1.4961	238	9 3/8	381	15	4	660380	448.00

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
31/64	.4844	4 3/8	7 3/4	1	66831	$91.45
1/2	.5000	4 3/8	7 3/4	1	66832	71.80
33/64	.5156	4 5/8	8	1	66833	88.55
17/32	.5312	4 5/8	8	1	66834	75.90
35/64	.5469	4 7/8	8 1/4	1	66835	89.80
9/16	.5625	4 7/8	8 1/4	1	66836	76.45
51/64	.7969	6 1/8	10	2	66851	126.10
13/16	.8125	6 1/8	10	2	66852	107.00
53/64	.8281	6 1/8	10	2	66853	126.10
27/32	.8438	6 1/8	10	2	66854	109.25
55/64	.8594	6 1/8	10	2	66855	133.20
7/8	.8750	6 1/8	10	2	66856	116.35
29/32	.9062	6 1/8	10	2	66858	125.00
1 3/32	1.0938	6 7/8	11 1/2	3	66870	265.50
1 1/8	1.1250	7 1/8	11 3/4	3	66872	190.80
1 5/32	1.1562	7 1/4	11 7/8	3	66874	258.95
1 3/16	1.1875	7 3/8	12	3	66876	218.50
1 1/4	1.2500	7 7/8	12 1/2	3	66880	233.80

TAPER SHANK DRILLS CARBIDE TIPPED TYPES 664 & 665 FRACTIONAL

MATERIAL SPECIFIC

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

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

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

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	
FRAC.	DECIMAL	FLUTE	OVERALL		EDP NO.	PRICE
1/2	.5000	8	12	2	66432	$155.05
17/32	.5312	8	12	2	66434	179.30
9/16	.5625	8	12	2	66436	179.30
19/32	.5938	8	12	2	66438	179.30
5/8	.6250	8	12	2	66440	237.35
21/32	.6562	8	12	2	66442	249.20
11/16	.6875	8	12	2	66444	249.20
23/32	.7188	8	12	2	66446	261.70
3/4	.7500	8	12	2	66448	261.70
25/32	.7812	8	12	2	66450	274.75

While supplies last

TYPE 665 – 11" FLUTE LENGTH

TOOL DIAMETER		LENGTH		TAPER SHANK NO.	TYPE 665 – 11" 118° POINT	
FRAC.	DECIMAL	FLUTE	OVERALL		EDP NO.	PRICE
5/8	.6250	11	14 3/4	2	66540	$254.05
21/32	.6562	11	14 3/4	2	66542	266.65
43/64	.6719	11	14 3/4	2	66543	282.65
11/16	.6875	11	14 3/4	2	66544	266.65
23/32	.7188	11	14 3/4	2	66546	280.00
3/4	.7500	11	14 3/4	2	66548	280.00
25/32	.7812	11	14 3/4	2	66550	294.00
13/16	.8125	11	15 1/2	3	66552	321.30
27/32	.8438	11	15 1/2	3	66554	321.30
7/8	.8750	11	15 1/2	3	66556	321.30
29/32	.9062	11	15 1/2	3	66558	392.40
15/16	.9375	11	15 1/2	3	66560	392.40
31/32	.9688	11	15 1/2	3	66562	412.15
1	1.0000	11	15 1/2	3	66564	412.15
1 1/32	1.0312	11	15 1/2	3	66566	424.50
1 1/16	1.0625	11	15 1/2	3	66568	437.20

While supplies last

AIRCRAFT EXTENSION DRILLS CARBIDE TIPPED TYPES 610 & 611 FRACTIONAL

MATERIAL SPECIFIC

135° SPLIT POINT

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

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

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

DRILLS

TOOL DIAMETER FRAC.	WIRE/ LETTER	DECIMAL EQUIV.	FLUTE LENGTH	TYPE 610 - 6" EDP NO.	TYPE 610 - 6" PRICE	TYPE 611 - 12" EDP NO.	TYPE 611 - 12" PRICE
	32	.1160	1 5/8	61232	$30.55	61332	$36.10
	31	.1200	1 5/8	61231	27.40	61331	32.20
1/8		.1250	1 5/8	61008	21.25	61108	25.00
	30	.1285	1 5/8	61230	28.90	61330	33.95
	29	.1360	1 3/4	61229	29.80	61329	35.10
	28	.1405	1 3/4	61228	30.30	61328	35.75
9/64		.1406	1 3/4	61009	23.05	61109	27.10
	27	.1440	1 7/8	61227	31.00	61327	36.40
	26	.1470	1 7/8	61226	30.30	61326	35.75
	25	.1495	1 7/8	61225	30.30	61325	35.75
	24	.1520	2	61224	31.00	61324	36.40
	23	.1540	2	61223	30.30	61323	35.75
5/32		.1562	2	61010	22.55	61110	26.60
	22	.1570	2	61222	33.10	61322	39.00
	21	.1590	2 1/8	61221	32.10	61321	37.85
	20	.1610	2 1/8	61220	32.95	61320	38.70
	19	.1660	2 1/8	61219	32.95	61319	38.70
	18	.1695	2 1/8	61218	32.95	61318	38.70
11/64		.1719	2 1/8	61011	24.70	61111	29.00
	17	.1730	2 3/16	61217	32.95	61317	38.70
	16	.1770	2 3/16	61216	32.10	61316	37.85
	15	.1800	2 3/16	61215	33.10	61315	39.00
	14	.1820	2 3/16	61214	32.10	61314	37.85
	13	.1850	2 5/16	61213	32.10	61313	37.85
3/16		.1875	2 5/16	61012	24.05	61112	28.40
	12	.1890	2 5/16	61212	33.50	61312	39.35
	11	.1910	2 5/16	61211	33.85	61311	39.95
	10	.1935	2 7/16	61210	33.50	61310	39.35
	9	.1960	2 7/16	61209	33.85	61309	39.95
	8	.1990	2 7/16	61208	33.85	61308	39.95
	7	.2010	2 7/16	61207	33.85	61307	39.95
13/64		.2031	2 7/16	61013	26.40	61113	31.00
	6	.2040	2 1/2	61206	34.80	61306	41.00
	5	.2055	2 1/2	61205	33.85	61305	39.95
	4	.2090	2 1/2	61204	31.85	61304	37.50
	3	.2130	2 1/2	61203	33.85	61303	39.95
7/32		.2188	2 1/2	61014	26.40	61114	31.00
	2	.2210	2 5/8	61202	33.35	61302	39.20
	1	.2280	2 5/8	61201	32.95	61301	38.70
	A	.2340	2 5/8	61401	39.60	61501	46.45
15/64		.2344	2 5/8	61015	28.40	61115	33.40

TOOL DIAMETER FRAC.	LETTER	DECIMAL EQUIV.	FLUTE LENGTH	TYPE 610 - 6" EDP NO.	TYPE 610 - 6" PRICE	TYPE 611 - 12" EDP NO.	TYPE 611 - 12" PRICE
	B	.2380	2 3/4	61402	$39.60	61502	$46.45
	C	.2420	2 3/4	61403	39.60	61503	46.45
	D	.2460	2 3/4	61404	38.90	61504	45.70
1/4	E	.2500	2 3/4	61016	28.40	61116	33.40
	F	.2570	2 7/8	61406	40.60	61506	47.75
	G	.2610	2 7/8	61407	41.50	61507	48.90
17/64		.2656	2 7/8	61017	30.30	61117	35.75
	H	.2660	2 7/8	61408	42.40	61508	49.90
	I	.2720	2 7/8	61409	41.50	61509	48.90
	J	.2770	2 7/8	61410	42.40	61510	49.90
	K	.2810	2 15/16	61411	42.40	61511	49.90
9/32		.2812	2 15/16	61018	30.30	61118	35.75
	L	.2900	2 15/16	61412	42.40	61512	49.90
	M	.2950	3 1/16	61413	46.75	61513	55.00
19/64		.2969	3 1/16	61019	32.95	61119	38.70
	N	.3020	3 1/16	61414	45.70	61514	53.80
5/16		.3125	3 3/16	61020	32.95	61120	38.70
	O	.3160	3 3/16	61415	43.50	61515	51.10
	P	.3230	3 5/16	61416	46.25	61516	54.35
21/64		.3281	3 5/16	61021	35.00	61121	41.20
	Q	.3320	3 7/16	61417	47.50	61517	55.85
	R	.3390	3 7/16	61418	46.25	61518	54.35
11/32		.3438	3 7/16	61022	35.00	61122	41.20
	S	.3480	3 1/2	61419	50.00	61519	58.75
	T	.3580	3 1/2	61420	51.25	61520	60.25
23/64		.3594	3 1/2	61023	37.30	61123	43.75
	U	.3680	3 5/8	61421	49.25	61521	58.00
3/8		.3750	3 5/8	61024	37.30	61124	43.75
	V	.3770	3 5/8	61422	50.00	61522	58.75
	W	.3860	3 3/4	61423	53.65	61523	63.05
25/64		.3906	3 3/4	61025	38.30	61125	45.10
	X	.3970	3 3/4	61424	50.75	61524	59.75
	Y	.4040	3 7/8	61425	52.70	61525	62.00
13/32		.4062	3 7/8	61026	37.80	61126	44.40
	Z	.4130	3 7/8	61426	59.45	61526	69.90
27/64		.4219	3 15/16	61027	41.50	61127	48.90
7/16		.4375	4 1/16	61028	41.50	61128	48.90
29/64		.4531	4 3/16	61029	47.70	61129	56.15
15/32		.4688	4 5/16	61030	46.75	61130	55.00
31/64		.4844	4 3/8	61031	52.45	61131	61.70
1/2		.5000	4 1/2	61032	52.45	61132	61.70

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

TYPE 672 & 673 - POSITIVE ANGLE CUTTING EDGE

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

USE:

- 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

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 galling
  (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

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

TOOL DIAMETER		LENGTH		NEGATIVE EDGE		POSITIVE EDGE		ALL TYPES PRICE
FRAC.	DEC.	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	-	-	$32.60
* 5/64	.0781	-	1 1/2	67005	67105	-	-	32.60
* 3/32	.0938	-	2	67006	67106	-	-	35.80
* 7/64	.1094	-	2	67007	67107	-	-	35.80
* 1/8	.1250	-	2	67008	67108	-	-	36.85
* 9/64	.1406	-	2	67009	67109	-	-	36.85
* 5/32	.1562	-	2	67010	67110	-	-	38.80
* 11/64	.1719	-	2 3/8	67011	67111	-	-	38.80
3/16	.1875	1 1/2	3 1/2	67012	67112	67212	67312	35.20
13/64	.2031	1 1/2	3 1/2	67013	67113	67213	67313	35.20
7/32	.2188	1 3/4	3 3/4	67014	67114	67214	67314	36.35
15/64	.2344	1 3/4	3 3/4	67015	67115	67215	67315	37.50
1/4	.2500	2	4	67016	67116	67216	67316	37.50
17/64	.2656	2	4	67017	67117	67217	67317	39.65
9/32	.2812	2 1/4	4 1/4	67018	67118	67218	67318	39.65
19/64	.2969	2 1/4	4 1/4	67019	67119	67219	67319	41.50
5/16	.3125	2 1/2	4 1/2	67020	67120	67220	67320	41.50
21/64	.3281	2 1/2	4 1/2	67021	67121	67221	67321	44.20
11/32	.3438	2 3/4	4 3/4	67022	67122	67222	67322	44.20
23/64	.3594	2 3/4	4 3/4	67023	67123	67223	67323	47.60
3/8	.3750	3	5	67024	67124	67224	67324	47.60
25/64	.3906	3	5	67025	67125	67225	67325	53.65
13/32	.4062	3	5 1/4	67026	67126	67226	67326	55.60
27/64	.4219	3	5 1/4	67027	67127	67227	67327	60.10
7/16	.4375	3	5 1/2	67028	67128	67228	67328	64.60
29/64	.4531	3	5 1/2	67029	67129	67229	67329	67.75
15/32	.4688	3 1/4	5 3/4	67030	67130	67230	67330	71.00
31/64	.4844	3 1/4	5 3/4	67031	67131	67231	67331	86.05
1/2	.5000	3 1/2	6	67032	67132	67232	67332	83.20
17/32	.5312	3 1/2	6	67034	67134	67234	67334	95.40
9/16	.5625	3 1/2	6	67036	67136	67236	67336	98.70
19/32	.5938	4	7	67038	67138	67238	67338	104.45
5/8	.6250	4	7	67040	67140	67240	67340	107.65
21/32	.6562	4 1/2	7 1/2	67042	67142	67242	67342	115.25
11/16	.6875	4 1/2	7 1/2	67044	67144	67244	67344	118.25
23/32	.7188	4 3/4	8	67046	67146	67246	67346	123.95
3/4	.7500	4 3/4	8	67048	67148	67248	67348	127.40
25/32	.7812	4 3/4	8	67050	67150	67250	67350	245.95
13/16	.8125	4 3/4	8	67052	67152	67252	67352	228.30
7/8	.8750	4 3/4	8	67056	67156	67256	67356	233.05
15/16	.9375	4 3/4	8	67060	67160	67260	67360	259.55
1	1.0000	4 3/4	8	67064	67164	67264	67364	275.35

*Solid carbide

METRIC TOOL DIAMETERS

TOOL DIAMETER		LENGTH				TYPE 670 NEG. 118° PT METRIC EDP NO.	TYPE 672 POS. 118° PT METRIC EDP NO.	BOTH TYPES METRIC PRICE
		FLUTE		OVERALL				
mm	INCH	mm	INCH	mm	INCH			
5.0	.1969	38	1 1/2	89	3 1/2	670050	672050	$32.90
5.5	.2165	45	1 3/4	95	3 3/4	670055	672055	36.55
6.0	.2362	51	2	102	4	670060	672060	36.80
6.5	.2559	51	2	102	4	670065	672065	38.95
7.0	.2756	57	2 1/4	108	4 1/4	670070	672070	38.95
7.5	.2953	57	2 1/4	108	4 1/4	670075	672075	40.70
8.0	.3150	64	2 1/2	114	4 1/2	670080	672080	43.90
8.5	.3346	70	2 3/4	121	4 3/4	670085	672085	43.90
9.0	.3543	70	2 3/4	121	4 3/4	670090	672090	46.80
9.5	.3740	76	3	127	5	670095	672095	44.40
10.0	.3937	76	3	133	5 1/4	670100	672100	54.60
10.5	.4134	76	3	133	5 1/4	670105	672105	63.30
11.0	.4331	76	3	140	5 1/2	670110	672110	89.10
11.5	.4528	76	3	140	5 1/2	670115	672115	66.65
12.0	.4724	83	3 1/4	146	5 3/4	670120	672120	81.50
12.5	.4921	89	3 1/2	152	6	670125	672125	81.50
13.0	.5118	89	3 1/2	152	6	670130	672130	93.50
13.5	.5315	89	3 1/2	152	6	670135	672135	93.50
14.0	.5512	89	3 1/2	152	6	670140	672140	96.85

HARD STEEL DIE DRILLS
SOLID CARBIDE TYPES 674 & 675 FRACTIONAL

MATERIAL SPECIFIC

SPADE TYPE
120° OR 140° POINT

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

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

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

DRILLS

TOOL DIAMETER FRAC.	TOOL DIAMETER DECIMAL	OVER-ALL LENGTH	TYPE 674 120˚ PT. EDP NO.	TYPE 675 140˚ PT. EDP NO.	BOTH TYPES PRICE
* 3/32	.0938	2	67406	67506	$20.80
* 7/64	.1094	2	67407	67507	21.25
* 1/8	.1250	2	67408	67508	21.25
* 9/64	.1406	2	67409	67509	23.00
* 5/32	.1562	2	67410	67510	26.45
* 11/64	.1719	3	67411	67511	28.25
* 3/16	.1875	3	67412	67512	33.40
* 13/64	.2031	3	67413	67513	37.60

*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 FRAC.	TOOL DIAMETER DECIMAL	LENGTH FLUTE	LENGTH OVERALL	TYPE 893 140˚ PT. EDP NO.	PRICE
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 FRAC.	TOOL DIAMETER DECIMAL	LENGTH FLUTE	LENGTH OVERALL	TYPE 893 140˚ PT. EDP NO.	PRICE
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

REDUCED SHANK DIAMETER DRILLS CARBIDE TIPPED TYPES 600, 601, 640, 641, 670 FRACTIONAL

MATERIAL SPECIFIC

¼", ⅜", ½" OR ¾" 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

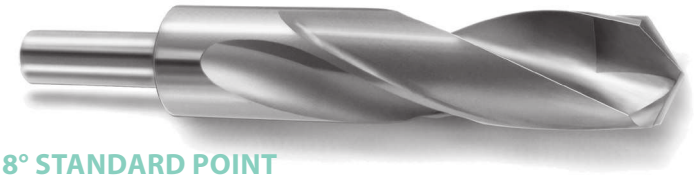
SHANK DIAM.	TOOL DIAMETER		STUB LENGTH DRILLS (reference pg. 120)					JOBBERS LENGTH DRILLS (reference pg. 122)					HARD STEEL DIE DRILLS (reference pg. 134)		
			OVER-ALL LENGTH	TYPE 640 118° PT.		TYPE 641 135° PT.		OVER-ALL LENGTH	TYPE 600 118° PT.		TYPE 601 135° PT.		OVER-ALL LENGTH	TYPE 670 NEG. 118° PT.	BOTH TYPES PRICE
	FRAC.	DEC.		EDP NO.	PRICE	EDP NO.	PRICE		EDP NO.	PRICE	EDP NO.	PRICE		EDP NO.	
¼	9/32	.2812	2 11/16	640618	$38.45	641618	$44.65	4 ¼	600618	$38.05	601618	$44.10	-	-	-
	5/16	.3125	2 13/16	640620	40.85	641620	47.50	4 ½	600620	41.10	601620	47.80	4 ½	670620	$62.30
	11/32	.3438	3	640622	47.60	641622	55.10	4 ¾	600622	43.70	601622	50.90	4 ¾	670622	66.35
	⅜	.3750	3 ⅛	640624	48.70	641624	56.60	5	600624	46.45	601624	54.05	5	670624	71.30
	13/32	.4062	3 5/16	640626	57.80	641626	67.25	5 ¼	600626	50.50	601626	58.80	5 ¼	670626	83.60
	7/16	.4375	3 7/16	640628	61.75	641628	68.50	5 ½	600628	55.00	601628	63.85	5 ½	670628	96.85
	15/32	.4688	3 ⅝	640630	87.90	641630	102.25	5 ¾	600630	61.85	601630	71.65	5 ¾	670630	106.40
	½	.5000	3 ¾	640632	84.10	641632	97.80	6	600632	76.10	601632	80.15	6	670632	124.80
⅜	13/32	.4062	3 5/16	640726	57.80	641726	67.25	5 ¼	600726	50.50	601726	58.80	-	-	-
	7/16	.4375	3 7/16	640728	61.75	641728	68.50	5 ½	600728	55.00	601728	63.85	5 ½	670728	96.85
	15/32	.4688	3 ⅝	640730	87.90	641730	102.25	5 ¾	600730	61.85	601730	71.65	5 ¾	670730	106.40
	½	.5000	3 ¾	640732	84.10	641732	97.80	6	600732	76.10	601732	80.15	6	670732	124.80
	17/32	.5312	3 ⅞	640734	104.90	641734	118.15	6 ⅝	600734	99.05	601734	115.10	6	670734	143.15
	9/16	.5625	4	640736	104.90	641736	118.15	6 ⅝	600736	100.00	601736	116.10	6	670736	148.10
	19/32	.5938	4 ⅛	640738	120.30	641738	135.60	7 ⅛	600738	107.40	601738	124.55	7	670738	156.70
	⅝	.6250	4 ¼	640740	120.30	641740	135.60	7 ⅛	600740	121.70	601740	141.05	7	670740	161.50
	21/32	.6562	4 ½	640742	144.65	641742	163.15	7 ⅛	600742	123.65	601742	143.45	7 ½	670742	172.80
	11/16	.6875	4 ⅝	640744	148.40	641744	167.45	7 ⅝	600744	126.05	601744	146.20	7 ½	670744	177.50
	23/32	.7188	4 ¾	640746	168.30	641746	195.40	7 ⅝	600746	148.80	601746	165.50	8	670746	185.95
	¾	.7500	5	640748	168.70	641748	190.00	8	600748	151.90	601748	168.85	8	670748	190.90
½	17/32	.5312	3 ⅞	640834	104.90	641834	118.15	6 ⅝	600834	99.05	601834	115.10	-	-	-
	9/16	.5625	4	640836	104.90	641836	118.15	6 ⅝	600836	100.00	601836	116.10	6	670836	148.10
	19/32	.5938	4 ⅛	640838	120.30	641838	135.60	7 ⅛	600838	107.40	601838	124.55	7	670838	156.70
	⅝	.6250	4 ¼	640840	120.30	641840	135.60	7 ⅛	600840	121.70	601840	141.05	7	670840	161.50
	21/32	.6562	4 ½	640842	144.65	641842	163.15	7 ⅛	600842	123.65	601842	143.45	7 ½	670842	172.80
	11/16	.6875	4 ⅝	640844	148.40	641844	167.45	7 ⅝	600844	126.05	601844	146.20	7 ½	670844	177.50
	23/32	.7188	4 ¾	640846	168.30	641846	195.40	7 ⅝	600846	148.80	601846	165.50	8	670846	185.95
	¾	.7500	5	640848	168.70	641848	190.00	8	600848	151.90	601848	168.85	8	670848	190.90
	13/16	.8125	5 ¼	640852	208.45	641852	235.30	-	-	-	-	-	8	670852	342.35
	⅞	.8750	5 ½	640856	228.85	641856	257.95	-	-	-	-	-	8	670856	349.50
	15/16	.9375	5 ¾	640860	245.65	641860	277.10	-	-	-	-	-	8	670860	389.45
	1	1.0000	6	640864	259.50	641864	292.80	-	-	-	-	-	8	670864	413.15
¾	13/16	.8125	5 ¼	640952	208.45	641952	235.30	-	-	-	-	-	8	670952	342.35
	⅞	.8750	5 ½	640956	228.85	641956	257.95	-	-	-	-	-	8	670956	349.50
	15/16	.9375	5 ¾	640960	245.65	641960	277.10	-	-	-	-	-	8	670960	389.45
	1	1.0000	6	640964	259.50	641964	292.80	-	-	-	-	-	8	670964	413.15
	1 1/16	1.0625	6 ¼	640968	325.20	641968	366.65	-	-	-	-	-	-	-	-
	1 ⅛	1.1250	6 ⅜	640972	361.10	641972	407.10	-	-	-	-	-	-	-	-
	1 3/16	1.1875	6 ⅝	640976	440.60	641976	493.90	-	-	-	-	-	-	-	-
	1 ¼	1.2500	6 ¾	640980	440.60	641980	493.90	-	-	-	-	-	-	-	-

SILVER & DEMING DRILLS
CARBIDE TIPPED TYPES 616 & 618 FRACTIONAL

MATERIAL SPECIFIC

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 : ½" diameter, 2¼" 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 ½" 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.	
FRAC.	DECIMAL	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
1/2	.5000	3 1/8	6	61632	$63.80	61832	$67.00
17/32	.5312	3 1/8	6	61634	93.30	61834	98.05
9/16	.5625	3 1/8	6	61636	96.70	61836	101.60
19/32	.5938	3 1/8	6	61638	100.55	61838	105.60
5/8	.6250	3 1/8	6	61640	111.80	61840	117.30
21/32	.6562	3 1/8	6	61642	121.20	61842	127.20
11/16	.6875	3 1/8	6	61644	125.90	61844	132.30
23/32	.7188	3 1/8	6	61646	130.60	61846	137.15
3/4	.7500	3 1/8	6	61648	136.85	61848	143.80
25/32	.7812	3 1/8	6	61650	150.90	61850	158.45
13/16	.8125	3 1/8	6	61652	151.30	61852	158.90
27/32	.8438	3 1/8	6	61654	151.30	61854	158.90
7/8	.8750	3 1/8	6	61656	157.40	61856	165.25

TOOL DIAMETER		LENGTH		TYPE 616 -118° PT.		TYPE 618 - 135° PT.	
FRAC.	DECIMAL	FLUTE	OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
29/32	.9062	3 1/8	6	61658	$161.15	61858	$169.25
15/16	.9375	3 1/8	6	61660	162.80	61860	170.90
31/32	.9688	3 1/8	6	61662	168.30	61862	176.65
1	1.0000	3 1/8	6	61664	171.90	61864	180.55
1 1/32	1.0312	3 1/8	6	61666	165.90	61866	174.25
1 1/16	1.0625	3 1/8	6	61668	179.95	61868	188.90
1 3/32	1.0938	3 1/8	6	61670	184.20	61870	193.45
1 1/8	1.1250	3 1/8	6	61672	187.85	61872	197.15
1 5/32	1.1562	3 1/8	6	61674	227.95	61874	239.40
1 3/16	1.1875	3 1/8	6	61676	232.10	61876	243.70
1 7/32	1.2188	3 1/8	6	61678	243.65	61878	255.95
1 1/4	1.2500	3 1/8	6	61680	222.50	61880	233.65

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

GENERAL PURPOSE

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

TOOL DIAMETER		LENGTH		TYPE 677 90° PT. EDP NO.	TYPE 678 120° PT. EDP NO.	TYPE 679 140° PT. EDP NO.	ALL TYPES PRICE
FRAC.	DECIMAL	FLUTE	OVER-ALL				
1/4	.2500	1	4	67716	67816	67916	$90.25
3/8	.3750	1 1/8	5	67724	67824	67924	105.35
1/2	.5000	1 1/2	6	67732	67832	67932	141.65
5/8	.6250	1 5/8	7	67740	67840	67940	205.15
3/4	.7500	1 7/8	8	67748	67848	67948	238.00
1	1.0000	2 1/4	8	67764	67864	67964	315.55

TYPE 647 – 90° POINT SHORT LENGTH
TYPE 648 – 120° POINT SHORT LENGTH
TYPE 649 – 140° POINT SHORT LENGTH

TOOL DIAMETER		LENGTH		TYPE 647 90° PT. EDP NO.	TYPE 648 120° PT. EDP NO.	TYPE 649 140° PT. EDP NO.	ALL TYPES PRICE
FRAC.	DECIMAL	FLUTE	OVER-ALL				
1/4	.2500	1	2 1/2	64716	64816	64916	$85.75
3/8	.3750	1 1/8	3 1/8	64724	64824	64924	100.10
1/2	.5000	1 1/2	3 3/4	64732	64832	64932	134.65
5/8	.6250	1 5/8	4 1/4	64740	64840	64940	194.95
3/4	.7500	1 7/8	5	64748	64848	64948	226.15
1	1.0000	2 1/4	6	64764	64864	64964	299.70

DRILLS

COBALT DRILLS FOR STEEL

COBALT TYPES 699 FRACTIONAL, WIRE, LETTER, & NUMBER

135° SPLIT POINT

DISCONTINUED - WHILE SUPPLIES LAST

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

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

MODIFICATIONS (Prompt delivery)

- Coatings available:

TITANIUM NITRIDE – TiN

TITANIUM CARBONITRIDE – TiCN

ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

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 DIAMETER			LENGTH		135° POINT	
FRAC.	DEC.	WIRE LETTER	FLT.	OAL	TYPE 699 EDP NO.	PRICE EACH
	.0400	60	1 1/16	1 5/8	6990400	$2.40
	.0410	59	1 1/16	1 5/8	6990410	2.40
	.0420	58	1 1/16	1 5/8	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
	.0730	49	1	2	6990730	1.90
	.0760	48	1	2	6990760	1.90
5/64	.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
	.0935	42	1 1/4	2 1/4	6990935	1.90
3/32	.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
	.1160	32	1 5/8	2 3/4	6991160	2.20
	.1200	31	1 5/8	2 3/4	6991200	2.20
1/8	.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	
FRAC.	DEC.	WIRE LETTER	FLT.	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
	.1520	24	2	3 1/8	6991520	2.95
	.1540	23	2	3 1/8	6991540	2.95
5/32	.1562		2	3 1/8	69910	2.75
	.1570	22	2	3 1/8	6991570	2.95
	.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
11/64	.1719		2 1/8	3 1/4	69911	2.85
	.1730	17	2 3/16	3 3/8	6991730	3.30
	.1770	16	2 3/16	3 3/8	6991770	3.35
	.1800	15	2 3/16	3 3/8	6991800	3.60
	.1820	14	2 3/16	3 3/8	6991820	3.60
	.1850	13	2 5/16	3 1/2	6991850	3.60
3/16	.1875		2 5/16	3 1/2	69912	3.25
	.1890	12	2 5/16	3 1/2	6991890	3.80
	.1910	11	2 5/16	3 1/2	6991910	3.80
	.1935	10	2 7/16	3 5/8	6991935	3.80
	.1960	9	2 7/16	3 5/8	6991960	3.80
	.1990	8	2 7/16	3 5/8	6991990	3.80
	.2010	7	2 7/16	3 5/8	6992010	3.80
13/64	.2031		2 7/16	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
	.2090	4	2 1/2	3 3/4	6992090	4.90
	.2130	3	2 1/2	3 3/4	6992130	4.90
7/32	.2188		2 1/2	3 3/4	69914	4.25
	.2210	2	2 5/8	3 7/8	6992210	5.20
	.2280	1	2 5/8	3 7/8	6992280	5.20
	.2340	A	2 5/8	3 7/8	6992340	6.00
15/64	.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	
FRAC.	DEC.	WIRE LETTER	FLT.	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
9/32	.2812		2 15/16	4 1/4	69918	5.75
	.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 1/16	4 3/8	6993020	9.35
5/16	.3125		3 3/16	4 1/2	69920	7.45
	.3160	O	3 1/16	4 1/2	6993160	10.30
	.3230	P	3 5/16	4 5/8	6993230	11.00
21/64	.3281		3 5/16	4 5/8	69921	8.25
	.3320	Q	3 7/16	4 3/4	6993320	11.35
	.3390	R	3 7/16	4 3/4	6993390	11.35
11/32	.3438		3 7/16	4 3/4	69922	9.05
	.3480	S	3 1/2	4 7/8	6993480	13.90
23/64	.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		3 5/8	5	69924	10.30
	.3770	V	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
	.4040	Y	3 7/8	5 1/4	6994040	16.25
13/32	.4062		3 7/8	5 1/4	69926	12.30
	.4130	Z	3 7/8	5 1/4	6994130	17.70
27/64	.4210		3 15/16	5 3/8	69927	13.60
7/16	.4375		4 1/16	5 1/2	69928	13.90
29/64	.4531		4 3/16	5 5/8	69929	16.70
15/32	.4688		4 5/16	5 3/4	69930	17.00
31/64	.4844		4 3/8	5 7/8	69931	17.55
1/2	.5000		4 1/2	6	69932	17.70

DRILLS

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	$42.00	7/16	1/4	1	9/64	59201	$77.35
2	4 3/16	9/16	5/16	59502	50.00	9/16	5/16	1 3/8	11/64	59202	95.80
3	5 1/4	7/8	1/2	59503	91.65	11/16	3/8	1 11/16	13/64	59203	144.75
4	6 3/4	7/8	1/2	59504	139.35	7/8	1/2	2 1/4	17/64	59204	211.65
5	8 1/2	1 1/16	5/8	59505	228.00	1 1/16	5/8	2 3/4	21/64	59205	353.80

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	$64.10	9/16	5/16	1 1/8	11/64	59307	$108.60
8	5 11/32	11/16	3/8	59608	89.95	9/16	5/16	1 5/16	11/64	59308	142.60
9	6	7/8	1/2	59609	114.10	11/16	3/8	1 1/2	13/64	59309	169.85
10	8 17/32	7/8	1/2	59610	163.05	7/8	1/2	2 1/4	17/64	59310	237.90
11	10 1/8	1 1/16	5/8	59611	216.60	1 1/16	5/8	2 1/2	3/8	59311	326.75

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	$45.90	7/16	1/4	25/32	9/64	59404	$84.40
5	3 5/8	7/16	1/4	59705	50.75	7/16	1/4	15/16	9/64	59405	93.45
6	4 1/2	9/16	5/16	59706	62.65	9/16	5/16	1 1/8	11/64	59406	104.15
7	5 1/4	11/16	3/8	59707	81.15	11/16	3/8	1 3/16	13/64	59407	136.50
8	6	7/8	1/2	59708	104.95	7/8	1/2	1 3/8	17/64	59408	168.65
9	6 3/4	7/8	1/2	59709	113.90	7/8	1/2	1 5/8	17/64	59409	190.00
10	7 1/2	7/8	1/2	59710	144.75	7/8	1/2	2	17/64	59410	224.90
11	8 1/4	7/8	1/2	59711	162.90	7/8	1/2	2	17/64	59411	248.95
12	9	1 1/16	5/8	59712	180.20	1 1/16	5/8	2 1/4	21/64	59412	280.45

CORE DRILLS CARBIDE TIPPED TYPES 620 & 622 FRACTIONAL

GENERAL PURPOSE

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

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

MODIFICATIONS (See list on page 141)

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						
		MIN. CUT DIAM.	LENGTH			SHANK DIAM.	EDP NO.	TAPER SHANK NO.	EDP NO.		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.		CAR-BIDE	FLT	OVER-ALL							1	2	3	4	5-7	8-14**
* 3/8	.3750	.262	5/8	3 1/2	6 3/4	3/8	62012	1	62212	$105.55	0.3471 - 0.3780	$144.10	$124.70	$118.30	$115.25	$111.85	$109.40
* 13/32	.4062	.284	5/8	3 5/8	7	13/32	62013	1	62213	105.55	0.3781 - 0.4090	144.10	124.70	118.30	115.25	111.85	109.40
* 7/16	.4375	.306	3/4	3 7/8	7 1/4	7/16	62014	1	62214	105.55	0.4091 - 0.4410	144.10	124.70	118.30	115.25	111.85	109.40
* 15/32	.4688	.328	3/4	4 1/8	7 1/2	15/32	62015	1	62215	105.55	0.4411 - 0.4720	144.10	124.70	118.30	115.25	111.85	109.40
1/2	.5000	.350	3/4	4 3/8	8 1/4	1/2	62016	2	62216	105.55	0.4721 - 0.5030	144.10	124.70	118.30	115.25	111.85	109.40
17/32	.5312	.372	3/4	4 3/8	8 1/4	17/32	62017	2	62217	105.95	0.5031 - 0.5340	144.65	125.30	118.75	115.75	112.40	109.70
9/16	.5625	.394	3/4	4 3/8	8 1/4	9/16	62018	2	62218	105.95	0.5341 - 0.5660	144.65	125.30	118.75	115.75	112.40	109.70
19/32	.5938	.416	3/4	4 3/8	8 1/4	19/32	62019	2	62219	111.30	0.5661 - 0.5970	149.85	130.50	124.10	121.00	117.70	115.15
5/8	.6250	.438	3/4	4 3/8	8 1/4	5/8	62020	2	62220	111.30	0.5971 - 0.6280	149.85	130.50	124.10	121.00	117.70	115.15
21/32	.6562	.459	3/4	4 3/8	8 1/4	21/32	62021	2	62221	112.55	0.6281 - 0.6590	151.20	131.85	125.45	122.25	119.10	116.45
11/16	.6875	.481	7/8	4 3/8	8 1/4	11/16	62022	2	62222	113.60	0.6591 - 0.6910	152.20	132.90	126.35	123.30	120.00	117.35
23/32	.7188	.503	7/8	4 3/8	8 1/4	23/32	62023	2	62223	113.60	0.6911 - 0.7220	152.20	132.90	126.35	123.30	120.00	117.35
3/4	.7500	.525	7/8	4 3/8	8 1/4	3/4	62024	2	62224	113.60	0.7221 - 0.7530	152.20	132.90	126.35	123.30	120.00	117.35
25/32	.7812	.547	7/8	4 3/8	8 1/4	25/32	62025	2	62225	116.05	0.7531 - 0.7840	154.65	135.35	128.90	125.80	122.55	119.90
13/16	.8125	.569	7/8	4 7/8	9 1/2	13/16	62026	3	62226	119.30	0.7841 - 0.8160	157.95	138.65	132.10	129.10	125.65	123.20
27/32	.8438	.591	7/8	4 7/8	9 1/2	27/32	62027	3	62227	125.65	0.8161 - 0.8470	164.30	145.00	138.50	135.40	132.10	129.50
7/8	.8750	.612	7/8	4 7/8	9 1/2	7/8	62028	3	62228	125.65	0.8471 - 0.8780	164.30	145.00	138.50	135.40	132.10	129.50
29/32	.9062	.634	7/8	4 7/8	9 1/2	29/32	62029	3	62229	126.45	0.8781 - 0.9090	165.05	145.80	139.25	136.20	132.95	130.30
15/16	.9375	.656	7/8	4 7/8	9 1/2	15/16	62030	3	62230	126.45	0.9091 - 0.9410	165.05	145.80	139.25	136.20	132.95	130.30
31/32	.9688	.678	7/8	4 7/8	9 1/2	31/32	62031	3	62231	131.25	0.9411 - 0.9720	169.70	150.35	144.00	140.95	137.55	135.00
1	1.0000	.700	7/8	4 7/8	9 1/2	1	62032	3	62232	133.65	0.9721 - 1.0030	172.25	152.90	146.35	143.35	140.00	137.40
1 1/32	1.0312	.722	7/8	4 7/8	9 1/2	1 1/32	62033	3	62233	134.75	1.0031 - 1.0340	173.30	153.90	147.55	144.40	141.15	138.50
1 1/16	1.0625	.744	7/8	4 7/8	9 1/2	1 1/16	62034	3	62234	136.60	1.0341 - 1.0660	175.25	155.85	149.40	146.30	142.95	140.40
1 3/32	1.0938	.766	1	4 7/8	10 1/2	1 3/32	62035	4	62235	159.10	1.0661 - 1.0970	197.65	178.40	171.90	168.85	165.50	162.90
1 1/8	1.1250	.787	1	4 7/8	10 1/2	1 1/8	62036	4	62236	159.10	1.0971 - 1.1280	197.65	178.40	171.90	168.85	165.50	162.90
1 5/32	1.1562	.809	1	4 7/8	10 1/2	1 5/32	62037	4	62237	173.70	1.1281 - 1.1590	212.25	193.00	186.55	183.45	180.15	177.50
1 3/16	1.1875	.831	1	4 7/8	10 1/2	1 3/16	62038	4	62238	178.75	1.1591 - 1.1905	217.30	198.10	191.50	188.45	185.20	182.60
1 7/32	1.2188	.853	1	4 7/8	10 1/2	1 7/32	62039	4	62239	179.40	1.1906 - 1.2220	218.00	198.65	192.25	189.10	185.75	183.20
1 1/4	1.2500	.875	1	4 7/8	10 1/2	1 1/4	62040	4	62240	180.15	1.2221 - 1.2530	218.75	199.40	192.95	189.80	186.55	183.90
1 9/32	1.2812	.897	1	4 7/8	10 1/2	1 9/32	62041	4	62241	193.00	1.2531 - 1.2840	231.60	212.20	205.80	202.65	199.40	196.70
1 5/16	1.3125	.919	1	4 7/8	10 1/2	1 5/16	62042	4	62242	198.35	1.2841 - 1.3150	237.00	217.65	211.10	208.10	204.75	202.10
1 11/32	1.3438	.940	1	4 7/8	10 1/2	1 11/32	62043	4	62243	202.50	1.3151 - 1.3470	241.10	221.80	215.30	212.20	209.00	206.25
1 3/8	1.3750	.962	1	4 7/8	10 1/2	1 3/8	62044	4	62244	207.45	1.3471 - 1.3780	246.00	226.70	220.20	217.15	213.85	211.15
1 13/32	1.4062	.984	1	4 7/8	10 1/2	1 13/32	62045	4	62245	212.15	1.3781 - 1.4090	250.75	231.50	224.90	221.85	218.55	215.95
1 7/16	1.4375	1.006	1	4 7/8	10 1/2	1 7/16	62046	4	62246	218.35	1.4091 - 1.4410	257.00	237.70	231.15	228.10	224.80	222.20
1 15/32	1.4688	1.025	1	4 7/8	10 1/2	1 15/32	62047	4	62247	224.85	1.4411 - 1.4720	263.40	244.10	237.70	234.60	231.20	228.70
1 1/2	1.5000	1.050	1	4 7/8	10 1/2	1 1/2	62048	4	62248	229.75	1.4721 - 1.5030	268.30	248.90	242.50	239.40	236.05	233.55

