DOGA®
USINAGE

SOLID CARBIDE END MILLS AND DRILLS

www.doga-usinage.fr

SGS
Solid Carbide Tools

VALUE AT THE SPINDLE

KYOCERA SGS Precision Tools (KSPT) is an ISO 9001:2015 Certified manufacturer of industry leading round solid carbide cutting tools. State of the art manufacturing and warehouse facilities have the capacity and processes to meet the quality and delivery demands of customers in all markets around the world. Complete inspections performed within its metallurgical lab and manufacturing quality departments ensure the use of high quality carbide and reliable manufacturing consistency regardless of when a cutting tool is produced.

KSPT is proud to have pioneered some of the world's most advanced cutting technologies due to rigorous testing of tools, coatings, and materials within its Technical Center. It is this commitment to innovation that has launched patented products and technologies like the Z-Carb with its variable geometry and cutting edge preparation, Series 43 APR and APF ultra high performance aluminum cutting tools, and the JetStream coolant technology.

SGS has become an important part of the KYOCERA Precision Tools family, and while the name has changed, one thing has not. Its dedicated people and their relentless commitment to the customer. KSPT Technical Sales Engineers, Application Specialists, and Distribution Partners blanket the globe, delivering reliable service and support to all market segments. It is these people and products that drive innovative application strategies and cutting tool technologies into the end user, continually exceeding expectations and providing the most Value at the Spindle.

Table of Contents

KYOCERA SGS Precision Tools 2
Technical Centers. 4
Tooling Services. 5
Custom Engineered Tooling Solutions 6
KYOCERA SGS Precision Tools Europe Ltd. . . 7
APEX Application Expert 8

OVERVIEW
Common Legend. 9
End Mill Legend. 11
Drill Legend. 12
Router Legend 13

COATINGS 14
Coating Application Guide. 15

MILLING
High Performance End Mills. 16
End Mill Matrix. 20
High Performance Aluminum End Mills 76
General Application End Mills 186

HOLE MAKING
High Performance Drills 102
Drill Matrix 106
General Application Drills. 214
General Application Countersinks 237
General Application Reamers 240

ROUTING
High Performance Routers. 248
General Application Routers 255

TECHNICAL INFORMATION
EDP Index 258
KSPT Reference Information 287
Decimal Equivalent Chart 288
Hardness Conversion Chart 289

Technical Centers in North America and Europe

Cutting Tool Innovation

Our mission is to deliver value at the spindle. We achieve this by engineering advanced, application-driven cutting tool geometries using the latest technologies and techniques. Every tool we design is built to push the limits of performance and move the industry forward.

- Precision measuring and tool monitoring technology
- Ongoing market research and innovation
- Unique, high-performance tool designs

Technical Training & Education

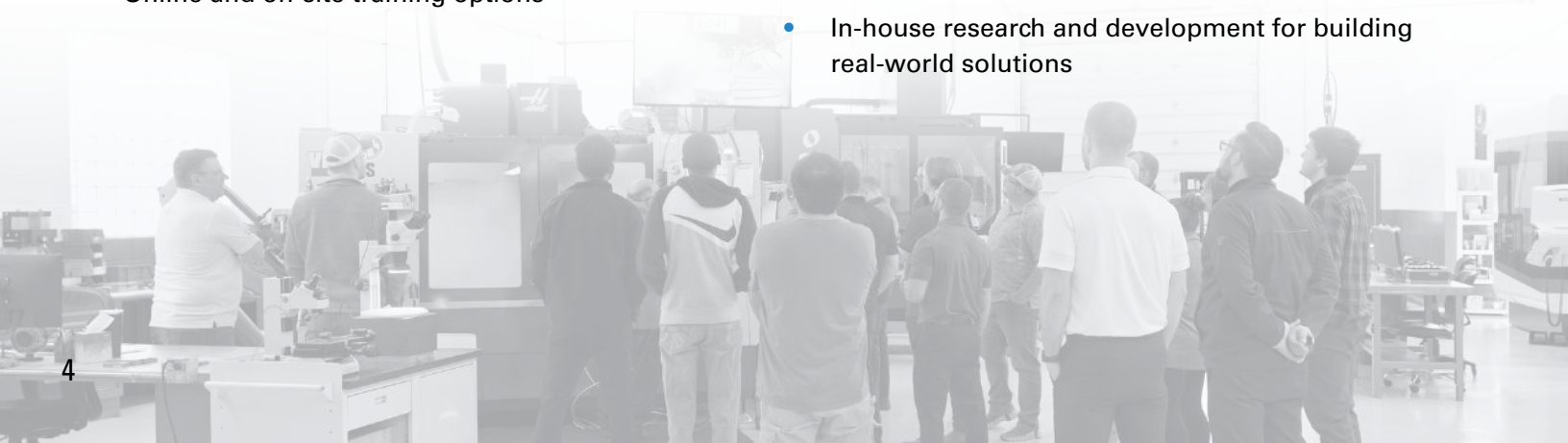
We believe in empowering machinists at every stage of their journey. Our training programs are hands-on, immersive, and tailored to real-world challenges, because great tools are only as good as the people who run them.

- Core training for both customers and KYOCERA SGS team members
- On-site tool clinics and cutting demonstrations
- Online and on-site training options

Application Support & Testing

Every job is different and so is every solution. Our engineers work directly with you to replicate real machining conditions, test potential setups, and recommend the best approach, all without interrupting your own production.

- Extensive inventory of holders, fixturing, materials, coolants, and machines
- Application troubleshooting by phone, email, or video call
- In-house research and development for building real-world solutions



Comprehensive Tooling Services

Tooling Services Facilities

KYOCERA SGS delivers expert tooling services designed to extend tool life, improve performance, and meet your specific application needs. From **Reconditioning**, **Recoating**, and **Regrinding** to **Custom Specials** and **Alterations**, our solutions are backed by the deep expertise of our KYOCERA SGS Technical Support Teams.

We proudly provide tooling services across North America and Europe, offering precision support wherever you need it.

BEFORE

AFTER

U.S.A.

KYOCERA SGS Precision Tools
150 Marc Drive
Cuyahoga Falls, Ohio 44223 U.S.A.
(330) 686-5700
sales@kyocera-sgstool.com

KYOCERA SGS Precision Tools West Coast Service Center
1832 W. Collins Ave.
Orange, California 92867 U.S.A.
(714) 363-3701
sgswest@kyocera-sgstool.com

Europe

KYOCERA SGS Precision Tools Europe Ltd
Nanscawen Road,
Fradley, Staffordshire
WS13 8LH
(44) 1189-795-200
saleseu@kyocera-sgstool.com

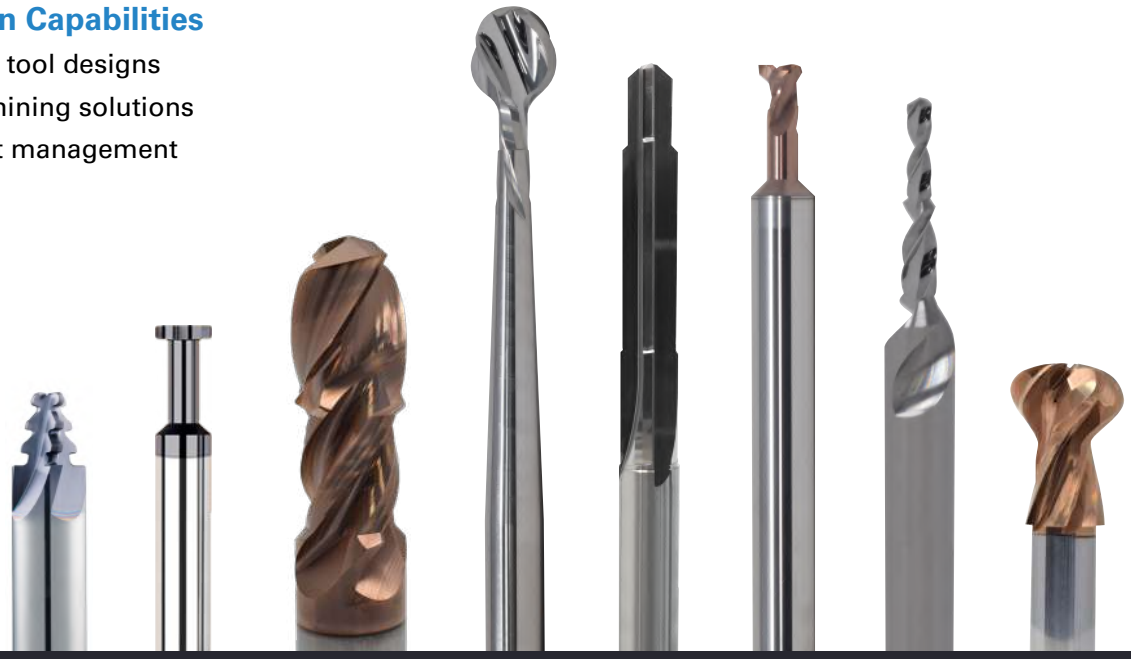
Custom Engineered Tooling Solutions

Complex Solutions Made Easy

At the heart of our engineered custom tooling capabilities lies our dedication to providing our customers with comprehensive solutions that align seamlessly with their needs. With the ability to integrate patented, industry-leading designs into each uniquely tailored tool, we ensure a perfect fit for your specific application.

Technology-Driven Capabilities

- **Complex** custom tool designs
- **Tailor-made** machining solutions
- **Complete** project management



Start an online quote request with us today!

North America

Europe

- Custom End Mills
- Custom Drills
- Custom Reamers
- Custom Chamfer & Rounding
- Custom Threading
- Combination Tooling
- Bulb Tooling
- Dovetail & T-Slots
- Form Tooling
- Taper Ball Nose Tools
- Micro Tooling

SGS
Solid Carbide Tools

KYOCERA SGS Precision Tools | Europe

More than just another cutting tool supplier

www.kyocera-sgstool.co.uk

KYOCERA SGS Precision Tools Europe

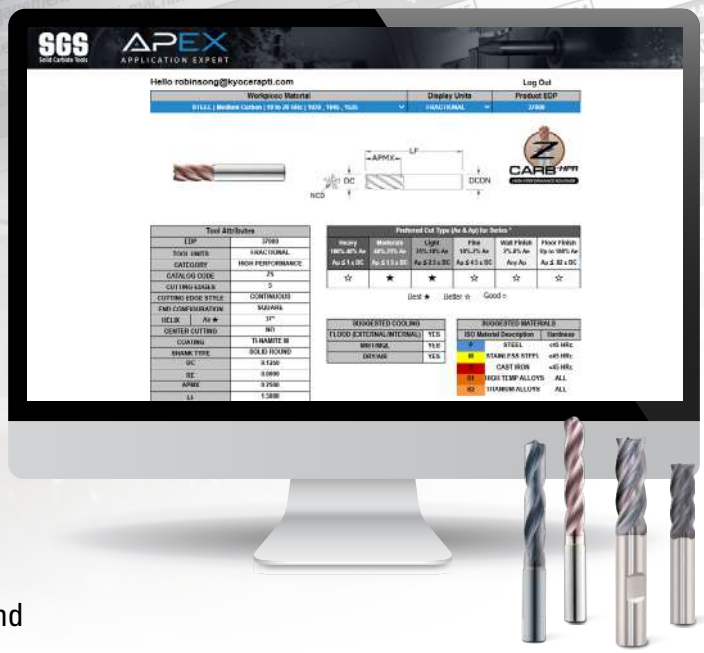
The state-of-the-art KYOCERA SGS Precision Tools Europe facility is located in Wokingham, England and is focused on the manufacture of special cutting tools, high accuracy form tools, tool modifications and regrinds. A highly skilled team of professionals specialise in the supply and support of high performance tools for the Aerospace, Medical, Power Generation, and Motorsport markets.

KYOCERA SGS Precision Tools Europe offers a full range of end mill and drill products:

- Multi-Million Euro Warehouse Stocking Full Range of Catalogue Products
- Same Day Shipment on Stock Items
- Multi-Lingual Sales and Technical Support
- Online Portal for Stock Availability
- High Performance Product and Application Training, Including KYOCERA SGS Tool Clinics

Additional Services

- A Fast Track for Special Tools Via Our Rapid Response Centre
- Inhouse PVD coating facility and R&D Centre
- Product Research and Development
- Product Engineering and Tool Application Support
- CAD/CAM Software Support



APEX

APPLICATION EXPERT

Say hello to APEX: Application Expert KYOCERA SGS's enhanced web application designed to make your SGS tool selection and parameter setup faster and more effective!

OPTIMIZE TOOL PERFORMANCE

Gain essential application data to optimize tool performance, including cutting parameters and material recommendations.

COMPARE AND CUSTOMIZE

Use powerful tools to tailor results, compare up to five options, and visualize ramping parameters with detailed drawings.

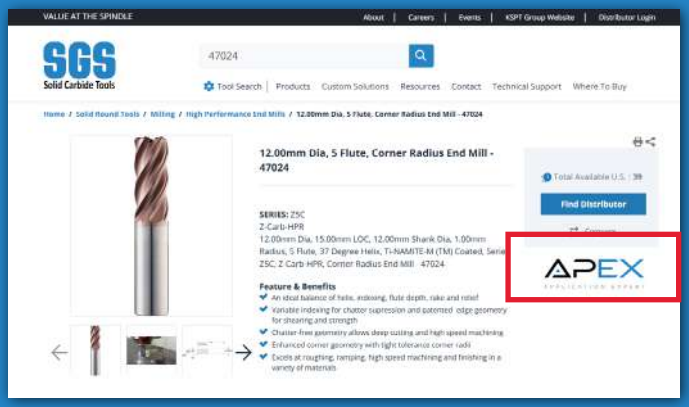
SAVE TIME

Easily select application types, units, and materials with our user-friendly interface and autofill features.

EXPORT AND SHARE

Generate PDFs with application data, add comments, and print precise line drawings with detailed specifications.

Visit: **www.kyocera-sgstool.com/apex**



or Click the APEX Logo on any Product Detail Page.

Common Legend
Leyenda habitual
Légende commune
Gemeinsame Legende

TO ORDER: Please specify quantity and EDP number.

PARA SU PEDIDO: Por favor especifique cantidad y número de EDP.

POUR COMMANDER: Veuillez préciser la quantité et le code article EDP.

BESTELLEN: Bitte Menge und EDV-Nummer angeben.

RETURN POLICY: An RMA number must accompany all product returns.
Contact your Customer Service Representative for an RMA number.

DEVOLUCIONES: Todo material devuelto debe ir acompañado de un número de RMA correspondiente.
Para solicitarlo, póngase en contacto con su Representante de Atención al Cliente.

POLITIQUE DE RETOUR: Tous les produits retournés doivent être accompagnés d'un numéro RMA.
Contacter votre interlocuteur commercial pour obtenir un numéro RMA.

RÜCKNAHMEGARANTIE: Eine RMA-Nummer (Rücksendegenehmigung) muss bei allen Produktrücksendungen beiliegen.
Wenden Sie sich bitte an Ihren Kundendienstmitarbeiter für RMA-Nummer.

REGULATION SAFETY GLASSES SHOULD ALWAYS BE WORN WHEN USING HIGH-SPEED CUTTING EQUIPMENT

DEBEN USARSE GAFAS PROTECTORAS CUANDO SE UTILICEN EQUIPOS DE ALTA VELOCIDAD

DES LUNNETTES DE SÉCURITE DOIVENT ÊTRE IMPÉRATIVEMENT PORTÉES LORS D'UTILISATION D'OUTILS À GRANDE VITESSE

BEI SCHNELLLAUFENDEN SPANABHEBENDEN MASCHINEN MÜSSEN IMMER DIE VORGESCHRIEBENEN SICHERHEITSBRILLEN GETRAGEN WERDEN

WARNING: This product can expose you to chemicals including Cobalt, which is known to the State of California to cause cancer. For more information go to www.p65warnings.ca.gov

ADVERTENCIA: Este producto puede exponerlo a químicos como el Cobalto, reconocido como cancerígeno en el estado de California. Para mas informacion visite esta pagina web: www.p65warnings.ca.gov

ATTENTION: Ce produit vous expose aux produits chimiques incluant le Cobalt, qui est reconnu par l'Etat de Californie a etre une cause de cancer. Pour plus d'information veuillez regarder sur: www.p65warnings.ca.gov

WARNUNG: Dieses Produkt kann Sie mit Chemikalien wie Kobalt aussetzen, das dem Staat Kalifornien als krebserregend bekannt ist. Für weitere Informationen, besuchen Sie: www.p65warnings.ca.gov

INTELLECTUAL PROPERTY
PROPIEDAD INTELECTUAL
PROPRIÈTÈ INTELLECTUELLE
GEISTIGES EIGENTUM

KYOCERA SGS Precision Tools holds more than 20 patents globally. Please visit our website at www.kyocera-sgstool.com to learn more.

KYOCERA SGS Precision Tools posee más de 20 patentes a nivel mundial. Para más información, visite nuestra página web www.kyocera-sgstool.com.

KYOCERA SGS Precision Tools possède plus de 20 brevets mondialement reconnus. Pour plus d'information, veuillez consulter notre site web www.kyocera-sgstool.com.

KYOCERA SGS Precision Tools besitzt mehr als 20 Patente weltweit. Bitte besuchen Sie unsere Webseite www.kyocera-sgstool.com für weitere Informationen.

Common Legend
Leyenda habitual
Légende commune
Gemeinsame Legende

MATERIALS
MATERIALES
MATÉRIAUX
WERKSTOFFE

Steels (P) Aceros Aciers Stähle	Stainless Steels (M) Aceros Inoxidables Aciers inoxydables Nichtrostende Stähle	Cast Iron (K) Acero de Fundición Fonte Grauguss
Non-Ferrous (N) No Férricos Non Ferreux Nichteisenmetalle	High Temp Alloys (S) Aleaciones Termorresistentes Alliages hautes températures Warmfeste Legierungen	Hardened Steels (H) Aceros Endurecidos Aciers Trempés Gehärteter Stahl

TOOL LENGTH
LONGITUDES DE HERRAMIENTAS
LONGUEUR DE L'OUTIL
WERKZEUGLÄNGE

Stub Corta Court Kurze Bauform	Regular Media Moyen Standard	Long Larga Long Lang	Long Reach Neck Larga con cuello Détalonnage longue portée Freischliff	Extra Long Extra-larga Extra-long Extra-Lang

FLUTES
FILOS
DENTS
SCHNEIDEN

2 2 Flutes 2 Filos 2 Dents 2 Schneiden	3 3 Flutes 3 Filos 3 Dents 3 Schneiden	4 4 Flutes 4 Filos 4 Dents 4 Schneiden	5 5 Flutes 5 Filos 5 Dents 5 Schneiden	6 6 Flutes 6 Filos 6 Dents 6 Schneiden	7 7 Flutes 7 Filos 7 Dents 7 Schneiden
8 8 Flutes 8 Filos 8 Dents 8 Schneiden	9 9 Flutes 9 Filos 9 Dents 9 Schneiden	10 10 Flutes 10 Filos 10 Dents 10 Schneiden	11 11 Flutes 11 Filos 11 Dents 11 Schneiden	12 12 Flutes 12 Filos 12 Dents 12 Schneiden	

End Mill Legend
Leyenda fresas
Légende fraise
Fräser-Legende

END CONFIGURATIONS
CONFIGURACIONES DE LA PUNTA
FORME DE L'OUTIL EN BOUT
ENDENAUSFÜHRUNG

Ball
Esférica
Boule
Kugelkopf

Corner
Plana con borde romo
Rayon mit Eckenradius

Square
Plana
Non rayonné
Scharfkantig

SIDE PROFILE
PERFIL LATERAL
PROFIL LATÉRAL
SEITENPROFI

Linear taper
Perfil Cónico
Conique Droit
Linear Kegel

Tapered Circle Segment
Perfil Cónico de Segmento Circular
Conique Segment de Cercle
Tonnen Segment

Picatinny Recoil Groove
Fresa Riel Picatinny
Rainure Décalée Picatinny
Picatinny Rückstoss Nut

Picatinny Dovetail Form
Fresa de Forma Picatinny Cola de Milano
Queue d'aronde Picatinny
Picatinny Schwalbenschwanz Form

SHANK TYPE
TIPO DE VÁSTAGO
TYPE DE QUEUE
SCHAFTART

Common
Normal
Dégagée
Standard

Straight
Recto
Cylindrique
Gerade

WELDON
Drive Flat
Plano en el zanco
Entrainement méplat
Spannfläche

DIN6535 HB
Drive Flat
DIN 6535 HB
Plano en el zanco
DIN 6535 HB
Entrainement méplat
DIN 6535 HB
Spannfläche
DIN 6535 HB

HELIX ANGLES
ANGULOS DE LAS HELICES
SPANWINKEL
ANGLES DE L'HÉLICE

Right Spiral
Hélice con corte a la derecha
Hélice droite
Rechtsspirale

Left Spiral
Hélice con corte a la izquierda
Hélice gauche
Linksspirale

Variable Right Spiral
Hélice con corte a la derecha y ángulo variable
Hélice droite variable
Rechtsspirale, variabel

COOLANT OPTIONS
OPCIONES DE REFRIGERACIÓN
OPTIONS DE REFROIDISSEMENT
KÜHLSCHMIERMITTEL-OPTIONEN

Internal Coolant
Refrigeración interna
Refroidissement interne
Innenkühlung

JetStream Coolant Slots
Ranuras de refrigeración JetStream
Fentes de refroidissement JetStream
JetStream-Kühlmittelschlitze

RAKE ANGLE
ANGULO DE DESPRENDIMIENTO
ANGLE DE COUPE
SPANWINKEL

Positive
Positivo
Positif
Positiv

Neutral
Neutro
Neutre
Neutral

Negative
Negativo
Négatif
Negativ

Variable
Variable
Variable
Variabel

ADDITIONAL GEOMETRY
GEOMETRÍAS ADICIONALES
GÉOMÉTRIE SUPPLÉMENTAIRE
WEITERE BAUFORMEN

Flute Spacing Unequal
Espaciado desigual de los filos
Denture décalée
Nutenabstand Ungleich

Chip Breaker
Rompevirutas
Brise-copeaux
Spanteiler

All tools are in Right Cut Direction unless noted
Todas las herramientas son con corte a la derecha a menos que se indique lo contrario
Tous les outils ont une coupe à droite, sauf indications contraires
Alle Werkzeuge sind rechtsschneidend, soweit nicht anders angegeben

All tools are straight or non-tapered unless noted
Todas las herramientas son rectas o no cónicas a menos que se indique lo contrario
Tous les outils sont droits ou non coniques, sauf indication contraire
Alle Werkzeuge sind gerade oder nicht konisch, sofern nicht anders angegeben

Drill Legend
Leyenda brocas
Légende perçage
Bohrer-Legende

SHANK TYPE
TIPO DE VÁSTAGO
TYPE DE TIGE
SCHAFTART

Common
Normal
Dégagée
Standard

Straight
Recto
Cylindrique
Gerade

REACH
ALCANCE
LONGUEUR
NUTZLÄNGE

3xD Reach
Alcance 3xD
Longueur 3xD
3xD Nutzlänge

5xD Reach
Alcance 5xD
Longueur 5xD
5xD Nutzlänge

8xD Reach
Alcance 8xD
Longueur 8xD
8xD Nutzlänge

12xD Reach
Alcance 12xD
Longueur 12xD
12xD Nutzlänge

HELIX ANGLES
ANGULOS DE LAS HELICES
ANGLES DE L'HÉLICE
SPANWINKEL

Right Spiral
Hélice con corte a la derecha
Hélice à droite
Rechtsspirale

None
Ninguno
Aucun
gerade genutet

COOLANT OPTIONS
OPCIONES DE REFRIGERACIÓN
OPTIONS DE REFROIDISSEMENT
KÜHLSCHMIERMITTEL-OPTIONEN

Internal Coolant
Refrigeración interna
Refroidissement interne
Innenkühlung

External Coolant
Refrigeración externa
Refroidissement externe
Auskühlung

POINT ANGLE
ANGULO DE PUNTA
POINT D'ANGLE
SPITZENWINKEL

Point Angle
Angulo de la Punta
Angle de pointe
Spitzenwinkel

Point Angles
Ángulos de punta
Angles de pointe
Spitzenwinkel

CHAMFER ANGLE
ÁNGULO DE CHAFLÁN
ANGLE DE CHANFREIN
FASENWINKEL

Chamfer Angle
Ángulo de chaflán
Angle de chanfrein
Fasenwinkel

NUMBER OF MARGINS
NÚMERO DE MÁRGENES
NOMBRE DE MARGES
ANZAHL DER RÄNDER

2 Margins
2 Márgenes
2 Marges
2 Ränder

3 Margins
3 Márgenes
3 Marges
3 Ränder

4 Margins
4 Márgenes
4 Marges
4 Ränder

NUMBER OF FLUTES
FILOS
DENTS
SCHNEIDEN

1 Flute
1 Filo
1 Dent
1 Schneiden

2 Flutes
2 Filos
2 Dents
2 Schneiden

3 Flutes
3 Filos
3 Dents
3 Schneiden

Router Legend
Leyenda ranuradores
Légende détourage
Konturenfräser-Legende

SHANK TYPE
TIPO DE VÁSTAGO
TYPE DE TIGE
SCHAFTART

Straight
Recto
Cylindrique
Gerade

RAKE ANGLE
ANGULO DE DESPRENDIMIENTO
ANGLE DE PENTE
SPANWINKEL

Positive
Positivo
Positif
Positiv

Neutral
Neutro
Neutre
Neutral

Negative
Negativo
Négatif
Negativ

Variable
Variable
Variable
Variabel

HELIX ANGLES
ANGULOS DE LAS HELICES
ANGLES DE L'HÉLICE
SPANWINKEL

Right Spiral
Hélice con corte
a la derecha
Hélice à droite
Rechtsspirale

Left Spiral
Hélice con corte
a la izquierda
Hélice à gauche
Linksspirale

ADDITIONAL GEOMETRY
GEOMETRÍAS ADICIONALES
GÉOMÉTRIE SUPPLÉMENTAIRE
WEITERE BAUFORMEN

Left Hand Cut Direction
Fresado sentido izquierda
Coupe vers la gauche
Rechtsschneidend

Right Hand Cut Direction
Fresado sentido derecha
Coupe vers la droite
Linksschneidend

Chip Breaker
Rompevirutas
Brise-copeaux
Spanbrecher

Coatings

Ti-NAMITE and Di-NAMITE Tool Coatings are specifically engineered for KSPT solid carbide rotary tools. The coating lineup includes proprietary processes that result in optimized tool life and increased speed and feed rates in a variety of applications.

	Coating	Identifying Color	Layer Structure	Thickness	Hardness (HV)	Coefficient of Friction (Fretting)	Thermal Stability	General Information
Ti-NAMITE	Titanium Nitride (TiN)	gold	Multilayer	1–5 microns	2200	0.40–0.65	600°C / 1112°F	A general purpose coating with good adhesion and abrasion resistant properties. Suitable for a wide variety of materials.
Ti-NAMITE-A	Aluminum Titanium Nitride (AlTiN)	dark grey	Nano structure	1–5 microns	3700	0.30	1100°C / 2010°F	Excellent thermal and chemical resistance allows for dry cutting and improvements in performance of carbide. The coating has a high hardness giving great protection against abrasive wear and erosion.
Ti-NAMITE-B	Titanium DiBoride (TiB2)	light grey-silver	Monolayer	1–2 microns	4000	0.10–0.20	850°C / 1562°F	This ceramic based coating ensures a smooth surface and a low affinity to cold welding or edge build up, which makes it optimal for aluminum, copper, and other non-ferrous applications. It has high toughness and high hardness.
Ti-NAMITE-C	Titanium Carbonitride (TiCN)	pink-red	Multilayer	1–5 microns	3000	0.30–0.45	400°C / 752°F	A very wear resistant coating with high toughness and shock resistance. Good in interrupted cuts found in applications like milling.
Ti-NAMITE-X	Proprietary (TX)	black	Nano Composite	1–5 microns	3600	0.45	1150°C / 2100°F	The structural design of Ti-Namite-X is adapted to meet a diverse range of applications; everything from high- and low-alloy steels to hardened materials (up to 65 HRC core hardness). Ti-Namite-X is suitable for operations which require high cutting speeds, high temperatures at the cutting edge, and high metal removal rates.
Di-NAMITE	Crystalline Diamond (Diamond)	black	Monolayer	6–20 microns	>8000	0.15–0.20	800°C / 1470°F	This is the hardest coating available with the best abrasion resistance. Diamond coating is suitable for machining highly abrasive, non-ferrous materials such as CFRP and graphite.
Ti-NAMITE-M	Proprietary (TM)	copper	Nano Composite	1–5 microns	3600	0.45	1150°C / 2100°F	Features include high wear resistance, reduced friction, and excellent prevention of edge build up. This coating provides superior material removal rates and tool life when used in high performance operations with difficult to machine materials like titanium.
Ti-NAMITE-H	Proprietary (TH)	copper	Nano Composite	1–5 microns	3800	0.30	1100°C / 2010°F	This coating demonstrates a superior combination of hardness and adhesion in hard machining of molds and dies and machining high-alloy stainless steels for high temperature applications such as turbines. The smooth surface ensures optimum surface quality and decreases the temperature in the cutting zone by reducing friction.
MEGACOAT NANO	Proprietary (MN)	Purple iridescent	Nano Composite	1-5 microns	3600	0.45	1150°C / 2100°F	The nano-layers of this coating provide high hardness for exceptional wear resistance and high oxidation resistance that allows for operation at high temperatures. The layered structure also gives the coating the toughness required to resist chipping. Megacoat Nano is particularly effective in high efficiency machining applications.

Other coatings available upon request.

Coating Application Guide

Preferred Applications for Coatings
★ Best ☆ Better ○ Good
(blank) Not Recommended

Coating	Type	Low Carbon ≤ 20 HRc	Medium Carbon, Alloy 20 to 35 HRc	High Carbon, Alloy 35 to 45 HRc	Ferritic & Martensitic ≤ 45 HRc	Austenitic & Duplex ≤ 25 HRc	Precipitation Hardened ≤ 45 HRc	Low Alloy, Grey, Ductile ≤ 25 HRc	Med-High Alloy, Nodular 25 to 35 HRc	High Alloy, Nodular ≥ 35 HRc	Aluminum Alloys	Copper Alloys	Plastics, Composites	Titanium Alloys ≤ 45 HRc	Iron, Nickel, Cobalt Alloys ≤ 45 HRc	Refractory Alloys, Mo, Ta, W ≤ 35 HRc	High Carbon, Med Alloy 45 to 50 HRc	Tool, Mold & Die 45 to 55 HRc	Tool, Mold & Die 55 to 65 HRc
		Steel			Stainless Steel			Cast Iron			Non Ferrous			HRSA			Hard Steel		
Ti-NAMITE	Titanium Nitride (TiN)	○									○	☆							
Ti-NAMITE-A	Aluminum Titanium Nitride (AlTiN)	☆	☆	☆	★	★	★	○	○	○				☆	★	★	○	○	○
Ti-NAMITE-B	Titanium DiBoride (TiB2)										★	★	○	☆					
Ti-NAMITE-C	Titanium Carbonitride (TiCN)										☆	○	☆						
Ti-NAMITE-X	Proprietary (TX)	★	★	★	☆	☆	☆	☆	☆	☆				☆	☆	☆	★	★	★
Di-NAMITE	Crystalline Diamond (Diamond)												★						
Ti-NAMITE-M	Proprietary (TM)	★	★	★	☆	☆	☆	★	★	★				★	☆	☆	☆	☆	☆
Ti-NAMITE-H	Proprietary (TH)	★	★	★	☆	☆	☆	★	★	★				★	☆	☆	☆	☆	☆
MEGACOAT NANO	Proprietary (MN)	☆	☆	☆	*	☆	*	☆	☆	☆				*	☆	☆			

SGS
Solid Carbide Tools

VALUE AT THE SPINDLE

High Performance End Mills

Milling

HIGH PERFORMANCE END MILLS	SERIES	DESCRIPTION	PAGE	S&F PAGE
Z-Carb-XPR	ZRM	4 Flute Plunging / Ramping / Rougher Square End Metric	28	29
	ZRMCR	4 Flute Plunging / Ramping / Rougher Corner Radius Metric	28	29
Z-Carb-AP	Z1MPCR	4 Flute Variable Rake Corner Radius Metric	31	35
	Z1MP	4 Flute Variable Rake Square End Metric	31	35
	Z1MPB	4 Flute Variable Rake Ball End Metric	33	35
	Z1MPIC	4 Flute Variable Rake Intermediate Reach Corner Radius Metric	34	35
	Z1MPLC	4 Flute Variable Rake Long Reach Corner Radius Metric	34	35
Z-Carb-HTA	ZH1MCR	4 Flute Variable Geometry High Temp Alloys Corner Radius Metric	37	38
	ZH1MCRS	4 Flute Variable Geometry High Temp Alloys Stub Corner Radius Metric	37	38
Z-Carb-MD	ZD1MCR	4 Flute Variable Geometry Hard Materials Long Reach Corner Radius Metric	39	39
Z-Carb-HPR	Z5MCR	5 Flute Rougher Corner Radius Metric	40	44
	Z5MLCR	5 Flute Rougher Long Reach Corner Radius Metric	43	44
V-Carb	55M	5 Flute Finisher & Semi-Finisher Square End Metric	46	49
	55MCR	5 Flute Finisher & Semi-Finisher Corner Radius Metric	46	49
	55MB	5 Flute Finisher & Semi-Finisher Ball End Metric	48	49
T-Carb	51M	6 Flute High Speed Machining Square End Metric	51	54
	51MCR	6 Flute High Speed Machining Corner Radius Metric	51	54
	51ML	6 Flute High Speed Machining Square End Long Reach Metric	52	54
	51MLC	6 Flute High Speed Machining Long Reach Corner Radius Metric	52	54
	51MB	6 Flute High Speed Machining Ball End Metric	53	54
	51MLB	6 Flute High Speed Machining Ball End Long Reach Metric	53	54
H-Carb	77M	7 Flute High Efficiency Square End Metric	56	59
	77MCR	7 Flute High Efficiency Corner Radius Metric	56	59
Multi-Carb	66M	Multi-Flute Finisher Square End Metric	61	62
	66MCR	Multi-Flute Finisher Corner Radius Metric	61	62
	67B	Multi-Flute Tapered (Circle Segment) Form Tools Metric	64	65
Series 33	33MCR	3 Flute Difficult to Machine Materials Corner Radius Metric	66	67
Series 7	7M	4 Flute Variable Geometry Long Length Square End Metric	69	70
	7MB	4 Flute Variable Geometry Long Length Ball End Metric	69	70
Turbo-Carb	56MB	2 Flute Contouring Long Reach Ball End Metric	71	71
Power-Carb	57M	6 Flute Finisher Square End Metric	72	73
CFRP Slow Helix	27M	4 Flute Slow Helix Square End Metric	74	75

Speed & Feed Recommendations listed after each series

Fresado

FRESAS DE ALTO RENDIMIENTO	SERIE	DESCRIPCIÓN	PÁGINA	S&F PÁGINA
Z-Carb-XPR	ZRM	4 filos, penetración / inclinación / desbastador, punta cuadrada, métrico	28	29
	ZRMCR	4 filos, penetración / inclinación / desbastador, radio angulado, métrico	28	29
Z-Carb-AP	Z1MPCR	4 filos, inclinación variable, radio angulado, métrico	31	35
	Z1MP	4 filos, inclinación variable, punta cuadrada, métrico	31	35
	Z1MPB	4 filos, inclinación variable, punta esférica, métrico	33	35
	Z1MPIC	4 filos, inclinación variable, medio alcance, radio angulado, métrico	34	35
	Z1MPLC	4 filos, inclinación variable, largo alcance, radio angulado, métrico	34	35
Z-Carb-HTA	ZH1MCR	4 filos, geometría variable, aleaciones termorresistentes, radio angulado, métrico	37	38
	ZH1MCRS	4 filos, geometría variable, aleaciones termorresistentes, versión corta, radio angulado, métrico	37	38
Z-Carb-MD	ZD1MCR	4 filos, geometría variable, materiales duros, largo alcance, radio angulado, métrico	39	39
Z-Carb-HPR	Z5MCR	5 filos, desbastador, radio angulado, métrico	40	44
	Z5MLCR	5 filos, desbastador, largo alcance, radio angulado, métrico	43	44
V-Carb	55M	5 filos, acabador y semiacabador, punta cuadrada, métrico	46	49
	55MCR	5 filos, acabador y semiacabador, radio angulado, métrico	46	49
	55MB	5 filos, acabador y semiacabador, punta esférica, métrico	48	49
T-Carb	51M	6 filos, mecanizado de alta velocidad, punta cuadrada, métrico	51	54
	51MCR	6 filos mecanizado de alta velocidad, radio angulado, métrico	51	54
	51ML	6 filos, mecanizado de alta velocidad, punta cuadrada, largo alcance, métrico	52	54
	51MLC	6 filos mecanizado de alta velocidad, largo alcance, radio angulado, métrico	52	54
	51MB	6 filos, fresa esférica para mecanizados de alta velocidad, métrico	53	54
	51MLB	6 filos, fresa esférica larga para mecanizados de alta velocidad, métrico	53	54
H-Carb	77M	7 filos métrica de alta eficiencia, punta cuadrada, métrico	56	59
	77MCR	7 filos métrica de alta eficiencia, radio angulado, métrico	56	59
Multi-Carb	66M	Filo múltiple, acabador, punta cuadrada, métrico	61	62
	66MCR	Filo múltiple, acabador, radio angulado, métrico	61	62
	67B	Fresas de forma cónica de segmento circular de múltiples filos, métrico	64	65
Series 33	33MCR	3 filos, materiales difíciles de mecanizar, radio angulado, métrico	66	67
Series 7	7M	4 filos, geometría variable, longitud larga, punta cuadrada, métrico	69	70
	7MB	4 filos, geometría variable, longitud larga, punta esférica, métrico	69	70
Turbo-Carb	56MB	2 filos, contorneado, largo alcance, punta esférica, métrico	71	71
Power-Carb	57M	6 filos, acabador, punta cuadrada, métrico	72	73
Helicoidal de avance lento CFRP	27M	4 filos, helicoidal de avance lento, punta cuadrada, métrico	74	75

Recomendaciones de velocidades y avances mostradas tras cada serie

Fraisage

FRAISES A DETOURER UNIVERSELLES	SÉRIES	DESCRIPTION	PAGE	S&F PAGE
Z-Carb-XPR	ZRM	4 dents non rayonné pour plongée / ramppage / ébauche (métrique)	28	29
	ZRMCR	4 dents rayonnée pour plongée / ramppage / ébauche (métrique)	28	29
Z-Carb-AP	Z1MPCR	4 dents pas décalé et hélice variable rayonnés (métrique)	31	35
	Z1MP	4 dents pas décalé et hélice variable non rayonné (métrique)	31	35
	Z1MPB	4 dents à vague de coupe variable à bout hémisphérique (métrique)	33	35
	Z1MPIC	4 dents pas décalé, hélice variable, détalonné, rayonnés (métrique)	34	35
	Z1MPLC	4 dents pas décalé et hélice variable rayonnés (métrique)	34	35
Z-Carb-HTA	ZH1MCR	4 dents géométrie variable alliages haute température rayonné (métrique)	37	38
	ZH1MCRS	4 dents géométrie variable, alliages haute température, longueur de l'outil court, rayonné (métrique)	37	38
Z-Carb-MD	ZD1MCR	4 dents géométrie variable matériaux durs longue portée rayonné (métrique)	39	39
Z-Carb-HPR	Z5MCR	5 dents rayonnée pour l'ébauche (métrique)	40	44
	Z5MLCR	5 dents rayonnée pour l'ébauche, longue portée (métrique)	43	44
V-Carb	55M	5 dents en bout de finition et semi-finition plat (métrique)	46	49
	55MCR	5 dents en bout finition et semi-finition rayonné (métrique)	46	49
	55MB	5 dents en bout de finition et semi-finition hémisphérique (métrique)	48	49
T-Carb	51M	6 dents pour usinage grande vitesse non rayonné (métrique)	51	54
	51MCR	6 dents pour usinage grande vitesse rayonné (métrique)	51	54
	51ML	6 dents pour usinage grande vitesse non rayonné extra longue (métrique)	52	54
	51MLC	6 dents pour usinage grande vitesse extra longue rayonné (métrique)	52	54
	51MB	6 dents hémisphérique UGV dimensions cotes (métrique)	53	54
	51MLB	6 dents hémisphérique détalonnée UGV dimensions cotes (métrique)	53	54
H-Carb	77M	7 dents hautes performances droite côtes (métrique)	56	59
	77MCR	7 dents hautes performances torique côtes (métrique)	56	59

FRAISES A DETOURER UNIVERSELLES	SÉRIES	DESCRIPTION	PAGE	S&F PAGE
Multi-Carb	66M	Multi-dents non rayonné pour finition (métrique)	61	62
	66MCR	Multi-dents rayonné pour finition (métrique)	61	62
	67B	Fraises de forme segmentaire conique à dents multiples (métrique)	64	65
Series 33	33MCR	3 dents rayonné pour l'ébauche dans tous les matériaux sauf non-ferreux (métrique)	66	67
Series 7	7M	4 dents géométrie variable à queue longue non rayonné (métrique)	69	70
	7MB	4 dents géométrie variable à queue longue à bout hémisphérique (métrique)	69	70
Turbo-Carb	56MB	2 dents contournage longue portée à bout hémisphérique (métrique)	71	71
Power-Carb	57M	6 dents en bout de finition plat (métrique)	72	73
CFRP hélice lente	27M	4 dents hélice lente non rayonné (métrique)	74	75

Recommandativons de vitesse et avance indiquées après chaque série

Fräsen

HOCHLEISTUNGS-SCHAFTFRÄSER	SERIE	BESCHREIBUNG	SEITE	S&F SEITE
Z-Carb-XPR	ZRM	Eintauchen / Rampenfahren / Schruppen mit 4 Schneiden ohne Eckenradien	28	29
	ZRMCR	Eintauchen / Rampenfahren / Schruppen mit 4 Schneiden und Eckenradien	28	29
Z-Carb-AP	Z1MPCR	Fräser mit 4 variablen Schneiden und Eckenradien	31	35
	Z1MP	Fräser mit 4 variablen Schneiden ohne Eckenradien	31	35
	Z1MPB	Radiusschaftfräser mit 4 Schneiden und variablem Spanwinkel	33	35
	Z1MPIC	Fräser mittlerer Länge mit 4 variablen Schneiden und Eckenradien	34	35
	Z1MPLC	Langlochfräser mit 4 variablen Schneiden und Eckenradien	34	35
Z-Carb-HTA	ZH1MCR	Hochwarmfester Fräser mit 4 variablen Schneiden und Eckenradien	37	38
	ZH1MCRS	Hochwarmfester Fräser mit 4 variablen Schneiden und Eckenradien	37	38
Z-Carb-MD	ZD1MCR	Langlochfräser mit 4 variablen Schneiden, Eckenradien und Form aus Hartmetall	39	39
Z-Carb-HPR	Z5MCR	Schruppfräser mit 5 Schneiden und Eckenradien	40	44
	Z5MLCR	Langlochfräser Schruppfräser mit 5 Schneiden und Eckenradien	43	44
V-Carb	55M	Schlicht- und Halbschlichtfräser mit 5 Schneiden ohne Eckenradien und variabler Form	46	49
	55MCR	Schlicht- und Halbschlichtfräser mit 5 Schneiden und Eckenradien	46	49
	55MB	Schlicht- und Halbschlicht-Radiusschaftfräser mit 5 Schneiden und variabler Form	48	49
T-Carb	51M	Schaftfräser für die Hochgeschwindigkeitsbearbeitung mit 6 Schneiden ohne Eckenradien	51	54
	51MCR	Fräser für die Hochgeschwindigkeitsbearbeitung mit 6 Schneiden und Eckenradien aus Schnellstahl	51	54
	51ML	Langloch-Schaftfräser aus Schnellstahl mit 6 Schneiden ohne Eckenradien	52	54
	51MLC	Langlochfräser für die Hochgeschwindigkeitsbearbeitung mit 6 Schneiden und Eckenradien	52	54
	51MB	6-Schneider Vollradiusfräser für Hochgeschwindigkeitsbearbeitung	53	54
	51MLB	6-Schneider Vollradiusfräser mit Freischliff für Hochgeschwindigkeitsbearbeitung	53	54
H-Carb	77M	Hocheffizienter mit 7 Schneiden ohne Eckenradien	56	59
	77MCR	Hocheffizienter mit 7 Schneiden und Eckenradien	56	59
Multi-Carb	66M	mehrschneidiger Schlichtfräser ohne Eckenradien	106	107
	66MCR	mehrschneidiger Schlichtfräser mit Eckenradien	106	107
	67B	Mehrschneidige konische Kreissegment-Formfräser	64	65
	33MCR	Fräser mit 3 Schneiden und Eckenradien für schwerspanbare Werkstoffe	66	67
Series 33	7M	Langloch-Schaftfräser mit 4 Schneiden ohne Eckenradien und variabler Form	69	70
Series 7	7MB	Langloch-Radiusschaftfräser mit 4 Schneiden und variabler Form	69	70
Turbo-Carb	56MB	Langloch-Profil-Radiusschaftfräser mit 2 Schneiden	71	71
	57M	Schlichtfräser mit 6 Schneiden ohne Eckenradien	72	73
CFRP Slow Helix	27M	Schaftfräser mit 4 steilen Schneiden ohne Eckenradien	74	75

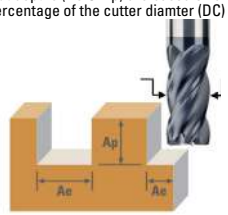
Empfehlungen für Drehzahl & Vorschub im Anhang zu jeder Serie

End Mill Matrix

Preferred materials for each Series are designated below.

Coolant required in these materials
Plunging not recommended in these materials

Cut depths (Ae & Ap) are based on a percentage of the cutter diamter (DC)

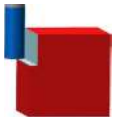
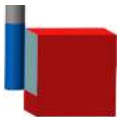
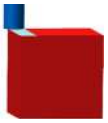
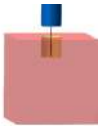


Material hardness and machinability affect speed, feed, and cut depths. Long flute or long reach tools require reduced rates and cut depths.

			Material																	
			Low Carbon ≤ 20 HRc	Medium Carbon, Alloy 20 to 35 HRc	High Carbon, Alloy 35 to 45 HRc	Ferritic & Martensitic ≤ 45 HRc	Austenitic & Duplex ≤ 25 HRc	Precipitation Hardened ≤ 45 HRc	Low Alloy, Grey, Ductile ≤ 25 HRc	Med-High Alloy, Nodular 25 to 35 HRc	High Alloy, Nodular ≥ 35 HRc	Aluminum Alloys	Copper Alloys	Plastics, Composites	Titanium Alloys ≤ 45 HRc	Iron, Nickel, Cobalt Alloys ≤ 45 HRc	Refractory Alloys, Mo, Ta, W ≤ 35 HRc	High Carbon, Med Alloy 45 to 50 HRc	Tool, Mold & Die 45 to 55 HRc	Tool, Mold & Die 55 to 65 HRc
Name	Series	Page	Steel			Stainless Steel			Cast Iron			Non Ferrous			HRSA			Hard Steel		
Series 33	33	66	★	★	★	★	★	☆	★	★	☆				★	☆	☆	○	○	
Z-Carb XPR	ZR	28	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
Z-Carb-AP	Z1P	31	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
Z-Carb-HTA	ZH1	37	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
Series 7	7	69	★	★	★	★	★	★	★	★	★				★	★	☆	☆	○	
Z-Carb HPR	Z5	40	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
V-Carb	55	46	★	★	★	★	★	★	★	★	★				★	★	☆	○	○	
T-Carb	51	51	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
H-Carb	77	56	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
Multi Carb	66	61	★	★	★	★	☆	★	★	★	★				★	★	★	☆	○	
Multi Carb-B	67B	64	★	★	★	★	★	★	★	★	★				★	★	★	☆	○	
Turbo Carb	56B	71	★	★	★				★	★	★							★	★	★
Z-Carb-MD	ZD1	39			☆					☆	★							★	★	★
Power-Carb	57	72									☆							★	★	★
Ski-Carb	44	100										★	☆	○						
S-Carb 2 Flute	47	97										★	★	○						
S-Carb 3 Flute	43	88										★	★	○						
S-Carb APR-3	43APR-3	81										★	★	○						
S-Carb APR-4	43APR-4	82										★	★	○						
S-Carb APF	43APF	84										★	★	○						
S-Carb APF-B	43APF-B	86										★	★	☆						
Slow Helix	27	74											☆	★						
CCR	20-CCR	248												★						
CCR Coarse	31-CCR	251												★						
Compression Router	25	253												★						
Up Cut Router	21	255										☆	○	★						
Down Cut Router	22	256										☆	○	★						

APEX View the KYOCERA SGS APEX application for detailed technical information
www.kyocera-sgstool.com/apex

End Mill Matrix

Preferred Cut Type for Series ★ Best ☆ Better ○ Good (blank) Not Recommended						Preferred Entry Method for Series			Preferred Tool Path for Series	
Unless blank, a high quality wall or floor finish can be achieved with any Series with adjusted speed & feed.						Speed & Feed are based on ramp angle.			For rough milling, HEM tool paths are usually preferred in most situations, however, Standard paths may be more efficient using suitable tools with moderate to heavy cut types.	
Heavy	Moderate	Light	Fine	Finish-Wall	Finish - Floor	Plunge	Straight Ramp	Helical Ramp		
Ae = 1 to .4 x DC Ap ≤ 1 x DC	Ae = .4 to .25 x DC Ap ≤ 1.5 x DC	Ae = .25 to .1 x DC Ap ≤ 2.5 x DC	Ae = .1 to .02 x DC Ap ≤ 4.5 x DC	Ae ≤ .02 x DC any Ap	Ae ≥ .5 x DC Ap ≤ .02 x DC	Ap ≤ 1 x DC lower feed rates	Ap ≤ 2 x DC medium feed rates	Ap ≤ 4 x DC higher feed rates	Standard Path	HEM Path
										
★	★	☆	☆	○	☆	☆	★	★	★	☆
★	★	☆	☆	○	★	★	★	★	★	☆
★	★	☆	☆	○	☆	☆	★	★	★	☆
★	★	☆	☆	○	☆	☆	★	★	★	☆
○	○	○	★	★	☆		○	☆	○	☆
☆	★	★	☆	☆	☆		★	★	★	★
○	☆	★	★	★	★		○	☆	☆	★
○	○	☆	★	★	★		○	★	○	★
○	○	○	★	★	★		○	★	○	★
○	○	○	☆	★	★		○	★	○	★
			★	★			○	○	★	
○	○	☆	★	★		○	○	★	★	★
★	★	☆	☆	☆	☆		☆	★	☆	★
○	○	☆	★	★	★		○	☆	☆	★
☆	☆	☆	★	★	☆	☆	★	★	★	☆
★	★	☆	☆	○	☆	☆	★	★	★	☆
★	★	☆	☆	☆	★	☆	★	★	★	☆
★	★	☆	☆		★	☆	★	★	★	☆
★	★	☆	☆		★	☆	★	★	★	☆
○	○	☆	★	★	★	○	☆	★	☆	★
			★	★	☆	○	○		★	
○	○	☆	★	★	☆	○	☆	★	★	☆
★	★	☆	☆		☆	○	☆	★	★	☆
★	★	☆	☆		☆	○	☆	★	★	☆
○	○	☆	☆	★	☆	○	☆	★	★	☆
★	★	☆	☆	○	☆	○	☆	★	★	☆
○	○	☆	☆	☆	☆				★	☆

View the KYOCERA SGS APEX application for detailed technical information
www.kyocera-sgstool.com/apex

End Mill Matrix

Name	Series	Flute Count	Cut Dia. Range inch mm	Cut Length Availability (x DC)	Reach Option (x DC)	End Styles Square (S) Radius (R) Ball (B)
Series 33	33	3	0.125 to 1 3 to 20	2.25 to 3	–	R
Z-Carb XPR	ZR	4	0.250 to 0.750 6 to 20	2 to 3	–	S,R
Z-Carb-AP	Z1P	4	0.0156 to 1 1 to 25	1 to 3.25	2.5 to 8.5	S, R, B
Z-Carb-HTA	ZH1	4	0.250 to 1 6 to 20	1.25 to 3	–	R
Series 7	7	4	0.125 to 1 3 to 25	2.25 to 8.25	–	S, B
Z-Carb HPR	Z5	5	0.125 – 1 6 – 25	1 to 3	4	S, R
V-Carb	55	5	0.125 to 1 6 to 20	1.25 to 5	–	S, R, B
T-Carb	51	6	0.250 to 1 6 to 20	1.25 to 3	3.25 to 5.5	S, R
H-Carb	77	7	0.250 to 1 6 to 25	2.5 to 4	–	S, R
Multi Carb	66	7, 9, 11	0.188 to 1 6 to 25	1.5 to 3.25	–	S, R
Multi Carb-B	67	4, 6, 8	– 6 to 16	1.2 to 1.9	–	B
Picatinny Groove F	PRT	3	0.2100 –	0.56	–	S
Picatinny Dovetail F	PRT	5	0.6050 –	0.68	–	S
Turbo Carb	56B	2	0.031 to 0.750 1 to 20	1	2 to 2.25	B
Z-Carb-MD	ZD1	4	0.118 to 0.750 5 to 20	1 to 1.25	2.25 to 5	R
Power-Carb	57	6	0.250 to 0.500 6 to 20	2 to 2.25	–	S
Ski-Carb	44	2	0.250 to 1 3 to 20	1.25 to 7	–	S, R
S-Carb 2 Flute	47	2	0.125 to 1 3 to 25	1 to 3	3 to 9	S, B
S-Carb 3 Flute	43	3	0.125 to 1 3 to 25	1 to 7	2.25 to 8.5	S, R, B
S-Carb APR-3	43APR–3	3	0.750 to 1 12 to 26	1.25 to 1.75	3 to 4	S, R
S-Carb APR-4	43APR–4	4	20 to 25	1.25 to 1.75	2.25 to 3.5	S, R
S-Carb APF	43APF	4	0.500 to 0.750 6 to 25	2.5 to 4	3 to 5	S, R
S-Carb APF-B	43APF–B	3, 4	– 6 to 16	1.2 to 1.9	–	B
Picatinny Groove NF	PRT	3	0.2100 –	0.56	–	S
Picatinny Dovetail NF	PRT	3	0.6050 –	0.68	–	S
Slow Helix	27	4	0.250 to 0.750 6 to 16	1.75 to 4	–	S
CCR	20–CCR	5, 8, 10, 12	0.250 to 0.500 2 to 12	2.75 to 4	–	S
CCR Coarse	31–CCR	5, 7, 8, 10	0.250 to 0.500 6 to 12	2.75 to 4	–	S
Compression Router	25	4, 6, 8	0.250 to 0.500 6 to 12	2.75 to 4	–	S
Up Cut Router	21	2	0.125 to 0.750 3 to 12	2.5 to 4.25	–	S
Down Cut Router	22	2	0.125 to 0.750 3 to 12	2.5 to 4.25	–	S

End Mill Matrix

Chipbreaker Option	Shank Option Solid Round (SR) Weldon Flat (WF) Jet Stream (JS) Coolant Hole (CH)	Center Cutting	Helix Angle	Flute Index	Coating	Maximum Recommended Ramp Angle °
By Request	SR, WF	Yes	32 / 48	Unequal	Ti–NAMITE–A	90
By Request	SR, WF	Yes	varies	Unequal	Ti-NAMITE-X MEGACOAT NANO	90
By Request	SR, WF, JS	Yes	35 / 38	Unequal	Ti–NAMITE–X	90
By Request	SR, WF	Yes	38 / 41	Unequal	Ti–NAMITE–A	20
By Request	SR	Yes	38	Unequal	Ti–NAMITE–A	1
By Request	SR, WF, CH	No	37	Unequal	Ti-NAMITE-M Ti-NAMITE-A MEGACOAT NANO	7
By Request	SR, WF	Yes	45	Unequal	Ti–NAMITE–A	5
By Request	SR	Yes	41	Unequal	Ti–NAMITE–X	3
In Stock Available	SR	No	37	Unequal	Ti–NAMITE–M Ti–NAMITE–A	1
By Request	SR	No	35	Equal	Ti–NAMITE–X	1
By Request	SR	Yes	varies	Equal	Ti–NAMITE–H	1
Not Available	SR	Yes	35	Unequal	Ti–NAMITE–M	–
Not Available	SR	No	37	Unequal	Ti–NAMITE–M	–
By Request	SR	Yes	30	Equal	Ti–NAMITE–X	25
By Request	SR	Yes	42 / 45	Unequal	Ti–NAMITE–X	2
By Request	SR	Yes	45	Equal	Ti–NAMITE–X	1
By Request	SR, WF	Yes	45	Equal	uncoated or Ti–NAMITE–B	90
By Request	SR	Yes	35	Equal	uncoated or Ti–NAMITE–B	90
In Stock Available	SR	Yes	38	Equal	uncoated or Ti–NAMITE–B	90
Standard	CH	Yes	38	Unequal	Ti–NAMITE–B	90
Standard	CH	Yes	38 / 41	Unequal	Ti–NAMITE–B	90
By Request	CH	Yes	38 / 41	Unequal	Ti–NAMITE–B	25
By Request	SR	Yes	varies	Equal	Ti–NAMITE–B	1
Not Available	SR	Yes	38	Equal	Ti–NAMITE–B	–
Not Available	SR	No	38	Equal	Ti–NAMITE–B	–
By Request	SR	Yes	10, 12	Unequal	uncoated or Di–NAMITE	5
Standard	SR	Based upon end style	15	Equal	uncoated or Di–NAMITE	5 (for end cut styles)
Standard	SR	Based upon end style	15	Equal	uncoated or Di–NAMITE	5 (for end cut styles)
By Request	SR	Yes	30	Equal	uncoated or Di–NAMITE	5
By Request	SR	Yes	35	Equal	various optional	90
By Request	SR	Yes	35	Equal	various optional	–

Application Tips

Tool	• Whenever possible, select an end mill with the largest diameter, shortest flute length, and shortest overall length for the best rigidity • Long flute tools are not intended for pocketing, slotting, or heavy profiling – limit Ae to .02D • High Performance tools minimize cycle time and extend tool life
Tool Holders	• Holders with adequate gripping pressure and TIR are required • Stub holders or zero length collet style holders are recommended for heavy stock removal • When using solid holders, hand ground screw flats are not recommended
Workpiece	• Secure clamping of the workpiece will reduce chatter and deflection
Machine	• Spindle must be in optimum condition for precise TIR and maximum tool life • Sufficient horsepower is required to perform at recommended speeds and feeds • Reduce rates for low power machines to prevent workpiece and / or tool damage
Coolant	• Avoid re-milling chips through use of air blast or liquid coolant as necessary • Maintain clean coolant with appropriate concentration • General recommendations: —Water Soluble Oil or Air Blast: Tool Steels, Mold & Die Steels, Carbon or Alloy Steels —Water Soluble Oil: Stainless Steels, Titanium, High Temperature Alloys, Non-Ferrous Alloys
Methods	• Climb milling is generally preferred • Attention to programming details, tool holders, TIR, balance, fixturing, etc. improve cutting tool performance and extend tool life

END MILLING GUIDELINE

DC = cutting diameter APMX = flute length

Speeds and Feeds for Cut Types are based on Radial Width (Ae) and Axial Depth (Ap)

Reductions to Speeds and Feeds may be necessary when:
- Ae and Ap exceed recommendations
- Using long flute or extended reach tools
- Using long tool holders
- Machining materials harder than listed

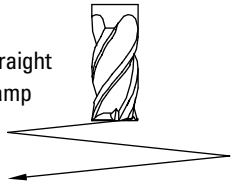
ENTRY METHODS

Pre-Drilled Hole

Pre-drilling is the preferred entry method for most applications.

Helical Ramp

Straight Ramp



Alternative methods are helical and straight ramping. High ramp angles require reduced feed. Lower ramp angles will allow higher feed rates and extend tool life. Use slotting speeds and feeds for ramp angles of 1° to 2°. Reduce feed to 25% when ramp angles approach 6°. General purpose tools and/or difficult to machine materials will require lower ramp angles and reduced feed.

Plunge

Plunge only in non-ferrous and short-chipping materials using slotting speeds and 25% slotting feeds.

Recomendaciones de uso

Herramientas	• Siempre que sea posible, seleccione la herramienta de mayor diámetro y menor longitud total y de filo para obtener una mayor rigidez. • Las herramientas con filos largos no son recomendadas para operaciones de apertura de cajas en el maquinado, operación de ranurado o perfilado pesado – limitar la profundidad radial (Ae) a .02D • Las herramientas de alto desempeño minimizan el tiempo de ciclo del maquinado y extienden la vida útil de la herramienta
Portaherramientas	• Los Portaherramientas deberán tener buena presión de amarre para la sujeción de la herramienta y una concentricidad máxima indicada (TIR) • Se recomienda usar portaherramientas de amarre directo cortos, o de boquilla con longitud cero para lograr un máximo arranque de viruta • Cuando se utilicen portaherramientas de amarre directo, no se recomienda hacer manualmente el plano para la sujeción del tornillo en el zanco de la herramienta
Pieza a maquinar	• La buena sujeción de la pieza a maquinar reducirá la vibración y la desviación de la herramienta
Máquina	• El husillo de la maquina debe estar en condiciones optimas, para asegurar la concentricidad de giro (TIR) y asegurar el máximo rendimiento de la herramienta • Para lograr los avances y velocidades recomendados, se necesita suficiente potencia (HP) en la maquina • Reducir los parámetros de corte en maquinas de baja potencia (HP) para prevenir el daño en la herramienta o pieza de trabajo
Refrigeración	• Evite el re-maquinado de virutas usando aire a presión o líquido refrigeración según sea necesario • Mantener limpio la refrigeración con su concentración adecuada • Recomendaciones generales: –Para el maquinado de aceros de herramienta, para Moldes y Dados o Aleaciones de Bajo Carbón, utilice Aceite Soluble en Agua o aire a presión –Para el maquinado de Aleaciones Inoxidables, Aleaciones Termorresistentes, Titanio y Aleaciones No Ferrosas, utilice solamente Aceite Soluble en Agua
Métodos	• Se recomienda el maquinado en sentido ascendente o trepado • El cuidado en los detalles de la programación, la concentricidad de giro (TIR) el balance de los portaherramientas, la sujeción de la pieza a maquinar, etc. son factores que contribuyen a prolongar la vida de la herramienta

GUÍAS DE FRESADO

DC = diámetro de corte APMX = largo de filo

Las velocidades y avances para cortes están basados en la profundidad radial (→|Ae|←), y profundidad axial (Ap)

Reducciones en velocidades y avances serán necesarias cuando:
- Ae y Ap exceda las recomendaciones
- Se utilicen filos largos o herramientas de largo alcance
- Se utilicen portaherramientas largos
- Se maquinen materiales más duros que los recomendados

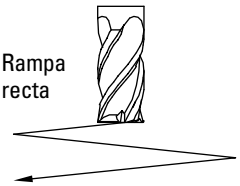
MÉTODOS DE ENTRADA

Barreno previo

Preferentemente usar un barreno previo como método de entrada para la mayor parte de las aplicaciones.

Rampa helicoidal

Rampa recta



Los métodos alternativos son las rampas helicoidales y rectas. Un ángulo elevado de rampa necesita un avance reducido. Un ángulo de rampa inferior permitirá tasas de avance más elevadas y una mayor duración de la herramienta. Usar velocidades y alcances de ranurado para ángulos de rampa de 1° a 2°. Disminuir el avance un 25% cuando los ángulos de rampa se aproximan a 6°. Las herramientas de uso general y/o materiales difíciles de mecanizar precisarán ángulos de rampa inferiores y un avance reducido.

Agujero o Barrenado

Este método se puede utilizar únicamente en materiales no ferrosos y materiales de formación de virutas cortas, usando la velocidad de ranurado y el 25% de su avance.

Conseils relatifs à l'application

Outil	• Chaque fois que possible, choisissez une fraise de plus grand diamètre possible, la plus courte possible, elle garantira la meilleure rigidité • Les outils longs ne sont pas optimum pour l'ébauche, le pocketing, le rainurage – Ae limité à 0,02 D • Les outils Haute performance optimisent les temps de cycle et de augmentent la durée de vie
Porte-outils	• Des attachements à serrage puissant et à faux rond précis sont recommandés • Attachements à méplats ou pinces à serrage nominale sont recommandées pour les ébauches • Lorsque vous utilisez des attachement rigides, les serrage de l'outil par vis ne sont pas recommandés
Pièce	• Le système de fixation et de bridage de la pièce devra permettre de réduire les vibrations et la déformation
Machine	• Broche doit être en bon état optimal au niveau de son faux rond • Suffisamment puissance est nécessaire pour effectuer à des vitesses recommandées et se nourrit • Réduire les efforts pour les machines de faible puissance pour éviter l'endommagement de la pièce et / ou de l'outil
Liquide de refroidissement	• Évitez les recyclage de copeaux par l'utilisation de soufflage d'air comprimé ou de liquide de refroidissement. • Maintenir le lubrifiant propre à la concentration appropriée • Recommandations générales – –Huile soluble ou Air comprimé: aciers à outils, aciers pour moules, aciersau carbone ou alliés –Huile soluble: aciers inoxydables, titane, alliages à haute température, alliages non ferreux
Méthodes	• L'usinage en avalant est généralement préconisé • Attention à la programmation, porte-outils, faux rond, équilibrage, fixation, etc améliorent les performances de l'outil en coupe et prolonge la durée de vie

GUIDE DU FRAISAGE

DC = diamètre de coupe APMX = longueur de coupe

Vitesses & avances pour ces cas d'usinage sont basées sur l'engagement radial (←| Ae |→), et axial (Ap)

La réduction de la vitesse et de l'avance doit être nécessaire quand:
- Les engagements Ae et Ap sont importants
- Des dentures longues ou des séries longues sont utilisées
- Des attachement longs sont utilisés
- Lors d'usinage de matériaux durs

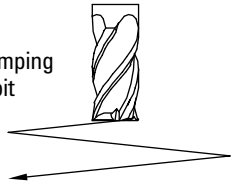
TYPES D'ENTREE MATIERE

Preperçage

Le préperçage est la méthode préférable dans la plupart de applications.

Ramping hélicoïdal

Ramping droit



Les autres méthodes sont un ramping hélicoïdal et un ramping droit. Les angles de ramping élevés exigent une avance inférieure. Les angles de ramping inférieurs permettent les taux d'avance supérieurs et prolongeront la vie de l'outil. Utilisez des avances et vitesses de mortaisage pour les angles de ramping de 1° à 2°. Réduisez l'avance à 25 % lorsque les angles de ramping avoisinent 6°. Les outils tout usage et/ou les matériaux difficiles à usiner exigeront des angles de ramping inférieurs et une charge réduite.

Plongée

Plongée uniquement dans les non ferreux. Vitesse rainurage et avances réduites de 25%.

Anwendungstipps

Werkzeug	• Wählen Sie möglichst immer den Schaftfräser mit dem größten Durchmesser, der kürzesten Schneide und Gesamtlänge, um eine hohe Steifigkeit zu erhalten • Langlochschaftfräser sind nicht zum Taschen-, Schlitz- oder Profilfräsen bestimmt – die Dehnung auf Ae 0,2 der Streckgrenze nicht überschreiten • Hochleistungswerkzeuge minimieren die Bearbeitungszeit und verlängern die Werkzeugstandzeit
Werkzeughalter	• Es werden Spannzangen mit genauem Rundlauf benötigt • Steilkegel oder bündige Spannfutter werden bei hohem Materialabtrag empfohlen • Von der Verwendung fester handverschraubter Halterungen wird abgeraten
Werkstück	• Sicheres Werkzeugspannen verringert Vibrationen und das Auswandern aus der Spannvorrichtung
Werkzeugmaschine	• Die Spindel muss in optimalem Zustand sein, um einen genauen Rundlauf und maximale Standzeit zu erzielen • Für die empfohlenen Drehzahlen und Vorschubgeschwindigkeiten ist genügend Leistung bereitzustellen • Bei leistungsschwachen Antrieben sind die Werte zu verringern, um Beschädigungen am Werkstück und/oder Werkzeug zu vermeiden
Kühlmittel	• Das Stauen der Späne durch Luftstrahl oder flüssige Kühlmittel möglichst verhindern • Kühlmittel in geeigneter Konzentration verwenden • Allgemeine Empfehlungen: – Wasser-Öl-Emulsionen oder Luftstrahl: Werkzeugstähle, Form- und Schneidstähle, unlegierte oder legierte Stähle – Wasser-Öl-Emulsion: Nichtrostender Stahl, Titan, Warmfeste Legierungen, Nichteisenlegierungen
Verfahren	• Vorzugsweise Gleichlauffräsen anwenden • Das Beachten der Fräsparameter, Werkzeughalter, Rundlauf, Auswuchten, Einspannen, usw. verbessert die Schnittleistung und verlängert die Standzeit

RICHTWERTE ZUM FRÄSEN

DC = Fräsdurchmesser APMX = Schnittlänge

Drehzahl und Vorschub für Fräsarbeiten hängen von Radialbreite (Ae) und Frästiefe (Ap) ab

Drehzahl und Vorschub müssen ggfs. verringert werden wenn:

- die empfohlenen Werte für Ae und Ap überschritten werden
- lange Schneiden oder Langschaftfräser verwendet werden
- lange Werkzeughalter verwendet werden
- die Werkstoffe härter als vorgesehen sind

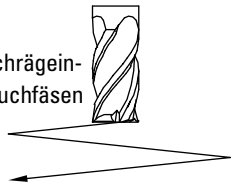
VORBEREITUNGEN

Vorbohrung

Vorbohren ist in den meisten Fällen ratsam.

Zirkulareintauchfräsen

Schrägeintauchfäsen

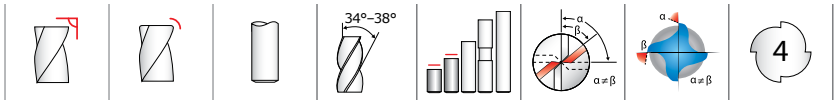


Alternative Verfahren sind Zirkulareintauchen und Schrägeintauchen. Starke Tauchwinkel erfordern verringerte Vorschubgeschwindigkeiten. Geringe Tauchwinkel ermöglichen höhere Vorschubgeschwindigkeiten und verlängern die Standzeit. Verwenden Sie die Drehzahlen und Vorschübe zum Schlitzfräsen für Tauchwinkel von 1° bis 2°. Den Vorschub auf 25 % verringern, wenn der Tauchwinkel 6° erreicht. Standardwerkzeuge und / oder schwer zu bearbeitende Werkstoffe verlangen kleine Tauchwinkel und verringerte Vorschubgeschwindigkeiten.

Stechen

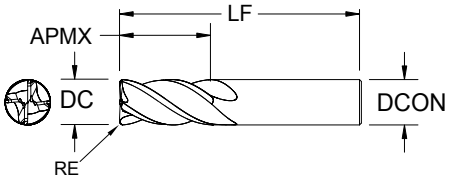
Stechen Sie in Nichteisenmetalle und kurzspanende Werkstoffe nur mit Schlitzfräsdrehzahl und 25 % der Schlitzvorschubgeschwindigkeit ein.

Z-Carb-XPR



ZRM • ZRMCR

METRIC SERIES



- Excels in advanced axial workpiece entry techniques, including plunging, ramping, and helical interpolation
- Variable helix, rake, and flute indexing eliminates harmonics, suppresses chatter, produces ideal chip shape, and controls cutting zone temperature
- End teeth wiper flat increases corner strength and significantly improves workpiece floor surface finish
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

mm					EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-X (TX)	MEGACOAT NANO (MN)
6,0	13,0	57,0	6,0	–	47801	47800
6,0	13,0	57,0	6,0	0,50	47803	47802
6,0	13,0	57,0	6,0	1,00	47805	47804
8,0	19,0	63,0	8,0	–	47807	47806
8,0	19,0	63,0	8,0	0,50	47809	47808
8,0	19,0	63,0	8,0	1,00	47811	47810
8,0	19,0	63,0	8,0	2,00	47813	47812
10,0	22,0	72,0	10,0	–	47815	47814
10,0	22,0	72,0	10,0	0,50	47817	47816
10,0	22,0	72,0	10,0	1,00	47819	47818
10,0	22,0	72,0	10,0	2,00	47821	47820
12,0	26,0	83,0	12,0	–	47823	47822
12,0	26,0	83,0	12,0	0,50	47825	47824
12,0	26,0	83,0	12,0	0,75	47829	47828
12,0	26,0	83,0	12,0	1,00	47831	47830
14,0	26,0	83,0	14,0	–	47833	47832
14,0	26,0	83,0	14,0	1,00	47835	47834
16,0	32,0	92,0	16,0	–	47837	47836
16,0	32,0	92,0	16,0	1,00	47839	47838
16,0	32,0	92,0	16,0	2,00	47841	47840
16,0	32,0	92,0	16,0	3,00	47843	47842
20,0	38,0	104,0	20,0	–	47845	47844
20,0	38,0	104,0	20,0	1,00	47847	47846

TOLERANCES (mm)

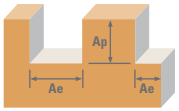
6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

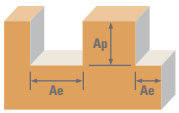
Z-Carb-XPR



	Series ZRM, ZRMCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.25	≤ APMX	206 (165-247)	RPM	10920	8190	6552	5460	4095	3276
							Fz	0.0464	0.0668	0.0870	0.1071	0.1247	0.1376
							Feed (mm/min)	2025	2189	2280	2338	2043	1803
			Slot	1	≤ 1	137 (110-165)	RPM	7280	5460	4368	3640	2730	2184
							Fz	0.0365	0.0526	0.0685	0.0843	0.0982	0.1083
							Feed (mm/min)	1063	1149	1197	1227	1072	946
			Plunge	1	≤ 1	195 (156-234)	RPM	10354	7765	6212	5177	3883	3106
							Fz	0.0334	0.0482	0.0627	0.0772	0.0882	0.0992
							Feed (mm/min)	1384	1496	1558	1598	1369	1232
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.25	≤ APMX	160 (128-192)	RPM	8493	6370	5096	4247	3185	2548
							Fz	0.0324	0.0518	0.0727	0.0932	0.1096	0.1207
							Feed (mm/min)	1100	1320	1481	1584	1396	1230
			Slot	1	≤ 1	107 (85-128)	RPM	5662	4247	3397	2831	2123	1699
							Fz	0.0255	0.0408	0.0572	0.0734	0.0863	0.0950
							Feed (mm/min)	578	693	777	831	733	645
			Plunge	1	≤ 1	152 (122-183)	RPM	8089	6067	4853	4044	3033	2427
							Fz	0.0233	0.0374	0.0524	0.0672	0.0771	0.0870
							Feed (mm/min)	755	906	1017	1087	935	844
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.25	≤ APMX	73 (59-88)	RPM	3883	2912	2330	1941	1456	1165
							Fz	0.0259	0.0396	0.0541	0.0685	0.0826	0.0935
							Feed (mm/min)	402	462	504	532	481	436
			Slot	1	≤ 0.5	49 (39-59)	RPM	2588	1941	1553	1294	971	777
							Fz	0.0204	0.0312	0.0426	0.0539	0.0650	0.0736
							Feed (mm/min)	211	242	265	279	252	229
			Plunge	1	≤ 0.5	67 (54-80)	RPM	3559	2669	2135	1780	1335	1068
							Fz	0.0187	0.0286	0.0390	0.0493	0.0584	0.0674
							Feed (mm/min)	266	305	333	351	312	288
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.25	≤ APMX	165 (132-198)	RPM	8736	6552	5242	4368	3276	2621
							Fz	0.0328	0.0488	0.0659	0.0829	0.0981	0.1090
							Feed (mm/min)	1145	1278	1382	1449	1285	1142
			Slot	1	≤ 1	110 (88-132)	RPM	5824	4368	3494	2912	2184	1747
							Fz	0.0258	0.0384	0.0519	0.0653	0.0772	0.0858
							Feed (mm/min)	601	671	725	761	674	600
			Plunge	1	≤ 1	155 (124-187)	RPM	8251	6188	4950	4125	3094	2475
							Fz	0.0236	0.0352	0.0475	0.0598	0.0692	0.0786
							Feed (mm/min)	780	870	941	987	856	778
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.25	≤ APMX	114 (91-137)	RPM	6067	4550	3640	3033	2275	1820
							Fz	0.0255	0.0390	0.0537	0.0683	0.0846	0.0979
							Feed (mm/min)	620	710	782	829	770	713
			Slot	1	≤ 0.5	76 (61-91)	RPM	4044	3033	2427	2022	1517	1213
							Fz	0.0201	0.0307	0.0423	0.0538	0.0666	0.0771
							Feed (mm/min)	325	372	411	435	404	374
			6° Ramp	1	≤ 0.5	107 (85-128)	RPM	5662	4247	3397	2831	2123	1699
							Fz	0.0184	0.0281	0.0387	0.0493	0.0599	0.0706
							Feed (mm/min)	417	477	526	558	509	480
	STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ 0.25	≤ APMX	110 (88-132)	RPM	5824	4368	3494	2912	2184	1747
							Fz	0.0254	0.0390	0.0537	0.0683	0.0846	0.0979
							Feed (mm/min)	592	681	751	796	739	684
			Slot	1	≤ 1	73 (59-88)	RPM	3883	2912	2330	1941	1456	1165
							Fz	0.0200	0.0307	0.0423	0.0538	0.0666	0.0771
							Feed (mm/min)	311	358	394	418	388	359
			6° Ramp	1	≤ 1	104 (83-124)	RPM	5500	4125	3300	2750	2063	1650
							Fz	0.0183	0.0281	0.0387	0.0493	0.0599	0.0706
							Feed (mm/min)	403	464	511	542	494	466

Continued on next page

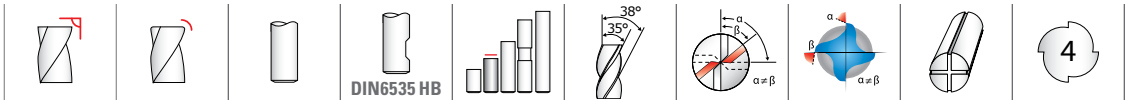
Z-Carb-XPR

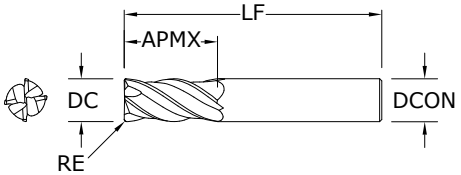


	Series ZRM, ZRMCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile	≤ 0.25	≤ APMX	192 (154-230)	RPM	10192	7644	6115	5096	3822	3058
							Fz	0.0363	0.0526	0.0699	0.0869	0.1059	0.1218
							Feed (mm/min)	1481	1608	1709	1771	1619	1490
			Slot	1	≤ 1	128 (102-154)	RPM	6795	5096	4077	3397	2548	2038
							Fz	0.0286	0.0414	0.0550	0.0684	0.0834	0.0959
							Feed (mm/min)	777	844	897	929	850	782
			Plunge	1	≤ 1	183 (146-219)	RPM	9707	7280	5824	4853	3640	2912
							Fz	0.0262	0.0379	0.0504	0.0626	0.0752	0.0878
							Feed (mm/min)	1017	1104	1173	1216	1095	1023
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc	Profile	≤ 0.25	≤ APMX	114 (91-137)	RPM	6067	4550	3640	3033	2275	1820
							Fz	0.0255	0.0390	0.0537	0.0683	0.0846	0.0979
							Feed (mm/min)	620	710	782	829	770	713
			Slot	1	≤ 1	76 (61-91)	RPM	4044	3033	2427	2022	1517	1213
							Fz	0.0201	0.0307	0.0423	0.0538	0.0666	0.0771
							Feed (mm/min)	325	372	411	435	404	374
			Plunge	1	≤ 1	107 (85-128)	RPM	5662	4247	3397	2831	2123	1699
							Fz	0.0184	0.0281	0.0387	0.0493	0.0599	0.0706
							Feed (mm/min)	417	477	526	558	509	480
S	SUPER ALLOYS (NICKEL , COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.25	≤ APMX	32 (26-38)	RPM	1699	1274	1019	849	637	510
							Fz	0.0174	0.0287	0.0413	0.0536	0.0650	0.0735
							Feed (mm/min)	118	146	168	182	166	150
			Slot	1	≤ 0.375	21 (17-26)	RPM	1132	849	679	566	425	340
							Fz	0.0137	0.0226	0.0325	0.0422	0.0512	0.0579
							Feed (mm/min)	62	77	88	96	87	79
			3° Ramp	1	≤ 0.5	30 (24-37)	RPM	1618	1213	971	809	607	485
							Fz	0.0125	0.0207	0.0298	0.0386	0.0458	0.0530
							Feed (mm/min)	81	100	116	125	111	103
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.25	≤ APMX	18 (15-22)	RPM	971	728	582	485	364	291
							Fz	0.0166	0.0271	0.0386	0.0500	0.0611	0.0695
							Feed (mm/min)	65	79	90	97	89	81
			Slot	1	≤ 0.375	12 (10-15)	RPM	647	485	388	324	243	194
							Fz	0.0131	0.0213	0.0304	0.0394	0.0481	0.0547
							Feed (mm/min)	34	41	47	51	47	42
			3° Ramp	1	≤ 0.5	15 (12-18)	RPM	809	607	485	404	303	243
							Fz	0.0120	0.0195	0.0278	0.0361	0.0431	0.0501
							Feed (mm/min)	39	47	54	58	52	49
	TITANIUM ALLOYS Pure Ttanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.25	≤ APMX	82 (66-99)	RPM	4368	3276	2621	2184	1638	1310
							Fz	0.0286	0.0429	0.0577	0.0721	0.0894	0.1040
							Feed (mm/min)	499	563	605	630	586	545
			Slot	1	≤ 0.5	55 (44-66)	RPM	2912	2184	1747	1456	1092	874
							Fz	0.0225	0.0338	0.0454	0.0568	0.0704	0.0819
							Feed (mm/min)	262	295	317	331	308	286
			6° Ramp	1	≤ 0.5	76 (61-91)	RPM	4044	3033	2427	2022	1517	1213
							Fz	0.0206	0.0309	0.0416	0.0520	0.0635	0.0750
							Feed (mm/min)	333	375	403	421	385	364
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	Profile	≤ 0.25	≤ APMX	46 (37-55)	RPM	2427	1820	1456	1213	910	728
							Fz	0.0243	0.0375	0.0512	0.0648	0.0837	0.1007
							Feed (mm/min)	235	273	298	314	305	293
			Slot	1	≤ 0.375	30 (24-37)	RPM	1618	1213	971	809	607	485
							Fz	0.0191	0.0295	0.0403	0.0510	0.0659	0.0793
							Feed (mm/min)	124	143	156	165	160	154
			6° Ramp	1	≤ 0.5	43 (34-51)	RPM	2265	1699	1359	1132	849	679
							Fz	0.0175	0.0270	0.0369	0.0467	0.0596	0.0726
							Feed (mm/min)	158	184	201	212	203	197

Bhn (Brinell) HRc (Rockwell C)
rpm = Vc x 3.82 / DC
ipm = Fz x 4 x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Z-Carb-AP





Z1MPCR • Z1MP

METRIC SERIES

TOLERANCES (mm)

<3 DIAMETER
DC = +0,012/–0,012
DCON = h_6
RE = +0,000/–0,025

>3–6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

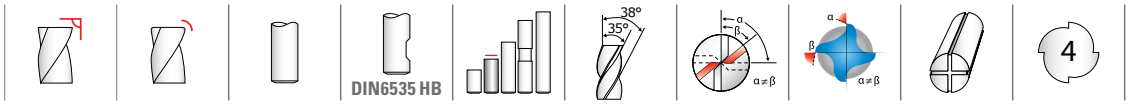
mm					EDP NO.		
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-X (TX)	Ti-NAMITE-X (TX) W/FLAT	JetStream
1,0	3,0	57,0	6,0	0,1	46873*	–	–
1,5	4,5	57,0	6,0	0,1	46849*	–	–
2,0	6,0	57,0	6,0	0,2	46850*	–	–
2,5	7,0	57,0	6,0	0,2	46874*	–	–
3,0	8,0	57,0	6,0	–	46357	–	–
3,0	8,0	57,0	6,0	0,3	46851	–	–
3,0	8,0	57,0	6,0	0,5	46880	–	–
4,0	11,0	57,0	6,0	–	46358	–	–
4,0	11,0	57,0	6,0	0,3	46852	–	–
4,0	11,0	57,0	6,0	0,5	46881	–	–
5,0	13,0	57,0	6,0	–	46359	–	–
5,0	13,0	57,0	6,0	0,3	46853	–	–
6,0	13,0	57,0	6,0	–	46360	–	–
6,0	13,0	57,0	6,0	0,25	46882	–	–
6,0	13,0	57,0	6,0	0,5	46854	–	–
6,0	13,0	57,0	6,0	1,0	46855	–	–
6,0	13,0	57,0	6,0	1,5	46884	–	–
8,0	19,0	63,0	8,0	–	46362	–	–
8,0	19,0	63,0	8,0	0,5	46856	–	–
8,0	19,0	63,0	8,0	1,0	46857	–	–
8,0	19,0	63,0	8,0	1,5	46886	–	–
8,0	19,0	63,0	8,0	2,0	46887	–	–
10,0	22,0	72,0	10,0	–	46364	–	–
10,0	22,0	72,0	10,0	0,5	46858	–	–
10,0	22,0	72,0	10,0	1,0	46859	–	–
10,0	22,0	72,0	10,0	1,5	46889	–	–
10,0	22,0	72,0	10,0	2,0	46890	–	–
10,0	22,0	72,0	10,0	2,5	46891	–	–
12,0	26,0	83,0	12,0	–	46366	–	–
12,0	26,0	83,0	12,0	0,5	46860	46909	–
12,0	26,0	83,0	12,0	0,75	46861	46910	46493
12,0	26,0	83,0	12,0	1,0	46893	46911	–

*Variable flute spacing. Helix and rake do not vary.