*3 flutes

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

CORE DRILLS
CARBIDE TIPPED TYPES 620 & 622 METRIC

GENERAL PURPOSE

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

DRILLS

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							
		MIN. CUT DIAM.	LENGTH			SHANK DIAM.	METRIC EDP NO.	TAPER SHANK NO.	METRIC EDP NO.		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH		CARBIDE	FLT	OVERALL							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	$118.30	8.815 - 9.601	$147.35	$128.10	$121.55	$118.40	$115.25	$112.50	$108.80
*10.0	.3937	.284	5/8	3 5/8	7	13/32	620100	1	622100	118.30	9.602 - 10.389	147.35	128.10	121.55	118.40	115.25	112.50	108.80
*11.0	.4331	.306	3/4	3 7/8	7 1/4	7/16	620110	1	622110	118.30	10.390 - 11.201	147.35	128.10	121.55	118.40	115.25	112.50	108.80
* -	-	.328	3/4	4 1/8	7 1/2	15/32	620119	1	622119	-	11.202 - 11.989	147.35	128.10	121.55	118.40	115.25	112.50	108.80
12.0	.4724	.350	3/4	4 3/8	8 1/4	1/2	620120	2	622120	118.30	11.990 - 12.776	147.35	128.10	121.55	118.40	115.25	112.50	108.80
13.0	.5118	.372	3/4	4 3/8	8 1/4	17/32	620130	2	622130	118.75	12.777 - 13.564	147.75	128.60	122.10	119.05	115.75	113.05	109.40
14.0	.5512	.394	3/4	4 3/8	8 1/4	9/16	620140	2	622140	118.75	13.565 - 14.376	147.75	128.60	122.10	119.05	115.75	113.05	109.40
15.0	.5906	.416	3/4	4 3/8	8 1/4	19/32	620150	2	622150	124.10	14.377 - 15.164	153.15	133.85	127.40	124.25	121.00	118.30	114.60
-	-	.438	3/4	4 3/8	8 1/4	5/8	620159	2	622159	-	15.165 - 15.951	153.15	133.85	127.40	124.25	121.00	118.30	114.60
16.0	.6299	.459	3/4	4 3/8	8 1/4	21/32	620160	2	622160	125.45	15.952 - 16.739	154.50	135.20	128.70	125.55	122.25	119.55	115.95
17.0	.6693	.481	7/8	4 3/8	8 1/4	11/16	620170	2	622170	126.35	16.740 - 17.551	155.45	136.10	129.60	126.45	123.30	120.55	116.85
18.0	.7087	.503	7/8	4 3/8	8 1/4	23/32	620180	2	622180	126.35	17.552 - 18.339	155.45	136.10	129.60	126.45	123.30	120.55	116.85
19.0	.7480	.525	7/8	4 3/8	8 1/4	3/4	620190	2	622190	126.35	18.340 - 19.126	155.45	136.10	129.60	126.45	123.30	120.55	116.85
-	-	.547	7/8	4 3/8	8 1/4	25/32	620199	2	622199	-	19.127 - 19.914	157.95	138.75	132.30	129.10	125.80	123.20	119.40
20.0	.7874	.569	7/8	4 7/8	9 1/2	13/16	620200	3	622200	132.10	19.915 - 20.726	161.15	141.95	135.40	132.35	129.10	126.35	122.65
21.0	.8268	.591	7/8	4 7/8	9 1/2	27/32	620210	3	622210	138.50	20.727 - 21.514	167.60	148.30	141.85	138.75	135.40	132.80	129.10
22.0	.8661	.612	7/8	4 7/8	9 1/2	7/8	620220	3	622220	138.50	21.515 - 22.301	167.60	148.30	141.85	138.75	135.40	132.80	129.10
23.0	.9055	.634	7/8	4 7/8	9 1/2	29/32	620230	3	622230	139.25	22.302 - 23.089	168.35	149.10	142.70	139.40	136.20	133.60	129.85
-	-	.656	7/8	4 7/8	9 1/2	15/16	620239	3	622239	-	23.090 - 23.901	168.35	149.10	142.70	139.40	136.20	133.60	129.85
24.0	.9449	.678	7/8	4 7/8	9 1/2	31/32	620240	3	622240	144.00	23.902 - 24.689	173.00	153.75	147.30	144.10	140.95	138.15	134.45
25.0	.9843	.700	7/8	4 7/8	9 1/2	1	620250	3	622250	146.35	24.690 - 25.476	175.45	156.20	149.75	146.55	143.35	140.65	136.95
26.0	1.0236	.722	7/8	4 7/8	9 1/2	1 1/32	620260	3	622260	147.55	25.477 - 26.264	176.55	157.30	150.85	147.65	144.40	141.80	138.00
27.0	1.0630	.744	7/8	4 7/8	9 1/2	1 1/16	620270	3	622270	149.40	26.265 - 27.076	178.55	159.15	152.70	149.60	146.30	143.65	139.95
-	-	.766	1	4 7/8	10 1/2	1 3/32	620279	4	622279	-	27.077 - 27.864	200.95	181.65	175.25	172.00	168.85	166.10	162.50
28.0	1.1024	.787	1	4 7/8	10 1/2	1 1/8	620280	4	622280	171.90	27.865 - 28.651	200.95	181.65	175.25	172.00	168.85	166.10	162.50
29.0	1.1417	.809	1	4 7/8	10 1/2	1 5/32	620290	4	622290	186.55	28.652 - 29.439	215.55	196.35	189.80	186.70	183.45	180.70	176.95
30.0	1.1811	.831	1	4 7/8	10 1/2	1 3/16	620300	4	622300	191.50	29.440 - 30.239	220.60	201.30	194.95	191.60	188.45	185.75	182.10
31.0	1.2205	.853	1	4 7/8	10 1/2	1 7/32	620310	4	622310	192.25	30.240 - 31.039	221.25	201.95	195.55	192.35	189.10	186.35	182.70
-	-	.875	1	4 7/8	10 1/2	1 1/4	620319	4	622319	-	31.040 - 31.826	221.90	202.65	196.30	193.10	189.80	187.15	183.45
32.0	1.2598	.897	1	4 7/8	10 1/2	1 9/32	620320	4	622320	205.80	31.827 - 32.614	234.90	215.55	209.10	205.95	202.65	200.00	196.35
33.0	1.2992	.919	1	4 7/8	10 1/2	1 5/16	620330	4	622330	211.10	32.615 - 33.401	240.15	220.85	214.40	211.25	208.10	205.40	201.70
34.0	1.3386	.940	1	4 7/8	10 1/2	1 11/32	620340	4	622340	215.30	33.402 - 34.214	244.45	225.20	218.65	215.50	212.20	209.60	205.90
35.0	1.3780	.962	1	4 7/8	10 1/2	1 3/8	620350	4	622350	220.20	34.215 - 35.001	249.35	230.00	223.55	220.35	217.15	214.40	210.80
-	-	.984	1	4 7/8	10 1/2	1 13/32	620359	4	622359	-	35.002 - 35.789	254.00	234.80	228.20	225.20	221.85	219.20	215.50
36.0	1.4173	1.006	1	4 7/8	10 1/2	1 7/16	620360	4	622360	231.15	35.790 - 36.601	260.25	240.95	234.55	231.25	228.10	225.40	221.75
37.0	1.4567	1.025	1	4 7/8	10 1/2	1 15/32	620370	4	622370	237.70	36.602 - 37.389	266.70	247.45	240.95	237.85	234.60	231.85	228.15
38.0	1.4961	1.050	1	4 7/8	10 1/2	1 1/2	620380	4	622380	242.50	37.390 - 38.176	271.50	252.25	245.85	242.60	239.40	236.70	232.95

*3 flutes

CORE DRILLS - FOR STEELS
CARBIDE TIPPED TYPES 621 & 623 FRACTIONAL

MATERIAL SPECIFIC

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						
		MIN. CUT DIAM.	LENGTH			SHANK DIAM.	STEEL EDP NO.	TAPER SHANK NO.	STEEL EDP NO.		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.		CAR-BIDE	FLT	OVER-ALL							1	2	3	4	5-7	8-14**
* 3/8	.3750	.262	5/8	3 1/2	6 3/4	3/8	62112	1	62312	$116.20	0.3471 - 0.3780	$154.80	$135.40	$128.95	$125.90	$122.60	$120.00
* 13/32	.4062	.284	5/8	3 5/8	7	13/32	62113	1	62313	116.20	0.3781 - 0.4090	154.80	135.40	128.95	125.90	122.60	120.00
* 7/16	.4375	.306	3/4	3 7/8	7 1/4	7/16	62114	1	62314	116.20	0.4091 - 0.4410	154.80	135.40	128.95	125.90	122.60	120.00
* 15/32	.4688	.328	3/4	4 1/8	7 1/2	15/32	62115	1	62315	116.20	0.4411 - 0.4720	154.80	135.40	128.95	125.90	122.60	120.00
1/2	.5000	.350	3/4	4 3/8	8 1/4	1/2	62116	2	62316	116.20	0.4721 - 0.5030	154.80	135.40	128.95	125.90	122.60	120.00
17/32	.5312	.372	3/4	4 3/8	8 1/4	17/32	62117	2	62317	116.60	0.5031 - 0.5340	155.15	135.90	129.35	126.30	122.95	120.40
9/16	.5625	.394	3/4	4 3/8	8 1/4	9/16	62118	2	62318	116.60	0.5341 - 0.5660	155.15	135.90	129.35	126.30	122.95	120.40
19/32	.5938	.416	3/4	4 3/8	8 1/4	19/32	62119	2	62319	122.55	0.5661 - 0.5970	161.05	141.80	135.25	132.30	128.90	126.30
5/8	.6250	.438	3/4	4 3/8	8 1/4	5/8	62120	2	62320	122.55	0.5971 - 0.6280	161.05	141.80	135.25	132.30	128.90	126.30
21/32	.6562	.459	3/4	4 3/8	8 1/4	21/32	62121	2	62321	123.95	0.6281 - 0.6590	162.50	143.05	136.60	133.60	130.25	127.60
11/16	.6875	.481	7/8	4 3/8	8 1/4	11/16	62122	2	62322	125.00	0.6591 - 0.6910	163.55	144.15	137.75	134.65	131.40	128.70
23/32	.7188	.503	7/8	4 3/8	8 1/4	23/32	62123	2	62323	125.00	0.6911 - 0.7220	163.55	144.15	137.75	134.65	131.40	128.70
3/4	.7500	.525	7/8	4 3/8	8 1/4	3/4	62124	2	62324	125.00	0.7221 - 0.7530	163.55	144.15	137.75	134.65	131.40	128.70
25/32	.7812	.547	7/8	4 3/8	8 1/4	25/32	62125	2	62325	127.60	0.7531 - 0.7840	166.15	146.95	140.40	137.30	133.95	131.45
13/16	.8125	.569	7/8	4 7/8	9 1/2	13/16	62126	3	62326	131.30	0.7841 - 0.8160	169.85	150.55	144.05	141.05	137.70	135.05
27/32	.8438	.591	7/8	4 7/8	9 1/2	27/32	62127	3	62327	138.30	0.8161 - 0.8470	176.85	157.55	151.05	148.00	144.75	142.10
7/8	.8750	.612	7/8	4 7/8	9 1/2	7/8	62128	3	62328	138.30	0.8471 - 0.8780	176.85	157.55	151.05	148.00	144.75	142.10
29/32	.9062	.634	7/8	4 7/8	9 1/2	29/32	62129	3	62329	139.10	0.8781 - 0.9090	177.70	158.45	151.95	148.85	145.60	142.90
15/16	.9375	.656	7/8	4 7/8	9 1/2	15/16	62130	3	62330	139.10	0.9091 - 0.9410	177.70	158.45	151.95	148.85	145.60	142.90
31/32	.9688	.678	7/8	4 7/8	9 1/2	31/32	62131	3	62331	144.20	0.9411 - 0.9720	182.80	163.55	157.00	153.90	150.75	148.10
1	1.0000	.700	7/8	4 7/8	9 1/2	1	62132	3	62332	147.05	0.9721 - 1.0030	185.60	166.35	159.80	156.75	153.50	150.85
1 1/32	1.0312	.722	7/8	4 7/8	9 1/2	1 1/32	62133	3	62333	148.15	1.0031 - 1.0340	186.75	167.35	160.90	157.90	154.55	151.95
1 1/16	1.0625	.744	7/8	4 7/8	9 1/2	1 1/16	62134	3	62334	150.20	1.0341 - 1.0660	188.80	169.45	162.95	159.85	156.65	153.90
1 3/32	1.0938	.766	1	4 7/8	10 1/2	1 3/32	62135	4	62335	175.05	1.0661 - 1.0970	213.50	194.25	187.75	184.75	181.40	178.75
1 1/8	1.1250	.787	1	4 7/8	10 1/2	1 1/8	62136	4	62336	182.85	1.0971 - 1.1280	221.55	202.25	195.75	192.60	189.35	186.75
1 5/32	1.1562	.809	1	4 7/8	10 1/2	1 5/32	62137	4	62337	191.15	1.1281 - 1.1590	229.75	210.35	203.90	200.80	197.45	194.95
1 3/16	1.1875	.831	1	4 7/8	10 1/2	1 3/16	62138	4	62338	196.60	1.1591 - 1.1905	235.20	215.95	209.45	206.35	203.10	200.50
1 7/32	1.2188	.853	1	4 7/8	10 1/2	1 7/32	62139	4	62339	197.35	1.1906 - 1.2220	235.95	216.65	210.20	207.05	203.85	201.20
1 1/4	1.2500	.875	1	4 7/8	10 1/2	1 1/4	62140	4	62340	198.15	1.2221 - 1.2530	236.70	217.30	210.90	207.85	204.55	201.90
1 9/32	1.2812	.897	1	4 7/8	10 1/2	1 9/32	62141	4	62341	212.20	1.2531 - 1.2840	250.80	231.55	224.95	221.90	218.65	216.00
1 5/16	1.3125	.919	1	4 7/8	10 1/2	1 5/16	62142	4	62342	218.10	1.2841 - 1.3150	256.70	237.40	230.95	227.85	224.60	221.90
1 11/32	1.3438	.940	1	4 7/8	10 1/2	1 11/32	62143	4	62343	222.80	1.3151 - 1.3470	261.45	242.10	235.65	232.60	229.15	226.65
1 3/8	1.3750	.962	1	4 7/8	10 1/2	1 3/8	62144	4	62344	228.15	1.3471 - 1.3780	266.75	247.45	240.95	237.90	234.60	231.90
1 13/32	1.4062	.984	1	4 7/8	10 1/2	1 13/32	62145	4	62345	233.55	1.3781 - 1.4090	272.05	252.75	246.25	243.20	239.90	237.25
1 7/16	1.4375	1.006	1	4 7/8	10 1/2	1 7/16	62146	4	62346	240.30	1.4091 - 1.4410	278.90	259.45	253.00	249.95	246.70	244.00
1 15/32	1.4688	1.025	1	4 7/8	10 1/2	1 15/32	62147	4	62347	247.40	1.4411 - 1.4720	286.00	266.65	260.15	257.10	253.70	251.15
1 1/2	1.5000	1.050	1	4 7/8	10 1/2	1 1/2	62148	4	62348	252.60	1.4721 - 1.5030	291.20	271.90	265.45	262.35	259.15	256.50

*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

DRILLS

NOTE: Tool diameter in millimeters (mm): all other dimensions in inches.

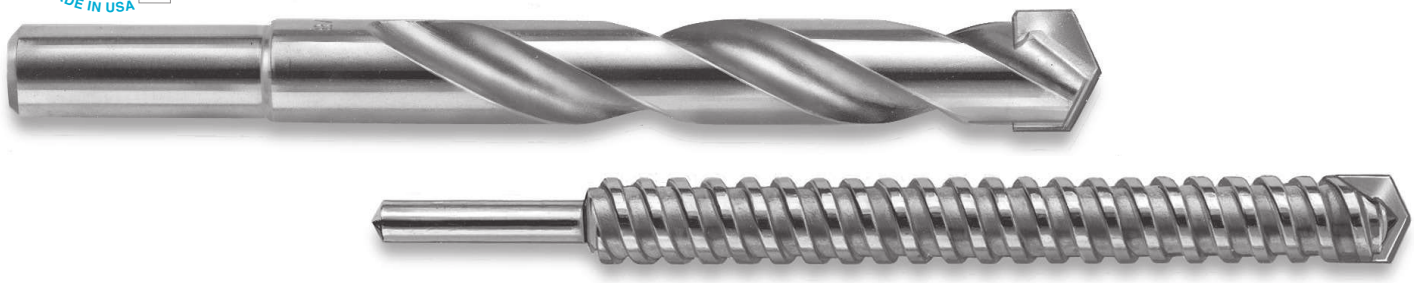
TOOL DIAMETER		DIMENSIONS				TYPE 621		TYPE 623		BOTH TYPES METRIC PRICE	FINISHED TO MODIFIED TOOL DIAMETER							
		MIN. CUT DIAM.	LENGTH			SHANK DIAM.	STEEL METRIC EDP NO.	TAPER SHANK NO.	STEEL METRIC EDP NO.		MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH		CAR-BIDE	FLT	OVER-ALL							1	2	3	4	5-7	8-14	OVER 14
* 9.0	.3543	.262	5/8	3 1/2	6 3/4	3/8	621090	1	623090	$128.95	8.815-9.601	$158.00	$138.80	$132.35	$129.15	$125.90	$123.25	$119.45
*10.0	.3937	.284	5/8	3 5/8	7	13/32	621100	1	623100	128.95	9.602-10.389	158.00	138.80	132.35	129.15	125.90	123.25	119.45
*11.0	.4331	.306	3/4	3 7/8	7 1/4	7/16	621110	1	623110	128.95	10.390-11.201	158.00	138.80	132.35	129.15	125.90	123.25	119.45
* -	-	.328	3/4	4 1/8	7 1/2	15/32	621119	1	623119	-	11.202-11.989	158.00	138.80	132.35	129.15	125.90	123.25	119.45
12.0	.4724	.350	3/4	4 3/8	8 1/4	1/2	621120	2	623120	128.95	11.990-12.776	158.00	138.80	132.35	129.15	125.90	123.25	119.45
13.0	.5118	.372	3/4	4 3/8	8 1/4	17/32	621130	2	623130	129.35	12.777-13.564	158.45	139.10	132.60	129.50	126.30	123.50	119.90
14.0	.5512	.394	3/4	4 3/8	8 1/4	9/16	621140	2	623140	129.35	13.565-14.376	158.45	139.10	132.60	129.50	126.30	123.50	119.90
15.0	.5906	.416	3/4	4 3/8	8 1/4	19/32	621150	2	623150	135.25	14.377-15.164	164.30	145.05	138.65	135.40	132.30	129.50	125.80
-	-	.438	3/4	4 3/8	8 1/4	5/8	621159	2	623159	-	15.165-15.951	164.30	145.05	138.65	135.40	132.30	129.50	125.80
16.0	.6299	.459	3/4	4 3/8	8 1/4	21/32	621160	2	623160	136.60	15.952-16.739	165.65	146.35	139.95	136.75	133.60	130.85	127.15
17.0	.6693	.481	7/8	4 3/8	8 1/4	11/16	621170	2	623170	137.75	16.740-17.551	166.80	147.55	141.10	137.90	134.65	131.90	128.30
18.0	.7087	.503	7/8	4 3/8	8 1/4	23/32	621180	2	623180	137.75	17.552-18.339	166.80	147.55	141.10	137.90	134.65	131.90	128.30
19.0	.7480	.525	7/8	4 3/8	8 1/4	3/4	621190	2	623190	137.75	18.340-19.126	166.80	147.55	141.10	137.90	134.65	131.90	128.30
-	-	.547	7/8	4 3/8	8 1/4	25/32	621199	2	623199	-	19.127-19.914	169.45	150.20	143.85	140.55	137.30	134.65	130.95
20.0	.7874	.569	7/8	4 7/8	9 1/2	13/16	621200	3	623200	144.05	19.915-20.726	173.05	153.80	147.35	144.15	141.05	138.30	134.50
21.0	.8268	.591	7/8	4 7/8	9 1/2	27/32	621210	3	623210	151.05	20.727-21.514	180.15	160.85	154.40	151.20	148.00	145.30	141.65
22.0	.8661	.612	7/8	4 7/8	9 1/2	7/8	621220	3	623220	151.05	21.515-22.301	180.15	160.85	154.40	151.20	148.00	145.30	141.65
23.0	.9055	.634	7/8	4 7/8	9 1/2	29/32	621230	3	623230	151.95	22.302-23.089	181.00	161.80	155.20	152.15	148.85	146.20	142.45
-	-	.656	7/8	4 7/8	9 1/2	15/16	621239	3	623239	-	23.090-23.901	181.00	161.80	155.20	152.15	148.85	146.20	142.45
24.0	.9449	.678	7/8	4 7/8	9 1/2	31/32	621240	3	623240	157.00	23.902-24.689	186.15	166.90	160.45	157.20	153.90	151.25	147.60
25.0	.9843	.700	7/8	4 7/8	9 1/2	1	621250	3	623250	159.80	24.690-25.476	188.90	169.55	163.15	159.90	156.75	153.95	150.30
26.0	1.0236	.722	7/8	4 7/8	9 1/2	1 1/32	621260	3	623260	160.90	25.477-26.264	190.05	170.70	164.20	161.05	157.90	155.15	151.50
27.0	1.0630	.744	7/8	4 7/8	9 1/2	1 1/16	621270	3	623270	162.95	26.265-27.076	192.10	172.80	166.35	163.15	159.85	157.20	153.55
-	-	.766	1	4 7/8	10 1/2	1 3/32	621279	4	623279	-	27.077-27.864	216.85	197.55	191.15	187.90	184.75	181.95	178.30
28.0	1.1024	.787	1	4 7/8	10 1/2	1 1/8	621280	4	623280	195.75	27.865-28.651	224.80	205.55	199.05	195.95	192.60	190.05	186.25
29.0	1.1417	.809	1	4 7/8	10 1/2	1 5/32	621290	4	623290	203.90	28.652-29.439	232.90	213.70	207.15	204.05	200.80	198.15	194.40
30.0	1.1811	.831	1	4 7/8	10 1/2	1 3/16	621300	4	623300	209.45	29.440-30.239	238.55	219.25	212.85	209.65	206.35	203.65	200.00
31.0	1.2205	.853	1	4 7/8	10 1/2	1 7/32	621310	4	623310	210.20	30.240-31.039	239.20	220.05	213.45	210.35	207.05	204.50	200.70
-	-	.875	1	4 7/8	10 1/2	1 1/4	621319	4	623319	-	31.040-31.826	239.95	220.70	214.25	211.05	207.85	205.05	201.35
32.0	1.2598	.897	1	4 7/8	10 1/2	1 9/32	621320	4	623320	224.95	31.827-32.614	254.15	234.90	228.30	225.25	221.90	219.25	215.55
33.0	1.2992	.919	1	4 7/8	10 1/2	1 5/16	621330	4	623330	230.95	32.615-33.401	260.00	240.75	234.20	231.10	227.85	225.25	221.45
34.0	1.3386	.940	1	4 7/8	10 1/2	1 11/32	621340	4	623340	235.65	33.402-34.214	264.60	245.40	238.95	235.80	232.60	229.85	226.10
35.0	1.3780	.962	1	4 7/8	10 1/2	1 3/8	621350	4	623350	240.95	34.215-35.001	270.10	250.75	244.35	241.10	237.90	235.15	231.55
-	-	.984	1	4 7/8	10 1/2	1 13/32	621359	4	623359	-	35.002-35.789	275.30	256.00	249.60	246.40	243.20	240.45	236.75
36.0	1.4173	1.006	1	4 7/8	10 1/2	1 7/16	621360	4	623360	253.00	35.790-36.601	282.15	262.85	256.35	253.20	249.95	247.35	243.60
37.0	1.4567	1.025	1	4 7/8	10 1/2	1 15/32	621370	4	623370	260.15	36.602-37.389	289.15	269.95	263.40	260.35	257.10	254.40	250.70
38.0	1.4961	1.050	1	4 7/8	10 1/2	1 1/2	621380	4	623380	265.45	37.390-38.176	294.45	275.15	268.75	265.55	262.35	259.70	255.90

*3 flutes

MASONRY DRILLS CARBIDE TIPPED TYPES 681, 682, 683, 684 FRACTIONAL

MATERIAL SPECIFIC

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	$5.10
3/16	3/16	3	68112	68212	5.10
1/4	1/4	4	68116	68216	5.10
1/4	1/4	6	68117	68217	5.80
5/16	1/4	4	68120	68220	5.80
5/16	1/4	6	68121	68221	6.30
3/8	1/4	4	68124	68224	6.30
3/8	1/4	6	68125	68225	6.30
7/16	1/4	4	68128	68228	6.95
7/16	1/4	6	68129	68229	7.15
1/2	1/4	4	68132	68232	7.70
1/2	1/4	6	68133	68233	7.70
1/2	3/8	6	68134	68234	7.70
9/16	3/8	6	68136	68236	10.40
5/8	1/2	6	68140	68240	11.05
11/16	1/2	6	68144	68244	12.55
3/4	1/2	6	68148	68248	13.70
7/8	1/2	6	68156	68256	17.10
1	1/2	6	68164	68264	21.15

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	$13.25	68416	$17.85
5/16	1/4	68320	15.15	68420	20.70
3/8	1/4	68324	16.65	68424	21.85
7/16	1/4	68328	18.25	68428	23.90
1/2	3/8	68332	20.90	68432	24.55
9/16	3/8	68336	23.90	68436	26.75
5/8	1/2	68340	26.75	68440	30.00
11/16	1/2	68344	29.95	68444	32.35
3/4	1/2	68348	30.75	68448	34.60
7/8	1/2	68356	37.95	68456	43.25
1	1/2	68364	42.00	68464	47.35

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

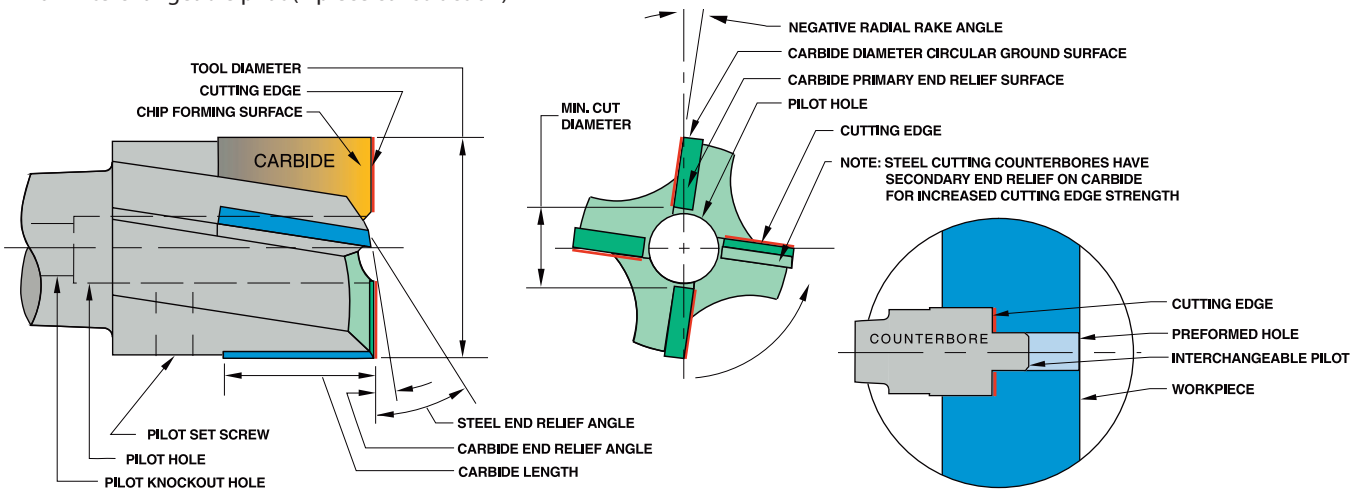
TOOL DIAMETER		SHANK DIAMETER	OVERALL LENGTH	TYPE 680 EDP NO.	PRICE EACH
FRAC.	DECIMAL				
1/8	.1250	7/64	2 1/2	68008	$26.65
3/16	.1875	5/32	2 1/2	68012	26.65
1/4	.2500	7/32	2 1/2	68016	30.60
5/16	.3125	1/4	3	68020	39.35
3/8	.3750	5/16	3 1/2	68024	43.80
7/16	.4375	3/8	3 1/2	68028	49.70
1/2	.5000	7/16	3 1/2	68032	54.25
9/16	.5625	1/2	4	68036	76.20
5/8	.6250	9/16	4	68040	91.80

CARBIDE TIPPED COUNTERBORES INDEX AND TECHNICAL INFORMATION

MOST TYPES FOR INTERCHANGEABLE PILOTS

DESCRIPTION	HANNIBAL FRAC. PAGE	HANNIBAL METRIC PAGE	HANNIBAL TOOL TYPE	CLEVELAND	ECLIPSE	METCUT	MORSE	WHITNEY
AIRCRAFT COUNTERBORES								
3 Flutes (similar to Craig 850 series)	147	–	522	–	–	–	–	–
STRAIGHT SHANK COUNTERBORES								
4 Flutes	148	149	512	–	–	–	–	–
3 - 4 Flutes	148	149	514	779	–	–	5779	–
3 - 4 Flutes – For Steels	152	153	510	–	–	–	–	–
TAPER SHANK COUNTERBORES								
4 Flutes	150	151	518	–	–	–	–	–
3 - 4 Flutes	150	151	516	–	–	–	5780	–
3 - 4 Flutes – For Steels	152	153	511	–	–	–	–	–
STUB LENGTH COUNTERBORES								
Pin Drive – For Non-Ferrous & Cast Irons	155	–	573	–	412	200	–	–
Pin Drive – For Steels	155	–	574	–	–	–	–	–
Stub Taper – For Non-Ferrous & Cast Irons	154	–	575	–	427	210	–	–
Stub Taper – For Steels	154	–	576	–	–	–	–	–
Radial Drive – For Non-Ferrous & Cast Irons	156	–	577	–	402	220	–	–
Radial Drive – For Steels	156	–	578	-	–	–	–	–
***CAPSCREW COUNTERBORES**								
Straight Shank - For Non-Ferrous & Cast Iron	157	157	513	–	–	–	–	–
Straight Shank - For Steels	157	157	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

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.

RPM=SFPM*3.82/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

AIRCRAFT COUNTERBORES CARBIDE TIPPED TYPE 522 FRACTIONAL

GENERAL PURPOSE

INTERCHANGEABLE PILOT TYPE STRAIGHT SHANK

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

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

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)

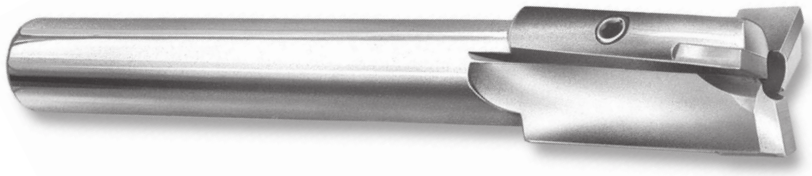
TOOL DIAMETER		DIMENSIONS				TYPE 522 EDP NO.	PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
FRACTION	DECIMAL	MIN CUT DIAM.	PILOT HOLE DIAM.	SMALL SHANK DIAM.	OVERALL LENGTH			MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
									1	2	3	4	5-7	8-14*
1/4	.2500	.1250	.0938	1/4	2 3/8	52208	$62.30	0.2381 - 0.2530	$105.95	$84.25	$76.85	$73.40	$69.70	$66.65
9/32	.2812	.1250	.0938	1/4	2 3/8	52209	62.40	0.2531 - 0.2840	106.05	84.30	77.00	73.45	69.75	66.75
5/16	.3125	.1250	.0938	1/4	2 3/8	52210	64.05	0.2841 - 0.3150	107.75	85.80	78.50	74.90	71.30	68.35
11/32	.3438	.1250	.0938	1/4	2 3/8	52211	65.30	0.3151 - 0.3470	109.00	87.05	79.85	76.25	72.60	69.65
3/8	.3750	.1250	.0938	1/4	2 3/8	52212	65.50	0.3471 - 0.3780	109.10	87.25	80.10	76.45	72.70	69.75
13/32	.4062	.1560	.1250	1/4	2 3/4	52213	74.45	0.3781 - 0.4090	118.00	96.35	88.95	85.45	81.70	78.80
7/16	.4375	.1560	.1250	1/4	2 3/4	52214	80.25	0.4091 - 0.4410	123.90	102.05	94.85	91.15	87.60	84.55
15/32	.4688	.1560	.1250	1/4	2 3/4	52215	81.60	0.4411 - 0.4720	125.25	103.40	96.15	92.65	88.90	85.90
1/2	.5000	.1560	.1250	1/4	2 3/4	52216	82.60	0.4721 - 0.5030	126.30	104.45	97.15	93.50	89.85	86.85
17/32	.5312	.1560	.1250	1/4	2 3/4	52217	83.05	0.5031 - 0.5340	126.65	104.80	97.55	93.95	90.25	87.25
9/16	.5625	.1560	.1250	1/4	2 3/4	52218	83.40	0.5341 - 0.5660	127.00	105.25	97.90	94.30	90.70	87.65
19/32	.5938	.1560	.1250	1/4	2 3/4	52219	83.80	0.5661 - 0.5970	127.55	105.70	98.50	94.85	91.10	88.10
5/8	.6250	.1560	.1250	1/4	2 3/4	52220	84.75	0.5971 - 0.6280	128.40	106.65	99.30	95.80	92.10	89.00
21/32	.6562	.2190	.1875	1/4	2 3/4	52221	94.15	0.6281 - 0.6590	137.80	115.95	108.80	105.25	101.50	98.55
11/16	.6875	.2190	.1875	1/4	2 3/4	52222	98.95	0.6591 - 0.6910	142.55	120.80	113.45	109.90	106.10	103.20
23/32	.7188	.2190	.1875	1/4	2 3/4	52223	102.25	0.6911 - 0.7220	145.80	124.10	116.75	113.30	109.50	106.60
3/4	.7500	.2190	.1875	1/4	2 3/4	52224	103.55	0.7221 - 0.7530	147.15	125.40	118.00	114.55	110.85	107.85
25/32	.7812	.2190	.1875	1/4	2 3/4	52225	103.95	0.7531 - 0.7840	147.65	125.80	118.55	114.85	111.25	108.25
13/16	.8125	.2190	.1875	1/4	2 3/4	52226	104.85	0.7841 - 0.8160	148.65	126.70	119.45	115.85	112.20	109.15
27/32	.8438	.2190	.1875	1/4	2 3/4	52227	105.65	0.8161 - 0.8470	149.30	127.30	120.10	116.55	112.85	109.90
7/8	.8750	.2190	.1875	1/4	2 3/4	52228	106.65	0.8471 - 0.8780	150.25	128.40	121.20	117.60	113.85	110.90
29/32	.9062	.2190	.1875	1/4	2 3/4	52229	107.30	0.8781 - 0.9090	151.00	129.20	122.00	118.35	114.65	111.65
15/16	.9375	.2190	.1875	1/4	2 3/4	52230	108.35	0.9091 - 0.9410	152.05	130.25	122.95	119.35	115.75	112.60
31/32	.9688	.2190	.1875	1/4	2 3/4	52231	109.10	0.9411 - 0.9720	152.75	130.90	123.75	120.05	116.40	113.40
1	1.0000	.2190	.1875	1/4	2 3/4	52232	109.45	0.9721 - 1.0030	153.15	131.30	123.95	120.40	116.65	113.70
1 1/16	1.0625	.2190	.1875	3/8	2 3/4	52234	139.70	1.0031 - 1.0660	183.30	161.45	154.30	150.60	146.90	143.95
1 1/8	1.1250	.2190	.1875	3/8	2 3/4	52236	149.05	1.0661 - 1.1280	192.65	170.85	163.65	160.05	156.30	153.30
1 3/16	1.1875	.2190	.1875	3/8	2 3/4	52238	150.95	1.1281 - 1.1905	194.60	172.80	165.50	161.95	158.25	155.25
1 1/4	1.2500	.2810	.2500	3/8	2 3/4	52240	153.75	1.1906 - 1.2530	197.55	175.60	168.25	164.70	161.15	158.10
1 5/16	1.3125	.2810	.2500	3/8	2 3/4	52242	156.60	1.2531 - 1.3155	200.20	178.40	171.20	167.60	163.80	160.85
1 3/8	1.3750	.2810	.2500	3/8	2 3/4	52244	158.40	1.3156 - 1.3780	202.15	180.40	173.05	169.40	165.80	162.70
1 7/16	1.4375	.2810	.2500	3/8	2 3/4	52246	160.30	1.3781 - 1.4405	204.05	182.15	174.95	171.30	167.65	164.65
1 1/2	1.5000	.2810	.2500	3/8	2 3/4	52248	168.80	1.4406 - 1.5030	214.00	191.40	183.85	180.15	176.25	173.25
1 9/16	1.5625	.3430	.3125	1/2	3 1/16	52250	187.75	1.5031 - 1.5660	232.95	210.40	202.85	199.15	195.35	192.30
1 5/8	1.6250	.3430	.3125	1/2	3 1/16	52252	190.20	1.5661 - 1.6280	235.50	212.85	205.40	201.65	197.80	194.65
1 11/16	1.6875	.3430	.3125	1/2	3 1/16	52254	192.70	1.6281 - 1.6910	238.00	215.40	207.85	204.15	200.35	197.20
1 3/4	1.7500	.3430	.3125	1/2	3 1/16	52256	195.70	1.6911 - 1.7530	240.95	218.25	210.75	207.00	203.25	200.15
1 13/16	1.8125	.3430	.3125	1/2	3 1/16	52258	198.05	1.7531 - 1.8160	242.85	220.30	212.75	209.05	205.10	202.05
1 7/8	1.8750	.3430	.3125	1/2	3 1/16	52260	199.45	1.8161 - 1.8780	244.75	222.10	214.50	210.90	207.00	203.90
1 15/16	1.9375	.3430	.3125	1/2	3 1/16	52262	220.10	1.8781 - 1.9410	265.35	242.70	235.15	231.45	227.60	224.55
2	2.0000	.3430	.3125	1/2	3 1/16	52264	273.85	1.9411 - 2.0030	319.30	296.65	289.10	285.35	281.50	278.35

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

COUNTERBORES CARBIDE TIPPED TYPES 512 & 514 FRACTIONAL

GENERAL PURPOSE

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

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

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)

TOOL DIAMETER		DIMENSIONS				TYPE 512		TYPE 514		BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
		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					
FRAC.	DEC.											1	2	3	4	5-7	8-14*
1/4	.2500	.1140	.0938	15/64	3 13/16	-	-	3	51408	$77.25	0.2381 - 0.2530	$120.90	$99.10	$91.85	$88.20	$84.50	$81.50
9/32	.2812	.1140	.0938	17/64	3 13/16	-	-	3	51409	94.45	0.2531 - 0.2840	137.95	116.30	109.00	105.40	101.75	98.70
5/16	.3125	.1140	.0938	19/64	3 13/16	-	-	3	51410	80.60	0.2841 - 0.3150	121.50	101.10	94.30	90.90	87.45	84.60
11/32	.3438	.1140	.0938	5/16	3 13/16	-	-	3	51411	102.05	0.3151 - 0.3470	142.90	122.40	115.60	112.25	108.80	105.90
3/8	.3750	.1820	.1562	5/16	4 1/16	-	-	3	51412	85.45	0.3471 - 0.3780	123.25	104.35	98.05	94.95	91.75	89.20
13/32	.4062	.1820	.1562	3/8	4 1/16	-	-	3	51413	96.35	0.3781 - 0.4090	134.10	115.30	108.95	105.85	102.65	100.10
7/16	.4375	.1820	.1562	3/8	4 1/16	-	-	3	51414	87.70	0.4091 - 0.4410	125.45	106.55	100.25	97.25	93.95	91.40
15/32	.4688	.2280	.1875	7/16	4 5/16	-	-	3	51415	107.05	0.4411 - 0.4720	144.80	125.90	119.70	116.60	113.30	110.75
1/2	.5000	.2280	.1875	7/16	4 5/16	4	51216	3	51416	97.35	0.4721 - 0.5030	135.05	116.10	109.95	106.75	103.60	101.05
17/32	.5312	.2280	.1875	1/2	4 5/16	4	51217	3	51417	110.15	0.5031 - 0.5340	147.90	129.10	122.80	119.70	116.45	113.85
9/16	.5625	.2280	.1875	1/2	4 5/16	4	51218	3	51418	100.20	0.5341 - 0.5660	137.95	119.05	112.80	109.60	106.50	103.80
19/32	.5938	.2280	.1875	1/2	5 1/8	4	51219	3	51419	111.35	0.5661 - 0.5970	149.05	130.20	123.95	120.80	117.55	115.00
5/8	.6250	.2280	.1875	1/2	5 1/8	4	51220	3	51420	101.20	0.5971 - 0.6280	138.90	119.95	113.70	110.65	107.40	104.85
21/32	.6562	.2280	.1875	1/2	5 1/8	4	51221	3	51421	117.80	0.6281 - 0.6590	155.50	136.70	130.35	127.25	124.10	121.50
11/16	.6875	.2280	.1875	1/2	5 1/8	4	51222	3	51422	107.15	0.6591 - 0.6910	144.90	126.00	119.75	116.65	113.50	110.80
23/32	.7188	.2900	.2500	1/2	5 3/8	4	51223	3	51423	120.60	0.6911 - 0.7220	158.25	139.45	133.15	130.15	126.85	124.30
3/4	.7500	.2900	.2500	1/2	5 3/8	4	51224	3	51424	109.55	0.7221 - 0.7530	147.35	128.45	122.15	119.05	115.90	113.20
25/32	.7812	.2900	.2500	5/8	5 3/8	4	51225	3	51425	123.20	0.7531 - 0.7840	160.85	141.95	135.75	132.60	129.35	126.80
13/16	.8125	.2900	.2500	5/8	5 3/8	4	51226	3	51426	111.85	0.7841 - 0.8160	149.60	130.70	124.45	121.25	118.20	115.60
27/32	.8438	.2900	.2500	3/4	5 3/8	4	51227	3	51427	130.40	0.8161 - 0.8470	168.20	149.25	143.05	139.90	136.75	134.10
7/8	.8750	.2900	.2500	3/4	5 3/8	4	51228	3	51428	118.60	0.8471 - 0.8780	156.35	137.50	131.25	128.05	124.90	122.25
29/32	.9062	.2900	.2500	3/4	6 1/8	4	51229	3	51429	133.05	0.8781 - 0.9090	170.85	151.95	145.65	142.60	139.40	136.80
15/16	.9375	.2900	.2500	3/4	6 1/8	4	51230	3	51430	121.05	0.9091 - 0.9410	158.85	139.90	133.65	130.50	127.30	124.70
31/32	.9688	.3530	.3125	3/4	6 3/8	4	51231	3	51431	136.95	0.9411 - 0.9720	174.65	155.75	149.50	146.40	143.25	140.65
1	1.0000	.3530	.3125	3/4	6 3/8	4	51232	3	51432	124.50	0.9721 - 1.0030	162.30	143.35	137.05	133.95	130.80	128.15
1 1/16	1.0625	.3530	.3125	3/4	6 3/8	4	51234	3	51434	125.80	1.0031 - 1.0660	163.60	144.65	138.35	135.35	132.10	129.50
1 1/8	1.1250	.3530	.3125	1	6 3/8	4	51236	3	51436	129.10	1.0661 - 1.1280	166.75	147.90	141.70	138.45	135.35	132.75
1 3/16	1.1875	.3530	.3125	1	6 3/8	4	51238	3	51438	134.75	1.1281 - 1.1905	172.45	153.70	147.40	144.25	141.05	138.45
1 1/4	1.2500	.4260	.3750	1	6 5/8	-	-	4	51440	150.10	1.1906 - 1.2530	190.95	170.60	163.75	160.40	156.85	154.20
1 5/16	1.3125	.4260	.3750	1	6 5/8	-	-	4	51442	162.00	1.2531 - 1.3155	203.00	182.55	175.65	172.30	168.85	166.05
1 3/8	1.3750	.4260	.3750	1	6 5/8	-	-	4	51444	170.50	1.3156 - 1.3780	211.35	190.85	184.00	180.60	177.25	174.40
1 7/16	1.4375	.4260	.3750	1 1/4	7 7/8	-	-	4	51446	186.85	1.3781 - 1.4405	231.25	209.05	201.60	197.90	194.25	191.15
1 1/2	1.5000	.4260	.3750	1 1/4	7 7/8	-	-	4	51448	216.00	1.4406 - 1.5030	262.15	239.00	231.35	227.65	223.70	220.50
1 9/16	1.5625	.4890	.4375	1 1/4	8 1/8	-	-	4	51450	222.35	1.5031 - 1.5660	268.55	245.40	237.70	233.90	230.05	226.90
1 5/8	1.6250	.4890	.4375	1 1/4	8 1/8	-	-	4	51452	227.00	1.5661 - 1.6280	273.20	250.10	242.50	238.65	234.75	231.60
1 11/16	1.6875	.4890	.4375	1 1/4	8 1/8	-	-	4	51454	271.65	1.6281 - 1.6910	321.40	296.55	288.20	284.05	279.90	276.45
1 3/4	1.7500	.4890	.4375	1 1/4	8 1/8	-	-	4	51456	271.65	1.6911 - 1.7530	321.40	296.55	288.20	284.05	279.90	276.45
1 13/16	1.8125	.4890	.4375	1 1/2	8 1/8	-	-	4	51458	321.55	1.7531 1.8160	371.35	346.50	338.20	334.10	329.75	326.45
1 7/8	1.8750	.4890	.4375	1 1/2	8 1/8	-	-	4	51460	321.55	1.8161 - 1.8780	371.35	346.50	338.20	334.10	329.75	326.45
1 15/16	1.9375	.4890	.4375	1 1/2	8 1/8	-	-	4	51462	351.40	1.8781 - 1.9410	401.30	376.40	368.05	363.85	359.70	356.30
2	2.0000	.5510	.5000	1 1/2	8 3/8	-	-	4	51464	351.40	1.9411 - 2.0030	401.30	376.40	368.05	363.85	359.70	356.30