continued on next page

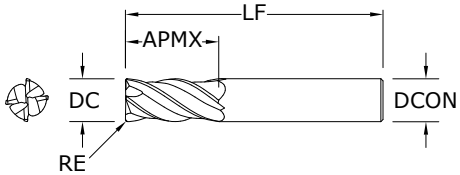
- Variable rake geometry alters and controls the cutting dynamic taking chatter suppression to an unprecedented level
- Unequal helix design changes the cutting angle to improve harmonics
- Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge helping to suppress damaging harmonics
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

Z-Carb-AP



Z1MPCR • Z1MP

METRIC SERIES



CONTINUED

mm					EDP NO.		
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-X (TX)	Ti-NAMITE-X (TX) W/FLAT	JetStream
12,0	26,0	83,0	12,0	1,5	46894	46912	–
12,0	26,0	83,0	12,0	2,0	46895	46913	–
12,0	26,0	83,0	12,0	2,5	46896	46914	–
12,0	26,0	83,0	12,0	3,0	42718	46915	42719
14,0	26,0	83,0	14,0	–	46368	–	46506
14,0	26,0	83,0	14,0	1,0	46862	46916	46494
16,0	32,0	92,0	16,0	–	46370	–	46507
16,0	32,0	92,0	16,0	1,0	46863	46917	46495
16,0	32,0	92,0	16,0	1,5	46898	46918	–
16,0	32,0	92,0	16,0	2,0	46899	46919	–
16,0	32,0	92,0	16,0	2,5	46900	46920	–
16,0	32,0	92,0	16,0	3,0	46864	46921	42721
16,0	32,0	92,0	16,0	4,0	46867	46944	–
18,0	32,0	92,0	18,0	–	46372	–	46508
20,0	38,0	104,0	20,0	–	46374	–	46509
20,0	38,0	104,0	20,0	1,0	46865	46922	46497
20,0	38,0	104,0	20,0	1,5	46903	46923	–
20,0	38,0	104,0	20,0	2,0	46904	46924	–
20,0	38,0	104,0	20,0	2,5	46905	46925	–
20,0	38,0	104,0	20,0	3,0	42722	46926	42723
20,0	38,0	104,0	20,0	4,0	46868	46945	–
20,0	38,0	104,0	20,0	5,0	46869	46946	–
25,0	38,0	104,0	25,0	–	46376	–	46510
25,0	38,0	104,0	25,0	1,0	46866	46927	46498

TOLERANCES (mm)

<3 DIAMETER
DC = +0,012/–0,012
DCON = h_6
RE = +0,000/–0,025

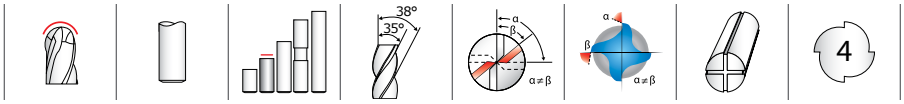
>3–6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

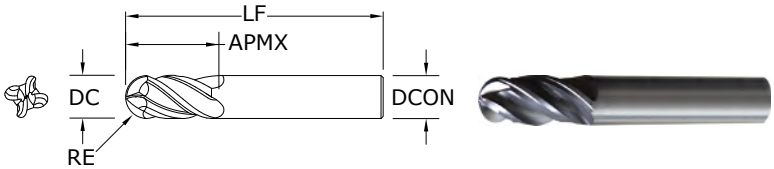
>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS

Z-Carb-AP





Z1MPB
METRIC SERIES

TOLERANCES (mm)

3–6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,015

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,020

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,025
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

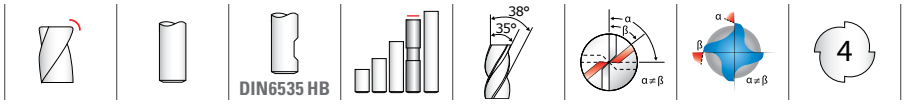
- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	Ti-NAMITE-X (TX)	JetStream
3,0	8,0	57,0	6,0	46354	–
4,0	11,0	57,0	6,0	46355	–
5,0	13,0	57,0	6,0	46356	–
6,0	13,0	57,0	6,0	46343	–
8,0	19,0	63,0	8,0	46344	–
10,0	22,0	72,0	10,0	46345	–
12,0	26,0	83,0	12,0	46346	–
14,0	26,0	83,0	14,0	46347	46518
16,0	32,0	92,0	16,0	46348	46519
18,0	32,0	92,0	18,0	46349	46520
20,0	38,0	104,0	20,0	46350	46521
25,0	38,0	104,0	25,0	46351	46522

RE = 1/2 Cutting Diameter (DC)

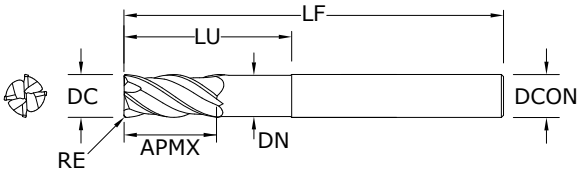
- Variable rake geometry alters and controls the cutting dynamic taking chatter suppression to an unprecedented level
- Unequal helix design reduces damaging harmonics by changing the angle at which each cutting edge enters and exits the material
- Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge helping to suppress damaging harmonics
- Optimal material removal rates through increased feed and depths of cut
- Ball end design ideal for finishing operations in complex workpieces
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

Z-Carb-AP



Z1MPIC • Z1MPLC

METRIC SERIES



- Variable rake geometry alters and controls the cutting dynamic taking chatter suppression to an unprecedented level
- Unequal helix design changes the cutting angle to improve harmonics
- Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge helping to suppress damaging harmonics
- Long reach design allows for deeper and faster cuts
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

mm							EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	Ti-NAMITE-X (TX)	Ti-NAMITE-X (TX) W/FLAT
6,0	8,0	75,0	6,0	24,0	5,49	0,5	46821	–
8,0	10,0	75,0	8,0	32,0	7,49	1,0	46822	–
8,0	10,0	75,0	8,0	32,0	7,49	2,0	46823	–
10,0	12,0	100,0	10,0	40,0	9,50	1,0	46824	–
10,0	12,0	100,0	10,0	40,0	9,50	2,0	46825	–
12,0	15,0	100,0	12,0	48,0	11,48	1,0	46826	46928
12,0	15,0	100,0	12,0	48,0	11,48	1,5	46827	46929
12,0	15,0	100,0	12,0	48,0	11,48	2,0	46828	46930
12,0	15,0	100,0	12,0	48,0	11,48	3,0	46829	46931
12,0	26,0	83,0	12,0	36,0	11,48	2,5	–	42731
12,0	26,0	83,0	12,0	36,0	11,48	3,0	–	42732
12,0	26,0	83,0	12,0	36,0	11,48	4,0	–	42733
16,0	32,0	92,0	16,0	42,0	15,49	2,5	–	42734
16,0	32,0	92,0	16,0	42,0	15,49	4,0	–	42735
16,0	32,0	92,0	16,0	42,0	15,49	6,0	–	42736
16,0	20,0	115,0	16,0	65,0	15,49	1,0	46830	46932
16,0	20,0	115,0	16,0	65,0	15,49	1,5	46831	46933
16,0	20,0	115,0	16,0	65,0	15,49	2,0	46832	46934
16,0	20,0	115,0	16,0	65,0	15,49	3,0	46833	46935
16,0	20,0	115,0	16,0	65,0	15,49	4,0	46834	46936
16,0	20,0	115,0	16,0	65,0	15,49	5,0	46835	46937
20,0	24,0	140,0	20,0	80,0	19,48	1,0	46836	46938
20,0	24,0	140,0	20,0	80,0	19,48	1,5	46837	46939
20,0	24,0	140,0	20,0	80,0	19,48	2,0	46838	46940
20,0	24,0	140,0	20,0	80,0	19,48	3,0	46839	46941
20,0	24,0	140,0	20,0	80,0	19,48	4,0	46840	46942
20,0	24,0	140,0	20,0	80,0	19,48	5,0	46841	46943
20,0	38,0	104,0	20,0	52,0	19,48	2,5	–	42737
20,0	38,0	104,0	20,0	52,0	19,48	4,0	–	42738
20,0	38,0	104,0	20,0	52,0	19,48	6,0	–	42739

TOLERANCES (mm)

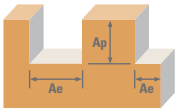
6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

>10–20 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

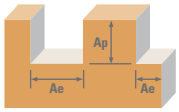
Z-Carb-AP



	Series Z1MP, Z1MPB, Z1MPCR, Z1MPIC, Z1MPLC Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 1	3	6	8	10	12	16	20	25
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.5	≤ 1.5	169	RPM	53803	17934	8967	6725	5380	4484	3363	2690	2152
						(135-203)	Fz	0.0030	0.0109	0.029	0.049	0.061	0.074	0.087	0.099	0.108
							Feed (mm/min)	646	782	1040	1318	1313	1327	1170	1065	930
			Slot	1	≤ 1	134	RPM	42654	14218	7109	5332	4265	3555	2666	2133	1706
						(107-161)	Fz	0.0030	0.0109	0.029	0.049	0.061	0.074	0.087	0.099	0.108
							Feed (mm/min)	512	620	825	1045	1041	1052	928	845	737
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.5	≤ 1.5	96	RPM	30537	10179	5089	3817	3054	2545	1909	1527	1221
						(77-115)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	281	330	448	550	550	560	511	458	391
			Slot	1	≤ 1	76	RPM	24235	8078	4039	3029	2424	2020	1515	1212	969
						(61-91)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	223	262	355	436	436	444	406	364	310
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.5	≤ 1.5	56	RPM	17934	5978	2989	2242	1793	1495	1121	897	717
						(45-68)	Fz	0.0018	0.0066	0.017	0.030	0.037	0.043	0.051	0.059	0.065
							Feed (mm/min)	129	158	203	269	265	257	229	212	187
			Slot	1	≤ 1	44	RPM	14057	4686	2343	1757	1406	1171	879	703	562
						(35-53)	Fz	0.0018	0.0066	0.017	0.030	0.037	0.043	0.051	0.059	0.065
							Feed (mm/min)	101	124	159	211	208	201	179	166	146
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.5	≤ 1.5	149	RPM	47501	15834	7917	5938	4750	3958	2969	2375	1900
						(119-179)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	437	513	697	855	855	871	796	713	608
			Slot	1	≤ 1	119	RPM	37807	12602	6301	4726	3781	3151	2363	1890	1512
						(95-143)	Fz	0.0023	0.0081	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	348	408	555	681	681	693	633	567	484
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.5	≤ 1.5	104	RPM	32960	10987	5493	4120	3296	2747	2060	1648	1318
						(83-124)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	237	281	374	494	488	472	420	389	332
			Slot	1	≤ 1	82	RPM	26174	8725	4362	3272	2617	2181	1636	1309	1047
						(66-99)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	188	223	297	393	387	375	334	309	264
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ 0.5	≤ 1.5	94	RPM	30052	10017	5009	3756	3005	2504	1878	1503	1202
						(76-113)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	216	256	341	451	445	431	383	355	303
			Slot	1	≤ 1	76	RPM	24235	8078	4039	3029	2424	2020	1515	1212	969
						(61-91)	Fz	0.0018	0.0064	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	174	207	275	364	359	347	309	286	244

continued on next page

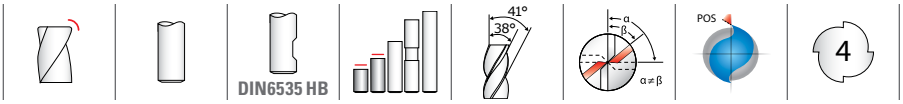
Z-Carb-AP

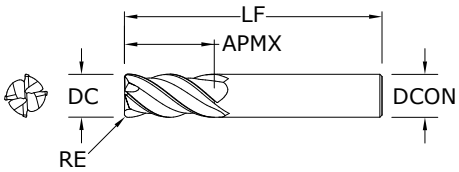


	Series Z1MP, Z1MPB, Z1MPCR, Z1MPIC, Z1MPLC Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 1	3	6	8	10	12	16	20	25
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile	≤ 0.5	≤ 1.5	136	RPM	43139	14380	7190	5392	4314	3595	2696	2157	1726
						(109-163)	Fz	0.0028	0.0099	0.026	0.045	0.056	0.067	0.079	0.091	0.098
							Feed (mm/min)	483	569	748	971	966	963	852	785	676
			Slot	1	≤ 1	108	RPM	34414	11471	5736	4302	3441	2868	2151	1721	1377
						(87-130)	Fz	0.0028	0.0099	0.026	0.045	0.056	0.067	0.079	0.091	0.098
							Feed (mm/min)	385	454	597	774	771	769	680	626	540
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc	Profile	≤ 0.5	≤ 1.5	104	RPM	32960	10987	5493	4120	3296	2747	2060	1648	1318
						(83-124)	Fz	0.0020	0.0074	0.020	0.034	0.043	0.050	0.059	0.067	0.074
							Feed (mm/min)	264	325	439	560	567	549	486	442	390
			Slot	1	≤ 1	82	RPM	26174	8725	4362	3272	2617	2181	1636	1309	1047
						(66-99)	Fz	0.0020	0.0074	0.020	0.034	0.043	0.050	0.059	0.067	0.074
							Feed (mm/min)	209	258	349	445	450	436	386	351	310
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.5	≤ 1.5	24	RPM	7755	2585	1293	969	776	646	485	388	310
						(20-29)	Fz	0.0018	0.0061	0.016	0.027	0.034	0.041	0.048	0.053	0.060
							Feed (mm/min)	56	63	83	105	105	106	93	82	74
			Slot	1	≤ 1	20	RPM	6301	2100	1050	788	630	525	394	315	252
						(16-24)	Fz	0.0018	0.0061	0.016	0.027	0.034	0.041	0.048	0.053	0.060
							Feed (mm/min)	45	51	67	85	86	86	76	67	60
	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.5	≤ 1.5	19	RPM	6010	2003	1002	751	601	501	376	301	240
						(15-23)	Fz	0.0013	0.0043	0.011	0.019	0.024	0.028	0.033	0.037	0.042
							Feed (mm/min)	31	34	44	57	58	56	50	44	40
			Slot	1	≤ 1	15	RPM	4847	1616	808	606	485	404	303	242	194
						(12-18)	Fz	0.0013	0.0043	0.011	0.019	0.024	0.028	0.033	0.037	0.042
							Feed (mm/min)	25	28	36	46	47	45	40	36	33
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.5	≤ 1.5	66	RPM	20842	6947	3474	2605	2084	1737	1303	1042	834
						(52-79)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
							Feed (mm/min)	167	197	264	333	333	333	292	267	233
			Slot	1	≤ 1	52	RPM	16480	5493	2747	2060	1648	1373	1030	824	659
						(41-62)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
							Feed (mm/min)	132	156	209	264	264	264	231	211	185
	TITANIUM ALLOYS (DIFFICULT) Ti10V2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 420 Bhn or ≤ 45 HRc	Profile	≤ 0.5	≤ 1.5	23	RPM	7271	2424	1212	909	727	606	454	364	291
						(18-27)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
							Feed (mm/min)	58	69	92	116	116	116	102	93	81
			Slot	1	≤ 1	18	RPM	5816	1939	969	727	582	485	364	291	233
						(15-22)	Fz	0.0020	0.0071	0.019	0.032	0.040	0.048	0.056	0.064	0.070
							Feed (mm/min)	47	55	74	93	93	93	81	74	65

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 4 x rpm
maximum Slotting Ap for Z1PCR <3mm diameter and all Z1MPLC / Z1MPLB is .25 x DC
maximum Profile Ae for Z1PCR <3mm diameter and all Z1MPLC / Z1MPLB is .20 x DC
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Z-Carb-HTA





ZH1MCRS • ZH1MCR

METRIC SERIES

TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

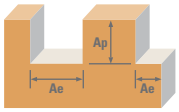
>10–20 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

HIGH TEMP ALLOYS

mm					EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-A (AlTiN)	Ti-NAMITE-A (AlTiN) W/FLAT
6,0	10,0	54,0	6,0	0,5	42712	–
6,0	13,0	57,0	6,0	0,5	46450	–
6,0	13,0	57,0	6,0	1,0	46451	–
6,0	13,0	57,0	6,0	1,5	46452	–
8,0	12,0	58,0	8,0	0,5	42713	–
8,0	19,0	63,0	8,0	0,5	46453	–
8,0	19,0	63,0	8,0	1,0	46454	–
8,0	19,0	63,0	8,0	1,5	46455	–
10,0	14,0	66,0	10,0	0,5	42714	–
10,0	22,0	72,0	10,0	0,5	46456	–
10,0	22,0	72,0	10,0	1,0	46457	–
10,0	22,0	72,0	10,0	1,5	46458	–
10,0	22,0	72,0	10,0	2,0	46459	–
12,0	16,0	73,0	12,0	0,7	42715	–
12,0	26,0	83,0	12,0	0,5	46460	46471
12,0	26,0	83,0	12,0	1,0	46461	46472
12,0	26,0	83,0	12,0	1,5	46462	46473
12,0	26,0	83,0	12,0	2,0	46463	46474
12,0	26,0	83,0	12,0	3,0	46464	46475
16,0	22,0	82,0	16,0	1,0	42716	–
16,0	32,0	92,0	16,0	1,5	46465	46476
16,0	32,0	92,0	16,0	2,0	46466	46477
16,0	32,0	92,0	16,0	3,0	46467	46478
16,0	32,0	92,0	16,0	4,0	46482	46483
20,0	26,0	92,0	20,0	1,0	42717	–
20,0	38,0	104,0	20,0	3,0	46468	46479
20,0	38,0	104,0	20,0	4,0	46469	46480
20,0	38,0	104,0	20,0	5,0	46470	46481

- The original Z-Carb design with an enhanced core and higher helix suited for the demands of high temperature alloys
- Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge helping to suppress damaging harmonics
- Optimal material removal rates through increased feed and depths of cut for difficult to machine materials
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

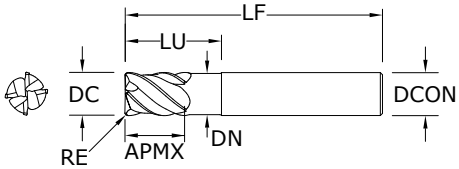
Z-Carb-HTA



	Series ZH1MCRS, ZH1MCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	10	12	20
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.5	≤ 1.5	26	RPM	1373	824	687	412
						(21-31)	Fz	0.017	0.032	0.041	0.053
							Feed (mm/min)	93	105	113	87
			Slot	1	≤ 1	21	RPM	1131	679	565	339
						(17-26)	Fz	0.017	0.032	0.041	0.053
							Feed (mm/min)	77	87	93	72
	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.5	≤ 1.5	21	RPM	1131	679	565	339
						(17-26)	Fz	0.012	0.024	0.029	0.037
							Feed (mm/min)	54	65	66	50
			Slot	1	≤ 1	17	RPM	889	533	444	267
						(13-20)	Fz	0.012	0.024	0.029	0.037
							Feed (mm/min)	43	51	52	39
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.5	≤ 1.5	66	RPM	3474	2084	1737	1042
						(52-79)	Fz	0.019	0.041	0.049	0.057
							Feed (mm/min)	264	342	340	238
			Slot	1	≤ 1	52	RPM	2747	1648	1373	824
						(41-62)	Fz	0.019	0.041	0.049	0.057
							Feed (mm/min)	209	270	269	188
	TITANIUM ALLOYS (DIFFICULT) Ti10V2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 420 Bhn or ≤ 45 HRc	Profile	≤ 0.5	≤ 1.5	23	RPM	1212	727	606	364
						(18-27)	Fz	0.019	0.041	0.049	0.057
							Feed (mm/min)	92	119	119	83
			Slot	1	≤ 1	18	RPM	969	582	485	291
						(15-22)	Fz	0.019	0.041	0.049	0.057
							Feed (mm/min)	74	95	95	66

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
ipm = Fz x 4 x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Z-Carb-MD



ZD1MCR
METRIC SERIES

TOLERANCES (mm)

3–6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

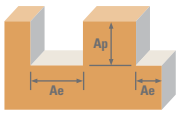
>10–20 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

STEELS

HARDENED STEELS

mm							EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	Ti-NAMITE-X (TX)
3,0	4,0	57,0	6,0	15,0	2,62	0,2	46560
4,0	5,0	57,0	6,0	15,0	3,61	0,3	46561
5,0	6,0	57,0	6,0	15,0	4,60	0,5	46562
6,0	7,0	57,0	6,0	15,0	5,61	1,0	46563
8,0	10,0	63,0	8,0	25,0	7,62	1,0	46564
10,0	12,0	72,0	10,0	30,0	9,60	1,0	46565
12,0	15,0	83,0	12,0	35,0	11,61	1,0	46566
16,0	20,0	92,0	16,0	45,0	15,60	1,5	46567
20,0	24,0	104,0	20,0	55,0	19,61	2,0	46568

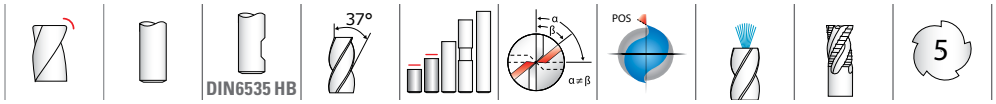
- The original Z-Carb design with negative rake, heavy core, and higher helix for strength and shearing of hard mold & die materials
- Unequal flute spacing helps to disrupt the rhythmic pattern created by the cutting edge helping to suppress damaging harmonics
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials 35-60HRc (327 to 654 Bhn)



	Series ZD1MCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		Diameter (DC) (mm) 3	6	8	10	12	16	20
P	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.4	≤ 1	123	RPM	13087	6544	4908	3926	3272	2454	1963
						(99-148)	Fz	0.012	0.029	0.049	0.061	0.072	0.083	0.112
							Feed (mm/min)	628	754	963	963	942	817	879
			Slot	1	≤ 0.4	98	RPM	10340	5170	3878	3102	2585	1939	1551
						(78-117)	Fz	0.012	0.029	0.049	0.061	0.072	0.083	0.112
							Feed (mm/min)	496	596	761	761	744	645	695
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	Profile	≤ 0.4	≤ 1	64	RPM	6786	3393	2545	2036	1696	1272	1018
						(51-77)	Fz	0.010	0.024	0.041	0.051	0.060	0.068	0.093
							Feed (mm/min)	261	326	413	413	407	347	380
			Slot	1	≤ 0.4	52	RPM	5493	2747	2060	1648	1373	1030	824
						(41-62)	Fz	0.010	0.024	0.041	0.051	0.060	0.068	0.093
							Feed (mm/min)	211	264	334	334	330	281	308
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 655 Bhn or ≤ 60 HRc	Profile	≤ 0.4	≤ 1	27	RPM	2908	1454	1091	872	727	545	436
						(22-33)	Fz	0.005	0.012	0.021	0.027	0.031	0.036	0.048
							Feed (mm/min)	56	70	93	93	91	79	84
			Slot	1	≤ 0.4	21	RPM	2262	1131	848	679	565	424	339
						(17-26)	Fz	0.005	0.012	0.021	0.027	0.031	0.036	0.048
							Feed (mm/min)	43	54	72	72	71	62	65

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
ipm = Fz x 4 x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Z-Carb-HPR



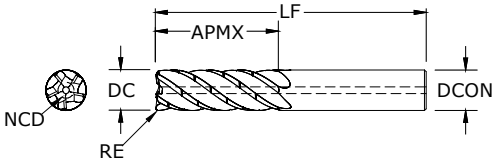
TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

Z5MCR
METRIC SERIES



- An ideal balance of helix, indexing, flute depth, rake and relief
- Variable indexing for chatter supression and patented edge geometry for shearing and strength
- Chatter-free geometry allows deep cutting and high speed machining
- Central coolant hole delivers coolant effectively to the cutting zone enhancing chip removal when pocketing or slotting
- Enhanced corner geometry with tight tolerance corner radii
- Excels at roughing, ramping, high speed machining and finishing in a variety of materials
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

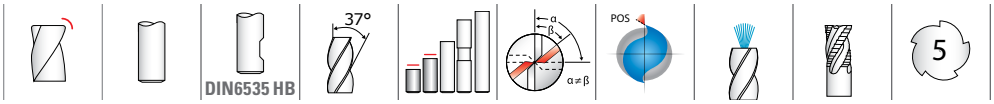
STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS

mm						EDP NO.									
						Ti-NAMITE-A (TA)				TI-NAMITE-M (TM)				MEGACOAT NANO (MN)	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	NON-CUTTING CENTER DIAMETER NCD	STANDARD	CHIPBREAKER	INTERNAL COOLANT	W/FLAT	STANDARD	CHIPBREAKER	INTERNAL COOLANT	W/FLAT	STANDARD	W/FLAT
6,0	9,0	54,0	6,0	0,5	2,11	48000	–	–	–	47000	–	–	–	–	–
6,0	13,0	57,0	6,0	0,3	2,11	48001	–	–	–	47001	–	–	–	47098	–
6,0	13,0	57,0	6,0	0,5	2,11	47120	–	–	–	47002	–	–	–	47099	–
6,0	13,0	57,0	6,0	1,0	2,11	48002	–	–	–	47003	–	–	–	47100	–
6,0	13,0	57,0	6,0	1,5	2,11	48003	–	–	–	47004	–	–	–	47101	–
6,0	18,0	63,0	6,0	0,3	2,11	47480	47481	–	–	47482	47483	–	–	–	–
6,0	18,0	63,0	6,0	0,5	2,11	47484	47485	–	–	47486	47487	–	–	–	–
6,0	18,0	63,0	6,0	1,0	2,11	47488	47489	–	–	47490	47491	–	–	–	–
6,0	18,0	63,0	6,0	1,5	2,11	47492	47493	–	–	47494	47495	–	–	–	–
8,0	11,0	58,0	8,0	0,5	2,79	48004	–	–	–	47005	–	–	–	–	–
8,0	18,0	63,0	8,0	0,5	2,79	47121	–	–	–	47006	–	–	–	47102	–
8,0	18,0	63,0	8,0	1,0	2,79	47122	–	–	–	47007	–	–	–	47103	–
8,0	18,0	63,0	8,0	1,5	2,79	48005	–	–	–	47008	–	–	–	–	–
8,0	18,0	63,0	8,0	2,0	2,79	48006	–	–	–	47009	–	–	–	–	–
8,0	24,0	75,0	8,0	0,5	2,79	47496	47497	–	–	47498	47499	–	–	–	–
8,0	24,0	75,0	8,0	1,0	2,79	47500	47501	–	–	47502	47503	–	–	–	–
8,0	24,0	75,0	8,0	1,5	2,79	47504	47505	–	–	47506	47507	–	–	–	–
8,0	24,0	75,0	8,0	2,0	2,79	47508	47509	–	–	47510	47511	–	–	–	–
10,0	13,0	66,0	10,0	1,0	3,51	48007	–	–	–	47010	–	–	–	47104	–
10,0	22,0	72,0	10,0	0,5	3,51	47123	–	–	–	47011	–	–	–	47105	–
10,0	22,0	72,0	10,0	1,0	3,51	47124	–	–	–	47012	–	–	–	47106	–
10,0	22,0	72,0	10,0	1,5	3,51	48008	–	–	–	47013	–	–	–	–	–
10,0	22,0	72,0	10,0	2,0	3,51	48009	–	–	–	47014	–	–	–	–	–
10,0	22,0	72,0	10,0	2,5	3,51	48010	–	–	–	47015	–	–	–	–	–
10,0	30,0	75,0	10,0	0,5	3,51	47512	47513	–	–	47514	47515	–	–	–	–
10,0	30,0	75,0	10,0	1,0	3,51	47516	47517	–	–	47518	47519	–	–	–	–
10,0	30,0	75,0	10,0	1,5	3,51	47520	47521	–	–	47522	47523	–	–	–	–
10,0	30,0	75,0	10,0	2,0	3,51	47524	47525	–	–	47526	47527	–	–	–	–
10,0	30,0	75,0	10,0	2,5	3,51	47528	47529	–	–	47530	47531	–	–	–	–
12,0	15,0	73,0	12,0	1,0	4,19	48011	–	–	48029	47016	–	–	47024	47107	–

continued on next page

Z-Carb-HPR

CARB-HPR
HIGH PERFORMANCE ROUGHER

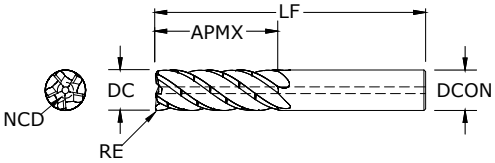


TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050



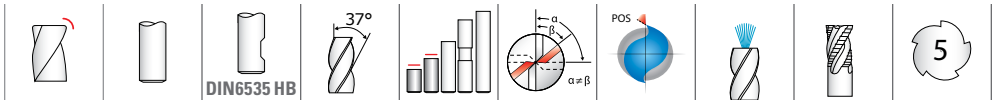
Z5MCR
METRIC SERIES

CONTINUED

mm						EDP NO.									
						Ti-NAMITE-A (TA)				TI-NAMITE-M (TM)				MEGACOAT NANO (MN)	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	NON-CUTTING CENTER DIAMETER NCD	STANDARD	CHIPBREAKER	INTERNAL COOLANT	W/FLAT	STANDARD	CHIPBREAKER	INTERNAL COOLANT	W/FLAT	STANDARD	W/FLAT
12,0	26,0	83,0	12,0	0,5	4,19	47125	–	47160	47128	47017	–	47161	47025	47108	–
12,0	26,0	83,0	12,0	0,76	4,19	47126	–	47162	47129	47018	–	47163	47026	–	–
12,0	26,0	83,0	12,0	1,0	4,19	47127	–	47164	47130	47019	–	47165	47027	47109	–
12,0	26,0	83,0	12,0	1,5	4,19	48012	–	47166	48030	47020	–	47167	47028	–	–
12,0	26,0	83,0	12,0	2,0	4,19	48013	–	47168	48031	47021	–	47169	47029	–	–
12,0	26,0	83,0	12,0	2,5	4,19	48014	–	47170	48032	47022	–	47171	47030	–	–
12,0	26,0	83,0	12,0	3,0	4,19	48015	–	47172	48033	47023	–	47173	47031	–	–
12,0	36,0	83,0	12,0	0,5	4,19	47532	47533	–	–	47534	47535	–	–	–	–
12,0	36,0	83,0	12,0	0,76	4,19	47536	47537	–	–	47538	47539	–	–	–	–
12,0	36,0	83,0	12,0	1,0	4,19	47540	47541	–	–	47542	47543	–	–	–	–
12,0	36,0	83,0	12,0	1,5	4,19	47544	47545	–	–	47546	47547	–	–	–	–
12,0	36,0	83,0	12,0	2,0	4,19	47548	47549	–	–	47550	47551	–	–	–	–
12,0	36,0	83,0	12,0	2,5	4,19	47552	47553	–	–	47554	47555	–	–	–	–
12,0	36,0	83,0	12,0	3,0	4,19	47556	47557	–	–	47558	47559	–	–	–	–
16,0	19,0	82,0	16,0	1,0	5,59	48016	–	48056	48034	47032	–	47046	47039	47110	–
16,0	19,0	82,0	16,0	1,5	5,59	48070	–	–	–	48071	–	–	–	–	–
16,0	35,0	92,0	16,0	1,0	5,59	47131	–	47134	48035	47033	–	47047	47040	47111	–
16,0	35,0	92,0	16,0	1,5	5,59	48017	–	48057	48036	47034	–	47048	47041	–	–
16,0	35,0	92,0	16,0	2,0	5,59	47132	–	47135	48037	47035	–	47049	47042	–	–
16,0	35,0	92,0	16,0	2,5	5,59	48018	–	48058	48038	47036	–	47050	47043	–	–
16,0	35,0	92,0	16,0	3,0	5,59	47133	–	47136	48039	47037	–	47051	47044	–	–
16,0	35,0	92,0	16,0	4,0	5,59	48019	–	48059	48040	47038	–	47052	47045	–	–
16,0	48,0	100,0	16,0	1,0	5,59	47560	47561	–	–	47562	47563	–	–	–	–
16,0	48,0	100,0	16,0	1,5	5,59	47564	47565	–	–	47566	47567	–	–	–	–
16,0	48,0	100,0	16,0	2,0	5,59	47568	47569	–	–	47570	47571	–	–	–	–
16,0	48,0	100,0	16,0	2,5	5,59	47572	47573	–	–	47574	47575	–	–	–	–
16,0	48,0	100,0	16,0	3,0	5,59	47576	47577	–	–	47578	47579	–	–	–	–
16,0	48,0	100,0	16,0	4,0	5,59	47580	47581	–	–	47582	47583	–	–	–	–
20,0	23,0	92,0	20,0	1,0	7,01	48020	–	48060	48041	47053	–	47069	47061	–	–
20,0	43,0	104,0	20,0	1,0	7,01	47137	–	47140	48042	47054	–	47070	47062	–	–

continued on next page

Z-Carb-HPR



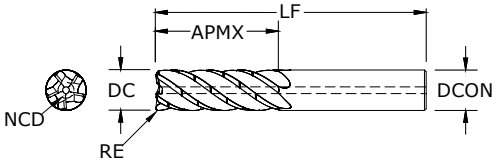
TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

Z5MCR
METRIC SERIES



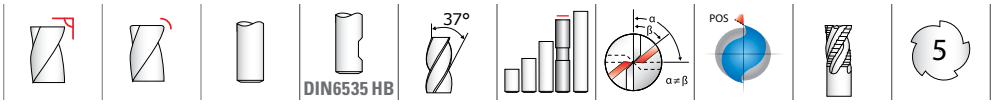
CONTINUED

mm						EDP NO.									
						Ti-NAMITE-A (TA)				TI-NAMITE-M (TM)				MEGACOAT NANO (MN)	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	NON-CUTTING CENTER DIAMETER NCD	STANDARD	CHIPBREAKER	INTERNAL COOLANT	W/FLAT	STANDARD	CHIPBREAKER	INTERNAL COOLANT	W/FLAT	STANDARD	W/FLAT
20,0	43,0	104,0	20,0	1,5	7,01	48021	–	48061	48043	47055	–	47071	47063	–	–
20,0	43,0	104,0	20,0	2,0	7,01	47138	–	47141	48044	47056	–	47072	47064	–	–
20,0	43,0	104,0	20,0	2,5	7,01	48022	–	48062	48045	47057	–	47073	47065	–	–
20,0	43,0	104,0	20,0	3,0	7,01	47139	–	47142	48046	47058	–	47074	47066	–	–
20,0	43,0	104,0	20,0	4,0	7,01	48023	–	48063	48047	47059	–	47075	47067	–	–
20,0	43,0	104,0	20,0	5,0	7,01	48024	–	48064	48048	47060	–	47076	47068	–	–
20,0	60,0	140,0	20,0	1,0	7,01	47584	47585	–	–	47586	47587	–	–	–	–
20,0	60,0	140,0	20,0	1,5	7,01	47588	47589	–	–	47590	47591	–	–	–	–
20,0	60,0	140,0	20,0	2,0	7,01	47592	47593	–	–	47594	47595	–	–	–	–
20,0	60,0	140,0	20,0	2,5	7,01	47596	47597	–	–	47598	47599	–	–	–	–
20,0	60,0	140,0	20,0	3,0	7,01	47600	47601	–	–	47602	47603	–	–	–	–
20,0	60,0	140,0	20,0	4,0	7,01	47604	47605	–	–	47606	47607	–	–	–	–
20,0	60,0	140,0	20,0	5,0	7,01	47608	47609	–	–	47610	47611	–	–	–	–
25,0	28,0	100,0	25,0	1,0	8,76	48025	–	48065	48049	47077	–	47091	47084	–	–
25,0	53,0	121,0	25,0	1,0	8,76	47143	–	47146	48050	47078	–	47092	47085	–	–
25,0	53,0	121,0	25,0	2,0	8,76	47144	–	47147	48051	47079	–	47093	47086	–	–
25,0	53,0	121,0	25,0	2,5	8,76	48026	–	48066	48052	47080	–	47094	47087	–	–
25,0	53,0	121,0	25,0	3,0	8,76	47145	–	47148	48053	47081	–	47095	47088	–	–
25,0	53,0	121,0	25,0	4,0	8,76	48027	–	48067	48054	47082	–	47096	47089	–	–
25,0	53,0	121,0	25,0	5,0	8,76	48028	–	48068	48055	47083	–	47097	47090	–	–
25,0	75,0	170,0	25,0	1,0	8,76	47612	47613	–	–	47614	47615	–	–	–	–
25,0	75,0	170,0	25,0	2,0	8,76	47616	47617	–	–	47618	47619	–	–	–	–
25,0	75,0	170,0	25,0	2,5	8,76	47620	47621	–	–	47622	47623	–	–	–	–
25,0	75,0	170,0	25,0	3,0	8,76	47624	47625	–	–	47626	47627	–	–	–	–
25,0	75,0	170,0	25,0	4,0	8,76	47628	47629	–	–	47630	47631	–	–	–	–
25,0	75,0	170,0	25,0	5,0	8,76	47632	47633	–	–	47634	47635	–	–	–	–

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

Z-Carb-HPR

CARB-HPR
HIGH PERFORMANCE ROUGHER

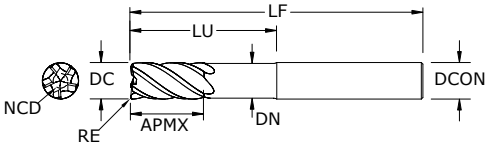


TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050



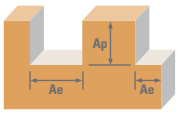
Z5MLCR
METRIC SERIES

mm								EDP NO.			
								Ti-NAMITE-A (TA)		Ti-NAMITE-M (TM)	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	NON-CUTTING CENTER DIAMETER NCD	STANDARD	CHIPBREAKER	STANDARD	CHIPBREAKER
6,0	13,0	75,0	6,0	24,0	5,70	0,3	2,11	47636	47637	47638	47639
6,0	13,0	75,0	6,0	24,0	5,70	0,5	2,11	47640	47641	47642	47643
6,0	13,0	75,0	6,0	24,0	5,70	1,0	2,11	47644	47645	47646	47647
6,0	13,0	75,0	6,0	24,0	5,70	1,5	2,11	47648	47649	47650	47651
8,0	18,0	75,0	8,0	32,0	7,60	0,5	2,79	47652	47653	47654	47655
8,0	18,0	75,0	8,0	32,0	7,60	1,0	2,79	47656	47657	47658	47659
8,0	18,0	75,0	8,0	32,0	7,60	1,5	2,79	47660	47661	47662	47663
8,0	18,0	75,0	8,0	32,0	7,60	2,0	2,79	47664	47665	47666	47667
10,0	22,0	100,0	10,0	40,0	9,50	0,5	3,51	47668	47669	47670	47671
10,0	22,0	100,0	10,0	40,0	9,50	1,0	3,51	47672	47673	47674	47675
10,0	22,0	100,0	10,0	40,0	9,50	1,5	3,51	47676	47677	47678	47679
10,0	22,0	100,0	10,0	40,0	9,50	2,0	3,51	47680	47681	47682	47683
10,0	22,0	100,0	10,0	40,0	9,50	2,5	3,51	47684	47685	47686	47687
12,0	26,0	100,0	12,0	48,0	11,40	0,5	4,19	47688	47689	47690	47691
12,0	26,0	100,0	12,0	48,0	11,40	0,76	4,19	47692	47693	47694	47695
12,0	26,0	100,0	12,0	48,0	11,40	1,0	4,19	47696	47697	47698	47699
12,0	26,0	100,0	12,0	48,0	11,40	1,5	4,19	47700	47701	47702	47703
12,0	26,0	100,0	12,0	48,0	11,40	2,0	4,19	47704	47705	47706	47707
12,0	26,0	100,0	12,0	48,0	11,40	2,5	4,19	47708	47709	47710	47711
12,0	26,0	100,0	12,0	48,0	11,40	3,0	4,19	47712	47713	47714	47715
16,0	35,0	125,0	16,0	64,0	15,20	1,0	5,59	47716	47717	47718	47719
16,0	35,0	125,0	16,0	64,0	15,20	1,5	5,59	47720	47721	47722	47723
16,0	35,0	125,0	16,0	64,0	15,20	2,0	5,59	47724	47725	47726	47727
16,0	35,0	125,0	16,0	64,0	15,20	2,5	5,59	47728	47729	47730	47731
16,0	35,0	125,0	16,0	64,0	15,20	3,0	5,59	47732	47733	47734	47735
16,0	35,0	125,0	16,0	64,0	15,20	4,0	5,59	47736	47737	47738	47739
20,0	43,0	150,0	20,0	80,0	19,00	1,0	7,01	47740	47741	47742	47743
20,0	43,0	150,0	20,0	80,0	19,00	1,5	7,01	47744	47745	47746	47747
20,0	43,0	150,0	20,0	80,0	19,00	2,0	7,01	47748	47749	47750	47751
20,0	43,0	150,0	20,0	80,0	19,00	2,5	7,01	47752	47753	47754	47755
20,0	43,0	150,0	20,0	80,0	19,00	3,0	7,01	47756	47757	47758	47759
20,0	43,0	150,0	20,0	80,0	19,00	4,0	7,01	47760	47761	47762	47763
20,0	43,0	150,0	20,0	80,0	19,00	5,0	7,01	47764	47765	47766	47767
25,0	53,0	170,0	25,0	100,0	23,75	1,0	8,76	47768	47769	47770	47771
25,0	53,0	170,0	25,0	100,0	23,75	2,0	8,76	47772	47773	47774	47775
25,0	53,0	170,0	25,0	100,0	23,75	2,5	8,76	47776	47777	47778	47779
25,0	53,0	170,0	25,0	100,0	23,75	3,0	8,76	47780	47781	47782	47783
25,0	53,0	170,0	25,0	100,0	23,75	4,0	8,76	47784	47785	47786	47787
25,0	53,0	170,0	25,0	100,0	23,75	5,0	8,76	47788	47789	47790	47791

- An ideal balance of helix, indexing, flute depth, rake and relief
- Variable indexing for chatter supression and patented edge geometry for shearing and strength
- Chatter-free geometry allows deep cutting and high speed machining
- Central coolant hole delivers coolant effectively to the cutting zone enhancing chip removal when pocketing or slotting
- Excels at roughing, ramping, high speed machining and finishing in a variety of materials
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

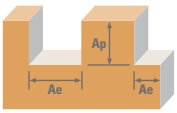
STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS

Z-Carb-HPR



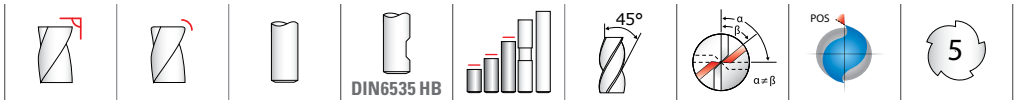
	Series Z5MCR, Z5MLCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20	25
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	HSM[1]	≤ 0.1	≤ APMX	219 (176-263)	RPM	11633	8725	6980	5816	4362	3490	2792
							Fz	0.050	0.083	0.104	0.125	0.146	0.165	0.183
							Feed (mm/min)	2931	3630	3629	3629	3183	2885	2548
			Profile	≤ 0.4	≤ APMX	169 (135-203)	RPM	8967	6725	5380	4484	3363	2690	2152
							Fz	0.029	0.049	0.061	0.074	0.087	0.099	0.108
							Feed (mm/min)	1291	1650	1650	1668	1463	1327	1157
			Slot[2]	1	≤ 1	134 (107-161)	RPM	7109	5332	4265	3555	2666	2133	1706
							Fz	0.029	0.049	0.061	0.074	0.087	0.099	0.108
							Feed (mm/min)	1024	1308	1308	1322	1160	1052	917
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	HSM[1]	≤ 0.1	≤ APMX	125 (100-150)	RPM	6624	4968	3975	3312	2484	1987	1590
							Fz	0.036	0.062	0.077	0.091	0.108	0.123	0.133
							Feed (mm/min)	1192	1537	1537	1510	1335	1219	1053
			Profile	≤ 0.5	≤ APMX	96 (77-115)	RPM	5089	3817	3054	2545	1909	1527	1221
							Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	550	692	692	702	635	570	489
			Slot[2]	1	≤ 1	76 (61-91)	RPM	4039	3029	2424	2020	1515	1212	969
							Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	436	549	549	557	504	452	388
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	HSM[1]	≤ 0.1	≤ APMX	73 (59-88)	RPM	3878	2908	2327	1939	1454	1163	931
							Fz	0.029	0.049	0.061	0.072	0.084	0.096	0.105
							Feed (mm/min)	558	714	713	698	614	558	489
			Profile	≤ 0.4	≤ APMX	56 (45-68)	RPM	2989	2242	1793	1495	1121	897	717
							Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.065
							Feed (mm/min)	251	335	335	323	287	263	233
			Slot[2]	1	≤ 1	44 (35-53)	RPM	2343	1757	1406	1171	879	703	562
							Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.065
							Feed (mm/min)	197	262	262	253	225	206	183
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	HSM[1]	≤ 0.1	≤ APMX	194 (155-232)	RPM	10260	7695	6156	5130	3847	3078	2462
							Fz	0.036	0.062	0.077	0.091	0.108	0.123	0.133
							Feed (mm/min)	1847	2381	2380	2339	2068	1888	1631
			Profile	≤ 0.4	≤ APMX	149 (119-179)	RPM	7917	5938	4750	3958	2969	2375	1900
							Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	855	1077	1077	1092	988	887	760
			Slot[2]	1	≤ 1	119 (95-143)	RPM	6301	4726	3781	3151	2363	1890	1512
							Fz	0.022	0.036	0.045	0.055	0.067	0.075	0.080
							Feed (mm/min)	680	857	857	869	786	706	605
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	HSM[1]	≤ 0.1	≤ APMX	134 (107-161)	RPM	7109	5332	4265	3555	2666	2133	1706
							Fz	0.029	0.049	0.061	0.072	0.084	0.096	0.105
							Feed (mm/min)	1024	1308	1308	1280	1126	1024	896
			Profile	≤ 0.4	≤ APMX	104 (83-124)	RPM	5493	4120	3296	2747	2060	1648	1318
							Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	461	615	615	593	527	483	412
			Slot[2]	1	≤ 1	82 (66-99)	RPM	4362	3272	2617	2181	1636	1309	1047
							Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	366	489	489	471	419	384	327
	STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325 Bhn or ≤ 35 HRc	HSM[1]	≤ 0.1	≤ APMX	125 (100-150)	RPM	6624	4968	3975	3312	2484	1987	1590
							Fz	0.029	0.049	0.061	0.072	0.084	0.096	0.105
							Feed (mm/min)	954	1219	1219	1192	1049	954	835
			Profile	≤ 0.4	≤ APMX	94 (76-113)	RPM	5009	3756	3005	2504	1878	1503	1202
							Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	421	561	561	541	481	441	376
			Slot[2]	1	≤ 1	76 (61-91)	RPM	4039	3029	2424	2020	1515	1212	969
							Fz	0.017	0.030	0.037	0.043	0.051	0.059	0.063
							Feed (mm/min)	339	452	452	436	388	355	303

Z-Carb-HPR



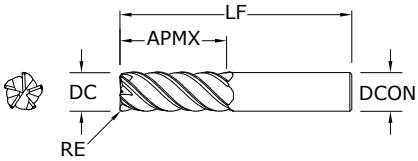
	Series Z5MCR, Z5MLCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20	25
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	HSM[1]	≤ 0.1	≤ APMX	175 (140-210)	RPM	9290	6968	5574	4645	3484	2787	2230
							Fz	0.046	0.075	0.093	0.113	0.133	0.149	0.165
							Feed (mm/min)	2118	2602	2601	2620	2319	2081	1840
			Profile	≤ 0.4	≤ APMX	136 (109-163)	RPM	7190	5392	4314	3595	2696	2157	1726
							Fz	0.026	0.045	0.056	0.067	0.079	0.091	0.098
							Feed (mm/min)	949	1208	1208	1208	1070	978	841
			Slot[2]	1	≤ 1	108 (87-130)	RPM	5736	4302	3441	2868	2151	1721	1377
							Fz	0.026	0.045	0.056	0.067	0.079	0.091	0.098
							Feed (mm/min)	757	964	964	964	853	780	671
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc	HSM[1]	≤ 0.1	≤ APMX	134 (107-161)	RPM	7109	5332	4265	3555	2666	2133	1706
							Fz	0.034	0.055	0.069	0.084	0.100	0.112	0.123
							Feed (mm/min)	1194	1479	1479	1493	1331	1194	1045
			Profile	≤ 0.4	≤ APMX	104 (83-124)	RPM	5493	4120	3296	2747	2060	1648	1318
							Fz	0.020	0.034	0.043	0.050	0.059	0.067	0.073
							Feed (mm/min)	554	703	703	692	606	549	478
			Slot[2]	1	≤ 1	82 (66-99)	RPM	4362	3272	2617	2181	1636	1309	1047
							Fz	0.020	0.034	0.043	0.050	0.059	0.067	0.073
							Feed (mm/min)	440	558	558	550	482	436	380
S	SUPER ALLOYS (NICKEL , COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	HSM[1]	≤ 0.1	≤ APMX	35 (28-42)	RPM	1858	1394	1115	929	697	557	446
							Fz	0.026	0.045	0.056	0.067	0.079	0.091	0.098
							Feed (mm/min)	245	312	312	312	276	253	217
			Profile	≤ 0.4	≤ APMX	24 (20-29)	RPM	1293	969	776	646	485	388	310
							Fz	0.016	0.027	0.034	0.041	0.048	0.054	0.060
							Feed (mm/min)	105	132	132	132	116	105	92
			Slot[2]	1	≤ 1	20 (16-24)	RPM	1050	788	630	525	394	315	252
							Fz	0.016	0.027	0.034	0.041	0.048	0.054	0.060
							Feed (mm/min)	86	108	108	107	94	86	75
	SUPER ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	HSM[1]	≤ 0.1	≤ APMX	30 (24-37)	RPM	1616	1212	969	808	606	485	388
							Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
							Feed (mm/min)	155	194	194	194	171	155	136
			Profile	≤ 0.4	≤ APMX	19 (15-23)	RPM	1002	751	601	501	376	301	240
							Fz	0.012	0.019	0.024	0.029	0.033	0.037	0.043
							Feed (mm/min)	58	72	72	72	63	56	51
			Slot[2]	1	≤ 1	15 (12-18)	RPM	808	606	485	404	303	242	194
							Fz	0.012	0.019	0.024	0.029	0.033	0.037	0.043
							Feed (mm/min)	47	58	58	58	50	45	41
	TITANIUM ALLOYS Pure Ttanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	HSM[1]	≤ 0.1	≤ APMX	85 (68-102)	RPM	4524	3393	2714	2262	1696	1357	1086
							Fz	0.031	0.053	0.067	0.079	0.092	0.107	0.115
							Feed (mm/min)	706	905	905	896	782	724	624
			Profile	≤ 0.4	≤ APMX	66 (52-79)	RPM	3474	2605	2084	1737	1303	1042	834
							Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
							Feed (mm/min)	333	417	417	417	367	333	292
			Slot[2]	1	≤ 1	52 (41-62)	RPM	2747	2060	1648	1373	1030	824	659
							Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
							Feed (mm/min)	264	330	330	330	290	264	231
	TITANIUM ALLOYS (DIFFICULT) Ti10Al2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 440 Bhn or ≤ 47 HRc	HSM[1]	≤ 0.1	≤ APMX	47 (38-57)	RPM	2504	1878	1503	1252	939	751	601
							Fz	0.031	0.053	0.067	0.079	0.092	0.107	0.115
							Feed (mm/min)	391	501	501	496	433	401	346
			Profile	≤ 0.4	≤ APMX	23 (18-27)	RPM	1212	909	727	606	454	364	291
							Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
							Feed (mm/min)	116	145	145	145	128	116	102
			Slot[2]	1	≤ 1	18 (15-22)	RPM	969	727	582	485	364	291	233
							Fz	0.019	0.032	0.040	0.048	0.056	0.064	0.070
							Feed (mm/min)	93	116	116	116	102	93	81

Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)
rpm = Vc x 1000 / (DC x 3.14)
ipm = Fz x 5 x rpm
1 HSM method strongly recommended, particularly when using 4 x DC tools
2 reduce Ap to ≤.5 x DC when slotting with 4 x DC tools
ramp up to 5 degrees using slotting speed and feed rates. Do not plunge.
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)



55M • 55MCR

METRIC SERIES



- Unequal indexing, high helix and an ideal rake and relief combination for unmatched finishing capability
- The choice when peak finish quality is the requirement
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

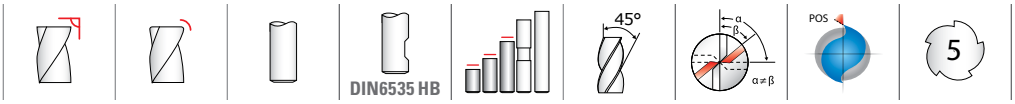
mm					EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-A (AlTiN)	Ti-NAMITE-A (AlTiN) W/FLAT
6,0	12,0	50,0	6,0	–	42606	–
6,0	12,0	50,0	6,0	0,5	42660	–
6,0	19,0	63,0	6,0	–	42607	–
6,0	19,0	63,0	6,0	0,25	42661	–
6,0	19,0	63,0	6,0	0,5	42662	–
6,0	19,0	63,0	6,0	1,0	42663	–
6,0	19,0	63,0	6,0	1,5	42664	–
6,0	25,0	75,0	6,0	–	42608	–
6,0	25,0	75,0	6,0	0,5	42665	–
8,0	12,0	50,0	8,0	–	42609	–
8,0	12,0	50,0	8,0	0,5	42666	–
8,0	20,0	63,0	8,0	–	42610	–
8,0	20,0	63,0	8,0	0,5	42667	–
8,0	20,0	63,0	8,0	1,0	42668	–
8,0	20,0	63,0	8,0	1,5	42669	–
8,0	20,0	63,0	8,0	2,0	42670	–
8,0	25,0	75,0	8,0	–	42611	–
8,0	25,0	75,0	8,0	0,5	42671	–
10,0	16,0	50,0	10,0	–	42612	–
10,0	16,0	50,0	10,0	0,5	42672	–
10,0	22,0	75,0	10,0	–	42622	42613
10,0	22,0	75,0	10,0	0,5	42673	–
10,0	22,0	75,0	10,0	1,0	42674	–
10,0	22,0	75,0	10,0	1,5	42675	–
10,0	22,0	75,0	10,0	2,0	42676	–
10,0	22,0	75,0	10,0	2,5	42677	–
10,0	38,0	100,0	10,0	–	42614	–
10,0	38,0	100,0	10,0	0,5	42678	–
12,0	19,0	63,0	12,0	–	42615	–
12,0	19,0	63,0	12,0	0,5	42679	–
12,0	25,0	75,0	12,0	–	42616	42623
12,0	25,0	75,0	12,0	0,5	42680	–
12,0	25,0	75,0	12,0	1,0	42681	–
12,0	25,0	75,0	12,0	1,5	42682	–
12,0	25,0	75,0	12,0	2,0	42683	–
12,0	25,0	75,0	12,0	2,5	42684	–

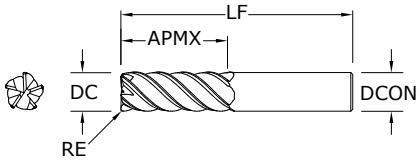
continued on next page

TOLERANCES (mm)

DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS





55M • 55MCR

METRIC SERIES

CONTINUED

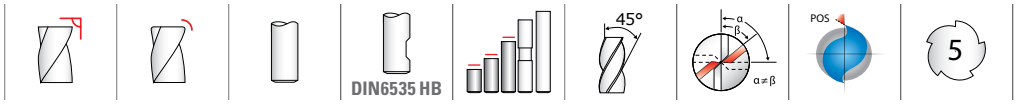
TOLERANCES (mm)

DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

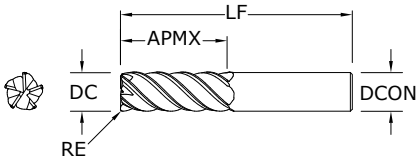
mm					EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-A (AlTiN)	Ti-NAMITE-A (AlTiN) W/FLAT
12,0	25,0	75,0	12,0	3,0	42685	–
12,0	50,0	100,0	12,0	–	42617	–
12,0	50,0	100,0	12,0	0,5	42686	–
12,0	50,0	100,0	12,0	3,0	42630	–
12,0	50,0	100,0	12,0	4,0	42631	–
16,0	32,0	89,0	16,0	–	42618	42624
16,0	32,0	89,0	16,0	1,0	42687	–
16,0	32,0	89,0	16,0	1,5	42688	–
16,0	32,0	89,0	16,0	2,0	42689	–
16,0	32,0	89,0	16,0	2,5	42690	–
16,0	32,0	89,0	16,0	3,0	42691	–
16,0	32,0	89,0	16,0	4,0	42692	–
16,0	50,0	100,0	16,0	–	42626	–
16,0	50,0	100,0	16,0	2,0	42656	–
16,0	50,0	100,0	16,0	2,5	42657	–
16,0	50,0	100,0	16,0	3,0	42658	–
16,0	50,0	100,0	16,0	4,0	42659	–
16,0	50,0	100,0	16,0	5,0	42628	–
16,0	75,0	150,0	16,0	–	42619	–
16,0	75,0	150,0	16,0	1,0	42693	–
16,0	75,0	150,0	16,0	3,0	42632	–
16,0	75,0	150,0	16,0	4,0	42633	–
20,0	38,0	100,0	20,0	–	42620	42625
20,0	38,0	100,0	20,0	1,0	42694	–
20,0	38,0	100,0	20,0	1,5	42695	–
20,0	38,0	100,0	20,0	2,0	42696	–
20,0	38,0	100,0	20,0	2,5	42697	–
20,0	38,0	100,0	20,0	3,0	42698	–
20,0	38,0	100,0	20,0	4,0	42699	–
20,0	38,0	100,0	20,0	5,0	42700	–
20,0	38,0	100,0	20,0	6,0	42648	–
20,0	50,0	100,0	20,0	–	42627	–
20,0	50,0	100,0	20,0	2,0	42649	–
20,0	50,0	100,0	20,0	2,5	42650	–

continued on next page



55M • 55MCR

METRIC SERIES



- Unequal indexing, high helix and an ideal rake and relief combination for unmatched finishing capability
- The choice when peak finish quality is the requirement
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

mm					EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-A (AlTiN)	Ti-NAMITE-A (AlTiN) W/FLAT
20,0	50,0	100,0	20,0	3,0	42651	–
20,0	50,0	100,0	20,0	4,0	42652	–
20,0	50,0	100,0	20,0	5,0	42653	–
20,0	50,0	100,0	20,0	6,0	42654	–
20,0	75,0	150,0	20,0	–	42621	–
20,0	75,0	150,0	20,0	1,0	42701	–
20,0	75,0	150,0	20,0	2,0	42702	–
20,0	75,0	150,0	20,0	3,0	42703	–
20,0	75,0	150,0	20,0	4,0	42704	–
20,0	75,0	150,0	20,0	5,0	42705	–
20,0	75,0	150,0	20,0	6,0	42655	–

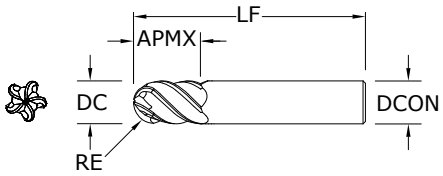
TOLERANCES (mm)

DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

55MB

METRIC SERIES



- Unequal indexing, high helix and an ideal rake and relief combination for unmatched finishing capability
- The choice when peak finish quality is the requirement
- Ball end design ideal for finishing operations in complex workpieces
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

mm				EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	Ti-NAMITE-A (AlTiN)
6,0	13,0	57,0	6,0	42750
8,0	19,0	63,0	8,0	42751
10,0	22,0	72,0	10,0	42752
12,0	26,0	83,0	12,0	42753
16,0	32,0	92,0	16,0	42754
20,0	38,0	104,0	20,0	42755

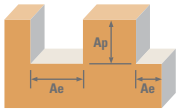
RE = 1/2 Cutting Diameter (DC)

TOLERANCES (mm)

DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

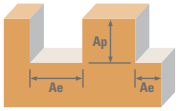
V-Carb



	Series 55M, 55MCR, 55MB Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.25	≤ 1.5	117	RPM	6220	4665	3732	3110	2333	1866
						(94-141)	Fz	0.022	0.036	0.061	0.070	0.072	0.085
							Feed (mm/min)	672	846	1145	1082	836	796
			HSM	≤ 0.05	≤ 2	192	RPM	10179	7634	6107	5089	3817	3054
						(154-230)	Fz	0.043	0.073	0.123	0.137	0.141	0.154
							Feed (mm/min)	2198	2769	3746	3481	2687	2345
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.25	≤ 1.5	99	RPM	5251	3938	3151	2626	1969	1575
						(79-119)	Fz	0.017	0.028	0.045	0.053	0.054	0.064
							Feed (mm/min)	441	546	571	693	529	504
			HSM	≤ 0.05	≤ 2	162	RPM	8563	6422	5138	4282	3211	2569
						(129-194)	Fz	0.034	0.055	0.091	0.103	0.105	0.128
							Feed (mm/min)	1438	1781	2329	2209	1685	1644
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.25	≤ 1.5	53	RPM	2827	2121	1696	1414	1060	848
						(43-64)	Fz	0.012	0.021	0.035	0.038	0.044	0.048
							Feed (mm/min)	170	226	294	271	231	204
			HSM	≤ 0.05	≤ 2	88	RPM	4686	3514	2811	2343	1757	1406
						(71-106)	Fz	0.024	0.041	0.067	0.077	0.084	0.093
							Feed (mm/min)	562	712	937	900	742	656
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.25	≤ 1.5	113	RPM	5978	4484	3587	2989	2242	1793
						(90-135)	Fz	0.017	0.028	0.045	0.053	0.059	0.064
							Feed (mm/min)	502	622	813	789	660	574
			HSM	≤ 0.05	≤ 2	171	RPM	9048	6786	5429	4524	3393	2714
						(137-205)	Fz	0.034	0.055	0.091	0.103	0.113	0.128
							Feed (mm/min)	1520	1882	2461	2334	1911	1737
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.25	≤ 1.5	78	RPM	4120	3090	2472	2060	1545	1236
						(62-93)	Fz	0.014	0.026	0.043	0.048	0.054	0.061
							Feed (mm/min)	297	396	527	494	415	379
			HSM	≤ 0.05	≤ 2	117	RPM	6220	4665	3732	3110	2333	1866
						(94-141)	Fz	0.031	0.051	0.085	0.096	0.105	0.120
							Feed (mm/min)	970	1194	1592	1493	1224	1120
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ 0.25	≤ 1.5	72	RPM	3797	2848	2278	1898	1424	1139
						(57-86)	Fz	0.014	0.021	0.037	0.041	0.046	0.051
							Feed (mm/min)	273	304	425	387	328	289
			HSM	≤ 0.05	≤ 2	108	RPM	5736	4302	3441	2868	2151	1721
						(87-130)	Fz	0.026	0.045	0.075	0.082	0.092	0.104
							Feed (mm/min)	757	964	1285	1170	991	895

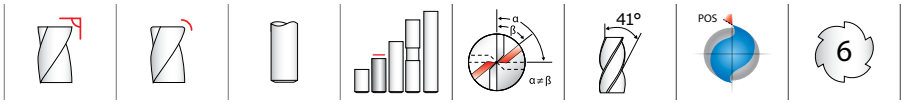
continued on next page

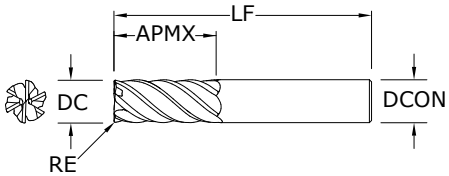
V-Carb



	Series 55M, 55MCR, 55MB Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile	≤ 0.25	≤ 1.5	143	RPM	7594	5695	4556	3797	2848	2278
						(115-172)	Fz	0.022	0.036	0.061	0.070	0.077	0.085
							Feed (mm/min)	820	1033	1397	1321	1093	972
			HSM	≤ 0.05	≤ 2	215	RPM	11391	8543	6834	5695	4271	3417
						(172-258)	Fz	0.043	0.073	0.123	0.137	0.151	0.171
							Feed (mm/min)	2460	3099	4192	3895	3226	2916
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc	Profile	≤ 0.25	≤ 1.5	110	RPM	5816	4362	3490	2908	2181	1745
						(88-132)	Fz	0.017	0.028	0.045	0.053	0.059	0.064
							Feed (mm/min)	489	605	791	768	642	558
			HSM	≤ 0.05	≤ 2	165	RPM	8725	6544	5235	4362	3272	2617
						(132-198)	Fz	0.034	0.055	0.091	0.103	0.113	0.128
							Feed (mm/min)	1466	1815	2373	2251	1843	1675
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.25	≤ 1.5	21	RPM	1131	848	679	565	424	339
						(17-26)	Fz	0.014	0.021	0.037	0.041	0.046	0.051
							Feed (mm/min)	81	90	127	115	98	86
			HSM	≤ 0.05	≤ 2	33	RPM	1729	1297	1037	864	648	519
						(26-39)	Fz	0.026	0.045	0.075	0.082	0.092	0.104
							Feed (mm/min)	228	290	387	353	299	270
	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.25	≤ 1.5	17	RPM	889	666	533	444	333	267
						(13-20)	Fz	0.010	0.017	0.027	0.031	0.036	0.040
							Feed (mm/min)	43	57	71	69	60	53
			HSM	≤ 0.05	≤ 2	26	RPM	1373	1030	824	687	515	412
						(21-31)	Fz	0.019	0.032	0.056	0.062	0.069	0.077
							Feed (mm/min)	132	165	231	214	178	159
S	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.25	≤ 1.5	72	RPM	3797	2848	2278	1898	1424	1139
						(57-86)	Fz	0.014	0.026	0.043	0.048	0.054	0.061
							Feed (mm/min)	273	365	486	456	383	349
			HSM	≤ 0.05	≤ 2	119	RPM	6301	4726	3781	3151	2363	1890
						(95-143)	Fz	0.031	0.051	0.085	0.096	0.105	0.120
							Feed (mm/min)	983	1210	1613	1512	1240	1134
	TITANIUM ALLOYS (DIFFICULT) Ti10V2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 420 Bhn or ≤ 45 HRc	Profile	≤ 0.25	≤ 1.5	26	RPM	1373	1030	824	687	515	412
						(21-31)	Fz	0.014	0.026	0.043	0.048	0.054	0.061
							Feed (mm/min)	99	132	176	165	138	126
			HSM	≤ 0.05	≤ 2	43	RPM	2262	1696	1357	1131	848	679
						(34-51)	Fz	0.031	0.051	0.085	0.096	0.108	0.120
							Feed (mm/min)	353	434	579	543	456	407

Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 5 x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
reduce Ap to 1 x DC (maximum) when profile milling with long or extra long flute length tools
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)





51M • 51MCR

METRIC SERIES

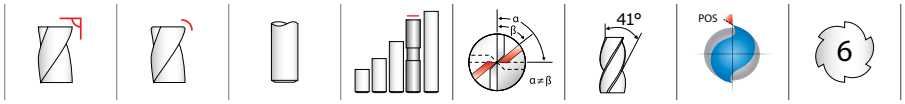
TOLERANCES (mm)

DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

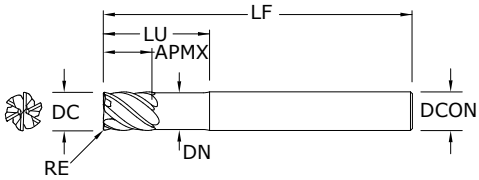
mm					EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-X (TX)
6,0	19,0	63,0	6,0	–	45100
6,0	19,0	63,0	6,0	0,5	45112
6,0	19,0	63,0	6,0	1,0	45170
6,0	19,0	63,0	6,0	1,5	45171
8,0	20,0	63,0	8,0	–	45101
8,0	20,0	63,0	8,0	0,5	45113
8,0	20,0	63,0	8,0	1,0	45114
8,0	20,0	63,0	8,0	1,2	45150
8,0	20,0	63,0	8,0	1,5	45172
8,0	20,0	63,0	8,0	2,0	45173
10,0	22,0	75,0	10,0	–	45102
10,0	22,0	75,0	10,0	0,5	45174
10,0	22,0	75,0	10,0	1,0	45115
10,0	22,0	75,0	10,0	1,5	45116
10,0	22,0	75,0	10,0	2,0	45117
10,0	22,0	75,0	10,0	2,5	45175
12,0	26,0	83,0	12,0	–	45103
12,0	26,0	83,0	12,0	0,5	45176
12,0	26,0	83,0	12,0	0,76	45177
12,0	26,0	83,0	12,0	1,0	45118
12,0	26,0	83,0	12,0	1,5	45119
12,0	26,0	83,0	12,0	2,0	45120
12,0	26,0	83,0	12,0	2,5	45178
12,0	26,0	83,0	12,0	3,0	45179
16,0	32,0	92,0	16,0	–	45104
16,0	32,0	92,0	16,0	1,0	45121
16,0	32,0	92,0	16,0	1,5	45122
16,0	32,0	92,0	16,0	2,0	45123
16,0	32,0	92,0	16,0	2,5	45180
16,0	32,0	92,0	16,0	3,0	45181
16,0	32,0	92,0	16,0	4,0	45182
20,0	38,0	104,0	20,0	–	45105
20,0	38,0	104,0	20,0	1,0	45124
20,0	38,0	104,0	20,0	1,5	45125
20,0	38,0	104,0	20,0	2,0	45126
20,0	38,0	104,0	20,0	2,5	45183
20,0	38,0	104,0	20,0	3,0	45184
20,0	38,0	104,0	20,0	4,0	45185
20,0	38,0	104,0	20,0	5,0	45186

- Engineered for High Speed Milling using Trochoidal and Peel Milling techniques
- Eccentric relief provides superior strength and smoother surface finish
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)



51ML • 51MLC

METRIC SERIES



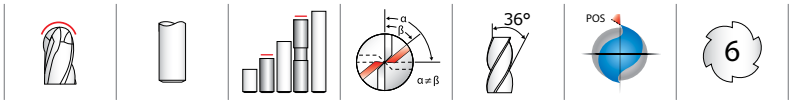
- Engineered for High Speed Milling using Trochoidal and Peel Milling techniques
- Eccentric relief provides superior strength and smoother surface finish
- Necked design with blended diameter transitions provide clearance to reach
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

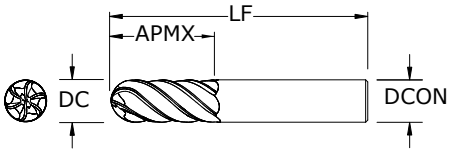
			mm				EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	Ti-NAMITE-X (TX)
6,0	8,0	75,0	6,0	32,0	5,69	–	45106
6,0	8,0	75,0	6,0	32,0	5,69	0,5	45127
6,0	8,0	75,0	6,0	32,0	5,69	1,0	45187
6,0	8,0	75,0	6,0	32,0	5,69	1,5	45188
8,0	10,0	75,0	8,0	32,0	7,59	–	45107
8,0	10,0	75,0	8,0	32,0	7,59	0,5	45128
8,0	10,0	75,0	8,0	32,0	7,59	1,0	45129
8,0	10,0	75,0	8,0	32,0	7,59	1,5	45189
8,0	10,0	75,0	8,0	32,0	7,59	2,0	45190
10,0	12,0	100,0	10,0	40,0	9,50	–	45108
10,0	12,0	100,0	10,0	40,0	9,50	0,5	45191
10,0	12,0	100,0	10,0	40,0	9,50	1,0	45130
10,0	12,0	100,0	10,0	40,0	9,50	1,5	45131
10,0	12,0	100,0	10,0	40,0	9,50	2,0	45132
10,0	12,0	100,0	10,0	40,0	9,50	2,5	45192
12,0	15,0	100,0	12,0	48,0	11,38	–	45109
12,0	15,0	100,0	12,0	48,0	11,38	0,5	45193
12,0	15,0	100,0	12,0	48,0	11,38	0,76	45194
12,0	15,0	100,0	12,0	48,0	11,38	1,0	45133
12,0	15,0	100,0	12,0	48,0	11,38	1,5	45134
12,0	15,0	100,0	12,0	48,0	11,38	2,0	45135
12,0	15,0	100,0	12,0	48,0	11,38	2,5	45195
12,0	15,0	100,0	12,0	48,0	11,38	3,0	45196
16,0	20,0	115,0	16,0	65,0	15,19	–	45110
16,0	20,0	115,0	16,0	65,0	15,19	1,0	45136
16,0	20,0	115,0	16,0	65,0	15,19	1,5	45137
16,0	20,0	115,0	16,0	65,0	15,19	2,0	45138
16,0	20,0	115,0	16,0	65,0	15,19	2,5	45197
16,0	20,0	115,0	16,0	65,0	15,19	3,0	45198
16,0	20,0	115,0	16,0	65,0	15,19	4,0	45199
20,0	24,0	150,0	20,0	80,0	19,00	–	45111
20,0	24,0	150,0	20,0	80,0	19,00	1,0	45139
20,0	24,0	150,0	20,0	80,0	19,00	1,5	45140
20,0	24,0	150,0	20,0	80,0	19,00	2,0	45141
20,0	24,0	150,0	20,0	80,0	19,00	2,5	45200
20,0	24,0	150,0	20,0	80,0	19,00	3,0	45201
20,0	24,0	150,0	20,0	80,0	19,00	4,0	45202
20,0	24,0	150,0	20,0	80,0	19,00	5,0	45203

TOLERANCES (mm)

DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS





51MB
METRIC SERIES

TOLERANCES (mm)

6,0–10,0 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,025

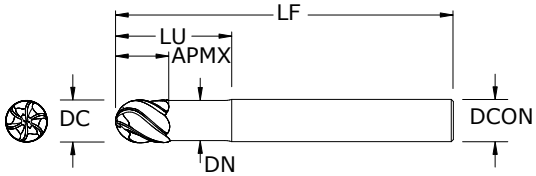
12,0–20,0 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,025

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

mm				EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	Ti-NAMITE-X (TX)
6,0	19,0	63,0	6,0	45204
8,0	20,0	63,0	8,0	45206
10,0	22,0	75,0	10,0	45208
12,0	26,0	83,0	12,0	45210
16,0	32,0	92,0	16,0	45212
20,0	38,0	104,0	20,0	45214

RE=1/2 Cutting Diameter (DC)

- Engineered for High Speed Milling using Trochoidal and Peel Milling techniques
- Faceted relief provides superior strength and smoother surface finish
- Ball end design ideal for finishing operations in complex workpieces
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)



51MLB
METRIC SERIES

TOLERANCES (mm)

6,0–10,0 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,025

12,0–20,0 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,025

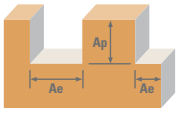
- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

mm						EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	Ti-NAMITE-X (TX)
6,0	8,0	75,0	6,0	32,0	5,68	45205
8,0	10,0	75,0	8,0	32,0	7,58	45207
10,0	12,0	100,0	10,0	40,0	9,49	45209
12,0	15,0	100,0	12,0	48,0	11,37	45211
16,0	20,0	115,0	16,0	65,0	15,18	45213
20,0	24,0	150,0	20,0	80,0	18,99	45215

RE=1/2 Cutting Diameter (DC)

- Engineered for High Speed Milling using Trochoidal and Peel Milling techniques
- Faceted relief provides superior strength and smoother surface finish
- Ball end design ideal for finishing operations in complex workpieces
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

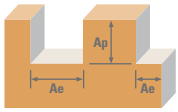
T-Carb



	Series 51M, 51MCR, 51ML, 51MLC, 51MB, 51MLB Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.1	≤ 1	219	RPM	11633	8725	6980	5816	4362	3490
						(176-263)	Fz	0.048	0.075	0.093	0.120	0.141	0.163
							Feed (mm/min)	3350	3909	3909	4188	3685	3406
			HSM	≤ 0.05	≤ 2	279	RPM	14784	11088	8870	7392	5544	4435
						(223-335)	Fz	0.067	0.113	0.141	0.168	0.197	0.227
							Feed (mm/min)	5960	7523	7522	7450	6557	6032
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.1	≤ 1	149	RPM	7917	5938	4750	3958	2969	2375
						(119-179)	Fz	0.036	0.062	0.077	0.091	0.108	0.123
							Feed (mm/min)	1710	2204	2204	2166	1915	1748
			HSM	≤ 0.05	≤ 2	189	RPM	10017	7513	6010	5009	3756	3005
						(151-227)	Fz	0.050	0.083	0.104	0.125	0.146	0.165
							Feed (mm/min)	3029	3751	3750	3750	3289	2981
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.1	≤ 1	73	RPM	3878	2908	2327	1939	1454	1163
						(59-88)	Fz	0.029	0.049	0.061	0.072	0.087	0.099
							Feed (mm/min)	670	856	856	838	759	689
			HSM	≤ 0.05	≤ 2	93	RPM	4928	3696	2957	2464	1848	1478
						(74-112)	Fz	0.041	0.068	0.085	0.101	0.118	0.133
							Feed (mm/min)	1206	1514	1514	1490	1306	1183
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.1	≤ 1	155	RPM	8240	6180	4944	4120	3090	2472
						(140-171)	Fz	0.036	0.060	0.075	0.091	0.105	0.120
							Feed (mm/min)	1780	2215	2215	2254	1946	1780
			HSM	≤ 0.05	≤ 2	198	RPM	10502	7877	6301	5251	3938	3151
						(178-218)	Fz	0.050	0.081	0.101	0.122	0.143	0.163
							Feed (mm/min)	3176	3832	3831	3856	3387	3075
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.1	≤ 1	107	RPM	5655	4241	3393	2827	2121	1696
						(96-117)	Fz	0.029	0.049	0.061	0.072	0.084	0.096
							Feed (mm/min)	977	1249	1249	1221	1075	977
			HSM	≤ 0.05	≤ 2	137	RPM	7271	5453	4362	3635	2726	2181
						(123-151)	Fz	0.041	0.068	0.085	0.101	0.118	0.133
							Feed (mm/min)	1780	2234	2234	2198	1926	1745
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ 0.1	≤ 1	99	RPM	5251	3938	3151	2626	1969	1575
						(89-109)	Fz	0.029	0.049	0.061	0.072	0.084	0.096
							Feed (mm/min)	907	1160	1159	1134	998	907
			HSM	≤ 0.05	≤ 2	125	RPM	6624	4968	3975	3312	2484	1987
						(112-137)	Fz	0.041	0.068	0.085	0.101	0.118	0.133
							Feed (mm/min)	1621	2035	2035	2003	1755	1590

continued on next page

T-Carb



	Series 51M, 51MCR, 51ML, 51MLC, 51MB, 51MLB Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile	≤ 0.25	≤ 1.5	575	RPM	9290	6968	5574	4645	3484	2787
						(460-690)	Fz	0.043	0.075	0.093	0.108	0.128	0.147
							Feed (mm/min)	2408	3122	3122	3010	2675	2453
			HSM	≤ 0.05	≤ 2	730	RPM	11795	8846	7077	5897	4423	3538
						(584-876)	Fz	0.060	0.100	0.125	0.154	0.179	0.203
							Feed (mm/min)	4246	5322	5322	5434	4755	4303
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc	Profile	≤ 0.25	≤ 1.5	430	RPM	6947	5211	4168	3474	2605	2084
						(344-516)	Fz	0.043	0.075	0.093	0.108	0.128	0.147
							Feed (mm/min)	1801	2335	2334	2251	2001	1834
			HSM	≤ 0.05	≤ 2	545	RPM	8806	6604	5283	4403	3302	2642
						(436-654)	Fz	0.060	0.100	0.125	0.154	0.179	0.203
							Feed (mm/min)	3170	3974	3973	4057	3550	3212
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.1	≤ 1	32	RPM	1696	1272	1018	848	636	509
						(26-38)	Fz	0.034	0.058	0.072	0.086	0.100	0.115
							Feed (mm/min)	342	440	440	440	381	350
			HSM	≤ 0.05	≤ 2	40	RPM	2100	1575	1260	1050	788	630
						(32-48)	Fz	0.038	0.077	0.096	0.115	0.136	0.155
							Feed (mm/min)	484	726	726	726	641	585
	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.1	≤ 1	24	RPM	1293	969	776	646	485	388
						(20-29)	Fz	0.024	0.038	0.048	0.060	0.069	0.077
							Feed (mm/min)	186	223	223	233	201	180
			HSM	≤ 0.05	≤ 2	30	RPM	1616	1212	969	808	606	485
						(24-37)	Fz	0.031	0.053	0.067	0.082	0.095	0.109
							Feed (mm/min)	302	388	388	395	344	318
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.1	≤ 1	85	RPM	4524	3393	2714	2262	1696	1357
						(68-102)	Fz	0.024	0.038	0.048	0.060	0.069	0.077
							Feed (mm/min)	651	782	782	814	704	630
			HSM	≤ 0.05	≤ 2	108	RPM	5736	4302	3441	2868	2151	1721
						(87-130)	Fz	0.031	0.053	0.067	0.082	0.095	0.109
							Feed (mm/min)	1074	1377	1377	1404	1222	1129
	TITANIUM ALLOYS (DIFFICULT) Ti10V2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 420 Bhn or ≤ 45 HRc	Profile	≤ 0.1	≤ 1	47	RPM	2504	1878	1503	1252	939	751
						(38-57)	Fz	0.024	0.038	0.048	0.060	0.069	0.077
							Feed (mm/min)	361	433	433	451	389	349
			HSM	≤ 0.05	≤ 2	61	RPM	3231	2424	1939	1616	1212	969
						(49-73)	Fz	0.031	0.053	0.067	0.082	0.095	0.109
							Feed (mm/min)	605	776	776	791	689	636

Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 6 x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

H-Carb

H-CARB

TOLERANCES (mm)

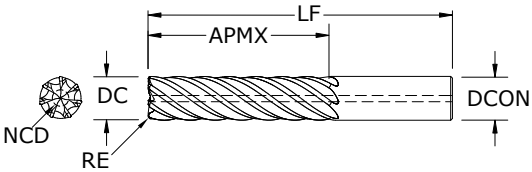
6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000 / -0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000 / -0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000 / -0,050

77M • 77MCR

METRIC SERIES



- Specializes in deep axial trochoidal and high-speed milling applications
- Optimized core improves rigidity, chip flow and reduces deflection
- Chip Breaker design breaks up chips from the long flute length allowing for better chip flow and evacuation in deep pocketing operations
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS

mm						Ti-NAMITE-A (TA)				Ti-NAMITE-M (TM)			
						EXTERNAL COOLANT		INTERNAL COOLANT		EXTERNAL COOLANT		INTERNAL COOLANT	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	NON-CUTTING CENTER DIAMETER NCD	EDP NO.	WITH CHIP BREAKER EDP NO.	EDP NO.	WITH CHIP BREAKER EDP NO.	EDP NO.	WITH CHIP BREAKER EDP NO.	EDP NO.	CHIP BREAKER EDP NO.
6,0	15,0	63,0	6,0	–	2,03	74300	74302	–	–	74301	74303	–	–
6,0	15,0	63,0	6,0	0,3	2,03	74304	74306	–	–	74305	74307	–	–
6,0	15,0	63,0	6,0	0,5	2,03	74308	74310	–	–	74309	74311	–	–
6,0	18,0	63,0	6,0	–	2,03	74316	74318	–	–	74317	74319	–	–
6,0	18,0	63,0	6,0	0,3	2,03	74320	74322	–	–	74321	74323	–	–
6,0	18,0	63,0	6,0	0,5	2,03	74324	74326	–	–	74325	74327	–	–
6,0	24,0	75,0	6,0	–	2,03	74332	74334	–	–	74333	74335	–	–
6,0	24,0	75,0	6,0	0,3	2,03	74336	74338	–	–	74337	74339	–	–
6,0	24,0	75,0	6,0	0,5	2,03	74340	74342	–	–	74341	74343	–	–
8,0	20,0	75,0	8,0	–	2,71	74348	74350	–	–	74349	74351	–	–
8,0	20,0	75,0	8,0	0,5	2,71	74352	74354	–	–	74353	74355	–	–
8,0	20,0	75,0	8,0	1,0	2,71	74356	74358	–	–	74357	74359	–	–
8,0	20,0	75,0	8,0	2,0	2,71	74360	74362	–	–	74361	74363	–	–
8,0	24,0	75,0	8,0	–	2,71	74364	74366	–	–	74365	74367	–	–
8,0	24,0	75,0	8,0	0,5	2,71	74368	74370	–	–	74369	74371	–	–
8,0	24,0	75,0	8,0	1,0	2,71	74372	74374	–	–	74373	74375	–	–
8,0	24,0	75,0	8,0	2,0	2,71	74376	74378	–	–	74377	74379	–	–
8,0	32,0	85,0	8,0	–	2,71	74380	74382	–	–	74381	74383	–	–
8,0	32,0	85,0	8,0	0,5	2,71	74384	74386	–	–	74385	74387	–	–
8,0	32,0	85,0	8,0	1,0	2,71	74388	74390	–	–	74389	74391	–	–
8,0	32,0	85,0	8,0	2,0	2,71	74392	74394	–	–	74393	74395	–	–
10,0	25,0	75,0	10,0	–	3,38	74396	74398	–	–	74397	74399	–	–
10,0	25,0	75,0	10,0	0,5	3,38	74400	74402	–	–	74401	74403	–	–
10,0	25,0	75,0	10,0	1,0	3,38	74404	74406	–	–	74405	74407	–	–
10,0	30,0	80,0	10,0	–	3,38	74408	74410	–	–	74409	74411	–	–
10,0	30,0	80,0	10,0	0,5	3,38	74412	74414	–	–	74413	74415	–	–
10,0	30,0	80,0	10,0	1,0	3,38	74416	74418	–	–	74417	74419	–	–
10,0	40,0	100,0	10,0	–	3,38	74420	74422	–	–	74421	74423	–	–
10,0	40,0	100,0	10,0	0,5	3,38	74424	74426	–	–	74425	74427	–	–
10,0	40,0	100,0	10,0	1,0	3,38	74428	74430	–	–	74429	74431	–	–
12,0	30,0	83,0	12,0	–	4,06	74432	74434	74672	74674	74433	74435	74673	74675
12,0	30,0	83,0	12,0	0,5	4,06	74436	74438	74676	74678	74437	74439	74677	74679
12,0	30,0	83,0	12,0	1,0	4,06	74440	74442	74680	74682	74441	74443	74681	74683
12,0	30,0	83,0	12,0	2,0	4,06	74600	74601	74684	74686	74602	74603	74685	74687

continued on next page

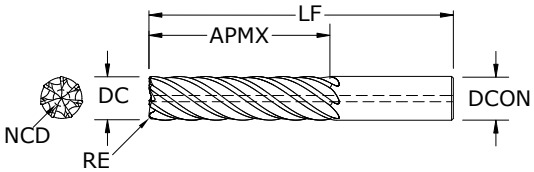
H-CARB

TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000 / -0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000 / -0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000 / -0,050



77M • 77MCR
METRIC SERIES

CONTINUED

mm						Ti-NAMITE-A (TA)				Ti-NAMITE-M (TM)			
						EXTERNAL COOLANT		INTERNAL COOLANT		EXTERNAL COOLANT		INTERNAL COOLANT	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	NON-CUTTING CENTER DIAMETER NCD	EDP NO.	WITH CHIP BREAKER EDP NO.	EDP NO.	WITH CHIP BREAKER EDP NO.	EDP NO.	WITH CHIP BREAKER EDP NO.	EDP NO.	CHIP BREAKER EDP NO.
12,0	30,0	83,0	12,0	3,0	4,06	74604	74605	74688	74690	74606	74607	74689	74691
12,0	36,0	83,0	12,0	–	4,06	74444	74446	74692	74694	74445	74447	74693	74695
12,0	36,0	83,0	12,0	0,5	4,06	74448	74450	74696	74698	74449	74451	74697	74699
12,0	36,0	83,0	12,0	1,0	4,06	74452	74454	74700	74702	74453	74455	74701	74703
12,0	36,0	83,0	12,0	2,0	4,06	74608	74609	74704	74706	74610	74611	74705	74707
12,0	36,0	83,0	12,0	3,0	4,06	74612	74613	74708	74710	74614	74615	74709	74711
12,0	48,0	100,0	12,0	–	4,06	74456	74458	74712	74714	74457	74459	74713	74715
12,0	48,0	100,0	12,0	0,5	4,06	74460	74462	74716	74718	74461	74463	74717	74719
12,0	48,0	100,0	12,0	1,0	4,06	74464	74466	74720	74722	74465	74467	74721	74723
12,0	48,0	100,0	12,0	2,0	4,06	74616	74617	74724	74726	74618	74619	74725	74727
12,0	48,0	100,0	12,0	3,0	4,06	74620	74621	74728	74730	74622	74623	74729	74731
16,0	40,0	92,0	16,0	–	5,41	74468	74470	74732	74734	74469	74471	74733	74735
16,0	40,0	92,0	16,0	0,5	5,41	74472	74474	74736	74738	74473	74475	74737	74739
16,0	40,0	92,0	16,0	1,0	5,41	74476	74478	74740	74742	74477	74479	74741	74743
16,0	40,0	92,0	16,0	2,0	5,41	74624	74625	74744	74746	74626	74627	74745	74747
16,0	40,0	92,0	16,0	3,0	5,41	74628	74629	74748	74750	74630	74631	74749	74751
16,0	48,0	100,0	16,0	–	5,41	74480	74482	74752	74754	74481	74483	74753	74755
16,0	48,0	100,0	16,0	0,5	5,41	74484	74486	74756	74758	74485	74487	74757	74759
16,0	48,0	100,0	16,0	1,0	5,41	74488	74490	74760	74762	74489	74491	74761	74763
16,0	48,0	100,0	16,0	2,0	5,41	74632	74633	74764	74766	74634	74635	74765	74767
16,0	48,0	100,0	16,0	3,0	5,41	74636	74637	74768	74770	74638	74639	74769	74771
16,0	64,0	115,0	16,0	–	5,41	74492	74494	74772	74774	74493	74495	74773	74775
16,0	64,0	115,0	16,0	0,5	5,41	74496	74498	74776	74778	74497	74499	74777	74779
16,0	64,0	115,0	16,0	1,0	5,41	74500	74502	74780	74782	74501	74503	74781	74783
16,0	64,0	115,0	16,0	2,0	5,41	74640	74641	74784	74786	74642	74643	74785	74787
16,0	64,0	115,0	16,0	3,0	5,41	74644	74645	74788	74790	74646	74647	74789	74791
20,0	50,0	100,0	20,0	–	6,76	74504	74506	74792	74794	74505	74507	74793	74795
20,0	50,0	100,0	20,0	0,5	6,76	74508	74510	74796	74798	74509	74511	74797	74799
20,0	50,0	100,0	20,0	1,0	6,76	74512	74514	74800	74802	74513	74515	74801	74803
20,0	50,0	100,0	20,0	2,0	6,76	74516	74518	74804	74806	74517	74519	74805	74807
20,0	50,0	100,0	20,0	3,0	6,76	74648	74649	74808	74810	74650	74651	74809	74811
20,0	50,0	100,0	20,0	4,0	6,76	74652	74653	74812	74814	74654	74655	74813	74815
20,0	60,0	115,0	20,0	–	6,76	74520	74522	74816	74818	74521	74523	74817	74819
20,0	60,0	115,0	20,0	0,5	6,76	74524	74526	74820	74822	74525	74527	74821	74823

continued on next page

STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS

H-Carb

H-CARB

TOLERANCES (mm)

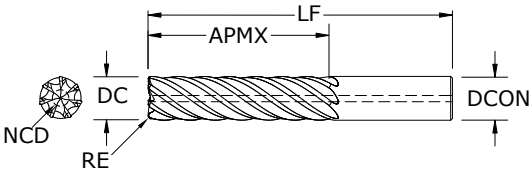
6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000 / -0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000 / -0,050

>10–25 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000 / -0,050

77M • 77MCR

METRIC SERIES

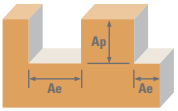


CONTINUED

mm						Ti-NAMITE-A (TA)				Ti-NAMITE-M (TM)			
						EXTERNAL COOLANT		INTERNAL COOLANT		EXTERNAL COOLANT		INTERNAL COOLANT	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	NON-CUTTING CENTER DIAMETER NCD	EDP NO.	WITH CHIP BREAKER EDP NO.	EDP NO.	WITH CHIP BREAKER EDP NO.	EDP NO.	WITH CHIP BREAKER EDP NO.	EDP NO.	CHIP BREAKER EDP NO.
20,0	60,0	115,0	20,0	1,0	6,76	74528	74530	74824	74826	74529	74531	74825	74827
20,0	60,0	115,0	20,0	2,0	6,76	74532	74534	74828	74830	74533	74535	74829	74831
20,0	60,0	115,0	20,0	3,0	6,76	74656	74657	74832	74834	74658	74659	74833	74835
20,0	60,0	115,0	20,0	4,0	6,76	74660	74661	74836	74838	74662	74663	74837	74839
20,0	80,0	140,0	20,0	–	6,76	74536	74538	74840	74842	74537	74539	74841	74843
20,0	80,0	140,0	20,0	0,5	6,76	74540	74542	74844	74846	74541	74543	74845	74847
20,0	80,0	140,0	20,0	1,0	6,76	74544	74546	74848	74850	74545	74547	74849	74851
20,0	80,0	140,0	20,0	2,0	6,76	74548	74550	74852	74854	74549	74551	74853	74855
20,0	80,0	140,0	20,0	3,0	6,76	74664	74665	74856	74858	74666	74667	74857	74859
20,0	80,0	140,0	20,0	4,0	6,76	74668	74669	74860	74862	74670	74671	74861	74863
25,0	63,0	135,0	25,0	–	8,45	74552	74554	74864	74866	74553	74555	74865	74867
25,0	63,0	135,0	25,0	1,0	8,45	74556	74558	74868	74870	74557	74559	74869	74871
25,0	63,0	135,0	25,0	2,0	8,45	74560	74562	74872	74874	74561	74563	74873	74875
25,0	63,0	135,0	25,0	3,0	8,45	74564	74566	74876	74878	74565	74567	74877	74879
25,0	75,0	150,0	25,0	–	8,45	74568	74570	74880	74882	74569	74571	74881	74883
25,0	75,0	150,0	25,0	1,0	8,45	74572	74574	74884	74886	74573	74575	74885	74887
25,0	75,0	150,0	25,0	2,0	8,45	74576	74578	74888	74890	74577	74579	74889	74891
25,0	75,0	150,0	25,0	3,0	8,45	74580	74582	74892	74894	74581	74583	74893	74895
25,0	100,0	170,0	25,0	–	8,45	74584	74586	74896	74898	74585	74587	74897	74899
25,0	100,0	170,0	25,0	1,0	8,45	74588	74590	74900	74902	74589	74591	74901	74903
25,0	100,0	170,0	25,0	2,0	8,45	74592	74594	74904	74906	74593	74595	74905	74907
25,0	100,0	170,0	25,0	3,0	8,45	74596	74598	74908	74910	74597	74599	74909	74911

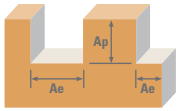
STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS

H-Carb



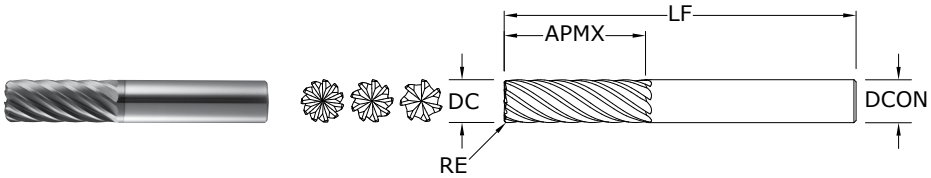
	Series 77M, 77MCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20	25
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	HSM	2.5xD		284 (227-341)	RPM	12208	9156	7325	6104	4578	3662	2930
				≤ 0.2	≤ APMX		Fz	0.0413	0.0411	0.0640	0.0711	0.0889	0.1013	0.1050
							Feed (mm/min)	3529	2634	3282	3038	2849	2597	2154
			HSM	3xD		257 (206-308)	Fz	0.0347	0.0461	0.0717	0.0797	0.0996	0.1135	0.1176
				≤ 0.15	≤ APMX		Feed (mm/min)	2965	2955	3676	3405	3192	2910	2412
			HSM	4xD		230 (184-276)	Fz	0.0362	0.0480	0.0747	0.0830	0.1037	0.1182	0.0919
				≤ 0.1	≤ APMX		Feed (mm/min)	3094	3076	3830	3546	3323	3030	1885
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc					RPM	8068	6051	4841	4034	3025	2420	1936
			HSM	2.5xD		132 (106-159)	Fz	0.0213	0.0285	0.0512	0.0610	0.0711	0.0827	0.0875
				≤ 0.2	≤ APMX		Feed (mm/min)	1203	1207	1735	1723	1506	1401	1186
			HSM	3xD		138 (111-166)	Fz	0.0239	0.0319	0.0574	0.0683	0.0797	0.0926	0.0980
				≤ 0.15	≤ APMX		Feed (mm/min)	1350	1351	1945	1929	1688	1569	1328
			HSM	4xD		152 (122-182)	Fz	0.0249	0.0332	0.0597	0.0711	0.0830	0.0964	0.1021
				≤ 0.1	≤ APMX		Feed (mm/min)	1406	1406	2023	2008	1758	1633	1384
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc					RPM	4087	3065	2452	2044	1533	1226	981
			HSM	2.5xD		83 (66-100)	Fz	0.0140	0.0183	0.0294	0.0356	0.0457	0.0560	0.0625
				≤ 0.2	≤ APMX		Feed (mm/min)	401	393	505	509	490	481	429
			HSM	3xD		86 (69-103)	Fz	0.0157	0.0205	0.0330	0.0398	0.0512	0.0627	0.0700
				≤ 0.15	≤ APMX		Feed (mm/min)	449	440	566	569	549	538	481
			HSM	4xD		77 (62-92)	Fz	0.0163	0.0213	0.0344	0.0415	0.0533	0.0653	0.0729
				≤ 0.1	≤ APMX		Feed (mm/min)	466	457	590	594	572	560	501
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc					RPM	9660	7245	5796	4830	3623	2898	2318
			HSM	2.5xD		197 (158-236)	Fz	0.0216	0.0285	0.0448	0.0533	0.0635	0.0747	0.0800
				≤ 0.2	≤ APMX		Feed (mm/min)	1461	1445	1818	1803	1610	1515	1298
			HSM	3xD		204 (163-245)	Fz	0.0242	0.0319	0.0502	0.0598	0.0711	0.0837	0.0896
				≤ 0.15	≤ APMX		Feed (mm/min)	1636	1618	2037	2022	1803	1698	1454
			HSM	4xD		182 (146-218)	Fz	0.0252	0.0332	0.0523	0.0622	0.0741	0.0871	0.0933
				≤ 0.1	≤ APMX		Feed (mm/min)	1704	1684	2122	2104	1879	1767	1514
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc					RPM	6369	4777	3822	3185	2389	1911	1529
			HSM	2.5xD		130 (104-156)	Fz	0.0168	0.0221	0.0371	0.0432	0.0584	0.0693	0.0750
				≤ 0.2	≤ APMX		Feed (mm/min)	749	739	993	963	976	927	803
			HSM	3xD		134 (107-161)	Fz	0.0188	0.0248	0.0416	0.0484	0.0655	0.0777	0.0840
				≤ 0.15	≤ APMX		Feed (mm/min)	838	829	1113	1079	1095	1039	899
			HSM	4xD		120 (96-144)	Fz	0.0196	0.0258	0.0433	0.0504	0.0682	0.0809	0.0875
				≤ 0.1	≤ APMX		Feed (mm/min)	874	863	1158	1124	1140	1082	936
	STAINLESS STEELS (PH) 13-8 PH, 15-5PH, 17-4 PH, CUSTOM 450	≤ 325 Bhn or ≤ 35 HRc					RPM	6104	4578	3662	3052	2289	1831	1465
			HSM	2.5xD		124 (99-149)	Fz	0.0168	0.0221	0.0371	0.0432	0.0584	0.0693	0.0750
				≤ 0.2	≤ APMX		Feed (mm/min)	718	708	952	923	936	888	769
			HSM	3xD		129 (103-155)	Fz	0.0188	0.0248	0.0416	0.0484	0.0655	0.0777	0.0840
				≤ 0.15	≤ APMX		Feed (mm/min)	803	795	1066	1034	1050	996	861
			HSM	4xD		115 (92-138)	Fz	0.0196	0.0258	0.0433	0.0504	0.0682	0.0809	0.0875
				≤ 0.1	≤ APMX		Feed (mm/min)	837	827	1110	1077	1093	1037	897

H-Carb



	Series 77M, 77MCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20	25
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	HSM	2.5xD		218 (174-262)	RPM	10722	8041	6433	5361	4021	3217	2573
				≤ 0.2	≤ APMX		Fz	0.0239	0.0315	0.0474	0.0559	0.0762	0.0880	0.0925
							Feed (mm/min)	1794	1773	2135	2098	2145	1981	1666
			HSM	3xD		225 (180-270)	Fz	0.0268	0.0353	0.0531	0.0626	0.0854	0.0986	0.1036
				≤ 0.15	≤ APMX		Feed (mm/min)	2011	1987	2391	2349	2404	2220	1866
			HSM	4xD		202 (162-242)	Fz	0.0279	0.0368	0.0553	0.0652	0.0889	0.1027	0.1079
				≤ 0.1	≤ APMX		Feed (mm/min)	2094	2071	2490	2447	2502	2312	1944
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc					RPM	6369	4777	3822	3185	2389	1911	1529
			HSM	2.5xD		130 (104-156)	Fz	0.0168	0.0221	0.0371	0.0432	0.0584	0.0693	0.0750
				≤ 0.2	≤ APMX		Feed (mm/min)	749	739	993	963	976	927	803
			HSM	3xD		134 (107-161)	Fz	0.0188	0.0248	0.0416	0.0484	0.0655	0.0777	0.0840
				≤ 0.15	≤ APMX		Feed (mm/min)	838	829	1113	1079	1095	1039	899
			HSM	4xD		120 (96-144)	Fz	0.0196	0.0258	0.0433	0.0504	0.0682	0.0809	0.0875
				≤ 0.1	≤ APMX		Feed (mm/min)	874	863	1158	1124	1140	1082	936
S	HIGH TEMP ALLOYS (NICKEL , COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc					RPM	2017	1513	1210	1008	756	605	484
			HSM	2.5xD		41 (33-49)	Fz	0.0140	0.0183	0.0294	0.0356	0.0457	0.0560	0.0625
				≤ 0.2	≤ APMX		Feed (mm/min)	198	194	249	251	242	237	212
			HSM	3xD		43 (34-52)	Fz	0.0157	0.0205	0.0330	0.0398	0.0512	0.0627	0.0700
				≤ 0.15	≤ APMX		Feed (mm/min)	222	217	280	281	271	266	237
			HSM	4xD		38 (30-46)	Fz	0.0163	0.0213	0.0344	0.0415	0.0533	0.0653	0.0729
				≤ 0.1	≤ APMX		Feed (mm/min)	230	226	291	293	282	277	247
	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc					RPM	1274	955	764	637	478	382	306
			HSM	2.5xD		26 (21-31)	Fz	0.0114	0.0152	0.0243	0.0305	0.0381	0.0480	0.0550
				≤ 0.2	≤ APMX		Feed (mm/min)	102	102	130	136	127	128	118
			HSM	3xD		27 (22-32)	Fz	0.0128	0.0171	0.0273	0.0342	0.0427	0.0538	0.0616
				≤ 0.15	≤ APMX		Feed (mm/min)	114	114	146	152	143	144	132
			HSM	4xD		24 (19-29)	Fz	0.0133	0.0178	0.0284	0.0356	0.0445	0.0560	0.0642
				≤ 0.1	≤ APMX		Feed (mm/min)	119	119	152	159	149	150	137
	TITANIUM ALLOYS Pure Ttanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc					RPM	4352	3264	2611	2176	1632	1306	1045
			HSM	2.5xD		88 (70-106)	Fz	0.0191	0.0254	0.0397	0.0483	0.0635	0.0747	0.0800
				≤ 0.2	≤ APMX		Feed (mm/min)	582	580	726	736	725	683	585
			HSM	3xD		91 (73-109)	Fz	0.0213	0.0285	0.0445	0.0541	0.0711	0.0837	0.0896
				≤ 0.15	≤ APMX		Feed (mm/min)	649	651	813	824	812	765	655
			HSM	4xD		82 (66-98)	Fz	0.0222	0.0296	0.0463	0.0563	0.0741	0.0871	0.0933
				≤ 0.1	≤ APMX		Feed (mm/min)	676	676	846	858	847	796	682
	TITANIUM ALLOYS (DIFFICULT) Ti10V2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 420 Bhn or ≤ 45 HRc					RPM	2548	1911	1529	1274	955	764	611
			HSM	2.5xD		52 (42-62)	Fz	0.0163	0.0254	0.0397	0.0483	0.0635	0.0747	0.0800
				≤ 0.2	≤ APMX		Feed (mm/min)	291	340	425	431	425	400	342
			HSM	3xD		54 (43-65)	Fz	0.0182	0.0285	0.0445	0.0541	0.0711	0.0837	0.0896
				≤ 0.15	≤ APMX		Feed (mm/min)	325	381	476	482	476	448	384
			HSM	4xD		48 (38-58)	Fz	0.0190	0.0296	0.0463	0.0563	0.0741	0.0871	0.0933
				≤ 0.1	≤ APMX		Feed (mm/min)	339	396	495	502	496	466	399

Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 7 x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)



66M • 66MCR

METRIC SERIES

TOLERANCES (mm)

DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

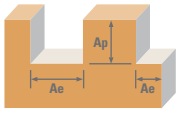
- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

mm							EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	NON-CUTTING CENTER DIAMETER NCD	NO. OF FLUTES	Ti-NAMITE-X (TX)
6,0	19,0	63,0	6,0	–	1,63	7	46620
6,0	19,0	63,0	8,0	0,5	1,63	7	46627
6,0	19,0	63,0	6,0	1,0	1,63	7	46628
8,0	20,0	63,0	8,0	–	1,78	7	46621
8,0	20,0	63,0	8,0	0,5	1,78	7	46629
8,0	20,0	63,0	8,0	1,0	1,78	7	46630
8,0	20,0	63,0	8,0	1,5	1,78	7	46631
10,0	22,0	75,0	10,0	–	2,03	7	46622
10,0	22,0	75,0	10,0	0,5	2,03	7	46632
10,0	22,0	75,0	10,0	1,0	2,03	7	46633
10,0	22,0	75,0	10,0	1,5	2,03	7	46634
10,0	22,0	75,0	10,0	2,0	2,03	7	46635
12,0	26,0	83,0	12,0	–	3,45	9	46623
12,0	26,0	83,0	12,0	1,0	3,45	9	46636
12,0	26,0	83,0	12,0	1,5	3,45	9	46637
12,0	26,0	83,0	12,0	2,0	3,45	9	46638
12,0	26,0	83,0	12,0	2,5	3,45	9	46639
12,0	26,0	83,0	12,0	3,0	3,45	9	46640
16,0	32,0	92,0	16,0	–	2,92	9	46624
16,0	32,0	92,0	16,0	1,0	2,92	9	46641
16,0	32,0	92,0	16,0	1,5	2,92	9	46642
16,0	32,0	92,0	16,0	2,0	2,92	9	46643
16,0	32,0	92,0	16,0	2,5	2,92	9	46644
16,0	32,0	92,0	16,0	3,0	2,92	9	46645
16,0	32,0	92,0	16,0	4,0	2,92	9	46646
20,0	38,0	104,0	20,0	–	4,57	11	46625
20,0	38,0	104,0	20,0	1,0	4,57	11	46647
20,0	38,0	104,0	20,0	1,5	4,57	11	46648
20,0	38,0	104,0	20,0	2,0	4,57	11	46649
20,0	38,0	104,0	20,0	2,5	4,57	11	46650
20,0	38,0	104,0	20,0	3,0	4,57	11	46651
20,0	38,0	104,0	20,0	4,0	4,57	11	46652
20,0	38,0	104,0	20,0	5,0	4,57	11	46653
25,0	38,0	104,0	25,0	–	7,49	11	46626
25,0	38,0	104,0	25,0	1,0	7,49	11	46654
25,0	38,0	104,0	25,0	1,5	7,49	11	46655
25,0	38,0	104,0	25,0	2,0	7,49	11	46656
25,0	38,0	104,0	25,0	2,5	7,49	11	46657
25,0	38,0	104,0	25,0	3,0	7,49	11	46658
25,0	38,0	104,0	25,0	4,0	7,49	11	46659
25,0	38,0	104,0	25,0	5,0	7,49	11	46660

Neck Option Available

- Heavy core and rigid design allow for straight walls
- High flute count design results in smoother cutting performance and enhanced tool life in precise finishing applications
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

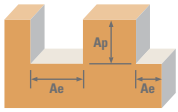
Multi-Carb



	Series 66M, 66MCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20	25
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.05	≤ 1	194	RPM	10260	7695	6156	5130	3847	3078	2462
						(155-232)	Fz	0.029	0.047	0.059	0.072	0.095	0.101	0.105
							Feed (mm/min)	2068	2528	2528	3324	3280	3431	2844
			Finish	≤ 0.02	≤ 2	232	RPM	12312	9234	7387	6156	4617	3693	2955
						(186-279)	Fz	0.023	0.038	0.047	0.058	0.076	0.081	0.084
							Feed (mm/min)	1985	2427	2427	3191	3149	3294	2730
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.05	≤ 1	110	RPM	5816	4362	3490	2908	2181	1745	1396
						(88-132)	Fz	0.022	0.036	0.045	0.055	0.074	0.080	0.080
							Feed (mm/min)	879	1108	1107	1445	1457	1536	1229
			Finish	≤ 0.02	≤ 2	132	RPM	6980	5235	4188	3490	2617	2094	1675
						(105-158)	Fz	0.017	0.029	0.036	0.044	0.059	0.064	0.064
							Feed (mm/min)	844	1063	1063	1387	1399	1474	1179
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.05	≤ 1	88	RPM	4686	3514	2811	2343	1757	1406	1125
						(71-106)	Fz	0.014	0.026	0.032	0.038	0.051	0.056	0.055
							Feed (mm/min)	472	630	630	810	810	866	680
			Finish	≤ 0.02	≤ 2	106	RPM	5623	4217	3374	2811	2108	1687	1349
						(85-127)	Fz	0.012	0.020	0.026	0.031	0.041	0.045	0.044
							Feed (mm/min)	453	605	605	777	777	831	653
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.05	≤ 1	171	RPM	9048	6786	5429	4524	3393	2714	2171
						(137-205)	Fz	0.022	0.036	0.045	0.055	0.074	0.080	0.080
							Feed (mm/min)	1368	1723	1723	2247	2267	2389	1911
			Finish	≤ 0.02	≤ 2	137	RPM	7238	5429	4343	3619	2714	2171	1737
						(109-164)	Fz	0.017	0.029	0.036	0.044	0.059	0.064	0.064
							Feed (mm/min)	875	1103	1103	1438	1451	1529	1223
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.05	≤ 1	117	RPM	6220	4665	3732	3110	2333	1866	1493
						(94-141)	Fz	0.017	0.030	0.037	0.043	0.059	0.064	0.065
							Feed (mm/min)	731	975	975	1209	1236	1314	1067
			Finish	≤ 0.02	≤ 2	141	RPM	7465	5598	4479	3732	2799	2239	1791
						(113-169)	Fz	0.013	0.024	0.030	0.035	0.047	0.051	0.052
							Feed (mm/min)	702	17	936	1161	1187	1261	1025
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ 0.05	≤ 1	108	RPM	5736	4302	3441	2868	2151	1721	1377
						(87-130)	Fz	0.017	0.030	0.037	0.043	0.059	0.064	0.065
							Feed (mm/min)	674	899	899	1115	1140	1211	984
			Finish	≤ 0.02	≤ 2	130	RPM	6883	5162	4130	3441	2581	2065	1652
						(104-156)	Fz	0.013	0.024	0.030	0.035	0.047	0.051	0.052
							Feed (mm/min)	647	863	863	1070	1094	1163	945

continued on next page

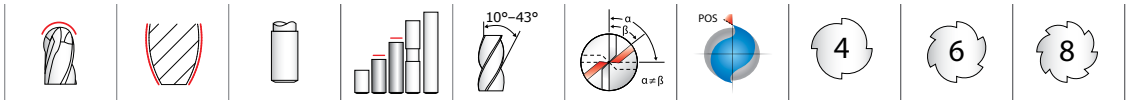
Multi-Carb

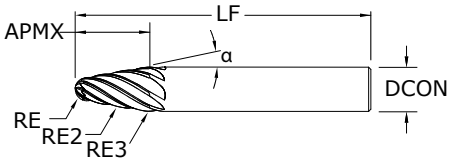


	Series 66M, 66MCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20	25
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile	≤ 0.05	≤ 1	215	RPM	11391	8543	6834	5695	4271	3417	2734
						(172-258)	Fz	0.029	0.047	0.059	0.072	0.095	0.101	0.105
							Feed (mm/min)	2296	2807	2807	3690	3641	3809	3158
			Finish	≤ 0.02	≤ 2	258	RPM	13669	10252	8201	6834	5126	4101	3281
						(206-309)	Fz	0.023	0.038	0.047	0.058	0.076	0.081	0.084
							Feed (mm/min)	2204	2695	2694	3543	3496	3657	3031
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc	Profile	≤ 0.05	≤ 1	165	RPM	8725	6544	5235	4362	3272	2617	2094
						(132-198)	Fz	0.022	0.036	0.045	0.055	0.074	0.080	0.080
							Feed (mm/min)	1319	1661	1661	2167	2186	2303	1843
			Finish	≤ 0.02	≤ 2	198	RPM	10470	7852	6282	5235	3926	3141	2513
						(158-237)	Fz	0.017	0.029	0.036	0.044	0.059	0.064	0.064
							Feed (mm/min)	1266	1595	1595	2080	2099	2211	1769
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.05	≤ 1	32	RPM	1696	1272	1018	848	636	509	407
						(26-38)	Fz	0.017	0.030	0.037	0.043	0.059	0.064	0.065
							Feed (mm/min)	199	266	213	330	337	358	291
			Finish	≤ 0.02	≤ 2	38	RPM	2036	1527	1221	1018	763	611	489
						(31-46)	Fz	0.013	0.024	0.030	0.035	0.047	0.051	0.052
							Feed (mm/min)	192	255	255	317	324	344	279
	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.05	≤ 1	26	RPM	1373	1030	824	687	515	412	330
						(21-31)	Fz	0.012	0.019	0.024	0.026	0.036	0.040	0.040
							Feed (mm/min)	115	138	138	163	166	181	145
			Finish	≤ 0.02	≤ 2	31	RPM	1648	1236	989	824	618	494	396
						(25-37)	Fz	0.010	0.015	0.019	0.021	0.029	0.032	0.032
							Feed (mm/min)	111	133	133	157	159	174	139
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.05	≤ 1	119	RPM	6301	4726	3781	3151	2363	1890	1512
						(95-143)	Fz	0.019	0.032	0.040	0.050	0.067	0.072	0.073
							Feed (mm/min)	847	1059	1059	1429	1415	1497	1206
			Finish	≤ 0.02	≤ 2	143	RPM	7561	5671	4537	3781	2836	2268	1815
						(114-171)	Fz	0.015	0.026	0.032	0.040	0.053	0.058	0.058
							Feed (mm/min)	813	1016	1016	1372	1359	1437	1158
	TITANIUM ALLOYS (DIFFICULT) Ti10V2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 420 Bhn or ≤ 45 HRc	Profile	≤ 0.05	≤ 1	43	RPM	2262	1696	1357	1131	848	679	543
						(34-51)	Fz	0.019	0.032	0.040	0.050	0.067	0.072	0.073
							Feed (mm/min)	304	380	380	513	508	537	433
			Finish	≤ 0.02	≤ 2	51	RPM	2714	2036	1629	1357	1018	814	651
						(41-61)	Fz	0.015	0.026	0.032	0.040	0.053	0.058	0.058
							Feed (mm/min)	292	365	365	492	488	516	416

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x number of flutes x rpm
reduce speed and feed for materials harder than listed
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Multi-Carb





67B

METRIC SERIES

- Designed to significantly improve traditional ball end applications
- Highly efficient at finishing and semi-finishing profiling
- Main application areas include profiling and pocket milling
- Especially suited to machining deep pockets and hard-to-reach areas without using long-reach tools
- Their versatility also allows for machining profiles and blends with one tool
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

mm								EDP NO.
SHANK DIAMETER DCON	LENGTH OF CUT APMX	OVERALL LENGTH LF	CENTERLINE ANGLE α	TIP RADIUS RE	TAPERED RADIUS RE2	BLENDED RADIUS RE3	NO. OF FLUTES	Ti-NAMITE-H (TH)
6,0	9,5	58,0	17.5°	1,0	250,0	3,0	4	45700
6,0	8,0	58,0	17.5°	1,5	250,0	3,0	4	45701
8,0	10,5	80,0	20.0°	1,5	250,0	4,0	4	45702
8,0	9,5	80,0	20.0°	2,0	250,0	4,0	4	45703
10,0	12,5	89,0	20.0°	2,0	250,0	5,0	6	45704
10,0	11,5	89,0	20.0°	2,5	250,0	5,0	6	45705
12,0	13,5	100,0	20.0°	3,0	250,0	6,0	8	45706
12,0	14,4	100,0	20.0°	2,5	250,0	6,0	8	45707
12,0	20,0	100,0	14.0°	2,0	60,0	6,0	6	45708
16,0	31,0	109,0	12.5°	2,0	1000,0	5,0	6	45709
16,0	27,5	109,0	12.5°	3,0	1000,0	5,0	8	45710
16,0	24,0	109,0	12.5°	4,0	1000,0	5,0	8	45711
16,0	21,0	109,0	15.0°	4,0	1000,0	5,0	8	45712
16,0	18,5	109,0	20.0°	4,0	1500,0	8,0	8	45713
16,0	28,5	109,0	10.0°	4,0	1000,0	5,0	8	45714
16,0	19,0	109,0	20.0°	3,0	750,0	5,0	8	45715
16,0	15,0	109,0	30.0°	2,0	750,0	3,0	6	45716
16,0	18,5	109,0	20.0°	3,0	60,0	5,0	8	45717

TOLERANCES (mm)

DCON = h_6
RE = +0,010/–0,010

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

Multi-Carb

			DCON	6		8		10		12		16	
			Ae max	0,20	0,45	0,25	0,55	0,30	0,60	0,35	0,65	0,40	0,70
			Diameter	3,0	6,0	4,0	8,0	5,0	10,0	6,0	12,0	8,0	16,0
Metric	Hardness (HRc)	Vc (m/min)	Cut Zone	RE	RE2	RE	RE2	RE	RE2	RE	RE2	RE	RE2
P Alloy Steels	≤28	194	RPM	20583	10292	15438	7719	12350	6175	10292	5146	7719	3859
		(155-232)	Fz	0,013	0,030	0,017	0,040	0,021	0,050	0,025	0,060	0,033	0,080
			Feed (mm/min)	1029	1235	1029	1235	1544	1853	1544	1853	1544	1853
	≤40	110	RPM	11671	5836	8753	4377	7003	3501	5836	2918	4377	2188
		(88-132)	Fz	0,008	0,020	0,013	0,030	0,017	0,040	0,021	0,050	0,029	0,070
			Feed (mm/min)	389	467	438	525	700	840	729	875	766	919
P Tool Steels	≤35	93	RPM	9867	4934	7400	3700	5920	2960	4934	2467	3700	1850
		(69-118)	Fz	0,013	0,030	0,017	0,040	0,021	0,050	0,025	0,060	0,033	0,080
			Feed (mm/min)	493	592	493	592	740	888	740	888	740	888
	≤45	64	RPM	6790	3395	5093	2546	4074	2037	3395	1698	2546	1273
		(51-77)	Fz	0,008	0,020	0,013	0,030	0,017	0,040	0,021	0,050	0,025	0,060
			Feed (mm/min)	226	272	255	306	407	489	424	509	382	458
M Stainless Steels	≤28	117	RPM	12414	6207	9310	4655	7448	3724	6207	3103	4655	2328
		(94-141)	Fz	0,013	0,030	0,017	0,040	0,021	0,050	0,025	0,060	0,029	0,070
			Feed (mm/min)	621	745	621	745	931	1117	931	1117	815	978
	≤35	108	RPM	11459	5729	8594	4297	6875	3438	5729	2865	4297	2149
		(87-130)	Fz	0,008	0,020	0,013	0,030	0,017	0,040	0,021	0,050	0,025	0,060
			Feed (mm/min)	382	458	430	516	688	825	716	859	645	773
S High Temperature Alloys	≤32	32	RPM	3395	1698	2546	1273	2037	1019	1698	849	1273	637
		(26-38)	Fz	0,008	0,020	0,013	0,030	0,017	0,040	0,021	0,050	0,025	0,060
			Feed (mm/min)	113	136	127	153	204	244	212	255	191	229
	≤43	26	RPM	2759	1379	2069	1034	1655	828	1379	690	1034	517
		(21-31)	Fz	0,004	0,010	0,008	0,020	0,013	0,030	0,017	0,040	0,021	0,050
			Feed (mm/min)	46	55	69	83	124	149	138	166	129	155
S Titanium Alloys	≤35	109	RPM	11565	5782	8674	4337	6939	3469	5782	2891	4337	2168
		(85-133)	Fz	0,013	0,030	0,017	0,040	0,021	0,050	0,025	0,060	0,029	0,070
			Feed (mm/min)	578	694	578	694	867	1041	867	1041	759	911
	≤45	53	RPM	5623	2812	4217	2109	3374	1687	2812	1406	2109	1054
		(44-61)	Fz	0,008	0,020	0,013	0,030	0,017	0,040	0,021	0,050	0,025	0,060
			Feed (mm/min)	187	225	211	253	337	405	351	422	316	380

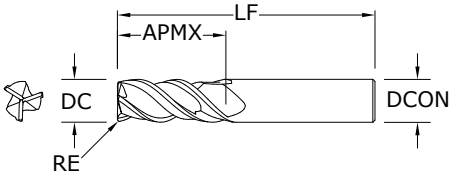
rpm= (Vc x 1000) / (DC x 3.14)
Feed= Fz x No. of teeth x rpm
Adjust speed and feed according to material hardness
Consider rpm according to cutting area of tool being utilized
Avoid using tip of the tool where possible due to reduced chip space

Be aware of max cut Ae, especially on the lower portion of the tool
Medical applications:
- Titanium can be cut dry while keeping cut size to a minimum and providing good chip evacuation (air blast)
- For cobalt chrome applications, a surface speed of 45M/min is a guide (It can also be cut dry as per colbalt)

refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

33MCR

METRIC SERIES



- Specially engineered step core design provides stability for aggressive ramping and rigidity when flutes are completely engaged
- Open design at axial end accommodates material flow and load reduction during machining operations
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

mm					EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	Ti-NAMITE-A (AlTiN)
3,0	9,0	57,0	6,0	0,3	43445
3,0	9,0	57,0	6,0	0,5	43470
4,0	12,0	57,0	6,0	0,3	43446
4,0	12,0	57,0	6,0	0,5	43471
5,0	15,0	57,0	6,0	0,3	43447
5,0	15,0	57,0	6,0	0,5	43472
6,0	18,0	57,0	6,0	0,5	43448
6,0	18,0	57,0	6,0	1,0	43473
6,0	18,0	57,0	6,0	1,5	43474
6,0	18,0	57,0	6,0	2,0	43475
8,0	20,0	63,0	8,0	0,5	43449
8,0	20,0	63,0	8,0	1,0	43476
8,0	20,0	63,0	8,0	1,5	43477
8,0	20,0	63,0	8,0	2,0	43478
10,0	27,0	72,0	10,0	0,5	43450
10,0	27,0	72,0	10,0	1,0	43479
10,0	27,0	72,0	10,0	1,5	43480
10,0	27,0	72,0	10,0	2,0	43481
10,0	27,0	72,0	10,0	2,5	43482
12,0	30,0	83,0	12,0	0,5	43451
12,0	30,0	83,0	12,0	1,0	43483
12,0	30,0	83,0	12,0	1,5	43484
12,0	30,0	83,0	12,0	2,0	43485
12,0	30,0	83,0	12,0	2,5	43486
12,0	30,0	83,0	12,0	3,0	43487
12,0	30,0	83,0	12,0	4,0	43488
16,0	38,0	92,0	16,0	1,0	43452
16,0	38,0	92,0	16,0	1,5	43489
16,0	38,0	92,0	16,0	2,0	43490
16,0	38,0	92,0	16,0	2,5	43491
16,0	38,0	92,0	16,0	3,0	43492
16,0	38,0	92,0	16,0	4,0	43493
20,0	46,0	104,0	20,0	1,0	43453
20,0	46,0	104,0	20,0	2,0	43494
20,0	46,0	104,0	20,0	2,5	43495
20,0	46,0	104,0	20,0	3,0	43496
20,0	46,0	104,0	20,0	4,0	43497

TOLERANCES (mm)

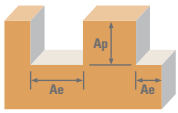
3–6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,050

>10–20 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,050

STEELS
STAINLESS STEELS
CAST IRON
HIGH TEMP ALLOYS

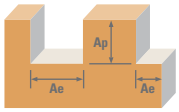
Series 33



	Series 33MCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	8	10	12	16	20
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.5	≤ 1.5	168	RPM	17773	8886	6665	5332	4443	3332	2666
						(134-201)	Fz	0.012	0.029	0.049	0.061	0.074	0.100	0.107
							Feed (mm/min)	640	768	981	981	992	998	853
			Slot	1	≤ 1	134	RPM	14218	7109	5332	4265	3555	2666	2133
						(107-161)	Fz	0.012	0.029	0.049	0.061	0.074	0.100	0.107
							Feed (mm/min)	512	614	785	785	793	798	682
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.5	≤ 1.5	96	RPM	10179	5089	3817	3054	2545	1909	1527
						(77-115)	Fz	0.010	0.022	0.036	0.045	0.055	0.074	0.080
							Feed (mm/min)	293	330	415	415	421	425	366
			Slot	1	≤ 1	76	RPM	8078	4039	3029	2424	2020	1515	1212
						(61-91)	Fz	0.010	0.022	0.036	0.045	0.055	0.074	0.080
							Feed (mm/min)	233	262	330	330	334	337	291
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Profile	≤ 0.5	≤ 1.5	56	RPM	5978	2989	2242	1793	1495	1121	897
						(45-68)	Fz	0.007	0.017	0.030	0.037	0.043	0.059	0.064
							Feed (mm/min)	129	151	201	201	194	198	172
			Slot	1	≤ 1	44	RPM	4686	2343	1757	1406	1171	879	703
						(35-53)	Fz	0.007	0.017	0.030	0.037	0.043	0.059	0.064
							Feed (mm/min)	101	118	157	157	152	155	135
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.5	≤ 1.5	149	RPM	15834	7917	5938	4750	3958	2969	2375
						(119-179)	Fz	0.009	0.024	0.041	0.051	0.060	0.079	0.085
							Feed (mm/min)	433	570	722	722	712	707	608
			Slot	1	≤ 1	119	RPM	12602	6301	4726	3781	3151	2363	1890
						(95-143)	Fz	0.009	0.024	0.041	0.051	0.060	0.079	0.085
							Feed (mm/min)	345	454	575	575	567	563	484
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.5	≤ 1.5	104	RPM	10987	5493	4120	3296	2747	2060	1648
						(83-124)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
							Feed (mm/min)	237	316	396	396	395	396	343
			Slot	1	≤ 1	82	RPM	8725	4362	3272	2617	2181	1636	1309
						(66-99)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
							Feed (mm/min)	188	251	314	314	314	314	272
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	Profile	≤ 0.5	≤ 1.5	94	RPM	10017	5009	3756	3005	2504	1878	1503
						(76-113)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
							Feed (mm/min)	216	288	361	361	361	361	313
			Slot	1	≤ 1	76	RPM	8078	4039	3029	2424	2020	1515	1212
						(61-91)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
							Feed (mm/min)	174	233	291	291	291	291	252

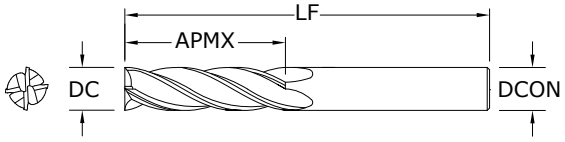
continued on next page

Series 33



	Series 33MCR Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	8	10	12	16	20
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile	≤ 0.5	≤ 1.5	136	RPM	14380	7190	5392	4314	3595	2696	2157
						(109-163)	Fz	0.008	0.026	0.045	0.056	0.067	0.090	0.096
							Feed (mm/min)	362	569	725	725	725	725	621
			Slot	1	≤ 1	108	RPM	11471	5736	4302	3441	2868	2151	1721
						(87-130)	Fz	0.008	0.026	0.045	0.056	0.067	0.090	0.096
							Feed (mm/min)	289	454	578	578	578	578	496
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc	Profile	≤ 0.5	≤ 1.5	104	RPM	10987	5493	4120	3296	2747	2060	1648
						(83-124)	Fz	0.007	0.019	0.034	0.043	0.050	0.067	0.072
							Feed (mm/min)	237	316	422	422	415	411	356
			Slot	1	≤ 1	82	RPM	8725	4362	3272	2617	2181	1636	1309
						(66-99)	Fz	0.007	0.019	0.034	0.043	0.050	0.067	0.072
							Feed (mm/min)	188	251	335	335	330	327	283
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.5	≤ 1.5	24	RPM	2585	1293	969	776	646	485	388
						(20-29)	Fz	0.006	0.017	0.028	0.035	0.041	0.054	0.059
							Feed (mm/min)	48	65	81	65	79	78	68
			Slot	1	≤ 1	20	RPM	2100	1050	788	630	525	394	315
						(16-24)	Fz	0.006	0.017	0.028	0.035	0.041	0.054	0.059
							Feed (mm/min)	39	53	66	66	64	64	55
	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Profile	≤ 0.5	≤ 1.5	19	RPM	2003	1002	751	601	501	376	301
						(15-23)	Fz	0.005	0.012	0.019	0.024	0.029	0.038	0.043
							Feed (mm/min)	29	36	43	43	43	43	38
			Slot	1	≤ 1	15	RPM	1583	792	594	475	396	297	238
						(12-18)	Fz	0.005	0.012	0.019	0.024	0.029	0.038	0.043
							Feed (mm/min)	23	28	34	34	34	34	30
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.5	≤ 1.5	66	RPM	6947	3474	2605	2084	1737	1303	1042
						(52-79)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
							Feed (mm/min)	150	200	250	250	250	250	217
			Slot	1	≤ 1	52	RPM	5493	2747	2060	1648	1373	1030	824
						(41-62)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
							Feed (mm/min)	119	158	198	198	198	198	171
	TITANIUM ALLOYS (DIFFICULT) Ti10V2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 420 Bhn or ≤ 45 HRc	Profile	≤ 0.5	≤ 1.5	23	RPM	2424	1212	909	727	606	454	364
						(18-27)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
							Feed (mm/min)	52	70	87	87	87	87	76
			Slot	1	≤ 1	18	RPM	1939	969	727	582	485	364	291
						(15-22)	Fz	0.007	0.019	0.032	0.040	0.048	0.064	0.069
							Feed (mm/min)	42	56	70	70	70	70	60

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 3 x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)



7M
METRIC SERIES

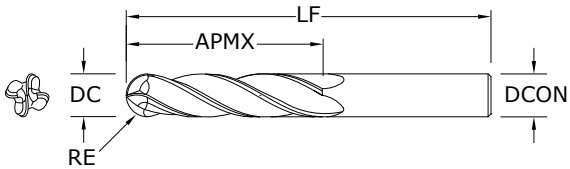
TOLERANCES (mm)

DC = +0,000/+0,050
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

mm				EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	Ti-NAMITE-X (TX)
3,0	25,0	75,0	3,0	70551
4,0	25,0	75,0	4,0	70552
5,0	25,0	75,0	5,0	70553
6,0	25,0	75,0	6,0	70554
8,0	25,0	75,0	8,0	70555
10,0	38,0	100,0	10,0	70556
12,0	50,0	100,0	12,0	70557
12,0	75,0	150,0	12,0	70558
14,0	75,0	150,0	14,0	70559
16,0	75,0	150,0	16,0	70560
18,0	75,0	150,0	18,0	70561
20,0	75,0	150,0	20,0	70562
25,0	75,0	150,0	25,0	70563

- Variable pitch allows for improved chatter suppression along with improved surface finish and enhanced tool life
- Raised land and increased core diameter designed to enhance tool life and decrease tool deflection
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)



7MB
METRIC SERIES

TOLERANCES (mm)

DC = +0,000/+0,050
DCON = h_6
RE = +0,000/–0,025

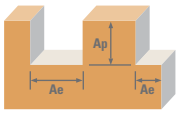
- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

mm				EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	Ti-NAMITE-X (TX)
3,0	25,0	75,0	3,0	70527
4,0	25,0	75,0	4,0	70529
5,0	25,0	75,0	5,0	70531
6,0	25,0	75,0	6,0	70533
8,0	25,0	75,0	8,0	70535
10,0	38,0	100,0	10,0	70537
12,0	50,0	100,0	12,0	70539
12,0	75,0	150,0	12,0	70540
14,0	75,0	150,0	14,0	70542
16,0	75,0	150,0	16,0	70544
18,0	75,0	150,0	18,0	70546
20,0	75,0	150,0	20,0	70548
25,0	75,0	150,0	25,0	70550

RE = 1/2 Cutting Diameter (DC)

- Variable pitch allows for improved chatter suppression along with improved surface finish and enhanced tool life
- Raised land and increased core diameter designed to enhance tool life and decrease tool deflection
- Ball end design ideal for finishing operations in complex workpieces
- Recommended for materials ≤ 45 HRc (≤ 420 Bhn)

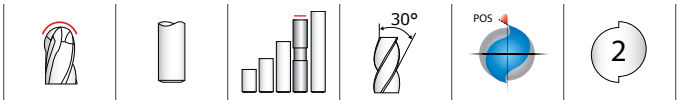
Series 7

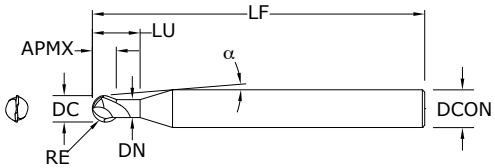


	Series 7M, 7MB Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	8	10	12	16	20	25
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 275 Bhn or ≤ 28 HRc	Finish	≤ 0.02	≤ 2	146	RPM	15511	7755	5816	4653	3878	2908	2327	1861
						(117-176)	Fz	0.0166	0.043	0.075	0.093	0.110	0.125	0.147	0.160
							Feed (mm/min)	1030	1334	1745	1731	1706	1454	1368	1191
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 375 Bhn or ≤ 40 HRc	Finish	≤ 0.02	≤ 2	84	RPM	8886	4443	3332	2666	2222	1666	1333	1066
						(67-101)	Fz	0.0122	0.034	0.051	0.069	0.082	0.091	0.109	0.120
							Feed (mm/min)	434	604	680	736	729	606	581	512
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Finish	≤ 0.02	≤ 2	70	RPM	7432	3716	2787	2230	1858	1394	1115	892
						(56-84)	Fz	0.0070	0.019	0.040	0.043	0.048	0.057	0.064	0.070
							Feed (mm/min)	208	282	446	384	357	318	285	250
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Finish	≤ 0.02	≤ 2	128	RPM	13572	6786	5089	4072	3393	2545	2036	1629
						(102-154)	Fz	0.0086	0.024	0.040	0.048	0.058	0.065	0.077	0.087
							Feed (mm/min)	467	651	814	782	787	662	627	567
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L	≤ 275 Bhn or ≤ 28 HRc	Finish	≤ 0.02	≤ 2	88	RPM	9371	4686	3514	2811	2343	1757	1406	1125
						(71-106)	Fz	0.0082	0.022	0.037	0.045	0.048	0.060	0.072	0.078
							Feed (mm/min)	307	412	520	506	450	422	405	351
	STAINLESS STEELS (PH) 13-8 PH, 15-5 PH, 17-4 PH, Custom 450	≤ 325 Bhn or ≤ 35 HRc	Finish	≤ 0.02	≤ 2	81	RPM	8563	4282	3211	2569	2141	1606	1284	1028
						(65-97)	Fz	0.0070	0.019	0.029	0.040	0.048	0.055	0.064	0.070
							Feed (mm/min)	240	325	372	411	411	353	329	288
K	CAST IRONS (LOW & MEDIUM ALLOY) Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Finish	≤ 0.02	≤ 2	184	RPM	19550	9775	7331	5865	4887	3666	2932	2346
						(148-221)	Fz	0.0132	0.036	0.052	0.075	0.089	0.099	0.117	0.130
							Feed (mm/min)	1032	1408	1525	1759	1740	1452	1372	1220
	CAST IRONS (HIGH ALLOY) Gray, Malleable, Ductile	≤ 260 Bhn or ≤ 26 HRc	Finish	≤ 0.02	≤ 2	142	RPM	15026	7513	5635	4508	3756	2817	2254	1803
						(113-170)	Fz	0.0132	0.036	0.052	0.075	0.089	0.099	0.117	0.130
							Feed (mm/min)	793	1082	1172	1352	1337	1116	1055	938
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400	≤ 300 Bhn or ≤ 32 HRc	Finish	≤ 0.02	≤ 2	24	RPM	2585	1293	969	776	646	485	388	310
						(20-29)	Fz	0.0072	0.019	0.029	0.037	0.046	0.053	0.061	0.085
							Feed (mm/min)	74	98	112	90	119	103	95	105
	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 718, X-750, Incoloy, Waspaloy, Hastelloy, Rene	≤ 400 Bhn or ≤ 43 HRc	Finish	≤ 0.02	≤ 2	20	RPM	2100	1050	788	630	525	394	315	252
						(16-24)	Fz	0.0075	0.016	0.021	0.030	0.038	0.044	0.051	0.070
							Feed (mm/min)	63	67	66	76	80	69	64	71
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si	≤ 350 Bhn or ≤ 38 HRc	Finish	≤ 0.02	≤ 2	91	RPM	9694	4847	3635	2908	2424	1818	1454	1163
						(73-110)	Fz	0.0091	0.024	0.040	0.050	0.060	0.070	0.080	0.088
							Feed (mm/min)	353	465	51	59	582	509	465	409
	TITANIUM ALLOYS (DIFFICULT) Ti10V2Fe3Al, Ti5Al5V5Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti15V3 Cr3Sn3Al	≤ 420 Bhn or ≤ 45 HRc	Finish	≤ 0.02	≤ 2	32	RPM	3393	1696	1272	1018	848	636	509	407
						(26-38)	Fz	0.0082	0.019	0.029	0.037	0.046	0.053	0.061	0.085
							Feed (mm/min)	111	129	148	151	156	135	124	138

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 4 x rpm
reduce speed and feed for materials harder than listed
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Turbo-Carb HIGH PERFORMANCE CARBIDE END MILLS





56MB
METRIC SERIES

TOLERANCES (mm)

1–2,5 DIAMETER
DC = +0,000/–0,025
DCON = h_6
RE = +0,000/–0,0013

>2,5–6 DIAMETER
DC = +0,000/–0,030
DCON = h_6
RE = +0,000/–0,0013

>6–10 DIAMETER
DC = +0,000/–0,040
DCON = h_6
RE = +0,000/–0,0020

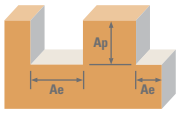
>10–20 DIAMETER
DC = +0,000/–0,050
DCON = h_6
RE = +0,000/–0,0025

STEELS
HARDENED STEELS

mm							EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CENTER LINE ANGLE α	REACH LU	NECK DIAMETER DN	Ti-NAMITE-X (TX)
1,0	1,0	76,0	6,0	8°10'	2,0	0,91	91349
1,5	1,5	76,0	6,0	7°45'	3,0	1,37	91350
2,0	2,0	76,0	6,0	7°10'	4,0	1,83	91351
2,5	2,5	76,0	6,0	6°35'	5,0	2,29	91352
3,0	3,0	76,0	6,0	6°	6,0	2,72	91353
4,0	4,0	76,0	6,0	4°30'	8,0	3,63	91354
5,0	5,0	89,0	6,0	2°30'	10,0	4,55	91355
6,0	6,0	89,0	6,0	–	12,0	5,49	91356
8,0	8,0	102,0	8,0	–	16,0	7,49	91357
10,0	10,0	102,0	10,0	–	20,0	9,47	91358
12,0	12,0	114,0	12,0	–	24,0	11,48	91359
16,0	16,0	140,0	16,0	–	32,0	15,62	91360
20,0	20,0	165,0	20,0	–	40,0	19,61	91361

Extended Neck Option Available, contact your local KSPT representative for more information.
RE = 1/2 Cutting Diameter (DC)

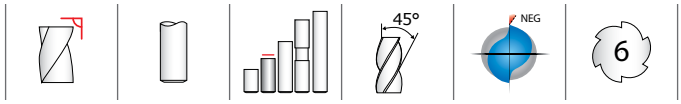
- Short flute length and rigid design to reduce deflection
- S-Gash Ball geometry minimizes load and heat produced during the cutting process, ultimately enhancing tool life
- Ideal for machining complex contoured shapes in hardened steels
- Recommended for materials 35 to 60 HRc (327 to 654 Bhn)



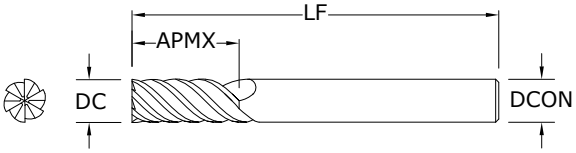
	Series 56MB Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 1	1.5	3	5	6	10	12	20
P	TOOL STEELS MOLD AND DIE STEEL 300M, 4340, 52100, HP-9-4-20, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 375 Bhn or ≤ 40 HRc	Rough	≤ 0.4	≤ 0.1	191	RPM	60748	40498	20249	12150	10125	6075	5062	3037
						(153-229)	Fz	0.015	0.038	0.076	0.102	0.127	0.203	0.254	0.305
							Feed (mm/min)	1822	3078	3078	2479	2572	2466	2572	1853
			HSM	≤ 0.4	≤ 0.03	290	RPM	92235	61490	46117	18447	15372	9223	7686	4612
						(232-348)	Fz	0.018	0.043	0.084	0.112	0.117	0.224	0.279	0.330
							Feed (mm/min)	3320	5288	7748	4132	3597	4132	4289	3044
H	TOOL STEELS MOLD AND DIE STEEL 300M, 4340, 52100, HP-9-4-20, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	Rough	≤ 0.4	≤ 0.05	229	RPM	72833	48556	24278	14567	12139	7283	6069	3642
						(183-275)	Fz	0.013	0.028	0.058	0.076	0.097	0.152	0.191	0.216
							Feed (mm/min)	1894	2719	2816	2214	2355	2214	2319	1573
			HSM	≤ 0.4	≤ 0.02	351	RPM	111636	74424	37212	22327	18606	11164	9303	5582
						(281-421)	Fz	0.015	0.030	0.064	0.084	0.107	0.168	0.208	0.254
							Feed (mm/min)	3349	4465	4763	3751	3982	3751	3870	2836
	TOOL STEELS MOLD AND DIE STEEL 300M, 4340, 52100, HP-9-4-20, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 655 Bhn or ≤ 60 HRc	Rough	≤ 0.4	≤ 0.04	152	RPM	48344	32229	16115	9669	8057	4834	4029	2417
						(122-182)	Fz	0.010	0.020	0.043	0.058	0.074	0.114	0.145	0.160
							Feed (mm/min)	967	1289	1386	1122	1192	1102	1168	773
			HSM	≤ 0.4	≤ 0.01	305	RPM	97005	64670	32335	19401	16168	9701	8084	4850
						(244-366)	Fz	0.013	0.023	0.048	0.064	0.081	0.127	0.160	0.180
							Feed (mm/min)	2522	2975	3104	2483	2619	2464	2587	1746

Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 2 x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Power-Carb



57M
METRIC SERIES



- Ideal in Trochoidal milling applications in hardened steels and dry machining
- Short flute length and large core design to reduce deflection
- Unsurpassed edge strength with extreme negative rake and eccentric relief
- Recommended for materials 45 to 65 HRc (421 to 739 Bhn)

mm				EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	Ti-NAMITE-X (TX)
6,0	13,0	89,0	6,0	46140
8,0	18,0	102,0	8,0	46141
10,0	22,0	102,0	10,0	46142
12,0	26,0	114,0	12,0	46143
16,0	32,0	140,0	16,0	46145
20,0	38,0	165,0	20,0	46147

Neck Option Available

TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,030
DCON = h_6

8 DIAMETER
DC = +0,000/–0,040
DCON = h_6

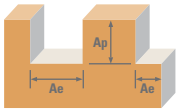
10 DIAMETER
DC = +0,000/–0,040
DCON = h_6

12–20 DIAMETER
DC = +0,000/–0,050
DCON = h_6

STEELS

HARDENED STEELS

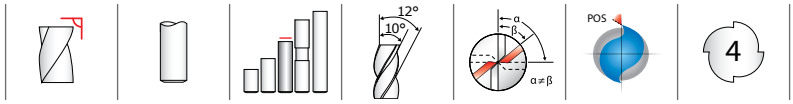
Power-Carb



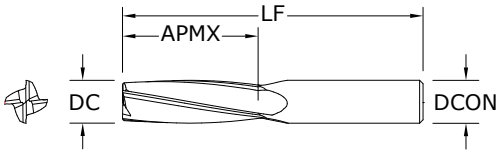
	Series 57M Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20
P	TOOL STEELS MOLD AND DIE STEEL 300M, 4340, 52100, HP-9-4-20, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 420 Bhn or ≤ 45 HRc	Slot	1	≤ 0.3	66	RPM	3499	2624	2099	1749	1312	1050
						(53-79)	Fz	0.032	0.048	0.064	0.079	0.094	0.109
							Feed (mm/min)	672	756	806	829	740	686
			Profile	≤ 0.1	≤ 1.5	81	RPM	4294	3220	2576	2147	1610	1288
						(65-97)	Fz	0.046	0.066	0.089	0.112	0.132	0.152
							Feed (mm/min)	1185	1275	1376	1443	1275	1175
			HSM	≤ 0.04	≤ 1.5	171	RPM	9064	6798	5439	4532	3399	2719
						(137-205)	Fz	0.056	0.084	0.112	0.140	0.170	0.200
							Feed (mm/min)	3046	3426	3655	3807	3467	3263
H	TOOL STEELS MOLD AND DIE STEEL 300M, 4340, 52100, HP-9-4-20, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 560 Bhn or ≤ 55 HRc	Slot	1	≤ 0.3	37	RPM	1961	1471	1177	981	735	588
						(30-44)	Fz	0.025	0.038	0.051	0.064	0.077	0.090
							Feed (mm/min)	294	335	360	377	340	318
			Profile	≤ 0.1	≤ 1.5	46	RPM	2438	1829	1463	1219	914	732
						(37-55)	Fz	0.036	0.053	0.071	0.089	0.107	0.125
							Feed (mm/min)	527	582	623	651	587	549
			HSM	≤ 0.04	≤ 1.5	149	RPM	7898	5924	4739	3949	2962	2369
						(119-179)	Fz	0.046	0.066	0.089	0.112	0.135	0.158
							Feed (mm/min)	2180	2346	2531	2654	2399	2246
	TOOL STEELS MOLD AND DIE STEEL 300M, 4340, 52100, HP-9-4-20, M50, A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 740 Bhn or ≤ 65 HRc	Slot	1	≤ 0.3	20	RPM	1060	795	636	530	398	318
						(16-24)	Fz	0.020	0.028	0.038	0.048	0.058	0.068
							Feed (mm/min)	127	134	145	153	138	130
			Profile	≤ 0.1	≤ 1.5	24	RPM	1272	954	763	636	477	382
						(19-29)	Fz	0.028	0.041	0.053	0.066	0.078	0.090
							Feed (mm/min)	214	235	243	252	223	206
			HSM	≤ 0.04	≤ 1.5	76	RPM	4029	3021	2417	2014	1511	1209
						(61-91)	Fz	0.033	0.048	0.064	0.079	0.094	0.109
							Feed (mm/min)	798	870	928	955	852	790

Bhn (Brinell) HRc (Rockwell C) HSM (High Speed Machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 6 x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Series 27



27M



METRIC SERIES

- Slow helix design adds strength to the edge allowing ease for milling highly abrasive materials
- Two levels of chatter suppression: variable helix and indexing
- Excels at roughing (slotting, profiling) and finishing in a variety of plastics and composites

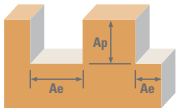
mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Di-NAMITE (Diamond)
6,0	25,0	63,0	6,0	83056	83057
8,0	25,0	63,0	8,0	83058	83059
10,0	28,0	63,0	10,0	83060	83061
12,0	38,0	89,0	12,0	83062	83063
16,0	48,0	115,0	16,0	83064	83065

TOLERANCES (mm)

DC = +0,000/–0,080
DCON = h_6

NON-FERROUS

Series 27



	Series 27M Metric		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16
N	CFRP, AFRP (CARBON FIBER, ARAMID FIBER)	Slot	1	≤ 1	120	RPM	6361	4771	3817	3181	2385
					(96-164)	Fz	0.040	0.065	0.075	0.100	0.120
						Feed (mm/min)	1018	1240	1145	1272	1145
		Profile	≤ 0.5	≤ 1.5	150	RPM	7951	5963	4771	3976	2982
					(120-180)	Fz	0.040	0.065	0.075	0.100	0.120
						Feed (mm/min)	1272	1550	1431	1590	1431
		HSM	≤ 0.5	≤ 2	250	RPM	13252	9939	7951	6626	4970
					(200-300)	Fz	0.095	0.145	0.175	0.235	0.280
						Feed (mm/min)	5036	5765	5566	6228	5566
	GFRP (FIBERGLASS)	Slot	1	≤ 1	100	RPM	5301	3976	3181	2650	1988
					(80-120)	Fz	0.040	0.065	0.075	0.100	0.120
						Feed (mm/min)	848	1034	954	1060	954
		Profile	≤ 0.5	≤ 1.5	120	RPM	6361	4771	3817	3181	2385
					(96-164)	Fz	0.040	0.065	0.075	0.100	0.120
						Feed (mm/min)	1018	1240	1145	1272	1145
		HSM	≤ 0.5	≤ 2	200	RPM	10602	7951	6361	5301	3976
					(160-240)	Fz	0.095	0.145	0.175	0.235	0.280
						Feed (mm/min)	4029	4612	4453	4983	4453
	CARBON, GRAPHITE	Slot	1	≤ 1	145	RPM	7686	5765	4612	3843	2882
					(116-174)	Fz	0.050	0.080	0.095	0.125	0.150
						Feed (mm/min)	1537	1845	1752	1922	1729
		Profile	≤ 0.5	≤ 1.5	185	RPM	9807	7355	5884	4903	3677
					(148-222)	Fz	0.050	0.080	0.095	0.125	0.150
						Feed (mm/min)	1961	2354	2236	2452	2206
		HSM	≤ 0.5	≤ 2	300	RPM	15903	11927	9542	7951	5963
					(240-360)	Fz	0.115	0.185	0.220	0.290	0.350
						Feed (mm/min)	7315	8826	8397	9223	8349
	PLASTICS	Slot	1	≤ 1	245	RPM	12987	9740	7792	6494	4870
					(196-294)	Fz	0.050	0.080	0.095	0.125	0.150
						Feed (mm/min)	2597	3117	2961	3247	2922
		Profile	≤ 0.5	≤ 1.5	305	RPM	16168	12126	9701	8084	6063
					(244-366)	Fz	0.050	0.080	0.095	0.125	0.150
						Feed (mm/min)	3234	3880	3686	4042	3638
		HSM	≤ 0.5	≤ 2	505	RPM	26769	20077	16062	13385	10038
					(404-606)	Fz	0.115	0.185	0.220	0.290	0.350
						Feed (mm/min)	12314	14857	14134	15526	14054
	MACHINABLE CERAMICS MACHINABLE GLASS	Slot	1	≤ 1	10	RPM	530	398	318	265	199
					(8-12)	Fz	0.020	0.035	0.045	0.050	0.060
						Feed (mm/min)	42	56	57	53	48
		Profile	≤ 0.5	≤ 1.5	15	RPM	795	596	477	398	298
					(12-18)	Fz	0.020	0.035	0.045	0.050	0.060
						Feed (mm/min)	64	83	86	80	72
		HSM	≤ 0.5	≤ 2	25	RPM	1325	994	795	663	497
					(20-30)	Fz	0.045	0.075	0.085	0.115	0.140
						Feed (mm/min)	239	298	270	305	278

HSM (High Speed Machining)
rpm = Vc x 3.82 / DC
mm/min = Fz x 4 x rpm
adjust parameters based on resin type and fiber structure
reduce speed when overheating causes melting or damage to resin
reduce feed if delamination or fraying occur
finish cuts typically required reduced feed and cutting depths

rates shown are for use without coolant; rates may be increased with coolant
dust collection is vital when machining dry
diamond coating will increase tool life in graphite and composite materials
feed rates listed have chip thinning adjustments included where applicable
refer to the **KYOCERA SGS APEX** for complete technical information
(www.kyocera-sgstool.com/apex)

SGS
Solid Carbide Tools

VALUE AT THE SPINDLE

High Performance Aluminum End Mills

Milling

HIGH PERFORMANCE ALUMINUM END MILLS	SERIES	DESCRIPTION	PAGE	S&F PAGE
S-Carb APR & APF	43APR-3	3 Flute Advanced Productivity Rougher Metric	81	83
	43APR-4	4 Flute Advanced Productivity Rougher Metric	82	83
	43MAPF	4 Flute Advanced Productivity Finisher Metric	84	85
S-Carb APF-B	43APF-B	Multi-Flute Tapered (Circle Segment) Form Tools Metric	86	87
S-Carb (3 Flute)	43M	3 Flute Non-Ferrous Square End Metric	88	95
	43MCR	3 Flute Non-Ferrous Corner Radius Metric	88	96
	43ML	3 Flute Non-Ferrous Square End Long Reach Metric	91	96
	43MLC	3 Flute Non-Ferrous Long Reach Corner Radius Metric	91	96
	43MB	3 Flute Non-Ferrous Ball End Metric	93	96
	43MLB	3 Flute Non-Ferrous Ball End Long Reach Metric	94	96
S-Carb Rougher (3 Flute)	43MCB	3 Flute Rougher Non-Ferrous Chip Breaker Metric	95	96
S-Carb (2 Flute)	47M	2 Flute Non-Ferrous Square End Metric	97	99
	47ML	2 Flute Non-Ferrous Square End Long Reach Metric	97	99
	47MB	2 Flute Non-Ferrous Ball End Metric	98	99
	47MLB	2 Flute Non-Ferrous Ball End Long Reach Metric	98	99
Ski-Carb	44M	2 Flute Non-Ferrous Materials Square End Metric	100	101

Speed & Feed Recommendations listed after each series

Fresado

FRESAS DE ALTO RENDIMIENTO PARA ALUMINIO	SERIE	DESCRIPCIÓN	PÁGINA	S&F PÁGINA
S-Carb APR y APF	43APR-3	3 filos, productividad avanzada, desbastador, métrico	81	83
	43APR-4	4 filos, productividad avanzada, desbastador, métrico	82	83
	43MAPF	4 filos, productividad avanzada, acabador, métrico	84	85
S-Carb APF-B	43APF-B	Fresas de forma cónica de segmento circular de múltiples filos, métrico	86	87
S-Carb (3 filos)	43M	3 filos, no férrico, punta cuadrada, métrico	88	95
	43MCR	3 filos, no férrico, radio angulado, métrico	88	96
	43ML	3 filos, no férrico, punta cuadrada, largo alcance, métrico	91	96
	43MLC	3 filos, no férrico, largo alcance, radio angulado, métrico	91	96
	43MB	3 filos, no férrico, punta esférica, métrico	93	96
	43MLB	3 filos, no férrico, punta esférica, largo alcance, métrico	94	96
Desbastador S-Carb (3 filos)	43MCB	3 filos, desbastador, no férrico, rompevirutas, métrico	95	96
S-Carb (2 filos)	47M	2 filos, no férrico, punta cuadrada, métrico	97	99
	47ML	2 filos, no férrico, punta cuadrada, largo alcance, métrico	97	99
	47MB	2 filos, no férrico, punta esférica, métrico	98	99
	47MLB	2 filos, no férrico, punta esférica, largo alcance, métrico	98	99
Ski-Carb	44M	2 filos, materiales no férricos, punta cuadrada, métrico	100	101

Recomendaciones de velocidades y avances mostradas tras cada serie

FRAISE HAUTE PERFORMANCE POUR ALUMINIUM	SÉRIES	DESCRIPTION	PAGE	S&F PAGE
S-Carb APR/APF	43APR-3	3 dents productivité avancée d'ébauche (métrique)	81	83
	43APR-4	4 dents productivité avancée d'ébauche (métrique)	82	83
	43MAPF	4 dents productivité avancée de finition (métrique)	84	85
S-Carb APF-B	43APF-B	Fraises de forme segmentaire conique à dents multiples (métrique)	86	87
S-Carb (3 dents)	43M	3 dents non-ferreux non rayonné (métrique)	88	95
	43MCR	3 dents matériaux non-ferreux rayonné (métrique)	88	96
	43ML	3 dents non-ferreux non rayonné longue portée (métrique)	91	96
	43MLC	3 dents non-ferreux longue portée rayonné (métrique)	91	96
	43MB	3 dents non-ferreux à bout hémisphérique (métrique)	93	96
	43MLB	3 dents non-ferreux à bout hémisphérique longue portée (métrique)	94	96
S-Carb d'ébauche (3 dents)	43MCB	3 dents d'ébauche non-ferreux brise-copeaux (métrique)	95	96
S-Carb (2 dents)	47M	2 dents non-ferreux non rayonné (métrique)	97	99
	47ML	2 dents non-ferreux non rayonné longue portée (métrique)	97	99
	47MB	2 dents non-ferreux à bout hémisphérique (métrique)	98	99
	47MLB	2 dents non-ferreux à bout hémisphérique longue portée (métrique)	98	99
Ski-Carb	44M	2 dents matériaux non-ferreux non rayonné (métrique)	100	101

Recommandations de vitesse et avance indiquées après chaque série

Fräsen

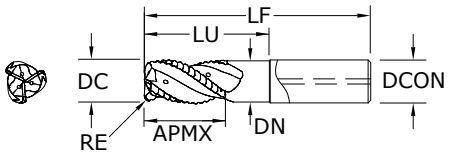
HOCHLEISTUNGSSCHAFTFRÄSER FÜR ALUMINIUM	SERIE	BESCHREIBUNG	SEITE	S&F SEITE
S-Carb APR & APF	43APR-3	Hochleistungs-Schruppfräser mit 3 Schneiden (Erweiterung)	81	83
	43APR-4	Hochleistungs-Schruppfräser mit 4 Schneiden	82	83
	43MAPF	Hochleistungs-Schlichtfräser mit 4 Schneiden	84	85
S-Carb APF-B	43APF-B	Mehrschneidige konische Kreissegment-Formfräser	86	87
S-Carb (3 Schneiden)	43M	NE-Schaftfräser mit 3 Schneiden ohne Eckenradien	88	95
	43MCR	NE-Fräser mit 3 Schneiden und Eckenradien	88	96
	43ML	NE-Langloch-Schaftfräser mit 3 Schneiden ohne Eckenradien	91	96
	43MLC	NE-Langlochfräser mit 3 Schneiden und Eckenradien	91	96
	43MB	NE-Radiusschaftfräser mit 3 Schneiden	93	96
	43MLB	NE-Langloch-Radiusschaftfräser mit 3 Schneiden	94	96
S-Carb Schruppfräser (3 Schneiden)	43MCB	NE-Schruppfräser mit 3 Schneiden und Spanbrechern	95	96
S-Carb (2 Schneiden)	47M	NE-Schaftfräser mit 2 Schneiden ohne Eckenradien	97	99
	47ML	NE-Langloch-Schaftfräser mit 2 Schneiden ohne Eckenradien	97	99
	47MB	NE-Radiusschaftfräser mit 2 Schneiden	98	99
	47MLB	NE-Langloch-Radiusschaftfräser mit 2 Schneiden	98	99
Ski-Carb	44M	NE-Schaftfräser mit 2 Schneiden ohne Eckenradien	100	101

Empfehlungen für Drehzahl & Vorschub im Anhang zu jeder Serie

APR-3

ADVANCED PRODUCTIVITY ROUGHER

S-Carb APR



43APR-3

METRIC SERIES

TOLERANCES (mm)

12–25 DIAMETER

DC = –0,010/–0,100

DCON = h_6

RE = +/–0,05

NON-FERROUS

mm							EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	Ti-NAMITE-B (TiB_2)
12,0	26,0	83,0	12,0	39,0	11,40	1,0	44976
12,0	26,0	83,0	12,0	39,0	11,40	2,0	44977
12,0	26,0	83,0	12,0	39,0	11,40	3,0	44978
12,0	26,0	83,0	12,0	39,0	11,40	4,0	44979
12,0	26,0	95,0	12,0	–	–	–	44975
16,0	35,0	92,0	16,0	–	–	–	44980*
16,0	35,0	92,0	16,0	51,0	15,20	2,0	44981*
16,0	35,0	92,0	16,0	51,0	15,20	3,0	44982*
16,0	35,0	92,0	16,0	51,0	15,20	4,0	44983*
16,0	35,0	108,0	16,0	67,0	15,20	2,0	44985*
16,0	35,0	108,0	16,0	67,0	15,20	3,0	44986*
16,0	35,0	108,0	16,0	67,0	15,20	4,0	44987*
16,0	35,0	124,0	16,0	–	–	–	44984*
20,0	35,0	86,0	20,0	–	–	–	44990
20,0	35,0	86,0	20,0	45,0	19,00	3,0	44991
20,0	35,0	86,0	20,0	45,0	19,00	4,0	44992
20,0	35,0	106,0	20,0	–	–	–	44993*
20,0	35,0	106,0	20,0	65,0	19,00	2,0	44994*
20,0	35,0	106,0	20,0	65,0	19,00	3,0	44995*
20,0	35,0	106,0	20,0	65,0	19,00	4,0	44996*
20,0	35,0	106,0	20,0	65,0	19,00	5,0	44997*
20,0	35,0	145,0	20,0	–	–	–	45020*
20,0	35,0	125,0	20,0	84,0	19,00	2,0	45021*
20,0	35,0	125,0	20,0	84,0	19,00	3,0	45022*
20,0	35,0	125,0	20,0	84,0	19,00	4,0	45023*
25,0	43,0	108,0	25,0	–	–	–	44998
25,0	43,0	108,0	25,0	60,0	23,75	2,0	44999
25,0	43,0	108,0	25,0	60,0	23,75	3,0	45000
25,0	43,0	108,0	25,0	60,0	23,75	4,0	45001
25,0	35,0	140,0	25,0	–	–	–	45002*
25,0	35,0	140,0	25,0	80,0	23,75	3,0	45003*
25,0	35,0	140,0	25,0	90,0	23,75	3,0	45004*
25,0	35,0	151,0	25,0	105,0	23,75	3,0	45025*
25,0	35,0	176,0	25,0	–	–	–	45024*

*Variable Helix

- Ultra high-productivity rougher for Aluminum alloys, specifically for aircraft components
- Designed for high material removal rates (MRR)
- New 3 flute variable geometry with side exit coolant holes
- Open fluting for deep slotting and profiling
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

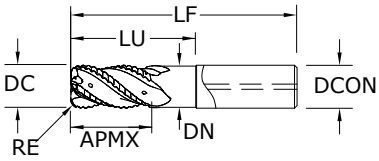
S-Carb APR

APR-4

ADVANCED PRODUCTIVITY ROUGHER

43APR-4

METRIC SERIES



- Ultra high-productivity rougher for Aluminum alloys, specifically for aircraft components
- Designed for high material removal rates (MRR)
- 4 flute variable geometry with side exit coolant holes
- Open fluting for deep slotting and profiling
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

mm							EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	Ti-NAMITE-B (TiB_2)
20,0	35,0	86,0	20,0	–	–	–	45005
20,0	35,0	86,0	20,0	45,0	19,00	3,0	45006
20,0	35,0	86,0	20,0	45,0	19,00	4,0	45007
20,0	35,0	106,0	20,0	–	–	–	45008
20,0	35,0	106,0	20,0	65,0	19,00	2,0	45009
20,0	35,0	106,0	20,0	65,0	19,00	3,0	45010
20,0	35,0	106,0	20,0	65,0	19,00	4,0	45011
20,0	35,0	106,0	20,0	65,0	19,00	5,0	45012
25,0	43,0	108,0	25,0	–	–	–	45013
25,0	43,0	108,0	25,0	60,0	23,75	2,0	45014
25,0	43,0	108,0	25,0	60,0	23,75	3,0	45015
25,0	43,0	108,0	25,0	60,0	23,75	4,0	45016
25,0	35,0	140,0	25,0	–	–	–	45017
25,0	35,0	140,0	25,0	80,0	23,75	3,0	45018
25,0	35,0	140,0	25,0	90,0	23,75	3,0	45019

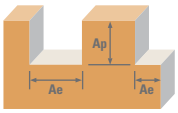
TOLERANCES (mm)

20–25 DIAMETER

DC = –0,010/–0,100
DCON = h_6
RE = ±0,050

NON-FERROUS

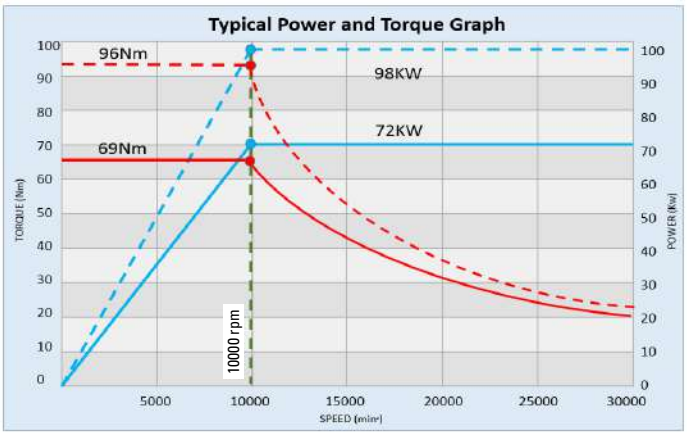
S-Carb APR



Series 43APR-3 43APR-4 Metric			Ae x DC	Ap x DC	Vc (m/min)		DC • mm APR-3 20	APR-3 25	APR-4 20	APR-4 25
N	ALUMINIUM ALLOYS 6068, 7075	Slot	1	≤ 1	1600	RPM	25461	20369	25461	20369
					(300-2100)	Fz	0.14	0.15	0.12	0.13
						Feed (mm/min)	10694	9166	12222	10592
		Profile	≤ 0.5	≤ 1.5	1800	RPM	28644	22915	28644	22915
					(300-2100)	Fz	0.16	0.17	0.14	015
						Feed (mm/min)	13749	11687	16041	13749
		HSM	≤ 0.25	≤ 2	2100	RPM	33418	26735	33418	26735
					(300-2100)	Fz	0.19	0.20	0.16	0.17
						Feed (mm/min)	19048	16041	21388	18180

Series 43APR-3 43APR-4 Metric			Ae x DC	Ap x DC	Vc (m/min)		DC • mm APR-3 LONG 12	16	20	25
N	ALUMINIUM ALLOYS 6068, 7075	Slot	1	≤ 1	1600	RPM	26522	19892	15913	12731
					(300-2100)	Fz	0.10	0.11	0.12	0.13
						Feed (mm/min)	7957	6564	5729	4965
		Profile	≤ 0.5	≤ 1.5	1800	RPM	31827	23870	19096	15277
					(300-2100)	Fz	0.12	0.13	0.14	0.15
						Feed (mm/min)	11458	9309	8020	6875
		HSM	≤ 0.25	≤ 2	2100	RPM	37131	27849	22279	17823
					(300-2100)	Fz	0.14	0.15	0.16	0.17
						Feed (mm/min)	15595	12532	10694	9090

RPM stated may be outside of most machine tools in the smaller sizes, adjust the surface speed but maintain the Fz
For best results use the peak power of the specific machine torque chart.
Typically 10kw is required to remove 1 litre of material (MMR).
Eg. >> (Ae x Ap x Feed) / 1000000 >> Therefore Full slotting Ø25: 25 x 25 x 7333 = 4.58 Litres so it needs a min of 46Kw.
Larger cuts and chip load consume more power.
Review the power chart of each machine to determine MAX power for ultimate performance.
Example below shows peak power @ 10,000 rpm.
The APR-4 design is for ultimate metal removal but typicaly requires more power, and is also better suited to horizontal machines.
The new coolant supply is designed for MQL as well as normal emulsion coolant on the same data.
Ensure max MQL flow prior to cutting.
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)



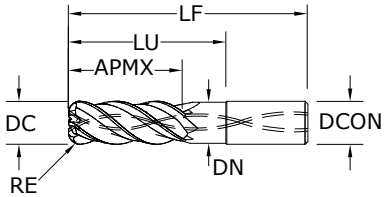
S-Carb APF

APF

ADVANCED PRODUCTIVITY FINISHER

43MAPF

METRIC SERIES



- Ultra high-productivity finisher for Aluminum alloys, specifically for aircraft components
- Two levels of chatter suppression: variable helix and indexing
- Designed for single axial pass semi-finishing and finishing
- Polished flutes maximize chip evacuation and provides enhanced finish
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

mm							EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	Ti-NAMITE-B (TiB_2)
6,0	24,0	66,0	6,0	30,0	5,70	–	44627
8,0	32,0	78,0	8,0	40,0	7,60	–	44628
10,0	40,0	90,0	10,0	50,0	9,50	–	44629
12,0	30,0	83,0	12,0	40,0	11,40	–	44630
12,0	30,0	83,0	12,0	40,0	11,40	2,0	44745
12,0	30,0	83,0	12,0	40,0	11,40	3,0	44746
12,0	30,0	83,0	12,0	40,0	11,40	4,0	44747
12,0	30,0	83,0	12,0	50,0	11,40	0,5	44641
12,0	30,0	83,0	12,0	50,0	11,40	5,0	44642
12,0	48,0	100,0	12,0	62,0	11,40	–	44631
12,0	48,0	100,0	12,0	62,0	11,40	2,0	44748
12,0	48,0	100,0	12,0	62,0	11,40	3,0	44749
12,0	48,0	100,0	12,0	62,0	11,40	4,0	44750
16,0	40,0	92,0	16,0	51,0	15,20	–	44634
16,0	40,0	92,0	16,0	51,0	15,20	2,0	44751
16,0	40,0	92,0	16,0	51,0	15,20	3,0	44752
16,0	40,0	92,0	16,0	51,0	15,20	4,0	44753
16,0	42,0	93,0	16,0	51,0	15,20	5,0	44643
16,0	64,0	125,0	16,0	82,0	15,20	–	44635
16,0	64,0	125,0	16,0	82,0	15,20	2,0	44754
16,0	64,0	125,0	16,0	82,0	15,20	3,0	44755
16,0	64,0	125,0	16,0	82,0	15,20	4,0	44756
20,0	50,0	108,0	20,0	63,0	19,00	–	44636
20,0	50,0	108,0	20,0	63,0	19,00	3,0	44757
20,0	50,0	108,0	20,0	63,0	19,00	4,0	44758
20,0	50,0	108,0	20,0	63,0	19,00	5,0	44759
20,0	80,0	150,0	20,0	102,0	19,00	–	44637
20,0	80,0	150,0	20,0	102,0	19,00	3,0	44760
20,0	80,0	150,0	20,0	102,0	19,00	4,0	44761
20,0	80,0	150,0	20,0	102,0	19,00	5,0	44762
25,0	63,0	130,0	25,0	79,0	23,75	–	44638
25,0	63,0	130,0	25,0	79,0	23,75	3,0	44763
25,0	63,0	130,0	25,0	79,0	23,75	4,0	44764
25,0	63,0	130,0	25,0	79,0	23,75	5,0	44765
25,0	100,0	175,0	25,0	120,0	23,75	–	44639
25,0	100,0	175,0	25,0	120,0	23,75	3,0	44766
25,0	100,0	175,0	25,0	120,0	23,75	4,0	44767
25,0	100,0	175,0	25,0	120,0	23,75	5,0	44768