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

COUNTERBORES CARBIDE TIPPED TYPES 512 & 514 METRIC

GENERAL PURPOSE

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							
											MODIFIED DIAMETER RANGE (mm)	PRICE EACH - BASED ON QUANTITY ORDERED						
mm	INCH	MIN CUT DIAM.	PILOT HOLE DIAM.	SHANK DIAM.	OVER-ALL LENGTH	NO. OF FLTS	METRIC EDP NO.	NO. OF FLTS	METRIC EDP NO.			1	2	3	4	5-7	8-14	OVER 14
6.0	.2362	.1140	.0938	15⁄64	3 13⁄16	-	-	3	514060	$91.85	6.000-6.426	$124.35	$102.55	$95.30	$91.85	$88.15	$85.25	$80.90
6.5	.2559	.1140	.0938	17⁄64	3 13⁄16	-	-	3	514065	109.00	6.427-7.214	141.55	119.75	112.50	109.00	105.35	102.40	98.05
7.0	.2756	.1140	.0938	17⁄64	3 13⁄16	-	-	3	514070	109.00	-	-	-	-	-	-	-	-
7.5	.2953	.1140	.0938	19⁄64	3 13⁄16	-	-	3	514075	94.30	7.215-8.001	124.80	104.35	97.50	94.30	90.85	88.05	84.00
8.0	.3150	.1140	.0938	19⁄64	3 13⁄16	-	-	3	514080	94.30	-	-	-	-	-	-	-	-
8.5	.3346	.1140	.0938	5⁄16	3 13⁄16	-	-	3	514085	115.60	8.002-8.814	146.20	125.70	118.85	115.60	112.15	109.35	105.40
9.0	.3543	.1820	.1562	5⁄16	4 1⁄16	-	-	3	514090	98.05	8.815-9.601	126.25	107.35	101.10	98.05	94.90	92.25	88.60
9.5	.3740	.1820	.1562	5⁄16	4 1⁄16	-	-	3	514095	98.05	-	-	-	-	-	-	-	-
10.0	.3937	.1820	.1562	3⁄8	4 1⁄16	-	-	3	514100	108.95	9.602-10.389	137.15	118.30	112.00	108.95	105.80	103.25	99.60
10.5	.4134	.1820	.1562	3⁄8	4 1⁄16	-	-	3	514105	100.25	10.390-11.201	128.45	109.55	103.30	100.25	97.15	94.50	90.85
11.0	.4331	.1820	.1562	3⁄8	4 1⁄16	-	-	3	514110	100.25	-	-	-	-	-	-	-	-
11.5	.4528	.2280	.1875	7⁄16	4 5⁄16	-	-	3	514115	119.70	11.202-11.989	147.75	128.95	122.70	119.70	116.45	113.85	110.15
12.0	.4724	.2280	.1875	7⁄16	4 5⁄16	4	512120	3	514120	109.95	11.990-12.776	138.10	119.25	112.95	109.95	106.70	104.15	100.35
12.5	.4921	.2280	.1875	7⁄16	4 5⁄16	4	512125	3	514125	109.95	-	-	-	-	-	-	-	-
13.0	.5118	.2280	.1875	1⁄2	4 5⁄16	4	512130	3	514130	122.80	12.777-13.564	150.90	132.05	125.75	122.80	119.55	117.00	113.20
13.5	.5315	.2280	.1875	1⁄2	4 5⁄16	4	512135	3	514135	122.80	-	-	-	-	-	-	-	-
14.0	.5512	.2280	.1875	1⁄2	4 5⁄16	4	512140	3	514140	112.80	13.565-14.376	140.95	122.10	115.85	112.80	109.55	107.00	103.30
14.5	.5709	.2280	.1875	1⁄2	5 1⁄8	4	512145	3	514145	123.95	14.377-15.164	152.10	133.15	126.85	123.95	120.70	118.15	114.35
15.0	.5906	.2280	.1875	1⁄2	5 1⁄8	4	512150	3	514150	123.95	-	-	-	-	-	-	-	-
15.5	.6102	.2280	.1875	1⁄2	5 1⁄8	4	512155	3	514155	113.70	15.165-15.951	141.90	123.15	116.80	113.70	110.60	107.95	104.30
16.0	.6299	.2280	.1875	1⁄2	5 1⁄8	4	512160	3	514160	130.35	15.952-16.739	158.50	139.65	133.35	130.35	127.20	124.60	120.95
16.5	.6496	.2280	.1875	1⁄2	5 1⁄8	4	512165	3	514165	130.35	-	-	-	-	-	-	-	-
17.0	.6693	.2280	.1875	1⁄2	5 1⁄8	4	512170	3	514170	119.75	16.740-17.551	147.90	129.10	122.80	119.75	116.60	113.95	110.25
17.5	.6890	.2280	.1875	1⁄2	5 1⁄8	4	512175	3	514175	119.75	-	-	-	-	-	-	-	-
18.0	.7087	.2900	.2500	1⁄2	5 3⁄8	4	512180	3	514180	133.15	17.552-18.339	161.40	142.50	136.20	133.15	130.00	127.40	123.65
18.5	.7283	.2900	.2500	1⁄2	5 3⁄8	4	512185	3	514185	122.15	18.340-19.126	150.30	131.50	125.20	122.15	118.95	116.30	112.70
19.0	.7480	.2900	.2500	1⁄2	5 3⁄8	4	512190	3	514190	122.15	-	-	-	-	-	-	-	-
19.5	.7677	.2900	.2500	5⁄8	5 3⁄8	4	512195	3	514195	135.75	19.127-19.914	163.85	145.05	138.75	135.75	132.55	129.90	126.25
20.0	.7874	.2900	.2500	5⁄8	5 3⁄8	4	512200	3	514200	124.45	19.915-20.726	152.60	133.80	127.45	124.45	121.20	118.70	115.00
20.5	.8071	.2900	.2500	5⁄8	5 3⁄8	4	512205	3	514205	124.45	-	-	-	-	-	-	-	-
21.0	.8268	.2900	.2500	3⁄4	5 3⁄8	4	512210	3	514210	143.05	20.727-21.514	171.20	152.35	146.15	143.05	139.80	137.20	133.55
21.5	.8465	.2900	.2500	3⁄4	5 3⁄8	4	512215	3	514215	143.05	-	-	-	-	-	-	-	-
22.0	.8661	.2900	.2500	3⁄4	5 3⁄8	4	512220	3	514220	131.25	21.515-22.301	159.40	140.55	134.20	131.25	128.00	125.45	121.75
22.5	.8858	.2900	.2500	3⁄4	6 1⁄8	4	512225	3	514225	145.65	22.302-23.089	173.85	155.00	148.70	145.65	142.50	139.90	136.20
23.0	.9055	.2900	.2500	3⁄4	6 1⁄8	4	512230	3	514230	145.65	-	-	-	-	-	-	-	-
23.5	.9252	.2900	.2500	3⁄4	6 1⁄8	4	512235	3	514235	133.65	23.090-23.901	161.80	142.95	136.70	133.65	130.40	127.85	124.15
24.0	.9449	.3530	.3125	3⁄4	6 3⁄8	4	512240	3	514240	149.50	23.902-24.689	177.65	158.90	152.55	149.50	146.35	143.85	140.00
24.5	.9646	.3530	.3125	3⁄4	6 3⁄8	4	512245	3	514245	149.50	-	-	-	-	-	-	-	-
25.0	.9843	.3530	.3125	3⁄4	6 3⁄8	4	512250	3	514250	137.05	24.690-25.476	165.30	146.40	140.15	137.05	133.90	131.40	127.70
25.5	1.0039	.3530	.3125	3⁄4	6 3⁄8	4	512255	3	514255	138.35	25.477-27.076	166.55	147.70	141.45	138.35	135.25	132.70	128.95
26.0	1.0236	.3530	.3125	3⁄4	6 3⁄8	4	512260	3	514260	138.35	-	-	-	-	-	-	-	-
27.0	1.0630	.3530	.3125	3⁄4	6 3⁄8	4	512270	3	514270	138.35	-	-	-	-	-	-	-	-
28.0	1.1024	.3530	.3125	1	6 3⁄8	4	512280	3	514280	141.70	27.077-28.651	169.85	150.90	144.60	141.70	138.35	135.85	132.10
29.0	1.1417	.3530	.3125	1	6 3⁄8	4	512290	3	514290	147.40	28.652 30.239	175.45	156.70	150.35	147.40	144.20	141.70	137.95
30.0	1.1811	.3530	.3125	1	6 3⁄8	4	512300	3	514300	147.40	-	-	-	-	-	-	-	-
31.0	1.2205	.4260	.3750	1	6 5⁄8	-	-	4	514310	163.75	30.240-31.826	194.30	173.85	167.05	163.75	160.30	157.45	153.50
32.0	1.2598	.4260	.3750	1	6 5⁄8	-	-	4	514320	175.65	31.827-33.414	206.25	185.75	179.00	175.65	172.25	169.45	165.40
33.0	1.2992	.4260	.3750	1	6 5⁄8	-	-	4	514330	175.65	-	-	-	-	-	-	-	-
34.0	1.3386	.4260	.3750	1	6 5⁄8	-	-	4	514340	184.00	33.415-35.001	214.55	194.20	187.25	184.00	180.55	177.70	173.70
35.0	1.3780	.4260	.3750	1	6 5⁄8	-	-	4	514350	184.00	-	-	-	-	-	-	-	-
36.0	1.4173	.4260	.3750	1 1⁄4	7 7⁄8	-	-	4	514360	201.60	35.002-36.589	234.80	212.70	205.15	201.60	197.80	194.80	190.50
37.0	1.4567	.4260	.3750	1 1⁄4	7 7⁄8	-	-	4	514370	222.95	36.590-38.176	256.20	234.00	226.60	222.95	219.25	216.15	211.85
38.0	1.4961	.4260	.3750	1 1⁄4	7 7⁄8	-	-	4	514380	222.95	-	-	-	-	-	-	-	-

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

COUNTERBORES CARBIDE TIPPED TYPES 516 & 518 FRACTIONAL

GENERAL PURPOSE

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

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

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)

TOOL DIAMETER		DIMENSIONS				TYPE 518		TYPE 516		BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
		MIN CUT DIAM.	PILOT HOLE DIAM.	TAPER SHANK NO.	OVER-ALL LENGTH	NO. OF FLTS	EDP NO.	NO. OF FLTS	EDP NO.		MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.											1	2	3	4	5-7	8-14*
1/4	.2500	.1140	.0938	1	3 13/16	-	-	3	51608	$93.75	0.2381-0.2530	$139.00	$116.40	$108.85	$105.10	$101.30	$98.20
9/32	.2812	.1140	.0938	1	3 13/16	-	-	3	51609	112.85	0.2531-0.2840	157.95	135.30	127.80	124.10	120.40	117.15
5/16	.3125	.1140	.0938	1	3 13/16	-	-	3	51610	96.35	0.2841-0.3150	138.80	117.55	110.55	107.05	103.40	100.50
11/32	.3438	.1140	.0938	1	3 13/16	-	-	3	51611	118.75	0.3151-0.3470	161.20	139.90	132.80	129.35	125.75	122.85
3/8	.3750	.1820	.1562	1	4 1/16	-	-	3	51612	99.50	0.3471-0.3780	138.50	119.05	112.45	109.30	106.00	103.35
13/32	.4062	.1820	.1562	1	4 1/16	-	-	3	51613	112.35	0.3781-0.4090	151.50	131.90	125.45	122.15	118.90	116.20
7/16	.4375	.1820	.1562	1	4 1/16	-	-	3	51614	102.15	0.4091-0.4410	141.20	121.70	115.15	112.00	108.70	106.00
15/32	.4688	.2280	.1875	1	4 5/16	-	-	3	51615	124.05	0.4411-0.4720	163.15	143.55	137.05	133.85	130.60	127.90
1/2	.5000	.2280	.1875	1	4 5/16	4	51816	3	51616	112.80	0.4721-0.5030	152.00	132.35	125.75	122.70	119.25	116.60
17/32	.5312	.2280	.1875	1	4 5/16	4	51817	3	51617	126.30	0.5031-0.5340	165.40	145.85	139.30	136.10	132.80	130.15
9/16	.5625	.2280	.1875	1	4 5/16	4	51818	3	51618	114.85	0.5341-0.5660	154.00	134.40	127.95	124.65	121.45	118.75
19/32	.5938	.2280	.1875	2	5 1/8	4	51819	3	51619	129.75	0.5661-0.5970	168.95	149.35	142.85	139.60	136.35	133.60
5/8	.6250	.2280	.1875	2	5 1/8	4	51820	3	51620	117.95	0.5971-0.6280	157.00	137.55	130.95	127.85	124.40	121.75
21/32	.6562	.2280	.1875	2	5 1/8	4	51821	3	51621	137.00	0.6281-0.6590	176.15	156.60	150.00	146.90	143.50	140.85
11/16	.6875	.2280	.1875	2	5 1/8	4	51822	3	51622	124.40	0.6591-0.6910	163.65	144.00	137.55	134.25	130.95	128.30
23/32	.7188	.2900	.2500	2	5 3/8	4	51823	3	51623	139.25	0.6911-0.7220	178.40	158.85	152.30	149.15	145.80	143.15
3/4	.7500	.2900	.2500	2	5 3/8	4	51824	3	51624	126.60	0.7221-0.7530	165.65	146.15	139.60	136.45	133.05	130.30
25/32	.7812	.2900	.2500	2	5 3/8	4	51825	3	51625	141.65	0.7531-0.7840	180.70	161.20	154.60	151.40	148.10	145.45
13/16	.8125	.2900	.2500	2	5 3/8	4	51826	3	51626	128.75	0.7841-0.8160	167.85	148.35	141.85	138.50	135.30	132.60
27/32	.8438	.2900	.2500	2	5 3/8	4	51827	3	51627	148.85	0.8161-0.8470	188.05	168.50	162.00	158.80	155.50	152.80
7/8	.8750	.2900	.2500	2	5 3/8	4	51828	3	51628	135.35	0.8471-0.8780	174.50	154.90	148.45	145.15	141.90	139.15
29/32	.9062	.2900	.2500	3	6 1/8	4	51829	3	51629	152.95	0.8781-0.9090	192.05	172.45	166.05	162.70	159.50	156.80
15/16	.9375	.2900	.2500	3	6 1/8	4	51830	3	51630	139.05	0.9091-0.9410	178.15	158.60	152.10	148.80	145.65	142.90
31/32	.9688	.3530	.3125	3	6 3/8	4	51831	3	51631	156.55	0.9411-0.9720	195.60	176.10	169.55	166.35	162.95	160.25
1	1.0000	.3530	.3125	3	6 3/8	4	51832	3	51632	147.65	0.9721-1.0030	188.30	167.95	161.20	157.90	154.35	151.60
1 1/16	1.0625	.3530	.3125	3	6 3/8	4	51834	3	51634	149.60	1.0031-1.0660	190.10	169.85	163.10	159.75	156.25	153.50
1 1/8	1.1250	.3530	.3125	3	6 3/8	4	51836	3	51636	154.30	1.0661-1.1280	194.95	174.70	167.80	164.50	161.05	158.30
1 3/16	1.1875	.3530	.3125	3	6 3/8	4	51838	3	51638	159.55	1.1281-1.1905	200.30	179.90	173.05	169.80	166.35	163.55
1 1/4	1.2500	.4260	.3750	3	6 5/8	-	-	4	51640	177.40	1.1906-1.2530	221.40	199.40	192.05	188.45	184.75	181.65
1 5/16	1.3125	.4260	.3750	3	6 5/8	-	-	4	51642	190.10	1.2531-1.3155	234.30	212.10	204.85	201.15	197.55	194.45
1 3/8	1.3750	.4260	.3750	3	6 5/8	-	-	4	51644	199.25	1.3156-1.3780	243.25	221.25	213.90	210.25	206.65	203.50
1 7/16	1.4375	.4260	.3750	4	7 7/8	-	-	4	51646	221.65	1.3781-1.4405	269.55	245.60	237.50	233.60	229.60	226.30
1 1/2	1.5000	.4260	.3750	4	7 7/8	-	-	4	51648	245.70	1.4406-1.5030	293.60	269.70	261.70	257.75	253.75	250.45
1 9/16	1.5625	.4890	.4375	4	8 1/8	-	-	4	51650	264.00	1.5031-1.5660	314.15	289.15	280.85	276.60	272.45	269.05
1 5/8	1.6250	.4890	.4375	4	8 1/8	-	-	4	51652	268.75	1.5661-1.6280	318.85	293.90	285.50	281.35	277.10	273.75
1 11/16	1.6875	.4890	.4375	4	8 1/8	-	-	4	51654	321.55	1.6281-1.6910	375.75	348.70	339.70	335.25	330.60	326.90
1 3/4	1.7500	.4890	.4375	4	8 1/8	-	-	4	51656	321.55	1.6911-1.7530	375.75	348.70	339.70	335.25	330.60	326.90
1 13/16	1.8125	.4890	.4375	4	8 1/8	-	-	4	51658	380.60	1.7531-1.8160	434.70	407.70	398.65	394.15	389.60	385.80
1 7/8	1.8750	.4890	.4375	4	8 1/8	-	-	4	51660	380.60	1.8161-1.8780	434.70	407.70	398.65	394.15	389.60	385.80
1 15/16	1.9375	.4890	.4375	4	8 1/8	-	-	4	51662	415.85	1.8781-1.9410	470.05	442.95	433.85	429.45	424.90	421.15
2	2.0000	.5510	.5000	4	8 3/8	-	-	4	51664	415.85	1.9411-2.0030	470.05	442.95	433.85	429.45	424.90	421.15

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

COUNTERBORES CARBIDE TIPPED TYPES 516 & 518 METRIC

GENERAL PURPOSE

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 13/16	-	-	3	516060	$108.85	6.000-6.426	$142.60	$119.95	$112.45	$108.85	$105.05	$101.90	$97.50
6.5	.2559	.1140	.0938	1	3 13/16	-	-	3	516065	127.80	6.427-7.214	161.55	139.00	131.40	127.80	124.05	120.95	116.50
7.0	.2756	.1140	.0938	1	3 13/16	-	-	3	516070	127.80	-	-	-	-	-	-	-	-
7.5	.2953	.1140	.0938	1	3 13/16	-	-	3	516075	110.55	7.215-8.001	142.20	121.00	113.85	110.55	106.95	103.95	99.80
8.0	.3150	.1140	.0938	1	3 13/16	-	-	3	516080	110.55	-	-	-	-	-	-	-	-
8.5	.3346	.1140	.0938	1	3 13/16	-	-	3	516085	132.80	8.002-8.814	164.60	143.35	136.35	132.80	129.30	126.40	122.15
9.0	.3543	.1820	.1562	1	4 1/16	-	-	3	516090	112.45	8.815-9.601	141.75	122.15	115.65	112.45	109.15	106.50	102.65
9.5	.3740	.1820	.1562	1	4 1/16	-	-	3	516095	112.45	-	-	-	-	-	-	-	-
10.0	.3937	.1820	.1562	1	4 1/16	-	-	3	516100	125.45	9.602-10.389	154.60	135.10	128.60	125.45	122.05	119.30	115.60
10.5	.4134	.1820	.1562	1	4 1/16	-	-	3	516105	115.15	10.390-11.201	144.45	124.85	118.35	115.15	111.85	109.15	105.30
11.0	.4331	.1820	.1562	1	4 1/16	-	-	3	516110	115.15	-	-	-	-	-	-	-	-
11.5	.4528	.2280	.1875	1	4 5/16	-	-	3	516115	137.05	11.202-11.989	166.35	146.80	140.25	137.05	133.80	131.00	127.15
12.0	.4724	.2280	.1875	1	4 5/16	4	518120	3	516120	125.75	11.990-12.776	155.15	135.45	128.95	125.75	122.65	119.85	116.00
12.5	.4921	.2280	.1875	1	4 5/16	4	518125	3	516125	125.75	-	-	-	-	-	-	-	-
13.0	.5118	.2280	.1875	1	4 5/16	4	518130	3	516130	139.30	12.777-13.564	168.60	149.10	142.45	139.30	136.05	133.35	129.50
13.5	.5315	.2280	.1875	1	4 5/16	4	518135	3	516135	139.30	-	-	-	-	-	-	-	-
14.0	.5512	.2280	.1875	1	4 5/16	4	518140	3	516140	127.95	13.565-14.376	157.20	137.65	131.00	127.95	124.50	121.85	118.05
14.5	.5709	.2280	.1875	2	5 1/8	4	518145	3	516145	142.85	14.377-15.164	172.15	152.40	145.90	142.85	139.55	136.75	132.95
15.0	.5906	.2280	.1875	2	5 1/8	4	518150	3	516150	142.85	-	-	-	-	-	-	-	-
15.5	.6102	.2280	.1875	2	5 1/8	4	518155	3	516155	130.95	15.165-15.951	160.20	140.65	134.10	130.95	127.75	125.05	121.15
16.0	.6299	.2280	.1875	2	5 1/8	4	518160	3	516160	150.00	15.952-16.739	179.30	159.65	153.15	150.00	146.80	144.00	140.25
16.5	.6496	.2280	.1875	2	5 1/8	4	518165	3	516165	150.00	-	-	-	-	-	-	-	-
17.0	.6693	.2280	.1875	2	5 1/8	4	518170	3	516170	137.55	16.740-17.551	166.70	147.15	140.65	137.55	134.20	131.50	127.75
17.5	.6890	.2280	.1875	2	5 1/8	4	518175	3	516175	137.55	-	-	-	-	-	-	-	-
18.0	.7087	.2900	.2500	2	5 3/8	4	518180	3	516180	152.30	17.552-18.339	181.55	162.00	155.50	152.30	149.10	146.30	142.45
18.5	.7283	.2900	.2500	2	5 3/8	4	518185	3	516185	139.60	18.340-19.126	168.85	149.25	142.70	139.60	136.35	133.60	129.75
19.0	.7480	.2900	.2500	2	5 3/8	4	518190	3	516190	139.60	-	-	-	-	-	-	-	-
19.5	.7677	.2900	.2500	2	5 3/8	4	518195	3	516195	154.60	19.127-19.914	183.90	164.25	157.85	154.60	151.35	148.65	144.80
20.0	.7874	.2900	.2500	2	5 3/8	4	518200	3	516200	141.85	19.915-20.726	171.05	151.50	144.90	141.85	138.45	135.85	132.00
20.5	.8071	.2900	.2500	2	5 3/8	4	518205	3	516205	141.85	-	-	-	-	-	-	-	-
21.0	.8268	.2900	.2500	2	5 3/8	4	518210	3	516210	162.00	20.727-21.514	191.30	171.65	165.15	162.00	158.70	156.00	152.15
21.5	.8465	.2900	.2500	2	5 3/8	4	518215	3	516215	162.00	-	-	-	-	-	-	-	-
22.0	.8661	.2900	.2500	2	5 3/8	4	518220	3	516220	148.45	21.515-22.301	177.60	158.10	151.60	148.45	145.05	142.40	138.50
22.5	.8858	.2900	.2500	3	6 1/8	4	518225	3	516225	166.05	22.302-23.089	195.25	175.70	169.10	166.05	162.65	160.00	156.10
23.0	.9055	.2900	.2500	3	6 1/8	4	518230	3	516230	166.05	-	-	-	-	-	-	-	-
23.5	.9252	.2900	.2500	3	6 1/8	4	518235	3	516235	152.10	23.090-23.901	181.35	161.75	155.25	152.10	148.75	146.15	142.25
24.0	.9449	.3530	.3125	3	6 3/8	4	518240	3	516240	169.55	23.902-24.689	198.80	179.15	172.65	169.55	166.30	163.55	159.65
24.5	.9646	.3530	.3125	3	6 3/8	4	518245	3	516245	169.55	-	-	-	-	-	-	-	-
25.0	.9843	.3530	.3125	3	6 3/8	4	518250	3	516250	155.35	24.690-25.476	184.55	165.00	158.45	155.35	152.05	149.35	145.60
25.5	1.0039	.3530	.3125	3	6 3/8	4	518255	3	516255	163.10	25.477-27.076	193.45	173.05	166.35	163.10	159.65	156.85	152.85
26.0	1.0236	.3530	.3125	3	6 3/8	4	518260	3	516260	163.10	-	-	-	-	-	-	-	-
27.0	1.0630	.3530	.3125	3	6 3/8	4	518270	3	516270	163.10	-	-	-	-	-	-	-	-
28.0	1.1024	.3530	.3125	3	6 3/8	4	518280	3	516280	167.80	27.077-28.651	198.20	177.90	171.15	167.80	164.40	161.70	157.65
29.0	1.1417	.3530	.3125	3	6 3/8	4	518290	3	516290	173.05	28.652-30.239	203.45	183.20	176.40	173.05	169.70	166.95	162.95
30.0	1.1811	.3530	.3125	3	6 3/8	4	518300	3	516300	173.05	-	-	-	-	-	-	-	-
31.0	1.2205	.4260	.3750	3	6 5/8	-	-	4	516310	192.05	30.240-31.826	224.95	202.95	195.60	192.05	188.40	185.40	180.95
32.0	1.2598	.4260	.3750	3	6 5/8	-	-	4	516320	204.85	31.827-33.414	237.85	215.75	208.40	204.85	201.10	198.15	193.75
33.0	1.2992	.4260	.3750	3	6 5/8	-	-	4	516330	204.85	-	-	-	-	-	-	-	-
34.0	1.3386	.4260	.3750	3	6 5/8	-	-	4	516340	213.90	33.415-35.001	246.90	224.80	217.40	213.90	210.20	207.25	202.80
35.0	1.3780	.4260	.3750	3	6 5/8	-	-	4	516350	213.90	-	-	-	-	-	-	-	-
36.0	1.4173	.4260	.3750	4	7 7/8	-	-	4	516360	237.50	35.002-36.589	273.35	249.40	241.45	237.50	233.55	230.35	225.50
37.0	1.4567	.4260	.3750	4	7 7/8	-	-	4	516370	261.70	36.590-38.176	297.45	273.55	265.50	261.70	257.70	254.35	249.70
38.0	1.4961	.4260	.3750	4	7 7/8	-	-	4	516380	261.70	-	-	-	-	-	-	-	-

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

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						
											MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.	MIN CUT DIAM.	PILOT HOLE DIAM.	OVER-ALL LENGTH	NO. OF FLTS	SHANK DIAM.	STEEL EDP NO.	TAPER SHANK NO.	STEEL EDP NO.			1	2	3	4	5-7	8-14*
1/4	.2500	.1140	.0938	3 13/16	3	15/64	51008	1	51108	$93.75	0.2381 - 0.2530	$139.00	$116.40	$108.85	$105.10	$101.30	$98.20
9/32	.2812	.1140	.0938	3 13/16	3	17/64	51009	1	51109	112.85	0.2531 - 0.2840	157.95	135.30	127.80	124.10	120.40	117.15
5/16	.3125	.1140	.0938	3 13/16	3	19/64	51010	1	51110	96.35	0.2841 - 0.3150	138.80	117.55	110.55	107.05	103.40	100.50
11/32	.3438	.1140	.0938	3 13/16	3	5/16	51011	1	51111	118.75	0.3151 - 0.3470	161.20	139.90	132.80	129.35	125.75	122.85
3/8	.3750	.1820	.1562	4 1/16	3	5/16	51012	1	51112	99.50	0.3471 - 0.3780	138.50	119.05	112.45	109.30	106.00	103.35
13/32	.4062	.1820	.1562	4 1/16	3	3/8	51013	1	51113	112.35	0.3781 - 0.4090	151.50	131.90	125.45	122.15	118.90	116.20
7/16	.4375	.1820	.1562	4 1/16	3	3/8	51014	1	51114	102.15	0.4091 - 0.4410	141.20	121.70	115.15	112.00	108.70	106.00
15/32	.4688	.2280	.1875	4 5/16	3	7/16	51015	1	51115	124.05	0.4411 - 0.4720	163.15	143.55	137.05	133.85	130.60	127.90
1/2	.5000	.2280	.1875	4 5/16	3	7/16	51016	1	51116	112.80	0.4721 - 0.5030	152.00	132.35	125.75	122.70	119.25	116.60
17/32	.5312	.2280	.1875	4 5/16	3	1/2	51017	1	51117	121.75	0.5031 - 0.5340	159.45	140.60	134.30	131.25	128.00	125.45
9/16	.5625	.2280	.1875	4 5/16	3	1/2	51018	1	51118	110.70	0.5341 - 0.5660	148.45	129.50	123.30	120.05	117.00	114.35
19/32	.5938	.2280	.1875	5 1/8	3	1/2	51019	2	51119	125.05	0.5661 - 0.5970	162.75	143.95	137.65	134.50	131.40	128.70
5/8	.6250	.2280	.1875	5 1/8	3	1/2	51020	2	51120	113.65	0.5971 - 0.6280	151.40	132.55	126.25	123.20	119.90	117.35
21/32	.6562	.2280	.1875	5 1/8	3	1/2	51021	2	51121	132.00	0.6281 - 0.6590	169.70	150.85	144.55	141.45	138.25	135.75
11/16	.6875	.2280	.1875	5 1/8	3	1/2	51022	2	51122	119.90	0.6591 - 0.6910	157.70	138.80	132.55	129.35	126.25	123.55
23/32	.7188	.2900	.2500	5 3/8	3	1/2	51023	2	51123	134.20	0.6911 - 0.7220	171.95	153.10	146.85	143.70	140.55	137.95
3/4	.7500	.2900	.2500	5 3/8	3	1/2	51024	2	51124	122.00	0.7221 - 0.7530	159.65	140.75	134.50	131.45	128.15	125.60
25/32	.7812	.2900	.2500	5 3/8	3	5/8	51025	2	51125	136.50	0.7531 - 0.7840	174.15	155.35	149.05	145.85	142.75	140.15
13/16	.8125	.2900	.2500	5 3/8	3	5/8	51026	2	51126	124.10	0.7841 - 0.8160	161.80	142.95	136.70	133.55	130.35	127.80
27/32	.8438	.2900	.2500	5 3/8	3	3/4	51027	2	51127	143.45	0.8161 - 0.8470	181.30	162.40	156.10	152.95	149.85	147.20
7/8	.8750	.2900	.2500	5 3/8	3	3/4	51028	2	51128	130.40	0.8471 - 0.8780	168.20	149.25	143.05	139.90	136.75	134.10
29/32	.9062	.2900	.2500	6 1/8	3	3/4	51029	3	51129	147.40	0.8781 - 0.9090	185.05	166.20	160.00	156.80	153.70	151.10
15/16	.9375	.2900	.2500	6 1/8	3	3/4	51030	3	51130	133.95	0.9091 - 0.9410	171.65	152.80	146.50	143.40	140.30	137.70
31/32	.9688	.3530	.3125	6 3/8	3	3/4	51031	3	51131	150.80	0.9411 - 0.9720	188.45	169.65	163.35	160.25	156.95	154.45
1	1.0000	.3530	.3125	6 3/8	3	3/4	51032	3	51132	142.25	0.9721 - 1.0030	181.50	161.90	155.35	152.15	148.70	146.15
1 1/16	1.0625	.3530	.3125	6 3/8	3	3/4	51034	3	51134	144.15	1.0031 - 1.0660	183.20	163.65	157.15	153.90	150.60	147.95
1 1/8	1.1250	.3530	.3125	6 3/8	3	1	51036	3	51136	148.65	1.0661 - 1.1280	187.85	168.35	161.75	158.50	155.20	152.55
1 3/16	1.1875	.3530	.3125	6 3/8	3	1	51038	3	51138	153.75	1.1281 - 1.1905	193.00	173.40	166.80	163.60	160.25	157.65
1 1/4	1.2500	.4260	.3750	6 5/8	4	1	51040	3	51140	170.95	1.1906 - 1.2530	213.35	192.10	185.05	181.60	178.00	175.10
1 5/16	1.3125	.4260	.3750	6 5/8	4	1	51042	3	51142	183.20	1.2531 - 1.3155	225.75	204.45	197.45	193.85	190.35	187.40
1 3/8	1.3750	.4260	.3750	6 5/8	4	1	51044	3	51144	192.00	1.3156 - 1.3780	234.40	213.20	206.15	202.65	199.05	196.10
1 7/16	1.4375	.4260	.3750	7 7/8	4	1 1/4	51046	4	51146	213.50	1.3781 - 1.4405	259.75	236.70	228.90	225.20	221.25	218.05
1 1/2	1.5000	.4260	.3750	7 7/8	4	1 1/4	51048	4	51148	245.70	1.4406 - 1.5030	293.60	269.70	261.70	257.75	253.75	250.45
1 9/16	1.5625	.4890	.4375	8 1/8	4	1 1/4	51050	4	51150	264.00	1.5031 - 1.5660	314.15	289.15	280.85	276.60	272.45	269.05
1 5/8	1.6250	.4890	.4375	8 1/8	4	1 1/4	51052	4	51152	268.75	1.5661 - 1.6280	318.85	293.90	285.50	281.35	277.10	273.75
1 11/16	1.6875	.4890	.4375	8 1/8	4	1 1/4	51054	4	51154	321.55	1.6281 - 1.6910	375.75	348.70	339.70	335.25	330.60	326.90
1 3/4	1.7500	.4890	.4375	8 1/8	4	1 1/4	51056	4	51156	321.55	1.6911 - 1.7530	375.75	348.70	339.70	335.25	330.60	326.90
1 13/16	1.8125	.4890	.4375	8 1/8	4	1 1/2	51058	4	51158	380.60	1.7531 - 1.8160	434.70	407.70	398.65	394.15	389.60	385.80
1 7/8	1.8750	.4890	.4375	8 1/8	4	1 1/2	51060	4	51160	380.60	1.8161 - 1.8780	434.70	407.70	398.65	394.15	389.60	385.80
1 15/16	1.9375	.4890	.4375	8 1/8	4	1 1/2	51062	4	51162	415.85	1.8781 - 1.9410	470.05	442.95	433.85	429.45	424.90	421.15
2	2.0000	.5510	.5000	8 3/8	4	1 1/2	51064	4	51164	415.85	1.9411 - 2.0030	470.05	442.95	433.85	429.45	424.90	421.15

*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 13/16	3	15/64	510060	1	511060	$108.85	6.000-6.426	$142.60	$119.95	$112.45	$108.85	$105.05	$101.90	$97.50
6.5	.2559	.1140	.0938	3 13/16	3	17/64	510065	1	511065	127.80	6.427-7.214	161.55	139.00	131.40	127.80	124.05	120.95	116.50
7.0	.2756	.1140	.0938	3 13/16	3	17/64	510070	1	511070	127.80	-	-	-	-	-	-	-	-
7.5	.2953	.1140	.0938	3 13/16	3	19/64	510075	1	511075	110.55	7.215-8.001	142.20	121.00	113.85	110.55	106.95	103.95	99.80
8.0	.3150	.1140	.0938	3 13/16	3	19/64	510080	1	511080	110.55	-	-	-	-	-	-	-	-
8.5	.3346	.1140	.0938	3 13/16	3	5/16	510085	1	511085	132.80	8.002-8.814	164.60	143.35	136.35	132.80	129.30	126.40	122.15
9.0	.3543	.1820	.1562	4 1/16	3	5/16	510090	1	511090	112.45	8.815-9.601	141.75	122.15	115.65	112.45	109.15	106.50	102.65
9.5	.3740	.1820	.1562	4 1/16	3	5/16	510095	1	511095	112.45	-	-	-	-	-	-	-	-
10.0	.3937	.1820	.1562	4 1/16	3	3/8	510100	1	511100	125.45	9.602-10.389	154.60	135.10	128.60	125.45	122.05	119.30	115.60
10.5	.4134	.1820	.1562	4 1/16	3	3/8	510105	1	511105	115.15	10.390-11.201	144.45	124.85	118.35	115.15	111.85	109.15	105.30
11.0	.4331	.1820	.1562	4 1/16	3	3/8	510110	1	511110	115.15	-	-	-	-	-	-	-	-
11.5	.4528	.2280	.1875	4 5/16	3	7/16	510115	1	511115	137.05	11.202-11.989	166.35	146.80	140.25	137.05	133.80	131.00	127.15
12.0	.4724	.2280	.1875	4 5/16	3	7/16	510120	1	511120	125.75	11.990-12.776	155.15	135.45	128.95	125.75	122.65	119.85	116.00
12.5	.4921	.2280	.1875	4 5/16	3	7/16	510125	1	511125	125.75	-	-	-	-	-	-	-	-
13.0	.5118	.2280	.1875	4 5/16	3	1/2	510130	1	511130	134.30	12.777-13.564	162.50	143.65	137.25	134.30	131.15	128.55	124.80
13.5	.5315	.2280	.1875	4 5/16	3	1/2	510135	1	511135	134.30	-	-	-	-	-	-	-	-
14.0	.5512	.2280	.1875	4 5/16	3	1/2	510140	1	511140	123.30	13.565-14.376	151.45	132.60	126.30	123.30	120.00	117.45	113.75
14.5	.5709	.2280	.1875	5 1/8	3	1/2	510145	2	511145	137.65	14.377-15.164	165.85	146.95	140.65	137.65	134.45	131.80	128.10
15.0	.5906	.2280	.1875	5 1/8	3	1/2	510150	2	511150	137.65	-	-	-	-	-	-	-	-
15.5	.6102	.2280	.1875	5 1/8	3	1/2	510155	2	511155	126.25	15.165-15.951	154.40	135.55	129.25	126.25	123.15	120.50	116.80
16.0	.6299	.2280	.1875	5 1/8	3	1/2	510160	2	511160	126.25	15.952-16.739	154.40	135.55	129.25	126.25	123.15	120.50	116.80
16.5	.6496	.2280	.1875	5 1/8	3	1/2	510165	2	511165	144.55	-	-	-	-	-	-	-	-
17.0	.6693	.2280	.1875	5 1/8	3	1/2	510170	2	511170	132.55	16.740-17.551	160.65	141.85	135.55	132.55	129.30	126.70	123.15
17.5	.6890	.2280	.1875	5 1/8	3	1/2	510175	2	511175	132.55	-	-	-	-	-	-	-	-
18.0	.7087	.2900	.2500	5 3/8	3	1/2	510180	2	511180	146.85	17.552-18.339	174.95	156.10	149.85	146.85	143.65	141.00	137.25
18.5	.7283	.2900	.2500	5 3/8	3	1/2	510185	2	511185	134.50	18.340-19.126	162.70	143.90	137.55	134.50	131.40	128.70	125.05
19.0	.7480	.2900	.2500	5 3/8	3	1/2	510190	2	511190	134.50	-	-	-	-	-	-	-	-
19.5	.7677	.2900	.2500	5 3/8	3	5/8	510195	2	511195	149.05	19.127-19.914	177.25	158.25	152.10	149.05	145.80	143.25	139.55
20.0	.7874	.2900	.2500	5 3/8	3	5/8	510200	2	511200	136.70	19.915-20.726	164.85	146.00	139.65	136.70	133.50	130.85	127.20
20.5	.8071	.2900	.2500	5 3/8	3	5/8	510205	2	511205	136.70	-	-	-	-	-	-	-	-
21.0	.8268	.2900	.2500	5 3/8	3	3/4	510210	2	511210	156.10	20.727-21.514	184.30	165.40	159.10	156.10	152.90	150.30	146.55
21.5	.8465	.2900	.2500	5 3/8	3	3/4	510215	2	511215	156.10	-	-	-	-	-	-	-	-
22.0	.8661	.2900	.2500	5 3/8	3	3/4	510220	2	511220	143.05	21.515-22.301	171.20	152.35	146.15	143.05	139.80	137.20	133.55
22.5	.8858	.2900	.2500	6 1/8	3	3/4	510225	3	511225	160.00	22.302-23.089	188.20	169.30	162.95	160.00	156.75	154.25	150.45
23.0	.9055	.2900	.2500	6 1/8	3	3/4	510230	3	511230	160.00	-	-	-	-	-	-	-	-
23.5	.9252	.2900	.2500	6 1/8	3	3/4	510235	3	511235	146.50	23.090-23.901	174.70	155.80	149.60	146.50	143.35	140.75	137.05
24.0	.9449	.3530	.3125	6 3/8	3	3/4	510240	3	511240	163.35	23.902-24.689	191.50	172.70	166.35	163.35	160.20	157.65	153.85
24.5	.9646	.3530	.3125	6 3/8	3	3/4	510245	3	511245	163.35	-	-	-	-	-	-	-	-
25.0	.9843	.3530	.3125	6 3/8	3	3/4	510250	3	511250	149.65	24.690-25.476	177.85	159.00	152.70	149.65	146.45	143.95	140.25
25.5	1.0039	.3530	.3125	6 3/8	3	3/4	510255	3	511255	157.15	25.477-27.076	186.35	166.80	160.25	157.15	153.85	151.20	147.30
26.0	1.0236	.3530	.3125	6 3/8	3	3/4	510260	3	511260	157.15	-	-	-	-	-	-	-	-
27.0	1.0630	.3530	.3125	6 3/8	3	3/4	510270	3	511270	157.15	-	-	-	-	-	-	-	-
28.0	1.1024	.3530	.3125	6 3/8	3	1	510280	3	511280	161.75	27.077-28.651	190.95	171.40	164.90	161.75	158.45	155.75	151.95
29.0	1.1417	.3530	.3125	6 3/8	3	1	510290	3	511290	166.80	28.652-30.239	196.05	176.50	170.00	166.80	163.55	160.85	156.95
30.0	1.1811	.3530	.3125	6 3/8	3	1	510300	3	511300	166.80	-	-	-	-	-	-	-	-
31.0	1.2205	.4260	.3750	6 5/8	4	1	510310	3	511310	185.05	30.240-31.826	216.80	195.55	188.45	185.05	181.55	178.65	174.40
32.0	1.2598	.4260	.3750	6 5/8	4	1	510320	3	511320	197.45	31.827-33.414	229.15	207.90	200.80	197.45	193.80	190.90	186.75
33.0	1.2992	.4260	.3750	6 5/8	4	1	510330	3	511330	197.45	-	-	-	-	-	-	-	-
34.0	1.3386	.4260	.3750	6 5/8	4	1	510340	3	511340	206.15	33.415-35.001	237.95	216.60	209.60	206.15	202.60	199.65	195.40
35.0	1.3780	.4260	.3750	6 5/8	4	1	510350	3	511350	206.15	-	-	-	-	-	-	-	-
36.0	1.4173	.4260	.3750	7 7/8	4	1 1/4	510360	4	511360	228.90	35.002-36.589	263.40	240.35	232.70	228.90	225.00	221.90	217.30
37.0	1.4567	.4260	.3750	7 7/8	4	1 1/4	510370	4	511370	252.20	36.590-38.176	286.65	263.55	255.85	252.20	248.35	245.15	240.65
38.0	1.4961	.4260	.3750	7 7/8	4	1 1/4	510380	4	511380	252.20	-	-	-	-	-	-	-	-