Available on request: • JetStream Technology

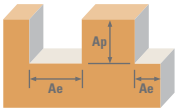
TOLERANCES (mm)

6–25 DIAMETER

DC = –0,010/–0,050
DCON = h_6
RE = +0,03/–0,03

NON-FERROUS

S-Carb APF



	Series 43MAPF Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12	16	20	25
N	**ALUMINUM ALLOYS 2024, 5052, 5086, 6061, 6063, 7075**	≤ 150 Bhn or ≤ 88 HRb	Profile	≤ 0.1	≤ 2.5	800	RPM	42440	31830	25464	21220	15915	12732	10186
						(640-960)	Fz	0.050	0.055	0.060	0.070	0.100	0.140	0.170
							Feed (mm/min)	8488	7003	6111	5942	6366	7130	6926
			Profile	≤ 0.1	≤ 4	800	RPM	42440	31830	25464	21220	15915	12732	10186
						(640-960)	Fz	0.040	0.045	0.050	0.050	0.070	0.100	0.120
							Feed (mm/min)	6790	5729	5093	4244	4456	5093	4889
	ALUMINUM ALLOYS (LITHIUM)* 2090, 2091, 2099, 2195, 2199, 2297, 8090	≤ 150 Bhn or ≤ 88 HRb	Profile	≤ 0.1	≤ 2.5	600	RPM	31830	23873	19098	15915	11936	9549	7639
						(480-720)	Fz	0.050	0.055	0.060	0.070	0.100	0.140	0.170
							Feed (mm/min)	6366	5252	4584	4456	4774	5347	5195
			Profile	≤ 0.1	≤ 4	600	RPM	31830	23873	19098	15915	11936	9549	7639
						(480-720)	Fz	0.040	0.045	0.050	0.050	0.070	0.100	0.120
							Feed (mm/min)	5093	4297	3820	3183	3342	3820	3667

Bhn (Brinell) HRb (Rockwell B)
surface speed is dependent on machine spindle and fixturing
balancing is recommended at ultra high surface speeds
*tool life may be reduced when machining Lithium Alloys
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 4 x rpm
maximum recommended depths shown
reduce speed and feed for materials harder than listed
finish cuts typically require reduced feed and cutting depths of 0.02 X DC maximum
ramp angle = 6° (feed rate = 50%)
plunging not recommended
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

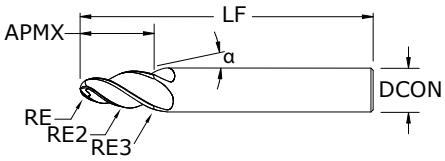
S-Carb APF-B

APF-B

ADVANCED PRODUCTIVITY FINISHER

43APF-B

METRIC SERIES



- Designed to significantly improve traditional ball end applications
- Highly efficient at finishing and semi-finishing profiling
- Main application areas include profiling and pocket milling
- Especially suited to machining deep pockets and hard-to-reach areas without using long-reach tools
- Their versatility also allows for machining profiles and blends with one tool
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

mm								EDP NO.
SHANK DIAMETER DCON	LENGTH OF CUT APMX	OVERALL LENGTH LF	CENTERLINE ANGLE α	TIP RADIUS RE	TAPERED RADIUS RE2	BLENDED RADIUS RE3	NO. OF FLUTES	Ti-NAMITE-B (TiB_2)
6,0	9,5	58,0	17.5°	1,0	250,0	3,0	3	45718
6,0	8,0	58,0	17.5°	1,5	250,0	3,0	3	45719
8,0	10,5	80,0	20°	1,5	250,0	4,0	3	45720
8,0	9,5	80,0	20°	2,0	250,0	4,0	3	45721
10,0	12,5	89,0	20°	2,0	250,0	5,0	3	45722
10,0	11,5	89,0	20°	2,5	250,0	5,0	3	45723
12,0	13,5	100,0	20°	3,0	250,0	6,0	4	45724
12,0	14,4	100,0	20°	2,5	250,0	6,0	4	45725
12,0	20,0	100,0	14°	2,0	60,0	6,0	4	45726
16,0	31,0	109,0	12.5°	2,0	1000,0	5,0	4	45727
16,0	27,5	109,0	12.5°	3,0	1000,0	5,0	4	45728
16,0	24,0	109,0	12.5°	4,0	1000,0	5,0	4	45729
16,0	21,0	109,0	15°	4,0	1000,0	5,0	4	45730
16,0	18,5	109,0	20°	4,0	1500,0	8,0	4	45731
16,0	28,5	109,0	10°	4,0	1000,0	5,0	4	45732
16,0	19,0	109,0	20°	3,0	750,0	5,0	4	45733
16,0	15,0	109,0	30°	2,0	750,0	3,0	4	45734
16,0	18,5	109,0	20°	3,0	60,0	5,0	4	45735

TOLERANCES (mm)

DCON = h_6

RE = –0,010/–0,010

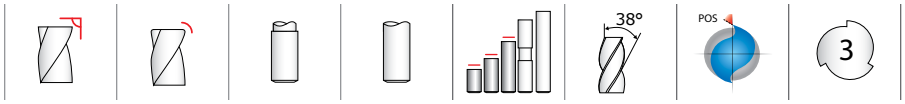
NON-FERROUS

S-Carb APF-B

			DCON	6		8		10		12		16	
			Ae max	0,20	0,45	0,25	0,55	0,30	0,60	0,35	0,65	0,40	0,70
			Diameter	3,0	6,0	4,0	8,0	5,0	10,0	6,0	12,0	8,0	16,0
Metric	Hardness (HRb)	Vc (m/min)	Cut Zone	RE	RE2	RE	RE2	RE	RE2	RE	RE2	RE	RE2
N Aluminum	≤88	510	RPM	54111	27056	40583	20292	32467	16233	27056	13528	20292	10146
		(388-632)	Fz	0,017	0,040	0,021	0,050	0,025	0,060	0,033	0,080	0,042	0,100
			Feed (mm/min)	2706	3247	2536	3044	2435	2922	3607	4329	3382	4058
	≥88	330	RPM	35013	17507	26260	13130	21008	10504	17507	8753	13130	6565
		(284-376)	Fz	0,013	0,030	0,017	0,040	0,021	0,050	0,025	0,060	0,033	0,080
			Feed (mm/min)	1313	1576	1313	1576	1313	1576	1751	2101	1751	2101

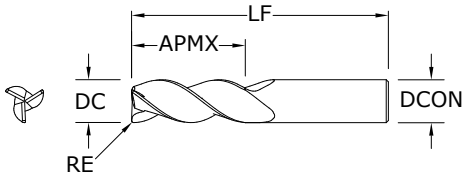
rpm = (Vc x 1000) / (DC x 3.14)
Feed= Fz x No. of flutes x rpm
Adjust speed and feed cutting
Adjust rates according to cutting area of tool being used
Avoid using tip of the tool where possible due to reduced chip space
Be aware of max cut Ae, especially on the lower portion of the tool
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

S-Carb



43M • 43MCR

METRIC SERIES



- Circular land allows for increased control at various speed and feed rates and reduces chatter
- Symmetrical end gashing for excellent balance at high speeds and aggressive plunging capability
- Open fluting for deep slotting and profiling
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

mm						EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	POLISHED FLUTES	UNCOATED	Ti-NAMITE-B (TiB_2)
3,0	8,0	52,0	6,0	–	•	–	44890
4,0	11,0	55,0	6,0	–	•	–	44891
5,0	13,0	57,0	6,0	–	•	–	44892
6,0	13,0	57,0	6,0	–		44701	44715
6,0	13,0	57,0	6,0	1,5		–	44732
6,0	13,0	57,0	6,0	0,5	•	–	44902
6,0	13,0	57,0	6,0	1,0	•	–	44894
6,0	13,0	72,0	6,0	–		44702	44716
6,0	13,0	72,0	6,0	0,8	•	–	44842
6,0	13,0	72,0	6,0	1,2	•	–	44843
6,0	24,0	75,0	6,0	–	•	–	44893
6,0	24,0	75,0	6,0	0,5	•	–	44844
6,0	24,0	75,0	6,0	1,0	•	–	44845
8,0	19,0	63,0	8,0	–		44703	44717
8,0	19,0	63,0	8,0	0,3	•	–	44846
8,0	19,0	63,0	8,0	0,5	•	–	44847
8,0	19,0	63,0	8,0	1,0	•	–	44848
8,0	19,0	63,0	8,0	1,5	•	–	44849
8,0	32,0	75,0	8,0	–	•	–	44895
8,0	32,0	75,0	8,0	0,5	•	–	44850
8,0	32,0	75,0	8,0	1,0	•	–	44851
8,0	32,0	75,0	8,0	1,5	•	–	44852
8,0	32,0	75,0	8,0	2,0	•	–	44853
10,0	22,0	72,0	10,0	–		44705	44719
10,0	22,0	72,0	10,0	0,3	•	–	44854
10,0	22,0	72,0	10,0	0,5	•	–	44855
10,0	22,0	72,0	10,0	1,0	•	–	44856
10,0	22,0	72,0	10,0	1,5	•	–	44857
10,0	40,0	100,0	10,0	–	•	–	44896
10,0	40,0	100,0	10,0	0,5	•	–	44858

continued on next page

TOLERANCES (mm)

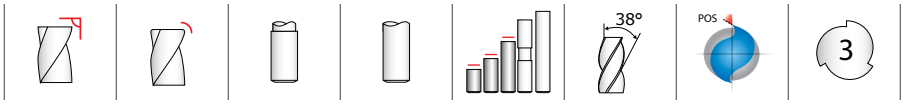
≤6 DIAMETER
DC = +0,000/–0,008
DCON = h_6
RE = +0,000/–0,050

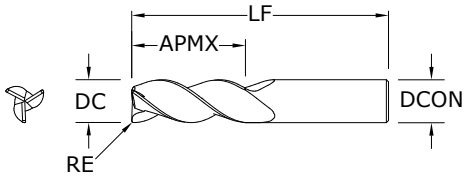
>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,000/–0,050

>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6
RE = +0,000/–0,050

>18–20 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,000/–0,050

NON-FERROUS





43M • 43MCR

METRIC SERIES

CONTINUED

TOLERANCES (mm)

≤6 DIAMETER
DC = +0,000/–0,008
DCON = h_6
RE = +0,000/–0,050

>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,000/–0,050

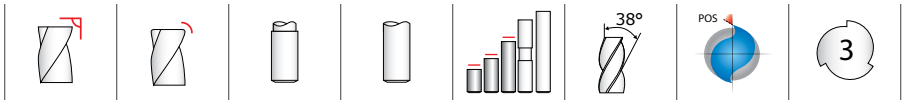
>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6
RE = +0,000/–0,050

>18–20 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,000/–0,050

NON-FERROUS

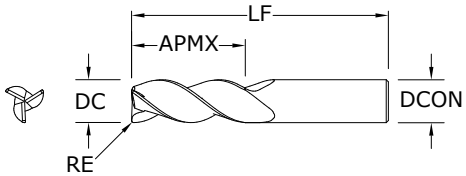
mm						EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	POLISHED FLUTES	UNCOATED	Ti-NAMITE-B (TiB_2)
10,0	40,0	100,0	10,0	1,0	•	–	44859
10,0	40,0	100,0	10,0	1,5	•	–	44860
10,0	40,0	100,0	10,0	2,0	•	–	44861
12,0	26,0	83,0	12,0	–		44708	44722
12,0	26,0	83,0	12,0	1,5		44814	44733
12,0	26,0	83,0	12,0	2,0		44815	44826
12,0	26,0	83,0	12,0	2,5		44816	44827
12,0	26,0	83,0	12,0	3,0		44817	44734
12,0	48,0	100,0	12,0	–	•	–	44897
12,0	48,0	100,0	12,0	0,5	•	–	44862
12,0	48,0	100,0	12,0	1,0	•	–	44863
12,0	48,0	100,0	12,0	1,5	•	–	44864
12,0	48,0	100,0	12,0	2,0	•	–	44865
12,0	48,0	100,0	12,0	2,5	•	–	44866
12,0	48,0	100,0	12,0	3,0	•	–	44867
14,0	30,0	89,0	14,0	–	•	–	44898
14,0	30,0	89,0	14,0	1,0	•	–	44868
14,0	30,0	89,0	14,0	2,0	•	–	44869
14,0	30,0	89,0	14,0	3,0	•	–	44870
16,0	32,0	92,0	16,0	–		44711	44725
16,0	32,0	92,0	16,0	1,5		44818	44735
16,0	32,0	92,0	16,0	2,0		44819	44828
16,0	32,0	92,0	16,0	2,5		44820	44829
16,0	32,0	92,0	16,0	3,0		44821	44736
16,0	32,0	92,0	16,0	4,0	•	–	44871
16,0	64,0	125,0	16,0	–	•	–	44900
16,0	64,0	125,0	16,0	0,5	•	–	44872
16,0	64,0	125,0	16,0	1,0	•	–	44873
16,0	64,0	125,0	16,0	1,5	•	–	44874
16,0	64,0	125,0	16,0	2,0	•	–	44875
16,0	64,0	125,0	16,0	2,5	•	–	44876
16,0	64,0	125,0	16,0	3,0	•	–	44877

continued on next page



43M • 43MCR

METRIC SERIES



CONTINUED

mm						EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	POLISHED FLUTES	UNCOATED	Ti-NAMITE-B (TiB_2)
16,0	64,0	125,0	16,0	4,0	•	–	44878
20,0	38,0	104,0	20,0	–		44714	44728
20,0	38,0	104,0	20,0	2,0		44822	44830
20,0	38,0	104,0	20,0	2,5		44823	44831
20,0	38,0	104,0	20,0	3,0		44824	44737
20,0	38,0	104,0	20,0	4,0	•	–	44879
20,0	80,0	150,0	20,0	–	•	–	44901
20,0	80,0	150,0	20,0	0,5	•	–	44880
20,0	80,0	150,0	20,0	1,0	•	–	44881
20,0	80,0	150,0	20,0	1,5	•	–	44882
20,0	80,0	150,0	20,0	2,0	•	–	44883
20,0	80,0	150,0	20,0	2,5	•	–	44884
20,0	80,0	150,0	20,0	3,0	•	–	44885
20,0	80,0	150,0	20,0	4,0	•	–	44886
25,0	50,0	125,0	25,0	–	•	–	44731

TOLERANCES (mm)

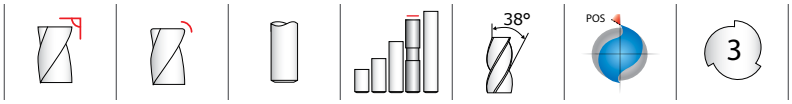
≤6 DIAMETER
DC = +0,000/–0,008
DCON = h_6
RE = +0,000/–0,050

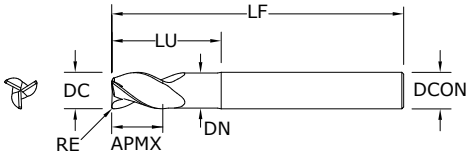
>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,000/–0,050

>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6
RE = +0,000/–0,050

>18–20 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,000/–0,050

NON-FERROUS





43ML • 43MLC

METRIC SERIES

TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,008
DCON = h_6

>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,000/–0,050

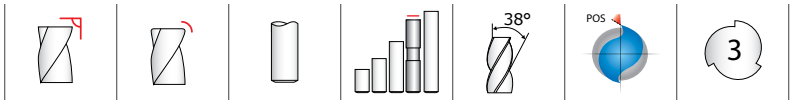
>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6
RE = +0,000/–0,050

>18–20 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,000/–0,050
RE = +0,000/–0,050

NON-FERROUS

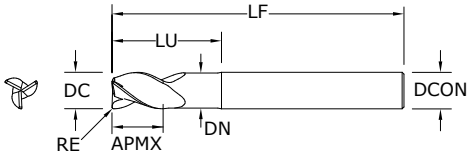
mm								EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	POLISHED FLUTES	UNCOATED	Ti-NAMITE-B (TiB_2)
6,0	10,0	63,0	6,0	20,0	5,49	0,5		44769	44789
6,0	10,0	63,0	6,0	20,0	5,49	1,0		44770	44790
6,0	10,0	75,0	6,0	20,0	5,49	–		–	42706
6,0	13,0	72,0	6,0	30,0	5,49	0,5		44771	44791
6,0	13,0	72,0	6,0	30,0	5,49	1,0		44772	44792
8,0	12,0	75,0	8,0	25,0	7,49	–		–	42707
8,0	12,0	75,0	8,0	25,0	7,49	0,3		44773	44793
8,0	12,0	75,0	8,0	25,0	7,49	0,5		44774	44794
8,0	12,0	75,0	8,0	25,0	7,49	0,8	•	–	44950
8,0	12,0	75,0	8,0	25,0	7,49	1,0		44775	44795
8,0	12,0	75,0	8,0	25,0	7,49	1,2	•	–	44951
8,0	12,0	75,0	8,0	25,0	7,49	1,5		44776	44796
8,0	12,0	75,0	8,0	25,0	7,49	1,6	•	–	44952
10,0	14,0	100,0	10,0	35,0	9,48	–		–	42708
10,0	14,0	100,0	10,0	35,0	9,48	0,3		44777	44797
10,0	14,0	100,0	10,0	35,0	9,48	0,5		44778	44798
10,0	14,0	100,0	10,0	35,0	9,48	1,0		44779	44799
10,0	14,0	100,0	10,0	35,0	9,48	1,5		44780	44800
10,0	14,0	100,0	10,0	35,0	9,50	0,8	•	–	44953
10,0	14,0	100,0	10,0	35,0	9,50	1,2	•	–	44954
10,0	14,0	100,0	10,0	35,0	9,50	1,6	•	–	44955
10,0	14,0	100,0	10,0	35,0	9,50	2,4	•	–	44956
12,0	16,0	100,0	12,0	40,0	11,48	–		–	42709
12,0	16,0	100,0	12,0	40,0	11,48	0,5		44781	44801
12,0	16,0	100,0	12,0	40,0	11,48	0,8	•	–	44957
12,0	16,0	100,0	12,0	40,0	11,48	1,0		44782	44802
12,0	16,0	100,0	12,0	40,0	11,48	1,2	•	–	44958
12,0	16,0	100,0	12,0	40,0	11,48	1,5		44783	44803
12,0	16,0	100,0	12,0	40,0	11,48	1,6	•	–	44959
12,0	16,0	100,0	12,0	40,0	11,48	2,0		44784	44804
12,0	16,0	100,0	12,0	40,0	11,48	2,4	•	–	44960
12,0	16,0	100,0	12,0	40,0	11,48	2,5		44832	44839
12,0	16,0	100,0	12,0	40,0	11,48	3,0		44833	44738
12,0	16,0	100,0	12,0	40,0	11,48	4,0		44834	44741

- Circular land allows for increased control at various speed and feed rates and reduces chatter
- Symmetrical end gashing for excellent balance at high speeds and aggressive plunging capability
- Open fluting for deep slotting and profiling
- Necked design with blended diameter transitions provide clearance to reach
- Enhanced corner geometry with tight tolerance corner radii
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)



43ML • 43MLC

METRIC SERIES



CONTINUED

mm								EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	CORNER RADIUS RE	POLISHED FLUTES	UNCOATED	Ti-NAMITE-B (TiB_2)
14,0	18,0	125,0	14,0	45,0	13,49	–	•	–	44899
14,0	18,0	125,0	14,0	45,0	13,49	1,0	•	–	44961
14,0	18,0	125,0	14,0	45,0	13,49	2,0	•	–	44962
14,0	18,0	125,0	14,0	45,0	13,49	3,0	•	–	44963
14,0	18,0	125,0	14,0	45,0	13,49	4,0	•	–	44964
16,0	20,0	125,0	16,0	50,0	15,47	–		–	42710
16,0	20,0	125,0	16,0	50,0	15,47	2,0		44785	44805
16,0	20,0	125,0	16,0	50,0	15,47	2,5		44835	44840
16,0	20,0	125,0	16,0	50,0	15,47	3,0		44836	44739
16,0	20,0	125,0	16,0	50,0	15,47	4,0		44786	44806
16,0	20,0	125,0	16,0	50,0	15,49	0,8	•	–	44965
16,0	20,0	125,0	16,0	50,0	15,49	1,2	•	–	44966
16,0	20,0	125,0	16,0	50,0	15,49	1,6	•	–	44967
16,0	20,0	125,0	16,0	50,0	15,49	2,4	•	–	44968
16,0	20,0	125,0	16,0	50,0	15,49	3,2	•	–	44969
20,0	25,0	150,0	20,0	65,0	19,46	–		–	42711
20,0	25,0	150,0	20,0	65,0	19,46	2,0		44787	44807
20,0	25,0	150,0	20,0	65,0	19,46	2,4	•	–	44973
20,0	25,0	150,0	20,0	65,0	19,46	2,5		44837	44841
20,0	25,0	150,0	20,0	65,0	19,46	3,0		44838	44740
20,0	25,0	150,0	20,0	65,0	19,46	4,0		44788	44808
20,0	25,0	150,0	20,0	65,0	19,48	0,8	•	–	44970
20,0	25,0	150,0	20,0	65,0	19,48	1,2	•	–	44971
20,0	25,0	150,0	20,0	65,0	19,48	1,6	•	–	44972
20,0	25,0	150,0	20,0	65,0	19,48	3,2	•	–	44974

TOLERANCES (mm)

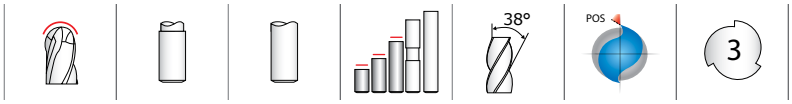
6 DIAMETER
DC = +0,000/–0,008
DCON = h_6

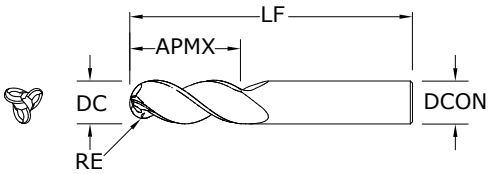
>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,000/–0,050

>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6
RE = +0,000/–0,050

>18–20 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,000/–0,050
RE = +0,000/–0,050

NON-FERROUS





43MB
METRIC SERIES

TOLERANCES (mm)

3 DIAMETER
DC = +0,000/–0,006
DCON = h_6
RE = +0,0127/–0,0127

>3–6 DIAMETER
DC = +0,000/–0,008
DCON = h_6
RE = +0,0127/–0,0127

>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,0127/–0,0127

>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6
RE = +0,0127/–0,0127

>18–25 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,0127/–0,0127

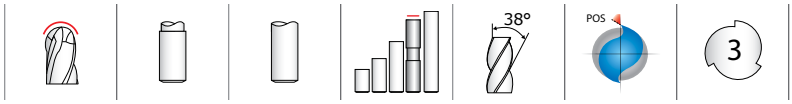
NON-FERROUS

mm					EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	POLISHED FLUTES	Ti-NAMITE-B (TiB_2)
3,0	4,5	57,0	6,0	•	44916
4,0	6,0	57,0	6,0	•	44919
5,0	7,5	57,0	6,0	•	44922
6,0	9,0	57,0	6,0	•	44925
8,0	12,0	63,0	8,0	•	44928
10,0	15,0	75,0	10,0	•	44931
12,0	18,0	83,0	12,0	•	44934
16,0	24,0	100,0	16,0	•	44937
20,0	30,0	108,0	20,0	•	44940
25,0	37,5	127,0	25,0	•	44943

RE = 1/2 Cutting Diameter (DC)

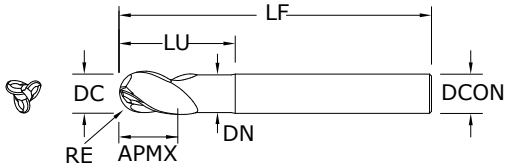
- **Circular land allows for increased control at various speed and feed rates and reduces chatter**
- **Open fluting for deep slotting and profiling**
- **Ball end design ideal for finishing operations in complex workpieces**
- **Recommended for materials ≤ 150 Bhn (≤ 7 HRc)**

S-Carb



43MLB

METRIC SERIES



- Circular land allows for increased control at various speed and feed rates and reduces chatter
- Open fluting for deep slotting and profiling
- Ball end design ideal for finishing operations in complex workpieces
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

mm							EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	POLISHED FLUTES	Ti-NAMITE-B (TiB_2)
3,0	6,0	57,0	6,0	10,0	2,74	•	44917
3,0	9,0	57,0	6,0	16,0	2,74	•	44918
4,0	8,0	57,0	6,0	13,0	3,73	•	44920
4,0	12,0	57,0	6,0	21,0	3,73	•	44921
5,0	10,0	63,0	6,0	16,0	4,50	•	44923
5,0	15,0	63,0	6,0	26,0	4,50	•	44924
6,0	12,0	63,0	6,0	19,0	5,49	•	44926
6,0	18,0	75,0	6,0	31,0	5,49	•	44927
8,0	16,0	75,0	8,0	25,0	7,49	•	44929
8,0	24,0	83,0	8,0	41,0	7,49	•	44930
10,0	20,0	83,0	10,0	31,0	9,50	•	44932
10,0	30,0	100,0	10,0	51,0	9,50	•	44933
12,0	24,0	100,0	12,0	37,0	11,48	•	44935
12,0	36,0	130,0	12,0	61,0	11,48	•	44936
16,0	32,0	130,0	16,0	49,0	15,49	•	44938
16,0	48,0	150,0	16,0	81,0	15,49	•	44939
20,0	40,0	130,0	20,0	61,0	19,48	•	44941
20,0	60,0	150,0	20,0	101,0	19,48	•	44942
25,0	50,0	152,0	25,0	76,0	24,49	•	44944
25,0	75,0	170,0	25,0	126,0	24,49	•	44945

RE = 1/2 Cutting Diameter (DC)

TOLERANCES (mm)

3 DIAMETER
DC = +0,000/–0,006
DCON = h_6
RE = +0,0127/–0,0127

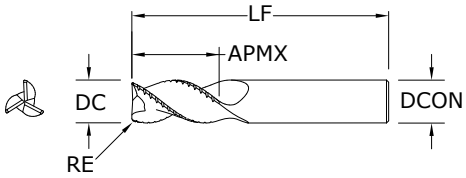
>3–6 DIAMETER
DC = +0,000/–0,008
DCON = h_6
RE = +0,0127/–0,0127

>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,0127/–0,0127

>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6
RE = +0,0127/–0,0127

>18–25 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,0127/–0,0127

NON-FERROUS



43MCB
METRIC SERIES

TOLERANCES (mm)

>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,000/–0,050

>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6
RE = +0,000/–0,050

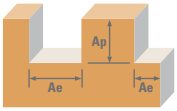
>18–20 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,000/–0,050

NON-FERROUS

mm					EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	UNCOATED	Ti-NAMITE-B (TiB_2)
6,0	19,0	63,0	6,0	0,5	44298	44299
8,0	19,0	63,0	8,0	0,3	44300	44305
10,0	22,0	72,0	10,0	0,3	44301	44306
12,0	26,0	83,0	12,0	1,0	44302	44307
16,0	32,0	92,0	16,0	1,0	44303	44308
20,0	38,0	104,0	20,0	1,0	44304	44309

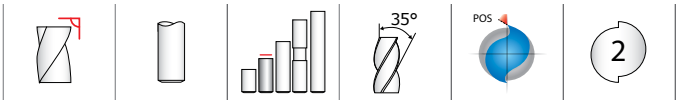
- Circular land allows for increased control at various speed and feed rates and reduces chatter
- Symmetrical end gashing for excellent balance at high speeds and aggressive plunging capability
- Chip breakers reduce machine loads up to 15% for increased roughing feed rate capability
- Open fluting for deep slotting and profiling
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

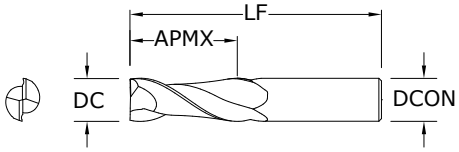
S-Carb



	Series 43M, 43MB, 43MBL, 43MCR, 43ML, 43MLC, 43MCB Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	10	12	16	20	25
N	ALUMINUM ALLOYS 2024, 5052, 5086, 6061, 6073, 7075	≤ 150 Bhn or ≤ 88 HRb	Slot	1	≤ 1	490	RPM	52022	26011	15607	13005	9754	7803	6243
						(392-588)	Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	3371	4682	5618	5618	4869	4370	3980
			Profile	≤ 0.5	≤ 1.5	610	RPM	64762	32381	19429	16190	12143	9714	7771
						(488-732)	Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	4196	5828	6994	6994	6061	5440	4955
			HSM	≤ 0.05	≤ 2	1005	RPM	106698	53349	32009	26674	20006	16005	12804
						(804-1206)	Fz	0.050	0.132	0.280	0.336	0.384	0.440	0.488
							Feed (mm/min)	16131	21124	26888	26885	23046	21126	18726
	ALUMINUM DIE CAST ALLOYS (HIGH SILICONE) A-390, A-392, B- 390	≤ 125 Bhn or ≤ 77 HRb	Slot	1	≤ 1	185	RPM	19641	9820	5892	4910	3683	2946	2357
						(148-222)	Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	1273	1768	2121	2121	1838	1650	1503
			Profile	≤ 0.5	≤ 1.5	230	RPM	24418	12209	7326	6105	4578	3663	2930
						(184-276)	Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	1582	2197	2637	2637	2285	2051	1868
			HSM	≤ 0.05	≤ 2	380	RPM	40343	20172	12103	10086	7564	6052	4841
						(304-456)	Fz	0.050	0.132	0.280	0.336	0.384	0.440	0.488
							Feed (mm/min)	6099	7987	10166	10166	8714	7988	7081
	COPPER ALLOYS Aluminum Bronze Brass Naval Brass Red Brass	≤ 140 Bhn or ≤ 3 HRc	Slot	1	≤ 1	265	RPM	28134	14067	8440	7034	5275	4220	3376
						(212-318)	Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	1620	2025	2701	2532	2228	2026	1773
			Profile	≤ 0.5	≤ 1.5	330	RPM	35035	17518	10511	8759	6569	5255	4204
						(264-396)	Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	2018	2522	3363	3153	2775	2523	2207
			HSM	≤ 0.05	≤ 2	545	RPM	57861	28930	17358	14465	10849	8679	6943
						(436-654)	Fz	0.041	0.108	0.227	0.276	0.320	0.373	0.400
							Feed (mm/min)	7082	9373	11804	11976	10415	9721	8332
	COPPER ALLOYS Beryllium Copper C110, Manganese Bronze, Tin Bronze	≤ 200 Bhn or ≤ 23 HRc	Slot	1	≤ 1	105	RPM	11148	5574	3344	2787	2090	1672	1338
						(84-126)	Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	642	803	1070	1003	883	803	702
			Profile	≤ 0.5	≤ 1.5	130	RPM	13802	6901	4141	3450	2588	2070	1656
						(104-156)	Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	795	994	1325	1242	1093	994	870
			HSM	≤ 0.05	≤ 2	215	RPM	22826	11413	6848	5706	4280	3424	2739
						(172-258)	Fz	0.041	0.108	0.227	0.276	0.320	0.373	0.400
							Feed (mm/min)	2794	3697	4656	4725	4109	3835	3287
	PLASTICS ABS, Polycarbonate, PVC, Polypropylene		Slot	1	≤ 1	490	RPM	52022	26011	15607	13005	9754	7803	6243
						(392-588)	Fz	0.036	0.096	0.200	0.240	0.282	0.320	0.350
							Feed (mm/min)	5618	7490	9364	9363	8240	7491	6555
			Profile	≤ 0.5	≤ 1.5	610	RPM	64762	32381	19429	16190	12143	9714	7771
						(488-732)	Fz	0.036	0.096	0.200	0.240	0.282	0.320	0.350
							Feed (mm/min)	6994	9325	11657	11656	10258	9326	8160
			HSM	≤ 0.05	≤ 2	1005	RPM	106698	53349	32009	26674	20006	16005	12804
						(804-1206)	Fz	0.082	0.216	0.453	0.552	0.640	0.733	0.800
							Feed (mm/min)	26117	34567	43532	44169	38410	35210	30730

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B) HSM (High Speed Machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 3 x rpm
reduce speed and feed for materials harder than listed
reduce cut depth and feed by 50% for long flute and long reach tools
reduce feed and Ae when finish milling (.02 x DC maximum)
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)





47M
METRIC SERIES

TOLERANCES (mm)

3 DIAMETER
DC = +0,000/–0,006
DCON = h_6

>3–6 DIAMETER
DC = +0,000/–0,008
DCON = h_6

>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6

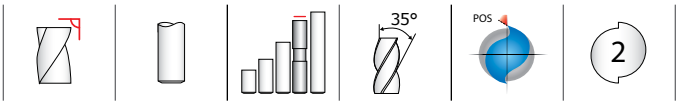
>10–18 DIAMETER
DC = +0,000/–0,012
DCON = h_6

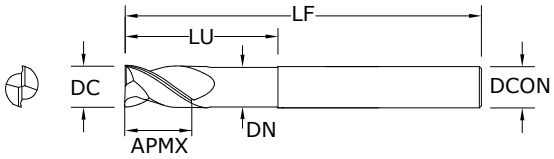
>18–25 DIAMETER
DC = +0,000/–0,013
DCON = h_6

NON-FERROUS

mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-B (TiB_2)
3,0	8,0	38,0	3,0	44550	44587
4,0	11,0	50,0	4,0	44551	44588
5,0	13,0	50,0	5,0	44552	44589
6,0	13,0	57,0	6,0	44553	44590
8,0	19,0	63,0	8,0	44554	44591
10,0	22,0	72,0	10,0	44555	44592
12,0	26,0	83,0	12,0	44556	44593
14,0	26,0	83,0	14,0	44557	44594
16,0	32,0	92,0	16,0	44558	44595
20,0	38,0	104,0	20,0	44559	44596
25,0	38,0	104,0	25,0	44560	44597

- Circular land reduces edge aggressiveness for varied speed and feed rates
- 2 Flutes effectively manage the large size and volume of chips produced during the aggressive machining process
- Excellent balance at high speeds and aggressive plunging capability
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)





47ML
METRIC SERIES

TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,008
DCON = h_6

>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6

>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6

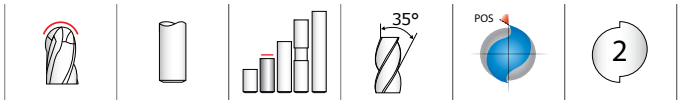
>18–20 DIAMETER
DC = +0,000/–0,013
DCON = h_6

NON-FERROUS

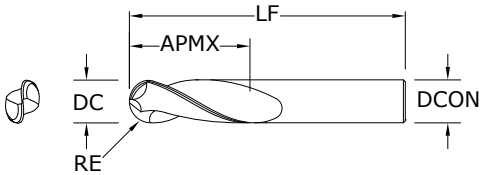
mm						EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	UNCOATED	Ti-NAMITE-B (TiB_2)
6,0	10,0	100,0	6,0	54,0	5,62	44561	44609
8,0	12,0	100,0	8,0	54,0	7,62	44562	44610
10,0	12,0	100,0	10,0	54,0	9,62	44563	44611
12,0	16,0	150,0	12,0	80,0	11,62	44564	44612
16,0	20,0	150,0	16,0	80,0	15,62	44565	44613
20,0	25,0	150,0	20,0	80,0	19,62	44566	44614

- Circular land reduces edge aggressiveness for varied speed and feed rates
- 2 Flutes effectively manage the large size and volume of chips produced during the aggressive machining process
- Excellent balance at high speeds and aggressive plunging capability
- Necked design with blended diameter transitions provide clearance to reach
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

S-Carb



47MB
METRIC SERIES



- Circular land reduces edge aggressiveness for varied speed and feed rates
- 2 Flutes effectively manage the large size and volume of chips produced during the aggressive machining process
- Excellent balance at high speeds and aggressive plunging capability
- Ball end design ideal for finishing operations in complex workpieces
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-B (TiB_2)
3,0	8,0	38,0	3,0	44570	44598
4,0	11,0	50,0	4,0	44571	44599
5,0	13,0	50,0	5,0	44572	44600
6,0	13,0	57,0	6,0	44573	44601
8,0	19,0	63,0	8,0	44574	44602
10,0	22,0	72,0	10,0	44575	44603
12,0	26,0	83,0	12,0	44576	44604
14,0	26,0	83,0	14,0	44577	44605
16,0	32,0	92,0	16,0	44578	44606
20,0	37,3	104,0	20,0	44579	44607
25,0	38,0	104,0	25,0	44580	44608

RE = 1/2 Cutting Diameter (DC)

TOLERANCES (mm)

3 DIAMETER
DC = +0,000/–0,006
DCON = h_6
RE = +0,0127/–0,0127

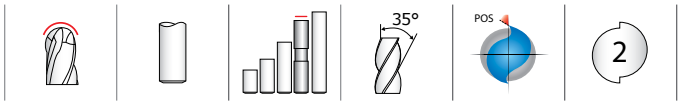
>3–6 DIAMETER
DC = +0,000/–0,008
DCON = h_6
RE = +0,0127/–0,0127

>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,0127/–0,0127

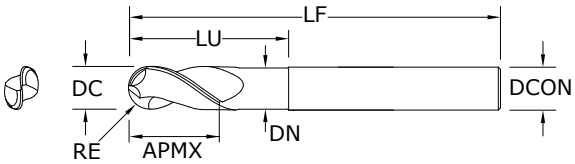
>10–18 DIAMETER
DC = +0,000/–0,012
DCON = h_6
RE = +0,0127/–0,0127

>18–25 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,0127/–0,0127

NON-FERROUS



47MLB
METRIC SERIES



- Circular land reduces edge aggressiveness for varied speed and feed rates
- 2 Flutes effectively manage the large size and volume of chips produced during the aggressive machining process
- Excellent balance at high speeds and aggressive plunging capability
- Necked design with blended diameter transitions provide clearance to reach
- Ball end design ideal for finishing operations in complex workpieces
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

mm						EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	REACH LU	NECK DIAMETER DN	UNCOATED	Ti-NAMITE-B (TiB_2)
6,0	10,0	100,0	6,0	54,0	5,62	44581	44615
8,0	12,0	100,0	8,0	54,0	7,62	44582	44616
10,0	12,0	100,0	10,0	54,0	9,62	44583	44617
12,0	16,0	150,0	12,0	80,0	11,62	44584	44618
16,0	20,0	150,0	16,0	80,0	15,62	44585	44619
20,0	25,0	150,0	20,0	80,0	19,62	44586	44620

RE = 1/2 Cutting Diameter (DC)

TOLERANCES (mm)

6 DIAMETER
DC = +0,000/–0,008
DCON = h_6
RE = +0,0127/–0,0127

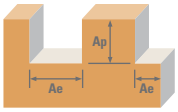
>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6
RE = +0,0127/–0,0127

>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6
RE = +0,0127/–0,0127

>18–20 DIAMETER
DC = +0,000/–0,013
DCON = h_6
RE = +0,0127/–0,0127

NON-FERROUS

S-Carb



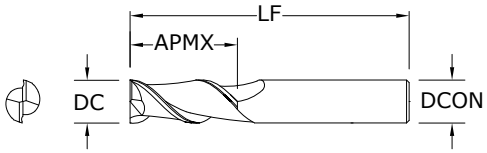
	Series 47M, 47MB, 47ML, 47MLB Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	10	12	16	20	25
N	ALUMINUM ALLOYS 2024, 5052, 5086, 6061, 6073, 7075	≤ 150 Bhn or ≤ 88 HRb	Slot	1	≤ 1	490	RPM	52022	26011	15607	13005	9754	7803	6243
						(392-588)	Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	2247	3121	3746	3745	3246	2913	2653
			Profile	≤ 0.5	≤ 1.5	610	RPM	64762	32381	19429	16190	12143	9714	7771
						(488-732)	Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	2797	3885	4663	4662	4041	3627	3303
			HSM	≤ 0.05	≤ 2	1005	RPM	106698	53349	32009	26674	20006	16005	12804
						(804-1206)	Fz	0.050	0.132	0.280	0.336	0.384	0.440	0.488
							Feed (mm/min)	10754	14083	17925	17924	15364	14084	12484
	ALUMINUM DIE CAST ALLOYS (HIGH SILICONE) A-390, A-392, B- 390	≤ 125 Bhn or ≤ 77 HRb	Slot	1	≤ 1	185	RPM	19641	9820	5892	4910	3683	2946	2357
						(148-222)	Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	848	1178	1414	1414	1226	1100	1002
			Profile	≤ 0.5	≤ 1.5	230	RPM	24418	12209	7326	6105	4578	3663	2930
						(184-276)	Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	1055	1465	1758	1758	1524	1367	1245
			HSM	≤ 0.05	≤ 2	380	RPM	40343	20172	12103	10086	7564	6052	4841
						(304-456)	Fz	0.050	0.132	0.280	0.336	0.384	0.440	0.488
							Feed (mm/min)	4066	5325	6778	6777	5809	5325	4720
	COPPER ALLOYS Aluminum Bronze Brass Naval Brass Red Brass	≤ 140 Bhn or ≤ 3 HRc	Slot	1	≤ 1	265	RPM	28134	14067	8440	7034	5275	4220	3376
						(212-318)	Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	1080	1350	1801	1688	1485	1350	1182
			Profile	≤ 0.5	≤ 1.5	330	RPM	35035	17518	10511	8759	6569	5255	4204
						(264-396)	Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	1345	1682	2242	2102	1850	1682	1472
			HSM	≤ 0.05	≤ 2	545	RPM	57861	28930	17358	14465	10849	8679	6943
						(436-654)	Fz	0.041	0.108	0.227	0.276	0.320	0.373	0.400
							Feed (mm/min)	4721	6248	7869	7984	6943	6480	5555
	COPPER ALLOYS Beryllium Copper C110, Manganese Bronze, Tin Bronze	≤ 200 Bhn or ≤ 23 HRc	Slot	1	≤ 1	105	RPM	11148	5574	3344	2787	2090	1672	1338
						(84-126)	Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	428	535	713	669	589	535	468
			Profile	≤ 0.5	≤ 1.5	130	RPM	13802	6901	4141	3450	2588	2070	1656
						(104-156)	Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	530	662	883	828	729	662	580
			HSM	≤ 0.05	≤ 2	215	RPM	22826	11413	6848	5706	4280	3424	2739
						(172-258)	Fz	0.041	0.108	0.227	0.276	0.320	0.373	0.400
							Feed (mm/min)	1862	2465	3104	3150	2739	2556	2191
	PLASTICS ABS, Polycarbonate, PVC, Polypropylene		Slot	1	≤ 1	490	RPM	52022	26011	15607	13005	9754	7803	6243
						(392-588)	Fz	0.036	0.096	0.200	0.240	0.282	0.320	0.350
							Feed (mm/min)	3745	4994	6243	6242	5493	4994	4370
			Profile	≤ 0.5	≤ 1.5	610	RPM	64762	32381	19429	16190	12143	9714	7771
						(488-732)	Fz	0.036	0.096	0.200	0.240	0.282	0.320	0.350
							Feed (mm/min)	4662	6217	7771	7771	6839	6217	5440
			HSM	≤ 0.05	≤ 2	1005	RPM	106698	53349	32009	26674	20006	16005	12804
						(804-1206)	Fz	0.082	0.216	0.453	0.552	0.640	0.733	0.800
							Feed (mm/min)	17412	23045	29022	29446	25607	23473	20487

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B) HSM (High Speed Machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 2 x rpm
reduce speed and feed for materials harder than listed
reduce cut depth and feed by 50% for long flute and long reach tools
reduce feed and Ae when finish milling (.02 x DC maximum)
refer to the KYOCERA SGS APEX for complete technical information (www.kyocera-sgstool.com/apex)

Ski-Carb

44M

METRIC SERIES



- Polished ski land with primary and secondary flute wall design minimizes chip interference by directing chips away from secondary flute
- Circular land allows for increased control at various speed and feed rates ultimately reducing chatter
- Recommended for materials ≤ 150 Bhn (≤ 7 HRc)

mm				EDP NO.			
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED W/FLAT	UNCOATED	Ti-NAMITE-B (TiB_2) W/FLAT	Ti-NAMITE-B (TiB_2)
3,0	8,0	52,0	6,0	44505	49663	44506	49674
4,0	11,0	55,0	6,0	44509	49664	44510	49675
5,0	13,0	57,0	6,0	44513	49665	44514	49676
6,0	13,0	57,0	6,0	44517	49666	44518	49677
8,0	19,0	69,0	10,0	44521	49667	44522	49678
10,0	22,0	72,0	10,0	44525	49668	44526	49679
12,0	26,0	83,0	12,0	44529	49669	44530	49680
14,0	26,0	83,0	14,0	44533	49670	44534	49681
16,0	32,0	92,0	16,0	44537	49671	44538	49682
18,0	32,0	92,0	18,0	44541	49672	44542	49683
20,0	38,0	104,0	20,0	44545	49673	44546	49684

Contact your KSPT Sales Representative for more information on Corner Radius options.

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,000/–0,006
DCON = h_6

>3–6 DIAMETER
DC = +0,000/–0,008
DCON = h_6

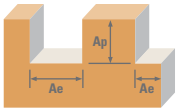
>6–10 DIAMETER
DC = +0,000/–0,009
DCON = h_6

>10–18 DIAMETER
DC = +0,000/–0,011
DCON = h_6

>18–20 DIAMETER
DC = +0,000/–0,013
DCON = h_6

NON-FERROUS

Ski-Carb



	Series 44M Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	10	12	16	20	25
N	**ALUMINUM ALLOYS 2024, 5052, 5086, 6061, 6073, 7075**	≤ 150 Bhn or ≤ 88 HRb	Slot	1	≤ 1	490 (392-588)	RPM	52022	26011	15607	13005	9754	7803	6243
							Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	2247	3121	3746	3745	3246	2913	2653
			Profile	≤ 0.5	≤ 1.5	610 (488-732)	RPM	64762	32381	19429	16190	12143	9714	7771
							Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	2797	3885	4663	4662	4041	3627	3303
			HSM	≤ 0.05	≤ 2	1005 (804-1206)	RPM	106698	53349	32009	26674	20006	16005	12804
							Fz	0.050	0.132	0.280	0.336	0.384	0.440	0.488
							Feed (mm/min)	10754	14083	17925	17924	15364	14084	12484
	ALUMINUM DIE CAST ALLOYS (HIGH SILICONE) A-390, A-392, B- 390	≤ 125 Bhn or ≤ 77 HRb	Slot	1	≤ 1	185 (148-222)	RPM	19641	9820	5892	4910	3683	2946	2357
							Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	848	1178	1414	1414	1226	1100	1002
			Profile	≤ 0.5	≤ 1.5	230 (184-276)	RPM	24418	12209	7326	6105	4578	3663	2930
							Fz	0.022	0.060	0.120	0.144	0.166	0.187	0.213
							Feed (mm/min)	1055	1465	1758	1758	1524	1367	1245
			HSM	≤ 0.05	≤ 2	380 (304-456)	RPM	40343	20172	12103	10086	7564	6052	4841
							Fz	0.050	0.132	0.280	0.336	0.384	0.440	0.488
							Feed (mm/min)	4066	5325	6778	6777	5809	5325	4720
	COPPER ALLOYS Aluminum Bronze Brass Naval Brass Red Brass	≤ 140 Bhn or ≤ 3 HRc	Slot	1	≤ 1	265 (212-318)	RPM	28134	14067	8440	7034	5275	4220	3376
							Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	1080	1350	1801	1688	1485	1350	1182
			Profile	≤ 0.5	≤ 1.5	330 (264-396)	RPM	35035	17518	10511	8759	6569	5255	4204
							Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	1345	1682	2242	2102	1850	1682	1472
			HSM	≤ 0.05	≤ 2	545 (436-654)	RPM	57861	28930	17358	14465	10849	8679	6943
							Fz	0.041	0.108	0.227	0.276	0.320	0.373	0.400
							Feed (mm/min)	4721	6248	7869	7984	6943	6480	5555
	COPPER ALLOYS Beryllium Copper C110, Manganese Bronze, Tin Bronze	≤ 200 Bhn or ≤ 23 HRc	Slot	1	≤ 1	105 (84-126)	RPM	11148	5574	3344	2787	2090	1672	1338
							Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	428	535	713	669	589	535	468
			Profile	≤ 0.5	≤ 1.5	130 (104-156)	RPM	13802	6901	4141	3450	2588	2070	1656
							Fz	0.019	0.048	0.107	0.120	0.141	0.160	0.175
							Feed (mm/min)	530	662	883	828	729	662	580
			HSM	≤ 0.05	≤ 2	215 (172-258)	RPM	22826	11413	6848	5706	4280	3424	2739
							Fz	0.041	0.108	0.227	0.276	0.320	0.373	0.400
							Feed (mm/min)	1862	2465	3104	3150	2739	2556	2191
	PLASTICS ABS, Polycarbonate, PVC, Polypropylene		Slot	1	≤ 1	490 (392-588)	RPM	52022	26011	15607	13005	9754	7803	6243
							Fz	0.036	0.096	0.200	0.240	0.282	0.320	0.350
							Feed (mm/min)	3745	4994	6243	6242	5493	4994	4370
			Profile	≤ 0.5	≤ 1.5	610 (488-732)	RPM	64762	32381	19429	16190	12143	9714	7771
							Fz	0.036	0.096	0.200	0.240	0.282	0.320	0.350
							Feed (mm/min)	4662	6217	7771	7771	6839	6217	5440
			HSM	≤ 0.05	≤ 2	1005 (804-1206)	RPM	106698	53349	32009	26674	20006	16005	12804
							Fz	0.082	0.216	0.453	0.552	0.640	0.733	0.800
							Feed (mm/min)	17412	23045	29022	29446	25607	23473	20487

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B) HSM (High Speed Machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 2 x rpm
reduce speed and feed for materials harder than listed
reduce cut depth and feed by 50% for long flute and long reach tools
reduce feed and Ae when finish milling (.02 x DC maximum)
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

SGS
Solid Carbide Tools

VALUE AT THE SPINDLE

High Performance Drills

Hole Making

HIGH PERFORMANCE DRILLS	SERIES	DESCRIPTION	APPLICATION ★ PREFERRED ☆ ALTERNATE	PAGE	S&F PAGE
Hi-PerCarb	142P (3XD)	2 Flute Internal Coolant 4 Margin 3XD	★	112	126
	142P (5XD)	2 Flute Internal Coolant 4 Margin 5XD	★	115	126
	142P (8XD)	2 Flute Internal Coolant 4 Margin 8XD	★	118	126
	142P (12XD)	2 Flute Internal Coolant 4 Margin 12XD	★	122	126
	143M-S (3XD)	2 Flute Internal Coolant 2 Margin 3XD	★ ★	128	136
	143M-S (5XD)	2 Flute Internal Coolant 2 Margin 5XD	★ ★	132	136
	141K (5xD)	3 Flute Internal Coolant 3 Margin 5xD	★	138	142
	131N (3xD)	3 Flute External Coolant 3 Margin 3xD	★	143	151
	131N (5xD)	3 Flute External Coolant 3 Margin 5xD	★	147	151
	135 (3xD)	2 Flute External Coolant 4 Margin 3xD	★ ★ ☆ ☆ ★ ★	154	160
	135 (5xD)	2 Flute External Coolant 4 Margin 5xD	★ ★ ☆ ☆ ★ ★	162	168
	146U (3xD)	2 Flute Internal Coolant 4 Margin 3xD	★ ★ ★ ★ ★ ★	170	184
	146U (5xD)	2 Flute Internal Coolant 4 Margin 5xD	★ ★ ★ ★ ★ ★	175	184
	136U (2xD)	2 Flute External Coolant 4 Margin 2xD	★ ★ ★ ★ ★ ★	179	184
CFRP 8 Facet	120	2 Flute External Coolant 4 Margin CFRP	★	152	153

Speed & Feed Recommendations listed after each series

Taladrado

BROCAS DE ALTO RENDIMIENTO	SERIE	DESCRIPCIÓN	APLICACIÓN ★ PREFERIDO ☆ ALTERNATIVO	PÁGINA	S&F PÁGINA
Hi-PerCarb	142P (3XD)	2 filos, refrigeración interna, 4 margen, 3XD	★	112	126
	142P (5XD)	2 filos, refrigeración interna, 4 margen, 5XD	★	115	126
	142P (8XD)	2 filos, refrigeración interna, 4 margen, 8XD	★	118	126
	142P (12XD)	2 filos, refrigeración interna, 4 margen, 12XD	★	122	126
	143M-S (3XD)	2 filos, refrigeracion interna, 2 margen, 3XD	★ ★	128	136
	143M-S (5XD)	2 filos, refrigeracion interna, 2 margen, 5XD	★ ★	132	136
	141K (5xD)	3 filos, refrigeración interna, 3 margen, 5xD	★	138	142
	131N (3xD)	3 filos, refrigeración externa, 3 margen, 3xD	★	143	151
	131N (5xD)	3 filos, refrigeración externa, 3 margen, 5xD	★	147	151
	135 (3xD)	2 filos, refrigeración externa, 4 margen, 3xD	★ ★ ☆ ☆ ★ ★	154	160
	135 (5xD)	2 filos, refrigeración externa, 4 margen, 5xD	★ ★ ☆ ☆ ★ ★	162	168
	146U (3xD)	2 filos, refrigeración interna, 4 margen, 3xD	★ ★ ★ ★ ★ ★	170	184
	146U (5xD)	2 filos, refrigeración interna, 4 margen, 5xD	★ ★ ★ ★ ★ ★	175	184
	136U (2xD)	2 filos, refrigeración externa, 4 margen, 2xD	★ ★ ★ ★ ★ ★	179	184
De 8 caras CFRP	120	2 filos, refrigeración externa, 4 margen, CFRP	★	152	153

Recomendaciones de velocidades y avances mostradas tras cada serie

Outils de perçage

FORETS HAUTE PERFORMANCE	SÉRIES	DESCRIPTION	APPLICATION ★ PRÉFÉRÉ ☆ ALTERNER	PAGE	S&F PAGE
Hi-PerCarb	142P (3XD)	2 dents trou d'huile 4 listel 3XD	★	112	126
	142P (5XD)	2 dents trou d'huile 4 listel 5XD	★	115	126
	142P (8XD)	2 dents trou d'huile 4 listel 8XD	★	118	126
	142P (12XD)	2 dents trou d'huile 4 listel 12XD	★	122	126
	143M-S (3XD)	2 dents trou d'huile 2 listel 3XD	★ ★	128	136
	143M-S (5XD)	2 dents trou d'huile 2 listel 5XD	★ ★	132	136
	141K (5xD)	3 dents refroidissement interne à 3 listel 5xD	★	138	142
	131N (3xD)	3 dents refroidissement externe à 3 listel 3xD	★	143	151
	131N (5xD)	3 dents refroidissement externe à 3 listel 5xD	★	147	151
	135 (3xD)	2 dents refroidissement externe à 4 listel 3xD	★ ★ ☆ ☆ ★ ★	154	160
	135 (5xD)	2 dents refroidissement externe à 4 listel 5xD	★ ★ ☆ ☆ ★ ★	162	168
	146U (3xD)	2 dents refroidissement interne à 4 listel 3xD	★ ★ ★ ★ ★ ★	170	184
	146U (5xD)	2 dents refroidissement interne à 4 listel 5xD	★ ★ ★ ★ ★ ★	175	184
	136U (2xD)	2 dents refroidissement externe à 4 listel 2xD	★ ★ ★ ★ ★ ★	179	184
CFRP à 8 facettes	120	2 dents refroidissement externe à 4 listel CFRP	★	152	153

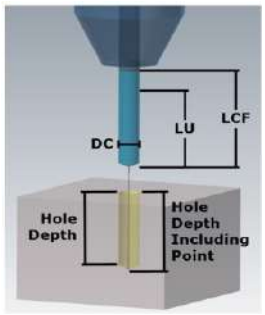
Recommandations de vitesse et avance indiquées après chaque série

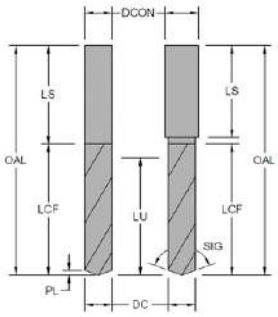
Bohren

HOCHLEISTUNGS-BOHRER	SERIE	BESCHREIBUNG	ANWENDUNG ★ BEVORZUGT ☆ WECHSELN						SEITE	S&F SEITE
Hi-PerCarb	142P (3XD)	Doppelfasenbohrer mit 4 Schneiden und Innenkühlung, 3xD	★						112	126
	142P (3XD)	Doppelfasenbohrer mit 4 Schneiden und Innenkühlung, 5xD	★						115	126
	142P (3XD)	Doppelfasenbohrer mit 4 Schneiden und Innenkühlung, 8xD	★						118	126
	142P (12XD)	Doppelfasenbohrer mit 4 Schneiden und Innenkühlung, 12xD	★						122	126
	143M-S (3XD)	2 Einfasenbohrer mit 2 Schneiden und Innenkühlung, 3xD		★			★		128	136
	143M-S (5XD)	2 Einfasenbohrer mit 2 Schneiden und Innenkühlung, 5xD		★			★		132	136
	141K (5xD)	Dreifasenbohrer 5xD mit 3 Schneiden und Innenkühlung			★				138	142
	131N (3xD)	Dreifasenbohrer 3xD mit 3 Schneiden und Außenkühlung				★			143	151
	131N (5xD)	Dreifasenbohrer 5xD mit 3 Schneiden und Außenkühlung				★			147	151
	135 (3xD)	Doppelfasenbohrer 3xD mit 4 Schneiden und Außenkühlung	★	★	☆	☆	★	★	154	160
	135 (5xD)	Doppelfasenbohrer 5xD mit 4 Schneiden und Außenkühlung	★	★	☆	☆	★	★	162	168
	146U (3xD)	Doppelfasenbohrer 3xD mit 4 Schneiden und Innenkühlung	★	★	★	★	★	★	170	184
	146U (5xD)	Doppelfasenbohrer 5xD mit 4 Schneiden und Innenkühlung	★	★	★	★	★	★	175	184
	136U (2xD)	Doppelfasenbohrer 2xD mit 4 Schneiden und Außenkühlung	★	★	★	★	★	★	179	184
CFRP 8 Facet	120	Doppelfasenbohrer CFRP mit 4 Schneiden und Außenkühlung				★			152	153

Empfehlungen für Drehzahl & Vorschub im Anhang zu jeder Serie

Drill Matrix





Item

Preferred Cut Type for Series
★ Best ☆ Better ○ Good (blank) Not Recommended

Name / Series	Tool Type	Coolant Delivery	Page	Material: Steel			Stainless Steel			Cast Iron			Non Ferrous			HRSA			Hard Steel		
				Low Carbon ≤ 20 HRc	Medium Carbon, Alloy 20 to 35 HRc	High Carbon, Alloy 35 to 45 HRc	Ferritic & Martensitic ≤ 45 HRc	Austenitic & Duplex ≤ 25 HRc	Precipitation Hardened ≤ 45 HRc	Low Alloy, Grey, Ductile ≤ 25 HRc	Med-High Alloy, Nodular 25 to 35 HRc	High Alloy, Nodular ≥ 35 HRc	Aluminum Alloys	Copper Alloys	Plastics, Composites	Titanium Alloys ≤ 45 HRc	Iron, Nickel, Cobalt Alloys ≤ 45 HRc	Refractory Alloys, Mo, Ta, W ≤ 35 HRc	High Carbon, Med Alloy 45 to 50 HRc	Tool, Mold & Die 45 to 55 HRc	Tool, Mold & Die 55 to 65 HRc
Hi-PerCarb 142P	High Performance Drill	Internal	112	★	★	★	☆	☆	☆	☆	☆	☆	☆	★		☆	☆	☆	★	☆	☆
Hi-PerCarb 143M-S	High Performance Drill	Internal	128	☆			★	★	★	☆	☆	☆	○	★		★	★	★			
Hi-PerCarb 141K	High Performance Drill	Internal	138	☆	☆	☆	○		○	★	★	★	☆	☆		○		○			
Hi-PerCarb 131N	High Performance Drill	External	143							○			★	★	☆	○					
Series 120	High Performance Drill	External	152												★						
Hi-PerCarb 135	High Performance Drill	External	154	★	★	★	★	☆	★	☆	☆	☆	○	○		☆	☆	☆	★	☆	☆
Hi-PerCarb 146U	High Performance Drill	Internal	170	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★
Hi-PerCarb 136U	High Performance Drill	External	179	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★
Series 106	General Application Drill	External	228	○	○	○						☆							★	★	☆
Series 101	General Application Drill	External	218	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
Series 103	General Application Drill	External	232	○	○	○	○	○	○	○	☆	☆	○			○	○	○			
Series 108	General Application Drill	External	223	★	☆	☆	☆	☆	☆	☆	☆	☆		○	○	☆	☆	☆			
Series 301M	Drill & Countersink	External	237	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	☆	○	○	☆	○	○
Series 201M	Reamer	External	240	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★	○

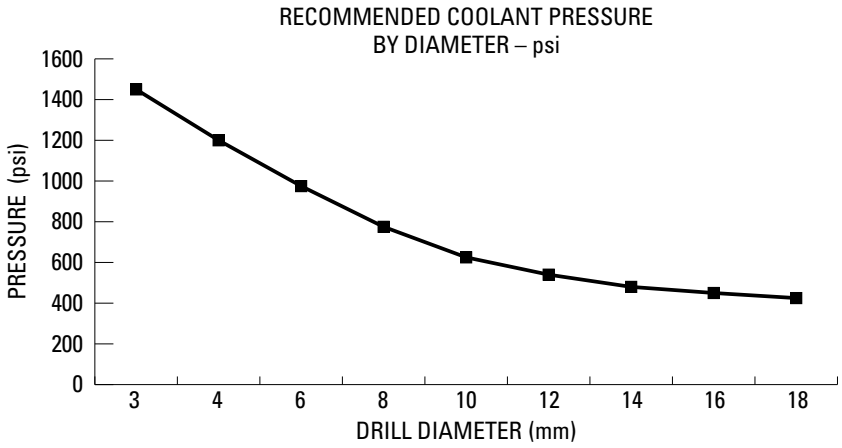
Drill Matrix

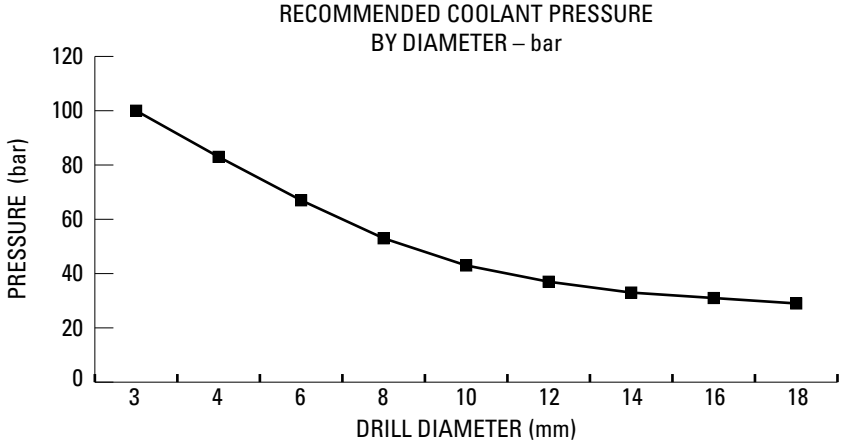
Attributes
Material hardness and machinability affect speed, feed, and cut depths. For dimensional and finish quality, a low TIR of the tool-holder assembly in the machine is critical: less than 0.1% drill diameter is preferred. Spot drilling is not necessary in most situations if the drilling surface is machined flat ; spot drill point angle should be greater than drill point angle. Liquid coolant (internal or external) such as oil based or synthetic is highly recommended for all drilling applications. For proper cooling, lubrication and chip evacuation, ensure the coolant is supplied throughout the entire depth of the hole. When liquid coolant cannot be applied for applications such as plastics or composites, clear the swarf with air or vacuum. Depending on material machinability, a peck cycle may be neccesary for external coolant drills beyond 2x or 3x depths.

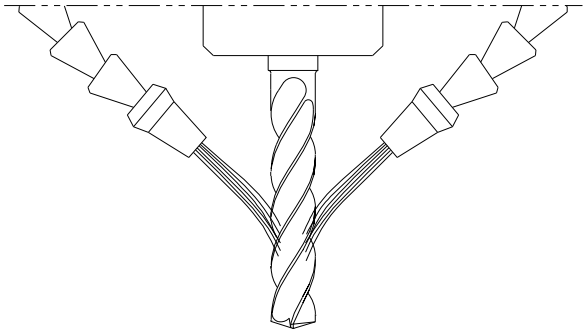
Diameter Range inch	Diameter Range mm	Tolerance	Length	Point Angle °	Self Centering	Flute Count	Margins	Helix Angle °	Shank	Coating
0.1250 0.7500	3,00 16,00	DC + / +	3x, 5x, 8x, 12x	137	yes	2	4	30	Common	Ti-NAMITE-X
0.1250 0.7500	3,00 16,00	DC + / +	3x, 5x	136	yes	2	2	30	Common	Ti-NAMITE-A
0.1250 0.7500	3,00 16,00	DC + / +	5x	124	yes	3	3	30	Common	Ti-NAMITE-X
0.1250 0.7500	3,00 16,00	DC + / +	3x, 5x	124	yes	3	3	30	Common	Ti-NAMITE-B
0.0980 0.5000	2,70 12,00	DC 0 / –	3x	145, 90	yes	2	4	20	Common	Di-NAMITE
0.0156 0.9219	1,25 22,00	DC + / +	3x, 5x	145	yes	2	4	32	Common	Ti-NAMITE-A
0.1250 0.8125	3,00 20,50	DC + / +	3x, 5x	180	yes	2	4	15	Common	Ti-NAMITE-X
0.0625 0.8125	1,50 20,50	DC + / +	2x	180	yes	2	4	15	Common	Ti-NAMITE-X
0.0400 0.5000	1,00 12,00	DC 0 / –	3x	140	yes	2	2	0	Straight	Ti-NAMITE-A or uncoated
0.0135 0.5000	0,70 12,00	DC 0 / –	5x	118	no	2	2	20	Straight	Ti-NAMITE-A or uncoated
0.1065 0.7500	3,00 20,00	DC 0 / –	3x	150	yes	3	3	30	Straight	Ti-NAMITE-A or uncoated
–	0,50 16,00	DC 0 / –	3x	118	yes	2	2	20	Straight	Ti-NAMITE-A or uncoated
0.0250 0.2188	0,50 5,00	DC + / 0	spot	118, 60	yes	2	2	0	Straight	Ti-NAMITE-A or uncoated
–	1,00 10,00	DC + / 0	varies	–	–	4 or 6	4 or 6	0	Straight	uncoated

Drilling Operations
Coolant Recommendations

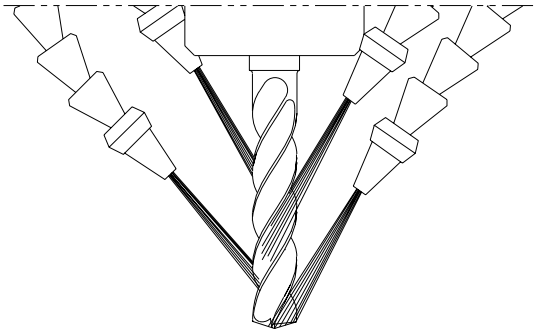
- Coolant works to mobilize chips away from the cut zone, reduce the heat created during the cutting process and minimize friction.
- It is important to optimize the coolant pressure and position in order to gain the full benefits coolant offers the cutting process.
- Proper coolant application promotes greater operating parameters, greater material removal rates, improved surface finishes, predictable tool life, reduced power consumption and reduced cycle times.
- Pressure is important, but more importantly is consistency of the pressure and application onto the tool; intermittent cooling of carbide leads to thermal stressing of the material and the formation of "microcracks."
- Proper cleanliness and filtration of coolants is important in order for the coolant to maintain its beneficial properties, and also to avoid a reduction in coolant pressure or the possibility of clogging the coolant channels in coolant through drills.







LARGE TIP – LOW VELOCITY
NO COVERAGE AT MAXIMUM DEPTH

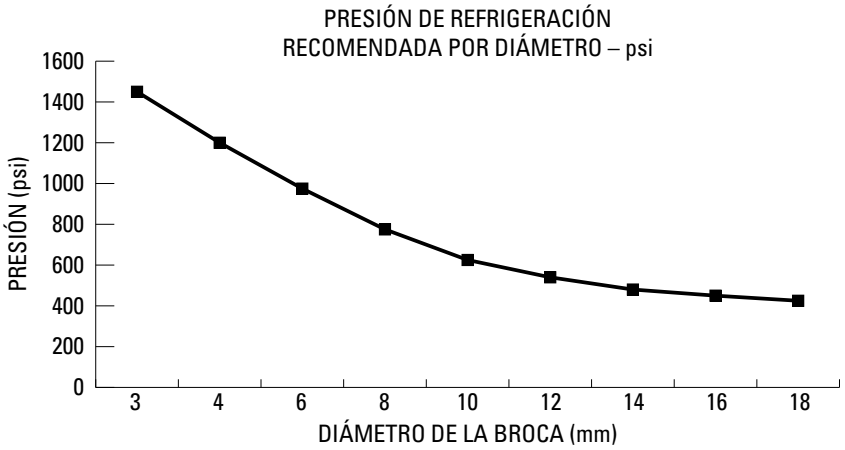


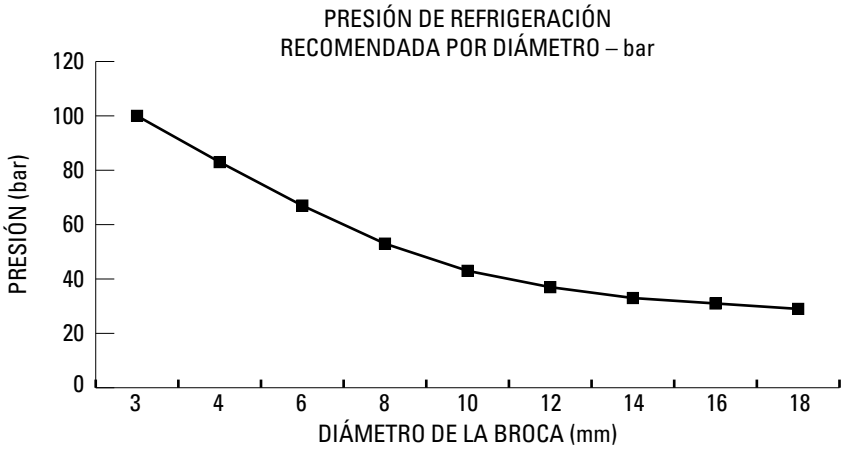
SMALL TIP – HIGH VELOCITY
COMPLETE COVERAGE

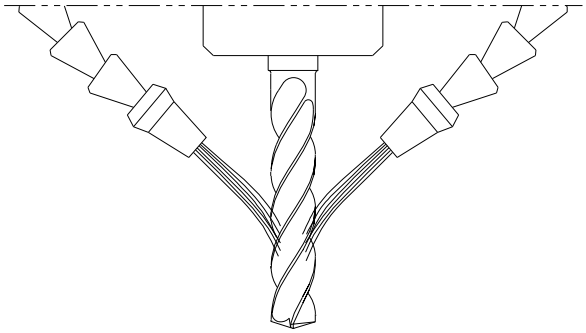
- Reducing the nozzle size helps maximize the cooling benefits of the unique double margin design on the Hi-PerCarb drill by increasing velocity. Aim the nozzles in line with the secondary flute located between the two margins as well as the flute for best results.

Recomendaciones en operacion de taladrado

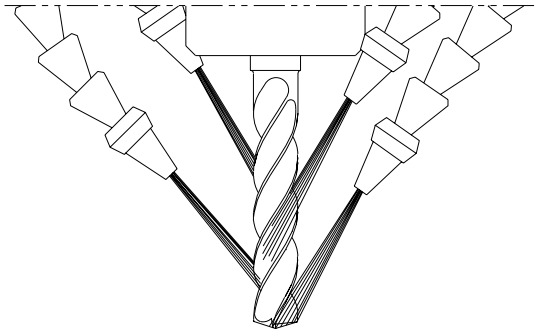
- El líquido de refrigeración actúa movilizando las virutas fuera de la zona de corte, disminuyendo el calor generado durante el proceso de corte y minimizando la fricción.
- Es importante optimizar la presión de la refrigeración y la posición para poder obtener todos los beneficios del refrigerante durante el proceso de corte.
- Una aplicación apropiada de la refrigeración fomenta mayores parámetros de operación, mayores índices de eliminación de material, acabados de superficie mejorados, una duración de la herramienta más predecible, bajo consumo de energía y un tiempo de ciclo reducido.
- La presión del refrigerante es importante, pero lo es más el flujo continuo aplicado a la herramienta; una refrigeración intermitente en el carburo puede ocasionar un estrés térmico en el material y la formación de "micro-fisuras".
- Una limpieza y filtración adecuadas son importantes para que el refrigerante mantenga sus propiedades y beneficios; por otra parte, se evita la reducción de la presión o la posibilidad de obstruir los canales de refrigeración de la broca.







PUNTA GRANDE – BAJA VELOCIDAD
SIN ALCANCE A PROFUNDIDAD MÁXIMA

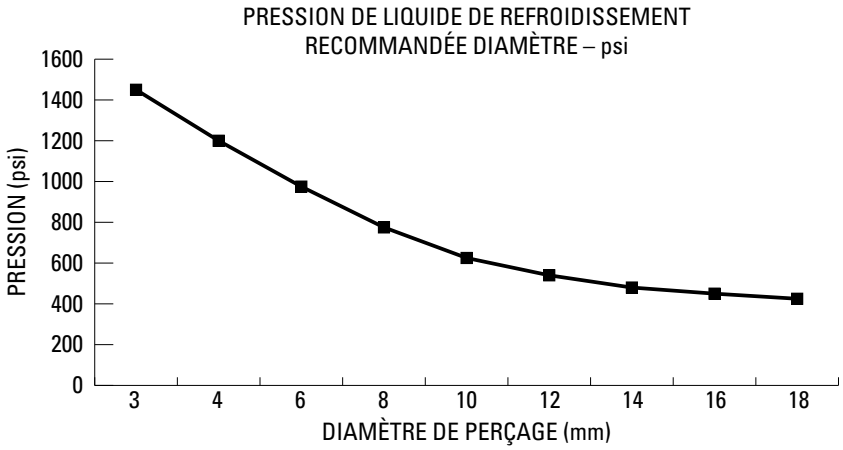


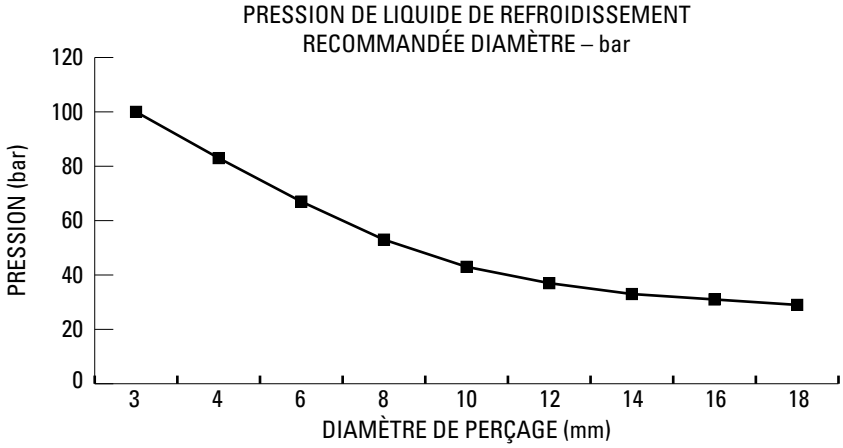
PUNTA PEQUEÑA – ALTA VELOCIDAD
COMPLETO ALCANCE

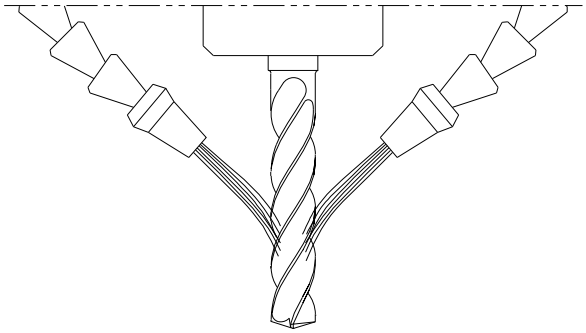
- Reducir el tamaño de la boquilla ayuda a maximizar los beneficios de refrigeración del exclusivo diseño de doble margen de la broca. Hi-PerCarb aumentando la velocidad. Coloque las boquillas en línea con el segundo filo que se encuentra entre los dos márgenes y también el filo para obtener mejores resultados.

Opérations de perçage
Recommandations en matière de refroidissement

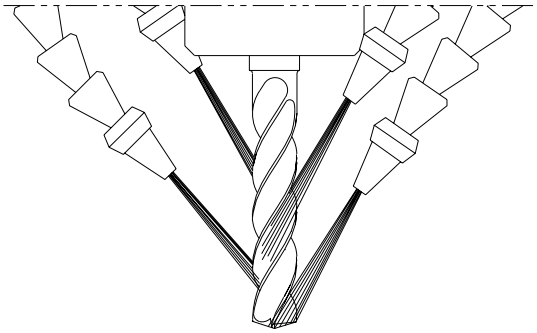
- Le liquide de refroidissement sert à éloigner les copeaux de la zone de coupe, à réduire la chaleur dégagée durant la coupe et à minimiser la friction.
- Il est important d'optimiser la pression et la position du réfrigérant pour en retirer les bénéfices maximums durant la coupe.
- L'application adéquate de réfrigérant se traduit par des paramètres opératoires supérieurs, des taux d'élimination supérieurs des matériaux, de plus belles finitions des surfaces, une durée de vie des outils prévisible, moins de consommation d'énergie et des temps de cycle réduits.
- La pression est importante, mais une pression régulière et l'application sur l'outil sont des facteurs encore plus importants ; le refroidissement intermittent du carbure se traduit par des contraintes thermiques pour le matériau et la formation de microfissures.
- La propreté et le filtrage adéquats des réfrigérants sont importants pour qu'ils conservent leur propriétés, mais aussi pour éviter la réduction de pression du réfrigérant ou le risque d'obturation des conduits à réfrigérant dans les perceuses à réfrigérant intégré.







POINTE LARGE – BASSE VITESSE
PAS DE COUVERTURE À LA PROFONDEUR MAXIMUM

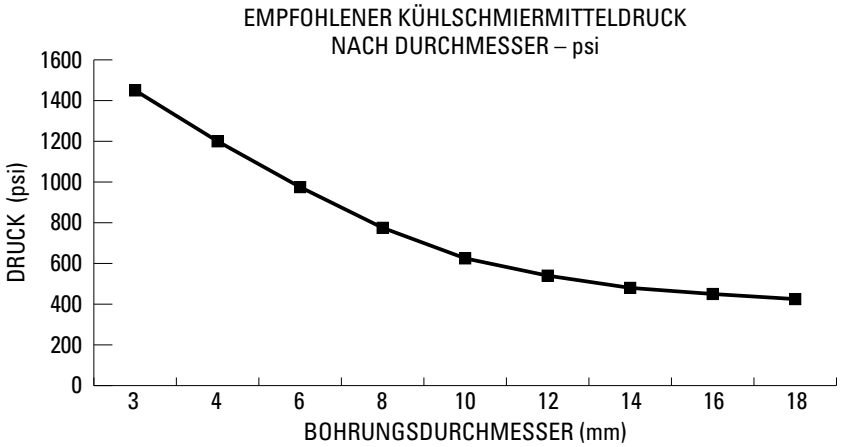


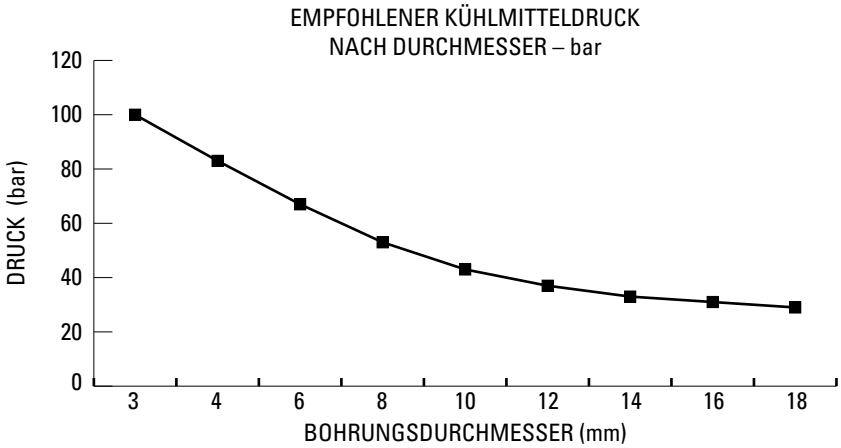
POINTE FINE – GRANDE VITESSE
COUVERTURE COMPLÈTE

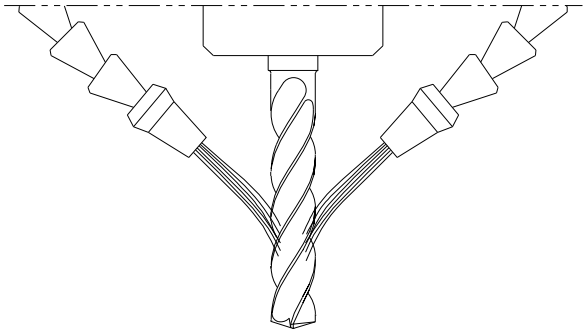
- La réduction de la taille de l'embout permet de maximiser les bienfaits du refroidissement du concept à double listel original de la perceuse Hi-PerCarb en augmentant la vitesse. Pour les meilleurs résultats, orientez les embouts dans l'axe de la goujure secondaire située entre les deux listels, de même que la goujure primaire.

Bohrarbeiten
Kühlmittelempfehlungen

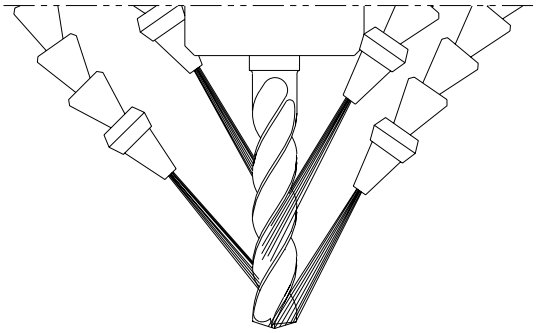
- Kühlmittel dienen dazu, die Späne aus dem Schneidenbereich zu entfernen, die beim Schneiden erzeugte Wärme abzutransportieren und die Reibung zu verringern.
- Es kommt darauf an, den Kühlschmiermitteldruck und die Zufuhr zu optimieren, um alle Vorteile beim Bohren nutzen zu können.
- Der richtige Kühlschmiermitteleinsatz ermöglicht höhere Schnittparameter, höheren Materialabtrag, bessere Oberflächengüte, vorhersehbare Standzeiten und geringere Leistungsaufnahme und Laufzeiten.
- Der Druck ist wichtig, aber wichtiger ist dessen Konstanz und die Zufuhr zum Werkzeug. Unterbrochene Kühlung des Hartmetalls führt zur thermischen Belastung und Bildung von "Mikrorissen".
- Kühlmitte sind sauber zu halten und zu filtern, damit die Qualität des Kühlmittels erhalten bleibt und der Kühlmitteldruck durch Verstopfung der Kühlmittelkanäle im Bohrer nicht absinkt.







BREITE QUERSCHNEIDE – GERINGE DREHZAHL
KEINE VOLLSTÄNDIGE BENETZUNG BEI MAX. BOHRUNGSTIEFE



SCHMALE QUERSCHNEIDE – HOHE DREHZAHL
VOLLSTÄNDIGE BENETZUNG

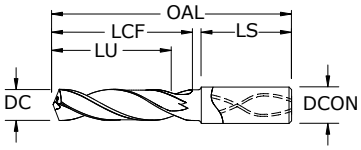
- Durch Verringern der Düsengröße können die vorteilhaften Eigenschaften der Doppelfase genutzt werden, um die Drehzahl des Hi-PerCarb-Bohrers zu steigern. Richten Sie die Düsen auf die Nebennut zwischen beiden Fasen sowie auf die Schneiden aus, um beste Ergebnisse zu erzielen.