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

C'BORES

COUNTERBORES CARBIDE TIPPED TYPES 575 & 576 FRACTIONAL

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

C'BORES

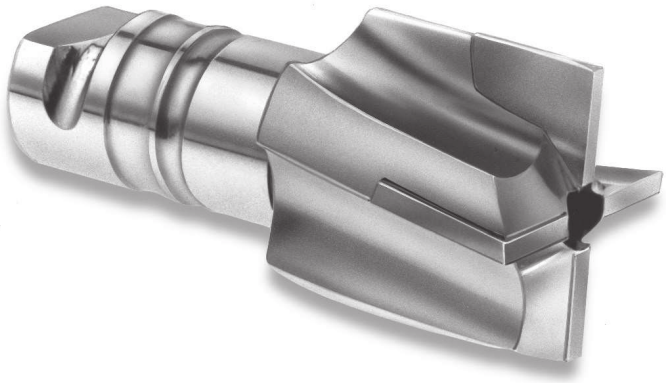
TOOL DIAMETER		DIMENSIONS						TYPE 575 N-F/CI EDP NO.	TYPE 576 STEEL EDP NO.	BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
		MIN. CUT DIAM.	PILOT HOLE DIAM.	STUB TAPER NO.	LENGTH		NO. OF FLTS				MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.				CARBIDE	OVER-ALL						1	2	3	4	5-7	8-14*
½	.5000	.2188	.1875	1	¾	2 9⁄16	3	57516	57616	$195.50	0.4721 - 0.5030	$269.95	$232.80	$220.30	$214.20	$207.90	$202.80
9⁄16	.5625	.2188	.1875	1	¾	2 9⁄16	3	57518	57618	195.50	0.5341 - 0.5660	269.95	232.80	220.30	214.20	207.90	202.80
⅝	.6250	.2188	.1875	1	¾	2 9⁄16	3	57520	57620	195.50	0.5971 - 0.6280	269.95	232.80	220.30	214.20	207.90	202.80
11⁄16	.6875	.2188	.1875	1	¾	2 9⁄16	3	57522	57622	195.50	0.6591 - 0.6910	269.95	232.80	220.30	214.20	207.90	202.80
¾	.7500	.2969	.2500	2	¾	2 ⅞	4	57524	57624	183.20	0.7221 - 0.7530	257.65	220.55	208.05	201.95	195.75	190.55
13⁄16	.8125	.2969	.2500	2	¾	2 ⅞	4	57526	57626	183.20	0.7841 - 0.8160	257.65	220.55	208.05	201.95	195.75	190.55
⅞	.8750	.2969	.2500	2	¾	2 ⅞	4	57528	57628	183.20	0.8471 - 0.8780	257.65	220.55	208.05	201.95	195.75	190.55
15⁄16	.9375	.2969	.2500	2	¾	2 ⅞	4	57530	57630	176.70	0.9091 - 0.9410	251.20	213.95	201.55	195.45	189.20	184.05
1	1.0000	.3594	.3125	2	¾	2 ⅞	4	57532	57632	176.70	0.9721 - 1.0030	251.20	213.95	201.55	195.45	189.20	184.05
1 1⁄16	1.0625	.3594	.3125	2	¾	2 ⅞	4	57534	57634	176.70	1.0031 - 1.0660	251.20	213.95	201.55	195.45	189.20	184.05
1 ⅛	1.1250	.3594	.3125	2	¾	2 ⅞	4	57536	57636	176.70	1.0661 - 1.1280	251.20	213.95	201.55	195.45	189.20	184.05
1 3⁄16	1.1875	.3594	.3125	2	¾	2 ⅞	4	57538	57638	183.20	1.1281 - 1.1905	257.65	220.55	208.05	201.95	195.75	190.55
1 ¼	1.2500	.3594	.3125	2	¾	2 ⅞	4	57540	57640	183.20	1.1906 - 1.2530	257.65	220.55	208.05	201.95	195.75	190.55
1 5⁄16	1.3125	.3594	.3125	2	¾	2 ⅞	4	57542	57642	186.15	1.2531 - 1.3155	260.60	223.40	210.95	204.75	198.65	193.45
1 ⅜	1.3750	.3594	.3125	2	¾	2 ⅞	4	57544	57644	205.15	1.3156 - 1.3780	279.55	242.45	229.95	223.80	217.65	212.50
1 7⁄16	1.4375	.3594	.3125	2	½	2 ⅞	4	57546	57646	224.10	1.3781 - 1.4405	298.50	261.30	248.85	242.70	236.45	231.20
1 ½	1.5000	.3594	.3125	2	½	2 ⅞	4	57548	57648	242.80	1.4406 - 1.5030	317.35	280.10	267.75	261.55	255.35	250.15
1 9⁄16	1.5625	.4844	.4375	3	½	3 3⁄16	6	57550	57650	258.60	1.5031 - 1.5660	333.10	295.80	283.45	277.40	271.10	266.00
1 ⅝	1.6250	.4844	.4375	3	½	3 3⁄16	6	57552	57652	290.25	1.5661 - 1.6280	364.60	327.45	315.05	308.85	302.55	297.45
1 11⁄16	1.6875	.4844	.4375	3	½	3 3⁄16	6	57554	57654	315.25	1.6281 - 1.6910	389.75	352.55	340.15	334.05	327.80	322.65
1 ¾	1.7500	.4844	.4375	3	½	3 3⁄16	6	57556	57656	340.55	1.6911 - 1.7530	414.95	377.80	365.40	359.25	352.95	347.90
1 13⁄16	1.8125	.4844	.4375	3	½	3 3⁄16	6	57558	57658	359.60	1.7531 - 1.8160	434.10	396.90	384.35	378.30	372.10	366.95
1 ⅞	1.8750	.4844	.4375	3	½	3 3⁄16	6	57560	57660	378.40	1.8161 - 1.8780	452.85	415.60	403.20	397.00	390.75	385.60
1 15⁄16	1.9375	.4844	.4375	3	½	3 3⁄16	6	57562	57662	397.50	1.8781 - 1.9410	471.95	434.70	422.30	416.15	409.95	404.70
2	2.0000	.5625	.5000	4	½	3 ¾	6	57564	57664	416.20	1.9411 - 2.0030	490.60	453.55	441.05	434.95	428.75	423.50
2 ⅛	2.1250	.5625	.5000	4	½	3 ¾	6	57568	57668	428.85	2.0661 - 2.1280	503.30	466.10	453.65	447.55	441.35	436.15
2 ¼	2.2500	.5625	.5000	4	½	3 ¾	6	57572	57672	441.30	2.1906 - 2.2530	515.70	478.55	466.05	459.95	453.65	448.55
2 ⅜	2.3750	.5625	.5000	4	½	3 ¾	6	57576	57676	474.55	2.3156 - 2.3780	551.70	513.10	500.25	493.90	487.45	482.15
2 ½	2.5000	.5625	.5000	4	½	3 ¾	6	57580	57680	491.05	2.4406 - 2.5030	568.35	529.75	516.85	510.50	504.05	498.65
2 ¾	2.7500	.5625	.5000	4	½	3 ¾	6	57588	57688	517.15	2.6911 - 2.7530	594.35	555.75	542.80	536.50	530.05	524.70
3	3.0000	.5625	.5000	4	½	3 ¾	6	57596	57696	543.25	2.9411 - 3.0030	620.35	581.90	568.95	562.55	556.10	550.80

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

COUNTERBORES CARBIDE TIPPED TYPES 573 & 574 FRACTIONAL

MATERIAL SPECIFIC

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 = 1⅜"
- 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

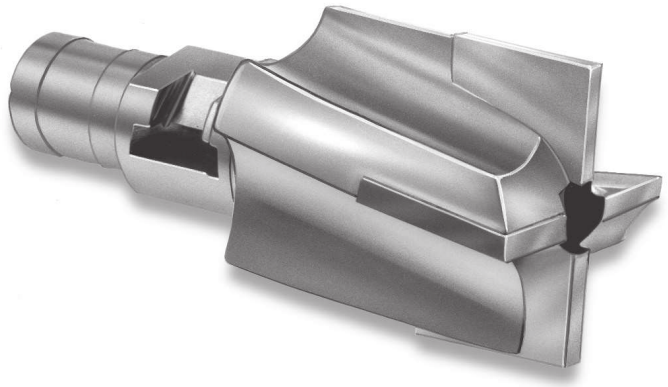
TOOL DIAMETER		DIMENSIONS							TYPE 573 N-F/CI EDP NO.	TYPE 574 STEEL EDP NO.	BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
		MIN. CUT DIAM.	PILOT HOLE DIAM.	PIN DRIVE NO.	SHANK DIAM.	LENGTH		NO. OF FLTS				MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL					CARBIDE	OVER-ALL						1	2	3	4	5-7	8-14*
½	.5000	.2188	.1875	1	9/16	¾	2 7/8	3	57316	57416	$168.20	0.4721 - 0.5030	$249.15	$208.70	$195.05	$188.45	$181.65	$176.00
9/16	.5625	.2188	.1875	1	9/16	¾	2 7/8	3	57318	57418	168.20	0.5341 - 0.5660	249.15	208.70	195.05	188.45	181.65	176.00
5/8	.6250	.2188	.1875	1	9/16	¾	2 7/8	3	57320	57420	168.20	0.5971 - 0.6280	249.15	208.70	195.05	188.45	181.65	176.00
11/16	.6875	.2969	.2500	1	9/16	¾	2 7/8	3	57322	57422	158.00	0.6591 - 0.6910	238.95	198.45	185.00	178.40	171.60	165.90
¾	.7500	.2969	.2500	1	9/16	¾	2 7/8	3	57324	57424	158.00	0.7221 - 0.7530	238.95	198.45	185.00	178.40	171.60	165.90
13/16	.8125	.2969	.2500	1	9/16	¾	2 7/8	4	57326	57426	158.00	0.7841 - 0.8160	238.95	198.45	185.00	178.40	171.60	165.90
7/8	.8750	.2969	.2500	1	9/16	¾	2 7/8	4	57328	57428	158.00	0.8471 - 0.8780	238.95	198.45	185.00	178.40	171.60	165.90
15/16	.9375	.2969	.2500	1	9/16	¾	2 7/8	4	57330	57430	161.55	0.9091 - 0.9410	242.55	202.15	188.60	182.00	175.10	169.50
1	1.0000	.2969	.2500	1	9/16	¾	2 7/8	4	57332	57432	164.60	0.9721 - 1.0030	245.50	205.10	191.45	184.80	178.05	172.45
1 1/16	1.0625	.2969	.2500	1	9/16	¾	2 7/8	4	57334	57434	182.00	1.0031 - 1.0660	262.80	222.45	208.95	202.25	195.45	189.85
1 1/16	1.0625	.3594	.3125	2	7/8	¾	3	4	57335	57435	192.25	1.0031 - 1.0660	273.15	232.70	219.15	212.50	205.70	200.15
1 1/8	1.1250	.2969	.2500	1	9/16	¾	2 7/8	4	57336	57436	182.00	1.0661 - 1.1280	262.80	222.45	208.95	202.25	195.45	189.85
1 1/8	1.1250	.3594	.3125	2	7/8	¾	3	4	57337	57437	192.25	1.0661 - 1.1280	273.15	232.70	219.15	212.50	205.70	200.15
1 3/16	1.1875	.3594	.3125	2	7/8	¾	3	4	57338	57438	199.25	1.1281 - 1.1905	280.25	239.80	226.25	219.55	212.80	207.25
1 ¼	1.2500	.3594	.3125	2	7/8	¾	3	4	57340	57440	199.25	1.1906 1.2530	280.25	239.80	226.25	219.55	212.80	207.25
1 5/16	1.3125	.3594	.3125	2	7/8	¾	3	4	57342	57442	202.40	1.2531 - 1.3155	283.40	242.95	229.35	222.70	215.95	210.35
1 3/8	1.3750	.3594	.3125	2	7/8	¾	3	4	57344	57444	202.40	1.3156 - 1.3780	283.40	242.95	229.35	222.70	215.95	210.35
1 7/16	1.4375	.3594	.3125	2	7/8	½	3	4	57346	57446	212.65	1.3781 - 1.4405	293.50	253.15	239.55	232.90	226.10	220.50
1 ½	1.5000	.3594	.3125	2	7/8	½	3	4	57348	57448	223.15	1.4406 - 1.5030	303.90	263.55	250.05	243.35	236.55	230.95
1 9/16	1.5625	.3594	.3125	2	7/8	½	3	4	57350	57450	239.90	1.5031 - 1.5660	320.80	280.35	266.90	260.15	253.45	247.80
1 5/8	1.6250	.3594	.3125	2	7/8	½	3	4	57352	57452	250.30	1.5661 - 1.6280	331.25	290.85	277.35	270.70	263.95	258.30
1 11/16	1.6875	.3594	.3125	2	7/8	½	3	4	57354	57454	260.55	1.6281 - 1.6910	341.60	301.05	287.60	280.90	274.15	268.55
1 ¾	1.7500	.3594	.3125	2	7/8	½	3	4	57356	57456	274.45	1.6911 - 1.7530	355.25	314.85	301.40	294.70	288.00	282.40
1 ¾	1.7500	.4844	.4375	3	1 ¼	½	3 1/16	6	57357	57457	312.35	1.6911 - 1.7530	393.40	352.90	339.35	332.70	326.00	320.35
1 7/8	1.8750	.4844	.4375	3	1 ¼	½	3 1/16	6	57360	57460	312.35	1.8161 - 1.8780	393.40	352.90	339.35	332.70	326.00	320.35
2	2.0000	.4844	.4375	3	1 ¼	½	3 1/16	6	57364	57464	353.60	1.9411 - 2.0030	434.45	394.10	380.55	373.95	367.05	361.45
2 1/8	2.1250	.4844	.4375	3	1 ¼	½	3 1/16	6	57368	57468	363.45	2.0661 - 2.1280	444.25	403.90	390.35	383.70	376.95	371.35
2 ¼	2.2500	.4844	.4375	3	1 ¼	½	3 1/16	6	57372	57472	377.25	2.1906 - 2.2530	458.25	417.75	404.20	397.55	390.80	385.20
2 3/8	2.3750	.4844	.4375	3	1 ¼	½	3 1/16	6	57376	57476	423.25	2.3156 - 2.3780	507.35	465.25	451.35	444.35	437.35	431.55
2 ½	2.5000	.5625	.5000	3	1 ¼	½	3 1/16	6	57380	57480	455.20	2.4406 - 2.5030	539.30	497.30	483.15	476.30	469.30	463.50
2 ¾	2.7500	.5625	.5000	3	1 ¼	½	3 1/16	6	57388	57488	505.35	2.6911 - 2.7530	589.35	547.35	533.25	526.35	519.35	513.60
3	3.0000	.5625	.5000	3	1 ¼	½	3 1/16	6	57396	57496	533.85	2.9411 - 3.0030	617.95	575.95	561.95	555.00	548.05	542.20

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

COUNTERBORES CARBIDE TIPPED TYPES 577 & 578 FRACTIONAL

MATERIAL SPECIFIC

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

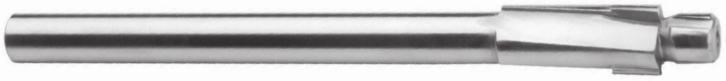
TOOL DIAMETER		DIMENSIONS							TYPE 577 N-F/CI EDP NO.	TYPE 578 STEEL EDP NO.	BOTH TYPES PRICE	FINISHED TO MODIFIED TOOL DIAMETER						
						LENGTH						MODIFIED DIAMETER RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DEC.	MIN. CUT DIAM.	PILOT HOLE DIAM.	RADIAL DRIVE SIZE	LARGE SHANK DIAM.	CAR-BIDE	OVER-ALL	NO. OF FLTS					1	2	3	4	5-7	8-14*
½	.5000	.2188	.1875	RB	⅝	¾	2 ⅞	3	57716	57816	$175.10	0.4721-0.5030	$256.00	$215.70	$202.15	$195.45	$188.70	$183.10
9/16	.5625	.2188	.1875	RB	⅝	¾	2 ⅞	3	57718	57818	175.10	0.5341-0.5660	256.00	215.70	202.15	195.45	188.70	183.10
⅝	.6250	.2188	.1875	RB	⅝	¾	2 ⅞	3	57720	57820	175.10	0.5971-0.6280	256.00	215.70	202.15	195.45	188.70	183.10
11/16	.6875	.2969	.2500	RB	⅝	¾	2 ⅞	3	57722	57822	175.10	0.6591-0.6910	256.00	215.70	202.15	195.45	188.70	183.10
¾	.7500	.2969	.2500	RB	⅝	¾	2 ⅞	4	57724	57824	175.10	0.7221-0.7530	256.00	215.70	202.15	195.45	188.70	183.10
13/16	.8125	.2969	.2500	RB	⅝	¾	2 ⅞	4	57726	57826	178.45	0.7841-0.8160	259.35	218.95	205.35	198.80	192.05	186.35
⅞	.8750	.2969	.2500	RB	⅝	¾	2 ⅞	4	57728	57828	178.45	0.8471-0.8780	259.35	218.95	205.35	198.80	192.05	186.35
15/16	.9375	.2969	.2500	RB	⅝	¾	2 ⅞	4	57730	57830	188.90	0.9091-0.9410	269.80	229.35	215.80	209.15	202.40	196.85
1	1.0000	.2969	.2500	RB	⅝	¾	2 ⅞	4	57732	57832	188.90	0.9721-1.0030	269.80	229.35	215.80	209.15	202.40	196.85
1	1.0000	.3594	.3125	RC	¾	¾	2 ⅞	4	57733	57833	192.25	0.9721-1.0030	273.15	232.70	219.15	212.50	205.70	200.15
1 1/16	1.0625	.3594	.3125	RC	¾	¾	2 ⅞	4	57734	57834	192.25	1.0031-1.0660	273.15	232.70	219.15	212.50	205.70	200.15
1 ⅛	1.1250	.3594	.3125	RC	¾	¾	2 ⅞	4	57736	57836	192.25	1.0661-1.1280	273.15	232.70	219.15	212.50	205.70	200.15
1 3/16	1.1875	.3594	.3125	RC	¾	¾	2 ⅞	4	57738	57838	205.70	1.1281-1.1905	286.60	246.15	232.70	226.00	219.25	213.70
1 ¼	1.2500	.3594	.3125	RC	¾	¾	2 ⅞	4	57740	57840	205.70	1.1906-1.2530	286.60	246.15	232.70	226.00	219.25	213.70
1 5/16	1.3125	.3594	.3125	RC	¾	¾	2 ⅞	4	57742	57842	205.70	1.2531-1.3155	286.60	246.15	232.70	226.00	219.25	213.70
1 ⅜	1.3750	.3594	.3125	RC	¾	¾	2 ⅞	4	57744	57844	205.70	1.3156-1.3780	286.60	246.15	232.70	226.00	219.25	213.70
1 ⅜	1.3750	.3594	.3125	RE	1	¾	3	4	57745	57845	223.15	1.3151-1.3780	303.90	263.55	250.05	243.35	236.55	230.95
1 ½	1.5000	.3594	.3125	RE	1	½	3	4	57748	57848	250.30	1.4406-1.5030	331.25	290.85	277.35	270.70	263.95	258.30
1 ½	1.5000	.4844	.4375	RF	1 ⅛	½	3 1/16	4	57749	57849	260.55	1.4406-1.5030	341.60	301.05	287.60	280.90	274.15	268.55
1 ⅝	1.6250	.3594	.3125	RE	1	½	3	4	57752	57852	260.55	1.5661-1.6280	341.60	301.05	287.60	280.90	274.15	268.55
1 ⅝	1.6250	.4844	.4375	RF	1 ⅛	½	3 1/16	4	57753	57853	267.65	1.5661-1.6280	348.55	308.15	294.65	288.00	281.25	275.65
1 ¾	1.7500	.4844	.4375	RF	1 ⅛	½	3 1/16	6	57756	57856	329.05	1.6911-1.7530	409.95	369.50	356.05	349.35	342.65	337.05
1 ⅞	1.8750	.4844	.4375	RF	1 ⅛	½	3 1/16	6	57760	57860	346.35	1.8161-1.8780	427.25	386.85	373.40	366.70	359.85	354.25
2	2.0000	.4844	.4375	RF	1 ⅛	½	3 1/16	6	57764	57864	377.25	1.9411-2.0030	458.25	417.75	404.20	397.55	390.80	385.20
2	2.0000	.5625	.5000	RJ	1 ⅜	½	3 1/16	6	57765	57865	377.25	1.9411-2.0030	458.25	417.75	404.20	397.55	390.80	385.20
2 ⅛	2.1250	.5625	.5000	RJ	1 ⅜	½	3 1/16	6	57768	57868	387.45	2.0661-2.1280	468.40	428.10	414.55	407.90	401.15	395.50
2 ¼	2.2500	.5625	.5000	RJ	1 ⅜	½	3 1/16	6	57772	57872	404.50	2.1906-2.2530	485.40	445.00	431.50	424.80	418.05	412.50
2 ⅜	2.3750	.5625	.5000	RJ	1 ⅜	½	3 1/16	6	57776	57876	426.95	2.3156-2.3780	510.95	468.95	454.90	448.15	440.90	435.05
2 ½	2.5000	.5625	.5000	RJ	1 ⅜	½	3 1/16	6	57780	57880	444.95	2.4406-2.5030	529.00	487.00	472.95	466.05	459.10	453.20
2 ⅝	2.6250	.5625	.5000	RJ	1 ⅜	½	3 1/16	6	57784	57884	455.20	2.5661-2.6280	539.30	497.30	483.15	476.30	469.30	463.50
2 ¾	2.7500	.5625	.5000	RS	1 ¾	½	3 ⅛	6	57788	57888	462.55	2.6911-2.7530	546.45	504.60	490.55	483.60	476.70	470.80
2 ⅞	2.8750	.5625	.5000	RS	1 ¾	½	3 ⅛	6	57792	57892	487.50	2.8161-2.8780	571.55	529.55	515.55	508.55	501.55	495.75
3	3.0000	.5625	.5000	RS	1 ¾	½	3 ⅛	6	57796	57896	523.10	2.9411-3.0030	607.00	565.05	551.05	544.15	537.15	531.30

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

CAPSCREW COUNTERBORES CARBIDE TIPPED TYPES 513 & 515 FRACTIONAL & METRIC

MATERIAL SPECIFIC

STRAIGHT SHANK FOR NON-FERROUS, CAST IRON AND STEEL



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

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

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)

USE:

- To form a recess for a capscrew head

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	$89.85	5152500	$98.80
.3980	1/4	.2650	.3125	5/16	5 5/8	3	5132650	99.80	5152650	109.85
.4140	1/4	.2810	.3125	5/16	5 5/8	3	5132810	99.80	5152810	109.85
.4750	5/16	.3125	.3750	3/8	6 1/8	3	5133125	100.45	5153125	110.60
.4910	5/16	.3280	.3750	3/8	6 1/8	3	5133280	100.45	5153280	110.60
.5070	5/16	.3430	.3750	3/8	6 1/8	3	5133430	100.45	5153430	110.60
.5720	3/8	.3750	.5000	1/2	6 1/2	3	5133750	113.30	5153750	124.65
.5880	3/8	.3900	.5000	1/2	6 1/2	3	5133900	113.30	5153900	124.65
.6040	3/8	.4060	.5000	1/2	6 1/2	3	5134060	113.30	5154060	124.65
.6630	7/16	.4375	.5000	1/2	7	3	5134375	109.45	5154375	120.40
.6790	7/16	.4530	.5000	1/2	7	3	5134530	109.45	5154530	120.40
.6950	7/16	.4680	.5000	1/2	7	3	5134680	109.45	5154680	120.40
.7570	1/2	.5000	.5000	1/2	7 1/2	3	5135000	124.10	5155000	136.60
.7730	1/2	.5150	.5000	1/2	7 1/2	3	5135150	124.10	5155150	136.60
.7890	1/2	.5310	.5000	1/2	7 1/2	3	5135310	124.10	5155310	136.60
.8510	9/16	.5625	.5625	5/8	7 5/8	3	5135625	119.95	5155625	132.00
.8670	9/16	.5780	.5625	5/8	7 5/8	3	5135780	119.95	5155780	132.00
.8830	9/16	.5930	.5625	5/8	7 5/8	3	5135930	119.95	5155930	132.00
.9450	5/8	.6250	.6250	5/8	7 5/8	3	5136250	136.75	5156250	150.45
.9610	5/8	.6400	.6250	5/8	7 5/8	3	5136400	136.75	5156400	150.45
.9770	5/8	.6560	.6250	5/8	7 5/8	3	5136560	136.75	5156560	150.45
1.1330	3/4	.7500	.7500	3/4	7 3/4	3	5137500	134.80	5157500	148.30
1.1490	3/4	.7650	.7500	3/4	7 3/4	3	5137650	134.80	5157650	148.30
1.1650	3/4	.7810	.7500	3/4	7 3/4	3	5137810	134.80	5157810	148.30
1.3220	7/8	.8750	.8750	7/8	8 1/8	4	5138750	149.85	5158750	164.95
1.3380	7/8	.8910	.8750	7/8	8 1/8	4	5138910	149.85	5158910	164.95
1.3540	7/8	.9060	.8750	7/8	8 1/8	4	5139060	149.85	5159060	164.95
1.5100	1	1.0000	1.0000	1	8 1/2	4	5130000	171.60	5150000	188.80
1.5260	1	1.0150	1.0000	1	8 1/2	4	5130156	171.60	5150156	188.80
1.5420	1	1.0310	1.0000	1	8 1/2	4	5130313	171.60	5150313	188.80

TYPE 513 - STRAIGHT SHANK - FOR NON-FERROUS AND CAST IRONS - METRIC
TYPE 515 - STRAIGHT SHANK - FOR STEELS - METRIC

USE:

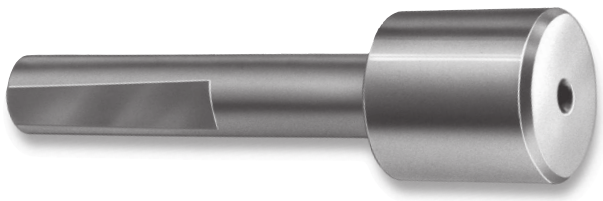
- Same as above except metric sizes.

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	$99.55	515055	$109.45
.4134	6	6.5	5/16	5/16	5 5/8	3	513065	105.05	515065	115.60
.5315	8	8.5	3/8	1/2	6 1/2	3	513085	124.80	515085	137.20
.6496	10	10.5	1/2	1/2	7	3	513105	135.75	515105	149.30
.7283	12	12.5	1/2	1/2	7 1/2	3	513125	127.35	515125	140.00
.8465	14	14.5	9/16	5/8	7 5/8	3	513145	148.50	515145	163.25
.9646	16	16.5	5/8	5/8	7 5/8	3	513165	155.15	515165	170.65
1.2008	20	20.5	3/4	7/8	8	3	513205	143.90	515205	158.25

C'BORES

INTERCHANGEABLE COUNTERBORE PILOTS TYPE 500 FRACTIONAL

SHORT SHANK PILOTS



PILOT HEAD DIAMETER	TOLERANCE
1/8" thru 1/4"	minus .001", minus .002"
over 1/4" thru 7/8"	minus .003", minus .004"
over 7/8" thru 1 1/4"	minus .005", minus .006"
over 1 1/4"	minus .006", minus .007"

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

MODIFICATIONS (prompt delivery)

- Modified pilot head diameter - priced below (ground down from finished pilot)
- Corner radius

PILOT HEAD DIAMETER		SHANK DIAMETER									ALL TYPES PRICE	FINISHED TO MODIFIED PILOT HEAD DIAMETER					
												PRICE EACH - BASED ON QUANTITY ORDERED					
FRAC.	DECIMAL	3/32 .0938 EDP NO.	1/8 .1250 EDP NO.	5/32 .1562 EDP NO.	3/16 .1875 EDP NO.	1/4 .2500 EDP NO.	5/16 .3125 EDP NO.	3/8 .3750 EDP NO.	7/16 .4375 EDP NO.	1/2 .5000 EDP NO.		1	2	3	4	5-7	OVER 7
1/8	.1250	50104	-	-	-	-	-	-	-	-	$24.15	$95.95	$60.10	$48.15	$42.25	$36.15	$31.15
5/32	.1562	50105	50205	-	-	-	-	-	-	-	19.60	91.35	55.55	43.55	37.50	31.60	26.60
3/16	.1875	50106	50206	50306	-	-	-	-	-	-	20.00	91.75	55.90	43.95	38.00	31.90	26.95
7/32	.2188	50107	50207	50307	50407	-	-	-	-	-	22.65	94.45	58.50	46.50	40.70	34.65	29.65
1/4	.2500	50108	50208	50308	50408	-	-	-	-	-	22.65	94.45	58.50	46.50	40.70	34.65	29.65
9/32	.2812	50109	50209	50309	50409	50509	-	-	-	-	24.15	95.95	60.10	48.15	42.25	36.15	31.15
5/16	.3125	50110	50210	50310	50410	50510	-	-	-	-	24.15	95.95	60.10	48.15	42.25	36.15	31.15
11/32	.3438	50111	50211	50311	50411	50511	50611	-	-	-	24.15	95.95	60.10	48.15	42.25	36.15	31.15
3/8	.3750	-	50212	50312	50412	50512	50612	-	-	-	26.60	98.45	62.55	50.55	44.55	38.60	33.70
13/32	.4062	-	50213	50313	50413	50513	50613	-	-	-	26.60	98.45	62.55	50.55	44.55	38.60	33.70
7/16	.4375	-	50214	50314	50414	50514	50614	50714	-	-	27.25	99.00	63.15	51.20	45.20	39.25	34.25
15/32	.4688	-	50215	-	50415	50515	50615	-	-	-	27.25	99.00	63.15	51.20	45.20	39.25	34.25
1/2	.5000	-	50216	-	50416	50516	50616	50716	50816	-	31.15	103.05	67.10	55.10	49.35	43.20	38.25
17/32	.5312	-	50217	-	50417	50517	50617	-	50817	-	36.35	108.15	72.30	60.40	54.40	48.35	43.45
9/16	.5625	-	50218	-	50418	50518	50618	50718	50818	50918	40.80	112.65	76.75	64.75	58.95	52.85	47.90
19/32	.5938	-	50219	-	-	50519	50619	-	50819	50919	44.85	116.60	80.75	68.75	62.75	56.75	51.85
5/8	.6250	-	50220	-	50420	50520	50620	50720	50820	50920	44.85	116.60	80.75	68.75	62.75	56.75	51.85
21/32	.6562	-	-	-	50421	50521	50621	-	50821	-	45.90	117.70	81.75	69.80	63.95	57.90	52.90
11/16	.6875	-	-	-	50422	50522	50622	50722	50822	50922	45.90	117.70	81.75	69.80	63.95	57.90	52.90
23/32	.7188	-	-	-	-	50523	50623	-	50823	50923	52.00	123.75	87.85	75.90	70.00	63.95	59.05
3/4	.7500	-	-	-	50424	50524	50624	50724	50824	50924	52.00	123.75	87.85	75.90	70.00	63.95	59.05
25/32	.7812	-	-	-	-	50525	50625	-	50825	50925	58.40	130.25	94.35	82.35	76.60	70.45	65.50
13/16	.8125	-	-	-	50426	50526	50626	50726	50826	50926	58.40	130.25	94.35	82.35	76.60	70.45	65.50
27/32	.8438	-	-	-	-	50527	-	-	-	-	64.65	136.45	100.55	88.60	82.55	76.65	71.65
7/8	.8750	-	-	-	50428	50528	50628	50728	50828	50928	64.65	136.45	100.55	88.60	82.55	76.65	71.65
15/16	.9375	-	-	-	50430	50530	50630	50730	50830	50930	68.20	139.95	104.10	92.15	86.20	80.15	75.25
1	1.0000	-	-	-	50432	50532	50632	50732	50832	50932	70.55	142.30	106.45	94.45	88.60	82.50	77.60
1 1/16	1.0625	-	-	-	-	-	50634	50734	50834	50934	73.15	144.90	108.95	97.00	91.00	85.15	80.15
1 1/8	1.1250	-	-	-	-	-	50636	50736	50836	50936	88.15	159.95	124.05	112.00	106.20	100.05	95.20
1 3/16	1.1875	-	-	-	-	-	50638	50738	50838	50938	90.85	162.55	126.65	114.75	108.85	102.80	97.85
1 1/4	1.2500	-	-	-	-	-	50640	50740	50840	50940	95.75	167.55	131.70	119.65	113.90	107.70	102.80
1 5/16	1.3125	-	-	-	-	-	-	50742	50842	50942	100.80	172.55	136.75	124.80	118.85	112.80	107.80
1 3/8	1.3750	-	-	-	-	-	50644	50744	50844	50944	110.05	182.00	146.10	134.15	128.15	122.15	117.20
1 7/16	1.4375	-	-	-	-	-	-	50746	50846	50946	111.45	183.20	147.25	135.25	129.45	123.30	118.45
1 1/2	1.5000	-	-	-	-	-	-	-	50848	50948	112.80	184.70	148.80	136.80	130.75	124.85	119.90
1 9/16	1.5625	-	-	-	-	-	-	-	50850	50950	114.15	186.15	150.25	138.25	132.25	126.25	121.30
1 5/8	1.6250	-	-	-	-	-	-	-	-	50952	115.40	187.15	151.30	139.25	133.40	127.30	122.50
1 11/16	1.6875	-	-	-	-	-	-	-	-	50954	116.95	188.65	152.80	140.75	134.90	128.80	123.95
1 3/4	1.7500	-	-	-	-	-	-	-	50856	50956	118.75	190.45	154.50	142.55	136.75	130.60	125.70
1 7/8	1.8750	-	-	-	-	-	-	-	-	50960	142.95	215.00	179.05	167.05	161.10	155.10	150.25
2	2.0000	-	-	-	-	-	-	-	-	50964	142.95	215.00	179.05	167.05	161.10	155.10	150.25

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

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

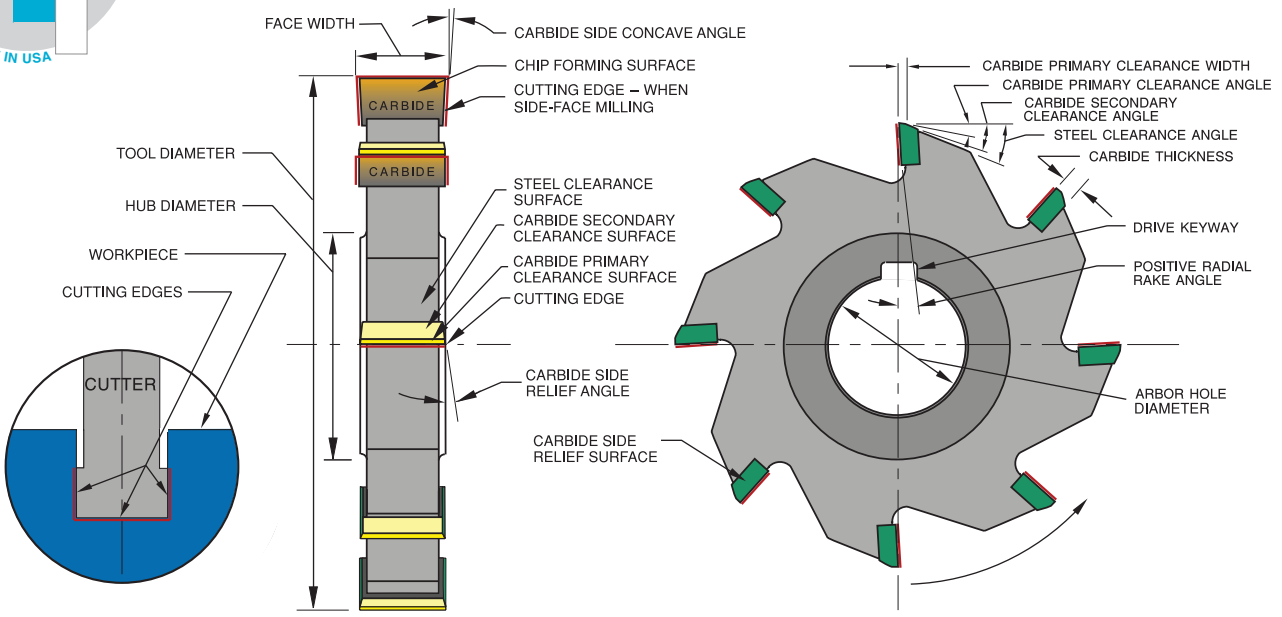
RPM FORMULA: $\frac{\text{SFM X 3.82}}{\text{Diameter}}$

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 1Sb, 4Sb, 6Sb, BSb, 9Sb	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, 10L5O, 11L44, 12LI3, 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, Nitralloy, 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

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

SIDE MILLING CUTTERS - STAGGERED TOOTH CARBIDE TIPPED TYPE 547 FRACTIONAL

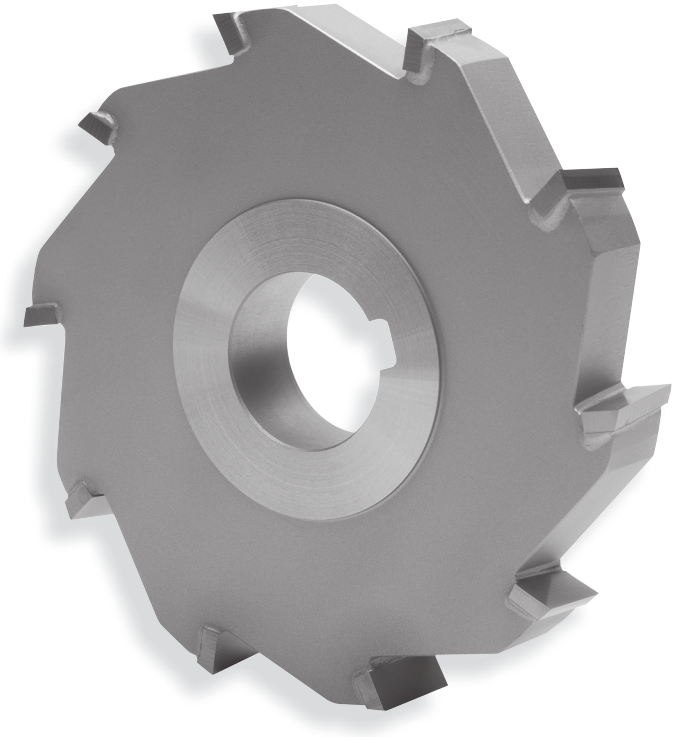
GENERAL PURPOSE

SUITABLE FOR MOST MATERIALS

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

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.



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 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.	1¼" 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
	3/4	.7500	10	54734	-	510.95
6	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

MATERIAL SPECIFIC

FOUR TYPES – FOR NON-FERROUS, CAST IRONS, STEELS, OR HIGH TEMPERATURE ALLOYS

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

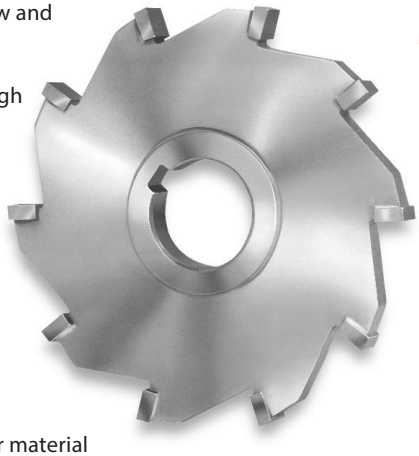
TYPE 540 – FOR NON-FERROUS MATERIALS
- Very large flute capacity assures good chip flow and permits high feed rates

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 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



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 FRAC.	FACE WIDTH DEC.	TYPE 540 FOR NON-FERROUS NO. OF TEETH	1" ARBOR EDP NO.	1¼" ARBOR EDP NO.	PRICE	TYPE 541 FOR CAST IRONS NO. OF TEETH	1" ARBOR EDP NO.	1¼" ARBOR EDP NO.	PRICE	TYPE 542 FOR STEELS NO. OF TEETH	1" ARBOR EDP NO.	1¼" ARBOR EDP NO.	PRICE	TYPE 543 FOR HIGH TEMP ALLOYS NO. OF TEETH	1" ARBOR EDP NO.	1¼" ARBOR EDP NO.	PRICE
3	¼	.2500	4	54030	-	$135.75	6	54130	-	$169.80	6	54230	-	$167.65	8	54330	-	$209.10
	5/16	.3125	4	54031	-	142.50	6	54131	-	170.55	6	54231	-	169.90	8	54331	-	219.10
	⅜	.3750	4	54032	-	147.70	6	54132	-	173.90	6	54232	-	172.10	8	54332	-	222.05
	7/16	.4375	4	54033	-	153.75	6	54133	-	188.05	6	54233	-	191.90	-	-	-	-
	½	.5000	4	54034	-	161.20	6	54134	-	195.85	6	54234	-	194.45	8	54334	-	248.30
4	¼	.2500	4	54040	-	176.90	8	54140	-	219.35	8	54240	-	220.75	10	54340	-	261.50
	5/16	.3125	4	54041	-	181.95	8	54141	-	226.70	8	54241	-	234.40	10	54341	-	274.70
	⅜	.3750	4	54042	54043	186.70	8	54142	54143	238.20	8	54242	54243	234.40	10	54342	54343	280.85
	7/16	.4375	4	54074	-	187.55	8	54174	-	243.05	8	54274	-	241.40	10	54374	-	304.95
	½	.5000	4	54044	54045	187.55	8	54144	54145	251.05	8	54244	54245	249.75	10	54344	54345	307.25
	9/16	.5625	4	54094	-	203.90	8	54194	-	258.00	8	54294	-	262.15	-	-	-	
	⅝	.6250	4	54046	54047	218.80	8	54146	54147	279.60	8	54246	54247	306.45	10	54346	54347	323.55
	¾	.7500	4	54048	54049	245.15	8	54148	54149	279.60	8	54248	54249	310.30	10	54348	54349	333.25
5	¼	.2500	6	54050	-	247.15	10	54150	-	290.45	10	54250	-	290.60	-	-	-	-
	5/16	.3125	-	-	-	-	10	54151	-	290.45	10	54251	-	290.60	-	-	-	-
	⅜	.3750	-	-	-	-	10	-	54153	297.45	10	-	54253	305.10	-	-	-	-
	7/16	.4375	6	-	54075	257.10	10	-	54175	298.95	10	-	54275	314.90	-	-	-	-
	½	.5000	6	54054	54055	260.15	10	54154	54155	317.35	10	54254	54255	315.00	12	54354	54355	352.95
	9/16	.5625	6	-	54095	268.50	10	-	54195	322.80	10	-	54295	328.90		-	-	-
	⅝	.6250	6	-	54057	282.45	10	-	54157	343.55	10	-	54257	386.00	12	-	54357	385.50
	¾	.7500	6	54058	54059	301.10	10	54158	54159	389.00	10	54258	54259	427.20	12	54358	54359	432.30
	1	1.0000	6	-	54015	301.60	10	-	54115	423.35	10	-	54215	450.60	-	-	-	-
6	⅜	.3750	6	54062	-	265.20	12	-	54163	365.45	12	-	54263	386.10	-	-	-	-
	½	.5000	6	54064	54065	290.45	12	54164	54165	388.10	12	54264	54265	397.65	14	54364	54365	454.05
	⅝	.6250	6	-	54067	318.30	12	-	54167	424.15	12	-	54267	432.60	14	-	54367	457.70
	¾	.7500	6	54068	54069	366.05	12	54168	54169	475.90	12	54268	54269	492.80	14	54368	54369	493.90
	1	1.0000	6	-	54016	419.60	12		54116	480.90	12	-	54216	502.75	-			-
				1¼" ARBOR	1½" ARBOR			1¼" ARBOR	1½" ARBOR			1¼" ARBOR	1½" ARBOR			1¼" ARBOR	1½" ARBOR	
8	¾	.7500	8	54088	54089	476.20	12	54188	54189	499.45	12	54288	54289	518.10	14	54388	-	529.55
	1	1.0000	8	54080	54081	516.80	12	54180	54181	520.50	12	54280	54281	539.25	-	-	-	-

CUTTERS

SLITTING SAWS - COARSE TOOTH CARBIDE TIPPED TYPES 550, 552, 554, 558 FRACTIONAL

MATERIAL SPECIFIC

FOUR TYPES – FOR NON-FERROUS, CAST IRONS, STEELS, OR HIGH TEMPERATURE ALLOYS

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

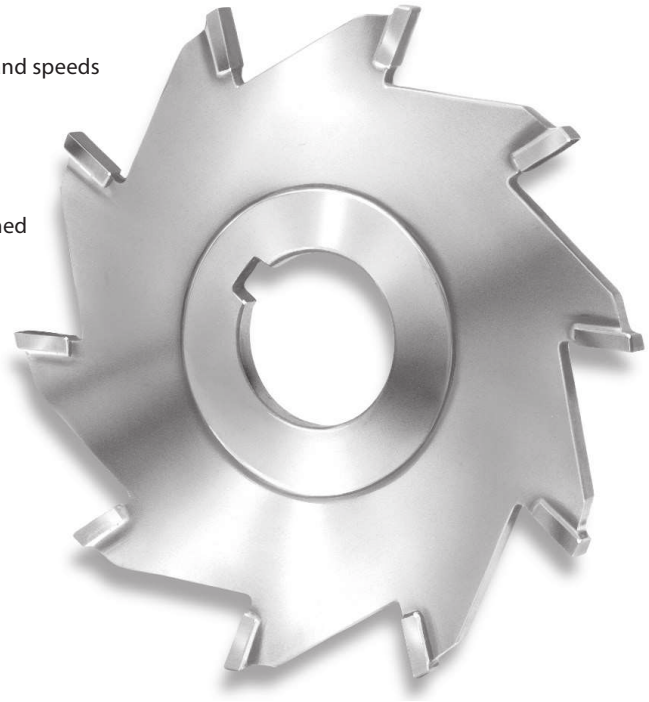
TYPE 550 – FOR NON-FERROUS MATERIALS
- Very large flute capacity assures good chip flow and permits high feed rates

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

CUTTERS

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		
	FRAC.	DEC.		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	$160.95	6	55232	$185.25	8	55432	$183.65	8	55832	$172.10
	1/8	.1250	1	6	55034	165.80	6	55234	196.15	8	55434	205.55	8	55834	178.65
	3/16	.1875	1	6	55036	172.35	6	55236	207.50	8	55436	207.50	8	55836	185.55
	1/4	.2500	1	6	55037	117.20	6	55237	170.10	8	55437	170.10	8	55837	204.15
	5/16	.3125	1	6	55031	123.15	6	55231	170.10	8	55431	170.10	8	55831	204.15
	3/8	.3750	1	6	55038	125.55	6	55238	172.85	8	55438	172.85	8	55838	207.50
4	3/32	.0938	1	6	55042	197.60	8	55242	237.50	8	55442	237.50	10	55842	247.60
	1/8	.1250	1	6	55044	203.45	8	55244	240.70	8	55444	240.70	10	55844	250.70
	3/16	.1875	1	6	55046	206.50	8	55246	259.35	8	55446	259.35	10	55846	254.15
	1/4	.2500	1	6	55047	150.65	8	55247	220.25	8	55447	220.25	10	55847	264.45
	5/16	.3125	1	6	55041	154.90	8	55241	228.80	8	55441	228.80	10	55841	274.40
	3/8	.3750	1	6	55048	159.00	8	55248	237.10	8	55448	237.10	10	55848	284.50
	3/8	.3750	1 1/4	6	55049	159.00	8	55249	237.10	8	55449	237.10	10	55849	284.50
5	3/32	.0938	1	8	55052	213.80	10	55252	318.85	10	55452	318.85	12	55852	336.55
	1/8	.1250	1	8	55054	213.80	10	55254	342.95	10	55454	342.95	12	55854	343.55
	3/16	.1875	1	-	-	-	10	55256	386.10	10	55456	386.10	12	55856	357.25
6	1/8	.1250	1 1/4	8	55063	291.15	12	55263	418.55	12	55463	418.55	14	55863	401.90
	3/16	.1875	1 1/4	8	55065	383.70	12	55265	432.35	12	55465	432.35	14	55865	412.25
	1/4	.2500	1 1/4	8	55067	397.45	12	55267	441.40	12	55467	441.40	14	55867	419.00
8	1/8	.1250	1 1/4	10	55083	372.20	-	-	-	-	-	-	-	-	-
	3/16	.1875	1 1/4	-	-	-	16	55285	595.00	16	55485	595.00	-	-	-
	1/4	.2500	1 1/4	-	-	-	16	55287	617.75	16	55487	617.75	-	-	-

HANNIBAL CARBIDE TOOL, INC. • TEL 800-451-9436 • FAX 800-633-7302 • sales@hannibalcarbide.com

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			
	FRAC.	DEC.	NO. OF TEETH	1" ARBOR EDP NO.	1¼" ARBOR EDP NO.	PRICE	NO. OF TEETH	1" ARBOR EDP NO.	1¼" ARBOR EDP NO.	PRICE	NO. OF TEETH	1" ARBOR EDP NO.	1¼" ARBOR EDP NO.	PRICE	NO. OF TEETH	1" ARBOR EDP NO.	1¼" ARBOR EDP NO.	PRICE
3	1/16	.0625	12	55198	-	$253.60	12	55398	-	$253.60	16	55698	-	$303.20	12	55998	-	$285.25
	5/64	.0781	12	55100	-	299.90	12	55300	-	299.90	16	55600	-	366.65	12	55900	-	319.50
	3/32	.0938	12	55102	-	253.60	12	55302	-	253.60	16	55602	-	303.20	12	55902	-	285.25
	7/64	.1094	12	55104	-	252.65	12	55304	-	252.65	16	55604	-	279.85	12	55904	-	272.25
	1/8	.1250	12	55106	55107	203.90	12	55306	55307	203.90	16	55606	-	253.55	12	55906	55907	260.05
	5/32	.1562	12	55108	-	243.00	12	55308	-	243.00	16	55608	-	266.30	12	55908	-	266.30
	3/16	.1875	12	55109	-	217.30	12	55309	-	217.30	16	55609	-	279.15	12	55909	-	272.70
	7/32	.2188	12	55110	-	251.40	12	55310	-	251.40	16	55610	-	291.95	12	55910	-	281.35
	1/4	.2500	12	55111	-	264.35	12	55311	-	264.35	16	55611	-	304.85	12	55911	-	289.80
	5/16	.3125	12	55112	-	289.80	12	55312	-	289.80	16	55612	-	334.20	12	55912	-	317.50
	3/8	.3750	12	55113	-	315.40	12	55313	-	315.40	16	55613	-	363.70	12	55913	-	347.30
	7/16	.4375	-	-	-	-	-	-	-	-	16	55614	-	404.15	12	55914	-	377.40
	1/2	.5000	-	-	-	-	-	-	-	-	16	55615	-	449.10	12	55915	-	407.30
4	1/16	.0625	14	55116	55117	295.30	14	55316	-	295.30	20	55616	-	366.65	14	55916	55917	324.40
	5/64	.0781	14	55118	55119	348.80	14	55318	55319	348.80	20	55618	55619	401.20	14	55918	55919	371.70
	3/32	.0938	14	55120	55121	295.30	14	55320	55321	295.30	20	55620	55621	366.65	14	55920	55921	324.40
	7/64	.1094	14	55122	55123	301.55	14	55322	55323	301.55	20	55622	55623	346.75	14	55922	55923	384.60
	1/8	.1250	14	55124	55125	266.30	14	55324	55325	266.30	20	55624	55625	323.90	14	55924	55925	323.90
	5/32	.1562	14	55126	55127	302.50	14	55326	55327	302.50	20	55626	55627	348.00	14	55926	55927	332.45
	3/16	.1875	14	55128	55129	283.50	14	55328	55329	283.50	20	55628	55629	349.50	14	55928	55929	343.00
	7/32	.2188	14	55130	55131	321.75	14	55330	55331	321.75	20	55630	55631	370.05	14	55930	55931	353.85
	1/4	.2500	14	55132	55133	328.00	14	55332	55333	328.00	20	55632	55633	374.85	14	55932	55933	362.30
	5/16	.3125	14	55134	55135	353.85	14	55334	55335	353.85	20	55634	55635	406.75	14	55934	55935	387.85
	3/8	.3750	14	55136	55137	379.30	14	55336	55337	379.30	20	55636	55637	436.20	14	55936	55937	417.60
	7/16	.4375	-	-	-	-	-	-	-	-	20	55638	-	484.65	14	55938	-	447.70
	1/2	.5000	-	-	-	-	-	-	-	-	20	55640	-	538.60	14	55940	-	477.70
5	5/64	.0781	16	55142	55143	432.10	16	55342	55343	432.10	24	55642	55643	496.80	16	55942	55943	458.00
	3/32	.0938	16	55144	55145	356.50	16	55344	55345	356.50	24	55644	55645	500.30	16	55944	55945	392.80
	7/64	.1094	16	55146	55147	405.85	16	55346	55347	405.85	24	55646	55647	466.80	16	55946	55947	432.10
	1/8	.1250	16	55148	55149	329.30	16	55348	55349	329.30	24	55648	55649	404.75	16	55948	55949	381.45
	5/32	.1562	16	55150	55151	360.10	16	55350	55351	360.10	24	55650	55651	414.05	16	55950	55951	394.05
	3/16	.1875	16	55152	55153	368.80	16	55352	55353	368.80	24	55652	55653	443.20	16	55952	55953	415.50
	7/32	.2188	16	55154	55155	396.30	16	55354	55355	396.30	24	55654	55655	455.80	16	55954	55955	436.85
	1/4	.2500	16	55156	55157	413.40	16	55356	55357	413.40	24	55656	55657	475.40	16	55956	55957	458.05
	5/16	.3125	16	55158	55159	449.50	16	55358	55359	449.50	24	55658	55659	517.05	16	55958	55959	494.30
	3/8	.3750	16	55160	55161	485.80	16	55360	55361	485.80	24	55660	55661	558.60	16	55960	55961	532.70
	7/16	.4375	-	-	-	-	-	-	-	-	24	55662	-	620.75	16	55962	-	562.70
	1/2	.5000	-	-	-	-	-	-	-	-	24	55664	-	689.70	16	55964	-	592.70
6	5/64	.0781	18	55166	55167	485.75	18	55366	55367	485.75	28	55666	55667	558.55	18	55966	55967	515.05
	3/32	.0938	18	55168	55169	432.60	18	55368	55369	432.60	28	55668	55669	511.70	18	55968	55969	474.30
	7/64	.1094	18	55170	55171	487.40	18	55370	55371	487.40	28	55670	55671	560.50	18	55970	55971	516.80
	1/8	.1250	18	55172	55173	412.30	18	55372	55373	412.30	28	55672	55673	536.90	18	55972	55973	487.90
	5/32	.1562	18	55174	55175	466.50	18	55374	55375	466.50	28	55674	55675	536.65	18	55974	55975	509.20
	3/16	.1875	18	55176	55177	451.70	18	55376	55377	451.70	28	55676	55677	575.70	18	55976	55977	530.45
	7/32	.2188	18	55178	55179	509.20	18	55378	55379	509.20	28	55678	55679	585.60	18	55978	55979	551.85
	1/4	.2500	18	55180	55181	530.55	18	55380	55381	530.55	28	55680	55681	625.95	18	55980	55981	581.25
	5/16	.3125	18	55182	55183	551.95	18	55382	55383	551.95	28	55682	55683	634.70	18	55982	55983	607.25
	3/8	.3750	18	55184	55185	573.10	18	55384	55385	573.10	28	55684	55685	659.10	18	55984	55985	630.60
	7/16	.4375	-	-	-	-	-	-	-	-	28	55690	-	732.25	18	55990	-	660.60
	1/2	.5000	-	-	-	-	-	-	-	-	28	55692	-	813.65	18	55992	-	690.65
8	1/8	.1250	24	-	55186	684.55	24	-	55386	684.55	24	-	55686	723.65	24	-	55986	723.65
	5/32	.1562	24	-	55187	692.70	24	-	55387	692.70	24	-	55687	731.85	24	-	55987	731.85
	3/16	.1875	24	-	55188	700.85	24	-	55388	700.85	24	-	55688	739.95	24	-	55988	739.95
	1/4	.2500	24	-	55189	743.10	24	-	55389	743.10	24	-	55689	782.30	24	-	55989	782.30

3" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

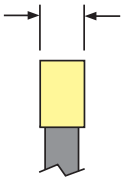
FOR STEEL

Modified width between .0600" and .5312"

TYPE 556

Cutter Notes (All cutters on page)

- 16 Teeth
- C-5 Carbide
- 1° - 3° Positve 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)



Width Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
3	.0555	55698D	0.0600 - 0.0703	$369.45	$344.50	$339.85	$337.55	$336.10	$303.20
3	.0711	55600D	0.0704 - 0.0859	432.80	407.85	403.30	401.05	399.60	366.65
3	.0867	55602D	0.0860 - 0.1015	369.45	344.50	339.85	337.55	336.10	303.20
3	.1024	55604D	0.1016 - 0.1171	345.90	320.90	316.35	314.10	312.60	279.85
3	.1180	55606D	0.1172 - 0.1406	319.65	294.70	290.20	287.95	286.35	253.55
3	.1562	55608D	0.1407 - 0.1718	332.50	307.55	303.00	300.70	299.15	266.30
3	.1875	55609D	0.1719 - 0.2031	345.30	320.35	315.80	313.50	312.00	279.15
3	.2188	55610D	0.2032 - 0.2343	358.05	333.15	328.65	326.25	324.90	291.95
3	.2500	55611D	0.2344 - 0.2812	371.00	346.00	341.50	339.25	337.70	304.85
3	.3125	55612D	0.2813 - 0.3437	400.40	375.35	370.90	368.60	367.10	334.25
3	.3750	55613D	0.3438 - 0.4062	429.95	405.00	400.40	398.10	396.60	363.70
3	.4375	55614D	0.4063 - 0.4687	470.25	445.30	440.80	438.50	437.00	404.15
3	.5000	55615D	0.4688 - 0.5312	515.20	490.25	485.75	483.45	481.95	449.10

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
3	.0555	55698R1	0.0600 - 0.0703	$386.10	$349.60	$344.50	$341.80	$340.20	$339.40
3	.0711	55600R1	0.0704 - 0.0859	449.55	413.00	407.90	405.25	403.65	402.85
3	.0867	55602R1	0.0860 - 0.1015	386.10	349.60	344.50	341.80	340.20	339.40
3	.1024	55604R1	0.1016 - 0.1171	362.65	326.05	320.95	318.35	316.80	315.85
3	.1180	55606R1	0.1172 - 0.1406	336.40	299.85	294.75	292.15	290.50	289.65
3	.1562	55608R1	0.1407 - 0.1718	349.15	312.70	307.60	305.00	303.25	302.50
3	.1875	55609R1	0.1719 - 0.2031	362.05	325.50	320.45	317.75	316.20	315.35
3	.2188	55610R1	0.2032 - 0.2343	374.85	338.30	333.20	330.55	329.00	328.10
3	.2500	55611R1	0.2344 - 0.2812	387.75	351.15	346.05	343.50	341.80	340.95
3	.3125	55612R1	0.2813 - 0.3437	417.10	380.50	375.40	372.80	371.20	370.40
3	.3750	55613R1	0.3438 - 0.4062	446.55	410.15	405.05	402.35	400.70	399.90
3	.4375	55614R1	0.4063 - 0.4687	487.05	450.45	445.40	442.75	441.20	440.40
3	.5000	55615R1	0.4688 - 0.5312	532.00	495.45	490.35	487.75	486.05	485.35

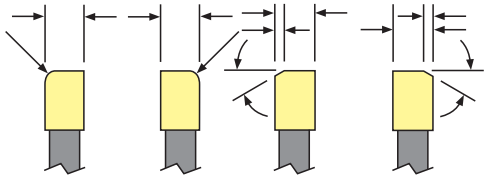
Specify right or left side for radius or chamfer

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is ½ the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

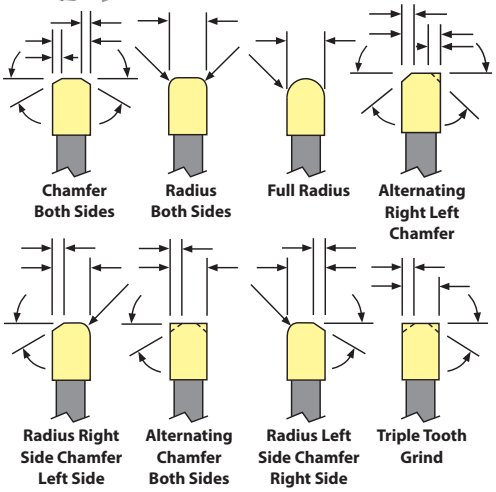
- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of ⅓ the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- ½°
- Chamfers greater than 45° must be quoted



Radius Left Side | Radius Right Side | Chamfer Left Side | Chamfer Right Side

Corner Radius or Chamfer on BOTH Sides OR a Full Radius

- Price Increases 5% for Alternating Chamfers



Chamfer Both Sides | Radius Both Sides | Full Radius | Alternating Right Left Chamfer

Radius Right Side Chamfer Left Side | Alternating Chamfer Both Sides | Radius Left Side Chamfer Right Side | Triple Tooth Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	RADII, 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	$395.30	$354.80	$349.05	$346.05	$344.40	$343.45
3	.0711	55600R2	0.0704 - 0.0859	458.80	418.20	412.45	409.55	407.80	406.75
3	.0867	55602R2	0.0860 - 0.1015	395.30	354.80	349.05	346.05	344.40	343.45
3	.1024	55604R2	0.1016 - 0.1171	371.80	331.25	325.50	322.60	320.85	319.90
3	.1180	55606R2	0.1172 - 0.1406	345.65	305.00	299.30	296.40	294.60	293.60
3	.1562	55608R2	0.1407 - 0.1718	358.40	317.75	312.15	309.25	307.40	306.50
3	.1875	55609R2	0.1719 - 0.2031	371.20	330.65	325.00	322.10	320.25	319.35
3	.2188	55610R2	0.2032 - 0.2343	384.15	343.50	337.75	334.85	333.10	332.05
3	.2500	55611R2	0.2344 - 0.2812	396.95	356.30	350.60	347.70	345.90	345.00
3	.3125	55612R2	0.2813 - 0.3437	426.35	385.70	380.00	377.05	375.30	374.35
3	.3750	55613R2	0.3438 - 0.4062	455.80	415.15	409.55	406.65	404.90	403.90
3	.4375	55614R2	0.4063 - 0.4687	496.25	455.65	450.00	447.10	445.25	444.30
3	.5000	55615R2	0.4688 - 0.5312	541.20	500.50	494.95	492.05	490.20	489.25

CUTTERS

4" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

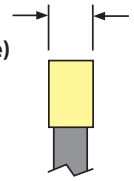
FOR STEEL

Modified width between .0600" and .5312"

TYPE 556

Cutter Notes (All cutters on page)

- 20 Teeth
- C-5 Carbide
- 1° - 3° Positve 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)



Width Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55616D	0.0600 - 0.0703	$444.75	$415.90	$410.45	$407.65	$405.95	$366.65
4	.0701	55618D	0.0704 - 0.0859	479.15	450.35	444.95	442.15	440.50	401.20
4	.0858	55620D	0.0860 - 0.1015	444.75	415.90	410.45	407.65	405.95	366.65
4	.1014	55622D	0.1016 - 0.1171	424.85	396.00	390.60	387.80	386.05	346.75
4	.1170	55624D	0.1172 - 0.1406	401.90	373.05	367.65	364.85	363.20	323.85
4	.1562	55626D	0.1407 - 0.1718	426.05	397.20	391.85	389.00	387.35	348.05
4	.1875	55628D	0.1719 - 0.2031	427.45	398.65	393.20	390.40	388.65	349.35
4	.2188	55630D	0.2032 - 0.2343	448.05	419.30	413.85	411.00	409.40	370.10
4	.2500	55632D	0.2344 - 0.2812	452.95	424.10	418.65	415.90	414.25	374.85
4	.3125	55634D	0.2813 - 0.3437	484.75	456.00	450.55	447.80	446.10	406.75
4	.3750	55636D	0.3438 - 0.4062	514.25	485.45	480.10	477.25	475.45	436.20
4	.4375	55638D	0.4063 - 0.4687	562.70	533.85	528.50	525.60	523.95	484.65
4	.5000	55640D	0.4688 - 0.5312	616.55	587.80	582.30	579.55	577.85	538.60

Corner Radius or Chamfer on ONE Side

TOOL DIAM.	HUB WIDTH	EDP NO.	ONE RADIUS OR CHAMFER FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55616R1	0.0600 - 0.0703	$462.75	$421.40	$415.50	$412.30	$410.40	$409.40
4	.0701	55618R1	0.0704 - 0.0859	497.30	456.00	450.00	446.75	444.95	443.90
4	.0858	55620R1	0.0860 - 0.1015	462.75	421.40	415.50	412.30	410.40	409.40
4	.1014	55622R1	0.1016 - 0.1171	442.80	401.55	395.60	392.45	390.55	389.55
4	.1170	55624R1	0.1172 - 0.1406	419.95	378.70	372.70	369.55	367.60	366.65
4	.1562	55626R1	0.1407 - 0.1718	444.15	402.85	396.90	393.70	391.85	390.80
4	.1875	55628R1	0.1719 - 0.2031	445.45	404.20	398.25	395.00	393.15	392.15
4	.2188	55630R1	0.2032 - 0.2343	466.20	424.90	418.90	415.70	413.85	412.85
4	.2500	55632R1	0.2344 - 0.2812	470.95	429.60	423.70	420.60	418.60	417.65
4	.3125	55634R1	0.2813 - 0.3437	502.80	461.65	455.50	452.40	450.55	449.50
4	.3750	55636R1	0.3438 - 0.4062	532.30	491.00	484.90	481.80	479.95	478.90
4	.4375	55638R1	0.4063 - 0.4687	580.75	539.45	533.50	530.35	528.40	527.45
4	.5000	55640R1	0.4688 - 0.5312	634.60	593.40	587.30	584.15	582.25	581.25

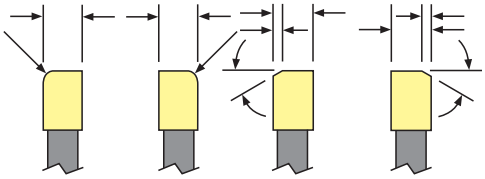
Specify right or left side for radius or chamfer

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is ½ the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

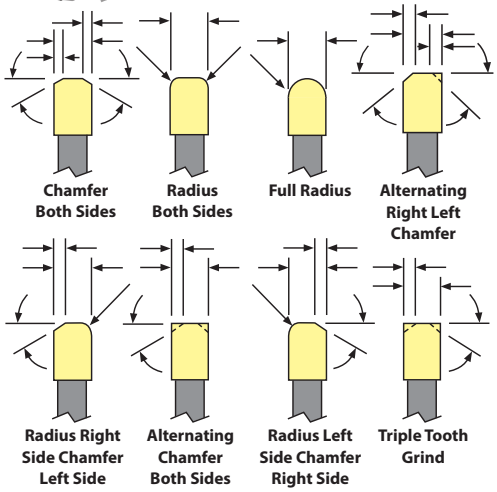
- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of ⅓ the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- ½°
- Chamfers greater than 45° must be quoted



Radius Left Side | Radius Right Side | Chamfer Left Side | Chamfer Right Side

Corner Radius or Chamfer on BOTH Sides OR a Full Radius

- Price Increases 5% for Alternating Chamfers



Chamfer Both Sides | Radius Both Sides | Full Radius | Alternating Right Left Chamfer

Radius Right Side Chamfer Left Side | Alternating Chamfer Both Sides | Radius Left Side Chamfer Right Side | Triple Tooth Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	RADII, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55616R2	0.0600 - 0.0703	$472.55	$427.05	$420.45	$417.00	$414.85	$413.75
4	.0701	55618R2	0.0704 - 0.0859	507.05	461.65	455.05	451.45	449.40	448.25
4	.0858	55620R2	0.0860 - 0.1015	472.55	427.05	420.45	417.00	414.85	413.75
4	.1014	55622R2	0.1016 - 0.1171	452.65	407.20	400.50	397.10	394.95	393.85
4	.1170	55624R2	0.1172 - 0.1406	429.85	384.30	377.70	374.15	372.10	371.00
4	.1562	55626R2	0.1407 - 0.1718	454.00	408.45	401.85	398.35	396.25	395.15
4	.1875	55628R2	0.1719 - 0.2031	455.35	409.75	403.10	399.80	397.65	396.50
4	.2188	55630R2	0.2032 - 0.2343	476.05	430.45	423.95	420.35	418.30	417.15
4	.2500	55632R2	0.2344 - 0.2812	480.75	435.30	428.70	425.20	423.05	422.00
4	.3125	55634R2	0.2813 - 0.3437	512.75	467.20	460.55	457.05	455.10	453.80
4	.3750	55636R2	0.3438 - 0.4062	542.10	496.60	489.95	486.50	484.45	483.35
4	.4375	55638R2	0.4063 - 0.4687	590.60	545.05	538.35	534.95	532.90	531.75
4	.5000	55640R2	0.4688 - 0.5312	644.45	598.90	592.30	588.85	586.80	585.65

CUTTERS

5" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

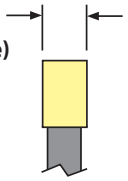
FOR STEEL

Modified width between .0704" and .5312"

TYPE 556

Cutter Notes (All cutters on page)

- 24 Teeth
- C-5 Carbide
- 1° - 3° Positve 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)



Width Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55642D	0.0704 - 0.0859	$576.55	$547.15	$541.70	$538.75	$537.05	$496.80
5	.0848	55644D	0.0860 - 0.1015	580.10	550.60	545.15	542.25	540.50	500.30
5	.1004	55646D	0.1016 - 0.1171	546.45	517.10	511.60	508.65	506.95	466.80
5	.1160	55648D	0.1172 - 0.1406	484.55	455.15	449.55	446.65	444.95	404.75
5	.1562	55650D	0.1407 - 0.1718	493.85	464.45	458.90	456.00	454.30	414.05
5	.1875	55652D	0.1719 - 0.2031	522.95	493.50	488.00	485.10	483.40	443.20
5	.2188	55654D	0.2032 - 0.2343	535.60	506.20	500.50	497.70	496.00	455.80
5	.2500	55656D	0.2344 - 0.2812	555.15	525.70	520.20	517.35	515.65	475.40
5	.3125	55658D	0.2813 - 0.3437	596.70	567.35	561.80	558.95	557.15	517.05
5	.3750	55660D	0.3438 - 0.4062	638.45	609.05	603.40	600.60	598.80	558.65
5	.4375	55662D	0.4063 - 0.4687	700.55	671.05	665.55	662.60	660.95	620.75
5	.5000	55664D	0.4688 - 0.5312	769.50	740.00	734.55	731.60	730.00	689.70

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
5	.0691	55642R1	0.0704 - 0.0859	$594.85	$552.75	$546.60	$543.40	$541.50	$540.45
5	.0848	55644R1	0.0860 - 0.1015	598.40	556.30	550.15	546.95	545.00	543.95
5	.1004	55646R1	0.1016 - 0.1171	564.80	522.65	516.50	513.30	511.45	510.45
5	.1160	55648R1	0.1172 - 0.1406	502.75	460.65	454.50	451.35	449.40	448.40
5	.1562	55650R1	0.1407 - 0.1718	512.15	470.05	463.90	460.65	458.80	457.70
5	.1875	55652R1	0.1719 - 0.2031	541.20	499.10	493.00	489.80	487.90	486.85
5	.2188	55654R1	0.2032 - 0.2343	553.85	511.75	505.55	502.45	500.40	499.45
5	.2500	55656R1	0.2344 - 0.2812	573.50	531.40	525.20	522.00	520.05	519.00
5	.3125	55658R1	0.2813 - 0.3437	615.05	572.90	566.85	563.65	561.70	560.70
5	.3750	55660R1	0.3438 - 0.4062	656.80	614.60	608.40	605.20	603.25	602.30
5	.4375	55662R1	0.4063 - 0.4687	718.75	676.70	670.50	667.35	665.45	664.40
5	.5000	55664R1	0.4688 - 0.5312	787.75	745.65	739.45	736.30	734.40	733.30

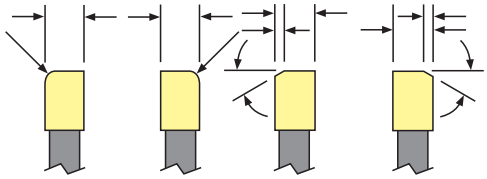
Specify right or left side for radius or chamfer

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is ½ the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

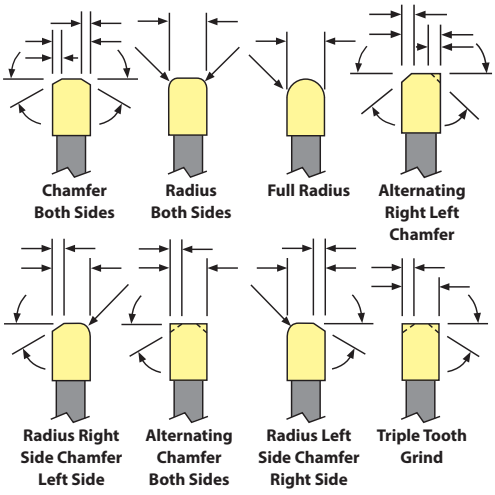
- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of ⅓ the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- ½°
- Chamfers greater than 45° must be quoted



Radius Left Side | Radius Right Side | Chamfer Left Side | Chamfer Right Side

Corner Radius or Chamfer on BOTH Sides OR a Full Radius

- Price Increases 5% for Alternating Chamfers



Chamfer Both Sides | Radius Both Sides | Full Radius | Alternating Right Left Chamfer

Radius Right Side Chamfer Left Side | Alternating Chamfer Both Sides | Radius Left Side Chamfer Right Side | Triple Tooth Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	RADII, 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	$614.45	$563.90	$556.60	$552.75	$550.45	$549.20
5	.0848	55644R2	0.0860 - 0.1015	618.00	567.45	560.10	556.15	553.85	552.70
5	.1004	55646R2	0.1016 - 0.1171	584.40	533.85	526.50	522.60	520.30	519.10
5	.1160	55648R2	0.1172 - 0.1406	522.40	471.85	464.50	460.60	458.30	457.10
5	.1562	55650R2	0.1407 - 0.1718	531.75	481.25	473.85	469.95	467.65	466.45
5	.1875	55652R2	0.1719 - 0.2031	560.85	510.30	502.90	499.10	496.80	495.50
5	.2188	55654R2	0.2032 - 0.2343	573.50	522.95	515.65	511.70	509.40	508.10
5	.2500	55656R2	0.2344 - 0.2812	593.05	542.50	535.15	531.35	529.00	527.75
5	.3125	55658R2	0.2813 - 0.3437	634.70	584.15	576.75	572.85	570.60	569.35
5	.3750	55660R2	0.3438 - 0.4062	676.25	625.80	618.40	614.50	612.20	611.00
5	.4375	55662R2	0.4063 - 0.4687	738.40	687.95	680.50	676.60	674.25	673.10
5	.5000	55664R2	0.4688 - 0.5312	807.35	756.85	749.40	745.60	743.35	742.10

6" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 556

MATERIAL SPECIFIC

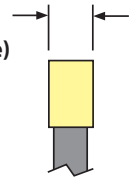
FOR STEEL

Modified width between .0704" and .5312"

TYPE 556

Cutter Notes (All cutters on page)

- 28 Teeth
- C-5 Carbide
- 1° - 3° Positve 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)



Width Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55666D	0.0704 - 0.0859	$647.95	$615.65	$609.35	$606.10	$604.15	$558.55
6	.0838	55668D	0.0860 - 0.1015	601.10	568.85	562.55	559.25	557.35	511.70
6	.0994	55670D	0.1016 - 0.1171	649.90	617.60	611.30	608.05	606.05	560.50
6	.1150	55672D	0.1172 - 0.1406	626.35	594.05	587.80	584.45	582.55	536.90
6	.1562	55674D	0.1407 - 0.1718	626.05	593.65	587.40	584.15	582.20	536.65
6	.1875	55676D	0.1719 - 0.2031	665.15	632.85	626.60	623.35	621.35	575.70
6	.2188	55678D	0.2032 - 0.2343	675.00	642.70	636.45	633.20	631.20	585.60
6	.2500	55680D	0.2344 - 0.2812	715.45	683.05	676.80	673.55	671.60	625.95
6	.3125	55682D	0.2813 - 0.3437	724.10	691.75	685.45	682.20	680.25	634.70
6	.3750	55684D	0.3438 - 0.4062	748.55	716.10	709.80	706.55	704.65	659.10
6	.4375	55690D	0.4063 - 0.4687	821.75	789.40	783.15	779.75	777.90	732.25
6	.5000	55692D	0.4688 - 0.5312	903.05	870.80	864.55	861.15	859.30	813.65

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	$667.30	$621.75	$614.85	$611.15	$609.05	$607.85
6	.0838	55668R1	0.0860 - 0.1015	620.35	574.95	568.00	564.35	562.15	560.95
6	.0994	55670R1	0.1016 - 0.1171	669.15	623.65	616.70	613.15	610.95	609.75
6	.1150	55672R1	0.1172 - 0.1406	645.55	600.15	593.20	589.55	587.35	586.15
6	.1562	55674R1	0.1407 - 0.1718	645.35	599.85	592.90	589.25	587.10	585.95
6	.1875	55676R1	0.1719 - 0.2031	684.45	638.95	632.00	628.30	626.20	625.05
6	.2188	55678R1	0.2032 - 0.2343	694.35	648.85	641.85	638.30	636.10	634.90
6	.2500	55680R1	0.2344 - 0.2812	734.70	689.20	682.20	678.65	676.50	675.30
6	.3125	55682R1	0.2813 - 0.3437	743.45	697.85	690.95	687.35	685.20	684.00
6	.3750	55684R1	0.3438 - 0.4062	767.75	722.20	715.30	711.70	709.50	708.30
6	.4375	55690R1	0.4063 - 0.4687	841.00	795.40	788.50	784.85	782.75	781.55
6	.5000	55692R1	0.4688 - 0.5312	922.35	876.80	869.90	866.25	864.05	862.95

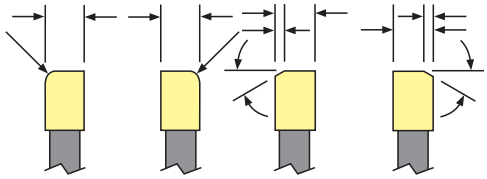
Specify right or left side for radius or chamfer

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is ½ the width of the cutter
- A non-tangent radii must be quoted

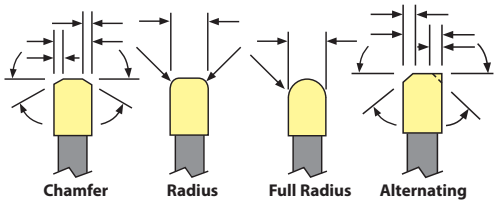
Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of ⅓ the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- ½°
- Chamfers greater than 45° must be quoted

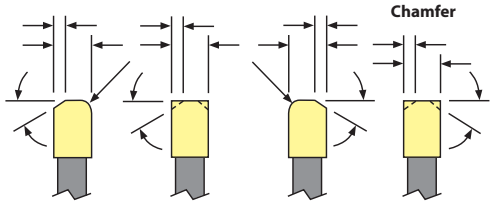


Radius Left Side | Radius Right Side | Chamfer Left Side | Chamfer Right Side

Corner Radius or Chamfer on BOTH Sides OR a Full Radius



Chamfer Both Sides | Radius Both Sides | Full Radius | Alternating Right Left Chamfer



Radius Right Side Chamfer Left Side | Alternating Chamfer Both Sides | Radius Left Side Chamfer Right Side | Triple Tooth Grind

- Price Increases 5% for Alternating Chamfers

TOOL DIAM.	HUB WIDTH	EDP NO.	RADII, 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	$688.20	$633.95	$625.55	$621.35	$618.75	$617.35
6	.0838	55668R2	0.0860 - 0.1015	641.35	587.05	578.75	574.45	571.85	570.50
6	.0994	55670R2	0.1016 - 0.1171	690.10	635.80	627.55	623.15	620.70	619.20
6	.1150	55672R2	0.1172 - 0.1406	666.55	612.20	603.95	599.60	597.15	595.70
6	.1562	55674R2	0.1407 - 0.1718	666.25	612.00	603.75	599.35	596.80	595.40
6	.1875	55676R2	0.1719 - 0.2031	705.35	651.10	642.75	638.45	635.90	634.45
6	.2188	55678R2	0.2032 - 0.2343	715.25	660.95	652.65	648.35	645.85	644.40
6	.2500	55680R2	0.2344 - 0.2812	755.55	701.30	693.10	688.70	686.15	684.70
6	.3125	55682R2	0.2813 - 0.3437	764.35	710.05	701.75	697.45	694.90	693.45
6	.3750	55684R2	0.3438 - 0.4062	788.65	734.40	726.10	721.70	719.25	717.75
6	.4375	55690R2	0.4063 - 0.4687	861.85	807.60	799.30	795.00	792.45	791.05
6	.5000	55692R2	0.4688 - 0.5312	943.30	889.00	880.70	876.40	873.85	872.40

3" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559

GENERAL PURPOSE

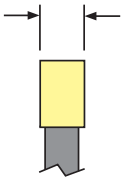
SUITABLE FOR MOST MATERIALS

Modified width between .0600" and .5312"

TYPE 559

Cutter Notes (All cutters on page)

- 12 Teeth
- C-2(m) Carbide
- 5° Positve 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)



Width Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
3	.0555	55998D	0.0600 - 0.0703	$350.65	$325.30	$320.95	$318.65	$317.30	$285.25
3	.0711	55900D	0.0704 - 0.0859	385.00	359.65	355.25	352.95	351.50	319.50
3	.0867	55902D	0.0860 - 0.1015	350.65	325.30	320.95	318.65	317.30	285.25
3	.1024	55904D	0.1016 - 0.1171	337.70	312.45	308.00	305.70	304.30	272.25
3	.1180	55906D	0.1172 - 0.1406	325.50	300.15	295.70	293.40	292.05	260.05
3	.1562	55908D	0.1407 - 0.1718	331.80	306.55	302.10	299.80	298.45	266.30
3	.1875	55909D	0.1719 - 0.2031	338.20	312.80	308.35	306.10	304.75	272.70
3	.2188	55910D	0.2032 - 0.2343	346.75	321.55	317.10	314.75	313.40	281.35
3	.2500	55911D	0.2344 - 0.2812	355.40	330.10	325.55	323.25	321.95	289.80
3	.3125	55912D	0.2813 - 0.3437	383.00	357.70	353.25	351.00	349.65	317.50
3	.3750	55913D	0.3438 - 0.4062	412.70	387.40	383.00	380.60	379.25	347.30
3	.4375	55914D	0.4063 - 0.4687	442.75	417.45	413.05	410.75	409.35	377.40
3	.5000	55915D	0.4688 - 0.5312	472.90	447.45	443.05	440.80	439.50	407.30

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	$367.80	$330.35	$325.30	$322.85	$321.35	$320.55
3	.0711	55900R1	0.0704 - 0.0859	402.15	364.65	359.65	357.10	355.55	354.80
3	.0867	55902R1	0.0860 - 0.1015	367.80	330.35	325.30	322.85	321.35	320.55
3	.1024	55904R1	0.1016 - 0.1171	354.90	317.40	312.45	309.90	308.30	307.50
3	.1180	55906R1	0.1172 - 0.1406	342.65	305.10	300.15	297.60	296.10	295.20
3	.1562	55908R1	0.1407 - 0.1718	348.90	311.45	306.55	303.90	302.40	301.55
3	.1875	55909R1	0.1719 - 0.2031	355.35	317.75	312.80	310.30	308.85	307.95
3	.2188	55910R1	0.2032 - 0.2343	363.85	326.55	321.55	318.85	317.40	316.50
3	.2500	55911R1	0.2344 - 0.2812	372.45	334.95	330.10	327.45	325.95	325.10
3	.3125	55912R1	0.2813 - 0.3437	400.10	362.70	357.70	355.10	353.65	352.70
3	.3750	55913R1	0.3438 - 0.4062	429.95	392.40	387.40	384.85	383.35	382.55
3	.4375	55914R1	0.4063 - 0.4687	459.90	422.45	417.45	414.90	413.40	412.55
3	.5000	55915R1	0.4688 - 0.5312	489.95	452.45	447.45	445.00	443.35	442.60