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

142P 3xD

METRIC SERIES



- High-performance point design stabilizes on entry for exceptional hole size and cylindricity while also allowing for low thrust force and extended tool life
- Internal coolant hole improves coolant flow to extend tool life and aid in chip evacuation
- 4-margin design improves hole straightness and roundness while providing improved stability for difficult applications like cross holes and when exiting on angle
- Proprietary Ti-NAMITE-X coating and industry leading carbide substrate provides exceptional wear resistance and toughness for demanding applications
- Recommended for materials ≤ 50HRc (475 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.1181	3,000 mm	6,0	62,0	20,0	15,0	36,0	66400
0.1220	3,100 mm	6,0	62,0	20,0	15,0	36,0	66401
0.1250	3,175 mm	6,0	62,0	20,0	15,0	36,0	56400
0.1260	3,200 mm	6,0	62,0	20,0	15,0	36,0	66402
0.1299	3,300 mm	6,0	62,0	20,0	15,0	36,0	66403
0.1339	3,400 mm	6,0	62,0	20,0	15,0	36,0	66404
0.1360	3,454 mm	6,0	62,0	20,0	15,0	36,0	56401
0.1378	3,500 mm	6,0	62,0	20,0	15,0	36,0	66405
0.1406	3,571 mm	6,0	62,0	20,0	15,0	36,0	56402
0.1417	3,600 mm	6,0	62,0	20,0	15,0	36,0	66406
0.1457	3,700 mm	6,0	62,0	20,0	15,0	36,0	66407
0.1496	3,800 mm	6,0	66,0	24,0	18,0	36,0	66408
0.1535	3,900 mm	6,0	66,0	24,0	18,0	36,0	66409
0.1562	3,967 mm	6,0	66,0	24,0	18,0	36,0	56403
0.1575	4,000 mm	6,0	66,0	24,0	18,0	36,0	66410
0.1590	4,039 mm	6,0	66,0	24,0	18,0	36,0	56404
0.1614	4,100 mm	6,0	66,0	24,0	18,0	36,0	66411
0.1654	4,200 mm	6,0	66,0	24,0	18,0	36,0	66412
0.1693	4,300 mm	6,0	66,0	24,0	18,0	36,0	66413
0.1719	4,366 mm	6,0	66,0	24,0	17,0	36,0	56405
0.1732	4,400 mm	6,0	66,0	24,0	17,0	36,0	66414
0.1772	4,500 mm	6,0	66,0	24,0	17,0	36,0	66415
0.1811	4,600 mm	6,0	66,0	24,0	17,0	36,0	66416
0.1850	4,699 mm	6,0	66,0	24,0	17,0	36,0	66417
0.1875	4,763 mm	6,0	66,0	28,0	21,0	36,0	56406
0.1890	4,801 mm	6,0	66,0	28,0	21,0	36,0	66418
0.1929	4,900 mm	6,0	66,0	28,0	21,0	36,0	66419
0.1969	5,000 mm	6,0	66,0	28,0	20,0	36,0	66420
0.2008	5,100 mm	6,0	66,0	28,0	20,0	36,0	66421
0.2031	5,159 mm	6,0	66,0	28,0	20,0	36,0	56407
0.2047	5,200 mm	6,0	66,0	28,0	20,0	36,0	66422
0.2087	5,300 mm	6,0	66,0	28,0	20,0	36,0	66423
0.2126	5,400 mm	6,0	66,0	28,0	20,0	36,0	66424
0.2165	5,500 mm	6,0	66,0	28,0	20,0	36,0	66425
0.2188	5,558 mm	6,0	66,0	28,0	20,0	36,0	56408
0.2205	5,600 mm	6,0	66,0	28,0	20,0	36,0	66426
0.2244	5,700 mm	6,0	66,0	28,0	19,0	36,0	66427
0.2283	5,800 mm	6,0	66,0	28,0	19,0	36,0	66428
0.2323	5,900 mm	6,0	66,0	28,0	19,0	36,0	66429
0.2344	5,954 mm	6,0	66,0	28,0	19,0	36,0	56409
0.2362	6,000 mm	6,0	66,0	28,0	19,0	36,0	66430
0.2402	6,100 mm	8,0	79,0	34,0	25,0	36,0	66431
0.2441	6,200 mm	8,0	79,0	34,0	25,0	36,0	66432
0.2480	6,300 mm	8,0	79,0	34,0	25,0	36,0	66433

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

HIGH PERFORMANCE CARBIDE DRILLS

142P 3xD

METRIC SERIES

CONTINUED

DECIMAL DC	METRIC DC	SHANK DIAMETER DCON (mm)	OVERALL LENGTH OAL (mm)	FLUTE LENGTH LCF (mm)	USABLE LENGTH LU (mm)	SHANK LENGTH LS (mm)	EDP NO. Ti-NAMITE-X (TX)
0.2500	6,350 mm	8,0	79,0	34,0	24,0	36,0	56410
0.2520	6,400 mm	8,0	79,0	34,0	24,0	36,0	66434
0.2559	6,500 mm	8,0	79,0	34,0	24,0	36,0	66435
0.2570	6,528 mm	8,0	79,0	34,0	24,0	36,0	56411
0.2598	6,600 mm	8,0	79,0	34,0	24,0	36,0	66436
0.2638	6,700 mm	8,0	79,0	34,0	24,0	36,0	66437
0.2656	6,746 mm	8,0	79,0	34,0	24,0	36,0	56412
0.2677	6,800 mm	8,0	79,0	34,0	24,0	36,0	66438
0.2717	6,900 mm	8,0	79,0	34,0	24,0	36,0	66439
0.2756	7,000 mm	8,0	79,0	34,0	24,0	36,0	66440
0.2795	7,100 mm	8,0	79,0	41,0	30,0	36,0	66441
0.2812	7,142 mm	8,0	79,0	41,0	30,0	36,0	56413
0.2835	7,200 mm	8,0	79,0	41,0	30,0	36,0	66442
0.2874	7,300 mm	8,0	79,0	41,0	30,0	36,0	66443
0.2913	7,400 mm	8,0	79,0	41,0	30,0	36,0	66444
0.2953	7,500 mm	8,0	79,0	41,0	30,0	36,0	66445
0.2969	7,541 mm	8,0	79,0	41,0	30,0	36,0	56414
0.2992	7,600 mm	8,0	79,0	41,0	30,0	36,0	66446
0.3031	7,700 mm	8,0	79,0	41,0	29,0	36,0	66447
0.3071	7,800 mm	8,0	79,0	41,0	29,0	36,0	66448
0.3110	7,900 mm	8,0	79,0	41,0	29,0	36,0	66449
0.3125	7,938 mm	8,0	79,0	41,0	29,0	36,0	56415
0.3150	8,000 mm	8,0	79,0	41,0	29,0	36,0	66450
0.3189	8,100 mm	10,0	89,0	47,0	35,0	40,0	66451
0.3228	8,200 mm	10,0	89,0	47,0	35,0	40,0	66452
0.3268	8,300 mm	10,0	89,0	47,0	35,0	40,0	66453
0.3281	8,334 mm	10,0	89,0	47,0	34,0	40,0	56416
0.3307	8,400 mm	10,0	89,0	47,0	34,0	40,0	66454
0.3320	8,433 mm	10,0	89,0	47,0	34,0	40,0	56417
0.3346	8,500 mm	10,0	89,0	47,0	34,0	40,0	66455
0.3386	8,600 mm	10,0	89,0	47,0	34,0	40,0	66456
0.3425	8,700 mm	10,0	89,0	47,0	34,0	40,0	66457
0.3438	8,733 mm	10,0	89,0	47,0	34,0	40,0	56418
0.3465	8,800 mm	10,0	89,0	47,0	34,0	40,0	66458
0.3504	8,900 mm	10,0	89,0	47,0	34,0	40,0	66459
0.3543	9,000 mm	10,0	89,0	47,0	34,0	40,0	66460
0.3583	9,100 mm	10,0	89,0	47,0	33,0	40,0	66461
0.3594	9,129 mm	10,0	89,0	47,0	33,0	40,0	56419
0.3622	9,200 mm	10,0	89,0	47,0	33,0	40,0	66462
0.3661	9,300 mm	10,0	89,0	47,0	33,0	40,0	66463
0.3680	9,347 mm	10,0	89,0	47,0	33,0	40,0	56420
0.3701	9,400 mm	10,0	89,0	47,0	33,0	40,0	66464
0.3740	9,500 mm	10,0	89,0	47,0	33,0	40,0	66465
0.3750	9,525 mm	10,0	89,0	47,0	33,0	40,0	56421
0.3780	9,600 mm	10,0	89,0	47,0	33,0	40,0	66466
0.3819	9,700 mm	10,0	89,0	47,0	32,0	40,0	66467
0.3858	9,800 mm	10,0	89,0	47,0	32,0	40,0	66468
0.3898	9,900 mm	10,0	89,0	47,0	32,0	40,0	66469
0.3906	9,921 mm	10,0	89,0	47,0	32,0	40,0	56422
0.3937	10,000 mm	10,0	89,0	47,0	32,0	40,0	66470
0.3976	10,100 mm	12,0	102,0	55,0	40,0	45,0	66471
0.4016	10,200 mm	12,0	102,0	55,0	40,0	45,0	66472
0.4055	10,300 mm	12,0	102,0	55,0	40,0	45,0	66473
0.4062	10,317 mm	12,0	102,0	55,0	40,0	45,0	56423

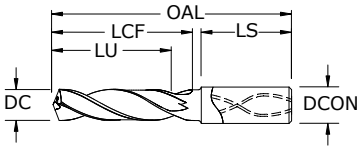
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

142P 3xD

METRIC SERIES



CONTINUED

- High-performance point design stabilizes on entry for exceptional hole size and cylindricity while also allowing for low thrust force and extended tool life
- Internal coolant hole improves coolant flow to extend tool life and aid in chip evacuation
- 4-margin design improves hole straightness and roundness while providing improved stability for difficult applications like cross holes and when exiting on angle
- Proprietary Ti-NAMITE-X coating and industry leading carbide substrate provides exceptional wear resistance and toughness for demanding applications
- Recommended for materials ≤ 50HRc (475 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.4095	10,400 mm	12,0	102,0	55,0	39,0	45,0	66474
0.4134	10,500 mm	12,0	102,0	55,0	39,0	45,0	66475
0.4173	10,600 mm	12,0	102,0	55,0	39,0	45,0	66476
0.4213	10,700 mm	12,0	102,0	55,0	39,0	45,0	66477
0.4219	10,716 mm	12,0	102,0	55,0	39,0	45,0	56424
0.4252	10,800 mm	12,0	102,0	55,0	39,0	45,0	66478
0.4291	10,900 mm	12,0	102,0	55,0	39,0	45,0	66479
0.4331	11,000 mm	12,0	102,0	55,0	39,0	45,0	66480
0.4370	11,100 mm	12,0	102,0	55,0	38,0	45,0	66481
0.4375	11,113 mm	12,0	102,0	55,0	38,0	45,0	56425
0.4409	11,200 mm	12,0	102,0	55,0	38,0	45,0	66482
0.4449	11,300 mm	12,0	102,0	55,0	38,0	45,0	66483
0.4488	11,400 mm	12,0	102,0	55,0	38,0	45,0	66484
0.4528	11,500 mm	12,0	102,0	55,0	38,0	45,0	66485
0.4567	11,600 mm	12,0	102,0	55,0	38,0	45,0	66486
0.4606	11,700 mm	12,0	102,0	55,0	37,0	45,0	66487
0.4646	11,800 mm	12,0	102,0	55,0	37,0	45,0	66488
0.4685	11,900 mm	12,0	102,0	55,0	37,0	45,0	66489
0.4688	11,908 mm	12,0	102,0	55,0	37,0	45,0	56426
0.4724	12,000 mm	12,0	102,0	55,0	37,0	45,0	66490
0.4844	12,304 mm	14,0	107,0	60,0	41,0	45,0	56427
0.4921	12,500 mm	14,0	107,0	60,0	41,0	45,0	66491
0.5000	12,700 mm	14,0	107,0	60,0	41,0	45,0	56428
0.5039	12,800 mm	14,0	107,0	60,0	41,0	45,0	66492
0.5118	13,000 mm	14,0	107,0	60,0	41,0	45,0	66493
0.5156	13,096 mm	14,0	107,0	60,0	40,0	45,0	56429
0.5315	13,500 mm	14,0	107,0	60,0	40,0	45,0	66494
0.5433	13,800 mm	14,0	107,0	60,0	39,0	45,0	66495
0.5512	14,000 mm	14,0	107,0	60,0	39,0	45,0	66496
0.5625	14,288 mm	16,0	115,0	65,0	43,0	48,0	56430
0.5709	14,500 mm	16,0	115,0	65,0	43,0	48,0	66497
0.5781	14,684 mm	16,0	115,0	65,0	43,0	48,0	56431
0.5827	14,800 mm	16,0	115,0	65,0	43,0	48,0	66498
0.5906	15,000 mm	16,0	115,0	65,0	42,0	48,0	66499
0.6102	15,500 mm	16,0	115,0	65,0	42,0	48,0	66500
0.6221	15,800 mm	16,0	115,0	65,0	41,0	48,0	66501
0.6250	15,875 mm	16,0	115,0	65,0	41,0	48,0	56432
0.6299	16,000 mm	16,0	115,0	65,0	41,0	48,0	66502
0.6562	16,667 mm	18,0	123,0	73,0	47,0	48,0	56433
0.6875	17,463 mm	18,0	123,0	73,0	47,0	48,0	56434
0.7500	19,050 mm	20,0	131,0	79,0	50,0	50,0	56435

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

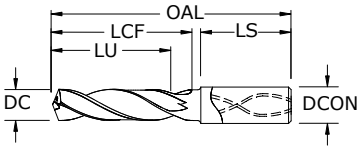
>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

HIGH PERFORMANCE CARBIDE DRILLS



142P 5xD

METRIC SERIES

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.1181	3,000 mm	6,0	66,0	28,0	23,0	36,0	66503
0.1220	3,100 mm	6,0	66,0	28,0	23,0	36,0	66504
0.1250	3,175 mm	6,0	66,0	28,0	23,0	36,0	56436
0.1260	3,200 mm	6,0	66,0	28,0	23,0	36,0	66505
0.1299	3,300 mm	6,0	66,0	28,0	23,0	36,0	66506
0.1339	3,400 mm	6,0	66,0	28,0	23,0	36,0	66507
0.1360	3,454 mm	6,0	66,0	28,0	23,0	36,0	56437
0.1378	3,500 mm	6,0	66,0	28,0	23,0	36,0	66508
0.1406	3,571 mm	6,0	66,0	28,0	23,0	36,0	56438
0.1417	3,600 mm	6,0	66,0	28,0	23,0	36,0	66509
0.1457	3,700 mm	6,0	66,0	28,0	23,0	36,0	66510
0.1496	3,800 mm	6,0	74,0	36,0	29,0	36,0	66511
0.1535	3,900 mm	6,0	74,0	36,0	29,0	36,0	66512
0.1562	3,967 mm	6,0	74,0	36,0	29,0	36,0	56439
0.1575	4,000 mm	6,0	74,0	36,0	29,0	36,0	66513
0.1590	4,039 mm	6,0	74,0	36,0	29,0	36,0	56440
0.1614	4,100 mm	6,0	74,0	36,0	29,0	36,0	66514
0.1654	4,200 mm	6,0	74,0	36,0	29,0	36,0	66515
0.1693	4,300 mm	6,0	74,0	36,0	29,0	36,0	66516
0.1719	4,366 mm	6,0	74,0	36,0	29,0	36,0	56441
0.1732	4,400 mm	6,0	74,0	36,0	29,0	36,0	66517
0.1772	4,500 mm	6,0	74,0	36,0	29,0	36,0	66518
0.1811	4,600 mm	6,0	74,0	36,0	29,0	36,0	66519
0.1850	4,699 mm	6,0	74,0	36,0	29,0	36,0	66520
0.1875	4,763 mm	6,0	82,0	44,0	37,0	36,0	56442
0.1890	4,801 mm	6,0	82,0	44,0	37,0	36,0	66521
0.1929	4,900 mm	6,0	82,0	44,0	37,0	36,0	66522
0.1969	5,000 mm	6,0	82,0	44,0	36,0	36,0	66523
0.2008	5,100 mm	6,0	82,0	44,0	36,0	36,0	66524
0.2031	5,159 mm	6,0	82,0	44,0	36,0	36,0	56443
0.2047	5,200 mm	6,0	82,0	44,0	36,0	36,0	66525
0.2087	5,300 mm	6,0	82,0	44,0	36,0	36,0	66526
0.2126	5,400 mm	6,0	82,0	44,0	36,0	36,0	66527
0.2165	5,500 mm	6,0	82,0	44,0	36,0	36,0	66528
0.2188	5,558 mm	6,0	82,0	44,0	36,0	36,0	56444
0.2205	5,600 mm	6,0	82,0	44,0	36,0	36,0	66529
0.2244	5,700 mm	6,0	82,0	44,0	35,0	36,0	66530
0.2283	5,800 mm	6,0	82,0	44,0	35,0	36,0	66531
0.2323	5,900 mm	6,0	82,0	44,0	35,0	36,0	66532
0.2344	5,954 mm	6,0	82,0	44,0	35,0	36,0	56445
0.2362	6,000 mm	6,0	82,0	44,0	35,0	36,0	66533
0.2402	6,100 mm	8,0	91,0	53,0	44,0	36,0	66534
0.2441	6,200 mm	8,0	91,0	53,0	44,0	36,0	66535

continued on next page

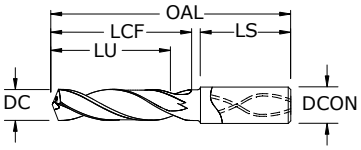
- High-performance point design stabilizes on entry for exceptional hole size and cylindricity while also allowing for low thrust force and extended tool life
- Internal coolant hole improves coolant flow to extend tool life and aid in chip evacuation
- 4 margin design improves hole straightness and roundness while providing improved stability for difficult applications like cross holes and when exiting on angle
- Proprietary TI-NAMITE-X coating and industry leading carbide substrate provides exceptional wear resistance and toughness for demanding applications
- Recommended for materials ≤50HRc (475 Bhn)

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

142P 5xD

METRIC SERIES



CONTINUED

- High-performance point design stabilizes on entry for exceptional hole size and cylindricity while also allowing for low thrust force and extended tool life
- Internal coolant hole improves coolant flow to extend tool life and aid in chip evacuation
- 4-margin design improves hole straightness and roundness while providing improved stability for difficult applications like cross holes and when exiting on angle
- Proprietary Ti-NAMITE-X coating and industry leading carbide substrate provides exceptional wear resistance and toughness for demanding applications
- Recommended for materials ≤ 50HRc (475 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.2480	6,300 mm	8,0	91,0	53,0	44,0	36,0	66536
0.2500	6,350 mm	8,0	91,0	53,0	43,0	36,0	56446
0.2520	6,400 mm	8,0	91,0	53,0	43,0	36,0	66537
0.2559	6,500 mm	8,0	91,0	53,0	43,0	36,0	66538
0.2570	6,528 mm	8,0	91,0	53,0	43,0	36,0	56447
0.2598	6,600 mm	8,0	91,0	53,0	43,0	36,0	66539
0.2638	6,700 mm	8,0	91,0	53,0	43,0	36,0	66540
0.2656	6,746 mm	8,0	91,0	53,0	43,0	36,0	56448
0.2677	6,800 mm	8,0	91,0	53,0	43,0	36,0	66541
0.2717	6,900 mm	8,0	91,0	53,0	43,0	36,0	66542
0.2756	7,000 mm	8,0	91,0	53,0	42,0	36,0	66543
0.2795	7,100 mm	8,0	91,0	53,0	42,0	36,0	66544
0.2812	7,142 mm	8,0	91,0	53,0	42,0	36,0	56449
0.2835	7,200 mm	8,0	91,0	53,0	42,0	36,0	66545
0.2874	7,300 mm	8,0	91,0	53,0	42,0	36,0	66546
0.2913	7,400 mm	8,0	91,0	53,0	42,0	36,0	66547
0.2953	7,500 mm	8,0	91,0	53,0	42,0	36,0	66548
0.2969	7,541 mm	8,0	91,0	53,0	42,0	36,0	56450
0.2992	7,600 mm	8,0	91,0	53,0	42,0	36,0	66549
0.3031	7,700 mm	8,0	91,0	53,0	41,0	36,0	66550
0.3071	7,800 mm	8,0	91,0	53,0	41,0	36,0	66551
0.3110	7,900 mm	8,0	91,0	53,0	41,0	36,0	66552
0.3125	7,938 mm	8,0	91,0	53,0	41,0	36,0	56451
0.3150	8,000 mm	8,0	91,0	53,0	41,0	36,0	66553
0.3189	8,100 mm	10,0	103,0	61,0	49,0	40,0	66554
0.3228	8,200 mm	10,0	103,0	61,0	49,0	40,0	66555
0.3268	8,300 mm	10,0	103,0	61,0	49,0	40,0	66556
0.3281	8,334 mm	10,0	103,0	61,0	48,0	40,0	56452
0.3307	8,400 mm	10,0	103,0	61,0	48,0	40,0	66557
0.3320	8,433 mm	10,0	103,0	61,0	48,0	40,0	56453
0.3346	8,500 mm	10,0	103,0	61,0	48,0	40,0	66558
0.3386	8,600 mm	10,0	103,0	61,0	48,0	40,0	66559
0.3425	8,700 mm	10,0	103,0	61,0	48,0	40,0	66560
0.3438	8,733 mm	10,0	103,0	61,0	48,0	40,0	56454
0.3465	8,800 mm	10,0	103,0	61,0	48,0	40,0	66561
0.3504	8,900 mm	10,0	103,0	61,0	48,0	40,0	66562
0.3543	9,000 mm	10,0	103,0	61,0	48,0	40,0	66563
0.3583	9,100 mm	10,0	103,0	61,0	47,0	40,0	66564
0.3594	9,129 mm	10,0	103,0	61,0	47,0	40,0	56455
0.3622	9,200 mm	10,0	103,0	61,0	47,0	40,0	66565
0.3661	9,300 mm	10,0	103,0	61,0	47,0	40,0	66566
0.3680	9,347 mm	10,0	103,0	61,0	47,0	40,0	56456
0.3701	9,400 mm	10,0	103,0	61,0	47,0	40,0	66567

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

HIGH PERFORMANCE CARBIDE DRILLS

142P 5xD

METRIC SERIES

CONTINUED

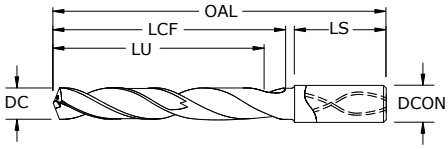
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON (mm)	OVERALL LENGTH OAL (mm)	FLUTE LENGTH LCF (mm)	USABLE LENGTH LU (mm)	SHANK LENGTH LS (mm)	EDP NO. Ti-NAMITE-X (TX)
0.3740	9,500 mm	10,0	103,0	61,0	47,0	40,0	66568
0.3750	9,525 mm	10,0	103,0	61,0	47,0	40,0	56457
0.3780	9,600 mm	10,0	103,0	61,0	47,0	40,0	66569
0.3819	9,700 mm	10,0	103,0	61,0	46,0	40,0	66570
0.3858	9,800 mm	10,0	103,0	61,0	46,0	40,0	66571
0.3898	9,900 mm	10,0	103,0	61,0	46,0	40,0	66572
0.3906	9,921 mm	10,0	103,0	61,0	46,0	40,0	56458
0.3937	10,000 mm	10,0	103,0	61,0	46,0	40,0	66573
0.3976	10,100 mm	12,0	118,0	71,0	56,0	45,0	66574
0.4016	10,200 mm	12,0	118,0	71,0	56,0	45,0	66575
0.4055	10,300 mm	12,0	118,0	71,0	56,0	45,0	66576
0.4062	10,317 mm	12,0	118,0	71,0	56,0	45,0	56459
0.4095	10,400 mm	12,0	118,0	71,0	55,0	45,0	66577
0.4134	10,500 mm	12,0	118,0	71,0	55,0	45,0	66578
0.4173	10,600 mm	12,0	118,0	71,0	55,0	45,0	66579
0.4213	10,700 mm	12,0	118,0	71,0	55,0	45,0	66580
0.4219	10,716 mm	12,0	118,0	71,0	55,0	45,0	56460
0.4252	10,800 mm	12,0	118,0	71,0	55,0	45,0	66581
0.4291	10,900 mm	12,0	118,0	71,0	55,0	45,0	66582
0.4331	11,000 mm	12,0	118,0	71,0	54,0	45,0	66583
0.4370	11,100 mm	12,0	118,0	71,0	54,0	45,0	66584
0.4375	11,113 mm	12,0	118,0	71,0	54,0	45,0	56461
0.4409	11,200 mm	12,0	118,0	71,0	54,0	45,0	66585
0.4449	11,300 mm	12,0	118,0	71,0	54,0	45,0	66586
0.4488	11,400 mm	12,0	118,0	71,0	54,0	45,0	66587
0.4528	11,500 mm	12,0	118,0	71,0	54,0	45,0	66588
0.4567	11,600 mm	12,0	118,0	71,0	54,0	45,0	66589
0.4606	11,700 mm	12,0	118,0	71,0	53,0	45,0	66590
0.4646	11,800 mm	12,0	118,0	71,0	53,0	45,0	66591
0.4685	11,900 mm	12,0	118,0	71,0	53,0	45,0	66592
0.4688	11,908 mm	12,0	118,0	71,0	53,0	45,0	56462
0.4724	12,000 mm	12,0	118,0	71,0	53,0	45,0	66593
0.4844	12,304 mm	14,0	124,0	77,0	58,0	45,0	56463
0.4921	12,500 mm	14,0	124,0	77,0	58,0	45,0	66594
0.5000	12,700 mm	14,0	124,0	77,0	58,0	45,0	56464
0.5039	12,800 mm	14,0	124,0	77,0	58,0	45,0	66595
0.5118	13,000 mm	14,0	124,0	77,0	58,0	45,0	66596
0.5156	13,096 mm	14,0	124,0	77,0	57,0	45,0	56465
0.5315	13,500 mm	14,0	124,0	77,0	57,0	45,0	66597
0.5433	13,800 mm	14,0	124,0	77,0	56,0	45,0	66598
0.5512	14,000 mm	14,0	124,0	77,0	56,0	45,0	66599
0.5625	14,288 mm	16,0	133,0	83,0	61,0	48,0	56466
0.5709	14,500 mm	16,0	133,0	83,0	61,0	48,0	66600
0.5781	14,684 mm	16,0	133,0	83,0	61,0	48,0	56467
0.5827	14,800 mm	16,0	133,0	83,0	61,0	48,0	66601
0.5906	15,000 mm	16,0	133,0	83,0	60,0	48,0	66602
0.6102	15,500 mm	16,0	133,0	83,0	60,0	48,0	66603
0.6221	15,800 mm	16,0	133,0	83,0	59,0	48,0	66604
0.6250	15,875 mm	16,0	133,0	83,0	59,0	48,0	56468
0.6299	16,000 mm	16,0	133,0	83,0	59,0	48,0	66605
0.6562	16,667 mm	18,0	143,0	93,0	68,0	48,0	56469
0.6875	17,463 mm	18,0	143,0	93,0	67,0	48,0	56470
0.7500	19,050 mm	20,0	153,0	101,0	72,0	50,0	56471

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

142P 8xD

METRIC SERIES



- High-performance point design stabilizes on entry for exceptional hole size and cylindricity while also allowing for low thrust force and extended tool life
- Internal coolant hole improves coolant flow to extend tool life and aid in chip evacuation
- 4-margin design improves hole straightness and roundness while providing improved stability for difficult applications like cross holes and when exiting on angle
- Proprietary Ti-NAMITE-X coating and industry leading carbide substrate provides exceptional wear resistance and toughness for demanding applications
- Recommended for materials ≤ 50HRc (475 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.1181	3,000 mm	6,0	72,0	34,0	29,0	36,0	66606
0.1220	3,100 mm	6,0	72,0	34,0	29,0	36,0	66607
0.1250	3,175 mm	6,0	72,0	34,0	29,0	36,0	56472
0.1260	3,200 mm	6,0	72,0	34,0	29,0	36,0	66608
0.1299	3,300 mm	6,0	72,0	34,0	29,0	36,0	66609
0.1339	3,400 mm	6,0	72,0	34,0	29,0	36,0	66610
0.1360	3,454 mm	6,0	72,0	34,0	29,0	36,0	56473
0.1378	3,500 mm	6,0	72,0	34,0	29,0	36,0	66611
0.1406	3,571 mm	6,0	72,0	34,0	29,0	36,0	56474
0.1417	3,600 mm	6,0	72,0	34,0	29,0	36,0	66612
0.1457	3,700 mm	6,0	72,0	34,0	29,0	36,0	66613
0.1496	3,800 mm	6,0	81,0	43,0	37,0	36,0	66614
0.1535	3,900 mm	6,0	81,0	43,0	37,0	36,0	66615
0.1562	3,967 mm	6,0	81,0	43,0	37,0	36,0	56475
0.1575	4,000 mm	6,0	81,0	43,0	37,0	36,0	66616
0.1590	4,039 mm	6,0	81,0	43,0	37,0	36,0	56476
0.1614	4,100 mm	6,0	81,0	43,0	37,0	36,0	66617
0.1654	4,200 mm	6,0	81,0	43,0	37,0	36,0	66618
0.1693	4,300 mm	6,0	81,0	43,0	37,0	36,0	66619
0.1719	4,366 mm	6,0	81,0	43,0	36,0	36,0	56477
0.1732	4,400 mm	6,0	81,0	43,0	36,0	36,0	66620
0.1772	4,500 mm	6,0	81,0	43,0	36,0	36,0	66621
0.1811	4,600 mm	6,0	81,0	43,0	36,0	36,0	66622
0.1850	4,699 mm	6,0	81,0	43,0	36,0	36,0	66623
0.1875	4,763 mm	6,0	95,0	57,0	50,0	36,0	56478
0.1890	4,801 mm	6,0	95,0	57,0	50,0	36,0	66624
0.1929	4,900 mm	6,0	95,0	57,0	50,0	36,0	66625
0.1969	5,000 mm	6,0	95,0	57,0	49,0	36,0	66626
0.2008	5,100 mm	6,0	95,0	57,0	49,0	36,0	66627
0.2031	5,159 mm	6,0	95,0	57,0	49,0	36,0	56479
0.2047	5,200 mm	6,0	95,0	57,0	49,0	36,0	66628
0.2087	5,300 mm	6,0	95,0	57,0	49,0	36,0	66629
0.2126	5,400 mm	6,0	95,0	57,0	49,0	36,0	66630
0.2165	5,500 mm	6,0	95,0	57,0	49,0	36,0	66631
0.2188	5,558 mm	6,0	95,0	57,0	49,0	36,0	56480
0.2205	5,600 mm	6,0	95,0	57,0	49,0	36,0	66632

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

142P 8xD

METRIC SERIES

CONTINUED

DECIMAL DC	METRIC DC	SHANK DIAMETER DCON (mm)	OVERALL LENGTH OAL (mm)	FLUTE LENGTH LCF (mm)	USABLE LENGTH LU (mm)	SHANK LENGTH LS (mm)	EDP NO. Ti-NAMITE-X (TX)
0.2244	5,700 mm	6,0	95,0	57,0	48,0	36,0	66633
0.2283	5,800 mm	6,0	95,0	57,0	48,0	36,0	66634
0.2323	5,900 mm	6,0	95,0	57,0	48,0	36,0	66635
0.2344	5,954 mm	6,0	95,0	57,0	48,0	36,0	56481
0.2362	6,000 mm	6,0	95,0	57,0	48,0	36,0	66636
0.2402	6,100 mm	8,0	114,0	76,0	67,0	36,0	66637
0.2441	6,200 mm	8,0	114,0	76,0	67,0	36,0	66638
0.2480	6,300 mm	8,0	114,0	76,0	67,0	36,0	66639
0.2500	6,350 mm	8,0	114,0	76,0	66,0	36,0	56482
0.2520	6,400 mm	8,0	114,0	76,0	66,0	36,0	66640
0.2559	6,500 mm	8,0	114,0	76,0	66,0	36,0	66641
0.2570	6,528 mm	8,0	114,0	76,0	66,0	36,0	56483
0.2598	6,600 mm	8,0	114,0	76,0	66,0	36,0	66642
0.2638	6,700 mm	8,0	114,0	76,0	66,0	36,0	66643
0.2656	6,746 mm	8,0	114,0	76,0	66,0	36,0	56484
0.2677	6,800 mm	8,0	114,0	76,0	66,0	36,0	66644
0.2717	6,900 mm	8,0	114,0	76,0	66,0	36,0	66645
0.2756	7,000 mm	8,0	114,0	76,0	65,0	36,0	66646
0.2795	7,100 mm	8,0	114,0	76,0	65,0	36,0	66647
0.2812	7,142 mm	8,0	114,0	76,0	65,0	36,0	56485
0.2835	7,200 mm	8,0	114,0	76,0	65,0	36,0	66648
0.2874	7,300 mm	8,0	114,0	76,0	65,0	36,0	66649
0.2913	7,400 mm	8,0	114,0	76,0	65,0	36,0	66650
0.2953	7,500 mm	8,0	114,0	76,0	65,0	36,0	66651
0.2969	7,541 mm	8,0	114,0	76,0	65,0	36,0	56486
0.2992	7,600 mm	8,0	114,0	76,0	65,0	36,0	66652
0.3031	7,700 mm	8,0	114,0	76,0	64,0	36,0	66653
0.3071	7,800 mm	8,0	114,0	76,0	64,0	36,0	66654
0.3110	7,900 mm	8,0	114,0	76,0	64,0	36,0	66655
0.3125	7,938 mm	8,0	114,0	76,0	64,0	36,0	56487
0.3150	8,000 mm	8,0	114,0	76,0	64,0	36,0	66656
0.3189	8,100 mm	10,0	142,0	95,0	83,0	40,0	66657
0.3228	8,200 mm	10,0	142,0	95,0	83,0	40,0	66658
0.3268	8,300 mm	10,0	142,0	95,0	83,0	40,0	66659
0.3281	8,334 mm	10,0	142,0	95,0	83,0	40,0	56488
0.3307	8,400 mm	10,0	142,0	95,0	82,0	40,0	66660
0.3320	8,433 mm	10,0	142,0	95,0	82,0	40,0	56489
0.3346	8,500 mm	10,0	142,0	95,0	82,0	40,0	66661
0.3386	8,600 mm	10,0	142,0	95,0	82,0	40,0	66662
0.3425	8,700 mm	10,0	142,0	95,0	82,0	40,0	66663
0.3438	8,733 mm	10,0	142,0	95,0	82,0	40,0	56490
0.3465	8,800 mm	10,0	142,0	95,0	82,0	40,0	66664
0.3504	8,900 mm	10,0	142,0	95,0	82,0	40,0	66665
0.3543	9,000 mm	10,0	142,0	95,0	82,0	40,0	66666

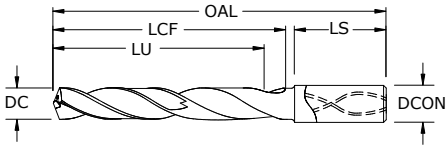
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

142P 8xD

METRIC SERIES



CONTINUED

- High-performance point design stabilizes on entry for exceptional hole size and cylindricity while also allowing for low thrust force and extended tool life
- Internal coolant hole improves coolant flow to extend tool life and aid in chip evacuation
- 4-margin design improves hole straightness and roundness while providing improved stability for difficult applications like cross holes and when exiting on angle
- Proprietary Ti-NAMITE-X coating and industry leading carbide substrate provides exceptional wear resistance and toughness for demanding applications
- Recommended for materials ≤ 50HRc (475 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.3583	9,100 mm	10,0	142,0	95,0	81,0	40,0	66667
0.3594	9,129 mm	10,0	142,0	95,0	81,0	40,0	56491
0.3622	9,200 mm	10,0	142,0	95,0	81,0	40,0	66668
0.3661	9,300 mm	10,0	142,0	95,0	81,0	40,0	66669
0.3680	9,347 mm	10,0	142,0	95,0	81,0	40,0	56492
0.3701	9,400 mm	10,0	142,0	95,0	81,0	40,0	66670
0.3740	9,500 mm	10,0	142,0	95,0	81,0	40,0	66671
0.3750	9,525 mm	10,0	142,0	95,0	81,0	40,0	56493
0.3780	9,600 mm	10,0	142,0	95,0	81,0	40,0	66672
0.3819	9,700 mm	10,0	142,0	95,0	80,0	40,0	66673
0.3858	9,800 mm	10,0	142,0	95,0	80,0	40,0	66674
0.3898	9,900 mm	10,0	142,0	95,0	80,0	40,0	66675
0.3906	9,921 mm	10,0	142,0	95,0	80,0	40,0	56494
0.3937	10,000 mm	10,0	142,0	95,0	80,0	40,0	66676
0.3976	10,100 mm	12,0	162,0	114,0	99,0	45,0	66677
0.4016	10,200 mm	12,0	162,0	114,0	99,0	45,0	66678
0.4055	10,300 mm	12,0	162,0	114,0	99,0	45,0	66679
0.4062	10,317 mm	12,0	162,0	114,0	99,0	45,0	56495
0.4095	10,400 mm	12,0	162,0	114,0	98,0	45,0	66680
0.4134	10,500 mm	12,0	162,0	114,0	98,0	45,0	66681
0.4173	10,600 mm	12,0	162,0	114,0	98,0	45,0	66682
0.4213	10,700 mm	12,0	162,0	114,0	98,0	45,0	66683
0.4219	10,716 mm	12,0	162,0	114,0	98,0	45,0	56496
0.4252	10,800 mm	12,0	162,0	114,0	98,0	45,0	66684
0.4291	10,900 mm	12,0	162,0	114,0	98,0	45,0	66685
0.4331	11,000 mm	12,0	162,0	114,0	97,0	45,0	66686
0.4370	11,100 mm	12,0	162,0	114,0	97,0	45,0	66687
0.4375	11,113 mm	12,0	162,0	114,0	97,0	45,0	56497
0.4409	11,200 mm	12,0	162,0	114,0	97,0	45,0	66688
0.4449	11,300 mm	12,0	162,0	114,0	97,0	45,0	66689
0.4488	11,400 mm	12,0	162,0	114,0	97,0	45,0	66690
0.4528	11,500 mm	12,0	162,0	114,0	97,0	45,0	66691
0.4567	11,600 mm	12,0	162,0	114,0	97,0	45,0	66692
0.4606	11,700 mm	12,0	162,0	114,0	96,0	45,0	66693

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

142P 8xD

METRIC SERIES

CONTINUED

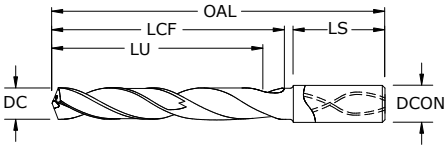
			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.4646	11,800 mm	12,0	162,0	114,0	96,0	45,0	66694
0.4685	11,900 mm	12,0	162,0	114,0	96,0	45,0	66695
0.4688	11,908 mm	12,0	162,0	114,0	96,0	45,0	56498
0.4724	12,000 mm	12,0	162,0	114,0	96,0	45,0	66696
0.4844	12,304 mm	14,0	178,0	133,0	114,0	45,0	56499
0.4921	12,500 mm	14,0	178,0	133,0	114,0	45,0	66697
0.5000	12,700 mm	14,0	178,0	133,0	114,0	45,0	56500
0.5039	12,800 mm	14,0	178,0	133,0	114,0	45,0	66698
0.5118	13,000 mm	14,0	178,0	133,0	114,0	45,0	66699
0.5156	13,096 mm	14,0	178,0	133,0	113,0	45,0	56501
0.5315	13,500 mm	14,0	178,0	133,0	113,0	45,0	66700
0.5433	13,800 mm	14,0	178,0	133,0	113,0	45,0	66701
0.5512	14,000 mm	14,0	178,0	133,0	113,0	45,0	66702
0.5625	14,288 mm	16,0	203,0	152,0	130,0	48,0	56502
0.5709	14,500 mm	16,0	203,0	152,0	130,0	48,0	66703
0.5781	14,684 mm	16,0	203,0	152,0	130,0	48,0	56503
0.5827	14,800 mm	16,0	203,0	152,0	130,0	48,0	66704
0.5906	15,000 mm	16,0	203,0	152,0	129,0	48,0	66705
0.6102	15,500 mm	16,0	203,0	152,0	129,0	48,0	66706
0.6221	15,800 mm	16,0	203,0	152,0	128,0	48,0	66707
0.6250	15,875 mm	16,0	203,0	152,0	128,0	48,0	56504
0.6299	16,000 mm	16,0	203,0	152,0	128,0	48,0	66708
0.6562	16,667 mm	18,0	222,0	171,0	145,0	48,0	56505
0.6875	17,463 mm	18,0	222,0	171,0	145,0	48,0	56506
0.7500	19,050 mm	20,0	243,0	190,0	161,0	50,0	56507

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

142P 12xD

METRIC SERIES



- High-performance point design stabilizes on entry for exceptional hole size and cylindricity while also allowing for low thrust force and extended tool life
- Internal coolant hole improves coolant flow to extend tool life and aid in chip evacuation
- 4-margin design improves hole straightness and roundness while providing improved stability for difficult applications like cross holes and when exiting on angle
- Proprietary Ti-NAMITE-X coating and industry leading carbide substrate provides exceptional wear resistance and toughness for demanding applications
- Recommended for materials ≤ 50HRc (475 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.1181	3,000 mm	6,0	87,0	49,0	44,0	36,0	66709
0.1220	3,100 mm	6,0	87,0	49,0	44,0	36,0	66710
0.1250	3,175 mm	6,0	87,0	49,0	44,0	36,0	56508
0.1260	3,200 mm	6,0	87,0	49,0	44,0	36,0	66711
0.1299	3,300 mm	6,0	87,0	49,0	44,0	36,0	66712
0.1339	3,400 mm	6,0	87,0	49,0	44,0	36,0	66713
0.1360	3,454 mm	6,0	87,0	49,0	44,0	36,0	56509
0.1378	3,500 mm	6,0	87,0	49,0	44,0	36,0	66714
0.1406	3,571 mm	6,0	87,0	49,0	43,0	36,0	56510
0.1417	3,600 mm	6,0	87,0	49,0	43,0	36,0	66715
0.1457	3,700 mm	6,0	87,0	49,0	43,0	36,0	66716
0.1496	3,800 mm	6,0	100,0	62,0	56,0	36,0	66717
0.1535	3,900 mm	6,0	100,0	62,0	56,0	36,0	66718
0.1562	3,967 mm	6,0	100,0	62,0	56,0	36,0	56511
0.1575	4,000 mm	6,0	100,0	62,0	56,0	36,0	66719
0.1590	4,039 mm	6,0	100,0	62,0	56,0	36,0	56512
0.1614	4,100 mm	6,0	100,0	62,0	56,0	36,0	66720
0.1654	4,200 mm	6,0	100,0	62,0	55,0	36,0	66721
0.1693	4,300 mm	6,0	100,0	62,0	55,0	36,0	66722
0.1719	4,366 mm	6,0	100,0	62,0	55,0	36,0	56513
0.1732	4,400 mm	6,0	100,0	62,0	55,0	36,0	66723
0.1772	4,500 mm	6,0	100,0	62,0	55,0	36,0	66724
0.1811	4,600 mm	6,0	100,0	62,0	55,0	36,0	66725
0.1850	4,699 mm	6,0	100,0	62,0	55,0	36,0	66726
0.1875	4,763 mm	6,0	119,0	81,0	74,0	36,0	56514
0.1890	4,801 mm	6,0	119,0	81,0	74,0	36,0	66727
0.1929	4,900 mm	6,0	119,0	81,0	74,0	36,0	66728
0.1969	5,000 mm	6,0	119,0	81,0	73,0	36,0	66729
0.2008	5,100 mm	6,0	119,0	81,0	73,0	36,0	66730
0.2031	5,159 mm	6,0	119,0	81,0	73,0	36,0	56515
0.2047	5,200 mm	6,0	119,0	81,0	73,0	36,0	66731
0.2087	5,300 mm	6,0	119,0	81,0	73,0	36,0	66732
0.2126	5,400 mm	6,0	119,0	81,0	73,0	36,0	66733
0.2165	5,500 mm	6,0	119,0	81,0	73,0	36,0	66734

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

HIGH PERFORMANCE CARBIDE DRILLS

142P 12xD

METRIC SERIES

CONTINUED

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.2188	5,558 mm	6,0	119,0	81,0	73,0	36,0	56516
0.2205	5,600 mm	6,0	119,0	81,0	73,0	36,0	66735
0.2244	5,700 mm	6,0	119,0	81,0	72,0	36,0	66736
0.2283	5,800 mm	6,0	119,0	81,0	72,0	36,0	66737
0.2323	5,900 mm	6,0	119,0	81,0	72,0	36,0	66738
0.2344	5,954 mm	6,0	119,0	81,0	72,0	36,0	56517
0.2362	6,000 mm	6,0	119,0	81,0	72,0	36,0	66739
0.2402	6,100 mm	8,0	146,0	108,0	99,0	36,0	66740
0.2441	6,200 mm	8,0	146,0	108,0	99,0	36,0	66741
0.2480	6,300 mm	8,0	146,0	108,0	99,0	36,0	66742
0.2500	6,350 mm	8,0	146,0	108,0	98,0	36,0	56518
0.2520	6,400 mm	8,0	146,0	108,0	98,0	36,0	66743
0.2559	6,500 mm	8,0	146,0	108,0	98,0	36,0	66744
0.2570	6,528 mm	8,0	146,0	108,0	98,0	36,0	56519
0.2598	6,600 mm	8,0	146,0	108,0	98,0	36,0	66745
0.2638	6,700 mm	8,0	146,0	108,0	98,0	36,0	66746
0.2656	6,746 mm	8,0	146,0	108,0	98,0	36,0	56520
0.2677	6,800 mm	8,0	146,0	108,0	98,0	36,0	66747
0.2717	6,900 mm	8,0	146,0	108,0	98,0	36,0	66748
0.2756	7,000 mm	8,0	146,0	108,0	97,0	36,0	66749
0.2795	7,100 mm	8,0	146,0	108,0	97,0	36,0	66750
0.2812	7,142 mm	8,0	146,0	108,0	97,0	36,0	56521
0.2835	7,200 mm	8,0	146,0	108,0	97,0	36,0	66751
0.2874	7,300 mm	8,0	146,0	108,0	97,0	36,0	66752
0.2913	7,400 mm	8,0	146,0	108,0	97,0	36,0	66753
0.2953	7,500 mm	8,0	146,0	108,0	97,0	36,0	66754
0.2969	7,541 mm	8,0	146,0	108,0	97,0	36,0	56522
0.2992	7,600 mm	8,0	146,0	108,0	97,0	36,0	66755
0.3031	7,700 mm	8,0	146,0	108,0	96,0	36,0	66756
0.3071	7,800 mm	8,0	146,0	108,0	96,0	36,0	66757
0.3110	7,900 mm	8,0	146,0	108,0	96,0	36,0	66758
0.3125	7,938 mm	8,0	146,0	108,0	96,0	36,0	56523
0.3150	8,000 mm	8,0	146,0	108,0	96,0	36,0	66759
0.3189	8,100 mm	10,0	182,0	135,0	123,0	40,0	66760
0.3228	8,200 mm	10,0	182,0	135,0	123,0	40,0	66761
0.3268	8,300 mm	10,0	182,0	135,0	123,0	40,0	66762
0.3281	8,334 mm	10,0	182,0	135,0	123,0	40,0	56524
0.3307	8,400 mm	10,0	182,0	135,0	122,0	40,0	66763
0.3320	8,433 mm	10,0	182,0	135,0	122,0	40,0	56525
0.3346	8,500 mm	10,0	182,0	135,0	122,0	40,0	66764
0.3386	8,600 mm	10,0	182,0	135,0	122,0	40,0	66765
0.3425	8,700 mm	10,0	182,0	135,0	122,0	40,0	66766

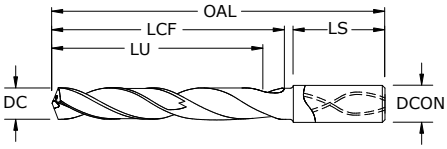
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

142P 12xD

METRIC SERIES



CONTINUED

- High-performance point design stabilizes on entry for exceptional hole size and cylindricity while also allowing for low thrust force and extended tool life
- Internal coolant hole improves coolant flow to extend tool life and aid in chip evacuation
- 4-margin design improves hole straightness and roundness while providing improved stability for difficult applications like cross holes and when exiting on angle
- Proprietary Ti-NAMITE-X coating and industry leading carbide substrate provides exceptional wear resistance and toughness for demanding applications
- Recommended for materials ≤ 50HRc (475 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.3438	8,733 mm	10,0	182,0	135,0	122,0	40,0	56526
0.3465	8,800 mm	10,0	182,0	135,0	122,0	40,0	66767
0.3504	8,900 mm	10,0	182,0	135,0	122,0	40,0	66768
0.3543	9,000 mm	10,0	182,0	135,0	122,0	40,0	66769
0.3583	9,100 mm	10,0	182,0	135,0	121,0	40,0	66770
0.3594	9,129 mm	10,0	182,0	135,0	121,0	40,0	56527
0.3622	9,200 mm	10,0	182,0	135,0	121,0	40,0	66771
0.3661	9,300 mm	10,0	182,0	135,0	121,0	40,0	66772
0.3680	9,347 mm	10,0	182,0	135,0	121,0	40,0	56528
0.3701	9,400 mm	10,0	182,0	135,0	121,0	40,0	66773
0.3740	9,500 mm	10,0	182,0	135,0	121,0	40,0	66774
0.3750	9,525 mm	10,0	182,0	135,0	121,0	40,0	56529
0.3780	9,600 mm	10,0	182,0	135,0	121,0	40,0	66775
0.3819	9,700 mm	10,0	182,0	135,0	120,0	40,0	66776
0.3858	9,800 mm	10,0	182,0	135,0	120,0	40,0	66777
0.3898	9,900 mm	10,0	182,0	135,0	120,0	40,0	66778
0.3906	9,921 mm	10,0	182,0	135,0	120,0	40,0	56530
0.3937	10,000 mm	10,0	182,0	135,0	120,0	40,0	66779
0.3976	10,100 mm	12,0	210,0	162,0	147,0	45,0	66780
0.4016	10,200 mm	12,0	210,0	162,0	147,0	45,0	66781
0.4055	10,300 mm	12,0	210,0	162,0	147,0	45,0	66782
0.4062	10,317 mm	12,0	210,0	162,0	147,0	45,0	56531
0.4095	10,400 mm	12,0	210,0	162,0	146,0	45,0	66783
0.4134	10,500 mm	12,0	210,0	162,0	146,0	45,0	66784
0.4173	10,600 mm	12,0	210,0	162,0	146,0	45,0	66785
0.4213	10,700 mm	12,0	210,0	162,0	146,0	45,0	66786
0.4219	10,716 mm	12,0	210,0	162,0	146,0	45,0	56532
0.4252	10,800 mm	12,0	210,0	162,0	146,0	45,0	66787
0.4291	10,900 mm	12,0	210,0	162,0	146,0	45,0	66788
0.4331	11,000 mm	12,0	210,0	162,0	145,0	45,0	66789
0.4370	11,100 mm	12,0	210,0	162,0	145,0	45,0	66790
0.4375	11,113 mm	12,0	210,0	162,0	145,0	45,0	56533
0.4409	11,200 mm	12,0	210,0	162,0	145,0	45,0	66791
0.4449	11,300 mm	12,0	210,0	162,0	145,0	45,0	66792

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

142P 12xD

METRIC SERIES

CONTINUED

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.4488	11,400 mm	12,0	210,0	162,0	145,0	45,0	66793
0.4528	11,500 mm	12,0	210,0	162,0	145,0	45,0	66794
0.4567	11,600 mm	12,0	210,0	162,0	145,0	45,0	66795
0.4606	11,700 mm	12,0	210,0	162,0	144,0	45,0	66796
0.4646	11,800 mm	12,0	210,0	162,0	144,0	45,0	66797
0.4685	11,900 mm	12,0	210,0	162,0	144,0	45,0	66798
0.4688	11,908 mm	12,0	210,0	162,0	144,0	45,0	56534
0.4724	12,000 mm	12,0	210,0	162,0	144,0	45,0	66799
0.4844	12,304 mm	14,0	234,0	189,0	171,0	45,0	56535
0.4921	12,500 mm	14,0	234,0	189,0	170,0	45,0	66800
0.5000	12,700 mm	14,0	234,0	189,0	170,0	45,0	56536
0.5039	12,800 mm	14,0	234,0	189,0	170,0	45,0	66801
0.5118	13,000 mm	14,0	234,0	189,0	170,0	45,0	66802
0.5156	13,096 mm	14,0	234,0	189,0	169,0	45,0	56537
0.5315	13,500 mm	14,0	234,0	189,0	169,0	45,0	66803
0.5433	13,800 mm	14,0	234,0	189,0	168,0	45,0	66804
0.5512	14,000 mm	14,0	234,0	189,0	168,0	45,0	66805
0.5625	14,288 mm	16,0	267,0	216,0	195,0	48,0	56538
0.5709	14,500 mm	16,0	267,0	216,0	194,0	48,0	66806
0.5781	14,684 mm	16,0	267,0	216,0	194,0	48,0	56539
0.5827	14,800 mm	16,0	267,0	216,0	194,0	48,0	66807
0.5906	15,000 mm	16,0	267,0	216,0	193,0	48,0	66808
0.6102	15,500 mm	16,0	267,0	216,0	193,0	48,0	66809
0.6221	15,800 mm	16,0	267,0	216,0	192,0	48,0	66810
0.6250	15,875 mm	16,0	267,0	216,0	192,0	48,0	56540
0.6299	16,000 mm	16,0	267,0	216,0	192,0	48,0	66811
0.6562	16,667 mm	18,0	292,0	241,0	216,0	48,0	56541
0.6875	17,463 mm	18,0	292,0	241,0	215,0	48,0	56542
0.7500	19,050 mm	20,0	319,0	266,0	238,0	50,0	56543

Hi-PerCarb

	Series 142P Metric	Hardness	Vc (m/min)		DC • mm 3	6	8	10	12	14	16
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	130	RPM	13733	6867	5150	4120	3433	2943	2575
			(104-155)	Fr	0.104	0.207	0.276	0.345	0.414	0.483	0.552
				Feed (mm/min)	1422	1422	1422	1422	1422	1422	1422
		≤ 275 Bhn or ≤ 28 HRc	116	RPM	12279	6140	4605	3684	3070	2631	2302
			(93-139)	Fr	0.093	0.186	0.248	0.310	0.372	0.434	0.496
				Feed (mm/min)	1143	1143	1143	1143	1143	1143	1143
		≤ 425 Bhn or ≤ 45 HRc	67	RPM	7109	3555	2666	2133	1777	1523	1333
			(54-80)	Fr	0.079	0.157	0.210	0.262	0.314	0.367	0.419
				Feed (mm/min)	559	559	559	559	559	559	559
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	101	RPM	10664	5332	3999	3199	2666	2285	1999
			(80-121)	Fr	0.079	0.157	0.210	0.262	0.314	0.367	0.419
				Feed (mm/min)	838	838	838	838	838	838	838
		≤ 375 Bhn or ≤ 40 HRc	61	RPM	6463	3231	2424	1939	1616	1385	1212
			(49-73)	Fr	0.067	0.134	0.178	0.223	0.267	0.312	0.356
				Feed (mm/min)	432	432	432	432	432	432	432
		≤ 425 Bhn or ≤ 45 HRc	43	RPM	4524	2262	1696	1357	1131	969	848
			(34-51)	Fr	0.048	0.095	0.127	0.159	0.191	0.223	0.255
				Feed (mm/min)	216	216	216	216	216	216	216
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 200 Bhn or ≤ 13 HRc	44	RPM	4686	2343	1757	1406	1171	1004	879
			(35-53)	Fr	0.068	0.136	0.181	0.226	0.271	0.316	0.361
				Feed (mm/min)	318	318	318	318	318	318	318
		≤ 375 Bhn or ≤ 40 HRc	29	RPM	3070	1535	1151	921	767	658	576
			(23-35)	Fr	0.032	0.065	0.086	0.108	0.129	0.151	0.172
				Feed (mm/min)	99	99	99	99	99	99	99
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 185 Bhn or ≤ 9 HRc	93	9856	9856	4928	3696	2957	2464	2112	1848
			(74-112)	0.062	0.062	0.124	0.165	0.206	0.247	0.289	0.330
				610	610	610	610	610	610	610	610
		≤ 275 Bhn or ≤ 28 HRc	59	6301	6301	3151	2363	1890	1575	1350	1181
			(48-71)	0.048	0.048	0.097	0.129	0.161	0.193	0.226	0.258
				305	305	305	305	305	305	305	305
	STAINLESS STEELS (DIFFICULT) 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	46	4847	4847	2424	1818	1454	1212	1039	909
			(37-55)	0.048	0.048	0.095	0.127	0.159	0.191	0.223	0.254
				231	231	231	231	231	231	231	231
		≤ 375 Bhn or ≤ 40 HRc	34	3555	3555	1777	1333	1066	889	762	666
			(27-40)	0.043	0.043	0.086	0.114	0.143	0.171	0.200	0.229
				152	152	152	152	152	152	152	152
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	110	RPM	11633	5816	4362	3490	2908	2493	2181
			(88-132)	Fr	0.109	0.218	0.291	0.364	0.437	0.509	0.582
				Feed (mm/min)	1270	1270	1270	1270	1270	1270	1270
		≤ 260 Bhn or ≤ 26 HRc	102	RPM	10825	5413	4059	3248	2706	2320	2030
			(82-123)	Fr	0.109	0.218	0.291	0.364	0.436	0.509	0.582
				Feed (mm/min)	1181	1181	1181	1181	1181	1181	1181

continued on next page

Hi-PerCarb

	Series 142P Metric	Hardness	Vc (m/min)		DC • mm 3	6	8	10	12	14	16
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 80 Bhn or ≤ 47 HRb	235	RPM	24882	12441	9331	7465	6220	5332	4665
			(188-282)	Fr	0.117	0.235	0.313	0.391	0.470	0.548	0.626
				Feed (mm/min)	2921	2921	2921	2921	2921	2921	2921
		≤ 150 Bhn or ≤ 88 HRb	201	RPM	21327	10664	7998	6398	5332	4570	3999
			(161-241)	Fr	0.119	0.238	0.318	0.397	0.476	0.556	0.635
				Feed (mm/min)	2540	2540	2540	2540	2540	2540	2540
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	168	RPM	17773	8886	6665	5332	4443	3808	3332
			(134-201)	Fr	0.048	0.096	0.128	0.160	0.192	0.223	0.255
				Feed (mm/min)	851	851	851	851	851	851	851
		≤ 200 Bhn or ≤ 23 HRc	134	RPM	14218	7109	5332	4265	3555	3047	2666
			(107-161)	Fr	0.048	0.096	0.129	0.161	0.193	0.225	0.257
				Feed (mm/min)	686	686	686	686	686	686	686
S	HIGH TEMP ALLOYS (Nickel , Cobalt, Iron Base) Inconel 601, 617, 625, Incoloy, Monel 400, Rene, Waspaloy	≤ 300 Bhn or ≤ 32 HRc	29	RPM	3070	1535	1151	921	767	658	576
			(23-35)	Fr	0.019	0.038	0.051	0.063	0.076	0.089	0.101
				Feed (mm/min)	58	58	58	58	58	58	58
		≤ 400 Bhn or ≤ 43 HRc	15	RPM	1616	808	606	485	404	346	303
			(12-18)	Fr	0.016	0.031	0.042	0.052	0.063	0.073	0.084
				Feed (mm/min)	25	25	25	25	25	25	25
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V	≤ 275 Bhn or ≤ 28 HRc	66	RPM	6947	3474	2605	2084	1737	1489	1303
			(52-79)	Fr	0.042	0.084	0.112	0.140	0.168	0.196	0.224
				Feed (mm/min)	292	292	292	292	292	292	292
		≤ 350 Bhn or ≤ 38 HRc	49	RPM	5170	2585	1939	1551	1293	1108	969
			(39-59)	Fr	0.038	0.077	0.102	0.128	0.153	0.179	0.204
				Feed (mm/min)	198	198	198	198	198	198	198
		≤ 440 Bhn or ≤ 47 HRc	26	RPM	2747	1373	1030	824	687	589	515
			(21-31)	Fr	0.029	0.057	0.076	0.096	0.115	0.134	0.153
				Feed (mm/min)	79	79	79	79	79	79	79
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	26	RPM	2747	1373	1030	824	687	589	515
			(21-31)	Fr	0.020	0.041	0.054	0.068	0.081	0.095	0.109
				Feed (mm/min)	56	56	56	56	56	56	56

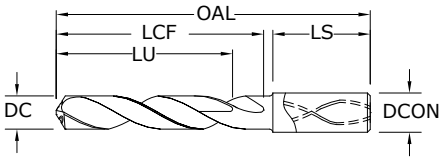
(Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x RPM
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

143M-S 3xD

METRIC SERIES



- Coolant through design improves coolant flow to extend tool life and aid in chip evacuation
- Eccentric 2-margin design reduces frictional heat and minimizes material adhesion to the margins without weakening the drill
- Computer controlled edge honing protects against chip damage
- High-performance point design stabilizes on contact for exceptional hole size and cylindricity allowing for low thrust force and extended tool life
- SGS Ti-NAMITE-A coating provides exceptional wear and erosion resistance when drilling heat resisting alloys like Inconel, Stainless Steel, and Titanium Alloys
- Recommended for materials ≤ 50HRc (475 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.1181	3,000 mm	6,0	62,0	20,0	15,0	36,0	69120
0.1220	3,100 mm	6,0	62,0	20,0	15,0	36,0	69121
0.1250	3,175 mm	6,0	62,0	20,0	15,0	36,0	56800
0.1260	3,200 mm	6,0	62,0	20,0	15,0	36,0	69122
0.1299	3,300 mm	6,0	62,0	20,0	15,0	36,0	69123
0.1339	3,400 mm	6,0	62,0	20,0	15,0	36,0	69124
0.1360	3,454 mm	6,0	62,0	20,0	15,0	36,0	56801
0.1378	3,500 mm	6,0	62,0	20,0	15,0	36,0	69125
0.1406	3,571 mm	6,0	62,0	20,0	15,0	36,0	56802
0.1417	3,600 mm	6,0	62,0	20,0	15,0	36,0	69126
0.1457	3,700 mm	6,0	62,0	20,0	15,0	36,0	69127
0.1496	3,800 mm	6,0	66,0	24,0	18,0	36,0	69128
0.1535	3,900 mm	6,0	66,0	24,0	18,0	36,0	69129
0.1562	3,967 mm	6,0	66,0	24,0	18,0	36,0	56803
0.1575	4,000 mm	6,0	66,0	24,0	18,0	36,0	69130
0.1590	4,039 mm	6,0	66,0	24,0	18,0	36,0	56804
0.1614	4,100 mm	6,0	66,0	24,0	18,0	36,0	69131
0.1654	4,200 mm	6,0	66,0	24,0	18,0	36,0	69132
0.1693	4,300 mm	6,0	66,0	24,0	18,0	36,0	69133
0.1719	4,366 mm	6,0	66,0	24,0	17,0	36,0	56805
0.1732	4,400 mm	6,0	66,0	24,0	17,0	36,0	69134
0.1772	4,500 mm	6,0	66,0	24,0	17,0	36,0	69135
0.1811	4,600 mm	6,0	66,0	24,0	17,0	36,0	69136
0.1850	4,699 mm	6,0	66,0	24,0	17,0	36,0	69137
0.1875	4,763 mm	6,0	66,0	28,0	21,0	36,0	56806
0.1890	4,801 mm	6,0	66,0	28,0	21,0	36,0	69138
0.1929	4,900 mm	6,0	66,0	28,0	21,0	36,0	69139
0.1969	5,000 mm	6,0	66,0	28,0	20,0	36,0	69140
0.2008	5,100 mm	6,0	66,0	28,0	20,0	36,0	69141
0.2031	5,159 mm	6,0	66,0	28,0	20,0	36,0	56807
0.2047	5,200 mm	6,0	66,0	28,0	20,0	36,0	69142
0.2087	5,300 mm	6,0	66,0	28,0	20,0	36,0	69143
0.2126	5,400 mm	6,0	66,0	28,0	20,0	36,0	69144
0.2165	5,500 mm	6,0	66,0	28,0	20,0	36,0	69145
0.2188	5,558 mm	6,0	66,0	28,0	20,0	36,0	56808
0.2205	5,600 mm	6,0	66,0	28,0	20,0	36,0	69146

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

143M-S 3xD

METRIC SERIES

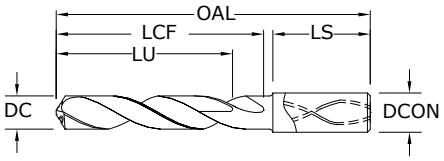
CONTINUED

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.2244	5,700 mm	6,0	66,0	28,0	19,0	36,0	69147
0.2283	5,800 mm	6,0	66,0	28,0	19,0	36,0	69148
0.2323	5,900 mm	6,0	66,0	28,0	19,0	36,0	69149
0.2344	5,954 mm	6,0	66,0	28,0	19,0	36,0	56809
0.2362	6,000 mm	6,0	66,0	28,0	19,0	36,0	69150
0.2402	6,100 mm	8,0	79,0	34,0	25,0	36,0	69151
0.2441	6,200 mm	8,0	79,0	34,0	25,0	36,0	69152
0.2480	6,300 mm	8,0	79,0	34,0	25,0	36,0	69153
0.2500	6,350 mm	8,0	79,0	34,0	24,0	36,0	56810
0.2520	6,400 mm	8,0	79,0	34,0	24,0	36,0	69154
0.2559	6,500 mm	8,0	79,0	34,0	24,0	36,0	69155
0.2570	6,528 mm	8,0	79,0	34,0	24,0	36,0	56811
0.2598	6,600 mm	8,0	79,0	34,0	24,0	36,0	69156
0.2638	6,700 mm	8,0	79,0	34,0	24,0	36,0	69157
0.2656	6,746 mm	8,0	79,0	34,0	24,0	36,0	56812
0.2677	6,800 mm	8,0	79,0	34,0	24,0	36,0	69158
0.2717	6,900 mm	8,0	79,0	34,0	24,0	36,0	69159
0.2756	7,000 mm	8,0	79,0	34,0	24,0	36,0	69160
0.2795	7,100 mm	8,0	79,0	41,0	30,0	36,0	69161
0.2812	7,142 mm	8,0	79,0	41,0	30,0	36,0	56813
0.2835	7,200 mm	8,0	79,0	41,0	30,0	36,0	69162
0.2874	7,300 mm	8,0	79,0	41,0	30,0	36,0	69163
0.2913	7,400 mm	8,0	79,0	41,0	30,0	36,0	69164
0.2953	7,500 mm	8,0	79,0	41,0	30,0	36,0	69165
0.2969	7,541 mm	8,0	79,0	41,0	30,0	36,0	56814
0.2992	7,600 mm	8,0	79,0	41,0	30,0	36,0	69166
0.3031	7,700 mm	8,0	79,0	41,0	29,0	36,0	69167
0.3071	7,800 mm	8,0	79,0	41,0	29,0	36,0	69168
0.3110	7,900 mm	8,0	79,0	41,0	29,0	36,0	69169
0.3125	7,938 mm	8,0	79,0	41,0	29,0	36,0	56815
0.3150	8,000 mm	8,0	79,0	41,0	29,0	36,0	69170
0.3189	8,100 mm	10,0	89,0	47,0	35,0	40,0	69171
0.3228	8,200 mm	10,0	89,0	47,0	35,0	40,0	69172
0.3268	8,300 mm	10,0	89,0	47,0	35,0	40,0	69173
0.3281	8,334 mm	10,0	89,0	47,0	34,0	40,0	56816
0.3307	8,400 mm	10,0	89,0	47,0	34,0	40,0	69174
0.3320	8,433 mm	10,0	89,0	47,0	34,0	40,0	56817
0.3346	8,500 mm	10,0	89,0	47,0	34,0	40,0	69175
0.3386	8,600 mm	10,0	89,0	47,0	34,0	40,0	69176
0.3425	8,700 mm	10,0	89,0	47,0	34,0	40,0	69177
0.3438	8,733 mm	10,0	89,0	47,0	34,0	40,0	56818
0.3465	8,800 mm	10,0	89,0	47,0	34,0	40,0	69178
0.3504	8,900 mm	10,0	89,0	47,0	34,0	40,0	69179
0.3543	9,000 mm	10,0	89,0	47,0	34,0	40,0	69180

continued on next page

143M-S 3xD

METRIC SERIES



CONTINUED

- Coolant through design improves coolant flow to extend tool life and aid in chip evacuation
- Eccentric 2-margin design reduces frictional heat and minimizes material adhesion to the margins without weakening the drill
- Computer controlled edge honing protects against chip damage
- High-performance point design stabilizes on contact for exceptional hole size and cylindricity allowing for low thrust force and extended tool life
- SGS Ti-NAMITE-A coating provides exceptional wear and erosion resistance when drilling heat resisting alloys like Inconel, Stainless Steel, and Titanium Alloys
- Recommended for materials ≤ 50HRc (475 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.3583	9,100 mm	10,0	89,0	47,0	33,0	40,0	69181
0.3594	9,129 mm	10,0	89,0	47,0	33,0	40,0	56819
0.3622	9,200 mm	10,0	89,0	47,0	33,0	40,0	69182
0.3661	9,300 mm	10,0	89,0	47,0	33,0	40,0	69183
0.3680	9,347 mm	10,0	89,0	47,0	33,0	40,0	56820
0.3701	9,400 mm	10,0	89,0	47,0	33,0	40,0	69184
0.3740	9,500 mm	10,0	89,0	47,0	33,0	40,0	69185
0.3750	9,525 mm	10,0	89,0	47,0	33,0	40,0	56821
0.3780	9,600 mm	10,0	89,0	47,0	33,0	40,0	69186
0.3819	9,700 mm	10,0	89,0	47,0	32,0	40,0	69187
0.3858	9,800 mm	10,0	89,0	47,0	32,0	40,0	69188
0.3898	9,900 mm	10,0	89,0	47,0	32,0	40,0	69189
0.3906	9,921 mm	10,0	89,0	47,0	32,0	40,0	56822
0.3937	10,000 mm	10,0	89,0	47,0	32,0	40,0	69190
0.3976	10,100 mm	12,0	102,0	55,0	40,0	45,0	69191
0.4016	10,200 mm	12,0	102,0	55,0	40,0	45,0	69192
0.4055	10,300 mm	12,0	102,0	55,0	40,0	45,0	69193
0.4062	10,317 mm	12,0	102,0	55,0	40,0	45,0	56823
0.4095	10,400 mm	12,0	102,0	55,0	39,0	45,0	69194
0.4134	10,500 mm	12,0	102,0	55,0	39,0	45,0	69195
0.4173	10,600 mm	12,0	102,0	55,0	39,0	45,0	69196
0.4213	10,700 mm	12,0	102,0	55,0	39,0	45,0	69197
0.4219	10,716 mm	12,0	102,0	55,0	39,0	45,0	56824
0.4252	10,800 mm	12,0	102,0	55,0	39,0	45,0	69198
0.4291	10,900 mm	12,0	102,0	55,0	39,0	45,0	69199
0.4331	11,000 mm	12,0	102,0	55,0	39,0	45,0	69200
0.4370	11,100 mm	12,0	102,0	55,0	38,0	45,0	69201
0.4375	11,113 mm	12,0	102,0	55,0	38,0	45,0	56825
0.4409	11,200 mm	12,0	102,0	55,0	38,0	45,0	69202
0.4449	11,300 mm	12,0	102,0	55,0	38,0	45,0	69203
0.4488	11,400 mm	12,0	102,0	55,0	38,0	45,0	69204
0.4528	11,500 mm	12,0	102,0	55,0	38,0	45,0	69205
0.4567	11,600 mm	12,0	102,0	55,0	38,0	45,0	69206
0.4606	11,700 mm	12,0	102,0	55,0	37,0	45,0	69207
0.4646	11,800 mm	12,0	102,0	55,0	37,0	45,0	69208
0.4685	11,900 mm	12,0	102,0	55,0	37,0	45,0	69209

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

143M-S 3xD

METRIC SERIES

CONTINUED

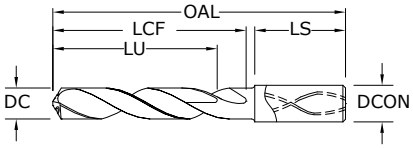
			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.4688	11,908 mm	12,0	102,0	55,0	37,0	45,0	56826
0.4724	12,000 mm	12,0	102,0	55,0	37,0	45,0	69210
0.4844	12,304 mm	14,0	107,0	60,0	41,0	45,0	56827
0.4921	12,500 mm	14,0	107,0	60,0	41,0	45,0	69211
0.5000	12,700 mm	14,0	107,0	60,0	41,0	45,0	56828
0.5039	12,800 mm	14,0	107,0	60,0	41,0	45,0	69212
0.5118	13,000 mm	14,0	107,0	60,0	41,0	45,0	69213
0.5156	13,096 mm	14,0	107,0	60,0	40,0	45,0	56829
0.5315	13,500 mm	14,0	107,0	60,0	40,0	45,0	69214
0.5433	13,800 mm	14,0	107,0	60,0	39,0	45,0	69215
0.5512	14,000 mm	14,0	107,0	60,0	39,0	45,0	69216
0.5625	14,288 mm	16,0	115,0	65,0	43,0	48,0	56830
0.5709	14,500 mm	16,0	115,0	65,0	43,0	48,0	69217
0.5781	14,684 mm	16,0	115,0	65,0	43,0	48,0	56831
0.5827	14,800 mm	16,0	115,0	65,0	43,0	48,0	69218
0.5906	15,000 mm	16,0	115,0	65,0	42,0	48,0	69219
0.6102	15,500 mm	16,0	115,0	65,0	42,0	48,0	69220
0.6221	15,800 mm	16,0	115,0	65,0	41,0	48,0	69221
0.6250	15,875 mm	16,0	115,0	65,0	41,0	48,0	56832
0.6299	16,000 mm	16,0	115,0	65,0	41,0	48,0	69222
0.6562	16,667 mm	18,0	123,0	73,0	47,0	48,0	56833
0.6875	17,463 mm	18,0	123,0	73,0	47,0	48,0	56834
0.7500	19,050 mm	20,0	131,0	79,0	50,0	50,0	56835

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

143M-S 5xD

METRIC SERIES



- Coolant through design improves coolant flow to extend tool life and aid in chip evacuation
- Eccentric 2-margin design reduces frictional heat and minimizes material adhesion to the margins without weakening the drill
- Computer controlled edge honing protects against chip damage
- High-performance point design stabilizes on contact for exceptional hole size and cylindricity allowing for low thrust force and extended tool life
- SGS Ti-NAMITE-A coating provides exceptional wear and erosion resistance when drilling heat resisting alloys like Inconel, Stainless Steel, and Titanium Alloys
- Recommended for materials ≤ 50HRc (475 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.1181	3,000 mm	6,0	66,0	28,0	23,0	36,0	69223
0.1220	3,100 mm	6,0	66,0	28,0	23,0	36,0	69224
0.1250	3,175 mm	6,0	66,0	28,0	23,0	36,0	56836
0.1260	3,200 mm	6,0	66,0	28,0	23,0	36,0	69225
0.1299	3,300 mm	6,0	66,0	28,0	23,0	36,0	69226
0.1339	3,400 mm	6,0	66,0	28,0	23,0	36,0	69227
0.1360	3,454 mm	6,0	66,0	28,0	23,0	36,0	56837
0.1378	3,500 mm	6,0	66,0	28,0	23,0	36,0	69228
0.1406	3,571 mm	6,0	66,0	28,0	23,0	36,0	56838
0.1417	3,600 mm	6,0	66,0	28,0	23,0	36,0	69229
0.1457	3,700 mm	6,0	66,0	28,0	23,0	36,0	69230
0.1496	3,800 mm	6,0	74,0	36,0	29,0	36,0	69231
0.1535	3,900 mm	6,0	74,0	36,0	29,0	36,0	69232
0.1562	3,967 mm	6,0	74,0	36,0	29,0	36,0	56839
0.1575	4,000 mm	6,0	74,0	36,0	29,0	36,0	69233
0.1590	4,039 mm	6,0	74,0	36,0	29,0	36,0	56840
0.1614	4,100 mm	6,0	74,0	36,0	29,0	36,0	69234
0.1654	4,200 mm	6,0	74,0	36,0	29,0	36,0	69235
0.1693	4,300 mm	6,0	74,0	36,0	29,0	36,0	69236
0.1719	4,366 mm	6,0	74,0	36,0	29,0	36,0	56841
0.1732	4,400 mm	6,0	74,0	36,0	29,0	36,0	69237
0.1772	4,500 mm	6,0	74,0	36,0	29,0	36,0	69238
0.1811	4,600 mm	6,0	74,0	36,0	29,0	36,0	69239
0.1850	4,699 mm	6,0	74,0	36,0	29,0	36,0	69240
0.1875	4,763 mm	6,0	82,0	44,0	37,0	36,0	56842
0.1890	4,801 mm	6,0	82,0	44,0	37,0	36,0	69241
0.1929	4,900 mm	6,0	82,0	44,0	37,0	36,0	69242
0.1969	5,000 mm	6,0	82,0	44,0	36,0	36,0	69243
0.2008	5,100 mm	6,0	82,0	44,0	36,0	36,0	69244
0.2031	5,159 mm	6,0	82,0	44,0	36,0	36,0	56843
0.2047	5,200 mm	6,0	82,0	44,0	36,0	36,0	69245
0.2087	5,300 mm	6,0	82,0	44,0	36,0	36,0	69246
0.2126	5,400 mm	6,0	82,0	44,0	36,0	36,0	69247
0.2165	5,500 mm	6,0	82,0	44,0	36,0	36,0	69248
0.2188	5,558 mm	6,0	82,0	44,0	36,0	36,0	56844
0.2205	5,600 mm	6,0	82,0	44,0	36,0	36,0	69249

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

143M-S 5xD

METRIC SERIES

CONTINUED

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.2244	5,700 mm	6,0	82,0	44,0	35,0	36,0	69250
0.2283	5,800 mm	6,0	82,0	44,0	35,0	36,0	69251
0.2323	5,900 mm	6,0	82,0	44,0	35,0	36,0	69252
0.2344	5,954 mm	6,0	82,0	44,0	35,0	36,0	56845
0.2362	6,000 mm	6,0	82,0	44,0	35,0	36,0	69253
0.2402	6,100 mm	8,0	91,0	53,0	44,0	36,0	69254
0.2441	6,200 mm	8,0	91,0	53,0	44,0	36,0	69255
0.2480	6,300 mm	8,0	91,0	53,0	44,0	36,0	69256
0.2500	6,350 mm	8,0	91,0	53,0	43,0	36,0	56846
0.2520	6,400 mm	8,0	91,0	53,0	43,0	36,0	69257
0.2559	6,500 mm	8,0	91,0	53,0	43,0	36,0	69258
0.2570	6,528 mm	8,0	91,0	53,0	43,0	36,0	56847
0.2598	6,600 mm	8,0	91,0	53,0	43,0	36,0	69259
0.2638	6,700 mm	8,0	91,0	53,0	43,0	36,0	69260
0.2656	6,746 mm	8,0	91,0	53,0	43,0	36,0	56848
0.2677	6,800 mm	8,0	91,0	53,0	43,0	36,0	69261
0.2717	6,900 mm	8,0	91,0	53,0	43,0	36,0	69262
0.2756	7,000 mm	8,0	91,0	53,0	42,0	36,0	69263
0.2795	7,100 mm	8,0	91,0	53,0	42,0	36,0	69264
0.2812	7,142 mm	8,0	91,0	53,0	42,0	36,0	56849
0.2835	7,200 mm	8,0	91,0	53,0	42,0	36,0	69265
0.2874	7,300 mm	8,0	91,0	53,0	42,0	36,0	69266
0.2913	7,400 mm	8,0	91,0	53,0	42,0	36,0	69267
0.2953	7,500 mm	8,0	91,0	53,0	42,0	36,0	69268
0.2969	7,541 mm	8,0	91,0	53,0	42,0	36,0	56850
0.2992	7,600 mm	8,0	91,0	53,0	42,0	36,0	69269
0.3031	7,700 mm	8,0	91,0	53,0	41,0	36,0	69270
0.3071	7,800 mm	8,0	91,0	53,0	41,0	36,0	69271
0.3110	7,900 mm	8,0	91,0	53,0	41,0	36,0	69272
0.3125	7,938 mm	8,0	91,0	53,0	41,0	36,0	56851
0.3150	8,000 mm	8,0	91,0	53,0	41,0	36,0	69273
0.3189	8,100 mm	10,0	103,0	61,0	49,0	40,0	69274
0.3228	8,200 mm	10,0	103,0	61,0	49,0	40,0	69275
0.3268	8,300 mm	10,0	103,0	61,0	49,0	40,0	69276
0.3281	8,334 mm	10,0	103,0	61,0	48,0	40,0	56852
0.3307	8,400 mm	10,0	103,0	61,0	48,0	40,0	69277
0.3320	8,433 mm	10,0	103,0	61,0	48,0	40,0	56853
0.3346	8,500 mm	10,0	103,0	61,0	48,0	40,0	69278
0.3386	8,600 mm	10,0	103,0	61,0	48,0	40,0	69279
0.3425	8,700 mm	10,0	103,0	61,0	48,0	40,0	69280
0.3438	8,733 mm	10,0	103,0	61,0	48,0	40,0	56854
0.3465	8,800 mm	10,0	103,0	61,0	48,0	40,0	69281
0.3504	8,900 mm	10,0	103,0	61,0	48,0	40,0	69282
0.3543	9,000 mm	10,0	103,0	61,0	48,0	40,0	69283

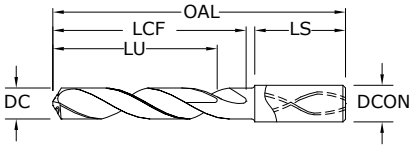
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

143M-S 5xD

METRIC SERIES



CONTINUED

- Coolant through design improves coolant flow to extend tool life and aid in chip evacuation
- Eccentric 2-margin design reduces frictional heat and minimizes material adhesion to the margins without weakening the drill
- Computer controlled edge honing protects against chip damage
- High-performance point design stabilizes on contact for exceptional hole size and cylindricity allowing for low thrust force and extended tool life
- SGS Ti-NAMITE-A coating provides exceptional wear and erosion resistance when drilling heat resisting alloys like Inconel, Stainless Steel, and Titanium Alloys
- Recommended for materials ≤ 50HRc (475 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.3583	9,100 mm	10,0	103,0	61,0	47,0	40,0	69284
0.3594	9,129 mm	10,0	103,0	61,0	47,0	40,0	56855
0.3622	9,200 mm	10,0	103,0	61,0	47,0	40,0	69285
0.3661	9,300 mm	10,0	103,0	61,0	47,0	40,0	69286
0.3680	9,347 mm	10,0	103,0	61,0	47,0	40,0	56856
0.3701	9,400 mm	10,0	103,0	61,0	47,0	40,0	69287
0.3740	9,500 mm	10,0	103,0	61,0	47,0	40,0	69288
0.3750	9,525 mm	10,0	103,0	61,0	47,0	40,0	56857
0.3780	9,600 mm	10,0	103,0	61,0	47,0	40,0	69289
0.3819	9,700 mm	10,0	103,0	61,0	46,0	40,0	69290
0.3858	9,800 mm	10,0	103,0	61,0	46,0	40,0	69291
0.3898	9,900 mm	10,0	103,0	61,0	46,0	40,0	69292
0.3906	9,921 mm	10,0	103,0	61,0	46,0	40,0	56858
0.3937	10,000 mm	10,0	103,0	61,0	46,0	40,0	69293
0.3976	10,100 mm	12,0	118,0	71,0	56,0	45,0	69294
0.4016	10,200 mm	12,0	118,0	71,0	56,0	45,0	69295
0.4055	10,300 mm	12,0	118,0	71,0	56,0	45,0	69296
0.4062	10,317 mm	12,0	118,0	71,0	56,0	45,0	56859
0.4095	10,400 mm	12,0	118,0	71,0	55,0	45,0	69297
0.4134	10,500 mm	12,0	118,0	71,0	55,0	45,0	69298
0.4173	10,600 mm	12,0	118,0	71,0	55,0	45,0	69299
0.4213	10,700 mm	12,0	118,0	71,0	55,0	45,0	69300
0.4219	10,716 mm	12,0	118,0	71,0	55,0	45,0	56860
0.4252	10,800 mm	12,0	118,0	71,0	55,0	45,0	69301
0.4291	10,900 mm	12,0	118,0	71,0	55,0	45,0	69302
0.4331	11,000 mm	12,0	118,0	71,0	54,0	45,0	69303
0.4370	11,100 mm	12,0	118,0	71,0	54,0	45,0	69304
0.4375	11,113 mm	12,0	118,0	71,0	54,0	45,0	56861
0.4409	11,200 mm	12,0	118,0	71,0	54,0	45,0	69305
0.4449	11,300 mm	12,0	118,0	71,0	54,0	45,0	69306
0.4488	11,400 mm	12,0	118,0	71,0	54,0	45,0	69307
0.4528	11,500 mm	12,0	118,0	71,0	54,0	45,0	69308
0.4567	11,600 mm	12,0	118,0	71,0	54,0	45,0	69309
0.4606	11,700 mm	12,0	118,0	71,0	53,0	45,0	69310
0.4646	11,800 mm	12,0	118,0	71,0	53,0	45,0	69311
0.4685	11,900 mm	12,0	118,0	71,0	53,0	45,0	69312

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

143M-S 5xD

METRIC SERIES

CONTINUED

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.4688	11,908 mm	12,0	118,0	71,0	53,0	45,0	56862
0.4724	12,000 mm	12,0	118,0	71,0	53,0	45,0	69313
0.4844	12,304 mm	14,0	124,0	77,0	58,0	45,0	56863
0.4921	12,500 mm	14,0	124,0	77,0	58,0	45,0	69314
0.5000	12,700 mm	14,0	124,0	77,0	58,0	45,0	56864
0.5039	12,800 mm	14,0	124,0	77,0	58,0	45,0	69315
0.5118	13,000 mm	14,0	124,0	77,0	58,0	45,0	69316
0.5156	13,096 mm	14,0	124,0	77,0	57,0	45,0	56865
0.5315	13,500 mm	14,0	124,0	77,0	57,0	45,0	69317
0.5433	13,800 mm	14,0	124,0	77,0	56,0	45,0	69318
0.5512	14,000 mm	14,0	124,0	77,0	56,0	45,0	69319
0.5625	14,288 mm	16,0	133,0	83,0	61,0	48,0	56866
0.5709	14,500 mm	16,0	133,0	83,0	61,0	48,0	69320
0.5781	14,684 mm	16,0	133,0	83,0	61,0	48,0	56867
0.5827	14,800 mm	16,0	133,0	83,0	61,0	48,0	69321
0.5906	15,000 mm	16,0	133,0	83,0	60,0	48,0	69322
0.6102	15,500 mm	16,0	133,0	83,0	60,0	48,0	69323
0.6221	15,800 mm	16,0	133,0	83,0	59,0	48,0	69324
0.6250	15,875 mm	16,0	133,0	83,0	59,0	48,0	56868
0.6299	16,000 mm	16,0	133,0	83,0	59,0	48,0	69325
0.6562	16,667 mm	18,0	143,0	93,0	68,0	48,0	56869
0.6875	17,463 mm	18,0	143,0	93,0	67,0	48,0	56870
0.7500	19,050 mm	20,0	153,0	101,0	72,0	50,0	56871