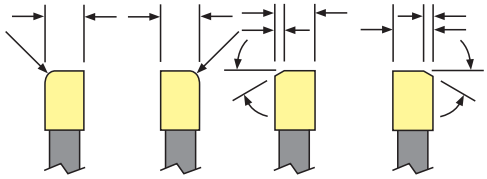
Specify right or left side for radius or chamfer

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is ½ the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

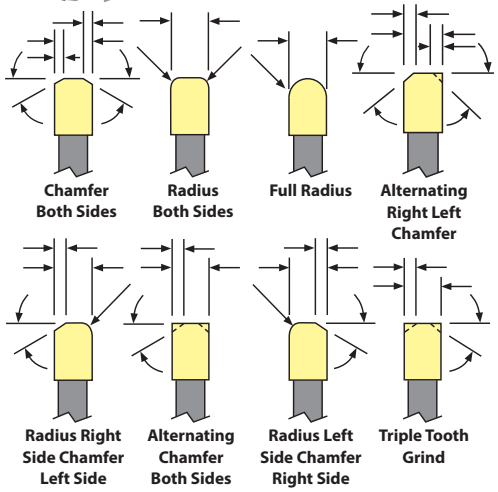
- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of ⅓ the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- ½°
- Chamfers greater than 45° must be quoted



Radius Left Side | Radius Right Side | Chamfer Left Side | Chamfer Right Side

Corner Radius or Chamfer on BOTH Sides OR a Full Radius

- Price Increases 5% for Alternating Chamfers



Chamfer Both Sides | Radius Both Sides | Full Radius | Alternating Right Left Chamfer

Radius Right Side Chamfer Left Side | Alternating Chamfer Both Sides | Radius Left Side Chamfer Right Side | Triple Tooth Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	RADII, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
3	.0555	55998R2	0.0600 - 0.0703	$376.95	$335.40	$329.90	$326.95	$325.25	$324.40
3	.0711	55900R2	0.0704 - 0.0859	411.30	369.65	364.20	361.30	359.50	358.55
3	.0867	55902R2	0.0860 - 0.1015	376.95	335.40	329.90	326.95	325.25	324.40
3	.1024	55904R2	0.1016 - 0.1171	364.15	322.40	316.95	314.10	312.35	311.40
3	.1180	55906R2	0.1172 - 0.1406	351.80	310.20	304.65	301.80	300.05	299.15
3	.1562	55908R2	0.1407 - 0.1718	358.15	316.45	311.00	308.15	306.45	305.45
3	.1875	55909R2	0.1719 - 0.2031	364.40	322.85	317.35	314.45	312.75	311.85
3	.2188	55910R2	0.2032 - 0.2343	373.20	331.45	326.00	323.15	321.40	320.55
3	.2500	55911R2	0.2344 - 0.2812	381.60	339.95	334.50	331.60	329.90	329.00
3	.3125	55912R2	0.2813 - 0.3437	409.30	367.65	362.10	359.30	357.65	356.70
3	.3750	55913R2	0.3438 - 0.4062	439.10	397.45	391.90	389.05	387.30	386.45
3	.4375	55914R2	0.4063 - 0.4687	469.05	427.50	422.00	419.05	417.40	416.45
3	.5000	55915R2	0.4688 - 0.5312	499.10	457.60	452.00	449.15	447.40	446.50

4" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559

GENERAL PURPOSE

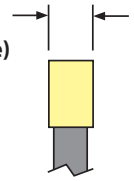
SUITABLE FOR MOST MATERIALS

Modified width between .0600" and .5312"

TYPE 559

Cutter Notes (All cutters on page)

- 14 Teeth
- C-2(m) Carbide
- 5° Positve 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)



Width Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55916D	0.0600 - 0.0703	$401.50	$372.45	$367.15	$364.40	$362.75	$324.45
4	.0701	55918D	0.0704 - 0.0859	448.85	419.70	414.40	411.65	410.10	371.70
4	.0858	55920D	0.0860 - 0.1015	401.50	372.45	367.15	364.40	362.75	324.45
4	.1014	55922D	0.1016 - 0.1171	461.80	432.70	427.40	424.75	423.00	384.60
4	.1170	55924D	0.1172 - 0.1406	401.10	371.90	366.55	363.80	362.25	323.90
4	.1562	55926D	0.1407 - 0.1718	409.55	380.45	375.15	372.45	370.75	332.45
4	.1875	55928D	0.1719 - 0.2031	420.10	391.00	385.70	383.05	381.35	343.00
4	.2188	55930D	0.2032 - 0.2343	430.95	401.85	396.50	393.80	392.05	353.80
4	.2500	55932D	0.2344 - 0.2812	439.50	410.30	405.00	402.25	400.55	362.30
4	.3125	55934D	0.2813 - 0.3437	464.90	435.80	430.45	427.75	426.05	387.85
4	.3750	55936D	0.3438 - 0.4062	494.80	465.70	460.40	457.65	455.90	417.60
4	.4375	55938D	0.4063 - 0.4687	524.80	495.75	490.35	487.65	485.90	447.70
4	.5000	55940D	0.4688 - 0.5312	554.90	525.65	520.40	517.65	516.00	477.70

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	55916R1	0.0600 - 0.0703	$420.05	$377.90	$372.05	$368.90	$367.15	$366.15
4	.0701	55918R1	0.0704 - 0.0859	467.30	425.15	419.30	416.15	414.40	413.40
4	.0858	55920R1	0.0860 - 0.1015	420.05	377.90	372.05	368.90	367.15	366.15
4	.1014	55922R1	0.1016 - 0.1171	480.40	438.15	432.25	429.25	427.40	426.40
4	.1170	55924R1	0.1172 - 0.1406	419.60	377.40	371.50	368.40	366.55	365.60
4	.1562	55926R1	0.1407 - 0.1718	428.05	385.80	380.00	376.95	375.15	374.10
4	.1875	55928R1	0.1719 - 0.2031	438.70	396.50	390.60	387.50	385.70	384.65
4	.2188	55930R1	0.2032 - 0.2343	449.50	407.25	401.35	398.35	396.50	395.45
4	.2500	55932R1	0.2344 - 0.2812	457.95	415.70	409.80	406.75	405.00	404.00
4	.3125	55934R1	0.2813 - 0.3437	483.45	441.20	435.35	432.30	430.45	429.40
4	.3750	55936R1	0.3438 - 0.4062	513.25	471.05	465.15	462.10	460.40	459.30
4	.4375	55938R1	0.4063 - 0.4687	543.35	501.20	495.20	492.20	490.35	489.35
4	.5000	55940R1	0.4688 - 0.5312	573.40	531.25	525.35	522.25	520.40	519.45

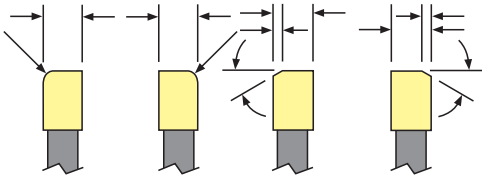
Specify right or left side for radius or chamfer

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is ½ the width of the cutter
- A non-tangent radii must be quoted

Chamfer Notes

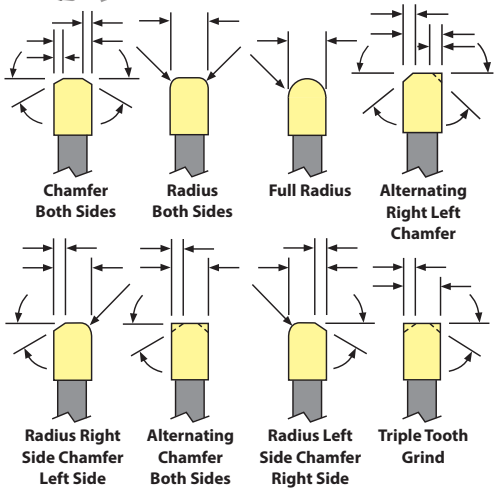
- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of ⅓ the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- ½°
- Chamfers greater than 45° must be quoted



Radius Left Side | Radius Right Side | Chamfer Left Side | Chamfer Right Side

Corner Radius or Chamfer on BOTH Sides OR a Full Radius

- Price Increases 5% for Alternating Chamfers



Chamfer Both Sides | Radius Both Sides | Full Radius | Alternating Right Left Chamfer

Radius Right Side Chamfer Left Side | Alternating Chamfer Both Sides | Radius Left Side Chamfer Right Side | Triple Tooth Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	RADII, CHAMFERS, OR COMBO FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
4	.0545	55916R2	0.0600 - 0.0703	$429.95	$383.40	$376.85	$373.50	$371.50	$370.40
4	.0701	55918R2	0.0704 - 0.0859	477.05	430.60	424.10	420.75	418.65	417.60
4	.0858	55920R2	0.0860 - 0.1015	429.95	383.40	376.85	373.50	371.50	370.40
4	.1014	55922R2	0.1016 - 0.1171	490.10	443.65	437.05	433.80	431.70	430.60
4	.1170	55924R2	0.1172 - 0.1406	429.30	382.80	376.30	372.95	370.95	369.80
4	.1562	55926R2	0.1407 - 0.1718	437.85	391.40	384.80	381.50	379.35	378.30
4	.1875	55928R2	0.1719 - 0.2031	448.50	401.95	395.45	392.05	390.00	389.00
4	.2188	55930R2	0.2032 - 0.2343	459.25	412.70	406.25	402.90	400.90	399.80
4	.2500	55932R2	0.2344 - 0.2812	467.65	421.20	414.70	411.30	409.30	408.15
4	.3125	55934R2	0.2813 - 0.3437	493.20	446.70	440.20	436.85	434.75	433.75
4	.3750	55936R2	0.3438 - 0.4062	523.10	476.55	470.05	466.70	464.70	463.55
4	.4375	55938R2	0.4063 - 0.4687	553.10	506.60	500.15	496.70	494.65	493.70
4	.5000	55940R2	0.4688 - 0.5312	583.15	536.70	530.10	526.75	524.70	523.55

5" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559

GENERAL PURPOSE

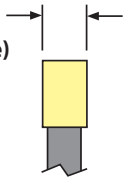
SUITABLE FOR MOST MATERIALS

Modified width between .0704" and .5312"

TYPE 559

Cutter Notes (All cutters on page)

- 16 Teeth
- C-2(m) Carbide
- 5° Positve 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)



Width Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
5	.0691	55942D	0.0704 - 0.0859	$536.90	$507.05	$501.60	$498.90	$497.25	$458.00
5	.0848	55944D	0.0860 - 0.1015	471.75	441.95	436.60	433.80	432.15	392.80
5	.1004	55946D	0.1016 - 0.1171	510.85	481.15	475.65	472.95	471.25	432.10
5	.1160	55948D	0.1172 - 0.1406	460.40	430.45	425.15	422.30	420.70	381.45
5	.1562	55950D	0.1407 - 0.1718	473.00	443.20	437.85	434.95	433.30	394.05
5	.1875	55952D	0.1719 - 0.2031	494.40	464.65	459.25	456.50	454.75	415.50
5	.2188	55954D	0.2032 - 0.2343	515.80	485.90	480.55	477.75	476.05	436.85
5	.2500	55956D	0.2344 - 0.2812	536.95	507.10	501.80	499.00	497.35	458.05
5	.3125	55958D	0.2813 - 0.3437	573.10	543.35	537.95	535.15	533.50	494.30
5	.3750	55960D	0.3438 - 0.4062	611.50	581.70	576.40	573.55	571.85	532.70
5	.4375	55962D	0.4063 - 0.4687	641.55	611.85	606.50	603.65	601.90	562.70
5	.5000	55964D	0.4688 - 0.5312	671.65	641.85	636.45	633.70	632.00	592.70

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
5	.0691	55942R1	0.0704 - 0.0859	$555.60	$512.50	$506.55	$503.35	$501.45	$500.50
5	.0848	55944R1	0.0860 - 0.1015	490.55	447.40	441.40	438.35	436.40	435.35
5	.1004	55946R1	0.1016 - 0.1171	529.65	486.60	480.55	477.45	475.50	474.55
5	.1160	55948R1	0.1172 - 0.1406	479.05	435.95	430.05	426.90	425.00	424.05
5	.1562	55950R1	0.1407 - 0.1718	491.75	448.60	442.65	439.60	437.60	436.70
5	.1875	55952R1	0.1719 - 0.2031	513.10	470.10	464.05	460.95	459.10	458.05
5	.2188	55954R1	0.2032 - 0.2343	534.45	491.40	485.40	482.35	480.40	479.40
5	.2500	55956R1	0.2344 - 0.2812	555.70	512.75	506.60	503.55	501.60	500.60
5	.3125	55958R1	0.2813 - 0.3437	591.90	548.75	542.80	539.65	537.85	536.80
5	.3750	55960R1	0.3438 - 0.4062	630.30	587.20	581.15	578.05	576.30	575.25
5	.4375	55962R1	0.4063 - 0.4687	660.35	617.30	611.25	608.15	606.25	605.25
5	.5000	55964R1	0.4688 - 0.5312	690.35	647.35	641.35	638.30	636.25	635.30

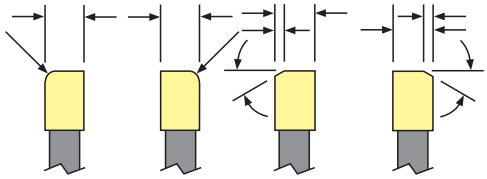
Specify right or left side for radius or chamfer

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is ½ the width of the cutter
- A non-tangent radii must be quoted

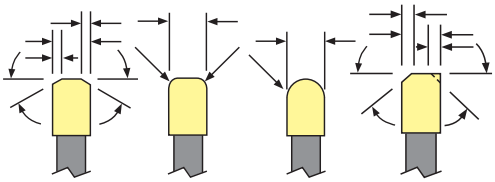
Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of ⅓ the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- ½°
- Chamfers greater than 45° must be quoted

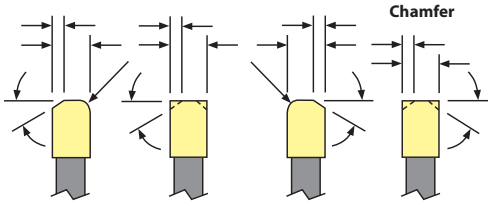


Radius Left Side | Radius Right Side | Chamfer Left Side | Chamfer Right Side

Corner Radius or Chamfer on BOTH Sides OR a Full Radius



Chamfer Both Sides | Radius Both Sides | Full Radius | Alternating Right Left Chamfer



Radius Right Side Chamfer Left Side | Alternating Chamfer Both Sides | Radius Left Side Chamfer Right Side | Triple Tooth Grind

- Price Increases 5% for Alternating Chamfers

TOOL DIAM.	HUB WIDTH	EDP NO.	RADII, 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	$575.15	$523.45	$516.20	$512.45	$510.20	$509.05
5	.0848	55944R2	0.0860 - 0.1015	510.05	458.30	451.10	447.35	445.10	443.95
5	.1004	55946R2	0.1016 - 0.1171	549.15	497.45	490.25	486.50	484.30	483.05
5	.1160	55948R2	0.1172 - 0.1406	498.60	446.90	439.70	435.90	433.75	432.50
5	.1562	55950R2	0.1407 - 0.1718	511.25	459.55	452.35	448.60	446.40	445.10
5	.1875	55952R2	0.1719 - 0.2031	532.70	481.00	473.70	470.05	467.80	466.60
5	.2188	55954R2	0.2032 - 0.2343	553.90	502.40	495.10	491.40	489.15	487.95
5	.2500	55956R2	0.2344 - 0.2812	575.25	523.50	516.25	512.60	510.45	509.20
5	.3125	55958R2	0.2813 - 0.3437	611.35	559.70	552.55	548.70	546.45	545.30
5	.3750	55960R2	0.3438 - 0.4062	649.85	598.10	590.95	587.15	584.90	583.80
5	.4375	55962R2	0.4063 - 0.4687	679.95	628.15	620.90	617.25	615.00	613.80
5	.5000	55964R2	0.4688 - 0.5312	709.90	658.25	651.05	647.35	645.00	643.80

6" MILLING CUTTERS & SLITTING SAWS CARBIDE TIPPED TYPE 559

GENERAL PURPOSE

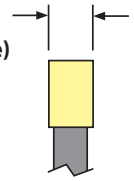
SUITABLE FOR MOST MATERIALS

Modified width between .0704" and .5312"

TYPE 559

Cutter Notes (All cutters on page)

- 18 Teeth
- C-2(m) Carbide
- 5° Positve 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)



Width Grind

TOOL DIAM.	HUB WIDTH	EDP NO.	FINISHED TO MODIFIED FACE WIDTH						
			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
				1	2	3	4	5	6
6	.0681	55966D	0.0704 - 0.0859	$597.45	$566.30	$560.70	$557.80	$555.95	$515.05
6	.0838	55968D	0.0860 - 0.1015	556.65	525.55	519.90	517.05	515.20	474.30
6	.0994	55970D	0.1016 - 0.1171	599.20	568.15	562.40	559.50	557.80	516.80
6	.1150	55972D	0.1172 - 0.1406	570.15	539.10	533.50	530.55	528.80	487.90
6	.1562	55974D	0.1407 - 0.1718	591.45	560.50	554.85	551.90	550.15	509.20
6	.1875	55976D	0.1719 - 0.2031	612.85	581.70	576.25	573.10	571.35	530.45
6	.2188	55978D	0.2032 - 0.2343	634.15	603.05	597.45	594.50	592.70	551.85
6	.2500	55980D	0.2344 - 0.2812	663.60	632.60	626.85	623.95	622.25	581.25
6	.3125	55982D	0.2813 - 0.3437	689.65	658.50	652.90	649.95	648.25	607.25
6	.3750	55984D	0.3438 - 0.4062	713.00	681.80	676.25	673.30	671.55	630.55
6	.4375	55990D	0.4063 - 0.4687	742.95	711.85	706.30	703.30	701.55	660.60
6	.5000	55992D	0.4688 - 0.5312	773.00	741.95	736.30	733.40	731.60	690.65

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	$616.50	$571.75	$565.45	$562.30	$560.30	$559.25
6	.0838	55968R1	0.0860 - 0.1015	575.75	530.95	524.70	521.55	519.60	518.55
6	.0994	55970R1	0.1016 - 0.1171	618.35	573.50	567.20	564.00	562.00	561.00
6	.1150	55972R1	0.1172 - 0.1406	589.35	544.55	538.25	535.00	533.10	532.05
6	.1562	55974R1	0.1407 - 0.1718	610.70	565.95	559.60	556.50	554.45	553.40
6	.1875	55976R1	0.1719 - 0.2031	632.00	587.20	580.95	577.70	575.75	574.75
6	.2188	55978R1	0.2032 - 0.2343	653.30	608.55	602.35	598.95	597.15	596.05
6	.2500	55980R1	0.2344 - 0.2812	682.80	638.05	631.75	628.55	626.55	625.45
6	.3125	55982R1	0.2813 - 0.3437	708.75	664.00	657.80	654.55	652.55	651.45
6	.3750	55984R1	0.3438 - 0.4062	732.05	687.35	681.05	677.80	675.90	674.85
6	.4375	55990R1	0.4063 - 0.4687	762.10	717.45	711.15	707.90	705.90	704.90
6	.5000	55992R1	0.4688 - 0.5312	792.20	747.40	741.10	737.90	736.00	734.85

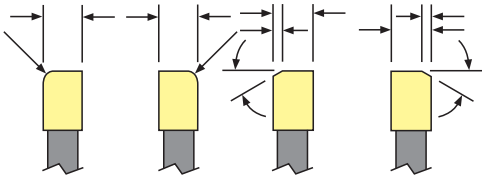
Specify right or left side for radius or chamfer

Radius Notes

- Maximum radius on one side is .2656"
- Full radius and maximum radius on both sides is ½ the width of the cutter
- A non-tangent radii must be quoted

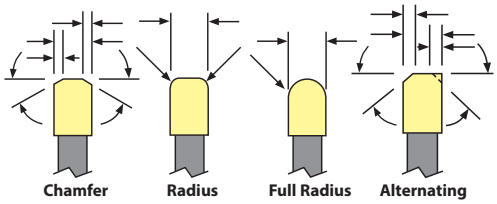
Chamfer Notes

- Chamfer Angles can range from 0° to 45°
- Chamfer is measured off the OD
- Maximum chamfer is the LESSER of ⅓ the width of the cutter OR .2656" length of angle when measured across the OD
- Chamfer Angle Tolerance: +/- ½°
- Chamfers greater than 45° must be quoted

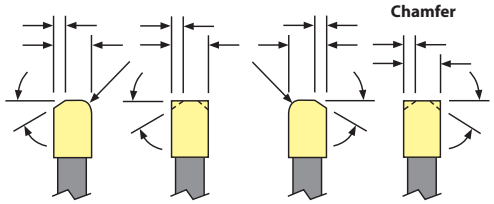


Radius Left Side | Radius Right Side | Chamfer Left Side | Chamfer Right Side

Corner Radius or Chamfer on BOTH Sides OR a Full Radius



Chamfer Both Sides | Radius Both Sides | Full Radius | Alternating Right Left Chamfer



Radius Right Side Chamfer Left Side | Alternating Chamfer Both Sides | Radius Left Side Chamfer Right Side | Triple Tooth Grind

- Price Increases 5% for Alternating Chamfers

TOOL DIAM.	HUB WIDTH	EDP NO.	RADII, 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	$636.10	$582.70	$575.25	$571.35	$569.00	$567.70
6	.0838	55968R2	0.0860 - 0.1015	595.30	541.95	534.45	530.60	528.30	526.95
6	.0994	55970R2	0.1016 - 0.1171	637.90	584.45	576.95	573.10	570.75	569.55
6	.1150	55972R2	0.1172 - 0.1406	608.95	555.55	548.00	544.15	541.85	540.55
6	.1562	55974R2	0.1407 - 0.1718	630.25	576.80	569.35	565.45	563.15	561.90
6	.1875	55976R2	0.1719 - 0.2031	651.45	598.10	590.65	586.85	584.55	583.25
6	.2188	55978R2	0.2032 - 0.2343	672.80	619.50	612.00	608.15	605.80	604.55
6	.2500	55980R2	0.2344 - 0.2812	702.30	648.90	641.45	637.55	635.20	634.05
6	.3125	55982R2	0.2813 - 0.3437	728.25	674.95	667.45	663.60	661.25	660.00
6	.3750	55984R2	0.3438 - 0.4062	751.55	698.25	690.80	686.95	684.60	683.40
6	.4375	55990R2	0.4063 - 0.4687	781.65	728.25	720.85	717.00	714.65	713.40
6	.5000	55992R2	0.4688 - 0.5312	811.70	758.35	750.90	747.10	744.75	743.45

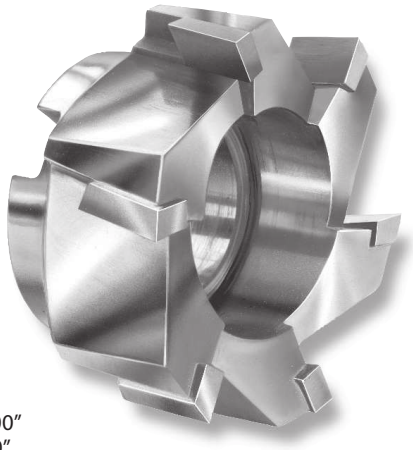
CUTTERS

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 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 1/4	1/2	1/2	1	1/4	5/32	4	53024	$202.95	4	53124	$202.95	4	53224	$211.10
1 1/2	1/2	1/2	1 1/8	1/4	5/32	4	53026	211.35	4	53126	211.35	4	53226	219.75
1 3/4	3/4	1/2	1 1/4	5/16	3/16	4	53028	263.35	4	53128	263.35	4	53228	273.80
2	3/4	5/8	1 3/8	5/16	3/16	4	53032	276.55	4	53132	294.25	4	53232	305.95
2 1/4	1	5/8	1 1/2	3/8	7/32	6	53036	292.15	6	53136	318.55	6	53236	331.30
2 1/2	1	5/8	1 5/8	3/8	7/32	6	53040	307.60	6	53140	347.20	6	53240	347.20
2 3/4	1	5/8	1 5/8	3/8	7/32	6	53044	324.60	6	53144	364.25	6	53244	364.25
3	1 1/4	3/4	1 3/4	1/2	9/32	6	53048	355.80	6	53148	396.15	6	53248	396.15
3 1/2	1 1/4	3/4	1 7/8	1/2	9/32	6	53056	435.55	8	53156	465.90	6	53256	492.50
4	1 1/2	3/4	2 1/4	5/8	3/8	6	53064	547.30	8	53164	576.40	6	53264	611.80

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	1/2	1	8	71408	71608	72408	72608	$423.75
4	1/2	1 1/4	10	71416	71616	72416	72616	524.40
4	3/4	1 1/4	10	71424	71624	72424	72624	568.90

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

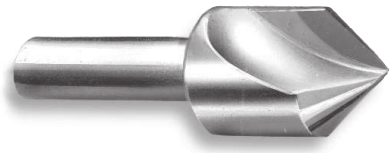
TOOL DIAMETER	WIDTH	ARBOR HOLES	NO. OF TEETH	45° TYPE 750 EDP NO.	60° TYPE 752 EDP NO.	90° TYPE 754 EDP NO.	ALL TYPES PRICE
2 3/4	1/2	1	8	-	75207	75407	$356.75
3	1/2	1	8	75008	75208	75408	444.90
4	1/2	1 1/4	10	75016	75216	75416	550.60
4	3/4	1 1/4	10	75024	75224	75424	597.25
4	1	1 1/4	10	-	75232	75432	699.00

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

GENERAL PURPOSE

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
- Reduced shank diameter
- Shank drive flat(s)
- 4 coatings available (listed on page 174)

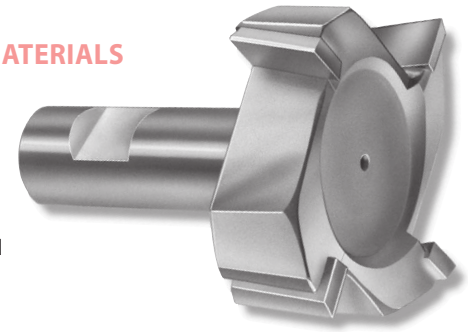
TOOL DIAM.	SHANK DIAM.	MIN. CUT DIAM.	TYPE 561 60˚ ANGLE EDP NO.	TYPE 581 82˚ ANGLE EDP NO.	TYPE 591 90˚ ANGLE EDP NO.	TYPE 584 100˚ ANGLE EDP NO.	PRICE ALL TYPES
¼	3⁄16	1⁄16	56108	58108	59108	58408	$66.90
3⁄8	¼	5⁄64	56112	58112	59112	58412	66.90
½	3⁄8	3⁄32	56116	58116	59116	58416	79.45
¾	½	⅛	56124	58124	59124	58424	99.35
1	½	⅛	56132	58132	59132	58432	129.75
1 ¼	½	5⁄32	56140	58140	59140	58440	165.15
1 ½	½	3⁄16	56148	58148	59148	58448	185.15

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
¼	3⁄16	5⁄64	56308	58308	59008	58508	$73.60
3⁄8	¼	7⁄64	56312	58312	59012	58512	73.60
½	3⁄8	9⁄64	56316	58316	59016	58516	87.40
5⁄8	3⁄8	9⁄64	56320	58320	59020	58520	91.95
¾	½	3⁄16	56324	58324	59024	58524	110.55
7⁄8	½	3⁄16	56328	58328	59028	58528	126.70
1	½	¼	56332	58332	59032	58532	138.20
1 ¼	½	5⁄16	56340	58340	59040	58540	171.90
1 ½	½	3⁄8	56348	58348	59048	58548	200.50

FACE MILLING CUTTERS - SHANK TYPE CARBIDE TIPPED TYPES 536, 537, 538 FRACTIONAL

MATERIAL SPECIFIC

CUTTERS



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

MODIFICATIONS (Prompt delivery)

- Corner chamfer or corner radius
- Additional shank drive flat(s)
- 4 coatings available (listed on page 174)

TOOL SELECTOR	CHIP CLASS	MATERIAL MACHINED	TOOL TYPE
	20	NON-FERROUS - LONG CHIPS	536
	40	NON-FERROUS - SHORT CHIPS	536/537
	60	CAST IRONS	537
	80	LOW STRENGTH STEELS	538
	100	MEDIUM STRENGTH STEELS	538
	120	HIGH STRENGTH STEELS	538
	140	HIGH TEMPERATURE ALLOYS	537

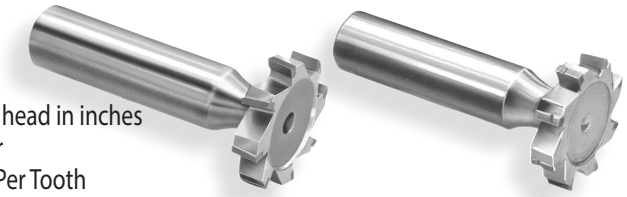
TOOL DIAM.	DIMENSIONS					NO. OF TEETH	TYPE 536 FOR NON-FERROUS		NO. OF TEETH	TYPE 537 FOR CAST IRONS		NO. OF TEETH	TYPE 538 FOR STEELS	
	SHANK DIAM.	TOOL WIDTH	CARBIDE DEPTH	LENGTH CAR-BIDE	LENGTH OVER-ALL		EDP NO.	PRICE		EDP NO.	PRICE		EDP NO.	PRICE
1 ½	¾	¾	¼	½	2 7⁄8	4	53624	$189.15	4	53724	189.15	4	53824	$194.65
2	¾	¾	¼	½	2 7⁄8	4	53632	231.25	4	53732	231.25	4	53832	236.70
2 ½	¾	¾	¼	½	2 7⁄8	6	53640	260.40	6	53740	260.40	6	53840	267.40
3 ½	1 ¼	1 ⅛	5⁄16	5⁄8	4	6	53656	449.40	6	53756	449.40	8	53856	464.85
3 ½	1 ½	1 ⅛	5⁄16	5⁄8	4	6	53657	471.90	6	53757	471.90	8	53857	488.00
4	1 ½	1 ½	3⁄8	¾	5	8	53664	504.95	8	53764	504.95	8	53864	505.55

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)/Cutter Diameter
IPM=IPT*RPM*#TeethIPT = Inches Per Tooth



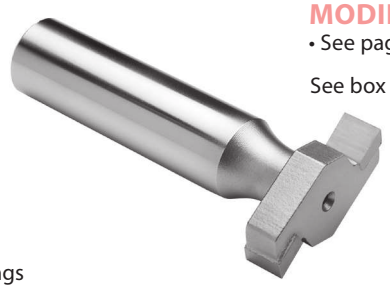
SPEEDS AND FEEDS FOR TYPE 704 ONLY:
Starting point for Aluminum slotting:
1K - 4K SFPM, .002 - .008 IPT. Reduce SFPM and IPT by 25% for widths under .0938.

CHIP CLASS	MATERIAL	BRINELL	SFPM	IPT	KEYSEAT CUTTER DIAMETER								
					½	⅝	¾	⅞	1	1 ⅛	1 ¼	1 ⅜	1 ½
					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
	STAINLESS STEEL - 400 SERIES FREE MACHINING	135-275	250-500	.002-.005	34	28	23	20	23	20	18	17	15
120	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

KEYSEAT CUTTERS
CHIP CLASS 20, 40 - CARBIDE TIPPED TYPE 704 FRACTIONAL

MATERIAL SPECIFIC

HIGH PERFORMANCE



MODIFICATIONS (Prompt delivery)
• See page 178

See box on page 176 for speeds and feeds

*TOOL DIAM.	SHANK DIAM.
Up to 1 ½"	½"
1 ¾" to 2 ½"	¾"

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

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			
-	5/8	1/16	.160	2 1/16	2	7042002	$128.05	.0575 - .0787
305	5/8	3/32	.191	2 3/32	2	7040305	128.05	.0788 - .1099
405	5/8	1/8	.223	2 1/8	2	7040405	128.05	.1100 - .1400
505	5/8	5/32	.252	2 5/32	2	7040505	128.05	.1401 - .1713
605	5/8	3/16	.279	2 3/16	2	7040605	128.05	.1714 - .2025
-	5/8	7/32	.342	2 7/32	2	7042007	128.05	.2026 - .2339
-	5/8	1/4	.342	2 1/4	2	7042008	128.05	.2340 - .2650
-	3/4	1/16	.160	2 1/16	2	7042402	134.45	.0575 - .0787
-	3/4	3/32	.191	2 3/32	2	7042403	134.45	.0788 - .1099
406	3/4	1/8	.217	2 1/8	2	7040406	134.45	.1100 - .1400
506	3/4	5/32	.246	2 5/32	2	7040506	134.45	.1401 - .1713
606	3/4	3/16	.279	2 3/16	2	7040606	134.45	.1714 - .2025
-	3/4	7/32	.342	2 7/32	2	7042407	134.45	.2026 - .2339
806	3/4	1/4	.342	2 1/4	2	7040806	134.45	.2340 - .2650
-	7/8	1/16	.160	2 1/16	2	7042802	144.10	.0575 - .0787
-	7/8	3/32	.191	2 3/32	2	7042803	144.10	.0788 - .1099
-	7/8	1/8	.217	2 1/8	2	7042804	144.10	.1100 - .1400
507	7/8	5/32	.246	2 5/32	2	7040507	144.10	.1401 - .1713
607	7/8	3/16	.279	2 3/16	2	7040607	144.10	.1714 - .2025
707	7/8	7/32	.312	2 7/32	2	7040707	144.10	.2026 - .2339
807	7/8	1/4	.342	2 1/4	2	7040807	144.10	.2340 - .2650
-	1	3/32	.191	2 3/32	2	7043203	152.10	.0788 - .1088
-	1	1/8	.217	2 1/8	2	7043204	152.10	.1089 - .1400
-	1	5/32	.246	2 5/32	2	7043205	152.10	.1401 - .1713
608	1	3/16	.279	2 3/16	2	7040608	152.10	.1714 - .2025
708	1	7/32	.312	2 7/32	2	7040708	152.10	.2026 - .2339
808	1	1/4	.342	2 1/4	2	7040808	152.10	.2340 - .2650
-	1	9/32	.401	2 9/32	2	7043209	152.10	.2651 - .2968
1008	1	5/16	.401	2 5/16	2	7041008	152.10	.2969 - .3281
-	1	11/32	.467	2 11/32	2	7043211	152.10	.3282 - .3593
1208	1	3/8	.467	2 3/8	2	7041208	152.10	.3594 - .3900
-	1 1/8	3/32	.217	2 3/32	2	7043603	152.10	.0788 - .1088
-	1 1/8	1/8	.246	2 1/8	2	7043604	152.10	.1089 - .1400
-	1 1/8	5/32	.279	2 5/32	2	7043605	152.10	.1401 - .1713
609	1 1/8	3/16	.312	2 3/16	2	7040609	152.10	.1714 - .2025
709	1 1/8	7/32	.342	2 7/32	2	7040709	152.10	.2026 - .2339
809	1 1/8	1/4	.374	2 1/4	2	7040809	152.10	.2340 - .2650
-	1 1/8	9/32	.435	2 9/32	2	7043609	152.10	.2651 - .2968
1009	1 1/8	5/16	.435	2 5/16	2	7041009	152.10	.2969 - .3281
-	1 1/8	11/32	.467	2 11/32	2	7043611	152.10	.3282 - .3593
-	1 1/8	3/8	.467	2 3/8	2	7043612	152.10	.3594 - .3900
-	1 1/4	3/32	.217	2 3/32	3	7044003	160.05	.0788 - .1088
-	1 1/4	1/8	.246	2 1/8	3	7044004	160.05	.1089 - .1400
-	1 1/4	5/32	.279	2 5/32	3	7044005	160.05	.1401 - .1713
610	1 1/4	3/16	.312	2 3/16	3	7040610	160.05	.1714 - .2025
710	1 1/4	7/32	.342	2 7/32	3	7040710	160.05	.2026 - .2339
810	1 1/4	1/4	.374	2 1/4	3	7040810	160.05	.2340 - .2650
-	1 1/4	9/32	.435	2 9/32	3	7044009	160.05	.2651 - .2968
1010	1 1/4	5/16	.435	2 5/16	3	7041010	160.05	.2969 - .3281
-	1 1/4	11/32	.467	2 11/32	3	7044011	160.05	.3282 - .3593
1210	1 1/4	3/8	.467	2 3/8	3	7041210	160.05	.3594 - .3900

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			
-	1 3/8	3/32	.312	2 3/32	3	7044403	$176.10	.0788 - .1088
-	1 3/8	1/8	.342	2 1/8	3	7044404	176.10	.1089 - .1400
-	1 3/8	5/32	.374	2 5/32	3	7044405	176.10	.1401 - .1713
-	1 3/8	3/16	.401	2 3/16	3	7044406	176.10	.1714 - .2025
-	1 3/8	7/32	.401	2 7/32	3	7044407	176.10	.2026 - .2339
811	1 3/8	1/4	.401	2 1/4	3	7040811	176.10	.2340 - .2650
-	1 3/8	9/32	.467	2 9/32	3	7044409	176.10	.2651 - .2968
1011	1 3/8	5/16	.467	2 5/16	3	7041011	176.10	.2969 - .3281
-	1 3/8	11/32	.467	2 11/32	3	7044411	176.10	.3282 - .3593
1211	1 3/8	3/8	.467	2 3/8	3	7041211	176.10	.3594 - .3900
-	1 1/2	3/32	.435	2 3/32	3	7044803	200.15	.0788 - .1088
-	1 1/2	1/8	.435	2 1/8	3	7044804	200.15	.1089 - .1400
-	1 1/2	5/32	.435	2 5/32	3	7044805	200.15	.1401 - .1713
-	1 1/2	3/16	.435	2 3/16	3	7044806	200.15	.1714 - .2025
-	1 1/2	7/32	.435	2 7/32	3	7044807	200.15	.2026 - .2339
812	1 1/2	1/4	.435	2 1/4	3	7040812	200.15	.2340 - .2650
-	1 1/2	9/32	.467	2 9/32	3	7044809	200.15	.2651 - .2968
1012	1 1/2	5/16	.467	2 5/16	3	7041012	200.15	.2969 - .3281
-	1 1/2	11/32	.467	2 11/32	3	7044811	200.15	.3282 - .3593
1212	1 1/2	3/8	.467	2 3/8	3	7041212	240.15	.3594 - .3900
-	1 1/2	13/32	.467	2 13/32	3	7044813	240.15	.3901 - .4219
-	1 1/2	7/16	.467	2 7/16	3	7044814	240.15	.4220 - .4531
-	1 1/2	15/32	.467	2 15/32	3	7044815	240.15	.4532 - .4843
-	1 1/2	1/2	.467	2 1/2	3	7044816	240.15	.4844 - .5150
-	1 3/4	1/8	.718	3 1/8	4	7045604	220.90	.1089 - .1400
-	1 3/4	5/32	.718	3 5/32	4	7045605	220.90	.1401 - .1713
-	1 3/4	3/16	.718	3 3/16	4	7045606	220.90	.1714 - .2025
-	1 3/4	7/32	.718	3 7/32	4	7045607	220.90	.2026 - .2339
-	1 3/4	1/4	.718	3 1/4	4	7045608	220.90	.2340 - .2650
-	1 3/4	9/32	.718	3 9/32	4	7045609	220.90	.2651 - .2968
-	1 3/4	5/16	.718	3 5/16	4	7045610	220.90	.2969 - .3281
-	1 3/4	11/32	.718	3 11/32	4	7045611	220.90	.3282 - .3593
-	1 3/4	3/8	.718	3 3/8	4	7045612	259.40	.3594 - .3900
-	1 3/4	13/32	.718	3 13/32	4	7045613	259.40	.3901 - .4219
-	1 3/4	7/16	.718	3 7/16	4	7045614	259.40	.4220 - .4531
-	1 3/4	15/32	.718	3 15/32	4	7045615	259.40	.4532 - .4843
-	1 3/4	1/2	.718	3 1/2	4	7045616	259.40	.4844 - .5150
-	2	1/8	.718	3 1/8	4	7046404	256.10	.1089 - .1400
-	2	5/32	.718	3 5/32	4	7046405	256.10	.1401 - .1713
-	2	3/16	.718	3 3/16	4	7046406	256.10	.1714 - .2025
-	2	7/32	.718	3 7/32	4	7046407	256.10	.2026 - .2339
-	2	1/4	.718	3 1/4	4	7046408	256.10	.2340 - .2650
-	2	9/32	.718	3 9/32	4	7046409	256.10	.2651 - .2968
-	2	5/16	.718	3 5/16	4	7046410	256.10	.2969 - .3281
-	2	11/32	.718	3 11/32	4	7046411	256.10	.3282 - .3593
-	2	3/8	.718	3 3/8	4	7046412	296.20	.3594 - .3900
-	2	13/32	.718	3 13/32	4	7046413	296.20	.3901 - .4219
-	2	7/16	.718	3 7/16	4	7046414	296.20	.4220 - .4531
-	2	15/32	.718	3 15/32	4	7046415	296.20	.4532 - .4843
-	2	1/2	.718	3 1/2	4	7046416	296.20	.4844 - .5150
-	-	-	-	-	-	-	-	-

*Contact Hannibal for price and availability on tool diameters greater than 2"

KEYSEAT CUTTERS
CHIP CLASS 20, 40, 60, 140 - CARBIDE TIPPED TYPE 700

MATERIAL SPECIFIC

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: ½" 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:
  - TITANIUM NITRIDE – TiN
  - TITANIUM CARBONITRIDE – TiCN
  - ZIRCONIUM NITRIDE – ZrN
  - AL TITANIUM NITRIDE – AlTiN
- Corner chamfer or corner radius on one or both sides
- Shortened shank or reduced shank diameter

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	½	1⁄16	.130	2 1⁄16	6	7000204	$104.45	.0575 - .0787	$140.70	$125.05	$119.85	$117.35	$114.70	$112.50
304	½	3⁄32	.160	2 3⁄32	6	7000304	104.45	.0788 - .1088	140.70	125.05	119.85	117.35	114.70	112.50
404	½	⅛	.191	2 ⅛	6	7000404	104.45	.1089 - .1400	140.70	125.05	119.85	117.35	114.70	112.50
305	⅝	3⁄32	.191	2 3⁄32	6	7000305	108.25	.0788 - .1088	144.65	129.00	123.75	121.15	118.55	116.45
405	⅝	⅛	.223	2 ⅛	6	7000405	108.25	.1089 - .1400	144.65	129.00	123.75	121.15	118.55	116.45
505	⅝	5⁄32	.252	2 5⁄32	6	7000505	108.25	.1401 - .1713	144.65	129.00	123.75	121.15	118.55	116.45
605	⅝	3⁄16	.279	2 3⁄16	6	7000605	108.25	.1714 - .2025	144.65	129.00	123.75	121.15	118.55	116.45
406	¾	⅛	.217	2 ⅛	6	7000406	112.95	.1100 - .1400	149.60	133.95	128.65	126.20	123.55	121.40
506	¾	5⁄32	.246	2 5⁄32	6	7000506	112.95	.1401 - .1713	149.60	133.95	128.65	126.20	123.55	121.40
606	¾	3⁄16	.279	2 3⁄16	6	7000606	112.95	.1714 - .2025	149.60	133.95	128.65	126.20	123.55	121.40
-	¾	7⁄32	.342	2 7⁄32	6	7002407	123.75	.2026 - .2339	149.60	133.95	128.65	126.20	123.55	121.40
806	¾	¼	.342	2 ¼	6	7000806	112.95	.2340 - .2650	149.60	133.95	128.65	126.20	123.55	121.40
507	⅞	5⁄32	.246	2 5⁄32	6	7000507	118.30	.1401 - .1713	155.15	139.55	134.25	131.85	129.15	126.95
607	⅞	3⁄16	.279	2 3⁄16	6	7000607	118.30	.1714 - .2025	155.15	139.55	134.25	131.85	129.15	126.95
707	⅞	7⁄32	.312	2 7⁄32	6	7000707	118.30	.2026 - .2339	155.15	139.55	134.25	131.85	129.15	126.95
807	⅞	¼	.342	2 ¼	6	7000807	118.30	.2340 - .2650	155.15	139.55	134.25	131.85	129.15	126.95
608	1	3⁄16	.279	2 3⁄16	8	7000608	133.50	.1714 - .2025	171.05	155.45	150.10	147.65	145.00	142.85
708	1	7⁄32	.312	2 7⁄32	8	7000708	133.50	.2026 - .2339	171.05	155.45	150.10	147.65	145.00	142.85
808	1	¼	.342	2 ¼	8	7000808	133.50	.2340 - .2650	171.05	155.45	150.10	147.65	145.00	142.85
-	1	9⁄32	.401	2 9⁄32	8	7003209	146.20	.2651 - .2968	171.05	155.45	150.10	147.65	145.00	142.85
1008	1	5⁄16	.401	2 5⁄16	8	7001008	133.50	.2969 - .3281	171.05	155.45	150.10	147.65	145.00	142.85
-	1	11⁄32	.467	2 11⁄32	8	7003211	146.20	.3282 - .3593	171.05	155.45	150.10	147.65	145.00	142.85
1208	1	⅜	.467	2 ⅜	8	7001208	133.50	.3594 - .3900	171.05	155.45	150.10	147.65	145.00	142.85
609	1 ⅛	3⁄16	.312	2 3⁄16	8	7000609	140.15	.1714 - .2025	178.05	162.50	157.20	154.70	152.05	149.90
709	1 ⅛	7⁄32	.342	2 7⁄32	8	7000709	140.15	.2026 - .2339	178.05	162.50	157.20	154.70	152.05	149.90
809	1 ⅛	¼	.374	2 ¼	8	7000809	140.15	.2340 - .2650	178.05	162.50	157.20	154.70	152.05	149.90
-	1 ⅛	9⁄32	.435	2 9⁄32	8	7003609	153.55	.2651 - .2968	178.05	162.50	157.20	154.70	152.05	149.90
1009	1 ⅛	5⁄16	.435	2 5⁄16	8	7001009	140.15	.2969 - .3281	178.05	162.50	157.20	154.70	152.05	149.90
610	1 ¼	3⁄16	.312	2 3⁄16	8	7000610	147.15	.1714 - .2025	185.40	169.85	164.60	162.05	159.40	157.20
710	1 ¼	7⁄32	.342	2 7⁄32	8	7000710	147.15	.2026 - .2339	185.40	169.85	164.60	162.05	159.40	157.20
810	1 ¼	¼	.374	2 ¼	8	7000810	147.15	.2340 - .2650	185.40	169.85	164.60	162.05	159.40	157.20
-	1 ¼	9⁄32	.435	2 9⁄32	8	7004009	161.20	.2651 - .2968	185.40	169.85	164.60	162.05	159.40	157.20
1010	1 ¼	5⁄16	.435	2 5⁄16	8	7001010	147.15	.2969 - .3281	185.40	169.85	164.60	162.05	159.40	157.20
-	1 ¼	11⁄32	.467	2 11⁄32	8	7004011	161.20	.3282 - .3593	185.40	169.85	164.60	162.05	159.40	157.20
1210	1 ¼	⅜	.467	2 ⅜	8	7001210	147.15	.3594 - .3900	185.40	169.85	164.60	162.05	159.40	157.20
811	1 ⅜	¼	.401	2 ¼	8	7000811	154.65	.2340 - .2650	193.20	177.60	172.35	169.85	167.15	165.05
-	1 ⅜	9⁄32	.467	2 9⁄32	8	7004409	169.35	.2651 - .2968	193.20	177.60	172.35	169.85	167.15	165.05
1011	1 ⅜	5⁄16	.467	2 5⁄16	8	7001011	154.65	.2969 - .3281	193.20	177.60	172.35	169.85	167.15	165.05
-	1 ⅜	11⁄32	.467	2 11⁄32	8	7004411	169.35	.3282 - .3593	193.20	177.60	172.35	169.85	167.15	165.05
1211	1 ⅜	⅜	.467	2 ⅜	8	7001211	154.65	.3594 - .3900	193.20	177.60	172.35	169.85	167.15	165.05
812	1 ½	¼	.435	2 ¼	8	7000812	162.35	.2340 - .2650	201.25	185.70	180.45	177.95	175.25	173.15
-	1 ½	9⁄32	.467	2 9⁄32	8	7004809	177.85	.2651 - .2968	201.25	185.70	180.45	177.95	175.25	173.15
1012	1 ½	5⁄16	.467	2 5⁄16	8	7001012	162.35	.2969 - .3281	201.25	185.70	180.45	177.95	175.25	173.15
-	1 ½	11⁄32	.467	2 11⁄32	8	7004811	177.85	.3282 - .3593	201.25	185.70	180.45	177.95	175.25	173.15
1212	1 ½	⅜	.467	2 ⅜	8	7001212	162.35	.3594 - .3900	201.25	185.70	180.45	177.95	175.25	173.15
-	1 ½	13⁄32	.467	2 13⁄32	8	7004813	177.85	.3901 - .4219	201.25	185.70	180.45	177.95	175.25	173.15
-	1 ½	7⁄16	.467	2 7⁄16	8	7004814	177.85	.4220 - .4531	201.25	185.70	180.45	177.95	175.25	173.15
-	1 ½	15⁄32	.467	2 15⁄32	8	7004815	177.85	.4532 - .4843	201.25	185.70	180.45	177.95	175.25	173.15
-	1 ½	½	.467	2 ½	8	7004816	177.85	.4844 - .5150	201.25	185.70	180.45	177.95	175.25	173.15

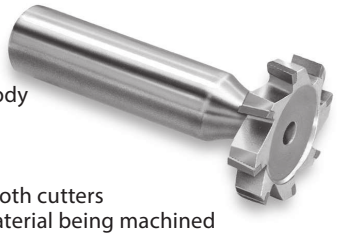
*Quantities of 15 or more - price of fractional size in same size range

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: ½" 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:
  - TITANIUM NITRIDE – TiN
  - TITANIUM CARBONITRIDE – TiCN
  - ZIRCONIUM NITRIDE – ZrN
  - AL TITANIUM NITRIDE – AlTiN
- Corner chamfer or corner radius on one or both sides
- Shortened shank or reduced shank diameter

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	½	1/16	.130	2 1/16	6	7010204	$122.90	.0575 - .0787	$160.00	$144.40	$139.10	$136.65	$133.95	$131.85
304	½	3/32	.160	2 3/32	6	7010304	122.90	.0788 - .1088	160.00	144.40	139.10	136.65	133.95	131.85
404	½	1/8	.191	2 1/8	6	7010404	122.90	.1089 - .1400	160.00	144.40	139.10	136.65	133.95	131.85
305	5/8	3/32	.191	2 3/32	6	7010305	127.30	.0788 - .1088	164.65	149.05	143.75	141.20	138.55	136.45
405	5/8	1/8	.223	2 1/8	6	7010405	127.30	.1089 - .1400	164.65	149.05	143.75	141.20	138.55	136.45
505	5/8	5/32	.252	2 5/32	6	7010505	127.30	.1401 - .1713	164.65	149.05	143.75	141.20	138.55	136.45
605	5/8	3/16	.279	2 3/16	6	7010605	127.30	.1714 - .2025	164.65	149.05	143.75	141.20	138.55	136.45
406	¾	1/8	.217	2 1/8	6	7010406	133.00	.1100 - .1400	170.60	155.00	149.70	147.15	144.60	142.45
506	¾	5/32	.246	2 5/32	6	7010506	133.00	.1401 - .1713	170.60	155.00	149.70	147.15	144.60	142.45
606	¾	3/16	.279	2 3/16	6	7010606	133.00	.1714 - .2025	170.60	155.00	149.70	147.15	144.60	142.45
-	¾	7/32	.342	2 7/32	6	7012407	145.70	.2026 - .2339	170.60	155.00	149.70	147.15	144.60	142.45
806	¾	1/4	.342	2 1/4	6	7010806	133.00	.2340 - .2650	170.60	155.00	149.70	147.15	144.60	142.45
507	⅞	5/32	.246	2 5/32	6	7010507	139.10	.1401 - .1713	176.95	161.30	156.10	153.55	150.90	148.80
607	⅞	3/16	.279	2 3/16	6	7010607	139.10	.1714 - .2025	176.95	161.30	156.10	153.55	150.90	148.80
707	⅞	7/32	.312	2 7/32	6	7010707	139.10	.2026 - .2339	176.95	161.30	156.10	153.55	150.90	148.80
807	⅞	1/4	.342	2 1/4	6	7010807	139.10	.2340 - .2650	176.95	161.30	156.10	153.55	150.90	148.80
608	1	3/16	.279	2 3/16	8	7010608	156.95	.1714 - .2025	195.70	180.00	174.80	172.25	169.60	167.55
708	1	7/32	.312	2 7/32	8	7010708	156.95	.2026 - .2339	195.70	180.00	174.80	172.25	169.60	167.55
808	1	1/4	.342	2 1/4	8	7010808	156.95	.2340 - .2650	195.70	180.00	174.80	172.25	169.60	167.55
-	1	9/32	.401	2 9/32	8	7013209	171.95	.2651 - .2968	195.70	180.00	174.80	172.25	169.60	167.55
1008	1	5/16	.401	2 5/16	8	7011008	156.95	.2969 - .3281	195.70	180.00	174.80	172.25	169.60	167.55
-	1	11/32	.467	2 11/32	8	7013211	171.95	.3282 - .3593	195.70	180.00	174.80	172.25	169.60	167.55
1208	1	3/8	.467	2 3/8	8	7011208	156.95	.3594 - .3900	195.70	180.00	174.80	172.25	169.60	167.55
609	1 1/8	3/16	.312	2 3/16	8	7010609	164.80	.1714 - .2025	203.85	188.20	182.95	180.45	177.85	175.65
709	1 1/8	7/32	.342	2 7/32	8	7010709	164.80	.2026 - .2339	203.85	188.20	182.95	180.45	177.85	175.65
809	1 1/8	1/4	.374	2 1/4	8	7010809	164.80	.2340 - .2650	203.85	188.20	182.95	180.45	177.85	175.65
-	1 1/8	9/32	.435	2 9/32	8	7013609	180.45	.2651 - .2968	203.85	188.20	182.95	180.45	177.85	175.65
1009	1 1/8	5/16	.435	2 5/16	8	7011009	164.80	.2969 - .3281	203.85	188.20	182.95	180.45	177.85	175.65
610	1 1/4	3/16	.312	2 3/16	8	7010610	173.10	.1714 - .2025	212.50	196.90	191.70	189.10	186.40	184.30
710	1 1/4	7/32	.342	2 7/32	8	7010710	173.10	.2026 - .2339	212.50	196.90	191.70	189.10	186.40	184.30
810	1 1/4	1/4	.374	2 1/4	8	7010810	173.10	.2340 - .2650	212.50	196.90	191.70	189.10	186.40	184.30
-	1 1/4	9/32	.435	2 9/32	8	7014009	189.55	.2651 - .2968	212.50	196.90	191.70	189.10	186.40	184.30
1010	1 1/4	5/16	.435	2 5/16	8	7011010	173.10	.2969 - .3281	212.50	196.90	191.70	189.10	186.40	184.30
-	1 1/4	11/32	.467	2 11/32	8	7014011	189.55	.3282 - .3593	212.50	196.90	191.70	189.10	186.40	184.30
1210	1 1/4	3/8	.467	2 3/8	8	7011210	173.10	.3594 - .3900	212.50	196.90	191.70	189.10	186.40	184.30
811	1 3/8	1/4	.401	2 1/4	8	7010811	181.80	.2340 - .2650	221.70	206.15	200.90	198.30	195.70	193.50
-	1 3/8	9/32	.467	2 9/32	8	7014409	199.15	.2651 - .2968	221.70	206.15	200.90	198.30	195.70	193.50
1011	1 3/8	5/16	.467	2 5/16	8	7011011	181.80	.2969 - .3281	221.70	206.15	200.90	198.30	195.70	193.50
-	1 3/8	11/32	.467	2 11/32	8	7014411	199.15	.3282 - .3593	221.70	206.15	200.90	198.30	195.70	193.50
1211	1 3/8	3/8	.467	2 3/8	8	7011211	181.80	.3594 - .3900	221.70	206.15	200.90	198.30	195.70	193.50
812	1 ½	1/4	.435	2 1/4	8	7010812	190.95	.2340 - .2650	231.20	215.60	210.35	207.90	205.20	203.05
-	1 ½	9/32	.467	2 9/32	8	7014809	209.15	.2651 - .2968	231.20	215.60	210.35	207.90	205.20	203.05
1012	1 ½	5/16	.467	2 5/16	8	7011012	190.95	.2969 - .3281	231.20	215.60	210.35	207.90	205.20	203.05
-	1 ½	11/32	.467	2 11/32	8	7014811	209.15	.3282 - .3593	231.20	215.60	210.35	207.90	205.20	203.05
1212	1 ½	3/8	.467	2 3/8	8	7011212	190.95	.3594 - .3900	231.20	215.60	210.35	207.90	205.20	203.05
-	1 ½	13/32	.467	2 13/32	8	7014813	209.15	.3901 - .4219	231.20	215.60	210.35	207.90	205.20	203.05
-	1 ½	7/16	.467	2 7/16	8	7014814	209.15	.4220 - .4531	231.20	215.60	210.35	207.90	205.20	203.05
-	1 ½	15/32	.467	2 15/32	8	7014815	209.15	.4532 - .4843	231.20	215.60	210.35	207.90	205.20	203.05
-	1 ½	½	.467	2 ½	8	7014816	209.15	.4844 - .5150	231.20	215.60	210.35	207.90	205.20	203.05

*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

MATERIAL SPECIFIC

STRAIGHT TOOTH FOR STEEL

TYPE 702 - FOR STEELS

- Woodruff type
- Carbide tips brazed to tough hardened alloy steel body
- Straight shank: ½" 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:
  - TITANIUM NITRIDE – TiN
  - TITANIUM CARBONITRIDE – TiCN
  - ZIRCONIUM NITRIDE – ZrN
  - AL TITANIUM NITRIDE – AlTiN
- Corner chamfer or corner radius on one or both sides
- Shortened shank or reduced shank diameter

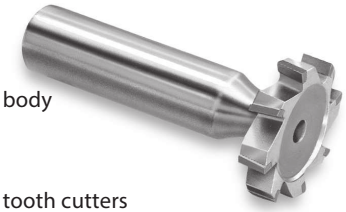
AMERICAN STANDARD NO.	TOOL DIAM.	DIMENSIONS				TYPE 702 FOR STEEL EDP NO.	PRICE EACH	FINISHED TO MODIFIED FACE WIDTH						
		FACE WIDTH	NECK DIAM.	OVERALL LENGTH	NO. OF TEETH			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
									1	2	3	4	5-7	8-14*
204	½	1⁄16	.130	2 1⁄16	6	7020204	$120.70	.0575 - .0787	$159.25	$142.85	$137.30	$134.70	$131.90	$129.65
304	½	3⁄32	.160	2 3⁄32	6	7020304	120.70	.0788 - .1088	159.25	142.85	137.30	134.70	131.90	129.65
404	½	⅛	.191	2 ⅛	6	7020404	120.70	.1089 - .1400	159.25	142.85	137.30	134.70	131.90	129.65
305	⅝	3⁄32	.191	2 3⁄32	6	7020305	125.05	.0788 - .1088	163.70	147.30	141.85	139.15	136.45	134.15
405	⅝	⅛	.223	2 ⅛	6	7020405	125.05	.1089 - .1400	163.70	147.30	141.85	139.15	136.45	134.15
505	⅝	5⁄32	.252	2 5⁄32	6	7020505	125.05	.1401 - .1713	163.70	147.30	141.85	139.15	136.45	134.15
605	⅝	3⁄16	.279	2 3⁄16	6	7020605	125.05	.1714 - .2025	163.70	147.30	141.85	139.15	136.45	134.15
406	¾	⅛	.217	2 ⅛	6	7020406	130.50	.1100 - .1400	169.55	153.15	147.60	144.90	142.15	139.90
506	¾	5⁄32	.246	2 5⁄32	6	7020506	130.50	.1401 - .1713	169.55	153.15	147.60	144.90	142.15	139.90
606	¾	3⁄16	.279	2 3⁄16	6	7020606	130.50	.1714 - .2025	169.55	153.15	147.60	144.90	142.15	139.90
-	¾	7⁄32	.342	2 7⁄32	6	7022407	142.90	.2026 - .2339	169.55	153.15	147.60	144.90	142.15	139.90
806	¾	¼	.342	2 ¼	6	7020806	130.50	.2340 - .2650	169.55	153.15	147.60	144.90	142.15	139.90
507	⅞	5⁄32	.246	2 5⁄32	6	7020507	136.70	.1401 - .1713	175.95	159.55	154.00	151.35	148.60	146.30
607	⅞	3⁄16	.279	2 3⁄16	6	7020607	136.70	.1714 - .2025	175.95	159.55	154.00	151.35	148.60	146.30
707	⅞	7⁄32	.312	2 7⁄32	6	7020707	136.70	.2026 - .2339	175.95	159.55	154.00	151.35	148.60	146.30
807	⅞	¼	.342	2 ¼	6	7020807	136.70	.2340 - .2650	175.95	159.55	154.00	151.35	148.60	146.30
608	1	3⁄16	.279	2 3⁄16	8	7020608	154.20	.1714 - .2025	194.20	177.90	172.30	169.70	166.95	164.70
708	1	7⁄32	.312	2 7⁄32	8	7020708	154.20	.2026 - .2339	194.20	177.90	172.30	169.70	166.95	164.70
808	1	¼	.342	2 ¼	8	7020808	154.20	.2340 - .2650	194.20	177.90	172.30	169.70	166.95	164.70
-	1	9⁄32	.401	2 9⁄32	8	7023209	168.90	.2651 - .2968	194.20	177.90	172.30	169.70	166.95	164.70
1008	1	5⁄16	.401	2 5⁄16	8	7021008	154.20	.2969 - .3281	194.20	177.90	172.30	169.70	166.95	164.70
-	1	11⁄32	.467	2 11⁄32	8	7023211	168.90	.3282 - .3593	194.20	177.90	172.30	169.70	166.95	164.70
1208	1	⅜	.467	2 ⅜	8	7021208	154.20	.3594 - .3900	194.20	177.90	172.30	169.70	166.95	164.70
609	1 ⅛	3⁄16	.312	2 3⁄16	8	7020609	161.95	.1714 - .2025	202.40	186.05	180.45	177.90	175.10	172.80
709	1 ⅛	7⁄32	.342	2 7⁄32	8	7020709	161.95	.2026 - .2339	202.40	186.05	180.45	177.90	175.10	172.80
809	1 ⅛	¼	.374	2 ¼	8	7020809	161.95	.2340 - .2650	202.40	186.05	180.45	177.90	175.10	172.80
-	1 ⅛	9⁄32	.435	2 9⁄32	8	7023609	177.35	.2651 - .2968	202.40	186.05	180.45	177.90	175.10	172.80
1009	1 ⅛	5⁄16	.435	2 5⁄16	8	7021009	161.95	.2969 - .3281	202.40	186.05	180.45	177.90	175.10	172.80
610	1 ¼	3⁄16	.312	2 3⁄16	8	7020610	170.00	.1714 - .2025	210.90	194.45	189.00	186.30	183.50	181.30
710	1 ¼	7⁄32	.342	2 7⁄32	8	7020710	170.00	.2026 - .2339	210.90	194.45	189.00	186.30	183.50	181.30
810	1 ¼	¼	.374	2 ¼	8	7020810	170.00	.2340 - .2650	210.90	194.45	189.00	186.30	183.50	181.30
-	1 ¼	9⁄32	.435	2 9⁄32	8	7024009	186.20	.2651 - .2968	210.90	194.45	189.00	186.30	183.50	181.30
1010	1 ¼	5⁄16	.435	2 5⁄16	8	7021010	170.00	.2969 - .3281	210.90	194.45	189.00	186.30	183.50	181.30
-	1 ¼	11⁄32	.467	2 11⁄32	8	7024011	186.20	.3282 - .3593	210.90	194.45	189.00	186.30	183.50	181.30
1210	1 ¼	⅜	.467	2 ⅜	8	7021210	170.00	.3594 - .3900	210.90	194.45	189.00	186.30	183.50	181.30
811	1 ⅜	¼	.401	2 ¼	8	7020811	178.60	.2340 - .2650	220.00	203.50	198.00	195.30	192.50	190.30
-	1 ⅜	9⁄32	.467	2 9⁄32	8	7024409	195.55	.2651 - .2968	220.00	203.50	198.00	195.30	192.50	190.30
1011	1 ⅜	5⁄16	.467	2 5⁄16	8	7021011	178.60	.2969 - .3281	220.00	203.50	198.00	195.30	192.50	190.30
-	1 ⅜	11⁄32	.467	2 11⁄32	8	7024411	195.55	.3282 - .3593	220.00	203.50	198.00	195.30	192.50	190.30
1211	1 ⅜	⅜	.467	2 ⅜	8	7021211	178.60	.3594 - .3900	220.00	203.50	198.00	195.30	192.50	190.30
812	1 ½	¼	.435	2 ¼	8	7020812	187.50	.2340 - .2650	229.25	212.90	207.40	204.75	201.90	199.75
-	1 ½	9⁄32	.467	2 9⁄32	8	7024809	205.35	.2651 - .2968	229.25	212.90	207.40	204.75	201.90	199.75
1012	1 ½	5⁄16	.467	2 5⁄16	8	7021012	187.50	.2969 - .3281	229.25	212.90	207.40	204.75	201.90	199.75
-	1 ½	11⁄32	.467	2 11⁄32	8	7024811	205.35	.3282 - .3593	229.25	212.90	207.40	204.75	201.90	199.75
1212	1 ½	⅜	.467	2 ⅜	8	7021212	187.50	.3594 - .3900	229.25	212.90	207.40	204.75	201.90	199.75
-	1 ½	13⁄32	.467	2 13⁄32	8	7024813	205.35	.3901 - .4219	229.25	212.90	207.40	204.75	201.90	199.75
-	1 ½	7⁄16	.467	2 7⁄16	8	7024814	205.35	.4220 - .4531	229.25	212.90	207.40	204.75	201.90	199.75
-	1 ½	15⁄32	.467	2 15⁄32	8	7024815	205.35	.4532 - .4843	229.25	212.90	207.40	204.75	201.90	199.75
-	1 ½	½	.467	2 ½	8	7024816	205.35	.4844 - .5150	229.25	212.90	207.40	204.75	201.90	199.75

*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: ½" 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:
  - TITANIUM NITRIDE – TiN
  - TITANIUM CARBONITRIDE – TiCN
  - ZIRCONIUM NITRIDE – ZrN
  - AL TITANIUM NITRIDE – AlTiN
- Corner chamfer or corner radius on one or both sides
- Shortened shank or reduced shank diameter

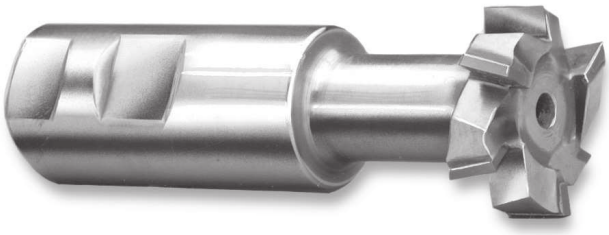
AMERICAN STANDARD NO.	TOOL DIAM.	DIMENSIONS				TYPE 703 FOR STEEL EDP NO.	PRICE EACH	FINISHED TO MODIFIED FACE WIDTH						
		FACE WIDTH	NECK DIAM.	OVERALL LENGTH	NO. OF TEETH			MODIFIED FACE WIDTH RANGE	PRICE EACH - BASED ON QUANTITY ORDERED					
									1	2	3	4	5-7	8-14*
204	½	1/16	.130	2 1/16	6	7030204	$142.00	.0575 - .0787	$181.55	$165.15	$159.65	$156.95	$154.20	$152.00
304	½	3/32	.160	2 3/32	6	7030304	142.00	.0788 - .1088	181.55	165.15	159.65	156.95	154.20	152.00
404	½	1/8	.191	2 1/8	6	7030404	142.00	.1089 - .1400	181.55	165.15	159.65	156.95	154.20	152.00
305	5/8	3/32	.191	2 3/32	6	7030305	147.00	.0788 - .1088	186.80	170.45	164.95	162.30	159.55	157.25
405	5/8	1/8	.223	2 1/8	6	7030405	147.00	.1089 - .1400	186.80	170.45	164.95	162.30	159.55	157.25
505	5/8	5/32	.252	2 5/32	6	7030505	147.00	.1401 - .1713	186.80	170.45	164.95	162.30	159.55	157.25
605	5/8	3/16	.279	2 3/16	6	7030605	147.00	.1714 - .2025	186.80	170.45	164.95	162.30	159.55	157.25
406	¾	1/8	.217	2 1/8	6	7030406	153.65	.1100 - .1400	193.75	177.40	171.90	169.25	166.40	164.15
506	¾	5/32	.246	2 5/32	6	7030506	153.65	.1401 - .1713	193.75	177.40	171.90	169.25	166.40	164.15
606	¾	3/16	.279	2 3/16	6	7030606	153.65	.1714 - .2025	193.75	177.40	171.90	169.25	166.40	164.15
-	¾	7/32	.342	2 7/32	6	7032407	168.25	.2026 - .2339	193.75	177.40	171.90	169.25	166.40	164.15
806	¾	¼	.342	2 ¼	6	7030806	153.65	.2340 - .2650	193.75	177.40	171.90	169.25	166.40	164.15
507	7/8	5/32	.246	2 5/32	6	7030507	160.75	.1401 - .1713	201.10	184.75	179.20	176.45	173.70	171.60
607	7/8	3/16	.279	2 3/16	6	7030607	160.75	.1714 - .2025	201.10	184.75	179.20	176.45	173.70	171.60
707	7/8	7/32	.312	2 7/32	6	7030707	160.75	.2026 - .2339	201.10	184.75	179.20	176.45	173.70	171.60
807	7/8	¼	.342	2 ¼	6	7030807	160.75	.2340 - .2650	201.10	184.75	179.20	176.45	173.70	171.60
608	1	3/16	.279	2 3/16	8	7030608	181.30	.1714 - .2025	222.65	206.35	200.80	198.15	195.35	193.15
708	1	7/32	.312	2 7/32	8	7030708	181.30	.2026 - .2339	222.65	206.35	200.80	198.15	195.35	193.15
808	1	¼	.342	2 ¼	8	7030808	181.30	.2340 - .2650	222.65	206.35	200.80	198.15	195.35	193.15
-	1	9/32	.401	2 9/32	8	7033209	198.65	.2651 - .2968	222.65	206.35	200.80	198.15	195.35	193.15
1008	1	5/16	.401	2 5/16	8	7031008	181.30	.2969 - .3281	222.65	206.35	200.80	198.15	195.35	193.15
-	1	11/32	.467	2 11/32	8	7033211	198.65	.3282 - .3593	222.65	206.35	200.80	198.15	195.35	193.15
1208	1	3/8	.467	2 3/8	8	7031208	181.30	.3594 - .3900	222.65	206.35	200.80	198.15	195.35	193.15
609	1 1/8	3/16	.312	2 3/16	8	7030609	190.30	.1714 - .2025	232.15	215.70	210.25	207.60	204.85	202.50
709	1 1/8	7/32	.342	2 7/32	8	7030709	190.30	.2026 - .2339	232.15	215.70	210.25	207.60	204.85	202.50
809	1 1/8	¼	.374	2 ¼	8	7030809	190.30	.2340 - .2650	232.15	215.70	210.25	207.60	204.85	202.50
-	1 1/8	9/32	.435	2 9/32	8	7033609	208.40	.2651 - .2968	232.15	215.70	210.25	207.60	204.85	202.50
1009	1 1/8	5/16	.435	2 5/16	8	7031009	190.30	.2969 - .3281	232.15	215.70	210.25	207.60	204.85	202.50
610	1 ¼	3/16	.312	2 3/16	8	7030610	199.90	.1714 - .2025	242.15	225.75	220.30	217.65	214.90	212.60
710	1 ¼	7/32	.342	2 7/32	8	7030710	199.90	.2026 - .2339	242.15	225.75	220.30	217.65	214.90	212.60
810	1 ¼	¼	.374	2 ¼	8	7030810	199.90	.2340 - .2650	242.15	225.75	220.30	217.65	214.90	212.60
-	1 ¼	9/32	.435	2 9/32	8	7034009	219.00	.2651 - .2968	242.15	225.75	220.30	217.65	214.90	212.60
1010	1 ¼	5/16	.435	2 5/16	8	7031010	199.90	.2969 - .3281	242.15	225.75	220.30	217.65	214.90	212.60
-	1 ¼	11/32	.467	2 11/32	8	7034011	219.00	.3282 - .3593	242.15	225.75	220.30	217.65	214.90	212.60
1210	1 ¼	3/8	.467	2 3/8	8	7031210	199.90	.3594 - .3900	242.15	225.75	220.30	217.65	214.90	212.60
811	1 3/8	¼	.401	2 ¼	8	7030811	210.10	.2340 - .2650	252.80	236.45	230.85	228.25	225.45	223.20
-	1 3/8	9/32	.467	2 9/32	8	7034409	230.00	.2651 - .2968	252.80	236.45	230.85	228.25	225.45	223.20
1011	1 3/8	5/16	.467	2 5/16	8	7031011	210.10	.2969 - .3281	252.80	236.45	230.85	228.25	225.45	223.20
-	1 3/8	11/32	.467	2 11/32	8	7034411	230.00	.3282 - .3593	252.80	236.45	230.85	228.25	225.45	223.20
1211	1 3/8	3/8	.467	2 3/8	8	7031211	210.10	.3594 - .3900	252.80	236.45	230.85	228.25	225.45	223.20
812	1 ½	¼	.435	2 ¼	8	7030812	220.55	.2340 - .2650	263.80	247.40	241.90	239.25	236.45	234.30
-	1 ½	9/32	.467	2 9/32	8	7034809	241.55	.2651 - .2968	263.80	247.40	241.90	239.25	236.45	234.30
1012	1 ½	5/16	.467	2 5/16	8	7031012	220.55	.2969 - .3281	263.80	247.40	241.90	239.25	236.45	234.30
-	1 ½	11/32	.467	2 11/32	8	7034811	241.55	.3282 - .3593	263.80	247.40	241.90	239.25	236.45	234.30
1212	1 ½	3/8	.467	2 3/8	8	7031212	220.55	.3594 - .3900	263.80	247.40	241.90	239.25	236.45	234.30
-	1 ½	13/32	.467	2 13/32	8	7034813	241.55	.3901 - .4219	263.80	247.40	241.90	239.25	236.45	234.30
-	1 ½	7/16	.467	2 7/16	8	7034814	241.55	.4220 - .4531	263.80	247.40	241.90	239.25	236.45	234.30
-	1 ½	15/32	.467	2 15/32	8	7034815	241.55	.4532 - .4843	263.80	247.40	241.90	239.25	236.45	234.30
-	1 ½	½	.467	2 ½	8	7034816	241.55	.4844 - .5150	263.80	247.40	241.90	239.25	236.45	234.30

*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)

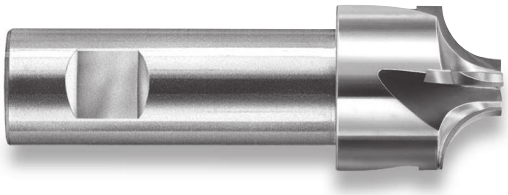
- Modified tool width
- Metric tool width
- Reduced neck diameter
- Shortened shank or reduced shank diameter
- Additional shank drive flat(s)
- Coolant outlets
- 4 coatings available (see bottom of page)

BOLT DIAM.	TOOL DIAM.	DIMENSIONS						TYPE 720 FOR NON-FERROUS/CAST IRONS		TYPE 721 FOR STEELS	
		TOOL WIDTH	SHANK DIAM.	NECK. DIAM.	LENGTH UNDERCUT	LENGTH OVERALL	NO. OF TEETH	EDP NO.	PRICE	EDP NO.	PRICE
1/4	9/16	15/64	1/2	17/64	35/64	2 19/32	6	72008	$143.70	72108	$155.20
5/16	21/32	17/64	1/2	21/64	39/64	2 11/16	6	72010	141.95	72110	153.30
3/8	25/32	21/64	3/4	13/32	55/64	3 1/4	6	72012	178.65	72112	193.00
1/2	31/32	25/64	3/4	17/32	63/64	3 7/16	6	72016	194.25	72116	209.75
5/8	1 1/4	31/64	1	21/32	1 9/64	3 15/16	6	72020	257.80	72120	278.50
3/4	1 15/32	5/8	1	25/32	1 1/2	4 7/16	6	72024	288.10	72124	311.10
1	1 27/32	53/64	1 1/4	1 1/32	1 43/64	4 13/16	8	72032	411.30	72132	444.25
1 1/4	2 7/32	1 3/32	1 1/4	1 7/32	1 31/32	5 3/8	8	72040	519.05	72140	560.60
1 1/2	2 21/32	1 11/32	1 1/4	1 17/32	2 1/8	5 29/32	8	72048	601.05	72148	649.15

CUTTERS

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

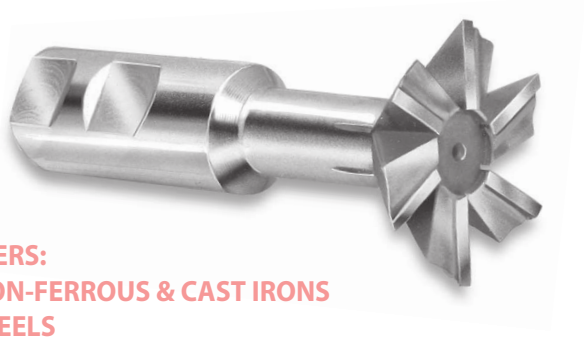
ZIRCONIUM NITRIDE – ZrN

AL TITANIUM NITRIDE – AlTiN

CIRCLE RADIUS	TOOL DIAMETER	DIMENSIONS				TYPE 740 FOR N-F/CI		TYPE 741 FOR STEELS	
		SHANK DIAM.	END DIAM.	LENGTH CAR-BIDE	LENGTH OVER-ALL	EDP NO.	PRICE	EDP NO.	PRICE
1/16	7/16	3/8	17/64	13/32	2 3/4	74002	$131.85	74102	$142.50
3/32	1/2	3/8	17/64	13/32	2 3/4	74003	131.85	74103	142.50
1/8	5/8	1/2	19/64	13/32	3	74004	136.55	74104	147.35
5/32	3/4	1/2	23/64	13/32	3	74005	144.80	74105	156.35
3/16	7/8	3/4	13/32	13/32	3 1/4	74006	153.20	74106	165.40
1/4	1	3/4	13/32	15/32	3 1/4	74008	174.60	74108	188.50
5/16	1 1/8	7/8	13/32	19/32	3 1/2	74010	179.35	74110	193.70
3/8	1 1/4	7/8	13/32	25/32	3 3/4	74012	186.30	74112	201.25
7/16	1 3/8	1	13/32	7/8	4	74014	207.50	74114	224.10
1/2	1 1/2	1	13/32	1	4	74016	230.90	74116	249.50
5/8	2	1 1/4	21/32	1 7/32	4 1/4	74020	284.15	74120	306.95

DOVETAIL CUTTERS
CARBIDE TIPPED TYPES 734, 735, 736, & 737 FRACTIONAL

MATERIAL SPECIFIC



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

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

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

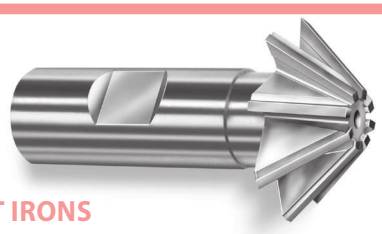
ZIRCONIUM NITRIDE – ZrN

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
½	⅜	3⁄16	2 ⅛	3	5⁄32	73416	$143.90	73516	$146.05	7⁄32	73616	$143.90	73716	$146.05
¾	⅜	¼	2 ¼	3	¼	73424	155.25	73524	157.40	¼	73624	155.25	73724	157.40
1	½	⅜	2 ½	4	5⁄16	73432	166.05	73532	168.45	⅜	73632	166.05	73732	168.45
1 ¼	⅝	½	2 ¾	4	⅜	73440	188.80	73540	191.50	½	73640	188.80	73740	191.50
1 ½	¾	½	3 ¼	4	½	73448	220.55	73548	223.75	⅝	73648	220.55	73748	223.75
2	1	¾	4 ¼	6	⅝	73464	354.40	73564	359.45	¾	73664	354.40	73764	359.45
2 ½	1 ¼	1	4 ⅜	6	¾	73480	479.30	73580	486.00	⅞	73680	479.30	73780	486.00
3	1 ¼	1	4 ½	6	1	73496	565.15	73596	573.30	1 ⅛	73696	565.15	73796	573.30

CHAMFER MILLING CUTTERS
CARBIDE TIPPED TYPES 730, 731, 732, & 733 FRACTIONAL

MATERIAL SPECIFIC



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

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

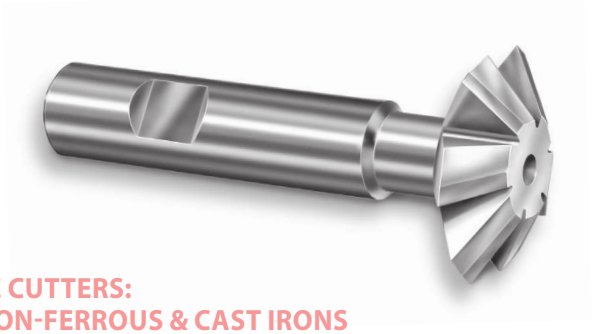
MODIFICATIONS (Prompt delivery)

- 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
½	⅜	2 ⅛	4	⅛	73016	$175.80	73116	$193.30	7⁄32	73216	$175.80	73316	$193.30
¾	⅜	2 ⅛	6	3⁄16	73024	189.50	73124	208.40	5⁄16	73224	189.50	73324	208.40
1	½	2 ½	6	5⁄16	73032	222.35	73132	244.50	7⁄16	73232	222.35	73332	244.50
1 ½	¾	2 ¾	8	½	73048	281.75	73148	310.10	⅝	73248	281.75	73348	310.10

DOUBLE ANGLE CUTTERS CARBIDE TIPPED TYPES 746, 747, 748, & 749 FRACTIONAL

MATERIAL SPECIFIC



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)

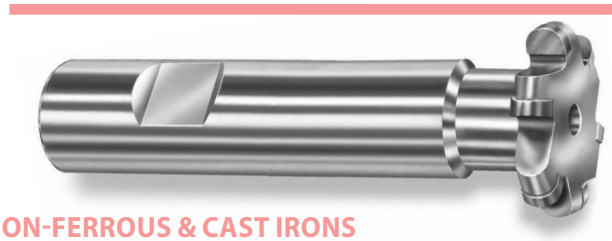
- Reduced neck diameter
- Shortened shank or reduced shank diameter
- Additional shank drive flat(s)
- Coatings available:

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
¾	⅜	6	3/16	2 ⅜	74624	$166.90	74724	$183.60	¼	2 ⅜	74824	$166.90	74924	$183.60
1	½	6	5/16	2 27/32	74632	197.10	74732	216.85	⅜	2 29/32	74832	197.10	74932	216.85
1 ⅜	⅝	6	7/16	3 7/32	74644	228.30	74744	251.20	½	3 9/32	74844	228.30	74944	251.20
1 ½	⅝	6	½	3 ⅜	74648	239.80	74748	263.75	9/16	3 7/16	74848	239.80	74948	263.75
1 ⅞	¾	6	⅝	3 25/32	74660	364.10	74760	400.55	⅝	3 25/32	74860	364.10	74960	400.55
2 ¼	⅞	6	¾	4 5/32	74672	492.85	74772	542.15	¾	4 5/32	74872	492.85	74972	542.15

RADIUS CUTTERS CARBIDE TIPPED TYPES 718 & 719 FRACTIONAL

MATERIAL SPECIFIC



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 ⅛" radius: plus .001", minus .001"
  over ⅛" radius: plus .002", minus .002"

MODIFICATIONS (Prompt delivery)

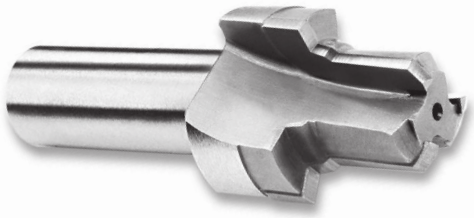
- Reduced neck diameter
- Shortened shank or reduced shank diameter
- Additional shank drive flat(s)
- Coatings available:

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	¾	1/16	½	3	6	71801	$208.20	71901	$229.05
1/16	¾	⅛	½	3	6	71802	208.20	71902	229.05
3/32	⅞	3/16	½	3	6	71803	227.65	71903	250.30
⅛	1 ¼	¼	¾	3 ½	6	71804	247.70	71904	272.55
5/32	1 5/16	5/16	¾	3 ½	6	71805	285.10	71905	313.55
3/16	1 ⅜	⅜	¾	3 ½	6	71806	301.65	71906	331.85
¼	1 ½	½	¾	4	6	71808	312.25	71908	343.55

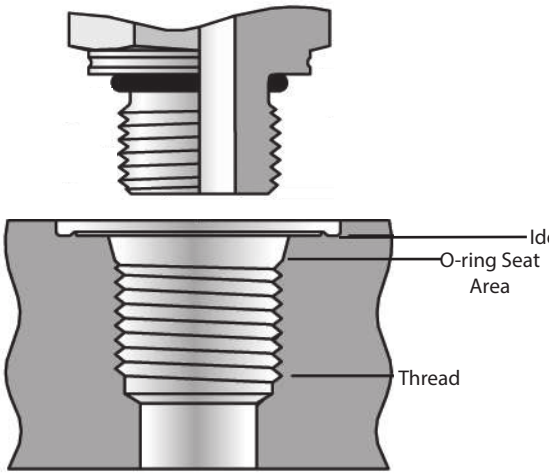
PORT CONTOUR TOOLS
CARBIDE TIPPED

PORTING TOOLS GUIDE



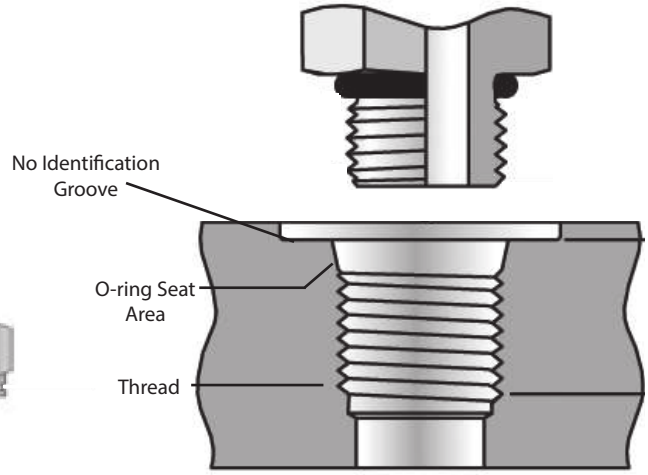
Port Contour Cutter

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.