Hi-PerCarb

	Series 143M-S Metric	Hardness	Vc (m/min)		DC • mm 3	6	8	10	12	14	16
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	130	RPM	13733	6867	5150	4120	3433	2943	2575
			(104-155)	Fr	0.094	0.189	0.252	0.314	0.377	0.440	0.503
				Feed (mm/min)	1295	1295	1295	1295	1295	1295	1295
		≤ 275 Bhn or ≤ 28 HRc	116	RPM	12279	6140	4605	3684	3070	2631	2302
			(93-139)	Fr	0.085	0.170	0.226	0.283	0.339	0.396	0.452
				Feed (mm/min)	1041	1041	1041	1041	1041	1041	1041
		≤ 425 Bhn or ≤ 45 HRc	67	RPM	7109	3555	2666	2133	1777	1523	1333
			(54-80)	Fr	0.071	0.143	0.191	0.238	0.286	0.333	0.381
				Feed (mm/min)	508	508	508	508	508	508	508
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	101	RPM	10664	5332	3999	3199	2666	2285	1999
			(80-121)	Fr	0.071	0.143	0.191	0.238	0.286	0.333	0.381
				Feed (mm/min)	762	762	762	762	762	762	762
		≤ 375 Bhn or ≤ 40 HRc	61	RPM	6463	3231	2424	1939	1616	1385	1212
			(49-73)	Fr	0.061	0.122	0.162	0.203	0.244	0.284	0.325
				Feed (mm/min)	394	394	394	394	394	394	394
		≤ 425 Bhn or ≤ 45 HRc	43	RPM	4524	2262	1696	1357	1131	969	848
			(34-51)	Fr	0.043	0.086	0.115	0.144	0.173	0.202	0.231
				Feed (mm/min)	196	196	196	196	196	196	196
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 200 Bhn or ≤ 13 HRc	44	RPM	4686	2343	1757	1406	1171	1004	879
			(35-53)	Fr	0.062	0.125	0.166	0.208	0.249	0.291	0.332
				Feed (mm/min)	292	292	292	292	292	292	292
		≤ 375 Bhn or ≤ 40 HRc	29	RPM	3070	1535	1151	921	767	658	576
			(23-35)	Fr	0.029	0.058	0.077	0.097	0.116	0.135	0.154
				Feed (mm/min)	89	89	89	89	89	89	89
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 185 Bhn or ≤ 9 HRc	99	RPM	10502	5251	3938	3151	2626	2250	1969
			(79-119)	Fr	0.073	0.145	0.193	0.242	0.290	0.339	0.387
				Feed (mm/min)	762	762	762	762	762	762	762
		≤ 275 Bhn or ≤ 28 HRc	64	RPM	6786	3393	2545	2036	1696	1454	1272
			(51-77)	Fr	0.056	0.112	0.150	0.187	0.225	0.262	0.299
				Feed (mm/min)	381	381	381	381	381	381	381
	STAINLESS STEELS (DIFFICULT) 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	49	RPM	5170	2585	1939	1551	1293	1108	969
			(39-59)	Fr	0.056	0.112	0.149	0.187	0.224	0.261	0.299
				Feed (mm/min)	290	290	290	290	290	290	290
		≤ 375 Bhn or ≤ 40 HRc	35	RPM	3716	1858	1394	1115	929	796	697
			(28-42)	Fr	0.050	0.100	0.133	0.166	0.200	0.233	0.266
				Feed (mm/min)	185	185	185	185	185	185	185

continued on next page

Hi-PerCarb

	Series 143M-S Metric	Hardness	Vc (m/min)		DC • mm 3	6	8	10	12	14	16
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	110	RPM	11633	5816	4362	3490	2908	2493	2181
			(88-132)	Fr	0.109	0.218	0.291	0.364	0.437	0.509	0.582
				Feed (mm/min)	1270	1270	1270	1270	1270	1270	1270
		≤ 260 Bhn or ≤ 26 HRc	102	RPM	10825	5413	4059	3248	2706	2320	2030
			(82-123)	Fr	0.109	0.218	0.291	0.364	0.436	0.509	0.582
				Feed (mm/min)	1181	1181	1181	1181	1181	1181	1181
S	HIGH TEMP ALLOYS (Nickel , Cobalt, Iron Base) Inconel 601, 617, 625, Incoloy, Monel 400, Rene, Waspaloy	≤ 300 Bhn or ≤ 32 HRc	40	RPM	4201	2100	1575	1260	1050	900	788
			(32-48)	Fr	0.034	0.069	0.092	0.115	0.138	0.161	0.184
				Feed (mm/min)	145	145	145	145	145	145	145
		≤ 400 Bhn or ≤ 43 HRc	21	RPM	2262	1131	848	679	565	485	424
			(17-26)	Fr	0.029	0.058	0.078	0.097	0.117	0.136	0.156
				Feed (mm/min)	66	66	66	66	66	66	66
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V	≤ 275 Bhn or ≤ 28 HRc	66	RPM	6947	3474	2605	2084	1737	1489	1303
			(52-79)	Fr	0.042	0.084	0.112	0.140	0.168	0.196	0.224
				Feed (mm/min)	292	292	292	292	292	292	292
		≤ 350 Bhn or ≤ 38 HRc	49	RPM	5170	2585	1939	1551	1293	1108	969
			(39-59)	Fr	0.038	0.077	0.102	0.128	0.153	0.179	0.204
				Feed (mm/min)	198	198	198	198	198	198	198
		≤ 440 Bhn or ≤ 47 HRc	26	RPM	2747	1373	1030	824	687	589	515
			(21-31)	Fr	0.029	0.057	0.076	0.096	0.115	0.134	0.153
				Feed (mm/min)	79	79	79	79	79	79	79

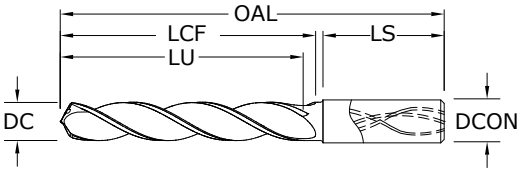
Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x RPM
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

141K 5xD

METRIC SERIES



- 3-margin design improves hole stability and size control while providing superior finish, roundness and cylindricity
- Self-stabilizing pyramid point design stabilizes the drill on contact with the workpiece
- Open flute structure efficiently transports chips while maintaining strength at high feed rates
- Sculpted gash allows chips to easily flow away from the drill center
- Recommended for materials ≤ 43 HRc (≤ 400 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-M (TM)
0.1181	3,000 mm	6,0	66,0	28,0	23,0	36,0	65160
0.1220	3,100 mm	6,0	66,0	28,0	23,0	36,0	65161
0.1250	3,175 mm	6,0	66,0	28,0	23,0	36,0	55160
0.1260	3,200 mm	6,0	66,0	28,0	23,0	36,0	65162
0.1299	3,300 mm	6,0	66,0	28,0	23,0	36,0	65163
0.1339	3,400 mm	6,0	66,0	28,0	23,0	36,0	65164
0.1360	3,454 mm	6,0	66,0	28,0	23,0	36,0	55161
0.1378	3,500 mm	6,0	66,0	28,0	23,0	36,0	65165
0.1406	3,571 mm	6,0	66,0	28,0	23,0	36,0	55162
0.1417	3,600 mm	6,0	66,0	28,0	23,0	36,0	65166
0.1457	3,700 mm	6,0	66,0	28,0	23,0	36,0	65167
0.1496	3,800 mm	6,0	74,0	36,0	29,0	36,0	65168
0.1535	3,900 mm	6,0	74,0	36,0	29,0	36,0	65169
0.1562	3,967 mm	6,0	74,0	36,0	29,0	36,0	55163
0.1575	4,000 mm	6,0	74,0	36,0	29,0	36,0	65170
0.1590	4,039 mm	6,0	74,0	36,0	29,0	36,0	55164
0.1614	4,100 mm	6,0	74,0	36,0	29,0	36,0	65171
0.1654	4,200 mm	6,0	74,0	36,0	29,0	36,0	65172
0.1693	4,300 mm	6,0	74,0	36,0	29,0	36,0	65173
0.1719	4,366 mm	6,0	74,0	36,0	29,0	36,0	55165
0.1732	4,400 mm	6,0	74,0	36,0	29,0	36,0	65174
0.1772	4,500 mm	6,0	74,0	36,0	29,0	36,0	65175
0.1811	4,600 mm	6,0	74,0	36,0	29,0	36,0	65176
0.1850	4,699 mm	6,0	74,0	36,0	29,0	36,0	65177
0.1875	4,763 mm	6,0	82,0	44,0	37,0	36,0	55166
0.1890	4,801 mm	6,0	82,0	44,0	37,0	36,0	65178
0.1929	4,900 mm	6,0	82,0	44,0	37,0	36,0	65179
0.1969	5,000 mm	6,0	82,0	44,0	36,0	36,0	65180
0.2008	5,100 mm	6,0	82,0	44,0	36,0	36,0	65181
0.2031	5,159 mm	6,0	82,0	44,0	36,0	36,0	55167
0.2047	5,200 mm	6,0	82,0	44,0	36,0	36,0	65182
0.2087	5,300 mm	6,0	82,0	44,0	36,0	36,0	65183
0.2126	5,400 mm	6,0	82,0	44,0	36,0	36,0	65184
0.2165	5,500 mm	6,0	82,0	44,0	36,0	36,0	65185
0.2188	5,558 mm	6,0	82,0	44,0	36,0	36,0	55168
0.2205	5,600 mm	6,0	82,0	44,0	36,0	36,0	65186

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

CAST IRON

141K 5xD

METRIC SERIES

CONTINUED

DECIMAL DC	METRIC DC	SHANK DIAMETER DCON (mm)	OVERALL LENGTH OAL (mm)	FLUTE LENGTH LCF (mm)	USABLE LENGTH LU (mm)	SHANK LENGTH LS (mm)	EDP NO. Ti-NAMITE-M (TM)
0.2244	5,700 mm	6,0	82,0	44,0	35,0	36,0	65187
0.2283	5,800 mm	6,0	82,0	44,0	35,0	36,0	65188
0.2323	5,900 mm	6,0	82,0	44,0	35,0	36,0	65189
0.2344	5,954 mm	6,0	82,0	44,0	35,0	36,0	55169
0.2362	6,000 mm	6,0	82,0	44,0	35,0	36,0	65190
0.2402	6,100 mm	8,0	91,0	53,0	44,0	36,0	65191
0.2441	6,200 mm	8,0	91,0	53,0	44,0	36,0	65192
0.2480	6,300 mm	8,0	91,0	53,0	44,0	36,0	65193
0.2500	6,350 mm	8,0	91,0	53,0	43,0	36,0	55170
0.2520	6,400 mm	8,0	91,0	53,0	43,0	36,0	65194
0.2559	6,500 mm	8,0	91,0	53,0	43,0	36,0	65195
0.2570	6,528 mm	8,0	91,0	53,0	43,0	36,0	55171
0.2598	6,600 mm	8,0	91,0	53,0	43,0	36,0	65196
0.2638	6,700 mm	8,0	91,0	53,0	43,0	36,0	65197
0.2656	6,746 mm	8,0	91,0	53,0	43,0	36,0	55172
0.2677	6,800 mm	8,0	91,0	53,0	43,0	36,0	65198
0.2717	6,900 mm	8,0	91,0	53,0	43,0	36,0	65199
0.2756	7,000 mm	8,0	91,0	53,0	42,0	36,0	65200
0.2795	7,100 mm	8,0	91,0	53,0	42,0	36,0	65201
0.2812	7,142 mm	8,0	91,0	53,0	42,0	36,0	55173
0.2835	7,200 mm	8,0	91,0	53,0	42,0	36,0	65202
0.2874	7,300 mm	8,0	91,0	53,0	42,0	36,0	65203
0.2913	7,400 mm	8,0	91,0	53,0	42,0	36,0	65204
0.2953	7,500 mm	8,0	91,0	53,0	42,0	36,0	65205
0.2969	7,541 mm	8,0	91,0	53,0	42,0	36,0	55174
0.2992	7,600 mm	8,0	91,0	53,0	42,0	36,0	65206
0.3031	7,700 mm	8,0	91,0	53,0	41,0	36,0	65207
0.3071	7,800 mm	8,0	91,0	53,0	41,0	36,0	65208
0.3110	7,900 mm	8,0	91,0	53,0	41,0	36,0	65209
0.3125	7,938 mm	8,0	91,0	53,0	41,0	36,0	55175
0.3150	8,000 mm	8,0	91,0	53,0	41,0	36,0	65210
0.3189	8,100 mm	10,0	103,0	61,0	49,0	40,0	65211
0.3228	8,200 mm	10,0	103,0	61,0	49,0	40,0	65212
0.3268	8,300 mm	10,0	103,0	61,0	49,0	40,0	65213
0.3281	8,334 mm	10,0	103,0	61,0	48,0	40,0	55176
0.3307	8,400 mm	10,0	103,0	61,0	48,0	40,0	65214
0.3320	8,433 mm	10,0	103,0	61,0	48,0	40,0	55177
0.3346	8,500 mm	10,0	103,0	61,0	48,0	40,0	65215
0.3386	8,600 mm	10,0	103,0	61,0	48,0	40,0	65216
0.3425	8,700 mm	10,0	103,0	61,0	48,0	40,0	65217
0.3438	8,733 mm	10,0	103,0	61,0	48,0	40,0	55178
0.3465	8,800 mm	10,0	103,0	61,0	48,0	40,0	65218
0.3504	8,900 mm	10,0	103,0	61,0	48,0	40,0	65219
0.3543	9,000 mm	10,0	103,0	61,0	48,0	40,0	65220
0.3583	9,100 mm	10,0	103,0	61,0	47,0	40,0	65221
0.3594	9,129 mm	10,0	103,0	61,0	47,0	40,0	55179

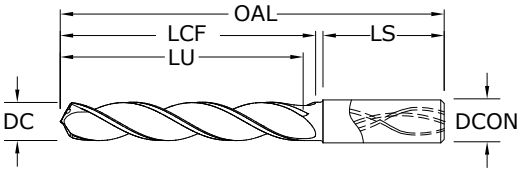
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

141K 5xD

METRIC SERIES



CONTINUED

- 3-margin design improves hole stability and size control while providing superior finish, roundness and cylindricity
- Self-stabilizing pyramid point design stabilizes the drill on contact with the workpiece
- Open flute structure efficiently transports chips while maintaining strength at high feed rates
- Sculpted gash allows chips to easily flow away from the drill center
- Recommended for materials ≤ 43 HRc (≤ 400 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-M (TM)
0.3622	9,200 mm	10,0	103,0	61,0	47,0	40,0	65222
0.3661	9,300 mm	10,0	103,0	61,0	47,0	40,0	65223
0.3680	9,347 mm	10,0	103,0	61,0	47,0	40,0	55180
0.3701	9,400 mm	10,0	103,0	61,0	47,0	40,0	65224
0.3740	9,500 mm	10,0	103,0	61,0	47,0	40,0	65225
0.3750	9,525 mm	10,0	103,0	61,0	47,0	40,0	55181
0.3780	9,600 mm	10,0	103,0	61,0	47,0	40,0	65226
0.3819	9,700 mm	10,0	103,0	61,0	46,0	40,0	65227
0.3858	9,800 mm	10,0	103,0	61,0	46,0	40,0	65228
0.3898	9,900 mm	10,0	103,0	61,0	46,0	40,0	65229
0.3906	9,921 mm	10,0	103,0	61,0	46,0	40,0	55182
0.3937	10,000 mm	10,0	103,0	61,0	46,0	40,0	65230
0.3976	10,100 mm	12,0	118,0	71,0	56,0	45,0	65231
0.4016	10,200 mm	12,0	118,0	71,0	56,0	45,0	65232
0.4055	10,300 mm	12,0	118,0	71,0	56,0	45,0	65233
0.4062	10,317 mm	12,0	118,0	71,0	56,0	45,0	55183
0.4095	10,400 mm	12,0	118,0	71,0	55,0	45,0	65234
0.4134	10,500 mm	12,0	118,0	71,0	55,0	45,0	65235
0.4173	10,600 mm	12,0	118,0	71,0	55,0	45,0	65236
0.4213	10,700 mm	12,0	118,0	71,0	55,0	45,0	65237
0.4219	10,716 mm	12,0	118,0	71,0	55,0	45,0	55184
0.4252	10,800 mm	12,0	118,0	71,0	55,0	45,0	65238
0.4291	10,900 mm	12,0	118,0	71,0	55,0	45,0	65239
0.4331	11,000 mm	12,0	118,0	71,0	54,0	45,0	65240
0.4370	11,100 mm	12,0	118,0	71,0	54,0	45,0	65241
0.4375	11,113 mm	12,0	118,0	71,0	54,0	45,0	55185
0.4409	11,200 mm	12,0	118,0	71,0	54,0	45,0	65242
0.4449	11,300 mm	12,0	118,0	71,0	54,0	45,0	65243
0.4488	11,400 mm	12,0	118,0	71,0	54,0	45,0	65244
0.4528	11,500 mm	12,0	118,0	71,0	54,0	45,0	65245
0.4567	11,600 mm	12,0	118,0	71,0	54,0	45,0	65246
0.4606	11,700 mm	12,0	118,0	71,0	53,0	45,0	65247
0.4646	11,800 mm	12,0	118,0	71,0	53,0	45,0	65248
0.4685	11,900 mm	12,0	118,0	71,0	53,0	45,0	65249
0.4688	11,908 mm	12,0	118,0	71,0	53,0	45,0	55186
0.4724	12,000 mm	12,0	118,0	71,0	53,0	45,0	65250

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

CAST IRON

141K 5xD
METRIC SERIES

CONTINUED

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-M (TM)
0.4844	12,304 mm	14,0	124,0	77,0	58,0	45,0	55187
0.4921	12,500 mm	14,0	124,0	77,0	58,0	45,0	65251
0.5000	12,700 mm	14,0	124,0	77,0	58,0	45,0	55188
0.5039	12,800 mm	14,0	124,0	77,0	58,0	45,0	65252
0.5118	13,000 mm	14,0	124,0	77,0	58,0	45,0	65253
0.5156	13,096 mm	14,0	124,0	77,0	57,0	45,0	55189
0.5315	13,500 mm	14,0	124,0	77,0	57,0	45,0	65254
0.5433	13,800 mm	14,0	124,0	77,0	56,0	45,0	65255
0.5512	14,000 mm	14,0	124,0	77,0	56,0	45,0	65256
0.5625	14,288 mm	16,0	133,0	83,0	61,0	48,0	55190
0.5709	14,500 mm	16,0	133,0	83,0	61,0	48,0	65257
0.5781	14,684 mm	16,0	133,0	83,0	61,0	48,0	55191
0.5827	14,800 mm	16,0	133,0	83,0	61,0	48,0	65258
0.5906	15,000 mm	16,0	133,0	83,0	60,0	48,0	65259
0.6102	15,500 mm	16,0	133,0	83,0	60,0	48,0	65260
0.6221	15,800 mm	16,0	133,0	83,0	59,0	48,0	65261
0.6250	15,875 mm	16,0	133,0	83,0	59,0	48,0	55192
0.6299	16,000 mm	16,0	133,0	83,0	59,0	48,0	65262
0.6562	16,667 mm	18,0	143,0	93,0	68,0	48,0	55193
0.6875	17,463 mm	18,0	143,0	93,0	67,0	48,0	55194
0.7500	19,050 mm	20,0	153,0	101,0	72,0	50,0	55195

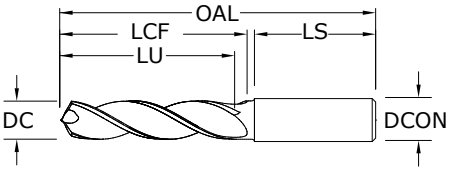
Hi-PerCarb

	Series 141K 5D Metric	Hardness	Vc (m/min)		DC • mm 3	6	8	10	12	14	16
K	GRAY CAST IRON FERRITIC ASTM A48: CLASS 20 SAE J431C: GRADE 1800	≤ 150 Bhn or ≤ 1 HRc	137	RPM	14541	7271	5453	4362	3635	3116	2726
			(110-165)	Fr	0.119	0.237	0.316	0.395	0.475	0.554	0.633
				Feed (mm/min)	1725	1725	1725	1725	1725	1725	1725
	GRAY CAST IRON PEARLITIC ASTM A48: CLASS 30, 35, 40 SAE J431C: GRADE 3000	≤ 220 Bhn or ≤ 19 HRc	114	RPM	12118	6059	4544	3635	3029	2597	2272
			(91-137)	Fr	0.094	0.189	0.252	0.315	0.378	0.441	0.504
				Feed (mm/min)	1145	1145	1145	1145	1145	1145	1145
	COMPACTED GRAPHITE IRON	≤ 250 Bhn or ≤ 25 HRc	99	RPM	10502	5251	3938	3151	2626	2250	1969
			(79-119)	Fr	0.094	0.189	0.251	0.314	0.377	0.440	0.503
				Feed (mm/min)	990	990	990	990	990	990	990
	MALLEABLE CAST IRON FERRITIC ASTM A220: GRADE 40010 SAE J158: GRADE M4504	≤ 160 Bhn or ≤ 3 HRc	137	RPM	14541	7271	5453	4362	3635	3116	2726
			(110-165)	Fr	0.119	0.237	0.316	0.395	0.475	0.554	0.633
				Feed (mm/min)	1725	1725	1725	1725	1725	1725	1725
	MALLEABLE CAST IRON MARTENSITE ASTM A220: GRADE 90001 SAE J158: GRADE M8501	≤ 320 Bhn or ≤ 34 HRc	76	RPM	8078	4039	3029	2424	2020	1731	1515
			(61-91)	Fr	0.076	0.151	0.201	0.252	0.302	0.352	0.403
				Feed (mm/min)	610	610	610	610	610	610	610

(Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Hi-PerCarb

HIGH PERFORMANCE CARBIDE DRILLS



131N 3xD

METRIC SERIES

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

NON-FERROUS

		mm					EDP NO.	
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	UNCOATED	Ti-NAMITE-B (TiB_2)
0.1181	3,000 mm	6,0	62,0	20,0	15,0	36,0	64600	67600
0.1220	3,100 mm	6,0	62,0	20,0	15,0	36,0	64601	67601
0.1250	3,175 mm	6,0	62,0	20,0	15,0	36,0	54600	54700
0.1260	3,200 mm	6,0	62,0	20,0	15,0	36,0	64602	67602
0.1299	3,300 mm	6,0	62,0	20,0	15,0	36,0	64603	67603
0.1339	3,400 mm	6,0	62,0	20,0	15,0	36,0	64604	67604
0.1360	3,454 mm	6,0	62,0	20,0	15,0	36,0	54601	54701
0.1378	3,500 mm	6,0	62,0	20,0	15,0	36,0	64605	67605
0.1406	3,571 mm	6,0	62,0	20,0	15,0	36,0	54602	54702
0.1417	3,600 mm	6,0	62,0	20,0	15,0	36,0	64606	67606
0.1457	3,700 mm	6,0	62,0	20,0	15,0	36,0	64607	67607
0.1496	3,800 mm	6,0	66,0	24,0	18,0	36,0	64608	67608
0.1535	3,900 mm	6,0	66,0	24,0	18,0	36,0	64609	67609
0.1562	3,967 mm	6,0	66,0	24,0	18,0	36,0	54603	54703
0.1575	4,000 mm	6,0	66,0	24,0	18,0	36,0	64610	67610
0.1590	4,039 mm	6,0	66,0	24,0	18,0	36,0	54604	54704
0.1614	4,100 mm	6,0	66,0	24,0	18,0	36,0	64611	67611
0.1654	4,200 mm	6,0	66,0	24,0	18,0	36,0	64612	67612
0.1693	4,300 mm	6,0	66,0	24,0	18,0	36,0	64613	67613
0.1719	4,366 mm	6,0	66,0	24,0	17,0	36,0	54605	54705
0.1732	4,400 mm	6,0	66,0	24,0	17,0	36,0	64614	67614
0.1772	4,500 mm	6,0	66,0	24,0	17,0	36,0	64615	67615
0.1811	4,600 mm	6,0	66,0	24,0	17,0	36,0	64616	67616
0.1850	4,699 mm	6,0	66,0	24,0	17,0	36,0	64617	67617
0.1875	4,763 mm	6,0	66,0	28,0	21,0	36,0	54606	54706
0.1890	4,801 mm	6,0	66,0	28,0	21,0	36,0	64618	67618
0.1929	4,900 mm	6,0	66,0	28,0	21,0	36,0	64619	67619
0.1969	5,000 mm	6,0	66,0	28,0	20,0	36,0	64620	67620
0.2008	5,100 mm	6,0	66,0	28,0	20,0	36,0	64621	67621
0.2031	5,159 mm	6,0	66,0	28,0	20,0	36,0	54607	54707
0.2047	5,200 mm	6,0	66,0	28,0	20,0	36,0	64622	67622
0.2087	5,300 mm	6,0	66,0	28,0	20,0	36,0	64623	67623
0.2126	5,400 mm	6,0	66,0	28,0	20,0	36,0	64624	67624
0.2165	5,500 mm	6,0	66,0	28,0	20,0	36,0	64625	67625
0.2188	5,558 mm	6,0	66,0	28,0	20,0	36,0	54608	54708
0.2205	5,600 mm	6,0	66,0	28,0	20,0	36,0	64626	67626

continued on next page

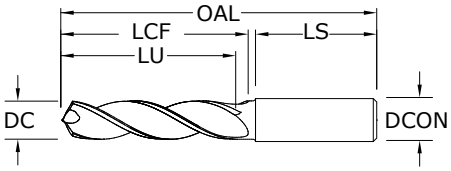
- 3-margin design improves hole stability and size control while providing superior finish, roundness and cylindricity
- Self-stabilizing pyramid point design stabilizes the drill on contact with the workpiece
- Open flute structure efficiently transports chips while maintaining strength at high feed rates
- Sculpted gash allows chips to easily flow away from the drill center
- Recommended for materials ≤ 175 Bhn (≤ 16 HRc)

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

131N 3xD

METRIC SERIES



CONTINUED

- 3-margin design improves hole stability and size control while providing superior finish, roundness and cylindricity
- Self-stabilizing pyramid point design stabilizes the drill on contact with the workpiece
- Open flute structure efficiently transports chips while maintaining strength at high feed rates
- Sculpted gash allows chips to easily flow away from the drill center
- Recommended for materials ≤ 175 Bhn (≤ 16 HRc)

		mm					EDP NO.	
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	UNCOATED	Ti-NAMITE-B (TiB_2)
0.2244	5,700 mm	6,0	66,0	28,0	19,0	36,0	64627	67627
0.2283	5,800 mm	6,0	66,0	28,0	19,0	36,0	64628	67628
0.2323	5,900 mm	6,0	66,0	28,0	19,0	36,0	64629	67629
0.2344	5,954 mm	6,0	66,0	28,0	19,0	36,0	54609	54709
0.2362	6,000 mm	6,0	66,0	28,0	19,0	36,0	64630	67630
0.2402	6,100 mm	8,0	79,0	34,0	25,0	36,0	64631	67631
0.2441	6,200 mm	8,0	79,0	34,0	25,0	36,0	64632	67632
0.2480	6,300 mm	8,0	79,0	34,0	25,0	36,0	64633	67633
0.2500	6,350 mm	8,0	79,0	34,0	24,0	36,0	54610	54710
0.2520	6,400 mm	8,0	79,0	34,0	24,0	36,0	64634	67634
0.2559	6,500 mm	8,0	79,0	34,0	24,0	36,0	64635	67635
0.2570	6,528 mm	8,0	79,0	34,0	24,0	36,0	54611	54711
0.2598	6,600 mm	8,0	79,0	34,0	24,0	36,0	64636	67636
0.2638	6,700 mm	8,0	79,0	34,0	24,0	36,0	64637	67637
0.2656	6,746 mm	8,0	79,0	34,0	24,0	36,0	54612	54712
0.2677	6,800 mm	8,0	79,0	34,0	24,0	36,0	64638	67638
0.2717	6,900 mm	8,0	79,0	34,0	24,0	36,0	64639	67639
0.2756	7,000 mm	8,0	79,0	34,0	24,0	36,0	64640	67640
0.2795	7,100 mm	8,0	79,0	41,0	30,0	36,0	64641	67641
0.2812	7,142 mm	8,0	79,0	41,0	30,0	36,0	54613	54713
0.2835	7,200 mm	8,0	79,0	41,0	30,0	36,0	64642	67642
0.2874	7,300 mm	8,0	79,0	41,0	30,0	36,0	64643	67643
0.2913	7,400 mm	8,0	79,0	41,0	30,0	36,0	64644	67644
0.2953	7,500 mm	8,0	79,0	41,0	30,0	36,0	64645	67645
0.2969	7,541 mm	8,0	79,0	41,0	30,0	36,0	54614	54714
0.2992	7,600 mm	8,0	79,0	41,0	30,0	36,0	64646	67646
0.3031	7,700 mm	8,0	79,0	41,0	29,0	36,0	64647	67647
0.3071	7,800 mm	8,0	79,0	41,0	29,0	36,0	64648	67648
0.3110	7,900 mm	8,0	79,0	41,0	29,0	36,0	64649	67649
0.3125	7,938 mm	8,0	79,0	41,0	29,0	36,0	54615	54715
0.3150	8,000 mm	8,0	79,0	41,0	29,0	36,0	64650	67650
0.3189	8,100 mm	10,0	89,0	47,0	35,0	40,0	64651	67651
0.3228	8,200 mm	10,0	89,0	47,0	35,0	40,0	64652	67652
0.3268	8,300 mm	10,0	89,0	47,0	35,0	40,0	64653	67653
0.3281	8,334 mm	10,0	89,0	47,0	34,0	40,0	54616	54716
0.3307	8,400 mm	10,0	89,0	47,0	34,0	40,0	64654	67654

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

NON-FERROUS

131N 3xD

METRIC SERIES

CONTINUED

		mm					EDP NO.	
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	UNCOATED	Ti-NAMITE-B (TiB_2)
0.3320	8,433 mm	10,0	89,0	47,0	34,0	40,0	54617	54717
0.3346	8,500 mm	10,0	89,0	47,0	34,0	40,0	64655	67655
0.3386	8,600 mm	10,0	89,0	47,0	34,0	40,0	64656	67656
0.3425	8,700 mm	10,0	89,0	47,0	34,0	40,0	64657	67657
0.3438	8,733 mm	10,0	89,0	47,0	34,0	40,0	54618	54718
0.3465	8,800 mm	10,0	89,0	47,0	34,0	40,0	64658	67658
0.3504	8,900 mm	10,0	89,0	47,0	34,0	40,0	64659	67659
0.3543	9,000 mm	10,0	89,0	47,0	34,0	40,0	64660	67660
0.3583	9,100 mm	10,0	89,0	47,0	33,0	40,0	64661	67661
0.3594	9,129 mm	10,0	89,0	47,0	33,0	40,0	54619	54719
0.3622	9,200 mm	10,0	89,0	47,0	33,0	40,0	64662	67662
0.3661	9,300 mm	10,0	89,0	47,0	33,0	40,0	64663	67663
0.3680	9,347 mm	10,0	89,0	47,0	33,0	40,0	54620	54720
0.3701	9,400 mm	10,0	89,0	47,0	33,0	40,0	64664	67664
0.3740	9,500 mm	10,0	89,0	47,0	33,0	40,0	64665	67665
0.3750	9,525 mm	10,0	89,0	47,0	33,0	40,0	54621	54721
0.3780	9,600 mm	10,0	89,0	47,0	33,0	40,0	64666	67666
0.3819	9,700 mm	10,0	89,0	47,0	32,0	40,0	64667	67667
0.3858	9,800 mm	10,0	89,0	47,0	32,0	40,0	64668	67668
0.3898	9,900 mm	10,0	89,0	47,0	32,0	40,0	64669	67669
0.3906	9,921 mm	10,0	89,0	47,0	32,0	40,0	54622	54722
0.3937	10,000 mm	10,0	89,0	47,0	32,0	40,0	64670	67670
0.3976	10,100 mm	12,0	102,0	55,0	40,0	45,0	64671	67671
0.4016	10,200 mm	12,0	102,0	55,0	40,0	45,0	64672	67672
0.4055	10,300 mm	12,0	102,0	55,0	40,0	45,0	64673	67673
0.4062	10,317 mm	12,0	102,0	55,0	40,0	45,0	54623	54723
0.4095	10,400 mm	12,0	102,0	55,0	39,0	45,0	64674	67674
0.4134	10,500 mm	12,0	102,0	55,0	39,0	45,0	64675	67675
0.4173	10,600 mm	12,0	102,0	55,0	39,0	45,0	64676	67676
0.4213	10,700 mm	12,0	102,0	55,0	39,0	45,0	64677	67677
0.4219	10,716 mm	12,0	102,0	55,0	39,0	45,0	54624	54724
0.4252	10,800 mm	12,0	102,0	55,0	39,0	45,0	64678	67678
0.4291	10,900 mm	12,0	102,0	55,0	39,0	45,0	64679	67679
0.4331	11,000 mm	12,0	102,0	55,0	39,0	45,0	64680	67680
0.4370	11,100 mm	12,0	102,0	55,0	38,0	45,0	64681	67681
0.4375	11,113 mm	12,0	102,0	55,0	38,0	45,0	54625	54725
0.4409	11,200 mm	12,0	102,0	55,0	38,0	45,0	64682	67682
0.4449	11,300 mm	12,0	102,0	55,0	38,0	45,0	64683	67683
0.4488	11,400 mm	12,0	102,0	55,0	38,0	45,0	64684	67684
0.4528	11,500 mm	12,0	102,0	55,0	38,0	45,0	64685	67685
0.4567	11,600 mm	12,0	102,0	55,0	38,0	45,0	64686	67686
0.4606	11,700 mm	12,0	102,0	55,0	37,0	45,0	64687	67687
0.4646	11,800 mm	12,0	102,0	55,0	37,0	45,0	64688	67688
0.4685	11,900 mm	12,0	102,0	55,0	37,0	45,0	64689	67689

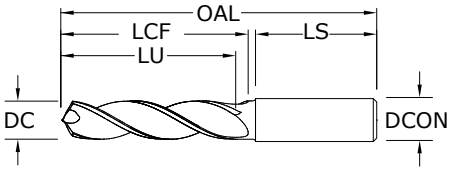
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

131N 3xD

METRIC SERIES



CONTINUED

- 3-margin design improves hole stability and size control while providing superior finish, roundness and cylindricity
- Self-stabilizing pyramid point design stabilizes the drill on contact with the workpiece
- Open flute structure efficiently transports chips while maintaining strength at high feed rates
- Sculpted gash allows chips to easily flow away from the drill center
- Recommended for materials ≤ 175 Bhn (≤ 16 HRc)

		mm					EDP NO.	
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	UNCOATED	Ti-NAMITE-B (TiB_2)
0.4688	11,908 mm	12,0	102,0	55,0	37,0	45,0	54626	54726
0.4724	12,000 mm	12,0	102,0	55,0	37,0	45,0	64690	67690
0.4844	12,304 mm	14,0	107,0	60,0	41,0	45,0	54627	54727
0.4921	12,500 mm	14,0	107,0	60,0	41,0	45,0	64691	67691
0.5000	12,700 mm	14,0	107,0	60,0	41,0	45,0	54628	54728
0.5039	12,800 mm	14,0	107,0	60,0	41,0	45,0	64692	67692
0.5118	13,000 mm	14,0	107,0	60,0	41,0	45,0	64693	67693
0.5156	13,096 mm	14,0	107,0	60,0	40,0	45,0	54629	54729
0.5315	13,500 mm	14,0	107,0	60,0	40,0	45,0	64694	67694
0.5433	13,800 mm	14,0	107,0	60,0	39,0	45,0	64695	67695
0.5512	14,000 mm	14,0	107,0	60,0	39,0	45,0	64696	67696
0.5625	14,288 mm	16,0	115,0	65,0	43,0	48,0	54630	54730
0.5709	14,500 mm	16,0	115,0	65,0	43,0	48,0	64697	67697
0.5781	14,684 mm	16,0	115,0	65,0	43,0	48,0	54631	54731
0.5827	14,800 mm	16,0	115,0	65,0	43,0	48,0	64698	67698
0.5906	15,000 mm	16,0	115,0	65,0	42,0	48,0	64699	67699
0.6102	15,500 mm	16,0	115,0	65,0	42,0	48,0	64700	67700
0.6221	15,800 mm	16,0	115,0	65,0	41,0	48,0	64701	67701
0.6250	15,875 mm	16,0	115,0	65,0	41,0	48,0	54632	54732
0.6299	16,000 mm	16,0	115,0	65,0	41,0	48,0	64702	67702
0.6562	16,667 mm	18,0	123,0	73,0	47,0	48,0	54633	54733
0.6875	17,463 mm	18,0	123,0	73,0	47,0	48,0	54634	54734
0.7500	19,050 mm	20,0	131,0	79,0	50,0	50,0	54635	54735

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

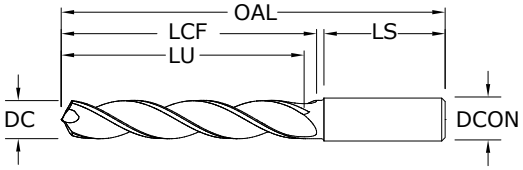
>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

NON-FERROUS

HIGH PERFORMANCE CARBIDE DRILLS



131N 5xD

METRIC SERIES

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

NON-FERROUS

		mm					EDP NO.	
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	UNCOATED	Ti-NAMITE-B (TiB_2)
0.1181	3,000 mm	6,0	66,0	28,0	23,0	36,0	65000	64800
0.1220	3,100 mm	6,0	66,0	28,0	23,0	36,0	65001	64801
0.1250	3,175 mm	6,0	66,0	28,0	23,0	36,0	55000	54800
0.1260	3,200 mm	6,0	66,0	28,0	23,0	36,0	65002	64802
0.1299	3,300 mm	6,0	66,0	28,0	23,0	36,0	65003	64803
0.1339	3,400 mm	6,0	66,0	28,0	23,0	36,0	65004	64804
0.1360	3,454 mm	6,0	66,0	28,0	23,0	36,0	55001	54801
0.1378	3,500 mm	6,0	66,0	28,0	23,0	36,0	65005	64805
0.1406	3,571 mm	6,0	66,0	28,0	23,0	36,0	55002	54802
0.1417	3,600 mm	6,0	66,0	28,0	23,0	36,0	65006	64806
0.1457	3,700 mm	6,0	66,0	28,0	23,0	36,0	65007	64807
0.1496	3,800 mm	6,0	74,0	36,0	29,0	36,0	65008	64808
0.1535	3,900 mm	6,0	74,0	36,0	29,0	36,0	65009	64809
0.1562	3,967 mm	6,0	74,0	36,0	29,0	36,0	55003	54803
0.1575	4,000 mm	6,0	74,0	36,0	29,0	36,0	65010	64810
0.1590	4,039 mm	6,0	74,0	36,0	29,0	36,0	55004	54804
0.1614	4,100 mm	6,0	74,0	36,0	29,0	36,0	65011	64811
0.1654	4,200 mm	6,0	74,0	36,0	29,0	36,0	65012	64812
0.1693	4,300 mm	6,0	74,0	36,0	29,0	36,0	65013	64813
0.1719	4,366 mm	6,0	74,0	36,0	29,0	36,0	55005	54805
0.1732	4,400 mm	6,0	74,0	36,0	29,0	36,0	65014	64814
0.1772	4,500 mm	6,0	74,0	36,0	29,0	36,0	65015	64815
0.1811	4,600 mm	6,0	74,0	36,0	29,0	36,0	65016	64816
0.1850	4,699 mm	6,0	74,0	36,0	29,0	36,0	65017	64817
0.1875	4,763 mm	6,0	82,0	44,0	37,0	36,0	55006	54806
0.1890	4,801 mm	6,0	82,0	44,0	37,0	36,0	65018	64818
0.1929	4,900 mm	6,0	82,0	44,0	37,0	36,0	65019	64819
0.1969	5,000 mm	6,0	82,0	44,0	36,0	36,0	65020	64820
0.2008	5,100 mm	6,0	82,0	44,0	36,0	36,0	65021	64821
0.2031	5,159 mm	6,0	82,0	44,0	36,0	36,0	55007	54807
0.2047	5,200 mm	6,0	82,0	44,0	36,0	36,0	65022	64822
0.2087	5,300 mm	6,0	82,0	44,0	36,0	36,0	65023	64823
0.2126	5,400 mm	6,0	82,0	44,0	36,0	36,0	65024	64824
0.2165	5,500 mm	6,0	82,0	44,0	36,0	36,0	65025	64825
0.2188	5,558 mm	6,0	82,0	44,0	36,0	36,0	55008	54808
0.2205	5,600 mm	6,0	82,0	44,0	36,0	36,0	65026	64826

continued on next page

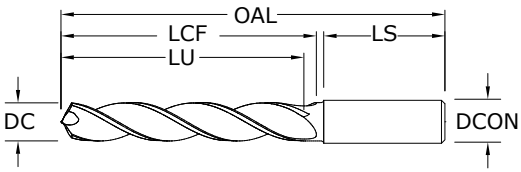
- 3-margin design improves hole stability and size control while providing superior finish, roundness and cylindricity
- Self-stabilizing pyramid point design stabilizes the drill on contact with the workpiece
- Open flute structure efficiently transports chips while maintaining strength at high feed rates
- Sculpted gash allows chips to easily flow away from the drill center
- Recommended for materials ≤ 175 Bhn (≤ 16 HRc)

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

131N 5xD

METRIC SERIES



CONTINUED

- 3-margin design improves hole stability and size control while providing superior finish, roundness and cylindricity
- Self-stabilizing pyramid point design stabilizes the drill on contact with the workpiece
- Open flute structure efficiently transports chips while maintaining strength at high feed rates
- Sculpted gash allows chips to easily flow away from the drill center
- Recommended for materials ≤ 175 Bhn (≤ 16 HRc)

		mm					EDP NO.	
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	UNCOATED	Ti-NAMITE-B (TiB_2)
0.2244	5,700 mm	6,0	82,0	44,0	35,0	36,0	65027	64827
0.2283	5,800 mm	6,0	82,0	44,0	35,0	36,0	65028	64828
0.2323	5,900 mm	6,0	82,0	44,0	35,0	36,0	65029	64829
0.2344	5,954 mm	6,0	82,0	44,0	35,0	36,0	55009	54809
0.2362	6,000 mm	6,0	82,0	44,0	35,0	36,0	65030	64830
0.2402	6,100 mm	8,0	91,0	53,0	44,0	36,0	65031	64831
0.2441	6,200 mm	8,0	91,0	53,0	44,0	36,0	65032	64832
0.2480	6,300 mm	8,0	91,0	53,0	44,0	36,0	65033	64833
0.2500	6,350 mm	8,0	91,0	53,0	43,0	36,0	55010	54810
0.2520	6,400 mm	8,0	91,0	53,0	43,0	36,0	65034	64834
0.2559	6,500 mm	8,0	91,0	53,0	43,0	36,0	65035	64835
0.2570	6,528 mm	8,0	91,0	53,0	43,0	36,0	55011	54811
0.2598	6,600 mm	8,0	91,0	53,0	43,0	36,0	65036	64836
0.2638	6,700 mm	8,0	91,0	53,0	43,0	36,0	65037	64837
0.2656	6,746 mm	8,0	91,0	53,0	43,0	36,0	55012	54812
0.2677	6,800 mm	8,0	91,0	53,0	43,0	36,0	65038	64838
0.2717	6,900 mm	8,0	91,0	53,0	43,0	36,0	65039	64839
0.2756	7,000 mm	8,0	91,0	53,0	42,0	36,0	65040	64840
0.2795	7,100 mm	8,0	91,0	53,0	42,0	36,0	65041	64841
0.2812	7,142 mm	8,0	91,0	53,0	42,0	36,0	55013	54813
0.2835	7,200 mm	8,0	91,0	53,0	42,0	36,0	65042	64842
0.2874	7,300 mm	8,0	91,0	53,0	42,0	36,0	65043	64843
0.2913	7,400 mm	8,0	91,0	53,0	42,0	36,0	65044	64844
0.2953	7,500 mm	8,0	91,0	53,0	42,0	36,0	65045	64845
0.2969	7,541 mm	8,0	91,0	53,0	42,0	36,0	55014	54814
0.2992	7,600 mm	8,0	91,0	53,0	42,0	36,0	65046	64846
0.3031	7,700 mm	8,0	91,0	53,0	41,0	36,0	65047	64847
0.3071	7,800 mm	8,0	91,0	53,0	41,0	36,0	65048	64848
0.3110	7,900 mm	8,0	91,0	53,0	41,0	36,0	65049	64849
0.3125	7,938 mm	8,0	91,0	53,0	41,0	36,0	55015	54815
0.3150	8,000 mm	8,0	91,0	53,0	41,0	36,0	65050	64850
0.3189	8,100 mm	10,0	103,0	61,0	49,0	40,0	65051	64851
0.3228	8,200 mm	10,0	103,0	61,0	49,0	40,0	65052	64852
0.3268	8,300 mm	10,0	103,0	61,0	49,0	40,0	65053	64853
0.3281	8,334 mm	10,0	103,0	61,0	48,0	40,0	55016	54816
0.3307	8,400 mm	10,0	103,0	61,0	48,0	40,0	65054	64854

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

NON-FERROUS

131N 5xD
METRIC SERIES

CONTINUED

		mm					EDP NO.	
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	UNCOATED	Ti-NAMITE-B (TiB_2)
0.3320	8,433 mm	10,0	103,0	61,0	48,0	40,0	55017	54817
0.3346	8,500 mm	10,0	103,0	61,0	48,0	40,0	65055	64855
0.3386	8,600 mm	10,0	103,0	61,0	48,0	40,0	65056	64856
0.3425	8,700 mm	10,0	103,0	61,0	48,0	40,0	65057	64857
0.3438	8,733 mm	10,0	103,0	61,0	48,0	40,0	55018	54818
0.3465	8,800 mm	10,0	103,0	61,0	48,0	40,0	65058	64858
0.3504	8,900 mm	10,0	103,0	61,0	48,0	40,0	65059	64859
0.3543	9,000 mm	10,0	103,0	61,0	48,0	40,0	65060	64860
0.3583	9,100 mm	10,0	103,0	61,0	47,0	40,0	65061	64861
0.3594	9,129 mm	10,0	103,0	61,0	47,0	40,0	55019	54819
0.3622	9,200 mm	10,0	103,0	61,0	47,0	40,0	65062	64862
0.3661	9,300 mm	10,0	103,0	61,0	47,0	40,0	65063	64863
0.3680	9,347 mm	10,0	103,0	61,0	47,0	40,0	55020	54820
0.3701	9,400 mm	10,0	103,0	61,0	47,0	40,0	65064	64864
0.3740	9,500 mm	10,0	103,0	61,0	47,0	40,0	65065	64865
0.3750	9,525 mm	10,0	103,0	61,0	47,0	40,0	55021	54821
0.3780	9,600 mm	10,0	103,0	61,0	47,0	40,0	65066	64866
0.3819	9,700 mm	10,0	103,0	61,0	46,0	40,0	65067	64867
0.3858	9,800 mm	10,0	103,0	61,0	46,0	40,0	65068	64868
0.3898	9,900 mm	10,0	103,0	61,0	46,0	40,0	65069	64869
0.3906	9,921 mm	10,0	103,0	61,0	46,0	40,0	55022	54822
0.3937	10,000 mm	10,0	103,0	61,0	46,0	40,0	65070	64870
0.3976	10,100 mm	12,0	118,0	71,0	56,0	45,0	65071	64871
0.4016	10,200 mm	12,0	118,0	71,0	56,0	45,0	65072	64872
0.4055	10,300 mm	12,0	118,0	71,0	56,0	45,0	65073	64873
0.4062	10,317 mm	12,0	118,0	71,0	56,0	45,0	55023	54823
0.4095	10,400 mm	12,0	118,0	71,0	55,0	45,0	65074	64874
0.4134	10,500 mm	12,0	118,0	71,0	55,0	45,0	65075	64875
0.4173	10,600 mm	12,0	118,0	71,0	55,0	45,0	65076	64876
0.4213	10,700 mm	12,0	118,0	71,0	55,0	45,0	65077	64877
0.4219	10,716 mm	12,0	118,0	71,0	55,0	45,0	55024	54824
0.4252	10,800 mm	12,0	118,0	71,0	55,0	45,0	65078	64878
0.4291	10,900 mm	12,0	118,0	71,0	55,0	45,0	65079	64879
0.4331	11,000 mm	12,0	118,0	71,0	54,0	45,0	65080	64880
0.4370	11,100 mm	12,0	118,0	71,0	54,0	45,0	65081	64881
0.4375	11,113 mm	12,0	118,0	71,0	54,0	45,0	55025	54825
0.4409	11,200 mm	12,0	118,0	71,0	54,0	45,0	65082	64882
0.4449	11,300 mm	12,0	118,0	71,0	54,0	45,0	65083	64883
0.4488	11,400 mm	12,0	118,0	71,0	54,0	45,0	65084	64884
0.4528	11,500 mm	12,0	118,0	71,0	54,0	45,0	65085	64885
0.4567	11,600 mm	12,0	118,0	71,0	54,0	45,0	65086	64886
0.4606	11,700 mm	12,0	118,0	71,0	53,0	45,0	65087	64887
0.4646	11,800 mm	12,0	118,0	71,0	53,0	45,0	65088	64888
0.4685	11,900 mm	12,0	118,0	71,0	53,0	45,0	65089	64889
0.4688	11,908 mm	12,0	118,0	71,0	53,0	45,0	55026	54826
0.4724	12,000 mm	12,0	118,0	71,0	53,0	45,0	65090	64890

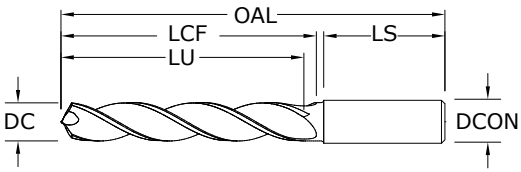
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

131N 5xD

METRIC SERIES



CONTINUED

- 3-margin design improves hole stability and size control while providing superior finish, roundness and cylindricity
- Self-stabilizing pyramid point design stabilizes the drill on contact with the workpiece
- Open flute structure efficiently transports chips while maintaining strength at high feed rates
- Sculpted gash allows chips to easily flow away from the drill center
- Recommended for materials ≤ 175 Bhn (≤ 16 HRc)

		mm					EDP NO.	
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	UNCOATED	Ti-NAMITE-B (TiB_2)
0.4844	12,304 mm	14,0	124,0	77,0	58,0	45,0	55027	54827
0.4921	12,500 mm	14,0	124,0	77,0	58,0	45,0	65091	64891
0.5000	12,700 mm	14,0	124,0	77,0	58,0	45,0	55028	54828
0.5039	12,800 mm	14,0	124,0	77,0	58,0	45,0	65092	64892
0.5118	13,000 mm	14,0	124,0	77,0	58,0	45,0	65093	64893
0.5156	13,096 mm	14,0	124,0	77,0	57,0	45,0	55029	54829
0.5315	13,500 mm	14,0	124,0	77,0	57,0	45,0	65094	64894
0.5433	13,800 mm	14,0	124,0	77,0	56,0	45,0	65095	64895
0.5512	14,000 mm	14,0	124,0	77,0	56,0	45,0	65096	64896
0.5625	14,288 mm	16,0	133,0	83,0	61,0	48,0	55030	54830
0.5709	14,500 mm	16,0	133,0	83,0	61,0	48,0	65097	64897
0.5781	14,684 mm	16,0	133,0	83,0	61,0	48,0	55031	54831
0.5827	14,800 mm	16,0	133,0	83,0	61,0	48,0	65098	64898
0.5906	15,000 mm	16,0	133,0	83,0	60,0	48,0	65099	64899
0.6102	15,500 mm	16,0	133,0	83,0	60,0	48,0	65100	64900
0.6221	15,800 mm	16,0	133,0	83,0	59,0	48,0	65101	64901
0.6250	15,875 mm	16,0	133,0	83,0	59,0	48,0	55032	54832
0.6299	16,000 mm	16,0	133,0	83,0	59,0	48,0	65102	64902
0.6562	16,667 mm	18,0	143,0	93,0	68,0	48,0	55033	54833
0.6875	17,463 mm	18,0	143,0	93,0	67,0	48,0	55034	54834
0.7500	19,050 mm	20,0	153,0	101,0	72,0	50,0	55035	54835

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

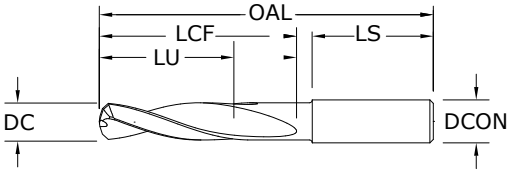
NON-FERROUS

Hi-PerCarb

	Series 131N 3D & 5D Metric	Hardness	Vc (m/min)		DC • mm 3	6	8	10	12	14	16
N	**ALUMINUM ALLOYS < 12% SI 6061, 2024, 7075**	≤ 150 Bhn or ≤ 88 HRb	244	RPM	25851	12926	9694	7755	6463	5540	4847
			(195-293)	Fr	0.133	0.265	0.354	0.442	0.531	0.619	0.708
				Feed (mm/min)	3430	3430	3430	3430	3430	3430	3430
	ALUMINUM ALLOYS > 12% SI A356.0, 390.0, 319.0	≤ 125 Bhn or ≤ 77 HRb	183	RPM	19388	9694	7271	5816	4847	4155	3635
			(146-219)	Fr	0.131	0.262	0.349	0.437	0.524	0.611	0.699
				Feed (mm/min)	2540	2540	2540	2540	2540	2540	2540
	COPPER ALLOYS Alum Bronze, Muntz Brass, Navel Brass	≤ 175 Bhn or ≤ 16 HRc	168	RPM	17773	8886	6665	5332	4443	3808	3332
			(134-201)	Fr	0.049	0.097	0.130	0.162	0.194	0.227	0.259
				Feed (mm/min)	864	864	864	864	864	864	864
	PLASTICS Acrylic, PVC, Polypropylene		137	RPM	14541	7271	5453	4362	3635	3116	2726
			(110-165)	Fr	0.059	0.119	0.158	0.198	0.238	0.277	0.317
				Feed (mm/min)	864	864	864	864	864	864	864

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Series 120



120
METRIC SERIES

- Double margin design stabilizes the drill for greater hole accuracy and improved surface finish
- Notched point reduces thrust force over conventional designs
- 8 facet point reduces fiber breakout and delamination on exit
- 90 degree secondary chamfer angle improves hole entrance and exit quality

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Di-NAMITE (Diamond)
0.0980	2,489 mm	1/8	2	9/16	7/16	1-1/4	50000
0.1063	2,700 mm	6,0	63,0	20,0	16,0	32,0	50001
0.1181	3,000 mm	6,0	63,0	20,0	16,0	36,0	50002
0.1250	3,175 mm	1/4	2-1/2	3/4	9/16	1-7/16	50003
0.1260	3,200 mm	6,0	63,0	20,0	15,0	36,0	50004
0.1285	3,264 mm	1/4	2-1/2	3/4	9/16	1-7/16	50005
0.1405	3,569 mm	1/4	2-1/2	3/4	9/16	1-7/16	50006
0.1570	3,988 mm	1/4	2-5/8	7/8	5/8	1-7/16	50007
0.1590	4,039 mm	1/4	2-5/8	7/8	5/8	1-7/16	50008
0.1614	4,100 mm	6,0	66,0	24,0	18,0	36,0	50009
0.1660	4,216 mm	1/4	2-5/8	7/8	5/8	1-7/16	50010
0.1719	4,366 mm	1/4	2-5/8	7/8	5/8	1-7/16	50011
0.1875	4,763 mm	1/4	2-5/8	1	23/32	1-7/16	50012
0.1910	4,851 mm	1/4	2-5/8	1	23/32	1-7/16	50013
0.1990	5,055 mm	1/4	2-5/8	1	23/32	1-7/16	50014
0.2010	5,105 mm	1/4	2-5/8	1	23/32	1-7/16	50015
0.2210	5,613 mm	1/4	2-5/8	1	21/32	1-7/16	50016
0.2362	6,000 mm	6,0	66,0	28,0	19,0	36,0	50017
0.2500	6,350 mm	1/4	3-1/8	1-5/16	15/16	1-7/16	50018
0.2510	6,380 mm	5/16	3-1/8	1-5/16	15/16	1-7/16	50019
0.2570	6,528 mm	5/16	3-1/8	1-5/16	15/16	1-7/16	50020
0.2720	6,909 mm	5/16	3-1/8	1-5/16	29/32	1-7/16	50021
0.2770	7,036 mm	5/16	3-1/8	1-5/16	29/32	1-7/16	50022
0.2810	7,137 mm	5/16	3-1/8	1-9/16	1-9/64	1-7/16	50023
0.3125	7,938 mm	5/16	3-1/8	1-9/16	1-3/32	1-7/16	50024
0.3150	8,000 mm	8,0	79,0	41,0	29,0	36,0	50025
0.3750	9,525 mm	3/8	3-1/2	1-27/32	1-9/32	1-9/16	50026
0.3770	9,576 mm	1/2	3-1/2	1-27/32	1-9/32	1-9/16	50027
0.3937	10,000 mm	10,0	89,0	47,0	32,0	40,0	50028
0.4375	11,113 mm	1/2	4-1/16	2-3/16	1-17/32	1-9/16	50029
0.4724	12,000 mm	12,0	102,0	55,0	37,0	45,0	50030
0.5000	12,700 mm	1/2	4-1/4	2-5/16	1-9/16	1-3/4	50031

TOLERANCES (mm)

DC = +0,000/+0,013
DCON = h_6

NON-FERROUS

Series 120

	Series 120 Metric	Vc (m/min)		DC • mm						
				2.5	3	4	6	8	10	12
N	CFRP, AFRP (Carbon Fiber, Aramid Fiber)	100	RPM	12722	10602	7951	5301	3976	3181	2650
		(80-120)	Fr	0.012	0.014	0.019	0.028	0.038	0.047	0.057
			Feed (mm/min)	150	150	150	150	150	150	150
	GFRP (Fiberglass)	75	RPM	9542	7951	5963	3976	2982	2385	1988
		(65-90)	Fr	0.012	0.014	0.019	0.029	0.039	0.048	0.058
			Feed (mm/min)	115	115	115	115	115	115	115
	CARBON, GRAPHITE	120	RPM	15266	12722	9542	6361	4771	3817	3181
		(96-144)	Fr	0.015	0.018	0.025	0.037	0.049	0.062	0.074
			Feed (mm/min)	235	235	235	235	235	235	235

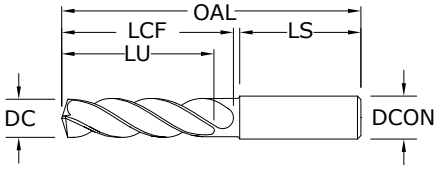
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
adjust speed and / or feed based on resin type and / or fiber structure
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Hi-PerCarb

HI-PER CARB
HIGH PERFORMANCE CARBIDE DRILLS

135 3xD

METRIC SERIES



- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 50 HRc (≤ 475 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.0156	0,396 mm	1/8	1-1/2	1/8	7/64	1	51752*
0.0312	0,792 mm	1/8	1-1/2	1/4	13/64	1	51269*
0.0469	1,191 mm	1/8	1-1/2	3/8	5/16	1	51270*
0.0492	1,250 mm	3,0	38,0	9,5	8,0	25,0	64500*
0.0571	1,450 mm	3,0	38,0	9,5	7,0	25,0	64501*
0.0595	1,511 mm	1/8	1-1/2	3/8	9/32	1	64502*
0.0625	1,588 mm	1/8	2	7/16	11/32	1-1/4	51271*
0.0630	1,600 mm	3,0	50,0	11,0	9,0	32,0	64503*
0.0689	1,750 mm	3,0	50,0	11,0	8,0	32,0	64504*
0.0700	1,778 mm	1/8	2	7/16	21/64	1-1/4	64505*
0.0781	1,984 mm	1/8	2	1/2	25/64	1-1/4	51272*
0.0785	1,994 mm	1/8	2	1/2	25/64	1-1/4	64506*
0.0807	2,050 mm	3,0	50,0	12,0	9,0	32,0	64507*
0.0810	2,057 mm	1/8	2	1/2	3/8	1-1/4	64508*
0.0890	2,261 mm	1/8	2	1/2	3/8	1-1/4	64509*
0.0935	2,375 mm	1/8	2	1/2	23/64	1-1/4	64510*
0.0938	2,383 mm	1/8	2	1/2	23/64	1-1/4	51273
0.0980	2,489 mm	1/8	2	9/16	27/64	1-1/4	51274
0.0984	2,500 mm	3,0	50,0	14,0	10,0	32,0	64511
0.0995	2,527 mm	1/8	2	9/16	27/64	1-1/4	51753
0.1015	2,578 mm	1/8	2	9/16	27/64	1-1/4	51754
0.1040	2,642 mm	1/8	2	9/16	13/32	1-1/4	51755
0.1065	2,705 mm	1/8	2	9/16	13/32	1-1/4	51756
0.1094	2,779 mm	1/8	2	5/8	15/32	1-1/4	51275
0.1100	2,794 mm	1/8	2	5/8	15/32	1-1/4	51276
0.1110	2,819 mm	1/8	2	5/8	15/32	1-1/4	51277
0.1130	2,870 mm	1/8	2	5/8	29/64	1-1/4	51757
0.1142	2,900 mm	3,0	50,0	16,0	12,0	32,0	64512
0.1160	2,946 mm	1/8	2	5/8	29/64	1-1/4	51758
0.1181	3,000 mm	6,0	62,0	20,0	16,0	36,0	63155
0.1200	3,048 mm	1/8	2	5/8	29/64	1-1/4	51759
0.1220	3,100 mm	6,0	62,0	20,0	15,0	36,0	63741
0.1250	3,175 mm	1/4	2-1/2	3/4	9/16	1-7/16	51330
0.1260	3,200 mm	6,0	62,0	20,0	15,0	36,0	63156
0.1285	3,264 mm	1/4	2-1/2	3/4	9/16	1-7/16	51278
0.1299	3,300 mm	6,0	62,0	20,0	15,0	36,0	63157

*Single Margin

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

135 3xD
METRIC SERIES

CONTINUED

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.1339	3,400 mm	6,0	62,0	20,0	15,0	36,0	63158
0.1360	3,454 mm	1/4	2-1/2	3/4	9/16	1-7/16	51331
0.1378	3,500 mm	6,0	62,0	20,0	15,0	36,0	63159
0.1405	3,569 mm	1/4	2-1/2	3/4	35/64	1-7/16	51760
0.1406	3,571 mm	1/4	2-1/2	3/4	9/16	1-7/16	51332
0.1417	3,600 mm	6,0	62,0	20,0	15,0	36,0	63160
0.1440	3,658 mm	1/4	2-1/2	3/4	35/64	1-7/16	51761
0.1457	3,700 mm	6,0	62,0	20,0	14,0	36,0	63161
0.1470	3,734 mm	1/4	2-1/2	3/4	17/32	1-7/16	51762
0.1495	3,797 mm	1/4	2-5/8	7/8	21/32	1-7/16	51333
0.1496	3,800 mm	6,0	66,0	24,0	18,0	36,0	63742
0.1520	3,861 mm	1/4	2-5/8	7/8	21/32	1-7/16	51763
0.1535	3,900 mm	6,0	66,0	24,0	18,0	36,0	63743
0.1540	3,912 mm	1/4	2-5/8	7/8	21/32	1-7/16	51764
0.1562	3,967 mm	1/4	2-5/8	7/8	41/64	1-7/16	51334
0.1570	3,988 mm	1/4	2-5/8	7/8	41/64	1-7/16	51765
0.1575	4,000 mm	6,0	66,0	24,0	18,0	36,0	63162
0.1590	4,039 mm	1/4	2-5/8	7/8	41/64	1-7/16	51335
0.1610	4,089 mm	1/4	2-5/8	7/8	5/8	1-7/16	51279
0.1614	4,100 mm	6,0	66,0	24,0	18,0	36,0	63744
0.1654	4,200 mm	6,0	66,0	24,0	18,0	36,0	63163
0.1660	4,216 mm	1/4	2-5/8	7/8	5/8	1-7/16	51766
0.1693	4,300 mm	6,0	66,0	24,0	18,0	36,0	63164
0.1695	4,305 mm	1/4	2-5/8	7/8	5/8	1-7/16	51767
0.1719	4,366 mm	1/4	2-5/8	7/8	39/64	1-7/16	51336
0.1730	4,394 mm	1/4	2-5/8	7/8	5/8	1-7/16	51768
0.1732	4,400 mm	6,0	66,0	24,0	17,0	36,0	63745
0.1770	4,496 mm	1/4	2-5/8	7/8	39/64	1-7/16	51769
0.1772	4,500 mm	6,0	66,0	24,0	17,0	36,0	63165
0.1800	4,572 mm	1/4	2-5/8	7/8	39/64	1-7/16	51770
0.1811	4,600 mm	6,0	66,0	24,0	17,0	36,0	63166
0.1820	4,623 mm	1/4	2-5/8	7/8	39/64	1-7/16	51771
0.1850	4,700 mm	1/4	2-5/8	7/8	39/64	1-7/16	51772
0.1850	4,700 mm	6,0	66,0	24,0	17,0	36,0	63746
0.1875	4,763 mm	1/4	2-5/8	1	23/32	1-7/16	51337
0.1890	4,800 mm	1/4	2-5/8	1	23/32	1-7/16	51773
0.1890	4,800 mm	6,0	66,0	28,0	21,0	36,0	63167
0.1910	4,851 mm	1/4	2-5/8	1	23/32	1-7/16	51774
0.1929	4,900 mm	6,0	66,0	28,0	21,0	36,0	63747
0.1935	4,915 mm	1/4	2-5/8	1	23/32	1-7/16	51775
0.1960	4,978 mm	1/4	2-5/8	1	23/32	1-7/16	51776
0.1969	5,000 mm	6,0	66,0	28,0	20,0	36,0	63168
0.1990	5,055 mm	1/4	2-5/8	1	45/64	1-7/16	51777
0.2008	5,100 mm	6,0	66,0	28,0	20,0	36,0	63748
0.2010	5,105 mm	1/4	2-5/8	1	45/64	1-7/16	51338
0.2031	5,159 mm	1/4	2-5/8	1	45/64	1-7/16	51339

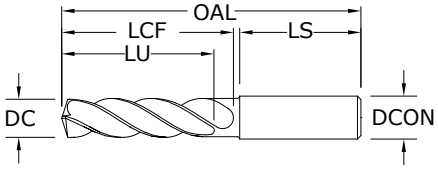
continued on next page

Hi-PerCarb

HI-PER CARB
HIGH PERFORMANCE CARBIDE DRILLS

135 3xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 50 HRc (≤ 475 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.2040	5,182 mm	1/4	2-5/8	1	45/64	1-7/16	51778
0.2047	5,200 mm	6,0	66,0	28,0	20,0	36,0	63749
0.2055	5,220 mm	1/4	2-5/8	1	45/64	1-7/16	51779
0.2067	5,250 mm	6,0	66,0	28,0	20,0	36,0	63169
0.2087	5,300 mm	6,0	66,0	28,0	20,0	36,0	63170
0.2090	5,309 mm	1/4	2-5/8	1	11/16	1-7/16	51780
0.2126	5,400 mm	6,0	66,0	28,0	20,0	36,0	63750
0.2130	5,410 mm	1/4	2-5/8	1	11/16	1-7/16	51340
0.2165	5,500 mm	6,0	66,0	28,0	20,0	36,0	63171
0.2188	5,558 mm	1/4	2-5/8	1	43/64	1-7/16	51341
0.2205	5,600 mm	6,0	66,0	28,0	20,0	36,0	63751
0.2210	5,613 mm	1/4	2-5/8	1	11/16	1-7/16	51781
0.2244	5,700 mm	6,0	66,0	28,0	19,0	36,0	63752
0.2280	5,791 mm	1/4	2-5/8	1	21/32	1-7/16	51782
0.2283	5,800 mm	6,0	66,0	28,0	19,0	36,0	63172
0.2323	5,900 mm	6,0	66,0	28,0	19,0	36,0	63753
0.2340	5,944 mm	1/4	2-5/8	1	21/32	1-7/16	51601
0.2344	5,954 mm	1/4	2-5/8	1	21/32	1-7/16	51342
0.2362	6,000 mm	6,0	66,0	28,0	19,0	36,0	63173
0.2380	6,045 mm	1/4	3-1/8	1-5/16	31/32	1-7/16	51602
0.2402	6,100 mm	8,0	79,0	34,0	25,0	36,0	63754
0.2420	6,147 mm	1/4	3-1/8	1-5/16	61/64	1-7/16	51603
0.2441	6,200 mm	8,0	79,0	34,0	25,0	36,0	63755
0.2460	6,248 mm	1/4	3-1/8	1-5/16	61/64	1-7/16	51604
0.2461	6,250 mm	8,0	79,0	34,0	25,0	36,0	63174
0.2480	6,300 mm	8,0	79,0	34,0	25,0	36,0	63756
0.2500	6,350 mm	1/4	3-1/8	1-5/16	15/16	1-7/16	51343
0.2520	6,400 mm	8,0	79,0	34,0	24,0	36,0	63175
0.2559	6,500 mm	8,0	79,0	34,0	24,0	36,0	63213
0.2570	6,528 mm	5/16	3-1/8	1-5/16	59/64	1-7/16	51344
0.2598	6,600 mm	8,0	79,0	34,0	24,0	36,0	63757
0.2610	6,629 mm	5/16	3-1/8	1-5/16	59/64	1-7/16	51606
0.2638	6,700 mm	8,0	79,0	34,0	24,0	36,0	63758
0.2656	6,746 mm	5/16	3-1/8	1-5/16	59/64	1-7/16	51345
0.2660	6,756 mm	5/16	3-1/8	1-5/16	59/64	1-7/16	51607
0.2677	6,800 mm	8,0	79,0	34,0	24,0	36,0	63176
0.2717	6,900 mm	8,0	79,0	34,0	24,0	36,0	63759
0.2720	6,909 mm	5/16	3-1/8	1-5/16	29/32	1-7/16	51346

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

135 3xD
METRIC SERIES

CONTINUED

DECIMAL DC	METRIC DC	SHANK DIAMETER DCON (mm)	OVERALL LENGTH OAL (mm)	FLUTE LENGTH LCF (mm)	USABLE LENGTH LU (mm)	SHANK LENGTH LS (mm)	EDP NO. Ti-NAMITE-A (AlTiN)
0.2756	7,000 mm	8,0	79,0	34,0	24,0	36,0	63177
0.2770	7,036 mm	5/16	3-1/8	1-5/16	29/32	1-7/16	51608
0.2795	7,100 mm	8,0	79,0	41,0	30,0	36,0	63760
0.2810	7,137 mm	5/16	3-1/8	1-9/16	1-9/64	1-7/16	51609
0.2812	7,142 mm	5/16	3-1/8	1-9/16	1-9/64	1-7/16	51347
0.2835	7,200 mm	8,0	79,0	41,0	30,0	36,0	63761
0.2854	7,250 mm	8,0	79,0	41,0	30,0	36,0	63178
0.2874	7,300 mm	8,0	79,0	41,0	30,0	36,0	63762
0.2900	7,366 mm	5/16	3-1/8	1-9/16	1-1/8	1-7/16	51610
0.2913	7,400 mm	8,0	79,0	41,0	30,0	36,0	63763
0.2950	7,493 mm	5/16	3-1/8	1-9/16	1-1/8	1-7/16	51611
0.2953	7,500 mm	8,0	79,0	41,0	30,0	36,0	63179
0.2969	7,541 mm	5/16	3-1/8	1-9/16	1-7/64	1-7/16	51348
0.2992	7,600 mm	8,0	79,0	41,0	30,0	36,0	63764
0.3020	7,671 mm	5/16	3-1/8	1-9/16	1-7/64	1-7/16	51612
0.3031	7,700 mm	8,0	79,0	41,0	29,0	36,0	63765
0.3071	7,800 mm	8,0	79,0	41,0	29,0	36,0	63180
0.3110	7,900 mm	8,0	79,0	41,0	29,0	36,0	63766
0.3125	7,938 mm	5/16	3-1/8	1-9/16	1-3/32	1-7/16	51349
0.3150	8,000 mm	8,0	79,0	41,0	29,0	36,0	63181
0.3160	8,026 mm	3/8	3-1/2	1-27/32	1-3/8	1-9/16	51613
0.3189	8,100 mm	10,0	89,0	47,0	35,0	40,0	63767
0.3228	8,200 mm	10,0	89,0	47,0	35,0	40,0	63768
0.3230	8,204 mm	3/8	3-1/2	1-27/32	1-23/64	1-9/16	51614
0.3268	8,300 mm	10,0	89,0	47,0	35,0	40,0	63769
0.3281	8,334 mm	3/8	3-1/2	1-27/32	1-23/64	1-9/16	51350
0.3307	8,400 mm	10,0	89,0	47,0	34,0	40,0	63182
0.3320	8,433 mm	3/8	3-1/2	1-27/32	1-11/32	1-9/16	51351
0.3346	8,500 mm	10,0	89,0	47,0	34,0	40,0	63183
0.3386	8,600 mm	10,0	89,0	47,0	34,0	40,0	63770
0.3390	8,611 mm	3/8	3-1/2	1-27/32	1-11/32	1-9/16	51615
0.3425	8,700 mm	10,0	89,0	47,0	34,0	40,0	63771
0.3438	8,733 mm	3/8	3-1/2	1-27/32	1-21/64	1-9/16	51352
0.3465	8,800 mm	10,0	89,0	47,0	34,0	40,0	63184
0.3480	8,839 mm	3/8	3-1/2	1-27/32	1-21/64	1-9/16	51616
0.3504	8,900 mm	10,0	89,0	47,0	34,0	40,0	63772
0.3543	9,000 mm	10,0	89,0	47,0	34,0	40,0	63185
0.3580	9,093 mm	3/8	3-1/2	1-27/32	1-5/16	1-9/16	51617
0.3583	9,100 mm	10,0	89,0	47,0	33,0	40,0	63773
0.3594	9,129 mm	3/8	3-1/2	1-27/32	1-21/64	1-9/16	51353
0.3622	9,200 mm	10,0	89,0	47,0	33,0	40,0	63774
0.3642	9,250 mm	10,0	89,0	47,0	33,0	40,0	63186
0.3661	9,300 mm	10,0	89,0	47,0	33,0	40,0	63775
0.3680	9,347 mm	3/8	3-1/2	1-27/32	1-19/64	1-9/16	51354
0.3701	9,400 mm	10,0	89,0	47,0	33,0	40,0	63776
0.3740	9,500 mm	10,0	89,0	47,0	33,0	40,0	63187

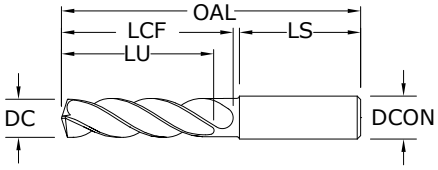
continued on next page

Hi-PerCarb

HI-PER CARB
HIGH PERFORMANCE CARBIDE DRILLS

135 3xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 50 HRc (≤ 475 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.3750	9,525 mm	3/8	3-1/2	1-27/32	1-9/32	1-9/16	51355
0.3770	9,576 mm	1/2	3-1/2	1-27/32	1-9/32	1-9/16	51618
0.3780	9,600 mm	10,0	89,0	47,0	33,0	40,0	63777
0.3819	9,700 mm	10,0	89,0	47,0	32,0	40,0	63778
0.3858	9,800 mm	10,0	89,0	47,0	32,0	40,0	63779
0.3860	9,804 mm	1/2	3-1/2	1-27/32	1-17/64	1-9/16	51619
0.3898	9,900 mm	10,0	89,0	47,0	40,0	40,0	63780
0.3906	9,921 mm	1/2	3-1/2	1-27/32	1-37/64	1-9/16	51356
0.3937	10,000 mm	10,0	89,0	47,0	40,0	40,0	63188
0.3970	10,083 mm	1/2	4-1/16	2-3/16	1-51/64	1-49/64	51620
0.3976	10,100 mm	12,0	102,0	55,0	45,0	45,0	63781
0.4016	10,200 mm	12,0	102,0	55,0	45,0	45,0	63189
0.4040	10,261 mm	1/2	4-1/16	2-3/16	1-51/64	1-49/64	51621
0.4055	10,300 mm	12,0	102,0	55,0	45,0	45,0	63782
0.4062	10,317 mm	1/2	4-1/16	2-3/16	1-51/64	1-49/64	51357
0.4095	10,400 mm	12,0	102,0	55,0	45,0	45,0	63783
0.4130	10,490 mm	1/2	4-1/16	2-3/16	1-51/64	1-49/64	51622
0.4134	10,500 mm	12,0	102,0	55,0	40,0	45,0	63190
0.4173	10,600 mm	12,0	102,0	55,0	40,0	45,0	63784
0.4213	10,700 mm	12,0	102,0	55,0	40,0	45,0	63785
0.4219	10,716 mm	1/2	4-1/16	2-3/16	1-19/32	1-49/64	51358
0.4252	10,800 mm	12,0	102,0	55,0	40,0	45,0	63191
0.4291	10,900 mm	12,0	102,0	55,0	40,0	45,0	63786
0.4331	11,000 mm	12,0	102,0	55,0	39,0	45,0	63192
0.4370	11,100 mm	12,0	102,0	55,0	39,0	45,0	63787
0.4375	11,113 mm	1/2	4-1/16	2-3/16	1-37/64	1-49/64	51359
0.4409	11,200 mm	12,0	102,0	55,0	39,0	45,0	63788
0.4429	11,250 mm	12,0	102,0	55,0	39,0	45,0	63193
0.4449	11,300 mm	12,0	102,0	55,0	39,0	45,0	63789
0.4488	11,400 mm	12,0	102,0	55,0	38,0	45,0	63790
0.4528	11,500 mm	12,0	102,0	55,0	38,0	45,0	63194
0.4531	11,509 mm	1/2	4-1/16	2-3/16	1-33/64	1-49/64	51360
0.4567	11,600 mm	12,0	102,0	55,0	38,0	45,0	63791
0.4606	11,700 mm	12,0	102,0	55,0	37,0	45,0	63792
0.4646	11,800 mm	12,0	102,0	55,0	37,0	45,0	63793
0.4685	11,900 mm	12,0	102,0	55,0	37,0	45,0	63794

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

135 3xD
METRIC SERIES

CONTINUED

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.4688	11,908 mm	1/2	4-1/16	2-3/16	1-31/64	1-49/64	51361
0.4724	12,000 mm	12,0	102,0	55,0	37,0	45,0	63195
0.4844	12,304 mm	1/2	4-1/4	2-5/16	1-19/32	1-49/64	51362
0.4921	12,500 mm	14,0	107,0	60,0	41,0	45,0	63196
0.5000	12,700 mm	1/2	4-1/4	2-5/16	1-9/16	1-49/64	51363
0.5039	12,800 mm	14,0	107,0	60,0	41,0	45,0	63197
0.5118	13,000 mm	14,0	107,0	60,0	41,0	45,0	63198
0.5156	13,096 mm	5/8	4-1/4	2-5/16	1-35/64	1-49/64	51364
0.5312	13,492 mm	5/8	4-1/4	2-5/16	1-33/64	1-49/64	51365
0.5315	13,500 mm	14,0	107,0	60,0	40,0	45,0	63199
0.5469	13,891 mm	5/8	4-1/4	2-5/16	1-1/2	1-49/64	51783
0.5512	14,000 mm	14,0	107,0	60,0	39,0	45,0	63200
0.5625	14,288 mm	5/8	4-9/16	2-1/2	1-21/32	1-57/64	51366
0.5709	14,500 mm	16,0	115,0	65,0	43,0	48,0	63201
0.5781	14,684 mm	5/8	4-9/16	2-1/2	1-41/64	1-57/64	51367
0.5906	15,000 mm	16,0	115,0	65,0	42,0	48,0	63202
0.5938	15,083 mm	5/8	4-9/16	2-1/2	1-39/64	1-57/64	51784
0.6094	15,479 mm	5/8	4-9/16	2-1/2	1-19/32	1-57/64	51785
0.6102	15,500 mm	16,0	115,0	65,0	42,0	48,0	63203
0.6250	15,875 mm	5/8	4-9/16	2-1/2	1-9/16	1-57/64	51368
0.6299	16,000 mm	16,0	115,0	65,0	41,0	48,0	63204
0.6406	16,271 mm	3/4	4-7/8	2-3/4	1-51/64	1-57/64	51786
0.6496	16,500 mm	18,0	123,0	73,0	48,0	48,0	63205
0.6562	16,667 mm	3/4	4-7/8	2-3/4	1-25/32	1-57/64	51369
0.6693	17,000 mm	18,0	123,0	73,0	47,0	48,0	63206
0.6719	17,066 mm	3/4	4-7/8	2-3/4	1-3/4	1-57/64	51787
0.6875	17,463 mm	3/4	4-7/8	2-3/4	1-47/64	1-57/64	51370
0.6890	17,500 mm	18,0	123,0	73,0	47,0	48,0	63207
0.7031	17,859 mm	3/4	4-7/8	2-3/4	1-45/64	1-57/64	51788
0.7087	18,000 mm	18,0	123,0	73,0	46,0	48,0	63208
0.7188	18,258 mm	3/4	4-7/8	2-3/4	1-43/64	1-57/64	51789
0.7283	18,500 mm	20,0	131,0	79,0	51,0	50,0	63209
0.7344	18,654 mm	3/4	4-7/8	2-3/4	1-21/32	1-57/64	51790
0.7480	19,000 mm	20,0	131,0	79,0	51,0	50,0	63210
0.7500	19,050 mm	3/4	5-1/4	3-1/16	1-15/16	1-31/32	51371
0.7656	19,446 mm	7/8	5-1/4	3-1/16	1-59/64	1-31/32	51372
0.7677	19,500 mm	20,0	131,0	79,0	50,0	50,0	63211
0.7812	19,842 mm	7/8	6	3-11/16	2-33/64	2-1/8	51791
0.7874	20,000 mm	20,0	131,0	79,0	49,0	50,0	63212
0.7969	20,241 mm	7/8	6	3-11/16	2-1/2	2-1/8	51792
0.8071	20,500 mm	22,0	150,0	93,0	62,0	53,0	64513
0.8125	20,638 mm	7/8	6	3-11/16	2-15/32	2-1/8	51373
0.8268	21,000 mm	22,0	150,0	93,0	61,0	53,0	64514
0.8661	22,000 mm	22,0	150,0	93,0	60,0	53,0	64515
0.8750	22,225 mm	7/8	6	3-11/16	2-3/8	2-1/8	51374
0.9219	23,416 mm	1	6	3-11/16	2-5/16	2-1/8	51375

Hi-PerCarb

	Series 135 3D Metric	Hardness	Vc (m/min)		DC • mm 1.5	3	6	8	10	12	16	20
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	117	RPM	24882	12441	6220	4665	3732	3110	2333	1866
			(94-141)	Fr	0.047	0.094	0.189	0.252	0.315	0.378	0.504	0.630
				Feed (mm/min)	1175	1175	1175	1175	1175	1175	1175	1175
		≤ 275 Bhn or ≤ 28 HRc	107	RPM	22620	11310	5655	4241	3393	2827	2121	1696
			(85-128)	Fr	0.043	0.086	0.172	0.229	0.286	0.343	0.457	0.572
				Feed (mm/min)	970	970	970	970	970	970	970	970
		≤ 475 Bhn or ≤ 45 HRc	61	RPM	12926	6463	3231	2424	1939	1616	1212	969
			(49-73)	Fr	0.036	0.071	0.142	0.190	0.237	0.285	0.380	0.475
				Feed (mm/min)	460	460	460	460	460	460	460	460
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	91	RPM	19388	9694	4847	3635	2908	2424	1818	1454
			(73-110)	Fr	0.036	0.071	0.142	0.190	0.237	0.285	0.380	0.475
				Feed (mm/min)	690	690	690	690	690	690	690	690
		≤ 375 Bhn or ≤ 40 HRc	56	RPM	11956	5978	2989	2242	1793	1495	1121	897
			(45-68)	Fr	0.031	0.061	0.122	0.163	0.204	0.244	0.326	0.407
				Feed (mm/min)	365	365	365	365	365	365	365	365
		≤ 425 Bhn or ≤ 45 HRc	40	RPM	8402	4201	2100	1575	1260	1050	788	630
			(32-48)	Fr	0.021	0.042	0.083	0.111	0.139	0.167	0.222	0.278
				Feed (mm/min)	175	175	175	175	175	175	175	175
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 200 Bhn or ≤ 13 HRc	40	RPM	8402	4201	2100	1575	1260	1050	788	630
			(32-48)	Fr	0.032	0.063	0.126	0.168	0.210	0.252	0.336	0.421
				Feed (mm/min)	265	265	265	265	265	265	265	265
		≤ 375 Bhn or ≤ 40 HRc	27	RPM	5816	2908	1454	1091	872	727	545	436
			(22-33)	Fr	0.014	0.028	0.055	0.073	0.092	0.110	0.147	0.183
				Feed (mm/min)	80	80	80	80	80	80	80	80
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 185 Bhn or ≤ 9 HRc	84	RPM	17773	8886	4443	3332	2666	2222	1666	1333
			(67-101)	Fr	0.031	0.061	0.123	0.164	0.204	0.245	0.327	0.409
				Feed (mm/min)	545	545	545	545	545	545	545	545
		≤ 275 Bhn or ≤ 28 HRc	52	RPM	10987	5493	2747	2060	1648	1373	1030	824
			(41-62)	Fr	0.024	0.047	0.095	0.126	0.158	0.189	0.252	0.316
				Feed (mm/min)	260	260	260	260	260	260	260	260
	STAINLESS STEELS (DIFFICULT) 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	27	RPM	5816	2908	1454	1091	872	727	545	436
			(22-33)	Fr	0.023	0.046	0.093	0.124	0.155	0.186	0.248	0.309
				Feed (mm/min)	135	135	135	135	135	135	135	135
		≤ 375 Bhn or ≤ 40 HRc	20	RPM	4201	2100	1050	788	630	525	394	315
			(16-24)	Fr	0.020	0.040	0.081	0.108	0.135	0.162	0.216	0.270
				Feed (mm/min)	85	85	85	85	85	85	85	85
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	98	RPM	20681	10340	5170	3878	3102	2585	1939	1551
			(78-117)	Fr	0.055	0.110	0.220	0.293	0.366	0.439	0.585	0.732
				Feed (mm/min)	1135	1135	1135	1135	1135	1135	1135	1135
		≤ 260 Bhn or ≤ 26 HRc	87	RPM	18419	9209	4605	3454	2763	2302	1727	1381
			(69-104)	Fr	0.055	0.110	0.219	0.292	0.366	0.439	0.585	0.731
				Feed (mm/min)	1010	1010	1010	1010	1010	1010	1010	1010

continued on next page

Hi-PerCarb

	Series 135 3D Metric	Hardness	Vc (m/min)		DC • mm 1.5	3	6	8	10	12	16	20
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 80 Bhn or ≤ 47 HRb	213	RPM	45239	22620	11310	8482	6786	5655	4241	3393
			(171-256)	Fr	0.059	0.119	0.238	0.317	0.396	0.476	0.634	0.793
				Feed (mm/min)	2690	2690	2690	2690	2690	2690	2690	2690
		≤ 150 Bhn or ≤ 8 HRb	183	RPM	38777	19388	9694	7271	5816	4847	3635	2908
			(146-219)	Fr	0.060	0.120	0.240	0.320	0.400	0.480	0.640	0.799
				Feed (mm/min)	2325	2325	2325	2325	2325	2325	2325	2325
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	152	RPM	32314	16157	8078	6059	4847	4039	3029	2424
			(122-183)	Fr	0.024	0.048	0.096	0.128	0.160	0.192	0.256	0.320
				Feed (mm/min)	776	776	776	776	776	776	776	776
		≤ 200 Bhn or ≤ 23 HRc	122	RPM	25851	12926	6463	4847	3878	3231	2424	1939
			(98-146)	Fr	0.024	0.049	0.097	0.130	0.162	0.195	0.260	0.325
				Feed (mm/min)	630	630	630	630	630	630	630	630
S	HIGH TEMP ALLOYS (NICKEL , COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy, Monel 400, Rene, Waspaloy	≤ 300 Bhn or ≤ 32 HRc	17	RPM	3555	1777	889	666	533	444	333	267
			(13-20)	Fr	0.010	0.020	0.039	0.053	0.066	0.079	0.105	0.131
				Feed (mm/min)	35	35	35	35	35	35	35	35
		≤ 400 Bhn or ≤ 43 HRc	9	RPM	1939	969	485	364	291	242	182	145
			(7-11)	Fr	0.008	0.015	0.031	0.041	0.052	0.062	0.083	0.103
				Feed (mm/min)	15	15	15	15	15	15	15	15
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V	≤ 275 Bhn or ≤ 28 HRc	41	RPM	8725	4362	2181	1636	1309	1091	818	654
			(33-49)	Fr	0.021	0.042	0.085	0.113	0.141	0.170	0.226	0.283
				Feed (mm/min)	185	185	185	185	185	185	185	185
		≤ 350 Bhn or ≤ 38 HRc	30	RPM	6463	3231	1616	1212	969	808	606	485
			(24-37)	Fr	0.019	0.039	0.077	0.103	0.129	0.155	0.206	0.258
				Feed (mm/min)	125	125	125	125	125	125	125	125
		≤ 440 Bhn or ≤ 47 HRc	17	RPM	3555	1777	889	666	533	444	333	267
			(13-20)	Fr	0.014	0.028	0.056	0.075	0.094	0.113	0.150	0.188
				Feed (mm/min)	50	50	50	50	50	50	50	50
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	23	RPM	4847	2424	1212	909	727	606	454	364
			(18-27)	Fr	0.009	0.019	0.037	0.050	0.062	0.074	0.099	0.124
				Feed (mm/min)	45	45	45	45	45	45	45	45