ISO Port

Typical Fitting



SAE or MS Port

When ordering you must know the required specification and either the tube size or thread size.

Ordering Examples:
Order by Tube Size: **SAE - # 4 TUBE SIZE**
OR
Order by Thread Size: **ISO - M 14 X 1.5 THREADS**

PORT CONTOUR TECHNICAL INFO:

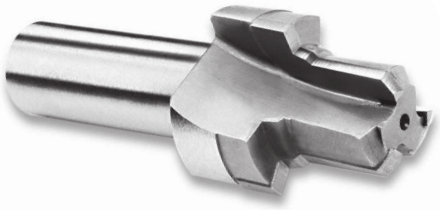
- Appropriate carbide grade for material being machined
- 3 flute design allows for smooth chip flow
- Positive axial rake allows for improved shearing action and better chip evacuation
- Negative radial rake reduces chatter and provides cutting edge strength

PORT CONTOUR CUTTERS
CARBIDE TIPPED TYPES 780 & 781 FRACTIONAL

MATERIAL SPECIFIC

INDEX

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

CUTTERS

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 NO.	TUBE SIZE	DIMENSIONS THREAD SIZE	DIAMETER REAMER	DIAMETER SPOTFACE	DIAMETER SHANK	SEALING SEAT ANGLE	LENGTH SHANK	LENGTH REAMER	LENGTH HEAD	LENGTH OVERALL	TYPE 780 N-F/CI EDP NO.	TYPE 781 STEEL EDP NO.	BOTH TYPES PRICE
2	1/8	5/16-24	.2720	.6820	.5000	12°	2	.4730	1 1/8	3 1/8	78002	78102	$332.75
3	3/16	3/8-24	.3350	.7600	.5000	12°	2	.4730	1 1/4	3 1/4	78003	78103	332.75
4	1/4	7/16-20	.3890	.8380	.5000	12°	2	.5520	1 1/4	3 1/4	78004	78104	332.75
5	5/16	1/2-20	.4520	.9160	.5000	12°	2	.5520	1 1/4	3 1/4	78005	78105	343.25
6	3/8	9/16-18	.5090	.9790	.5000	12°	2	.6140	1 1/4	3 1/4	78006	78106	343.25
8	1/2	3/4-16	.6890	1.1980	.7500	15°	2	.6930	1 3/8	3 3/8	78008	78108	375.65
10	5/8	7/8-14	.8060	1.3540	.7500	15°	2	.7860	1 5/8	3 5/8	78010	78110	424.85
12	3/4	1 1/16-12	.9810	1.6350	.7500	15°	2 1/4	.9110	1 7/8	4 1/8	78012	78112	458.30
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	465.70
16	1	1 5/16-12	1.2310	1.9200	.7500	15°	2 1/4	.9110	1 7/8	4 1/8	78016	78116	501.25
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	552.20
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	679.10
32	2	2 1/2-12	2.4190	3.4900	1.0000	15°	2 1/4	.9110	2 1/4	4 1/2	78032	78132	886.90

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

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

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

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 ⅛	3 ⅛	786080	787080	$357.75
M 10X1	.3560	.7870	.5000	3	12°	2	.4530	1 ¼	3 ¼	786100	787100	357.75
M 12X1.5	.4150	.9060	.5000	3	15°	2	.5510	1 ¼	3 ¼	786120	787120	374.70
M 14X1.5	.4930	.9840	.5000	3	15°	2	.5510	1 ¼	3 ¼	786140	787140	374.70
M 16X1.5	.5720	1.1020	.5000	3	15°	2	.6100	1 ¼	3 ¼	786160	787160	412.60
M 18X1.5	.6510	1.1810	.7500	3	15°	2	.6690	1 ⅜	3 ⅜	786180	787180	412.60
M 20X1.5	.7300	1.2600	.7500	3	15°	2	.6890	1 ⅜	3 ⅜	786200	787200	428.55
M 22X1.5	.8080	1.3390	.7500	3	15°	2	.7090	1 ⅝	3 ⅝	786220	787220	444.40
M 27X2	.9850	1.5750	.7500	3	15°	2 ¼	.8660	1 ⅞	4 ⅛	786270	787270	480.40
M 33X2	1.2210	1.9290	.7500	3	15°	2 ¼	.8660	1 ⅞	4 ⅛	786330	787330	552.55
M 42X2	1.5760	2.3620	1.0000	3	15°	2 ¼	.8860	1 ⅞	4 ⅛	786420	787420	603.80
M 48X2	1.8120	2.5890	1.0000	4	15°	2 ¼	.9840	2	4 ¼	786480	787480	638.35
M 60X2	2.2840	2.9920	1.0000	4	15°	2 ¼	1.0830	2	4 ¼	786600	787600	722.05

MS 33649 INTEGRAL REAMER PILOT 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	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

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

TUBE		THREAD SIZE	DIMENSIONS							TYPE 792 N-F/CI EDP NO.	TYPE 793 STEEL EDP NO.	BOTH TYPES PRICE
NO.	SIZE		DIAMETER			LENGTH						
			REAMER	SPOTFACE	SHANK	SHANK	REAMER	HEAD	OVERALL			
1	1/16	¼-28	.2150	.6500	.5000	2	.4070	1	3	79201	79301	$388.65
2	⅛	5/16-24	.2750	.7420	.5000	2	.5820	1 ⅛	3 ⅛	79202	79302	388.65
3	3/16	⅜-24	.3390	.8050	.5000	2	.5880	1 ¼	3 ¼	79203	79303	368.75
4	¼	7/16-20	.3930	.8880	.5000	2	.6610	1 ¼	3 ¼	79204	79304	378.70
5	5/16	½-20	.4550	.9500	.5000	2	.6610	1 ¼	3 ¼	79205	79305	388.65
6	⅜	9/16-18	.5120	1.0120	.5000	2	.7140	1 ½	3 ½	79206	79306	408.60
7	7/16	⅝-18	.5750	1.1050	.5000	2	.7300	1 ½	3 ½	79207	79307	418.55
8	½	¾-16	.6930	1.2400	.7500	2	.8390	1 ⅝	3 ⅝	79208	79308	428.55
9	9/16	13/16-16	.7560	1.3020	.7500	2	.8550	1 ⅝	3 ⅝	79209	79309	438.50
10	⅝	⅞-14	.8100	1.4150	.7500	2 ¼	.9350	1 ⅞	4 ⅛	79210	79310	448.45
11	11/16	1-12	.9250	1.6020	.7500	2 ¼	1.0690	2 ⅛	4 ⅜	79211	79311	488.30
12	¾	1 1/16-12	.9870	1.6650	.7500	2 ¼	1.0690	2 ⅛	4 ⅜	79212	79312	518.20
14	⅞	1 3/16-12	1.1120	1.7900	.7500	2 ¼	1.0690	2 ⅛	4 ⅜	79214	79314	592.00
16	1	1 5/16-12	1.2370	1.9650	.7500	2 ¼	1.0690	2 ⅛	4 ⅜	79216	79316	664.65
18	1 ⅛	1 ½-12	1.4250	2.0900	.7500	2 ¼	1.1210	2 ¼	4 ½	79218	79318	716.35
20	1 ¼	1 ⅝-12	1.5500	2.3100	1.0000	2 ¼	1.1210	2 ¼	4 ½	79220	79320	834.60
24	1 ½	1 ⅞-12	1.8000	2.6000	1.0000	2 ¼	1.1320	2 ¼	4 ½	79224	79324	1010.50
32	2	2 ½-12	2.4250	3.5200	1.0000	2 ½	1.3730	2 ½	5	79232	79332	1437.10

CARBIDE TIPPED END MILLS TECHNICAL INFORMATION

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

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).

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"

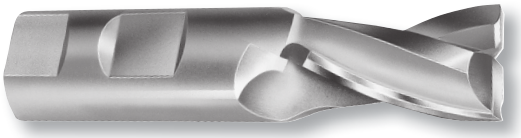
END MILL PROBLEM SOLVING GUIDE — CARBIDE TIPPED

MILLING PROBLEMS	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
1. ROUGH FINISH	Dull cutting edge Wrong feeds & speeds	Resharpen 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 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

END MILLS INDEX AND COMPARISON CHART

DESCRIPTION	HANNIBAL PAGE	HANNIBAL TOOL TYPE	FULLERTON	PUTNAM	MORSE	NIAGARA
CENTER CUTTING END MILLS						
Straight Flutes						
For Non-Ferrous & Cast Irons	**189**	314	60SK	SKM	5935	4800
For Steels	**189**	312	60SKS	–	5936	4780
25° Right Spiral Flutes						
For Non-Ferrous & Cast Irons	**189**	318	60CS	–	5966	–
HIGH SPIRAL SHEAR CUTTING END MILLS						
15° Right Spiral Flutes						
For Non-Ferrous & Cast Irons	**191**	375	–	HLS	5962	4840
For Cast Irons & High Temp Alloys	**191**	320	–	–	–	–
For Steels	**192**	350	60GSS	HES	5960	4820
25° Right Spiral Flutes			–	–	–	–
For Non-Ferrous (Sharp Edged)	**191**	327	–	–	–	–
For Non-Ferrous	**191**	325	60FS	HNS	5958	4860
SLOW SPIRAL END MILLS						
6° Right Spiral Flutes						
For Non-Ferrous (Sharp Edged)	**190**	307	–	–	–	–
For Non-Ferrous & Cast Irons	**190**	306	60RS	RSEM	5921	–
For Steels	**192**	308	60RSS	–	–	–
6° Left Spiral Flutes for Steels	**192**	310	60LSS	LSEM	5964	–
STRAIGHT FLUTES END MILLS						
Sharp Edged						
For Non-Ferrous (4 Flutes)	**190**	305	–	–	–	–
Radial Edged						
For Non-Ferrous & Cast Irons (2 Flutes)	**190**	302	60TF	TFEM	5923	4700
For Non-Ferrous & Cast Irons (4 or 6 Flts.)	**190**	304	60EM	EM	5925	4750
For Steels (2 Flutes)	**192**	300	60TFS	–	5927	–

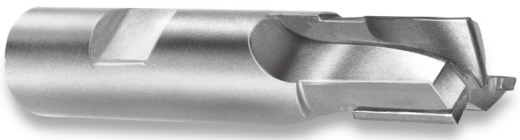
CENTER CUTTING TYPE TYPES 318, 312, 314 FRACTIONAL



25° RIGHT SPIRAL FLUTES
TYPE 318 - FOR NON-FERROUS & CAST IRONS

- Larger flute capacity for heavy milling
- Center cutting design for plunge, slot, profile and peripheral milling including splines, keyways, and spotfacing
- Radial edged for longer tool life
- Detailed specifications on page 188

TOOL DIAMETER FRAC.	TOOL DIAMETER DECIMAL	DIMENSIONS SHANK DIAM.	LENGTH CARBIDE	LENGTH OVERALL	NO. OF FLUTES	TYPE 318 FOR NON-FERR. EDP NO.	TYPE 318 FOR NON-FERR. PRICE
½	.5000	½	1	3	2	31816	$183.05
⅝	.6250	⅝	1 ¼	3 ⅜	2	31820	204.60
¾	.7500	¾	1 ¼	3 ⅜	2	31824	216.80
⅞	.8750	⅞	1 ½	3 ¾	2	31828	238.45
1	1.0000	1	1 ½	4	2	31832	274.00
1 ¼	1.2500	1 ¼	1 ¾	4 ¼	2	31840	372.45
1 ½	1.5000	1 ½	2	4 ¾	2	31848	434.60



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 FRAC.	TOOL DIAMETER DECIMAL	DIMENSIONS SHANK DIAM.	LENGTH CAR-BIDE	LENGTH OVER-ALL	NO. OF FLTS	TYPE 314 FOR NON-FERR. & C.I. EDP NO.	TYPE 314 FOR NON-FERR. & C.I. PRICE	TYPE 312 FOR STEELS EDP NO.	TYPE 312 FOR STEELS PRICE
⅜	.3750	⅜	½	2 ½	3	31412	$109.45	31212	$113.75
7⁄16	.4375	⅜	¾	2 ½	3	31414	111.90	31214	116.30
½	.5000	½	¾	3	3	31416	114.85	31216	119.15
9⁄16	.5625	½	¾	3	3	31418	119.25	31218	123.90
⅝	.6250	⅝	¾	3 ¼	3	31420	139.60	31220	144.85
¾	.7500	⅝	¾	3 ⅜	3	31424	146.05	31224	151.70
⅞	.8750	⅞	¾	3 ¾	3	31428	170.50	31228	177.10
1	1.0000	⅞	¾	3 ¾	3	31432	187.30	31232	194.55
1 ⅛	1.1250	1	¾	4	3	31436	200.65	31236	208.25
1 ¼	1.2500	1	¾	4	3	31440	232.45	31240	241.50
1 ½	1.5000	1 ¼	¾	4	3	31448	276.40	31248	287.05

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

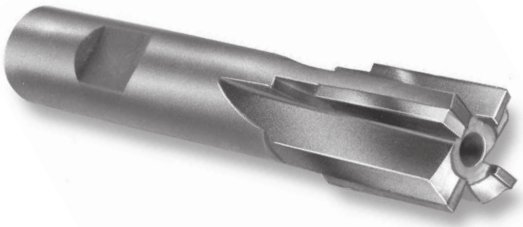
TITANIUM CARBONITRIDE – TiCN

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		
			LENGTH																
FRAC.	DEC.	SHANK DIAM.	CAR-BIDE	OVER-ALL	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
1/4	.2500	3/8	1/2	2 1/2	2	30208	$59.50	4	30408	$60.05	4	30508	$60.05	2	30608	$60.85	2	30708	$64.50
5/16	.3125	3/8	5/8	2 1/2	2	30210	61.75	4	30410	64.15	-	-	-	2	30610	63.00	-	-	-
3/8	.3750	3/8	5/8	2 1/2	2	30212	66.25	4	30412	67.60	-	-	-	2	30612	67.45	-	-	-
7/16	.4375	3/8	1	2 11/16	2	30214	66.25	4	30414	67.60	4	30514	65.05	2	30614	67.45	2	30714	71.50
1/2	.5000	1/2	1	3 1/4	2	30216	67.90	4	30416	69.20	4	30516	69.10	2	30616	69.25	2	30716	73.30
9/16	.5625	1/2	1	3 3/8	2	30218	75.05	4	30418	77.70	4	30518	77.55	2	30618	76.70	2	30718	81.10
5/8	.6250	1/2	1	3 3/8	2	30220	75.05	4	30420	81.35	4	30520	81.25	4	30620	79.65	4	30720	84.30
11/16	.6875	5/8	1	3 3/8	2	30222	81.25	4	30422	89.55	4	30522	89.35	-	-	-	-	-	-
3/4	.7500	5/8	1	3 5/8	2	30224	84.30	4	30424	83.75	4	30524	92.80	4	30624	91.00	4	30724	96.25
13/16	.8125	5/8	1	3 5/8	2	30226	101.90	4	30426	98.95	4	30526	106.20	-	-	-	-	-	-
7/8	.8750	5/8	1 1/4	4	2	30228	102.55	4	30428	98.95	4	30528	109.85	4	30628	121.65	4	30728	128.90
15/16	.9375	7/8	1 1/4	4	2	30230	109.85	4	30430	109.90	4	30530	116.85	-	-	-	-	-	-
1	1.0000	7/8	1 1/4	4	2	30232	110.10	4	30432	114.30	4	30532	126.75	4	30632	140.55	4	30732	148.85
1 1/8	1.1250	1	1 1/4	4 1/4	2	30236	113.00	4	30436	129.65	4	30536	143.60	4	30636	159.40	-	-	-
1 1/4	1.2500	1	1 1/4	4 1/4	2	30240	136.25	4	30440	145.80	4	30540	161.50	4	30640	179.15	4	30740	189.40
1 1/2	1.5000	1 1/4	1 1/2	4 1/2	2	30248	168.75	4	30448	187.95	4	30548	200.05	4	30648	221.75	4	30748	226.15
1 3/4	1.7500	1 1/4	1 1/2	4 1/2	2	30256	200.05	6	30456	242.25	-	-	-	6	30656	286.25	-	-	-
2	2.0000	1 1/4	1 1/2	4 1/2	2	30264	223.15	6	30464	279.10	-	-	-	6	30664	329.60	6	30764	335.90

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		
FRAC.	DECIMAL	SHANK DIAM.	LENGTH CARBIDE	LENGTH OVERALL	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
½	.5000	⅜	1	3	2	-	32516	$108.80	2	37516	$100.25	-	-	-
½	.5000	½	1	3	2	-	32517	108.80	2	37517	100.25	4	32017	$108.80
9⁄16	.5625	½	1	3	2	-	32518	116.85	2	37518	107.80	-	-	-
⅝	.6250	½	1 ¼	3 ¼	2	-	32520	125.80	2	37520	115.85	-	-	-
⅝	.6250	⅝	1 ¼	3 ⅜	2	32721	32521	125.80	2	37521	115.85	4	32021	125.80
11⁄16	.6875	½	1 ¼	3 ¼	2	-	32522	131.05	2	37522	120.80	-	-	-
11⁄16	.6875	⅝	1 ¼	3 ⅜	2	-	32523	131.05	2	37523	120.80	4	32023	131.05
¾	.7500	½	1 ¼	3 ¼	2	32724	32524	139.95	2	37524	128.95	-	-	-
¾	.7500	⅝	1 ¼	3 ⅜	2	32725	32525	139.95	2	37525	128.95	4	32025	139.95
13⁄16	.8125	⅝	1 ½	3 ⅝	2	32726	32526	151.00	2	37526	139.15	4	32026	151.00
⅞	.8750	⅝	1 ½	3 ⅝	2	-	32528	160.25	2	37528	147.75	-	-	-
⅞	.8750	⅞	1 ½	3 ¾	2	-	32529	160.25	2	37529	147.75	4	32029	160.25
15⁄16	.9375	⅝	1 ½	3 ¾	2	-	32530	181.30	3	37530	218.75	-	-	-
15⁄16	.9375	⅞	1 ½	3 ¾	2	-	32531	181.30	3	37531	218.75	-	-	-
1	1.0000	⅞	1 ½	3 ¾	2	32732	32532	185.05	3	37532	207.05	-	-	-
1	1.0000	1	1 ½	4	2	32733	32533	185.05	3	37533	207.05	6	32033	224.80
1 ⅛	1.1250	1	1 ¾	4 ¼	2	-	32536	202.65	3	37536	243.85	6	32036	264.55
1 ¼	1.2500	1	1 ¾	4 ¼	3	32740	32540	268.75	4	37540	279.45	6	32040	303.20
1 ⅜	1.3750	1	1 ¾	4 ¼	3	32744	32544	291.40	4	37544	326.30	6	32044	354.25
1 ½	1.5000	1 ¼	2	4 ½	3	32748	32548	325.45	4	37548	321.55	6	32048	348.90
1 ⅝	1.6250	1 ¼	2	4 ½	3	-	32552	385.20	4	37552	393.25	-	-	-
1 ¾	1.7500	1 ¼	2	4 ½	3	-	32556	413.30	4	37556	419.35	8	32056	438.70
1 ⅞	1.8750	1 ¼	2	4 ½	3	-	32560	444.90	4	37560	448.55	-	-	-
2	2.0000	1 ¼	2	4 ½	3	32764	32564	475.60	4	37564	473.80	8	32064	495.70

END MILLS

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

MATERIAL SPECIFIC

BASIC TYPES

MODIFICATIONS (See list on page 191)

TYPE 300 - TWO STRAIGHT FLUTES

- Two large flutes for easy chip removal
- Use when machine horsepower is too low for high chip capacity end mills

TYPE 308 - 6° RIGHT SPIRAL FLUTES

- Spiral flutes aid in chip removal, permitting heavier feeds and faster speeds

TYPE 310 - 6° LEFT SPIRAL FLUTES

- Left spiral flutes maintain a constant pressure on the workpiece and absorb the impact shock on entering steel
- Left hand helix best when milling tough steel alloys
- For peripheral milling

ALL TYPES:

- Radial edged for longer tool life
- Detailed specifications on page 188

TOOL DIAMETER		DIMENSIONS			TYPE 300 - 2 STRAIGHT FLUTES			TYPE 308 OR TYPE 310 - 6° SPIRAL FLUTES			
			LENGTH								
FRAC.	DECIMAL	SHANK DIAM.	CARBIDE	OVERALL	NO. OF FLTS	EDP NO.	PRICE	NO. OF FLTS	TYPE 308 RIGHT EDP NO.	TYPE 310 LEFT EDP NO.	PRICE
¼	.2500	⅜	½	2 ½	2	30008	$68.40	2	30808	31008	$70.40
5/16	.3125	⅜	⅝	2 ½	2	30010	71.25	2	30810	31010	75.95
⅜	.3750	⅜	⅝	2 ½	2	30012	76.05	2	30812	31012	80.50
7/16	.4375	⅜	1	2 11/16	2	30014	76.05	2	30814	31014	80.50
½	.5000	½	1	3 ¼	2	30016	77.80	4	30816	31016	86.70
9/16	.5625	½	1	3 ⅜	2	30018	86.30	4	30818	31018	93.20
⅝	.6250	½	1	3 ⅜	2	30020	86.30	4	30820	31020	115.00
¾	.7500	⅝	1	3 ⅝	2	30024	96.85	4	30824	31024	128.10
⅞	.8750	⅝	1 ¼	4	2	30028	114.45	4	30828	31028	154.35
1	1.0000	⅞	1 ¼	4	2	30032	126.45	6	30832	31032	177.45
1 ⅛	1.1250	1	1 ¼	4 ¼	2	30036	129.55	6	30836	31036	188.20
1 ¼	1.2500	1	1 ¼	4 ¼	2	30040	144.45	6	30840	31040	227.45
1 ½	1.5000	1 ¼	1 ½	4 ½	2	30048	186.05	6	30848	31048	276.60
1 ¾	1.7500	1 ¼	1 ½	4 ½	2	30056	208.65	8	30856	31056	333.10
2	2.0000	1 ¼	1 ½	4 ½	2	30064	249.15	8	30864	31064	371.85

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		
			LENGTH				
FRAC.	DECIMAL	SHANK DIAM.	CARBIDE	OVERALL	NO. OF FLTS	EDP NO.	PRICE
½	.5000	⅜	1	3	4	35016	$108.80
½	.5000	½	1	3	4	35017	108.80
9/16	.5625	½	1	3	4	35018	116.85
⅝	.6250	½	1 ¼	3 ¼	4	35020	125.80
⅝	.6250	⅝	1 ¼	3 ⅜	4	35021	125.80
11/16	.6875	½	1 ¼	3 ¼	4	35022	131.05
11/16	.6875	⅝	1 ¼	3 ⅜	4	35023	131.05
¾	.7500	½	1 ¼	3 ¼	4	35024	139.95
¾	.7500	⅝	1 ¼	3 ⅜	4	35025	139.95
13/16	.8125	⅝	1 ½	3 ⅝	4	35026	151.00
⅞	.8750	⅝	1 ½	3 ⅝	4	35028	160.25
⅞	.8750	⅞	1 ½	3 ¾	4	35029	160.25
15/16	.9375	⅝	1 ½	3 ¾	4	35030	237.40
15/16	.9375	⅞	1 ½	3 ¾	4	35031	237.40
1	1.0000	⅞	1 ½	3 ¾	6	35032	224.80
1	1.0000	1	1 ½	4	6	35033	224.80
1 ⅛	1.1250	1	1 ¾	4 ¼	6	35036	264.55
1 ¼	1.2500	1	1 ¾	4 ¼	6	35040	303.20
1 ⅜	1.3750	1	1 ¾	4 ¼	6	35044	354.25
1 ½	1.5000	1 ¼	2	4 ½	6	35048	348.90
1 ⅝	1.6250	1 ¼	2	4 ½	8	35052	465.15
1 ¾	1.7500	1 ¼	2	4 ½	8	35056	496.10
1 ⅞	1.8750	1 ¼	2	4 ½	8	35060	530.55
2	2.0000	1 ¼	2	4 ½	8	35064	560.30

BRAZED SINGLE POINT TOOLS
CARBIDE TIPPED

MATERIAL SPECIFIC

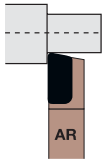
FINISH GROUND
READY FOR USE

883/PREMIUM C2 FOR NON-FERROUS & CAST IRONS
370/PREMIUM C5-C6 FOR STEELS

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	$11.45	11204	$8.35	¼	¼	2	12
AR-5	11105	10.10	11205	8.90	5/16	5/16	2 ¼	12
AR-6	11106	10.30	11206	9.05	⅜	⅜	2 ½	12
AR-7	11107	11.10	11207	9.85	7/16	7/16	3	12
AR-8	11108	9.50	11208	9.50	½	½	3 ½	12
AR-10	11110	14.10	11210	13.05	⅝	⅝	4	12
AR-12	11112	18.10	11212	16.20	¾	¾	4 ½	12
AR-16	11116	33.20	11216	32.35	1	1	7	6
AR-20	11120	CALL US	11220	CALL US	1 ¼	1 ¼	8	1
AR-44	11144	CALL US	11244	CALL US	½	1	7	12

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



For turning to a square shoulder

0° SIDE CUTTING EDGE ANGLE
For machining to a square shoulder

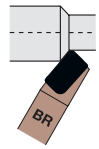
TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
AL-4	11404	$11.45	11504	$8.35	¼	¼	2	12
AL-5	11405	10.10	11505	8.90	5/16	5/16	2 ¼	12
AL-6	11406	10.30	11506	9.05	⅜	⅜	2 ½	12
AL-7	11407	11.10	11507	9.85	7/16	7/16	3	12
AL-8	11408	9.50	11508	9.50	½	½	3 ½	12
AL-10	11410	13.35	11510	13.05	⅝	⅝	4	12
AL-12	11412	17.25	11512	17.10	¾	¾	4 ½	12
AL-16	11416	33.65	11516	33.65	1	1	7	6
AL-20	-	-	11520	CALL US	1 ¼	1 ¼	8	1
AL-44	11444	CALL US	11544	CALL US	½	1	7	12

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

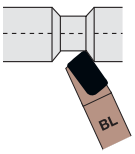
15° SIDE CUTTING EDGE ANGLE
For interrupted or irregular cuts

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	$11.45	12204	$8.35	¼	¼	2	12
BR-5	12105	10.10	12205	8.90	5/16	5/16	2 ¼	12
BR-6	12106	10.30	12206	9.05	⅜	⅜	2 ½	12
BR-7	12107	11.10	12207	9.85	7/16	7/16	3	12
BR-8	12108	9.50	12208	9.50	½	½	3 ½	12
BR-10	12110	14.10	12210	13.05	⅝	⅝	4	12
BR-12	12112	18.10	12212	16.20	¾	¾	4 ½	12
BR-16	12116	33.20	12216	32.35	1	1	7	6
BR-20	12120	CALL US	12220	CALL US	1 ¼	1 ¼	8	1
BR-44	12144	CALL US	12244	CALL US	½	1	7	12

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



For turning where square shoulder is not required



15° SIDE CUTTING EDGE ANGLE
For interrupted or irregular cuts

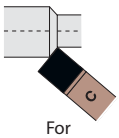
TOOL STYLE	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS			STD. PKG. QTY.
	EDP NO.	PRICE	EDP NO.	PRICE	W	H	L	
BL-4	12404	$11.45	12504	$8.35	¼	¼	2	12
BL-5	12405	10.10	12505	8.90	5/16	5/16	2 ¼	12
BL-6	12406	10.30	12506	9.05	⅜	⅜	2 ½	12
BL-7	12407	11.10	12507	9.85	7/16	7/16	3	12
BL-8	12408	9.50	12508	9.50	½	½	3 ½	12
BL-10	12410	13.35	12510	13.05	⅝	⅝	4	12
BL-12	12412	17.25	12512	17.10	¾	¾	4 ½	12
BL-16	12416	33.65	12516	33.65	1	1	7	6
BL-20	12420	CALL US	12520	CALL US	1 ¼	1 ¼	8	1
BL-44	12444	CALL US	12544	CALL US	½	1	7	12

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

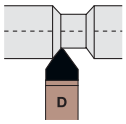
0° SQUARE NOSE
No nose radius

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	$7.55	13804	$7.55	¼	¼	2	12
C-5	13705	8.30	13805	8.00	5/16	5/16	2 ¼	12
C-6	13706	10.75	13806	8.90	⅜	⅜	2 ½	12
C-7	13707	8.20	13807	11.35	7/16	7/16	3	12
C-8	13708	13.20	13808	12.20	½	½	3 ½	12
C-10	13710	14.85	13810	16.20	⅝	⅝	4	12
C-12	13712	20.50	13812	23.25	¾	¾	4 ½	12
C-16	13716	42.55	13816	40.85	1	1	7	6
C-20	13720	CALL US	13820	CALL US	1 ¼	1 ¼	8	1
C-44	13744	CALL US	13844	CALL US	½	1	7	12

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



For undercutting or chamfering



For chamfering

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	$7.00	14804	$7.00	¼	¼	2	12
D-5	14705	8.10	14805	8.35	5/16	5/16	2 ¼	12
D-6	14706	8.30	14806	8.95	⅜	⅜	2 ½	12
D-7	14707	11.35	14807	13.80	7/16	7/16	3	12
D-8	14708	10.90	14808	11.55	½	½	3 ½	12
D-10	14710	15.25	14810	16.90	⅝	⅝	4	12
D-12	14712	21.80	14812	19.15	¾	¾	4 ½	12
D-16	14716	32.40	14816	33.45	1	1	7	6

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

BRAZED SINGLE POINT TOOLS
CARBIDE TIPPED

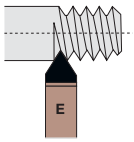
MATERIAL SPECIFIC

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	$7.00	15804	$7.00	¼	¼	2	12
E-5	15705	7.65	15805	7.65	5/16	5/16	2 ¼	12
E-6	15706	7.95	15806	7.75	⅜	⅜	2 ½	12
E-7	15707	12.30	15807	14.75	7/16	7/16	3	12
E-8	15708	18.25	15808	9.80	½	½	3 ½	12
E-10	15710	15.15	15810	13.75	⅝	⅝	4	12
E-12	15712	18.80	15812	19.05	¾	¾	4 ½	12
E-16	15716	32.95	15816	31.70	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

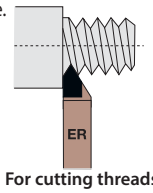
For threading, chamfering, notching, or undercutting

30° SIDE CUTTING EDGE ANGLE

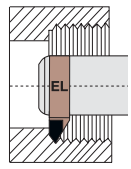
Offset for threading or boring

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	$8.70	15204	$7.00	¼	¼	2	12
ER-5	15105	8.70	15205	7.80	5/16	5/16	2 ¼	12
ER-6	15106	8.85	15206	8.00	⅜	⅜	2 ½	12
ER-8	15108	15.60	15208	15.60	½	½	3 ½	12
ER-10	15110	17.00	15210	17.00	⅝	⅝	4	12
ER-12	15112	18.40	15212	19.95	¾	¾	4 ½	12

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



For cutting threads



For bore threading in a 90° bar

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	
EL-4	15404	$10.00	15504	$7.00	¼	¼	2	12
EL-5	15405	10.00	15505	9.60	5/16	5/16	2 ¼	12
EL-6	15406	10.00	15506	9.70	⅜	⅜	2 ½	12
EL-8	15408	15.60	15508	17.15	½	½	3 ½	12
EL-10	15410	17.00	15510	18.75	⅝	⅝	4	12
EL-12	15412	18.40	15512	19.95	¾	¾	4 ½	12

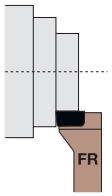
*Some sizes not available in premium grade carbide. Prices subject to change.

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	$13.10	16208	$12.90	½	½	3 ½	12
FR-10	16110	19.00	16210	18.05	⅝	⅝	4	12
FR-12	16112	24.55	16212	24.20	¾	¾	4 ½	6
FR-16	16116	51.30	16216	54.00	1	1	7	4
FR-44	16144	CALL US	16244	CALL US	½	1	6	6

*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	$13.20	16508	$12.55	½	½	3 ½	12
FL-10	16410	19.80	16510	18.05	⅝	⅝	4	12
FL-12	16412	25.45	16512	22.50	¾	¾	4 ½	6
FL-16	16416	47.85	16516	54.00	1	1	7	4
FL-44	16444	CALL US	16544	CALL US	½	1	6	6

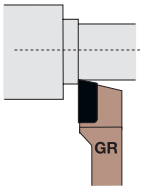
*Some sizes not available in premium grade carbide. Prices subject to change.

0° SIDE CUTTING EDGE ANGLE

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

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	$13.20	17208	$12.55	½	½	3 ½	12
GR-10	17110	19.80	17210	18.05	⅝	⅝	4	12
GR-12	17112	25.45	17212	22.50	¾	¾	4 ½	6
GR-16	17116	53.60	17216	54.00	1	1	7	4
GR-20	17120	CALL US	17220	CALL US	1 ¼	1 ¼	8	1
GR-44	17144	CALL US	17244	CALL US	½	1	6	6

*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	$13.10	17508	$12.90	½	½	3 ½	12
GL-10	17410	19.00	17510	18.05	⅝	⅝	4	12
GL-12	17412	24.55	17512	24.20	¾	¾	4 ½	6
GL-16	17416	52.00	17516	54.00	1	1	7	4
GL-20	17420	CALL US	17520	CALL US	1 ¼	1 ¼	8	1
GL-44	17444	CALL US	17544	CALL US	½	1	6	6

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

BRAZED CUT-OFF TOOLS
CARBIDE TIPPED

MATERIAL SPECIFIC

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	$16.95	10211	$17.65	1/2	1	5
CT-122	3/16	10122	17.45	10222	18.00	1/2	1	5
CT-121	1/4	10133	18.05	10233	18.65	1/2	1	5
CT-120	5/16	10144	18.00	10244	18.65	1/2	1	5
CT-130	3/8	10155	21.80	10255	23.20	5/8	1 1/4	5
CT-140	3/8	10166	24.15	10266	25.00	3/4	1 1/2	6

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

Standard packaging quantity is 6

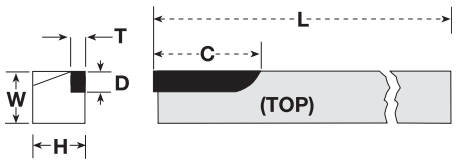
STANDARD CUT-OFF TOOL

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

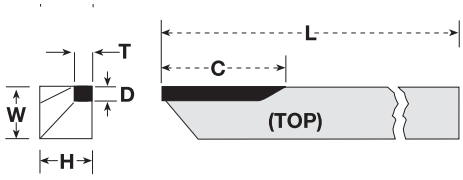
TOOL STYLE	CUT-OFF WIDTH	883/PREMIUM C2*		370/PREMIUM C5-C6*		SHANK DIMENSIONS		
		EDP NO.	PRICE	EDP NO.	PRICE	W	H	L
CTL-111	1/8	10411	$16.95	10511	$17.65	1/2	1	5
CTL-122	3/16	10422	17.45	10522	18.00	1/2	1	5
CTL-121	1/4	10433	18.05	10533	18.65	1/2	1	5
CTL-120	5/16	10444	18.00	10544	18.65	1/2	1	5
CTL-130	3/8	10455	21.80	10555	23.20	5/8	1 1/4	5
CTL-140	3/8	10466	24.15	10566	25.00	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	$15.35	1/4	1/4	6	3/32	1/8	1 1/4
SA7T	19902	16.45	9/32	9/32	6	3/32	1/8	1 1/4
SA8T	19903	17.95	5/16	5/16	6	3/32	3/16	1 1/4
SA9T	19904	19.05	3/8	3/8	6	3/32	3/16	1 1/4
SA10T	19905	20.60	13/32	13/32	6	3/32	3/16	1 1/4
SA11T	19906	21.35	7/16	7/16	6	1/8	1/4	1
SA11.5T	19907	21.50	15/32	15/32	6	1/8	1/4	1
SA12T	19908	22.80	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	$15.35	1/4	1/4	6	1/8	3/32	1 1/4
SA7C	19922	16.45	9/32	9/32	6	1/8	3/32	1 1/4
SA8C	19923	17.95	5/16	5/16	6	1/8	3/32	1 1/4
SA9C	19924	19.05	3/8	3/8	6	1/8	3/32	1 1/4
SA10C	19925	20.60	13/32	13/32	6	1/8	3/32	1 1/4
SA11C	19926	21.35	7/16	7/16	6	3/32	1/8	1 1/4
SA11.5C	19927	21.50	15/32	15/32	6	3/32	1/8	1 1/4
SA12C	19928	22.80	1/2	1/2	6	3/32	1/8	1 1/4

*Prices subject to change

Standard packaging quantity is 10

CATALOG INDEX
ALPHABETICAL BY PRODUCT SECTION

REAMERS - CARBIDE TIPPED

REAMERS - SOLID CARBIDE

REAMERS - SOLID CARBIDE (CONTINUED)

DRILLS

CATALOG INDEX (CONTINUED)
ALPHABETICAL BY PRODUCT SECTION

INDEX

CATALOG INDEX
NUMERICAL BY TOOL TYPE

INDEX

GENERAL INFORMATION

SELECTED DISTRIBUTION
To ensure exceptional service & technical application support, Hannibal only sells through selected distributors, your communications link with us. If you require direct technical assistance, contact our Engineering and Technical Service Team.
Phone: 800-451-9436
Fax: 800-633-7302
E-mail: sales@hannibalcarbide.com

STOCK STATUS
Because of our exceptionally broad product listing of over 20,000 line items, our distributors seldom stock our tools unless they have a consistent demand for particular tools requiring same day delivery. HANNIBAL maintains a 99% line item order fill rate. We have a huge inventory of finished tools ready to meet your needs.

SHIPPING
Normal procedure is to ship all distributor orders by UPS, unless requested otherwise. Our lost shipment insurance does not cover shipments sent "freight collect."

ORDERING
The only description required to order a standard tool is the EDP number. However, as a cross-check, orders should include a brief description of the tool.

MODIFICATIONS
Many standard tools ordered include requests for one or more modifications. On each page of this catalog is a list of the modifications most commonly requested. Just phone, fax, or e-mail us for an immediate quote. Modified tools are delivered promptly and are competitively priced.

APPLICATIONS ENGINEERING
HANNIBAL prides itself on the ability to solve end user tooling problems. We will suggest solutions including tool designs that have been used successfully to solve similar problems. Our proven applications engineering capability is reflected in the fact that some of the largest machine tool builders select HANNIBAL to design and produce the original cutting tools used in producing engines and transmissions.

FREE TECHNICAL REAMING GUIDE AVAILABLE
For technical reaming information see pages 23-29 or contact us to request your free hard copy, or PDF version of "HANNIBAL'S Guide to Cost Effective Reaming." It is continuously updated to include the latest reamer technical developments, including:
Reamer Stock Removal Chart • Titanium Coatings • Flute Geometry • Reamer Nomenclature & Definitions • Avoiding Reaming Problems • Runout Concerns • Developing Optimum Feeds & Speeds

QUALITY TOOLS
20% of HANNIBAL'S sales are special order tools made to end user's specifications and prints for the very demanding automotive, diesel engine, aircraft engine, aerospace, and construction equipment industries. To meet these stringent requirements, our engineers and tool makers work daily with exacting tolerances and procedures.

QUALITY APPROVED
Our plants have consistently passed quality system inspections by key engineering, production, and purchasing executives of our major tool users. HANNIBAL was Ford Q101 certified in 1989 and was originally ISO Certified on August 18, 1999 and continues to maintain ISO 9001 certifications.

TOLERANCES AND SPECIFICATIONS
All our tools are manufactured to one or more of the following specifications:

USCTI - United States Cutting Tool Institute
NAS - National Aerospace Standards
ISO - International Organization for Standardization
ASME/ANSI - American National Standards Institute, and affiliate of American Society of Mechanical Engineers

TOOL PERFORMANCE
While price is always a consideration, the real measure of the tool's value is its in-plant performance. HANNIBAL'S tool performance is proven wherever accurate records are kept, such as the aerospace and automotive industries. Here our tools earn "excellent" ratings... and that is why we are one of the fastest growing tool companies in the world.

PEOPLE
HANNIBAL'S engineers, technicians, tool makers, and sales & support staff are continually focused on the goal of producing the world's best carbide tipped tools. Our experienced tool makers sincerely want to do their very best every day making every effort to manufacture tools that will meet your exacting needs.

HANNIBAL

ACKNOWLEDGEMENTS
Cover Design – Poole Advertising
Printing – Crescent Printing Company

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