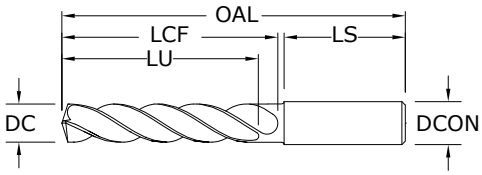
Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Hi-PerCarb

HI-PER CARB
HIGH PERFORMANCE CARBIDE DRILLS

135 5xD

METRIC SERIES



- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.0156	0,396 mm	1/8	1 1/2	5/32	1/8	1	52300*
0.0312	0,792 mm	1/8	1 1/2	5/16	17/64	1	52301*
0.0469	1,191 mm	1/8	1 1/2	25/64	21/64	1	52302*
0.0492	1,250 mm	3,0	38,0	10,0	8,0	25,0	64520*
0.0571	1,450 mm	3,0	38,0	10,0	8,0	25,0	64521*
0.0595	1,511 mm	1/8	1-1/2	25/64	5/16	1	64522*
0.0625	1,588 mm	1/8	2	15/32	3/8	1-1/4	52303*
0.0630	1,600 mm	3,0	50,0	12,0	10,0	32,0	64523*
0.0689	1,750 mm	3,0	50,0	12,0	9,0	32,0	64524*
0.0700	1,778 mm	1/8	2	15/32	23/64	1-1/4	64525*
0.0781	1,984 mm	1/8	2	35/64	7/16	1-1/4	52304*
0.0785	1,994 mm	1/8	2	35/64	7/16	1-1/4	64526*
0.0807	2,050 mm	3,0	50,0	14,0	11,0	32,0	64527*
0.0810	2,057 mm	1/8	2	35/64	27/64	1-1/4	64528*
0.0890	2,261 mm	1/8	2	19/32	15/32	1-1/4	64529*
0.0935	2,375 mm	1/8	2	5/8	31/64	1-1/4	64530*
0.0938	2,383 mm	1/8	2	5/8	31/64	1-1/4	52305
0.0980	2,489 mm	1/8	2	43/64	17/32	1-1/4	52306
0.0984	2,500 mm	3,0	50,0	17,0	13,0	32,0	64531
0.0995	2,527 mm	1/8	2	43/64	17/32	1-1/4	52307
0.1015	2,578 mm	1/8	2	43/64	17/32	1-1/4	52308
0.1040	2,642 mm	1/8	2	45/64	35/64	1-1/4	52309
0.1065	2,705 mm	1/8	2	45/64	35/64	1-1/4	52310
0.1094	2,779 mm	1/8	2	3/4	19/32	1-1/4	52311
0.1100	2,794 mm	1/8	2	3/4	19/32	1-1/4	52312
0.1110	2,819 mm	1/8	2	3/4	19/32	1-1/4	52313
0.1130	2,870 mm	1/8	2	3/4	19/32	1-1/4	52314
0.1142	2,900 mm	3,0	50,0	19,0	15,0	32,0	64532
0.1160	2,946 mm	1/8	2	3/4	37/64	1-1/4	52315
0.1181	3,000 mm	6,0	66,0	28,0	24,0	36,0	64100
0.1200	3,048 mm	1/8	2	3/4	37/64	1-1/4	52316
0.1220	3,100 mm	6,0	66,0	28,0	23,0	36,0	64101
0.1250	3,175 mm	1/4	3	1	13/16	1-7/16	51580
0.1260	3,200 mm	6,0	66,0	28,0	23,0	36,0	64102
0.1285	3,264 mm	1/4	3	1	13/16	1-7/16	51581
0.1299	3,300 mm	6,0	66,0	28,0	23,0	36,0	64103

*Single Margin

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

135 5xD
METRIC SERIES

CONTINUED

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.1339	3,400 mm	6,0	66,0	28,0	23,0	36,0	64104
0.1360	3,454 mm	1/4	3	1	51/64	1-7/16	51582
0.1378	3,500 mm	6,0	66,0	28,0	23,0	36,0	64105
0.1405	3,569 mm	1/4	3	1	51/64	1- 7/16	52317
0.1406	3,571 mm	1/4	3	1	51/64	1-7/16	51583
0.1417	3,600 mm	6,0	66,0	28,0	23,0	36,0	64106
0.1440	3,658 mm	1/4	3	1	51/64	1-7/16	52318
0.1457	3,700 mm	6,0	66,0	28,0	22,0	36,0	64107
0.1470	3,734 mm	1/4	3	1	25/32	1-7/16	52319
0.1495	3,797 mm	1/4	3-1/4	1-1/4	1-1/32	1-7/16	51584
0.1496	3,800 mm	6,0	74,0	36,0	30,0	36,0	64108
0.1520	3,861 mm	1/4	3-1/4	1-1/4	1-1/32	1-7/16	52321
0.1535	3,900 mm	6,0	74,0	36,0	30,0	36,0	64109
0.1540	3,912 mm	1/4	3-1/4	1-1/4	1-1/32	1-7/16	52322
0.1562	3,967 mm	1/4	3-1/4	1-1/4	1-1/64	1-7/16	51585
0.1570	3,988 mm	1/4	3-1/4	1-1/4	1-1/64	1-7/16	52323
0.1575	4,000 mm	6,0	74,0	36,0	30,0	36,0	64110
0.1590	4,039 mm	1/4	3-1/4	1-1/4	1-1/64	1-7/16	51586
0.1610	4,089 mm	1/4	3-1/4	1-1/4	1	1-7/16	51587
0.1614	4,100 mm	6,0	74,0	36,0	30,0	36,0	64111
0.1654	4,200 mm	6,0	74,0	36,0	30,0	36,0	64112
0.1660	4,216 mm	1/4	3-1/4	1-1/4	1	1-7/16	52324
0.1693	4,300 mm	6,0	74,0	36,0	30,0	36,0	64113
0.1695	4,305 mm	1/4	3-1/4	1-1/4	1	1-7/16	52325
0.1719	4,366 mm	1/4	3-1/4	1-1/4	1	1-7/16	51588
0.1730	4,394 mm	1/4	3-1/4	1-1/4	1	1-7/16	52326
0.1732	4,400 mm	6,0	74,0	36,0	29,0	36,0	64114
0.1772	4,500 mm	6,0	74,0	36,0	29,0	36,0	64115
0.1800	4,572 mm	1/4	3-1/4	1-1/4	63/64	1-7/16	52327
0.1811	4,600 mm	6,0	74,0	36,0	29,0	36,0	64116
0.1820	4,623 mm	1/4	3-1/4	1-1/4	63/64	1-7/16	52328
0.1850	4,699 mm	1/4	3-1/4	1-1/4	63/64	1-7/16	52329
0.1850	4,699 mm	6,0	74,0	36,0	29,0	36,0	64117
0.1875	4,763 mm	1/4	3-1/4	1-3/4	1-15/32	1-7/16	51589
0.1890	4,801 mm	1/4	3-1/4	1-3/4	1-15/32	1-7/16	52330
0.1890	4,801 mm	6,0	82,0	44,0	37,0	36,0	64118
0.1929	4,900 mm	6,0	82,0	44,0	37,0	36,0	64119
0.1935	4,915 mm	1/4	3-1/4	1-3/4	1-15/32	1-7/16	52331
0.1960	4,978 mm	1/4	3-1/4	1-3/4	1-15/32	1-7/16	52332
0.1969	5,000 mm	6,0	82,0	44,0	36,0	36,0	64120
0.1990	5,055 mm	1/4	3-1/4	1-3/4	1-15/32	1-7/16	52333
0.2008	5,100 mm	6,0	82,0	44,0	36,0	36,0	64121
0.2010	5,105 mm	1/4	3-1/4	1-3/4	1-29/64	1-7/16	51506
0.2031	5,159 mm	1/4	3-1/4	1-3/4	1-29/64	1-7/16	51507
0.2040	5,182 mm	1/4	3 1/4	1 3/4	1-29/64	1 7/16	52334
0.2047	5,200 mm	6,0	82,0	44,0	36,0	36,0	64122

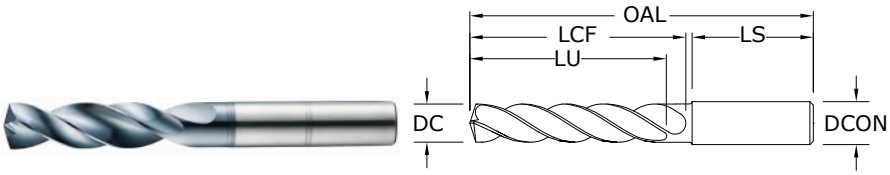
continued on next page

Hi-PerCarb

HI-PER CARB
HIGH PERFORMANCE CARBIDE DRILLS

135 5xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.2055	5,220 mm	1/4	3-1/4	1-3/4	1-29/64	1-7/16	51590
0.2067	5,250 mm	6,0	82,0	44,0	36,0	36,0	64123
0.2087	5,300 mm	6,0	82,0	44,0	36,0	36,0	64124
0.2090	5,309 mm	1/4	3-1/4	1-3/4	1-7/16	1-7/16	51508
0.2126	5,400 mm	6,0	82,0	44,0	36,0	36,0	64125
0.2130	5,410 mm	1/4	3-1/4	1-3/4	1-7/16	1-7/16	51509
0.2165	5,500 mm	6,0	82,0	44,0	36,0	36,0	64126
0.2188	5,558 mm	1/4	3-1/4	1-3/4	1-27/64	1-7/16	51510
0.2205	5,600 mm	6,0	82,0	44,0	36,0	36,0	64127
0.2210	5,613 mm	1/4	3-1/4	1-3/4	1-27/64	1-7/16	52335
0.2244	5,700 mm	6,0	82,0	44,0	35,0	36,0	64128
0.2280	5,791 mm	1/4	3-1/4	1-3/4	1-13/32	1-7/16	52336
0.2283	5,800 mm	6,0	82,0	44,0	35,0	36,0	64129
0.2323	5,900 mm	6,0	82,0	44,0	35,0	36,0	64130
0.2340	5,944 mm	1/4	3-1/4	1-3/4	1-13/32	1-7/16	52337
0.2344	5,954 mm	1/4	3-1/4	1-3/4	1-13/32	1-7/16	51591
0.2362	6,000 mm	6,0	82,0	44,0	35,0	36,0	64131
0.2380	6,045 mm	1/4	3 5/8	2-5/64	1-13/32	1-7/16	52338
0.2402	6,100 mm	8,0	91,0	53,0	44,0	36,0	64132
0.2420	6,147 mm	1/4	3 5/8	2-5/64	1-13/32	1-7/16	52339
0.2441	6,200 mm	8,0	91,0	53,0	44,0	36,0	64133
0.2460	6,248 mm	1/4	3 5/8	2-5/64	1-13/32	1-7/16	52340
0.2461	6,250 mm	8,0	91,0	53,0	44,0	36,0	64134
0.2480	6,300 mm	8,0	91,0	53,0	44,0	36,0	64135
0.2500	6,350 mm	1/4	3-5/8	2-5/64	1-45/64	1-7/16	51511
0.2520	6,400 mm	8,0	91,0	53,0	43,0	36,0	64136
0.2559	6,500 mm	8,0	91,0	53,0	43,0	36,0	64137
0.2570	6,528 mm	5/16	3-5/8	2-5/64	1-45/64	1-7/16	51512
0.2598	6,600 mm	8,0	91,0	53,0	43,0	36,0	64138
0.2610	6,629 mm	5/16	3 5/8	2 5/64	1-11/16	1 7/16	52341
0.2638	6,700 mm	8,0	91,0	53,0	43,0	36,0	64139
0.2656	6,746 mm	5/16	3-5/8	2-5/64	1-11/16	1-7/16	51513
0.2660	6,756 mm	5/16	3-5/8	2-5/64	1-11/16	1-7/16	52342
0.2677	6,800 mm	8,0	91,0	53,0	43,0	36,0	64140
0.2717	6,900 mm	8,0	91,0	53,0	43,0	36,0	64141
0.2720	6,909 mm	5/16	3-5/8	2-5/64	1-43/64	1-7/16	51514

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

135 5xD
METRIC SERIES

CONTINUED

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.2756	7,000 mm	8,0	91,0	53,0	42,0	36,0	64142
0.2770	7,036 mm	5/16	3 5/8	2-5/64	1-43/64	1-7/16	52343
0.2795	7,100 mm	8,0	91,0	53,0	42,0	36,0	64143
0.2810	7,137 mm	5/16	3 5/8	2-5/64	1-21/32	1-7/16	52344
0.2812	7,142 mm	5/16	3-5/8	2-5/64	1-21/32	1-7/16	51515
0.2835	7,200 mm	8,0	91,0	53,0	42,0	36,0	64144
0.2854	7,250 mm	8,0	91,0	53,0	42,0	36,0	64145
0.2874	7,300 mm	8,0	91,0	53,0	42,0	36,0	64146
0.2900	7,366 mm	5/16	3-5/8	2-5/64	1-41/64	1-7/16	52345
0.2913	7,400 mm	8,0	91,0	53,0	42,0	36,0	64147
0.2950	7,493 mm	5/16	3-5/8	2-5/64	1-41/64	1-7/16	52346
0.2953	7,500 mm	8,0	91,0	53,0	42,0	36,0	64148
0.2969	7,541 mm	5/16	3-5/8	2-5/64	1-41/64	1-7/16	51516
0.2992	7,600 mm	8,0	91,0	53,0	42,0	36,0	64149
0.3020	7,671 mm	5/16	3-5/8	2-5/64	1-5/8	1-7/16	52347
0.3031	7,700 mm	8,0	91,0	53,0	41,0	36,0	64150
0.3071	7,800 mm	8,0	91,0	53,0	41,0	36,0	64151
0.3110	7,900 mm	8,0	91,0	53,0	41,0	36,0	64152
0.3125	7,938 mm	5/16	3-5/8	2-5/64	1-39/64	1-7/16	51517
0.3150	8,000 mm	8,0	91,0	53,0	41,0	36,0	64153
0.3160	8,026 mm	3/8	4	2-13/32	1-15/16	1-9/16	52348
0.3189	8,100 mm	10,0	103,0	61,0	49,0	40,0	64154
0.3228	8,200 mm	10,0	103,0	61,0	49,0	40,0	64155
0.3230	8,204 mm	3/8	4	2-13/32	1-59/64	1-9/16	51518
0.3268	8,300 mm	10,0	103,0	61,0	49,0	40,0	64156
0.3281	8,334 mm	3/8	4	2-13/32	1-59/64	1-9/16	51519
0.3307	8,400 mm	10,0	103,0	61,0	48,0	40,0	64157
0.3320	8,433 mm	3/8	4	2-13/32	1-59/64	1-9/16	51520
0.3346	8,500 mm	10,0	103,0	61,0	48,0	40,0	64158
0.3386	8,600 mm	10,0	103,0	61,0	48,0	40,0	64159
0.3390	8,611 mm	3/8	4	2-13/32	1-29/32	1-9/16	52349
0.3425	8,700 mm	10,0	103,0	61,0	48,0	40,0	64160
0.3438	8,733 mm	3/8	4	2-13/32	1-57/64	1-9/16	51521
0.3465	8,800 mm	10,0	103,0	61,0	48,0	40,0	64161
0.3480	8,839 mm	3/8	4	2-13/32	1-57/64	1-9/16	51522
0.3504	8,900 mm	10,0	103,0	61,0	48,0	40,0	64162
0.3543	9,000 mm	10,0	103,0	61,0	48,0	40,0	64163
0.3580	9,093 mm	3/8	4	2 13/32	1-7/8	1 9/16	52350
0.3583	9,100 mm	10,0	103,0	61,0	47,0	40,0	64164
0.3594	9,129 mm	3/8	4	2-13/32	1-7/8	1-9/16	51523
0.3622	9,200 mm	10,0	103,0	61,0	47,0	40,0	64165
0.3642	9,250 mm	10,0	103,0	61,0	47,0	40,0	64166
0.3661	9,300 mm	10,0	103,0	61,0	47,0	40,0	64167
0.3680	9,347 mm	3/8	4	2-13/32	1-55/64	1-9/16	51524
0.3701	9,400 mm	10,0	103,0	61,0	47,0	40,0	64168
0.3740	9,500 mm	10,0	103,0	61,0	47,0	40,0	64169

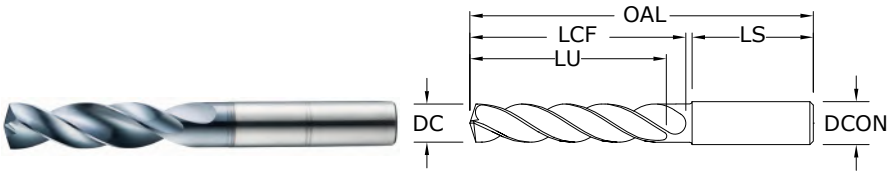
continued on next page

Hi-PerCarb

HI-PER CARB
HIGH PERFORMANCE CARBIDE DRILLS

135 5xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-A (AlTiN)
0.3750	9,525 mm	3/8	4	2-13/32	1-27/32	1-9/16	51525
0.3770	9,576 mm	1/2	4	2-13/32	1-27/32	1-9/16	52351
0.3780	9,600 mm	10,0	103,0	61,0	47,0	40,0	64170
0.3819	9,700 mm	10,0	103,0	61,0	46,0	40,0	64171
0.3858	9,800 mm	10,0	103,0	61,0	46,0	40,0	64172
0.3860	9,804 mm	1/2	4	2-13/32	1-53/64	1-9/16	51526
0.3898	9,900 mm	10,0	103,0	61,0	46,0	40,0	64173
0.3906	9,921 mm	1/2	4	2-13/32	1-53/64	1-9/16	51527
0.3937	10,000 mm	10,0	103,0	61,0	46,0	40,0	64174
0.3970	10,084 mm	1/2	4-11/16	2-3/4	2-5/32	1-49/64	52352
0.3976	10,100 mm	12,0	118,0	71,0	56,0	45,0	64175
0.4016	10,200 mm	12,0	118,0	71,0	56,0	45,0	64176
0.4040	10,262 mm	1/2	4-11/16	2-3/4	2-5/32	1-49/64	52353
0.4055	10,300 mm	12,0	118,0	71,0	56,0	45,0	64177
0.4062	10,317 mm	1/2	4-11/16	2-3/4	2-9/64	1-49/64	51528
0.4095	10,400 mm	12,0	118,0	71,0	55,0	45,0	64178
0.4130	10,490 mm	1/2	4-11/16	2-3/4	2-9/64	1-49/64	52354
0.4134	10,500 mm	12,0	118,0	71,0	55,0	45,0	64179
0.4173	10,600 mm	12,0	118,0	71,0	55,0	45,0	64180
0.4213	10,700 mm	12,0	118,0	71,0	55,0	45,0	64181
0.4219	10,716 mm	1/2	4-11/16	2-3/4	2-1/8	1-49/64	51529
0.4252	10,800 mm	12,0	118,0	71,0	55,0	45,0	64182
0.4291	10,900 mm	12,0	118,0	71,0	55,0	45,0	64183
0.4331	11,000 mm	12,0	118,0	71,0	54,0	45,0	64184
0.4370	11,100 mm	12,0	118,0	71,0	54,0	45,0	64185
0.4375	11,113 mm	1/2	4-11/16	2-3/4	2-3/32	1-49/64	51530
0.4409	11,200 mm	12,0	118,0	71,0	54,0	45,0	64186
0.4429	11,250 mm	12,0	118,0	71,0	54,0	45,0	64187
0.4449	11,300 mm	12,0	118,0	71,0	54,0	45,0	64188
0.4488	11,400 mm	12,0	118,0	71,0	54,0	45,0	64189
0.4528	11,500 mm	12,0	118,0	71,0	54,0	45,0	64190
0.4531	11,509 mm	1/2	4-11/16	2-3/4	2-5/64	1-49/64	51531
0.4567	11,600 mm	12,0	118,0	71,0	54,0	45,0	64191
0.4606	11,700 mm	12,0	118,0	71,0	53,0	45,0	64192
0.4646	11,800 mm	12,0	118,0	71,0	53,0	45,0	64193
0.4685	11,900 mm	12,0	118,0	71,0	53,0	45,0	64194

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

135 5xD
METRIC SERIES

CONTINUED

DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	EDP NO. Ti-NAMITE-A (AlTiN)
0.4688	11,908 mm	1/2	4-11/16	2-3/4	2-3/64	1-49/64	51532
0.4724	12,000 mm	12,0	118,0	71,0	53,0	45,0	64195
0.4844	12,304 mm	1/2	4-7/8	3-1/32	1-5/16	1-49/64	51533
0.4921	12,500 mm	14,0	124,0	77,0	58,0	45,0	64196
0.5000	12,700 mm	1/2	4-7/8	3-1/32	2-9/32	1-49/64	51534
0.5039	12,800 mm	14,0	124,0	77,0	58,0	45,0	64197
0.5118	13,000 mm	14,0	124,0	77,0	58,0	45,0	64198
0.5156	13,096 mm	5/8	4-7/8	3-1/32	2-17/64	1-49/64	51535
0.5312	13,492 mm	5/8	4-7/8	3-1/32	2-15/64	1-49/64	51536
0.5315	13,500 mm	14,0	124,0	77,0	57,0	45,0	64199
0.5469	13,800 mm	5/8	4-7/8	3-1/32	2-7/32	1-49/64	51537
0.5512	14,000 mm	14,0	124,0	77,0	56,0	45,0	64200
0.5625	14,288 mm	5/8	5-1/4	3-1/4	2-13/32	1-57/64	51538
0.5709	14,500 mm	16,0	133,0	83,0	61,0	48,0	64201
0.5781	14,684 mm	5/8	5-1/4	3-1/4	2-25/64	1-57/64	51539
0.5906	15,000 mm	16,0	133,0	83,0	60,0	48,0	64202
0.5938	15,083 mm	5/8	5-1/4	3-1/4	2-23/64	1-57/64	51592
0.6094	15,479 mm	5/8	5-1/4	3-1/4	2-11/32	1-57/64	51593
0.6102	15,500 mm	16,0	133,0	83,0	60,0	48,0	64203
0.6250	15,875 mm	5/8	5-1/4	3-1/4	2-5/16	1-57/64	51540
0.6299	16,000 mm	16,0	133,0	83,0	59,0	48,0	64204
0.6406	16,271 mm	3/4	5-5/8	3-5/8	2-43/64	1-57/64	51594
0.6496	16,500 mm	18,0	143,0	93,0	68,0	48,0	64205
0.6562	16,667 mm	3/4	5-5/8	3-5/8	2-41/64	1-57/64	51541
0.6693	17,000 mm	18,0	143,0	93,0	67,0	48,0	64206
0.6719	17,066 mm	3/4	5-5/8	3-5/8	2-5/8	1-57/64	51595
0.6875	17,463 mm	3/4	5-5/8	3-5/8	2-19/32	1-57/64	51542
0.6890	17,500 mm	18,0	143,0	93,0	67,0	48,0	64207
0.7031	17,859 mm	3/4	5-5/8	3-5/8	2-37/64	1-57/64	51543
0.7087	18,000 mm	18,0	143,0	93,0	66,0	48,0	64208
0.7188	18,258 mm	3/4	6	4	2-59/64	1-31/32	51596
0.7283	18,500 mm	20,0	153,0	101,0	73,0	50,0	64209
0.7344	18,654 mm	3/4	6	4	2-29/32	1-31/32	51544
0.7480	19,000 mm	20,0	153,0	101,0	73,0	50,0	64210
0.7500	19,050 mm	3/4	6	4	2-7/8	1-31/32	51545
0.7656	19,446 mm	7/8	6	4	2-55/64	1-31/32	52355
0.7677	19,500 mm	20,0	153,0	101,0	72,0	50,0	64211
0.7812	19,842 mm	7/8	6	4	2-55/64	1-31/32	52356
0.7874	20,000 mm	20,0	153,0	101,0	71,0	50,0	64212
0.7969	20,241 mm	7/8	6	4	2-13/16	1-31/32	52357
0.8071	20,500 mm	22,0	153,0	101,0	70,0	50,0	64533
0.8125	20,638 mm	7/8	6-1/2	4-1/2	3-3/32	1-31/32	52358
0.8268	21,000 mm	22,0	153,0	101,0	69,0	50,0	64534
0.8661	22,000 mm	22,0	178,0	127,0	94,0	50,0	64535
0.8750	22,225 mm	7/8	6-1/2	4-1/2	3-3/16	1-31/32	52359
0.9219	23,416 mm	1	7	5	3-5/8	2-1/8	52360

Hi-PerCarb

	Series 135M 5D Metric	Hardness	Vc (m/min)		DC • mm 1.5	3	6	8	10	12	16	20
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	105	RPM	22297	11148	5574	4181	3344	2787	2090	1672
			(84-126)	Fr	0.048	0.095	0.190	0.254	0.317	0.380	0.507	0.634
				Feed (mm/min)	1060	1060	1060	1060	1060	1060	1060	1060
		≤ 275 Bhn or ≤ 28 HRc	94	RPM	20035	10017	5009	3756	3005	2504	1878	1503
			(76-113)	Fr	0.043	0.085	0.171	0.228	0.285	0.341	0.455	0.569
				Feed (mm/min)	855	855	855	855	855	855	855	855
		≤ 425 Bhn or ≤ 45 HRc	55	RPM	11633	5816	2908	2181	1745	1454	1091	872
			(44-66)	Fr	0.036	0.071	0.143	0.190	0.238	0.285	0.381	0.476
				Feed (mm/min)	415	415	415	415	415	415	415	415
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	82	RPM	17449	8725	4362	3272	2617	2181	1636	1309
			(66-99)	Fr	0.036	0.072	0.143	0.191	0.239	0.287	0.382	0.478
				Feed (mm/min)	625	625	625	625	625	625	625	625
		≤ 375 Bhn or ≤ 40 HRc	50	RPM	10664	5332	2666	1999	1600	1333	1000	800
			(40-60)	Fr	0.031	0.062	0.124	0.165	0.206	0.248	0.330	0.413
				Feed (mm/min)	330	330	330	330	330	330	330	330
		≤ 425 Bhn or ≤ 45 HRc	35	RPM	7432	3716	1858	1394	1115	929	697	557
			(28-42)	Fr	0.022	0.043	0.086	0.115	0.144	0.172	0.230	0.287
				Feed (mm/min)	160	160	160	160	160	160	160	160
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 200 Bhn or ≤ 13 HRc	37	RPM	7755	3878	1939	1454	1163	969	727	582
			(29-44)	Fr	0.031	0.062	0.124	0.165	0.206	0.248	0.330	0.413
				Feed (mm/min)	240	240	240	240	240	240	240	240
		≤ 375 Bhn or ≤ 40 HRc	24	RPM	5170	2585	1293	969	776	646	485	388
			(20-29)	Fr	0.015	0.029	0.058	0.077	0.097	0.116	0.155	0.193
				Feed (mm/min)	75	75	75	75	75	75	75	75
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 185 Bhn or ≤ 9 HRc	76	RPM	16157	8078	4039	3029	2424	2020	1515	1212
			(61-91)	Fr	0.031	0.061	0.123	0.163	0.204	0.245	0.327	0.408
				Feed (mm/min)	495	495	495	495	495	495	495	495
		≤ 275 Bhn or ≤ 28 HRc	46	RPM	9694	4847	2424	1818	1454	1212	909	727
			(37-55)	Fr	0.024	0.047	0.095	0.127	0.158	0.190	0.253	0.316
				Feed (mm/min)	230	230	230	230	230	230	230	230
	STAINLESS STEELS (DIFFICULT) 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	24	RPM	5170	2585	1293	969	776	646	485	388
			(20-29)	Fr	0.023	0.046	0.093	0.124	0.155	0.186	0.248	0.309
				Feed (mm/min)	120	120	120	120	120	120	120	120
		≤ 375 Bhn or ≤ 40 HRc	17	RPM	3555	1777	889	666	533	444	333	267
			(13-20)	Fr	0.021	0.042	0.084	0.113	0.141	0.169	0.225	0.281
				Feed (mm/min)	75	75	75	75	75	75	75	75
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	91	RPM	19388	9694	4847	3635	2908	2424	1818	1454
			(73-110)	Fr	0.054	0.108	0.217	0.289	0.361	0.433	0.578	0.722
				Feed (mm/min)	1050	1050	1050	1050	1050	1050	1050	1050
		≤ 260 Bhn or ≤ 26 HRc	81	RPM	17126	8563	4282	3211	2569	2141	1606	1284
			(65-97)	Fr	0.055	0.109	0.218	0.291	0.364	0.437	0.582	0.728
				Feed (mm/min)	935	935	935	935	935	935	935	935

continued on next page

Hi-PerCarb

	Series 135M 5D Metric	Hardness	Vc (m/min)		DC • mm 1.5	3	6	8	10	12	16	20
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 80 Bhn or ≤ 47 HRb	194	RPM	41039	20519	10260	7695	6156	5130	3847	3078
			(155-232)	Fr	0.059	0.118	0.237	0.316	0.395	0.474	0.632	0.790
				Feed (mm/min)	2430	2430	2430	2430	2430	2430	2430	2430
		≤ 150 Bhn or ≤ 88 HRc	165	RPM	34899	17449	8725	6544	5235	4362	3272	2617
			(132-198)	Fr	0.059	0.118	0.237	0.316	0.394	0.473	0.631	0.789
				Feed (mm/min)	2065	2065	2065	2065	2065	2065	2065	2065
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	137	RPM	29082	14541	7271	5453	4362	3635	2726	2181
			(110-165)	Fr	0.027	0.053	0.107	0.142	0.178	0.213	0.284	0.355
				Feed (mm/min)	775	775	775	775	775	775	775	775
		≤ 200 Bhn or ≤ 23 HRc	110	RPM	23266	11633	5816	4362	3490	2908	2181	1745
			(88-132)	Fr	0.027	0.054	0.108	0.144	0.181	0.217	0.289	0.361
				Feed (mm/min)	630	630	630	630	630	630	630	630
S	HIGH TEMP ALLOYS (Nickel , Cobalt, Iron Base) Inconel 601, 617, 625, Incoloy, Monel 400, Rene, Waspaloy	≤ 300 Bhn or ≤ 32 HRc	12	RPM	2585	1293	646	485	388	323	242	194
			(10-15)	Fr	0.010	0.019	0.039	0.052	0.064	0.077	0.103	0.129
				Feed (mm/min)	25	25	25	25	25	25	25	25
		≤ 400 Bhn or ≤ 43 HRc	6	RPM	1293	646	323	242	194	162	121	97
			(5-7)	Fr	0.007	0.014	0.028	0.037	0.046	0.056	0.074	0.093
				Feed (mm/min)	9	9	9	9	9	9	9	9
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V	≤ 275 Bhn or ≤ 28 HRc	32	RPM	6786	3393	1696	1272	1018	848	636	509
			(26-38)	Fr	0.021	0.043	0.085	0.114	0.142	0.171	0.228	0.285
				Feed (mm/min)	145	145	145	145	145	145	145	145
		≤ 350 Bhn or ≤ 38 HRc	24	RPM	5170	2585	1293	969	776	646	485	388
			(20-29)	Fr	0.019	0.039	0.077	0.103	0.129	0.155	0.206	0.258
				Feed (mm/min)	100	100	100	100	100	100	100	100
		≤ 440 Bhn or ≤ 47 HRc	13	RPM	2714	1357	679	509	407	339	254	204
			(10-15)	Fr	0.015	0.029	0.059	0.079	0.098	0.118	0.157	0.196
				Feed (mm/min)	40	40	40	40	40	40	40	40
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	21	RPM	4524	2262	1131	848	679	565	424	339
			(17-26)	Fr	0.010	0.019	0.038	0.051	0.064	0.076	0.102	0.127
				Feed (mm/min)	43	43	43	43	43	43	43	43

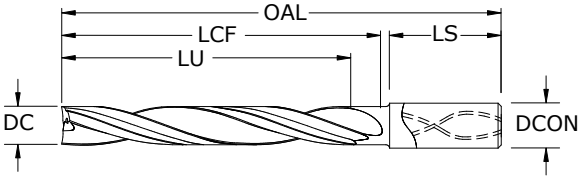
Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

146U 3xD

METRIC SERIES



- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.1181	3,000 mm	6,0	55,0	13,0	9,0	34,0	67705
0.1220	3,100 mm	6,0	55,0	14,0	9,0	34,0	67706
0.1250	3,175 mm	6,0	55,0	14,0	10,0	34,0	58800
0.1260	3,200 mm	6,0	55,0	14,0	10,0	34,0	67707
0.1299	3,300 mm	6,0	55,0	15,0	10,0	34,0	67708
0.1339	3,400 mm	6,0	55,0	15,0	10,0	34,0	67709
0.1360	3,454 mm	6,0	55,0	16,0	10,0	34,0	58801
0.1378	3,500 mm	6,0	55,0	16,0	11,0	34,0	67710
0.1405	3,569 mm	6,0	55,0	16,0	11,0	34,0	58802
0.1406	3,571 mm	6,0	55,0	16,0	11,0	34,0	58803
0.1417	3,600 mm	6,0	55,0	16,0	11,0	34,0	67711
0.1457	3,700 mm	6,0	60,0	17,0	11,0	34,0	67712
0.1470	3,734 mm	6,0	60,0	17,0	11,0	34,0	58804
0.1495	3,797 mm	6,0	60,0	17,0	11,0	34,0	58805
0.1496	3,800 mm	6,0	60,0	17,0	11,0	34,0	67713
0.1520	3,861 mm	6,0	60,0	17,0	12,0	34,0	58806
0.1535	3,900 mm	6,0	60,0	18,0	12,0	34,0	67714
0.1562	3,967 mm	6,0	60,0	18,0	12,0	34,0	58807
0.1570	3,988 mm	6,0	60,0	18,0	12,0	34,0	58808
0.1575	4,000 mm	6,0	60,0	18,0	12,0	34,0	67715
0.1590	4,039 mm	6,0	60,0	18,0	12,0	34,0	58809
0.1610	4,089 mm	6,0	60,0	18,0	12,0	34,0	58810
0.1614	4,100 mm	6,0	60,0	18,0	12,0	34,0	67716
0.1654	4,200 mm	6,0	60,0	19,0	13,0	34,0	67717
0.1693	4,300 mm	6,0	60,0	19,0	13,0	34,0	67718
0.1719	4,366 mm	6,0	60,0	20,0	13,0	34,0	58811
0.1732	4,400 mm	6,0	60,0	20,0	13,0	34,0	67719
0.1770	4,496 mm	6,0	60,0	20,0	13,0	34,0	58812
0.1772	4,500 mm	6,0	60,0	20,0	14,0	34,0	67720
0.1811	4,600 mm	6,0	60,0	21,0	14,0	34,0	67721
0.1850	4,699 mm	6,0	60,0	21,0	14,0	34,0	58813
0.1875	4,763 mm	6,0	60,0	21,0	14,0	34,0	58814
0.1890	4,801 mm	6,0	65,0	22,0	14,0	33,0	58815
0.1929	4,900 mm	6,0	65,0	22,0	15,0	33,0	67724
0.1935	4,915 mm	6,0	65,0	22,0	15,0	33,0	58816
0.1969	5,000 mm	6,0	65,0	23,0	15,0	33,0	67725

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

146U 3xD

METRIC SERIES

CONTINUED

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.2008	5,100 mm	6,0	65,0	23,0	15,0	33,0	67726
0.2010	5,105 mm	6,0	65,0	23,0	15,0	33,0	58817
0.2031	5,159 mm	6,0	65,0	23,0	15,0	33,0	58818
0.2047	5,200 mm	6,0	65,0	23,0	16,0	33,0	67727
0.2087	5,300 mm	6,0	65,0	24,0	16,0	33,0	67728
0.2090	5,309 mm	6,0	65,0	24,0	16,0	33,0	58819
0.2126	5,400 mm	6,0	65,0	24,0	16,0	33,0	67729
0.2130	5,410 mm	6,0	65,0	24,0	16,0	33,0	58820
0.2165	5,500 mm	6,0	65,0	25,0	16,0	33,0	67730
0.2188	5,558 mm	6,0	65,0	25,0	17,0	33,0	58821
0.2205	5,600 mm	6,0	65,0	25,0	17,0	33,0	67731
0.2244	5,700 mm	6,0	65,0	26,0	17,0	33,0	67732
0.2283	5,800 mm	6,0	65,0	26,0	17,0	33,0	67733
0.2323	5,900 mm	6,0	65,0	27,0	18,0	33,0	67734
0.2344	5,954 mm	6,0	65,0	27,0	18,0	33,0	58822
0.2362	6,000 mm	6,0	65,0	27,0	18,0	33,0	67735
0.2402	6,100 mm	8,0	70,0	28,0	19,0	34,0	67736
0.2441	6,200 mm	8,0	70,0	28,0	19,0	34,0	67737
0.2461	6,250 mm	8,0	70,0	28,0	19,0	34,0	67738
0.2480	6,300 mm	8,0	70,0	28,0	19,0	34,0	67739
0.2500	6,350 mm	8,0	70,0	29,0	19,0	34,0	58823
0.2520	6,400 mm	8,0	70,0	29,0	19,0	34,0	67740
0.2559	6,500 mm	8,0	70,0	29,0	19,0	34,0	67741
0.2570	6,528 mm	8,0	70,0	29,0	20,0	34,0	58824
0.2598	6,600 mm	8,0	70,0	30,0	20,0	34,0	67742
0.2638	6,700 mm	8,0	70,0	30,0	20,0	34,0	67743
0.2656	6,746 mm	8,0	70,0	30,0	20,0	34,0	58825
0.2677	6,800 mm	8,0	70,0	31,0	20,0	34,0	67744
0.2717	6,900 mm	8,0	70,0	31,0	21,0	34,0	67745
0.2720	6,909 mm	8,0	70,0	31,0	21,0	34,0	58826
0.2756	7,000 mm	8,0	75,0	32,0	21,0	34,0	67746
0.2795	7,100 mm	8,0	75,0	32,0	21,0	34,0	67747
0.2812	7,142 mm	8,0	75,0	32,0	21,0	34,0	58827
0.2835	7,200 mm	8,0	75,0	32,0	22,0	34,0	67748
0.2854	7,250 mm	8,0	75,0	33,0	22,0	34,0	67749
0.2874	7,300 mm	8,0	75,0	33,0	22,0	34,0	67750
0.2913	7,400 mm	8,0	75,0	33,0	22,0	34,0	67751
0.2953	7,500 mm	8,0	75,0	34,0	23,0	34,0	67752
0.2969	7,541 mm	8,0	75,0	34,0	23,0	34,0	58828
0.2992	7,600 mm	8,0	75,0	34,0	23,0	34,0	67753
0.3031	7,700 mm	8,0	75,0	35,0	23,0	34,0	67754
0.3071	7,800 mm	8,0	75,0	35,0	23,0	34,0	67755
0.3110	7,900 mm	8,0	75,0	36,0	24,0	34,0	67756
0.3125	7,938 mm	8,0	75,0	36,0	24,0	34,0	58829
0.3150	8,000 mm	8,0	75,0	36,0	24,0	34,0	67757
0.3189	8,100 mm	10,0	80,0	36,0	24,0	34,0	67758

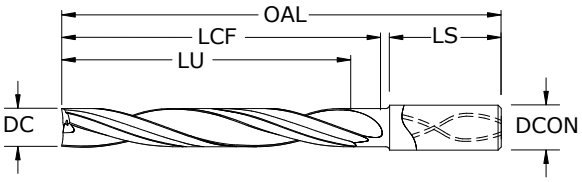
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

146U 3xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.3228	8,200 mm	10,0	80,0	37,0	25,0	34,0	67759
0.3268	8,300 mm	10,0	80,0	37,0	25,0	34,0	67760
0.3281	8,334 mm	10,0	80,0	38,0	25,0	34,0	58830
0.3307	8,400 mm	10,0	80,0	38,0	25,0	34,0	67761
0.3320	8,433 mm	10,0	80,0	38,0	25,0	34,0	58831
0.3346	8,500 mm	10,0	80,0	38,0	25,0	34,0	67762
0.3386	8,600 mm	10,0	80,0	39,0	26,0	34,0	67763
0.3425	8,700 mm	10,0	80,0	39,0	26,0	34,0	67764
0.3438	8,733 mm	10,0	80,0	39,0	26,0	34,0	58832
0.3465	8,800 mm	10,0	80,0	40,0	26,0	34,0	67765
0.3504	8,900 mm	10,0	80,0	40,0	27,0	34,0	67766
0.3543	9,000 mm	10,0	80,0	40,0	27,0	34,0	67767
0.3583	9,100 mm	10,0	80,0	41,0	27,0	34,0	67768
0.3594	9,129 mm	10,0	80,0	41,0	27,0	34,0	58833
0.3622	9,200 mm	10,0	80,0	41,0	28,0	35,0	67769
0.3661	9,300 mm	10,0	85,0	42,0	28,0	35,0	67770
0.3680	9,347 mm	10,0	85,0	42,0	28,0	35,0	58834
0.3701	9,400 mm	10,0	85,0	42,0	28,0	35,0	67771
0.3740	9,500 mm	10,0	85,0	43,0	28,0	35,0	67772
0.3750	9,525 mm	10,0	85,0	43,0	29,0	35,0	58835
0.3780	9,600 mm	10,0	85,0	43,0	29,0	35,0	67773
0.3819	9,700 mm	10,0	85,0	44,0	29,0	35,0	67774
0.3858	9,800 mm	10,0	85,0	44,0	29,0	35,0	67775
0.3898	9,900 mm	10,0	85,0	45,0	30,0	35,0	67776
0.3906	9,921 mm	10,0	85,0	45,0	30,0	35,0	58836
0.3937	10,000 mm	10,0	85,0	45,0	30,0	35,0	67777
0.3970	10,084 mm	12,0	90,0	46,0	31,0	36,0	58837
0.3976	10,100 mm	12,0	90,0	46,0	31,0	36,0	67778
0.4016	10,200 mm	12,0	90,0	46,0	31,0	36,0	67779
0.4040	10,262 mm	12,0	90,0	46,0	31,0	36,0	58838
0.4055	10,300 mm	12,0	90,0	46,0	31,0	36,0	67780
0.4062	10,317 mm	12,0	90,0	46,0	31,0	36,0	58839
0.4094	10,400 mm	12,0	90,0	47,0	31,0	36,0	67781
0.4134	10,500 mm	12,0	90,0	47,0	32,0	36,0	67782
0.4173	10,600 mm	12,0	90,0	48,0	32,0	36,0	67783
0.4213	10,700 mm	12,0	90,0	48,0	32,0	36,0	67784

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

146U 3xD
METRIC SERIES

CONTINUED

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.4219	10,716 mm	12,0	90,0	48,0	32,0	36,0	58840
0.4252	10,800 mm	12,0	90,0	49,0	32,0	36,0	67785
0.4291	10,900 mm	12,0	90,0	49,0	33,0	36,0	67786
0.4331	11,000 mm	12,0	95,0	50,0	33,0	36,0	67787
0.4370	11,100 mm	12,0	95,0	50,0	33,0	36,0	67788
0.4375	11,113 mm	12,0	95,0	50,0	33,0	36,0	58841
0.4409	11,200 mm	12,0	95,0	50,0	34,0	36,0	67789
0.4449	11,300 mm	12,0	95,0	51,0	34,0	36,0	67790
0.4488	11,400 mm	12,0	95,0	51,0	34,0	36,0	67791
0.4528	11,500 mm	12,0	95,0	52,0	35,0	36,0	67792
0.4531	11,509 mm	12,0	95,0	52,0	35,0	36,0	58842
0.4567	11,600 mm	12,0	95,0	52,0	35,0	36,0	67793
0.4606	11,700 mm	12,0	95,0	53,0	35,0	36,0	67794
0.4646	11,800 mm	12,0	95,0	53,0	35,0	36,0	67795
0.4685	11,900 mm	12,0	95,0	54,0	36,0	36,0	67796
0.4688	11,908 mm	12,0	95,0	54,0	36,0	36,0	58843
0.4724	12,000 mm	12,0	95,0	54,0	36,0	36,0	67797
0.4844	12,304 mm	14,0	105,0	55,0	37,0	37,0	58844
0.4921	12,500 mm	14,0	105,0	56,0	37,0	37,0	67798
0.5000	12,700 mm	14,0	105,0	57,0	38,0	37,0	58845
0.5039	12,800 mm	14,0	105,0	58,0	38,0	37,0	67799
0.5118	13,000 mm	14,0	105,0	58,0	39,0	37,0	67800
0.5156	13,096 mm	14,0	105,0	59,0	39,0	37,0	58846
0.5312	13,492 mm	14,0	105,0	61,0	40,0	37,0	58847
0.5315	13,500 mm	14,0	105,0	61,0	41,0	37,0	67801
0.5469	13,891 mm	14,0	105,0	63,0	42,0	37,0	58848
0.5512	14,000 mm	14,0	105,0	63,0	42,0	37,0	67802
0.5625	14,288 mm	16,0	115,0	64,0	43,0	38,0	58849
0.5709	14,500 mm	16,0	115,0	65,0	44,0	38,0	67803
0.5781	14,684 mm	16,0	115,0	66,0	44,0	38,0	58850
0.5906	15,000 mm	16,0	115,0	68,0	45,0	38,0	67804
0.5938	15,083 mm	16,0	115,0	68,0	45,0	38,0	58851
0.6094	15,479 mm	16,0	115,0	70,0	46,0	38,0	58852
0.6102	15,500 mm	16,0	115,0	70,0	46,0	38,0	67805
0.6250	15,875 mm	16,0	115,0	71,0	48,0	38,0	58853
0.6299	16,000 mm	16,0	115,0	72,0	48,0	38,0	67806
0.6406	16,271 mm	18,0	130,0	73,0	49,0	44,0	58854
0.6496	16,500 mm	18,0	130,0	74,0	49,0	44,0	67807
0.6562	16,667 mm	18,0	130,0	75,0	50,0	44,0	58855
0.6693	17,000 mm	18,0	130,0	77,0	51,0	44,0	67808
0.6719	17,066 mm	18,0	130,0	77,0	51,0	44,0	58856
0.6875	17,463 mm	18,0	130,0	79,0	52,0	44,0	58857
0.6890	17,500 mm	18,0	130,0	79,0	53,0	44,0	67809
0.7031	17,859 mm	18,0	130,0	80,0	54,0	44,0	58858

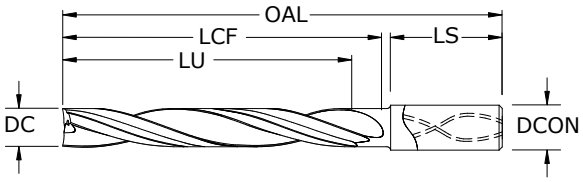
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

146U 3xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.7087	18,000 mm	18,0	130,0	81,0	54,0	44,0	67810
0.7188	18,258 mm	20,0	140,0	82,0	55,0	45,0	58859
0.7283	18,500 mm	20,0	140,0	83,0	55,0	45,0	67811
0.7344	18,654 mm	20,0	140,0	84,0	56,0	45,0	58860
0.7480	19,000 mm	20,0	140,0	85,0	57,0	45,0	67812
0.7500	19,050 mm	20,0	140,0	86,0	57,0	45,0	58861
0.7656	19,446 mm	20,0	140,0	88,0	58,0	45,0	58862
0.7677	19,500 mm	20,0	140,0	88,0	58,0	45,0	67813
0.7812	19,842 mm	20,0	140,0	89,0	60,0	45,0	58863
0.7874	20,000 mm	20,0	140,0	90,0	60,0	45,0	67814
0.7969	20,241 mm	22,0	150,0	91,0	61,0	52,0	58864
0.8071	20,500 mm	22,0	150,0	92,0	62,0	52,0	67815
0.8125	20,638 mm	22,0	150,0	93,0	62,0	52,0	58865

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

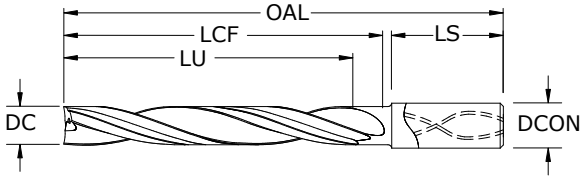
>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

Hi-PerCarb

HIGH PERFORMANCE CARBIDE DRILLS



146U 5xD

METRIC SERIES

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS
- NON-FERROUS

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.1181	3,000 mm	6,0	75,0	19,0	15,0	51,0	67816
0.1220	3,100 mm	6,0	80,0	20,0	15,0	49,0	67817
0.1250	3,175 mm	6,0	80,0	21,0	16,0	49,0	58866
0.1260	3,200 mm	6,0	80,0	21,0	16,0	49,0	67818
0.1299	3,300 mm	6,0	80,0	21,0	16,0	49,0	67819
0.1339	3,400 mm	6,0	80,0	22,0	17,0	49,0	67820
0.1360	3,454 mm	6,0	80,0	22,0	17,0	49,0	58867
0.1378	3,500 mm	6,0	80,0	23,0	18,0	49,0	67821
0.1405	3,569 mm	6,0	80,0	23,0	18,0	49,0	58868
0.1406	3,571 mm	6,0	80,0	23,0	18,0	49,0	58869
0.1417	3,600 mm	6,0	80,0	23,0	18,0	49,0	67822
0.1457	3,700 mm	6,0	80,0	24,0	19,0	49,0	67823
0.1470	3,734 mm	6,0	80,0	24,0	19,0	49,0	58870
0.1495	3,797 mm	6,0	80,0	25,0	19,0	49,0	58871
0.1496	3,800 mm	6,0	80,0	25,0	19,0	49,0	67824
0.1520	3,861 mm	6,0	80,0	25,0	19,0	49,0	58872
0.1535	3,900 mm	6,0	80,0	25,0	19,0	49,0	67825
0.1562	3,967 mm	6,0	80,0	26,0	20,0	49,0	58873
0.1570	3,988 mm	6,0	80,0	26,0	20,0	49,0	58874
0.1575	4,000 mm	6,0	80,0	26,0	20,0	49,0	67826
0.1590	4,039 mm	6,0	80,0	26,0	20,0	49,0	58875
0.1610	4,089 mm	6,0	90,0	27,0	20,0	53,0	58876
0.1614	4,100 mm	6,0	90,0	27,0	20,0	53,0	67827
0.1654	4,200 mm	6,0	90,0	27,0	21,0	53,0	67828
0.1693	4,300 mm	6,0	90,0	28,0	22,0	53,0	67829
0.1719	4,366 mm	6,0	90,0	28,0	22,0	53,0	58877
0.1732	4,400 mm	6,0	90,0	29,0	22,0	53,0	67830
0.1770	4,496 mm	6,0	90,0	29,0	22,0	53,0	58878
0.1772	4,500 mm	6,0	90,0	29,0	23,0	53,0	67831
0.1811	4,600 mm	6,0	90,0	30,0	23,0	53,0	67832
0.1850	4,699 mm	6,0	90,0	31,0	23,0	53,0	58879
0.1875	4,763 mm	6,0	90,0	31,0	24,0	53,0	58880
0.1890	4,801 mm	6,0	90,0	31,0	24,0	53,0	58881
0.1929	4,900 mm	6,0	90,0	32,0	24,0	53,0	67835
0.1935	4,915 mm	6,0	90,0	32,0	25,0	53,0	58882
0.1969	5,000 mm	6,0	95,0	33,0	25,0	51,0	67836
0.2008	5,100 mm	6,0	95,0	33,0	26,0	51,0	67837
0.2010	5,105 mm	6,0	95,0	33,0	26,0	51,0	58883
0.2031	5,159 mm	6,0	95,0	34,0	26,0	51,0	58884
0.2047	5,200 mm	6,0	95,0	34,0	26,0	51,0	67838
0.2087	5,300 mm	6,0	95,0	34,0	27,0	51,0	67839
0.2090	5,309 mm	6,0	95,0	35,0	27,0	51,0	58885

continued on next page

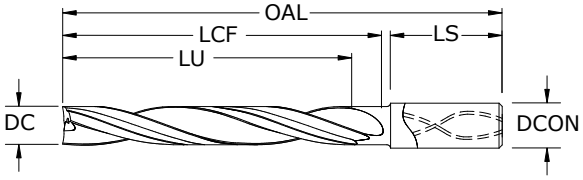
- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point reduces the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

146U 5xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point reduces the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.2126	5,400 mm	6,0	95,0	35,0	27,0	51,0	67840
0.2130	5,410 mm	6,0	95,0	35,0	27,0	51,0	58886
0.2165	5,500 mm	6,0	95,0	36,0	27,0	51,0	67841
0.2188	5,558 mm	6,0	95,0	36,0	28,0	51,0	58887
0.2205	5,600 mm	6,0	95,0	36,0	28,0	51,0	67842
0.2244	5,700 mm	6,0	95,0	37,0	28,0	51,0	67843
0.2283	5,800 mm	6,0	95,0	38,0	29,0	51,0	67844
0.2323	5,900 mm	6,0	95,0	38,0	30,0	51,0	67845
0.2344	5,954 mm	6,0	95,0	39,0	30,0	51,0	58888
0.2362	6,000 mm	6,0	95,0	39,0	30,0	51,0	67846
0.2402	6,100 mm	8,0	100,0	40,0	31,0	49,0	67847
0.2441	6,200 mm	8,0	100,0	40,0	31,0	49,0	67848
0.2461	6,250 mm	8,0	100,0	41,0	31,0	49,0	67849
0.2480	6,300 mm	8,0	100,0	41,0	31,0	49,0	67850
0.2500	6,350 mm	8,0	100,0	41,0	32,0	49,0	58889
0.2520	6,400 mm	8,0	100,0	42,0	32,0	49,0	67851
0.2559	6,500 mm	8,0	100,0	42,0	32,0	49,0	67852
0.2570	6,528 mm	8,0	100,0	42,0	33,0	49,0	58890
0.2598	6,600 mm	8,0	100,0	43,0	33,0	49,0	67853
0.2638	6,700 mm	8,0	100,0	44,0	34,0	49,0	67854
0.2656	6,746 mm	8,0	100,0	44,0	34,0	49,0	58891
0.2677	6,800 mm	8,0	100,0	44,0	34,0	49,0	67855
0.2717	6,900 mm	8,0	100,0	45,0	35,0	49,0	67856
0.2720	6,909 mm	8,0	100,0	45,0	35,0	49,0	58892
0.2756	7,000 mm	8,0	100,0	46,0	35,0	49,0	67857
0.2795	7,100 mm	8,0	100,0	46,0	35,0	49,0	67858
0.2812	7,142 mm	8,0	100,0	46,0	36,0	49,0	58893
0.2835	7,200 mm	8,0	110,0	47,0	36,0	53,0	67859
0.2854	7,250 mm	8,0	110,0	47,0	36,0	53,0	67860
0.2874	7,300 mm	8,0	110,0	47,0	36,0	53,0	67861
0.2913	7,400 mm	8,0	110,0	48,0	37,0	53,0	67862
0.2953	7,500 mm	8,0	110,0	49,0	38,0	53,0	67863
0.2969	7,541 mm	8,0	110,0	49,0	38,0	53,0	58894
0.2992	7,600 mm	8,0	110,0	49,0	38,0	53,0	67864
0.3031	7,700 mm	8,0	110,0	50,0	38,0	53,0	67865
0.3071	7,800 mm	8,0	110,0	51,0	39,0	53,0	67866
0.3110	7,900 mm	8,0	110,0	51,0	39,0	53,0	67867
0.3125	7,938 mm	8,0	110,0	52,0	40,0	53,0	58895
0.3150	8,000 mm	8,0	110,0	52,0	40,0	53,0	67868
0.3189	8,100 mm	10,0	115,0	53,0	41,0	51,0	67869
0.3228	8,200 mm	10,0	115,0	53,0	41,0	51,0	67870
0.3268	8,300 mm	10,0	115,0	54,0	42,0	51,0	67871

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

146U 5xD

METRIC SERIES

CONTINUED

DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	EDP NO. Ti-NAMITE-X (TX)
		mm					
0.3281	8,334 mm	10,0	115,0	54,0	42,0	51,0	58896
0.3307	8,400 mm	10,0	115,0	55,0	42,0	51,0	67872
0.3320	8,433 mm	10,0	115,0	55,0	42,0	51,0	58897
0.3346	8,500 mm	10,0	115,0	55,0	42,0	51,0	67873
0.3386	8,600 mm	10,0	115,0	56,0	43,0	51,0	67874
0.3425	8,700 mm	10,0	115,0	57,0	43,0	51,0	67875
0.3438	8,733 mm	10,0	115,0	57,0	44,0	51,0	58898
0.3465	8,800 mm	10,0	115,0	57,0	44,0	51,0	67876
0.3504	8,900 mm	10,0	115,0	58,0	45,0	51,0	67877
0.3543	9,000 mm	10,0	115,0	58,0	45,0	51,0	67878
0.3583	9,100 mm	10,0	115,0	59,0	46,0	51,0	67879
0.3594	9,129 mm	10,0	115,0	59,0	46,0	51,0	58899
0.3622	9,200 mm	10,0	125,0	60,0	46,0	55,0	67880
0.3661	9,300 mm	10,0	125,0	60,0	46,0	55,0	67881
0.3680	9,347 mm	10,0	125,0	61,0	47,0	55,0	58900
0.3701	9,400 mm	10,0	125,0	61,0	47,0	55,0	67882
0.3740	9,500 mm	10,0	125,0	62,0	47,0	55,0	67883
0.3750	9,525 mm	10,0	125,0	62,0	48,0	55,0	58901
0.3780	9,600 mm	10,0	125,0	62,0	48,0	55,0	67884
0.3819	9,700 mm	10,0	125,0	63,0	49,0	55,0	67885
0.3858	9,800 mm	10,0	125,0	64,0	49,0	55,0	67886
0.3898	9,900 mm	10,0	125,0	64,0	50,0	55,0	67887
0.3906	9,921 mm	10,0	125,0	64,0	50,0	55,0	58902
0.3937	10,000 mm	10,0	125,0	65,0	50,0	55,0	67888
0.3970	10,084 mm	12,0	135,0	66,0	50,0	57,0	58903
0.3976	10,100 mm	12,0	135,0	66,0	50,0	57,0	67889
0.4016	10,200 mm	12,0	135,0	66,0	51,0	57,0	67890
0.4040	10,262 mm	12,0	135,0	67,0	51,0	57,0	58904
0.4055	10,300 mm	12,0	135,0	67,0	51,0	57,0	67891
0.4062	10,317 mm	12,0	135,0	67,0	52,0	57,0	58905
0.4094	10,400 mm	12,0	135,0	68,0	52,0	57,0	67892
0.4134	10,500 mm	12,0	135,0	68,0	53,0	57,0	67893
0.4173	10,600 mm	12,0	135,0	69,0	53,0	57,0	67894
0.4213	10,700 mm	12,0	135,0	70,0	54,0	57,0	67895
0.4219	10,716 mm	12,0	135,0	70,0	54,0	57,0	58906
0.4252	10,800 mm	12,0	135,0	70,0	54,0	57,0	67896
0.4291	10,900 mm	12,0	135,0	71,0	54,0	57,0	67897
0.4331	11,000 mm	12,0	135,0	72,0	55,0	57,0	67898
0.4370	11,100 mm	12,0	135,0	72,0	55,0	57,0	67899
0.4375	11,113 mm	12,0	135,0	72,0	56,0	57,0	58907
0.4409	11,200 mm	12,0	135,0	73,0	56,0	57,0	67900
0.4449	11,300 mm	12,0	135,0	73,0	57,0	57,0	67901
0.4488	11,400 mm	12,0	145,0	74,0	57,0	62,0	67902
0.4528	11,500 mm	12,0	145,0	75,0	58,0	62,0	67903
0.4531	11,509 mm	12,0	145,0	75,0	58,0	62,0	58908
0.4567	11,600 mm	12,0	145,0	75,0	58,0	62,0	67904
0.4606	11,700 mm	12,0	145,0	76,0	58,0	62,0	67905
0.4646	11,800 mm	12,0	145,0	77,0	59,0	62,0	67906
0.4685	11,900 mm	12,0	145,0	77,0	59,0	62,0	67907
0.4688	11,908 mm	12,0	145,0	77,0	60,0	62,0	58909

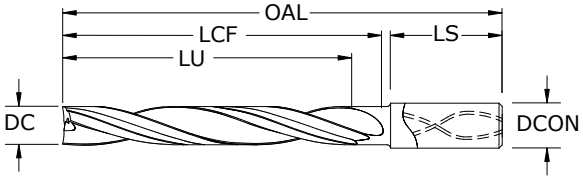
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

146U 5xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point reduces the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.4724	12,000 mm	12,0	145,0	78,0	60,0	62,0	67908
0.4844	12,304 mm	14,0	155,0	80,0	62,0	59,0	58910
0.4921	12,500 mm	14,0	155,0	81,0	62,0	59,0	67909
0.5000	12,700 mm	14,0	155,0	83,0	64,0	59,0	58911
0.5039	12,800 mm	14,0	155,0	83,0	64,0	59,0	67910
0.5118	13,000 mm	14,0	155,0	84,0	65,0	59,0	67911
0.5156	13,096 mm	14,0	155,0	85,0	65,0	59,0	58912
0.5312	13,492 mm	14,0	155,0	88,0	67,0	59,0	58913
0.5315	13,500 mm	14,0	155,0	88,0	68,0	59,0	67912
0.5469	13,891 mm	14,0	155,0	90,0	69,0	59,0	58914
0.5512	14,000 mm	14,0	155,0	91,0	70,0	59,0	67913
0.5625	14,288 mm	16,0	175,0	93,0	71,0	66,0	58915
0.5709	14,500 mm	16,0	175,0	94,0	73,0	66,0	67914
0.5781	14,684 mm	16,0	175,0	95,0	73,0	66,0	58916
0.5906	15,000 mm	16,0	175,0	98,0	75,0	66,0	67915
0.5938	15,083 mm	16,0	175,0	98,0	75,0	66,0	58917
0.6094	15,479 mm	16,0	175,0	101,0	77,0	66,0	58918
0.6102	15,500 mm	16,0	175,0	101,0	77,0	66,0	67916
0.6250	15,875 mm	16,0	175,0	103,0	79,0	66,0	58919
0.6299	16,000 mm	16,0	175,0	104,0	80,0	66,0	67917
0.6406	16,271 mm	18,0	195,0	106,0	81,0	73,0	58920
0.6496	16,500 mm	18,0	195,0	107,0	82,0	73,0	67918
0.6562	16,667 mm	18,0	195,0	108,0	83,0	73,0	58921
0.6693	17,000 mm	18,0	195,0	111,0	85,0	73,0	67919
0.6719	17,066 mm	18,0	195,0	111,0	85,0	73,0	58922
0.6875	17,463 mm	18,0	195,0	114,0	87,0	73,0	58923
0.6890	17,500 mm	18,0	195,0	114,0	88,0	73,0	67920
0.7031	17,859 mm	18,0	195,0	116,0	89,0	73,0	58924
0.7087	18,000 mm	18,0	195,0	117,0	90,0	73,0	67921
0.7188	18,258 mm	20,0	215,0	119,0	91,0	80,0	58925
0.7283	18,500 mm	20,0	215,0	120,0	92,0	80,0	67922
0.7344	18,654 mm	20,0	215,0	121,0	93,0	80,0	58926
0.7480	19,000 mm	20,0	215,0	123,0	95,0	80,0	67923
0.7500	19,050 mm	20,0	215,0	124,0	95,0	80,0	58927
0.7656	19,446 mm	20,0	215,0	126,0	97,0	80,0	58928
0.7677	19,500 mm	20,0	215,0	127,0	97,0	80,0	67924
0.7812	19,842 mm	20,0	215,0	129,0	99,0	80,0	58929
0.7874	20,000 mm	20,0	215,0	130,0	100,0	80,0	67925
0.7969	20,241 mm	22,0	220,0	132,0	101,0	81,0	58930
0.8071	20,500 mm	22,0	220,0	133,0	103,0	81,0	67926
0.8125	20,638 mm	22,0	220,0	134,0	103,0	81,0	58931

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

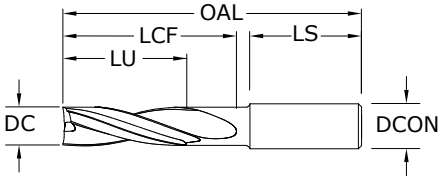
>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS



136U 2xD

METRIC SERIES

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- HIGH TEMP ALLOYS
- NON-FERROUS

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.0591	1,500 mm	6,0	45,0	5,0	3,0	33,0	67060
0.0625	1,588 mm	6,0	45,0	6,0	3,0	33,0	58480
0.0630	1,600 mm	6,0	45,0	6,0	3,0	33,0	67061
0.0669	1,700 mm	6,0	45,0	6,0	3,0	33,0	67062
0.0709	1,800 mm	6,0	45,0	6,0	4,0	33,0	67063
0.0748	1,900 mm	6,0	45,0	7,0	4,0	33,0	67064
0.0781	1,984 mm	6,0	45,0	7,0	4,0	33,0	58481
0.0787	2,000 mm	6,0	45,0	7,0	4,0	33,0	67065
0.0827	2,100 mm	6,0	45,0	7,0	4,0	33,0	67066
0.0866	2,200 mm	6,0	50,0	8,0	4,0	31,0	67067
0.0906	2,300 mm	6,0	50,0	8,0	5,0	31,0	67068
0.0938	2,383 mm	6,0	50,0	8,0	5,0	31,0	58482
0.0945	2,400 mm	6,0	50,0	8,0	5,0	31,0	67069
0.0984	2,500 mm	6,0	50,0	9,0	5,0	31,0	67070
0.1015	2,578 mm	6,0	50,0	9,0	5,0	31,0	58483
0.1024	2,600 mm	6,0	50,0	9,0	5,0	31,0	67071
0.1040	2,642 mm	6,0	50,0	9,0	5,0	31,0	58484
0.1063	2,700 mm	6,0	50,0	9,0	5,0	31,0	67072
0.1065	2,705 mm	6,0	50,0	9,0	5,0	31,0	58485
0.1094	2,779 mm	6,0	50,0	10,0	6,0	31,0	58486
0.1102	2,800 mm	6,0	50,0	10,0	6,0	31,0	67073
0.1130	2,870 mm	6,0	50,0	10,0	6,0	31,0	58487
0.1142	2,900 mm	6,0	50,0	10,0	6,0	31,0	67074
0.1181	3,000 mm	6,0	50,0	10,0	6,0	31,0	67075
0.1220	3,100 mm	6,0	50,0	11,0	6,0	31,0	67076
0.1250	3,175 mm	6,0	50,0	11,0	6,0	31,0	58488
0.1260	3,200 mm	6,0	50,0	11,0	6,0	31,0	67077
0.1299	3,300 mm	6,0	50,0	12,0	7,0	31,0	67078
0.1339	3,400 mm	6,0	50,0	12,0	7,0	31,0	67079
0.1360	3,454 mm	6,0	50,0	12,0	7,0	31,0	58489
0.1378	3,500 mm	6,0	50,0	12,0	7,0	31,0	67080
0.1405	3,569 mm	6,0	50,0	12,0	7,0	31,0	58490
0.1406	3,571 mm	6,0	50,0	12,0	7,0	31,0	58491
0.1417	3,600 mm	6,0	50,0	13,0	7,0	31,0	67081
0.1457	3,700 mm	6,0	50,0	13,0	7,0	31,0	67082
0.1470	3,734 mm	6,0	50,0	13,0	7,0	31,0	58492
0.1495	3,797 mm	6,0	50,0	13,0	8,0	31,0	58493
0.1496	3,800 mm	6,0	50,0	13,0	8,0	31,0	67083

continued on next page

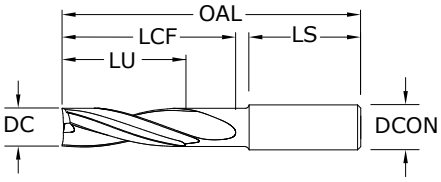
- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

136U 2xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.1520	3,861 mm	6,0	50,0	14,0	8,0	31,0	58494
0.1535	3,900 mm	6,0	50,0	14,0	8,0	31,0	67084
0.1562	3,967 mm	6,0	50,0	14,0	8,0	31,0	58495
0.1570	3,988 mm	6,0	50,0	14,0	8,0	31,0	58496
0.1575	4,000 mm	6,0	50,0	14,0	8,0	31,0	67085
0.1590	4,039 mm	6,0	50,0	14,0	8,0	31,0	58497
0.1610	4,089 mm	6,0	50,0	14,0	8,0	31,0	58498
0.1614	4,100 mm	6,0	50,0	14,0	8,0	31,0	67086
0.1654	4,200 mm	6,0	60,0	15,0	8,0	34,0	67087
0.1693	4,300 mm	6,0	60,0	15,0	9,0	34,0	67088
0.1719	4,366 mm	6,0	60,0	15,0	9,0	34,0	58499
0.1732	4,400 mm	6,0	60,0	15,0	9,0	34,0	67089
0.1770	4,496 mm	6,0	60,0	16,0	9,0	34,0	58500
0.1772	4,500 mm	6,0	60,0	16,0	9,0	34,0	67090
0.1811	4,600 mm	6,0	60,0	16,0	9,0	34,0	67091
0.1850	4,699 mm	6,0	60,0	16,0	9,0	34,0	58501
0.1875	4,763 mm	6,0	60,0	17,0	10,0	34,0	58502
0.1890	4,801 mm	6,0	60,0	17,0	10,0	34,0	58503
0.1929	4,900 mm	6,0	60,0	17,0	10,0	34,0	67094
0.1935	4,915 mm	6,0	60,0	17,0	10,0	34,0	58504
0.1969	5,000 mm	6,0	60,0	18,0	10,0	34,0	67095
0.2008	5,100 mm	6,0	60,0	18,0	10,0	34,0	67096
0.2010	5,105 mm	6,0	60,0	18,0	10,0	34,0	58505
0.2031	5,159 mm	6,0	60,0	18,0	10,0	34,0	58506
0.2047	5,200 mm	6,0	60,0	18,0	10,0	34,0	67097
0.2087	5,300 mm	6,0	60,0	19,0	11,0	34,0	67098
0.2090	5,309 mm	6,0	60,0	19,0	11,0	34,0	58507
0.2126	5,400 mm	6,0	60,0	19,0	11,0	34,0	67099
0.2130	5,410 mm	6,0	60,0	19,0	11,0	34,0	58508
0.2165	5,500 mm	6,0	60,0	19,0	11,0	34,0	67100
0.2188	5,558 mm	6,0	60,0	19,0	11,0	34,0	58509
0.2205	5,600 mm	6,0	60,0	20,0	11,0	34,0	67101
0.2244	5,700 mm	6,0	60,0	20,0	11,0	34,0	67102
0.2283	5,800 mm	6,0	60,0	20,0	12,0	34,0	67103
0.2323	5,900 mm	6,0	60,0	21,0	12,0	34,0	67104
0.2344	5,954 mm	6,0	60,0	21,0	12,0	34,0	58510
0.2362	6,000 mm	6,0	60,0	21,0	12,0	34,0	67105
0.2402	6,100 mm	8,0	70,0	22,0	13,0	37,0	67106

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

136U 2xD

METRIC SERIES

CONTINUED

DECIMAL DC	METRIC DC	SHANK DIAMETER DCON (mm)	OVERALL LENGTH OAL (mm)	FLUTE LENGTH LCF (mm)	USABLE LENGTH LU (mm)	SHANK LENGTH LS (mm)	EDP NO. Ti-NAMITE-X (TX)
0.2441	6,200 mm	8,0	70,0	22,0	12,0	37,0	67107
0.2461	6,250 mm	8,0	70,0	22,0	13,0	37,0	67108
0.2480	6,300 mm	8,0	70,0	22,0	13,0	37,0	67109
0.2500	6,350 mm	8,0	70,0	22,0	13,0	37,0	58511
0.2520	6,400 mm	8,0	70,0	22,0	13,0	37,0	67110
0.2559	6,500 mm	8,0	70,0	23,0	13,0	37,0	67111
0.2570	6,528 mm	8,0	70,0	23,0	13,0	37,0	58512
0.2598	6,600 mm	8,0	70,0	23,0	13,0	37,0	67112
0.2638	6,700 mm	8,0	70,0	23,0	13,0	37,0	67113
0.2656	6,746 mm	8,0	70,0	24,0	13,0	37,0	58513
0.2677	6,800 mm	8,0	70,0	24,0	14,0	37,0	67114
0.2717	6,900 mm	8,0	70,0	24,0	14,0	37,0	67115
0.2720	6,909 mm	8,0	70,0	24,0	14,0	37,0	58514
0.2756	7,000 mm	8,0	70,0	25,0	14,0	37,0	67116
0.2795	7,100 mm	8,0	70,0	25,0	14,0	37,0	67117
0.2812	7,142 mm	8,0	70,0	25,0	14,0	37,0	58515
0.2835	7,200 mm	8,0	70,0	25,0	14,0	37,0	67118
0.2854	7,250 mm	8,0	70,0	25,0	14,0	37,0	67119
0.2874	7,300 mm	8,0	70,0	26,0	15,0	37,0	67120
0.2913	7,400 mm	8,0	70,0	26,0	15,0	37,0	67121
0.2953	7,500 mm	8,0	70,0	26,0	15,0	37,0	67122
0.2969	7,541 mm	8,0	70,0	26,0	15,0	37,0	58516
0.2992	7,600 mm	8,0	70,0	27,0	15,0	37,0	67123
0.3031	7,700 mm	8,0	70,0	27,0	15,0	37,0	67124
0.3071	7,800 mm	8,0	70,0	27,0	16,0	37,0	67125
0.3110	7,900 mm	8,0	70,0	28,0	16,0	37,0	67126
0.3125	7,938 mm	8,0	70,0	28,0	16,0	37,0	58517
0.3150	8,000 mm	8,0	70,0	28,0	16,0	37,0	67127
0.3189	8,100 mm	10,0	80,0	29,0	17,0	40,0	67128
0.3228	8,200 mm	10,0	80,0	29,0	16,0	40,0	67129
0.3268	8,300 mm	10,0	80,0	29,0	17,0	40,0	67130
0.3281	8,334 mm	10,0	80,0	29,0	17,0	40,0	58518
0.3307	8,400 mm	10,0	80,0	29,0	17,0	40,0	67131
0.3320	8,433 mm	10,0	80,0	30,0	17,0	40,0	58519
0.3346	8,500 mm	10,0	80,0	30,0	17,0	40,0	67132
0.3386	8,600 mm	10,0	80,0	30,0	17,0	40,0	67133
0.3425	8,700 mm	10,0	80,0	30,0	17,0	40,0	67134
0.3438	8,733 mm	10,0	80,0	31,0	17,0	40,0	58520
0.3465	8,800 mm	10,0	80,0	31,0	18,0	40,0	67135
0.3504	8,900 mm	10,0	80,0	31,0	18,0	40,0	67136
0.3543	9,000 mm	10,0	80,0	31,0	18,0	40,0	67137
0.3583	9,100 mm	10,0	80,0	32,0	18,0	40,0	67138
0.3594	9,129 mm	10,0	80,0	32,0	18,0	40,0	58521
0.3622	9,200 mm	10,0	80,0	32,0	18,0	40,0	67139
0.3661	9,300 mm	10,0	80,0	33,0	19,0	40,0	67140
0.3680	9,347 mm	10,0	80,0	33,0	19,0	40,0	58522

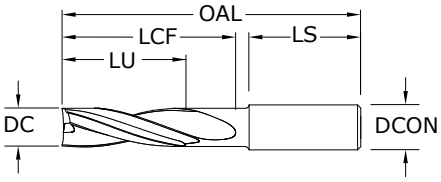
continued on next page

Hi-PerCarb

HI-PERCARB
HIGH PERFORMANCE CARBIDE DRILLS

136U 2xD

METRIC SERIES



CONTINUED

- 4-margin design improves accuracy and surface finish along with increased strength for aggressive drilling
- Specialized self-centering notched point eliminates the need for spot drilling decreasing thrust and deflection
- Engineered edge protection improves edge strength and reduces edge fatigue allowing for increased feed rates
- Recommended for materials ≤ 56 HRc (≤ 577 Bhn)

		mm					EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.3701	9,400 mm	10,0	80,0	33,0	19,0	40,0	67141
0.3740	9,500 mm	10,0	80,0	33,0	19,0	40,0	67142
0.3750	9,525 mm	10,0	80,0	33,0	19,0	40,0	58523
0.3780	9,600 mm	10,0	80,0	34,0	19,0	40,0	67143
0.3819	9,700 mm	10,0	80,0	34,0	19,0	40,0	67144
0.3858	9,800 mm	10,0	80,0	34,0	20,0	40,0	67145
0.3898	9,900 mm	10,0	80,0	35,0	20,0	40,0	67146
0.3906	9,921 mm	10,0	80,0	35,0	20,0	40,0	58524
0.3937	10,000 mm	10,0	80,0	35,0	20,0	40,0	67147
0.3970	10,084 mm	12,0	90,0	36,0	21,0	43,0	58525
0.3976	10,100 mm	12,0	90,0	36,0	21,0	43,0	67148
0.4016	10,200 mm	12,0	90,0	36,0	20,0	43,0	67149
0.4040	10,262 mm	12,0	90,0	36,0	21,0	43,0	58526
0.4055	10,300 mm	12,0	90,0	36,0	21,0	43,0	67150
0.4062	10,317 mm	12,0	90,0	36,0	21,0	43,0	58527
0.4094	10,400 mm	12,0	90,0	36,0	21,0	43,0	67151
0.4134	10,500 mm	12,0	90,0	37,0	21,0	43,0	67152
0.4173	10,600 mm	12,0	90,0	37,0	21,0	43,0	67153
0.4213	10,700 mm	12,0	90,0	37,0	21,0	43,0	67154
0.4219	10,716 mm	12,0	90,0	38,0	21,0	43,0	58528
0.4252	10,800 mm	12,0	90,0	38,0	22,0	43,0	67155
0.4291	10,900 mm	12,0	90,0	38,0	22,0	43,0	67156
0.4331	11,000 mm	12,0	90,0	39,0	22,0	43,0	67157
0.4370	11,100 mm	12,0	90,0	39,0	22,0	43,0	67158
0.4375	11,113 mm	12,0	90,0	39,0	22,0	43,0	58529
0.4409	11,200 mm	12,0	90,0	39,0	22,0	43,0	67159
0.4449	11,300 mm	12,0	90,0	40,0	23,0	43,0	67160
0.4488	11,400 mm	12,0	90,0	40,0	23,0	43,0	67161
0.4528	11,500 mm	12,0	90,0	40,0	23,0	43,0	67162
0.4531	11,509 mm	12,0	90,0	40,0	23,0	43,0	58530
0.4567	11,600 mm	12,0	90,0	41,0	23,0	43,0	67163
0.4606	11,700 mm	12,0	90,0	41,0	23,0	43,0	67164
0.4646	11,800 mm	12,0	90,0	41,0	24,0	43,0	67165
0.4685	11,900 mm	12,0	90,0	42,0	24,0	43,0	67166
0.4688	11,908 mm	12,0	90,0	42,0	24,0	43,0	58531
0.4724	12,000 mm	12,0	90,0	42,0	24,0	43,0	67167
0.4844	12,304 mm	14,0	100,0	43,0	25,0	46,0	58532
0.4921	12,500 mm	14,0	100,0	44,0	25,0	46,0	67168

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,002/+0,012
DCON = h_6

>3–6 DIAMETER
DC = +0,004/+0,016
DCON = h_6

>6–10 DIAMETER
DC = +0,006/+0,021
DCON = h_6

>10–18 DIAMETER
DC = +0,007/+0,025
DCON = h_6

>18–30 DIAMETER
DC = +0,008/+0,029
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

136U 2xD

METRIC SERIES

CONTINUED

			mm				EDP NO.
DECIMAL DC	METRIC DC	SHANK DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	SHANK LENGTH LS	Ti-NAMITE-X (TX)
0.5000	12,700 mm	14,0	100,0	44,0	25,0	46,0	58533
0.5039	12,800 mm	14,0	100,0	45,0	26,0	46,0	67169
0.5118	13,000 mm	14,0	100,0	45,0	26,0	46,0	67170
0.5156	13,096 mm	14,0	100,0	46,0	26,0	46,0	58534
0.5312	13,492 mm	14,0	100,0	47,0	27,0	46,0	58535
0.5315	13,500 mm	14,0	100,0	47,0	27,0	46,0	67171
0.5469	13,891 mm	14,0	100,0	49,0	28,0	46,0	58536
0.5512	14,000 mm	14,0	100,0	49,0	28,0	46,0	67172
0.5625	14,288 mm	16,0	110,0	50,0	29,0	49,0	58537
0.5709	14,500 mm	16,0	110,0	51,0	29,0	49,0	67173
0.5781	14,684 mm	16,0	110,0	51,0	29,0	49,0	58538
0.5906	15,000 mm	16,0	110,0	53,0	30,0	49,0	67174
0.5938	15,083 mm	16,0	110,0	53,0	30,0	49,0	58539
0.6094	15,479 mm	16,0	110,0	54,0	31,0	49,0	58540
0.6102	15,500 mm	16,0	110,0	54,0	31,0	49,0	67175
0.6250	15,875 mm	16,0	110,0	56,0	32,0	49,0	58541
0.6299	16,000 mm	16,0	110,0	56,0	32,0	49,0	67176
0.6406	16,271 mm	18,0	125,0	57,0	33,0	57,0	58542
0.6496	16,500 mm	18,0	125,0	58,0	33,0	57,0	67177
0.6562	16,667 mm	18,0	125,0	58,0	33,0	57,0	58543
0.6693	17,000 mm	18,0	125,0	60,0	34,0	57,0	67178
0.6719	17,066 mm	18,0	125,0	60,0	34,0	57,0	58544
0.6875	17,463 mm	18,0	125,0	61,0	35,0	57,0	58545
0.6890	17,500 mm	18,0	125,0	61,0	35,0	57,0	67179
0.7031	17,859 mm	18,0	125,0	63,0	36,0	57,0	58546
0.7087	18,000 mm	18,0	125,0	63,0	36,0	57,0	67180
0.7188	18,258 mm	20,0	135,0	64,0	37,0	60,0	58547
0.7283	18,500 mm	20,0	135,0	65,0	37,0	60,0	67181
0.7344	18,654 mm	20,0	135,0	65,0	37,0	60,0	58548
0.7480	19,000 mm	20,0	135,0	66,0	38,0	60,0	67182
0.7500	19,050 mm	20,0	135,0	67,0	38,0	60,0	58549
0.7656	19,446 mm	20,0	135,0	68,0	39,0	60,0	58550
0.7677	19,500 mm	20,0	135,0	68,0	39,0	60,0	67183
0.7812	19,842 mm	20,0	135,0	69,0	40,0	60,0	58551
0.7874	20,000 mm	20,0	135,0	70,0	40,0	60,0	67184
0.7969	20,241 mm	22,0	145,0	71,0	40,0	68,0	58552
0.8071	20,500 mm	22,0	145,0	72,0	41,0	68,0	67185
0.8125	20,638 mm	22,0	145,0	72,0	41,0	68,0	58553

Hi-PerCarb

	Series 146U, 136U Metric	Hardness	Vc (m/mm)		DC • mm 1.5	3	6	8	10	12	16	20
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	87	RPM	18419	9209	4605	3454	2763	2302	1727	1381
			(69-104)	Fr	0.037	0.074	0.149	0.199	0.248	0.298	0.397	0.496
				Feed (mm/min)	686	686	686	686	686	686	686	686
		≤ 275 Bhn or ≤ 28 HRc	78	RPM	16480	8240	4120	3090	2472	2060	1545	1236
			(62-93)	Fr	0.032	0.065	0.129	0.173	0.216	0.259	0.345	0.432
				Feed (mm/min)	533	533	533	533	533	533	533	533
		≤ 425 Bhn or ≤ 45 HRc	44	RPM	9371	4686	2343	1757	1406	1171	879	703
			(35-53)	Fr	0.027	0.054	0.108	0.145	0.181	0.217	0.289	0.361
				Feed (mm/min)	254	254	254	254	254	254	254	254
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	67	RPM	14218	7109	3555	2666	2133	1777	1333	1066
			(54-80)	Fr	0.036	0.071	0.143	0.191	0.238	0.286	0.381	0.476
				Feed (mm/min)	508	508	508	508	508	508	508	508
		≤ 375 Bhn or ≤ 40 HRc	41	RPM	8725	4362	2181	1636	1309	1091	818	654
			(33-49)	Fr	0.032	0.064	0.128	0.171	0.213	0.256	0.342	0.427
				Feed (mm/min)	279	279	279	279	279	279	279	279
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 200 Bhn or ≤ 13 HRc	38	RPM	8078	4039	2020	1515	1212	1010	757	606
			(30-46)	Fr	0.030	0.060	0.119	0.159	0.199	0.239	0.319	0.398
				Feed (mm/min)	241	241	241	241	241	241	241	241
		≤ 375 Bhn or ≤ 40 HRc	27	RPM	5816	2908	1454	1091	872	727	545	436
			(22-33)	Fr	0.013	0.026	0.052	0.070	0.087	0.105	0.140	0.175
				Feed (mm/min)	76	76	76	76	76	76	76	76
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 185 Bhn or ≤ 9 HRc	81	RPM	17126	8563	4282	3211	2569	2141	1606	1284
			(65-97)	Fr	0.019	0.039	0.077	0.103	0.129	0.154	0.206	0.257
				Feed (mm/min)	330	330	330	330	330	330	330	330
		≤ 275 Bhn or ≤ 28 HRc	52	RPM	10987	5493	2747	2060	1648	1373	1030	824
			(41-62)	Fr	0.015	0.030	0.060	0.080	0.100	0.120	0.160	0.200
				Feed (mm/min)	165	165	165	165	165	165	165	165
	STAINLESS STEELS (DIFFICULT) 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	40	RPM	8402	4201	2100	1575	1260	1050	788	630
			(32-48)	Fr	0.015	0.030	0.060	0.081	0.101	0.121	0.161	0.202
				Feed (mm/min)	127	127	127	127	127	127	127	127
		≤ 375 Bhn or ≤ 40 HRc	29	RPM	6140	3070	1535	1151	921	767	576	460
			(23-35)	Fr	0.014	0.027	0.055	0.073	0.091	0.109	0.146	0.182
				Feed (mm/min)	84	84	84	84	84	84	84	84
K	GRAY CAST IRONS	≤ 220 Bhn or ≤ 19 HRc	76	RPM	16157	8078	4039	3029	2424	2020	1515	1212
			(61-91)	Fr	0.038	0.075	0.151	0.201	0.252	0.302	0.402	0.503
				Feed (mm/min)	610	610	610	610	610	610	610	610
	DUCTILE CAST IRONS	≤ 260 Bhn or ≤ 26 HRc	67	RPM	14218	7109	3555	2666	2133	1777	1333	1066
			(54-80)	Fr	0.036	0.071	0.143	0.191	0.238	0.286	0.381	0.476
				Feed (mm/min)	508	508	508	508	508	508	508	508

continued on next page

Hi-PerCarb

	Series 146U, 136U Metric	Hardness	Vc (m/mm)		DC • mm 1.5	3	6	8	10	12	16	20
N	ALUMINUM ALLOYS (WROUGHT) 2024, 6061, 7075	≤ 150 Bhn or ≤ 88 HRb	145	RPM	30698	15349	7675	5756	4605	3837	2878	2302
			(116-174)	Fr	0.037	0.074	0.149	0.199	0.248	0.298	0.397	0.496
				Feed (mm/min)	1143	1143	1143	1143	1143	1143	1143	1143
	ALUMINUM ALLOYS (CAST) A356, A380, 390	≤ 140 Bhn or ≤ 3 HRc	116	RPM	24559	12279	6140	4605	3684	3070	2302	1842
			(93-139)	Fr	0.033	0.066	0.132	0.177	0.221	0.265	0.353	0.441
				Feed (mm/min)	813	813	813	813	813	813	813	813
S	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V	≤ 275 Bhn or ≤ 28 HRc	53	RPM	11310	5655	2827	2121	1696	1414	1060	848
			(43-64)	Fr	0.017	0.033	0.066	0.089	0.111	0.133	0.177	0.222
				Feed (mm/min)	188	188	188	188	188	188	188	188
		≤ 350 Bhn or ≤ 38 HRc	40	RPM	8402	4201	2100	1575	1260	1050	788	630
			(32-48)	Fr	0.015	0.030	0.060	0.081	0.101	0.121	0.161	0.202
				Feed (mm/min)	127	127	127	127	127	127	127	127
		≤ 440 Bhn or ≤ 47 HRc	21	RPM	4524	2262	1131	848	679	565	424	339
			(17-26)	Fr	0.011	0.022	0.045	0.060	0.075	0.090	0.120	0.150
				Feed (mm/min)	51	51	51	51	51	51	51	51
H	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 450 Bhn or ≤ 48 HRc	29	RPM	6140	3070	1535	1151	921	767	576	460
			(23-35)	Fr	0.019	0.037	0.074	0.099	0.124	0.149	0.199	0.248
				Feed (mm/min)	114	114	114	114	114	114	114	114
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	24	RPM	5170	2585	1293	969	776	646	485	388
			(20-29)	Fr	0.017	0.034	0.069	0.092	0.115	0.138	0.183	0.229
				Feed (mm/min)	89	89	89	89	89	89	89	89

reduce rates when material is harder than listed, when drilling conditions are not optimum, or coolant is not available
rates shown are for drilling into a flat surface and should be lowered using the reducion multiplier when the workpiece is angled or curved
reduce rates 10 to 20 percent when using drills without internal coolant
always use the shortest overhang possible
longer drills may require a spot drill operation to avoid walking on entry
internal coolant required in ISO S and M material groups or when drilling depth exceeds 3xD
Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

	reduction multiplier	
angle °	speed x	feed x
up to 30	1.0	0.6
over 30	0.7	0.4

SGS
Solid Carbide Tools

VALUE AT THE SPINDLE

General Application End Mills

Milling

SERIES	GENERAL APPLICATION END MILLS DESCRIPTION	PAGE	S&F PAGE
3M	2 Flute Square End Standard Length Metric	191	208
3XLM	2 Flute Square End Extra Long Reach Metric	191	208
3MB	2 Flute Ball End Standard Length Metric	192	209
3XLMB	2 Flute Ball End Extra Long Reach Metric	192	209
17M	2 Flute Square End Stub Metric	193	208
52M	2 Flute High Shear Square End Standard Length Metric	194	210
59M	2 Flute Square End Long Reach Metric	195	208
59MB	2 Flute Ball End Long Reach Metric	196	209
5M	3 Flute Square End Standard Length Metric	197	208
5XLM	3 Flute Square End Extra Long Reach Metric	197	208
5MB	3 Flute Ball End Standard Length Metric	198	208
5XLMB	3 Flute Ball End Extra Long Reach Metric	198	208
1M	4 Flute Square End Standard Length Metric	199	208
1XLM	4 Flute Square End Extra Long Reach Metric	199	208
1MCR	4 Flute Corner Radius Standard Length Metric	199	208
1MB	4 Flute Ball End Standard Length Metric	202	208
1XLMB	4 Flute Ball End Extra Long Reach Metric	202	208
14M	4 Flute Double End Square Stub Metric	203	208
14MB	4 Flute Double End Ball Stub Metric	204	208
16M	4 Flute Square End Stub Metric	199	208
54M	4 Flute High Shear Square End Standard Length Metric	205	210
61M	Multi-Flute Coarse Pitch Rougher Metric	206	212
62M	Multi-Flute Fine Pitch Rougher Metric	207	213

Speed & Feed Recommendations listed at the end of this section

Fresado

SERIE	DESCRIPCIÓN DE FRESAS DE USO GENERAL	PÁGINA	S&F PÁGINA
3M	2 filos, punta cuadrada, longitud estándar, métrico	191	208
3XLM	2 filos, punta cuadrada, alcance extralargo, métrico	191	208
3MB	2 filos, punta esférica, longitud estándar, métrico	192	209
3XLMB	2 filos, punta esférica, alcance extralargo, métrico	192	209
17M	2 filos, pieza de punta cuadrada, métrico	193	208
52M	2 filos, alto rendimiento, punta cuadrada, longitud estándar, métrico	194	210
59M	2 filos, punta cuadrada, largo alcance, métrico	195	208
59MB	2 filos, punta esférica, largo alcance, métrico	196	209
5M	3 filos, punta cuadrada, longitud estándar, métrico	197	208
5XLM	3 filos, punta cuadrada, alcance extralargo, métrico	197	208
5MB	3 filos, punta esférica, longitud estándar, métrico	198	208
5XLMB	3 filos, punta esférica, alcance extralargo, métrico	198	208
1M	4 filos, punta cuadrada, longitud estándar, métrico	199	208
1XLM	4 filos, punta cuadrada, alcance extralargo, métrico	199	208
1MCR	4 filos, radio angulado, longitud estándar, métrico	199	208
1MB	4 filos, punta esférica, longitud estándar, métrico	202	208
1XLMB	4 filos, punta esférica, alcance extralargo, métrico	202	208
14M	4 filos, pieza doble de punta cuadrada, métrico	203	208
14MB	4 filos, pieza doble de punta esférica, métrico	204	208
16M	4 filos, pieza de punta cuadrada, métrico	199	208
54M	4 filos, alto rendimiento, punta cuadrada, longitud estándar, métrico	205	210
61M	Filo múltiple, paso grueso, desbastador, métrico	206	212
62M	Filo múltiple, paso fino, desbastador, métrico	207	213

Recomendaciones de Velocidad y Avance mostrados al final de esta sección.

Fraisage

SÈRIES	DESCRIPTION DE FRAISES À USAGE GÉNÉRAL	PAGE	S&F PAGE
3M	2 dents non rayonné longueur standard (métrique)	191	208
3XLM	2 dents non rayonné portée extra-longue (métrique)	191	208
3MB	2 dents à bout hémisphérique longueur standard (métrique)	192	209
3XLMB	2 dents à bout hémisphérique portée extra-longue (métrique)	192	209
17M	2 dents non rayonné court (métrique)	193	208
52M	2 dents cisaillement élevé non rayonné longueur standard (métrique)	194	210
59M	2 dents non rayonné longue portée (métrique)	195	208
59MB	2 dents à bout hémisphérique longue portée (métrique)	196	209
5M	3 dents non rayonné longueur standard (métrique)	197	208
5XLM	3 dents non rayonné portée extra-longue (métrique)	197	208
5MB	3 dents à bout hémisphérique longueur standard (métrique)	198	208
5XLMB	3 dents à bout hémisphérique portée extra-longue (métrique)	198	208
1M	4 dents non rayonné longueur standard (métrique)	199	208
1XLM	4 dents non rayonné portée extra-longue (métrique)	199	208
1MCR	4 dents rayonné longueur standard (métrique)	199	208
1MB	4 dents à bout hémisphérique longueur standard (métrique)	202	208
1XLMB	4 dents à bout hémisphérique portée extra-longue (métrique)	202	208
14M	4 dents à double bouts plats court (métrique)	203	208
14MB	4 dents à double bouts hémisphériques court (métrique)	204	208
16M	4 dents non rayonné court (métrique)	199	208
54M	4 dents cisaillement élevé non rayonné longueur standard (métrique)	205	210
61M	Multi-dents à pas gros d'ébauche (métrique)	206	212
62M	Multi-dents à pas fin d'ébauche (métrique)	207	213

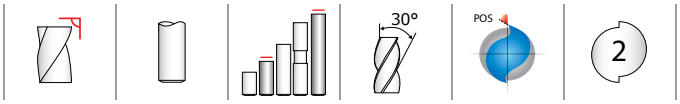
Les avances et les vitesses recommandées se trouvent à la fin du chapitre.

Fräsen

SERIE	BESCHREIBUNG DER STANDARD-SCHAFTFRÄSER	SEITE	S&F SEITE
3M	Schaftfräser mit 2 Schneiden ohne Eckenradien, Standardlänge	191	208
3XLM	Langloch-Schaftfräser mit 2 Schneiden ohne Eckenradien	191	208
3MB	Schaftfräser mit 2 Schneiden, Standardlänge	192	209
3XLMB	Superlangloch-Schaftfräser mit 2 Schneiden	192	209
17M	Schaftfräser mit 2 Schneiden ohne Eckenradien, kurze Ausführung	193	208
52M	Schaftfräser hoher Scherfestigkeit mit 2 Schneiden ohne Eckenradien, Standardlänge	194	210
59M	Langloch-Schaftfräser mit 2 Schneiden ohne Eckenradien	195	208
59MB	Langloch-Radiusschaftfräser mit 2 Schneiden	196	209
5M	Schaftfräser mit 3 Schneiden ohne Eckenradien, Standardlänge	197	208
5XLM	Langloch-Schaftfräser mit 3 Schneiden ohne Eckenradien	197	208
5MB	Schaftfräser mit 3 Schneiden, Standardlänge	198	208
5XLMB	Langloch-Schaftfräser mit 3 Schneiden	198	208
1M	Schaftfräser mit 4 Schneiden ohne Eckenradien, Standardlänge	199	208
1XLM	Superlangloch-Schaftfräser mit 4 Schneiden ohne Eckenradien	199	208
1MCR	Schaftfräser mit 4 Schneiden mit Eckenradien, Standardlänge	199	208
1MB	Schaftfräser mit 4 Schneiden, Standardlänge	202	208
1XLMB	Langloch-Radiusschaftfräser mit 4 Schneiden	202	208
14M	Schaftfräser mit 4 Schneiden, kurze Ausführung	203	208
14MB	Doppelend-Radiusschaftfräser mit 4 Schneiden, kurze Ausführung	204	208
16M	Schaftfräser mit 4 Schneiden ohne Eckenradien, kurze Ausführung	199	208
54M	Schaftfräser hoher Scherfestigkeit mit 4 Schneiden ohne Eckenradien, Standardlänge	205	210
61M	Mehrschneidiger fein verzahnter Schruppfräser	206	212
62M	Mehrschneidiger fein verzahnter Schruppfräser	207	213

Schnittwertempfehlungen finden Sie am Ende dieses Abschnitts

2 Flute Square End



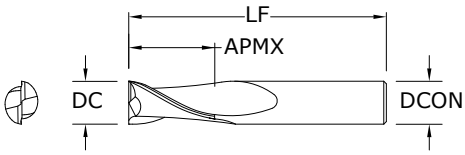
TOLERANCES (mm)

<3 DIAMETER

DC = +0,0000/–0.0254
DCON = h_6

≥3 DIAMETER

DC = +0,0000/–0.0508
DCON = h_6
RE = +0,0000/–0.0508

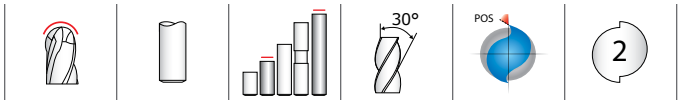


3M • 3XLM
METRIC SERIES

mm				EDP NO.		SERIES
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-A (AlTiN)	
1,0	4,0	38,0	3,0	40305	48671	3M
1,5	4,5	38,0	3,0	40309	48672	3M
2,0	6,3	38,0	3,0	40313	48673	3M
2,5	9,5	38,0	3,0	40317	48674	3M
3,0	12,0	38,0	3,0	40321	48675	3M
3,0	25,0	75,0	3,0	43301	49453	3XLM
3,5	12,0	50,0	4,0	40325	48676	3M
4,0	14,0	50,0	4,0	40329	48677	3M
4,0	25,0	75,0	4,0	43303	49454	3XLM
4,5	16,0	50,0	6,0	40333	48678	3M
5,0	16,0	50,0	6,0	40337	48679	3M
5,0	25,0	75,0	5,0	43307	49456	3XLM
6,0	19,0	50,0	6,0	40341	48680	3M
6,0	25,0	75,0	6,0	43305	49455	3XLM
7,0	19,0	63,0	8,0	40345	48681	3M
8,0	20,0	63,0	8,0	40349	48682	3M
8,0	25,0	75,0	8,0	43315	49457	3XLM
9,0	22,0	75,0	10,0	40353	48683	3M
10,0	22,0	75,0	10,0	40357	48684	3M
10,0	38,0	100,0	10,0	43325	49458	3XLM
11,0	25,0	75,0	12,0	40361	48685	3M
12,0	25,0	75,0	12,0	40365	48686	3M
12,0	50,0	100,0	12,0	43335	49459	3XLM
12,0	75,0	150,0	12,0	43345	49460	3XLM
14,0	32,0	89,0	14,0	40369	48687	3M
14,0	75,0	150,0	14,0	43355	49461	3XLM
16,0	32,0	89,0	16,0	40373	48688	3M
16,0	75,0	150,0	16,0	43365	49462	3XLM
18,0	38,0	100,0	18,0	40377	48689	3M
18,0	75,0	150,0	18,0	43375	49463	3XLM
20,0	38,0	100,0	20,0	40381	48690	3M
20,0	75,0	150,0	20,0	43385	49464	3XLM
25,0	38,0	100,0	25,0	40385	48691	3M
25,0	75,0	150,0	25,0	43395	49465	3XLM

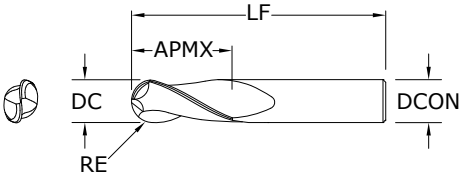
- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS

2 Flute Ball End



3MB • 3XLMB

METRIC SERIES



TOLERANCES (mm)

<3 DIAMETER

DC = +0,0000 /–0,0254
DCON = h_6
RE = +0,0000 /–0,0127

≥3 DIAMETER

DC = +0,0000 /–0,0508
DCON = h_6
RE = +0,0000 /–0,0254

STEELS
STAINLESS STEELS
CAST IRON
NON-FERROUS
HIGH TEMP ALLOYS

mm				EDP NO.		SERIES
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-A (AlTiN)	
1,0	4,0	38,0	3,0	40306	48735	3MB
1,5	4,5	38,0	3,0	40310	48736	3MB
2,0	6,3	38,0	3,0	40314	48737	3MB
2,5	9,5	38,0	3,0	40318	48738	3MB
3,0	12,0	38,0	3,0	40322	48739	3MB
3,0	25,0	75,0	3,0	43302	49570	3XLMB
3,5	12,0	50,0	4,0	40326	48740	3MB
4,0	14,0	50,0	4,0	40330	48741	3MB
4,0	25,0	75,0	4,0	43304	49571	3XLMB
4,5	16,0	50,0	6,0	40334	48742	3MB
5,0	16,0	50,0	6,0	40338	48743	3MB
5,0	25,0	75,0	5,0	43308	49573	3XLMB
6,0	19,0	50,0	6,0	40342	48744	3MB
6,0	25,0	75,0	6,0	43306	49572	3XLMB
7,0	19,0	63,0	8,0	40346	48745	3MB
8,0	20,0	63,0	8,0	40350	48746	3MB
8,0	25,0	75,0	8,0	43316	49574	3XLMB
9,0	22,0	75,0	10,0	40354	48747	3MB
10,0	22,0	75,0	10,0	40358	48748	3MB
10,0	38,0	100,0	10,0	43326	49575	3XLMB
11,0	25,0	75,0	12,0	40362	48749	3MB
12,0	25,0	75,0	12,0	40366	48750	3MB
12,0	50,0	100,0	12,0	43336	49576	3XLMB
12,0	75,0	150,0	12,0	43346	49577	3XLMB
14,0	32,0	89,0	14,0	40370	48751	3MB
14,0	75,0	150,0	14,0	43356	49578	3XLMB
16,0	32,0	89,0	16,0	40374	48752	3MB
16,0	75,0	150,0	16,0	43366	49579	3XLMB
18,0	38,0	100,0	18,0	40378	48753	3MB
18,0	75,0	150,0	18,0	43376	49580	3XLMB
20,0	38,0	100,0	20,0	40382	48754	3MB
20,0	75,0	150,0	20,0	43386	49581	3XLMB
25,0	38,0	100,0	25,0	40386	48755	3MB
25,0	75,0	150,0	25,0	43396	49582	3XLMB

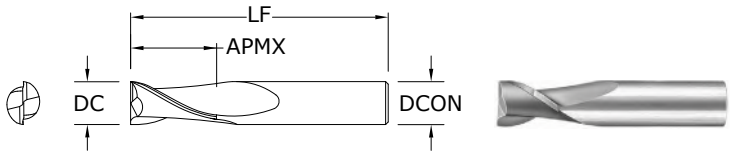
RE = 1/2 Cutting Diameter (DC)

2 Flute Square End Stub

TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000 /–0.0254
DCON = h_6

≥3 DIAMETER
DC = +0,0000 /–0.0508
DCON = h_6

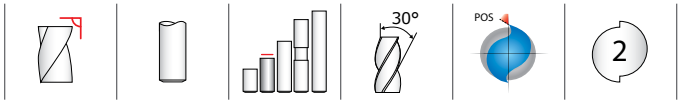


17M
METRIC SERIES

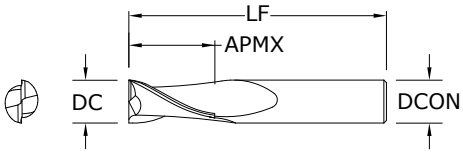
mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-A (AlTiN)
1,0	2,0	38,0	3,0	41705	49304
1,5	3,0	38,0	3,0	41709	49305
2,0	4,0	38,0	3,0	41713	49306
2,5	5,0	38,0	3,0	41717	49307
3,0	6,0	38,0	3,0	41721	49308
3,5	7,0	50,0	4,0	41725	49309
4,0	8,0	50,0	4,0	41729	49310
4,5	9,5	50,0	4,5	41733	49311
5,0	10,0	50,0	5,0	41737	49312
6,0	12,0	50,0	6,0	41741	49313
7,0	12,0	50,0	8,0	41745	49314
8,0	12,0	50,0	8,0	41749	49315
9,0	14,0	50,0	9,0	41753	49316
10,0	16,0	50,0	10,0	41757	49317
11,0	19,0	63,0	12,0	41761	49318
12,0	19,0	63,0	12,0	41765	49319

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS

2 Flute High Shear



52M
METRIC SERIES



TOLERANCES (mm)

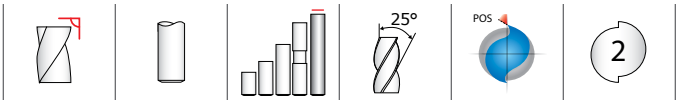
<3 DIAMETER
DC = +0,0000 / –0,0254
DCON = h_6

≥3 DIAMETER
DC = +0.0000 / –0,0508
DCON = h_6

mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-C (TiCN)
3,0	7,0	38,0	3,0	45277	49829
3,5	7,0	57,0	6,0	45279	49830
4,0	8,0	57,0	6,0	45281	49831
4,5	8,0	57,0	6,0	45283	49832
5,0	10,0	57,0	6,0	45285	49833
6,0	10,0	57,0	6,0	45287	49834
8,0	16,0	63,0	8,0	45289	49835
10,0	19,0	72,0	10,0	45291	49836
12,0	22,0	83,0	12,0	45293	49837
14,0	22,0	83,0	14,0	45295	49838
16,0	26,0	92,0	16,0	45297	49839
20,0	32,0	104,0	20,0	45299	49840

NON-FERROUS

2 Flute Square End Long Reach

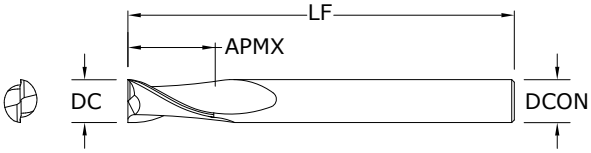


TOLERANCES (mm)

3–6 DIAMETER
DC = +0,0000 /–0,0254
DCON = h_6

>6–10 DIAMETER
DC = +0,0000 /–0,0406
DCON = h_6

>10–20 DIAMETER
DC = +0,0000 /–0,0508
DCON = h_6



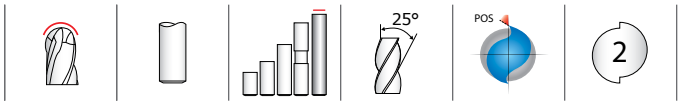
59M
METRIC SERIES

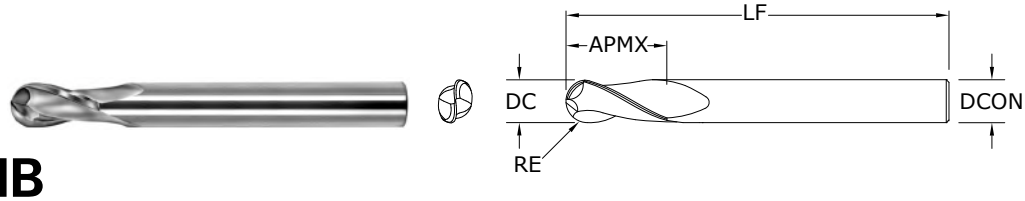
mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-A (AlTiN)
3,0	9,0	60,0	6,0	43910	43950
4,0	12,0	70,0	6,0	43911	43951
6,0	15,0	80,0	6,0	43912	43952
8,0	20,0	89,0	8,0	43913	43953
10,0	25,0	100,0	10,0	43914	43954
12,0	30,0	110,0	12,0	43915	43955
14,0	35,0	120,0	16,0	43916	43956
16,0	40,0	120,0	16,0	43917	43957
18,0	40,0	130,0	20,0	43918	43958
20,0	45,0	130,0	20,0	43919	43959

Neck Option Available

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS

2 Flute Ball End Long Reach





59MB
METRIC SERIES

TOLERANCES (mm)

3–6 DIAMETER
DC = +0,0000 /–0,0254
DCON = h_6
RE = +0,0000 /–0,0127

>6–10 DIAMETER
DC = +0,0000 /–0,0406
DCON = h_6
RE = +0,0000 /–0,0203

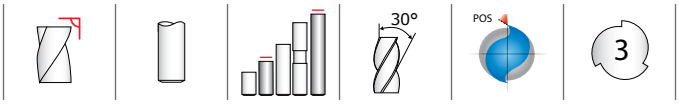
>10–20 DIAMETER
DC = +0,0000 /–0,0508
DCON = h_6
RE = +0,0000 /–0,0254

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS

mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-A (AlTiN)
3,0	9,0	60,0	6,0	43900	49642
4,0	12,0	70,0	6,0	43901	49643
6,0	15,0	80,0	6,0	43902	49644
8,0	20,0	89,0	8,0	43903	49645
10,0	25,0	100,0	10,0	43904	49646
12,0	30,0	110,0	12,0	43905	49647
14,0	35,0	120,0	16,0	43906	49648
16,0	40,0	120,0	16,0	43907	49649
18,0	40,0	130,0	20,0	43908	49650
20,0	45,0	130,0	20,0	43909	49651

Neck Option Available
RE = 1/2 Cutting Diameter (DC)

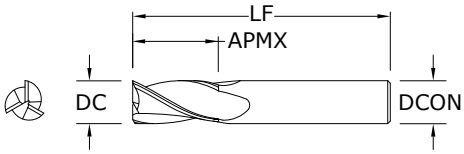
3 Flute Square End



TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000/–0,0254
DCON = h_6

≥3 DIAMETER
DC = +0,0000/–0,0508
DCON = h_6

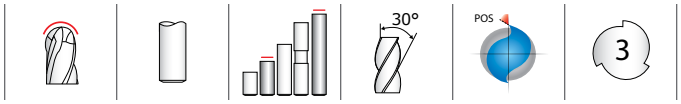


5M • 5XLM
METRIC SERIES

mm				EDP NO.		SERIES
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-A (AlTiN)	
1,0	4,0	38,0	3,0	40505	48799	5M
1,5	4,5	38,0	3,0	40509	48800	5M
2,0	6,3	38,0	3,0	40513	48801	5M
2,5	9,5	38,0	3,0	40517	48802	5M
3,0	12,0	38,0	3,0	40521	48803	5M
3,0	25,0	75,0	3,0	43501	49492	5XLM
3,5	12,0	50,0	4,0	40525	48804	5M
4,0	14,0	50,0	4,0	40529	48805	5M
4,0	25,0	75,0	4,0	43503	49493	5XLM
4,5	16,0	50,0	6,0	40533	48806	5M
5,0	16,0	50,0	6,0	40537	48807	5M
5,0	25,0	75,0	5,0	43507	49495	5XLM
6,0	19,0	50,0	6,0	40541	48808	5M
6,0	25,0	75,0	6,0	43505	49494	5XLM
7,0	19,0	63,0	8,0	40545	48809	5M
8,0	20,0	63,0	8,0	40549	48810	5M
8,0	25,0	75,0	8,0	43515	49496	5XLM
9,0	22,0	75,0	10,0	40553	48811	5M
10,0	22,0	75,0	10,0	40557	48812	5M
10,0	38,0	100,0	10,0	43525	49497	5XLM
11,0	25,0	75,0	12,0	40561	48813	5M
12,0	25,0	75,0	12,0	40565	48814	5M
12,0	50,0	100,0	12,0	43535	49498	5XLM
12,0	75,0	150,0	12,0	43545	49499	5XLM
14,0	32,0	89,0	14,0	40569	48815	5M
14,0	75,0	150,0	14,0	43555	49500	5XLM
16,0	32,0	89,0	16,0	40573	48816	5M
16,0	75,0	150,0	16,0	43565	49501	5XLM
18,0	38,0	100,0	18,0	40577	48817	5M
18,0	75,0	150,0	18,0	43575	49502	5XLM
20,0	38,0	100,0	20,0	40581	48818	5M
20,0	75,0	150,0	20,0	43585	49503	5XLM
25,0	38,0	100,0	25,0	40585	48819	5M
25,0	75,0	150,0	25,0	43595	49504	5XLM

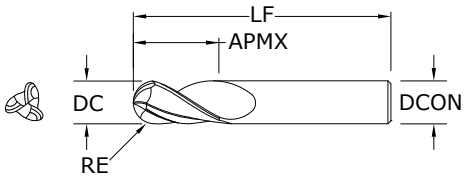
- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS

3 Flute Ball End



5MB • 5XLMB

METRIC SERIES



TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000 /–0.0254
DCON = h_6
RE = +0,0000 /–0.0127

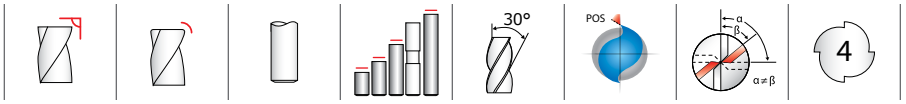
≥3 DIAMETER
DC = +0,0000 /–0.0508
DCON = h_6
RE = +0,0000 /–0.0254

STEELS
STAINLESS STEELS
CAST IRON
NON-FERROUS
HIGH TEMP ALLOYS

mm				EDP NO.		SERIES
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-A (AlTiN)	
1,0	4,0	38,0	3,0	40506	48863	5MB
1,5	4,5	38,0	3,0	40510	48864	5MB
2,0	6,3	38,0	3,0	40514	48865	5MB
2,5	9,5	38,0	3,0	40518	48866	5MB
3,0	12,0	38,0	3,0	40522	48867	5MB
3,0	25,0	75,0	3,0	43502	49609	5XLMB
3,5	12,0	50,0	4,0	40526	48868	5MB
4,0	14,0	50,0	4,0	40530	48869	5MB
4,0	25,0	75,0	4,0	43504	49610	5XLMB
4,5	16,0	50,0	6,0	40534	48870	5MB
5,0	16,0	50,0	6,0	40538	48871	5MB
5,0	25,0	75,0	5,0	43508	49612	5XLMB
6,0	19,0	50,0	6,0	40542	48872	5MB
6,0	25,0	75,0	6,0	43506	49611	5XLMB
7,0	19,0	63,0	8,0	40546	48873	5MB
8,0	20,0	63,0	8,0	40550	48874	5MB
8,0	25,0	75,0	8,0	43516	49613	5XLMB
9,0	22,0	75,0	10,0	40554	48875	5MB
10,0	22,0	75,0	10,0	40558	48876	5MB
10,0	38,0	100,0	10,0	43526	49614	5XLMB
11,0	25,0	75,0	12,0	40562	48877	5MB
12,0	25,0	75,0	12,0	40566	48878	5MB
12,0	50,0	100,0	12,0	43536	49615	5XLMB
12,0	75,0	150,0	12,0	43546	49616	5XLMB
14,0	32,0	89,0	14,0	40570	48879	5MB
14,0	75,0	150,0	14,0	43556	49617	5XLMB
16,0	32,0	89,0	16,0	40574	48880	5MB
16,0	75,0	150,0	16,0	43566	49618	5XLMB
18,0	38,0	100,0	18,0	40578	48881	5MB
18,0	75,0	150,0	18,0	43576	49619	5XLMB
20,0	38,0	100,0	20,0	40582	48882	5MB
20,0	75,0	150,0	20,0	43586	49620	5XLMB
25,0	38,0	100,0	25,0	40586	48883	5MB
25,0	75,0	150,0	25,0	43596	49621	5XLMB

RE = 1/2 Cutting Diameter (DC)

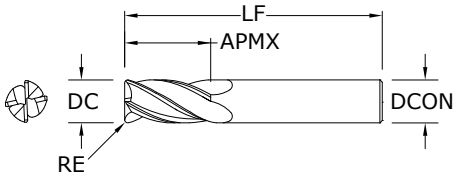
4 Flute Square End • 4 Flute Corner Radius



TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000/–0,0254
DCON = h_6

≥3 DIAMETER
DC = +0,0000/–0,0508
DCON = h_6
RE = +0,0000/–0,0508



1M • 1XLM • 1MCR • 16M

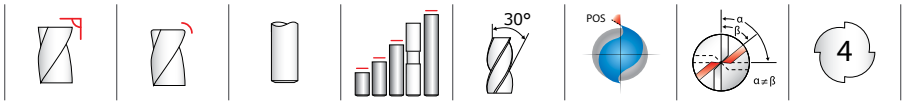
METRIC SERIES

mm					EDP NO.				SERIES
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	CORNER RADIUS RE	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE (TiN)	Ti-NAMITE-C (TiCN)	Ti-NAMITE-A (AlTiN)	
1,0	2,0	38,0	–	3,0	41605	49136	49157	49178	16M
1,0	4,0	38,0	–	3,0	40105	48500	48522	48543	1M
1,5	3,0	38,0	–	3,0	41609	49137	49158	49179	16M
1,5	4,5	38,0	–	3,0	40109	48501	48523	48544	1M
2,0	4,0	38,0	–	3,0	41613	49138	49159	49180	16M
2,0	6,3	38,0	–	3,0	40113	48502	48524	48545	1M
2,5	5,0	38,0	–	3,0	41617	49139	49160	49181	16M
2,5	9,5	38,0	–	3,0	40117	48503	48525	48546	1M
3,0	6,0	38,0	–	3,0	41621	49140	49161	49182	16M
3,0	12,0	38,0	–	3,0	40121	48504	48526	48547	1M
3,0	25,0	75,0	–	3,0	43101	49388	49401	49414	1XLM
3,5	7,0	50,0	–	4,0	41625	49141	49162	49183	16M
3,5	12,0	50,0	–	4,0	40125	48505	48527	48548	1M
4,0	8,0	50,0	–	4,0	41629	49142	49163	49184	16M
4,0	14,0	50,0	–	4,0	40129	48506	48528	48549	1M
4,0	14,0	50,0	0,25	4,0	–	–	–	40000	1MCR
4,0	14,0	50,0	0,50	4,0	–	–	–	40001	1MCR
4,0	14,0	50,0	0,76	4,0	–	–	–	40002	1MCR
4,0	14,0	50,0	1,00	4,0	–	–	–	40003	1MCR
4,0	25,0	75,0	–	4,0	43103	49389	49402	49415	1XLM
4,5	9,5	50,0	–	4,5	41633	49143	49164	49185	16M
4,5	16,0	50,0	–	6,0	40133	48507	48529	48550	1M
5,0	10,0	50,0	–	5,0	41637	49144	49165	49186	16M
5,0	16,0	50,0	–	6,0	40137	48508	48530	48551	1M
5,0	16,0	50,0	0,25	6,0	–	–	–	40004	1MCR
5,0	16,0	50,0	0,50	6,0	–	–	–	40005	1MCR
5,0	16,0	50,0	0,76	5,0	–	–	–	40006	1MCR
5,0	16,0	50,0	1,00	6,0	–	–	–	40007	1MCR
5,0	16,0	50,0	1,25	5,0	–	–	–	40008	1MCR
5,0	25,0	75,0	–	5,0	43107	49391	49404	49417	1XLM
6,0	12,0	50,0	–	6,0	41641	49145	49166	49187	16M
6,0	19,0	50,0	–	6,0	40141	48509	48531	48552	1M

continued on next page

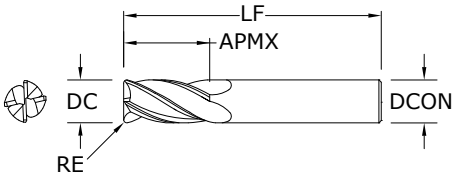
- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS

4 Flute Square End • 4 Flute Corner Radius



1M • 1XLM • 1MCR • 16M

METRIC SERIES



TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000/–0,0254
DCON = h_6

≥3 DIAMETER
DC = +0,0000/–0,0508
DCON = h_6
RE = +0,0000/–0,0508

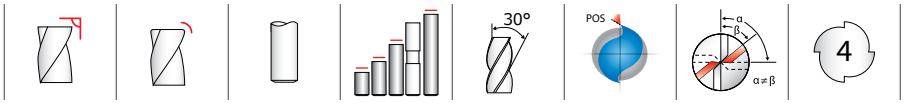
CONTINUED

STEELS
STAINLESS STEELS
CAST IRON
NON-FERROUS
HIGH TEMP ALLOYS

mm					EDP NO.				SERIES
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	CORNER RADIUS RE	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE (TiN)	Ti-NAMITE-C (TiCN)	Ti-NAMITE-A (AlTiN)	
6,0	19,0	50,0	0,25	6,0	–	–	–	40009	1MCR
6,0	19,0	50,0	0,50	6,0	–	–	–	40010	1MCR
6,0	19,0	50,0	0,75	6,0	–	–	–	40011	1MCR
6,0	19,0	50,0	1,00	6,0	–	–	–	40012	1MCR
6,0	19,0	50,0	1,50	6,0	–	–	–	40014	1MCR
6,0	25,0	75,0	–	6,0	43105	49390	49403	49416	1XLM
7,0	12,0	50,0		8,0	41645	49146	49167	49188	16M
7,0	19,0	63,0	–	8,0	40145	48510	48532	48553	1M
8,0	12,0	50,0		8,0	41649	49147	49168	49189	16M
8,0	20,0	63,0	–	8,0	40149	48511	48533	48554	1M
8,0	20,0	63,0	0,50	8,0	–	–	–	40015	1MCR
8,0	20,0	63,0	0,75	8,0	–	–	–	40016	1MCR
8,0	20,0	63,0	1,00	8,0	–	–	–	40017	1MCR
8,0	20,0	63,0	1,25	8,0	–	–	–	40018	1MCR
8,0	20,0	63,0	1,50	8,0	–	–	–	40019	1MCR
8,0	20,0	63,0	2,00	8,0	–	–	–	40020	1MCR
10,0	22,0	75,0	0,76	10,0	–	–	–	40022	1MCR
8,0	25,0	75,0	–	8,0	43115	49392	49405	49418	1XLM
9,0	14,0	50,0		9,0	41653	49148	49169	49190	16M
9,0	22,0	75,0	–	10,0	40153	48512	48534	48555	1M
10,0	16,0	50,0		10,0	41657	49149	49170	49191	16M
10,0	22,0	75,0	–	10,0	40157	48513	48535	48556	1M
10,0	22,0	75,0	0,50	10,0	–	–	–	40021	1MCR
10,0	22,0	75,0	1,00	10,0	–	–	–	40023	1MCR
10,0	22,0	75,0	1,50	10,0	–	–	–	40024	1MCR
10,0	22,0	75,0	2,00	10,0	–	–	–	40025	1MCR
10,0	22,0	75,0	3,00	10,0	–	–	–	40026	1MCR
10,0	38,0	100,0	–	10,0	43125	49393	49406	49419	1XLM
11,0	19,0	63,0		12,0	41661	49150	49171	49192	16M
11,0	25,0	75,0	–	12,0	40161	48514	48536	48557	1M
12,0	19,0	63,0		12,0	40165	49151	49172	49193	16M
12,0	25,0	75,0	–	12,0	41665	48515	48537	48558	1M
12,0	25,0	75,0	0,50	12,0	–	–	–	40028	1MCR
12,0	25,0	75,0	0,76	12,0	–	–	–	40029	1MCR
12,0	25,0	75,0	1,00	12,0	–	–	–	40030	1MCR
12,0	25,0	75,0	1,50	12,0	–	–	–	40031	1MCR

continued on next page

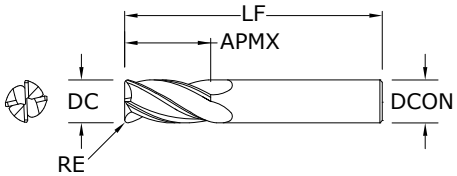
4 Flute Square End • 4 Flute Corner Radius



TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000/–0,0254
DCON = h_6

≥3 DIAMETER
DC = +0,0000/–0,0508
DCON = h_6
RE = +0,0000/–0,0508



1M • 1XLM • 1MCR • 16M

METRIC SERIES

CONTINUED

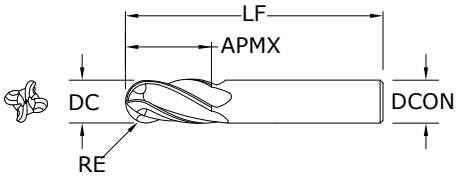
mm					EDP NO.				SERIES
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	CORNER RADIUS RE	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE (TiN)	Ti-NAMITE-C (TiCN)	Ti-NAMITE-A (AlTiN)	
12,0	25,0	75,0	2,00	12,0	–	–	–	40032	1MCR
12,0	25,0	75,0	3,00	12,0	–	–	–	40033	1MCR
12,0	50,0	100,0	–	12,0	43135	49394	49407	49420	1XLM
12,0	75,0	150,0	–	12,0	43145	49395	49408	49421	1XLM
14,0	32,0	89,0	–	14,0	40169	48516	48538	48559	1M
14,0	75,0	150,0	–	14,0	43155	49396	49409	49422	1XLM
16,0	32,0	89,0	–	16,0	40173	48517	48539	48560	1M
16,0	32,0	89,0	0,50	16,0	–	–	–	40035	1MCR
16,0	32,0	89,0	0,76	16,0	–	–	–	40036	1MCR
16,0	32,0	89,0	1,00	16,0	–	–	–	40037	1MCR
16,0	32,0	89,0	1,50	16,0	–	–	–	40038	1MCR
16,0	32,0	89,0	2,00	16,0	–	–	–	40039	1MCR
16,0	32,0	89,0	3,00	16,0	–	–	–	40040	1MCR
16,0	32,0	89,0	3,20	16,0	–	–	–	40041	1MCR
16,0	75,0	150,0	–	16,0	43165	49397	49410	49423	1XLM
18,0	38,0	100,0	–	18,0	40177	48518	48540	48561	1M
18,0	75,0	150,0	–	18,0	43175	49398	49411	49424	1XLM
20,0	38,0	100,0	–	20,0	40181	48519	48541	48562	1M
20,0	75,0	150,0	–	20,0	43185	49399	49412	49425	1XLM
25,0	38,0	100,0	–	25,0	40185	48520	48542	48563	1M
25,0	75,0	150,0	–	25,0	43195	49400	49413	49426	1XLM

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS

4 Flute Ball End

1MB• 1XLMB

METRIC SERIES



TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000 /–0.0254
DCON = h_6
RE = +0,0000 /–0.0127

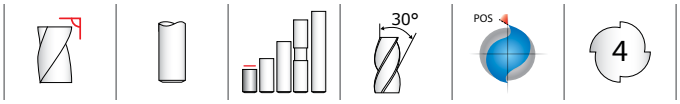
≥3 DIAMETER
DC = +0,0000 /–0.0508
DCON = h_6
RE = +0,0000 /–0.0254

STEELS
STAINLESS STEELS
CAST IRON
NON-FERROUS
HIGH TEMP ALLOYS

mm				EDP NO.		SERIES
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-A (AlTiN)	
1,0	4,0	38,0	3,0	40106	48607	1MB
1,5	4,5	38,0	3,0	40110	48608	1MB
2,0	6,3	38,0	3,0	40114	48609	1MB
2,5	9,5	38,0	3,0	40118	48610	1MB
3,0	12,0	38,0	3,0	40122	48611	1MB
3,0	25,0	75,0	3,0	43102	49531	1XLMB
3,5	12,0	50,0	4,0	40126	48612	1MB
4,0	14,0	50,0	4,0	40130	48613	1MB
4,0	25,0	75,0	4,0	43104	49532	1XLMB
4,5	16,0	50,0	6,0	40134	48614	1MB
5,0	16,0	50,0	6,0	40138	48615	1MB
5,0	25,0	75,0	5,0	43108	49534	1XLMB
6,0	19,0	50,0	6,0	40142	48616	1MB
6,0	25,0	75,0	6,0	43106	49533	1XLMB
7,0	19,0	63,0	8,0	40146	48617	1MB
8,0	20,0	63,0	8,0	40150	48618	1MB
8,0	25,0	75,0	8,0	43116	49535	1XLMB
9,0	22,0	75,0	10,0	40154	48619	1MB
10,0	22,0	75,0	10,0	40158	48620	1MB
10,0	38,0	100,0	10,0	43126	49536	1XLMB
11,0	25,0	75,0	12,0	40162	48621	1MB
12,0	25,0	75,0	12,0	40166	48622	1MB
12,0	50,0	100,0	12,0	43136	49537	1XLMB
12,0	75,0	150,0	12,0	43146	49538	1XLMB
14,0	32,0	89,0	14,0	40170	48623	1MB
14,0	75,0	150,0	14,0	43156	49539	1XLMB
16,0	32,0	89,0	16,0	40174	48624	1MB
16,0	75,0	150,0	16,0	43166	49540	1XLMB
18,0	38,0	100,0	18,0	40178	48625	1MB
18,0	75,0	150,0	18,0	43176	49541	1XLMB
20,0	38,0	100,0	20,0	40182	48626	1MB
20,0	75,0	150,0	20,0	43186	49542	1XLMB
25,0	38,0	100,0	25,0	40186	48627	1MB
25,0	75,0	150,0	25,0	43196	49543	1XLMB

RE = 1/2 Cutting Diameter (DC)

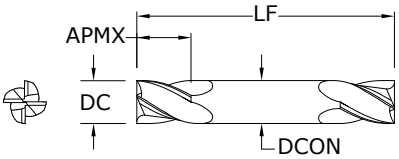
4 Flute Double End



TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000 / –0,0254
DCON = h_6

≥3 DIAMETER
DC = +0,0000 / –0,0508
DCON = h_6

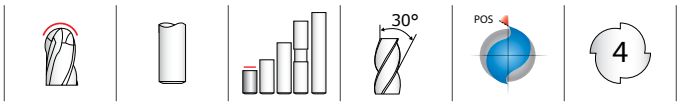


14M
METRIC SERIES

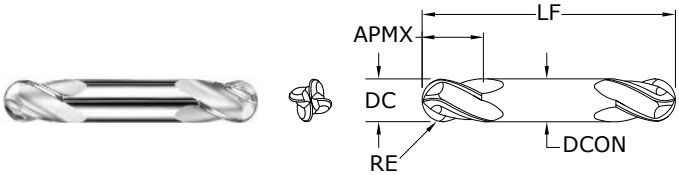
mm				EDP NO.			
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE (TiN)	Ti-NAMITE-C (TiCN)	Ti-NAMITE-A (AlTiN)
1,0	2,0	38,0	3,0	41405	48884	48905	48926
1,5	3,0	38,0	3,0	41409	48885	48906	48927
2,0	4,0	38,0	3,0	41413	48886	48907	48928
2,5	5,0	38,0	3,0	41417	48887	48908	48929
3,0	6,0	38,0	3,0	41421	48888	48909	48930
3,5	7,0	50,0	4,0	41425	48889	48910	48931
4,0	8,0	50,0	4,0	41429	48890	48911	48932
4,5	9,5	63,0	4,5	41433	48891	48912	48933
5,0	10,0	63,0	5,0	41437	48892	48913	48934
6,0	12,0	63,0	6,0	41441	48893	48914	48935
7,0	12,0	63,0	8,0	41445	48894	48915	48936
8,0	12,0	63,0	8,0	41449	48895	48916	48937
9,0	14,0	75,0	9,0	41453	48896	48917	48938
10,0	14,0	75,0	10,0	41457	48897	48918	48939
11,0	14,0	75,0	12,0	41461	48898	48919	48940
12,0	16,0	75,0	12,0	41465	48899	48920	48941

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS

4 Flute Double End Ball End



14MB
METRIC SERIES



TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000 / –0,0254
DCON = h_6
RE = +0,0000 / –0,0127

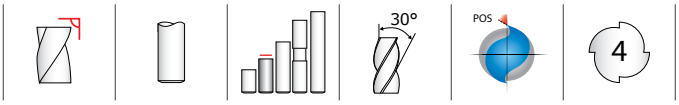
≥3 DIAMETER
DC = +0,0000 / –0,0508
DCON = h_6
RE = +0,0000 / –0,0254

mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-A (AlTiN)
1,0	2,0	38,0	3,0	41406	48989
1,5	3,0	38,0	3,0	41410	48990
2,0	4,0	38,0	3,0	41414	48991
2,5	5,0	38,0	3,0	41418	48992
3,0	6,0	38,0	3,0	41422	48993
3,5	7,0	50,0	4,0	41426	48994
4,0	8,0	50,0	4,0	41430	48995
4,5	9,5	63,0	4,5	41434	48996
5,0	10,0	63,0	5,0	41438	48997
6,0	12,0	63,0	6,0	41442	48998
7,0	12,0	63,0	8,0	41446	48999
8,0	12,0	63,0	8,0	41450	49000
9,0	14,0	75,0	9,0	41454	49001
10,0	14,0	75,0	10,0	41458	49002
11,0	14,0	75,0	12,0	41462	49003
12,0	16,0	75,0	12,0	41466	49004

RE = 1/2 Cutting Diameter (DC)

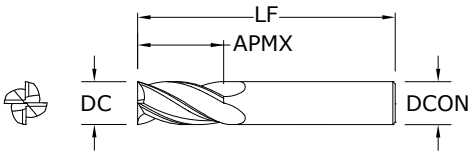
- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS

4 Flute High Shear



TOLERANCES (mm)

<3 DIAMETER
DC = +0,0000 /–0,0254
DCON = h_6
≥3 DIAMETER
DC = +0,0000 /–0,0508
DCON = h_6

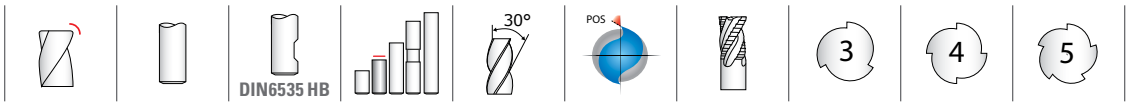


54M
METRIC SERIES

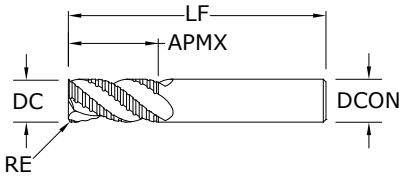
mm				EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED	Ti-NAMITE-C (TiCN)
3,0	8,0	38,0	3,0	45477	45478
3,5	10,0	57,0	6,0	45479	45480
4,0	11,0	57,0	6,0	45481	45482
4,5	11,0	57,0	6,0	45483	45484
5,0	13,0	57,0	6,0	45485	45486
6,0	13,0	57,0	6,0	45487	45488
8,0	19,0	63,0	8,0	45489	45490
10,0	22,0	72,0	10,0	45491	45492
12,0	26,0	83,0	12,0	45493	45494
14,0	26,0	83,0	14,0	45495	45496
16,0	32,0	92,0	16,0	45497	45498
20,0	38,0	104,0	20,0	45499	45500

NON-FERROUS

Single End Roughers (Coarse Pitch)



61M
METRIC SERIES



TOLERANCES (mm)

DC = +0,000 / –0,100
DCON = h_6
RE = +0,127/–0,127

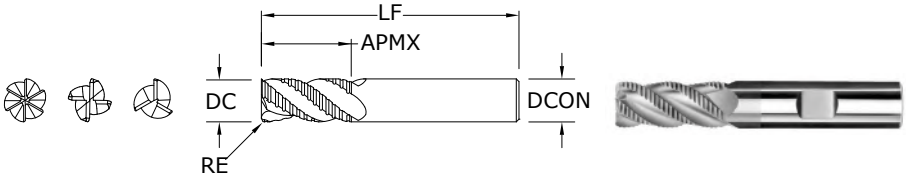
STEELS
CAST IRON

mm						EDP NO.		
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	NO. OF FLUTES	Ti-NAMITE (TiN)	Ti-NAMITE-C (TiCN)	Ti-NAMITE-A (AlTiN)
6,0	19,0	63,0	6,0	1,14	3	46107	46106	46110
8,0	19,0	63,0	8,0	1,14	3	46109	46108	46111
10,0	22,0	72,0	10,0	1,52	3	46113	46112	46114
12,0	26,0	83,0	12,0	1,52	4	46117	46116	46118
16,0	32,0	92,0	16,0	1,52	4	46121	46120	46122
20,0	38,0	104,0	20,0	1,52	4	46129	46128	46132
25,0	44,0	104,0	25,0	1,52	5	46131	46130	46133

Single End Roughers (Fine Pitch)

TOLERANCES (mm)

DC = +0,000 / –0,100
DCON = h_6
RE = +0,127/–0,127

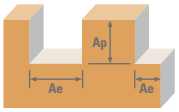


62M
METRIC SERIES

mm						EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	CORNER RADIUS RE	NO. OF FLUTES	Ti-NAMITE-C (TiCN)	Ti-NAMITE-A (AlTiN)
6,0	19,0	63,0	6,0	1,14	3	46206	46210
8,0	19,0	63,0	8,0	1,14	3	46208	46211
10,0	22,0	72,0	10,0	1,52	3	46212	46214
12,0	26,0	83,0	12,0	1,52	4	46216	46218
16,0	32,0	92,0	16,0	1,52	4	46220	46222
20,0	38,0	104,0	20,0	1,52	4	46228	46232
25,0	44,0	104,0	25,0	1,52	5	46230	46233

STAINLESS STEELS
HIGH TEMP ALLOYS

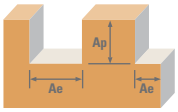
2 Flute: Square, Double, Stub, Long Reach, Ball
3 Flute: Square, Long Reach, Ball
4 Flute: Square, Double, Stub, Long Reach, Ball, Corner Radius



	Series 1M, 3M, 5M, 14M, 16M, 17M, 59M Metric	Hardness		Flutes	Ae x DC	Ap x DC	Vc (m/min)		DC • mm 0.4	0.75	1.5	3	6	10	12	20	25
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	Profile				140	RPM	111483	59458	29729	14864	7432	4459	3716	2230	1784
							(112-168)	Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070
				2	≤ 0.50	≤ 1.5		Feed (mm/min)	178	178	184	208	282	357	357	285	250
				3	≤ 0.25	≤ 1.5			268	268	276	312	424	535	535	428	375
				4	≤ 0.25	≤ 1.5			357	357	369	416	565	713	713	571	499
			Slot				102	RPM	81189	43301	21650	10825	5413	3248	2706	1624	1299
							(82-123)	Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070
				2	1	≤ 1		Feed (mm/min)	130	130	134	152	206	260	260	208	182
				3	1	≤ 0.5			195	195	201	227	309	390	390	312	273
				4	1	≤ 0.4			260	260	268	303	411	520	520	416	364
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	Profile				102	RPM	81189	43301	21650	10825	5413	3248	2706	1624	1299
							(82-123)	Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052
				2	≤ 0.50	≤ 1.5		Feed (mm/min)	81	104	95	130	152	188	195	156	135
				3	≤ 0.25	≤ 1.5			122	156	143	195	227	283	292	234	203
				4	≤ 0.25	≤ 1.5			162	208	191	260	303	377	390	312	270
			Slot				75	RPM	59377	31668	15834	7917	3958	2375	1979	1188	950
							(60-90)	Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052
				2	1	≤ 1		Feed (mm/min)	59	76	70	95	111	138	143	114	99
				3	1	≤ 0.5			119	152	139	190	222	276	285	228	198
				4	1	≤ 0.4			119	152	139	190	222	276	285	228	198
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 250 Bhn or ≤ 24 HRc	Profile				96	RPM	76342	40715	20358	10179	5089	3054	2545	1527	1221
							(77-115)	Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052
				2	≤ 0.50	≤ 1.5		Feed (mm/min)	76	98	90	122	143	177	183	147	127
				3	≤ 0.25	≤ 1.5			115	147	134	183	214	266	275	220	191
				4	≤ 0.25	≤ 1.5			153	195	179	244	285	354	366	293	254
			Slot				70	RPM	55741	29729	14864	7432	3716	2230	1858	1115	892
							(56-84)	Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052
				2	1	≤ 1		Feed (mm/min)	56	71	65	89	104	129	134	107	93
				3	1	≤ 0.5			84	107	98	134	156	194	201	161	139
				4	1	≤ 0.4			111	143	131	178	208	259	268	214	186
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F 440F	≤ 275 Bhn or ≤ 28 HRc	Profile				113	RPM	89671	47825	23912	11956	5978	3587	2989	1793	1435
							(90-135)	Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052
				2	≤ 0.50	≤ 1.5		Feed (mm/min)	90	115	105	143	167	208	215	172	149
				3	≤ 0.25	≤ 1.5			135	172	158	215	251	312	323	258	224
				4	≤ 0.25	≤ 1.5			179	230	210	287	335	416	430	344	298
			Slot				82	RPM	65436	34899	17449	8725	4362	2617	2181	1309	1047
							(66-99)	Fz	0.0005	0.0012	0.0022	0.006	0.014	0.029	0.036	0.048	0.052
				2	1	≤ 1		Feed (mm/min)	65	84	77	105	122	152	157	126	109
				3	1	≤ 0.5			98	126	115	157	183	228	236	188	163
				4	1	≤ 0.4			131	168	154	209	244	304	314	251	218
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L, 17-4 PH, 15-5, 13-4, Custom 450	≤ 275 Bhn or ≤ 28 HRc	Profile				78	RPM	61800	32960	16480	8240	4120	2472	2060	1236	989
							(62-93)	Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042
				2	≤ 0.50	≤ 1.5		Feed (mm/min)	62	66	63	66	99	119	119	91	83
				3	≤ 0.25	≤ 1.5			93	99	94	99	148	178	179	137	125
				4	≤ 0.25	≤ 1.5			124	132	125	132	198	237	239	183	166
			Slot				56	RPM	44836	23912	11956	5978	2989	1793	1495	897	717
							(45-68)	Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042
				2	1	≤ 1		Feed (mm/min)	45	48	45	48	72	86	87	66	60
				3	1	≤ 0.5			67	72	68	72	108	129	130	100	90
				4	1	≤ 0.4			90	96	91	96	143	172	173	133	121
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	Profile				102	RPM	81189	43301	21650	10825	5413	3248	2706	1624	1299
							(82-123)	Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070
				2	≤ 0.50	≤ 1.5		Feed (mm/min)	130	130	134	152	206	260	260	208	182
				3	≤ 0.25	≤ 1.5			195	195	201	227	309	390	390	312	273
				4	≤ 0.25	≤ 1.5			260	260	268	303	411	520	520	416	364
			Slot				75	RPM	59377	31668	15834	7917	3958	2375	1979	1188	950
							(60-90)	Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070
				2	1	≤ 1		Feed (mm/min)	95	95	98	111	150	190	190	152	133
				3	1	≤ 0.5			143	143	147	166	226	285	285	228	200
				4	1	≤ 0.4			190	190	196	222	301	380	380	304	266

continued on next page

2 Flute: Square, Double, Stub, Long Reach, Ball
3 Flute: Square, Long Reach, Ball
4 Flute: Square, Double, Stub, Long Reach, Ball, Corner Radius

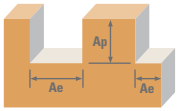


	Series 1M, 3M, 5M, 14M, 16M, 17M, 59M Metric	Hardness		Flutes	Ae x DC	Ap x DC	Vc (m/min)		DC • mm 0.4	0.75	1.5	3	6	10	12	20	25
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 150 Bhn or ≤ 88 HRb	Profile				268	RPM	213272	113745	56872	28436	14218	8531	7109	4265	3412
								Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140
				2	≤ 0.50	≤ 1.5	(215-322)	Feed (mm/min)	640	728	682	796	1081	1365	1365	1092	955
				3	≤ 0.25	≤ 1.5			960	1092	1024	1194	1621	2047	2047	1638	1433
			Slot				195	RPM	155107	82724	41362	20681	10340	6204	5170	3102	2482
								Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140
				2	1	≤ 1	(156-234)	Feed (mm/min)	465	529	496	579	786	993	993	794	695
				3	1	≤ 0.5			698	794	745	869	1179	1489	1489	1191	1042
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	Profile				148	RPM	117542	62689	31344	15672	7836	4702	3918	2351	1881
								Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070
				2	≤ 0.50	≤ 1.5	(118-177)	Feed (mm/min)	188	188	194	219	298	376	376	301	263
				3	≤ 0.25	≤ 1.5			282	282	292	329	447	564	564	451	395
				4	≤ 0.25	≤ 1.5			376	376	389	439	596	752	752	602	527
			Slot					RPM	84824	45239	22620	11310	5655	3393	2827	1696	1357
								Fz	0.0008	0.0015	0.0031	0.007	0.019	0.040	0.048	0.064	0.070
				2	1	≤ 1		Feed (mm/min)	136	136	140	158	215	271	271	217	190
				3	1	≤ 0.5			204	204	210	238	322	407	407	326	285
				4	1	≤ 0.4			271	271	280	317	430	543	543	434	380
	PLASTICS Polycarbonate, PVC, Polypropylene		Profile				268	RPM	213272	113745	56872	28436	14218	8531	7109	4265	3412
								Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140
				2	≤ 0.50	≤ 1.5	(215-322)	Feed (mm/min)	640	728	682	796	1081	1365	1365	1092	955
				3	≤ 0.25	≤ 1.5			960	1092	1024	1194	1621	2047	2047	1638	1433
				4	≤ 0.25	≤ 1.5			1280	1456	1365	1592	2161	2730	2730	2184	1911
			Slot				195	RPM	155107	82724	41362	20681	10340	6204	5170	3102	2482
								Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140
				2	1	≤ 1	(156-234)	Feed (mm/min)	465	529	496	579	786	993	993	794	695
				3	1	≤ 0.5			698	794	745	869	1179	1489	1489	1191	1042
				4	1	≤ 0.4			931	1059	993	1158	1572	1985	1985	1588	1390
	GRAPHITE		Profile				201	RPM	159954	85309	42654	21327	10664	6398	5332	3199	2559
								Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140
				2	≤ 0.50	≤ 1.5	(161-241)	Feed (mm/min)	480	546	512	597	810	1024	1024	819	717
				3	≤ 0.25	≤ 1.5			720	819	768	896	1216	1536	1536	1228	1075
				4	≤ 0.25	≤ 1.5			960	1092	1024	1194	1621	2047	2047	1638	1433
			Slot				146	RPM	116330	62043	31021	15511	7755	4653	3878	2327	1861
								Fz	0.0015	0.0032	0.0060	0.014	0.038	0.080	0.096	0.128	0.140
				2	1	≤ 1	(117-176)	Feed (mm/min)	349	397	372	434	589	745	745	596	521
				3	1	≤ 0.5			523	596	558	651	884	1117	1117	893	782
				4	1	≤ 0.4			698	794	745	869	1179	1489	1489	1191	1042
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, 718, Incoloy 800, Monel 400,Rene, Waspalloy	≤ 300 Bhn or ≤ 32 HRc	Profile				20	RPM	15753	8402	4201	2100	1050	630	525	315	252
								Fz	0.0005	0.0007	0.0014	0.004	0.010	0.021	0.024	0.032	0.035
				2	≤ 0.50	≤ 1.5	(16-24)	Feed (mm/min)	16	12	12	17	21	26	25	20	18
				3	≤ 0.25	≤ 1.5			24	18	18	25	32	40	38	30	26
				4	≤ 0.25	≤ 1.5			32	24	24	34	42	53	50	40	35
			Slot				14	RPM	10906	5816	2908	1454	727	436	364	218	174
								Fz	0.0005	0.0007	0.0014	0.004	0.010	0.021	0.024	0.032	0.035
				2	1	≤ 1	(11-16)	Feed (mm/min)	11	8	8	12	15	18	17	14	12
				3	1	≤ 0.5			16	12	12	17	22	27	26	21	18
				4	1	≤ 0.4			22	16	16	23	29	37	35	28	24
	TITANIUM ALLOYS Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti10V2Fe3Al, Ti5Al53Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti152 Cr3Sn3Al	≤ 350 Bhn or ≤ 38 HRc	Profile				55	RPM	43624	23266	11633	5816	2908	1745	1454	872	698
								Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042
				2	≤ 0.50	≤ 1.5	(44-66)	Feed (mm/min)	44	47	44	47	70	84	84	65	59
				3	≤ 0.25	≤ 1.5			65	70	66	70	105	126	127	97	88
				4	≤ 0.25	≤ 1.5			87	93	88	93	140	168	169	129	117
			Slot				40	RPM	31506	16803	8402	4201	2100	1260	1050	630	504
								Fz	0.0005	0.0010	0.0019	0.004	0.012	0.024	0.029	0.037	0.042
				2	1	≤ 1	(32-48)	Feed (mm/min)	32	34	32	34	50	60	61	47	42
				3	1	≤ 0.5			47	50	48	50	76	91	91	70	64
				4	1	≤ 0.4			63	67	64	67	101	121	122	93	85

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x number of flutes x rpm
reduce speed and feed for materials harder than listed

limit cut depths of long and extra long flute mills to .05 x DC when slotting or profiling
reduce feed and Ae when finish milling (.02 x DC maximum)
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex))

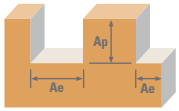
2 Flute: High Shear
4 Flute: High Shear



	Series 52M, 54M Metric	Hardness		Flutes	Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	10	12	20	25
N	ALUMINUM ALLOYS 2024, 5052, 5086, 6061, 6063, 7075	≤ 150 Bhn or ≤ 88 HRb	Profile				415	RPM	43947	21973	13184	10987	6592	5274
							(332-497)	Fz	0.0166	0.043	0.091	0.110	0.147	0.160
				2	≤ 0.3	≤ 1.5		Feed (mm/min)	1459	1890	2399	2417	1938	1688
				4	≤ 0.3	≤ 1.5			2918	3779	4799	4834	3876	3375
			Slot				332	RPM	35222	17611	10567	8806	5283	4227
							(266-399)	Fz	0.0151	0.041	0.085	0.101	0.133	0.148
				2	1	≤ 1		Feed (mm/min)	1064	1444	1796	1779	1405	1251
				4	1	≤ 0.25			2127	2888	3593	3557	2811	2502
	ALUMINUM DIE CAST ALLOYS (HIGH SILICON) A-390, A-392, B-390	≤ 125 Bhn or ≤ 77 HRb	Profile				155	RPM	16480	8240	4944	4120	2472	1978
							(124-187)	Fz	0.0166	0.043	0.091	0.110	0.147	0.160
				2	≤ 0.3	≤ 1.5		Feed (mm/min)	547	709	900	906	727	633
				4	≤ 0.3	≤ 1.5			1094	1417	1800	1813	1454	1266
			Slot				125	RPM	13249	6624	3975	3312	1987	1590
							(100-150)	Fz	0.0151	0.041	0.085	0.101	0.133	0.148
				2	1	≤ 1		Feed (mm/min)	400	543	676	669	529	471
				4	1	≤ 0.25			800	1086	1351	1338	1057	941
	COPPER ALLOYS Aluminum Bronze, Muntz Brass, Naval, Brass, Red Brass	≤ 140 Bhn or ≤ 3 HRc	Profile				180	RPM	19065	9533	5720	4766	2860	2288
							(144-216)	Fz	0.0094	0.024	0.053	0.062	0.083	0.093
				2	≤ 0.3	≤ 1.5		Feed (mm/min)	358	458	606	591	475	426
				4	≤ 0.3	≤ 1.5			717	915	1213	1182	949	851
			Slot				145	RPM	15349	7675	4605	3837	2302	1842
							(116-174)	Fz	0.0086	0.024	0.048	0.058	0.077	0.085
				2	1	≤ 1		Feed (mm/min)	264	368	442	445	355	313
				4	1	≤ 0.25			528	737	884	890	709	626
	COPPER ALLOYS Beryllium Copper, C110, Manganese Bronze, Tin Bronze	≤ 200 Bhn or ≤ 23 HRc	Profile				72	RPM	7594	3797	2278	1898	1139	911
							(57-86)	Fz	0.0094	0.024	0.053	0.062	0.083	0.093
				2	≤ 0.3	≤ 1.5		Feed (mm/min)	143	182	241	235	189	169
				4	≤ 0.3	≤ 1.5			286	365	483	471	378	339
			Slot				58	RPM	6140	3070	1842	1535	921	737
							(46-69)	Fz	0.0086	0.024	0.048	0.058	0.077	0.085
				2	1	≤ 1		Feed (mm/min)	106	147	177	178	142	125
				4	1	≤ 0.25			211	295	354	356	284	250

continued on next page

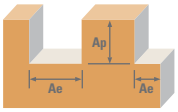
2 Flute: High Shear
4 Flute: High Shear



	Series 52M, 54M Metric	Hardness		Flutes	Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	10	12	20	25
N	PLASTICS ABS, Polycarbonate, PVC, Polypropylene		Profile				488	RPM	51702	25851	15511	12926	7755	6204
							(390-585)	Fz	0.0264	0.072	0.149	0.178	0.237	0.250
				2	≤ 0.3	≤ 1.5		Feed (mm/min)	2730	3723	4622	4601	3676	3102
				4	≤ 0.3	≤ 1.5			5460	7445	9244	9203	7352	6204
			Slot				390	RPM	41362	20681	12409	10340	6204	4963
							(312-468)	Fz	0.0240	0.065	0.136	0.163	0.210	0.238
				2	1	≤ 1		Feed (mm/min)	1985	2689	3375	3371	2606	2363
				4	1	≤ 0.25			3971	5377	6750	6742	5212	4725
	PLASTICS Fiberglass, Glass Filled		Profile				219	RPM	23266	11633	6980	5816	3490	2792
							(176-263)	Fz	0.0197	0.053	0.109	0.132	0.173	0.190
				2	≤ 0.3	≤ 1.5		Feed (mm/min)	917	1233	1522	1536	1208	1061
				4	≤ 0.3	≤ 1.5			1833	2466	3043	3071	2415	2122
			Slot				175	RPM	18580	9290	5574	4645	2787	2230
							(140-210)	Fz	0.0180	0.048	0.101	0.120	0.160	0.175
				2	1	≤ 1		Feed (mm/min)	669	892	1126	1115	892	780
				4	1	≤ 0.25			1338	1784	2252	2230	1784	1561

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x number of flutes x rpm
reduce speed and feed for materials harder than listed
reduce feed and Ae when finish milling (.02 x DC maximum)
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

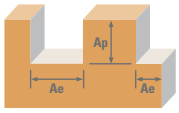
Single End Roughers (Coarse Pitch)



	Series 61M Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	10	12	20	25
P	**CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536**	≤ 175 Bhn or ≤ 7 HRc	Profile	≤ 0.5	≤ 1.5	152	RPM	8078	4847	4039	2424	1939
						(122-183)	Fz	0.014	0.029	0.034	0.045	0.050
							Feed (mm/min)	339	422	549	436	485
			Slot	1	≤ 1	122	RPM	6463	3878	3231	1939	1551
						(98-146)	Fz	0.014	0.029	0.034	0.045	0.050
							Feed (mm/min)	271	337	439	349	388
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.5	≤ 1.5	111	RPM	5897	3538	2949	1769	1415
						(89-134)	Fz	0.010	0.021	0.026	0.035	0.038
							Feed (mm/min)	177	223	307	248	269
			Slot	1	≤ 1	90	RPM	4766	2860	2383	1430	1144
						(72-108)	Fz	0.010	0.021	0.026	0.035	0.038
							Feed (mm/min)	143	180	248	200	217
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 250 Bhn or ≤ 24 HRc	Profile	≤ 0.5	≤ 1.5	105	RPM	5574	3344	2787	1672	1338
						(84-126)	Fz	0.014	0.024	0.036	0.048	0.053
							Feed (mm/min)	234	241	401	321	355
			Slot	1	≤ 1	84	RPM	4443	2666	2222	1333	1066
						(67-101)	Fz	0.014	0.024	0.036	0.048	0.053
							Feed (mm/min)	187	192	320	256	283
K	**CAST IRONS Gray, Malleable, Ductile**	≤ 220 Bhn or ≤ 19 HRc	Profile	≤ 0.5	≤ 1.5	111	RPM	5897	3538	2949	1769	1415
						(89-134)	Fz	0.019	0.040	0.048	0.064	0.070
							Feed (mm/min)	336	425	566	453	495
			Slot	1	≤ 1	90	RPM	4766	2860	2383	1430	1144
						(72-108)	Fz	0.019	0.040	0.048	0.064	0.070
							Feed (mm/min)	272	343	458	366	400

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x number of flutes x rpm
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Single End Roughers (Fine Pitch)



	Series 62M Metric	Hardness		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	10	12	20	25
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F, 440F	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.5	≤ 1.5	123	RPM	6544	3926	3272	1963	1570
						(99-148)	Fz	0.014	0.029	0.036	0.051	0.053
							Feed (mm/min)	283	345	471	398	495
			Slot	1	≤ 1	99	RPM	5251	3151	2626	1575	1260
						(79-119)	Fz	0.014	0.029	0.036	0.051	0.053
							Feed (mm/min)	227	277	378	319	397
	STAINLESS STEELS (DIFFICULT) 304, 304L, 316, 316L, 17-4PH, 15-5PH, 13-4PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	Profile	≤ 0.5	≤ 1.5	85	RPM	4524	2714	2262	1357	1086
						(68-102)	Fz	0.012	0.024	0.029	0.040	0.043
							Feed (mm/min)	163	195	261	217	277
			Slot	1	≤ 1	69	RPM	3635	2181	1818	1091	872
						(55-82)	Fz	0.012	0.024	0.029	0.040	0.043
							Feed (mm/min)	131	157	209	174	222
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy 800, Monel 400, Rene, Waspalloy	≤ 300 Bhn or ≤ 32 HRc	Profile	≤ 0.5	≤ 1.5	21	RPM	1131	679	565	339	271
						(17-26)	Fz	0.010	0.021	0.024	0.035	0.035
							Feed (mm/min)	33	43	54	47	57
			Slot	1	≤ 1	17	RPM	905	543	452	271	217
						(14-20)	Fz	0.010	0.021	0.024	0.035	0.035
							Feed (mm/min)	26	35	43	38	46
	TITANIUM ALLOYS Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti10V2Fe3Al, Ti5Al53Mo3Cr, Ti7Al4Mo, Ti3Al8V6Cr4Zr4Mo, Ti6Al6V6Sn, Ti152 Cr3Sn3Al	≤ 350 Bhn or ≤ 38 HRc	Profile	≤ 0.5	≤ 1.5	47	RPM	2504	1503	1252	751	601
						(38-57)	Fz	0.012	0.024	0.029	0.040	0.043
							Feed (mm/min)	90	108	144	120	153
			Slot	1	≤ 1	59	RPM	3151	1890	1575	945	756
						(48-71)	Fz	0.012	0.024	0.029	0.040	0.043
							Feed (mm/min)	113	136	181	151	193

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x number of flutes x rpm
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

SGS
Solid Carbide Tools

VALUE AT THE SPINDLE

General Application Drills

Hole Making

GENERAL APPLICATION DRILLS	SERIES	DESCRIPTION	PAGE	S&F PAGE
2 Flute	101	2 Flute Slow Spiral	218	226
Short Length Self Centering (DIN6539)	108M Plus	2 Flute Short Length DIN 6539	223	226
Straight Flute	106	Straight Flute 140 Point Geometry	228	231
3 Flute with 150 Point Geometry	103	3 Flute 150 Point Geometry	226	236

GENERAL APPLICATION COUNTERSINKS	SERIES	DESCRIPTION	PAGE	S&F PAGE
Combined Drill & Countersink	301M	2 Flute Straight Flute Combined Drill and Countersink Metric	237	238

GENERAL APPLICATION REAMERS	SERIES	DESCRIPTION	PAGE	S&F PAGE
Straight Flute Reamer	201M	Metric Reamer	240	241

Speed & Feed Recommendations listed after each series

Taladrado

BROCAS DE USO GENERAL	SERIE	DESCRIPCIÓN	PÁGINA	S&F PÁGINA
2 filos	101	2 filos, espiral de avance lento	218	226
Autocentrante de longitud corta (DIN6539)	108M Plus	2 filos, longitud corta, DIN 6539	223	226
Filo recto	106	Filo recto, geometría de 140 puntos	228	231
3 filos con geometría de 150 puntos	103	3 filos, geometría de 150 puntos	232	236

BROCAS DE USO AVELLANADORES	SERIE	DESCRIPCIÓN	PÁGINA	S&F PÁGINA
Broca y avellanador combinados	301M	2 filos, filo recto, broca y avellanador combinados, métrico	237	238

BROCAS DE USO ESCARIADORES	SERIE	DESCRIPCIÓN	PÁGINA	S&F PÁGINA
Escariador de filo recto	201M	Escariador métrico	240	241

Recomendaciones de velocidades y avances mostradas tras cada serie

Outils de perçage

FORETS UNIVERSELS	SÈRIES	DESCRIPTION	PAGE	S&F PAGE
2 dents	101	2 dents à spirale lente	218	226
Court autocentrant (DIN 6539)	108M Plus	2 dents court DIN 6539	223	226
Denture droite	106	Denture droite à angle de pointe 140º	228	231
3 dents à angle de pointe 150º	103	3 dents à angle de pointe 150º	232	236

FORETS À FRAISER	SÈRIES	DESCRIPTION	PAGE	S&F PAGE
Foret et foret à fraiser combinés	301M	2 dents denture droite foret et foret à fraiser combinés (métrique)	237	238

FORETS À ALÉSOIRS	SÈRIES	DESCRIPTION	PAGE	S&F PAGE
Alésoir denture droite	201M	Alésoir (métrique)	240	241

Recommandations de vitesse et avance indiquées après chaque série

Bohren

STANDARD-BOHRER	SERIE	BESCHREIBUNG	SEITE	S&F SEITE
2 Schneiden	101	2 Schneiden mit kleinem Spanwinkel	218	226
Kurze Bauform Selbstzentrierung (DIN 6539)	108M Plus	2 Schneiden Kurze Bauform DIN 6539	223	226
Gerade Schneiden	106	Gerade Schneiden Spitzengeometrie 140	228	231
3 Schneiden mit Spitzengeometrie 150	103	3 Schneiden Spitzengeometrie 150	232	236

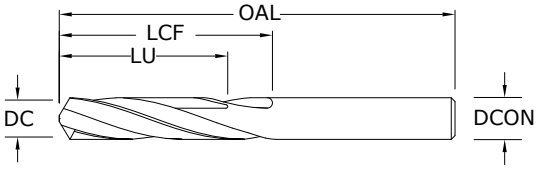
STANDARD-BOHRER	SERIE	BESCHREIBUNG	SEITE	S&F SEITE
Senkbohrer	301M	Metrischer Senkbohrer mit 2 geraden Schneiden	237	238

STANDARD-BOHRER	SERIE	BESCHREIBUNG	SEITE	S&F SEITE
Reibahle mit gerader Schneide	201M	Metrische Reibahle	240	241

Empfehlungen für Drehzahl & Vorschub im Anhang zu jeder Serie

2 Flute Drills • Metric: DIN 338

Pictured:
Series 101 Drill Set



101
METRIC SERIES

DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.0135	0,340 mm	3/4	3/16	–	51080	57076
0.0145	0,370 mm	3/4	3/16	–	51079	57077
0.0156	0,400 mm	3/4	3/16	–	51101	57078
0.0160	0,410 mm	3/4	3/16	–	51078	57079
0.0180	0,460 mm	3/4	3/16	–	51077	57080
0.0200	0,510 mm	7/8	1/4	–	51076	57081
0.0210	0,530 mm	7/8	1/4	–	51075	57082
0.0225	0,570 mm	7/8	1/4	–	51074	57083
0.0240	0,610 mm	7/8	1/4	–	51073	57084
0.0250	0,640 mm	1	5/16	–	51072	57085
0.0260	0,660 mm	1	5/16	–	51071	57086
0.0276	0,700 mm	28,0	9,0	–	61001	68268
0.0280	0,710 mm	1-1/4	1/2	–	51070	57087
0.0292	0,740 mm	1-1/4	1/2	–	51069	57088
0.0310	0,790 mm	1-1/4	1/2	–	51068	57089
0.0312	0,790 mm	1-1/4	1/2	–	51102	57090
0.0315	0,800 mm	30,0	10,0	–	61003	68269
0.0320	0,810 mm	1-1/4	1/2	–	51067	57091
0.0330	0,840 mm	1-1/4	1/2	–	51066	57092
0.0350	0,890 mm	1-3/8	5/8	1/2	51065	57093
0.0354	0,900 mm	32,0	11,0	8,0	61005	68270
0.0360	0,910 mm	1-3/8	5/8	1/2	51064	57094
0.0370	0,940 mm	1-3/8	5/8	1/2	51063	57095
0.0380	0,970 mm	1-3/8	5/8	1/2	51062	57096
0.0390	0,990 mm	1-3/8	5/8	1/2	51061	57097
0.0394	1,000 mm	34,0	12,0	9,0	61007	68271
0.0400	1,020 mm	1-1/2	3/4	39/64	51060	57098
0.0410	1,040 mm	1-1/2	3/4	39/64	51059	57099
0.0420	1,070 mm	1-1/2	3/4	39/64	51058	57100
0.0430	1,090 mm	1-1/2	3/4	39/64	51057	57101
0.0433	1,000 mm	36,0	14,0	11,0	61052	68294
0.0465	1,180 mm	1-1/2	3/4	39/64	51056	57102
0.0469	1,190 mm	1-1/2	3/4	39/64	51103	57103
0.0472	1,200 mm	38,0	16,0	12,0	61053	68295
0.0512	1,300 mm	38,0	16,0	12,0	61054	68296
0.0520	1,320 mm	1-1/2	3/4	39/64	51055	57104
0.0550	1,400 mm	1-1/2	3/4	39/64	51054	57105
0.0551	1,400 mm	40,0	18,0	14,0	61055	68297
0.0591	1,500 mm	40,0	18,0	14,0	61009	68272
0.0595	1,510 mm	1-1/2	3/4	39/64	51053	57106
0.0625	1,590 mm	1-1/2	3/4	39/64	51104	57107
0.0630	1,600 mm	43,0	20,0	16,0	61056	68298
0.0635	1,610 mm	1-1/2	3/4	39/64	51052	57108
0.0669	1,700 mm	43,0	20,0	17,0	61057	68299

continued on next page

TOLERANCES (mm)

DC = +0,0000/–0,0127

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

2 Flute Drills • Metric: DIN 338

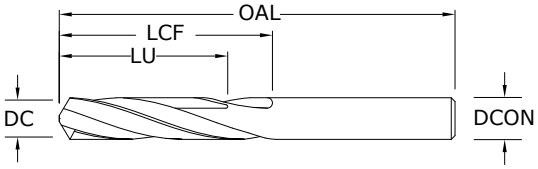
CONTINUED

DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.0670	1,700 mm	1-1/2	3/4	39/64	51051	57109
0.0700	1,780 mm	1-3/4	7/8	45/64	51050	57110
0.0709	1,800 mm	46,0	22,0	17,0	61058	68300
0.0730	1,850 mm	1-3/4	7/8	45/64	51049	57111
0.0748	1,900 mm	46,0	22,0	17,0	61059	68301
0.0760	1,930 mm	1-3/4	7/8	45/64	51048	57112
0.0781	1,980 mm	1-3/4	7/8	45/64	51105	57113
0.0785	1,990 mm	1-3/4	7/8	45/64	51047	57114
0.0787	2,000 mm	49,0	24,0	19,0	61011	68273
0.0810	2,060 mm	1-3/4	7/8	45/64	51046	57115
0.0820	2,080 mm	1-3/4	7/8	45/64	51045	57116
0.0827	2,100 mm	49,0	24,0	19,0	61060	68302
0.0860	2,180 mm	2	1	51/64	51044	57117
0.0866	2,200 mm	53,0	27,0	21,0	61061	68303
0.0890	2,260 mm	2	1	51/64	51043	57118
0.0906	2,300 mm	53,0	27,0	21,0	61062	68304
0.0935	2,370 mm	2	1	51/64	51042	57119
0.0938	2,380 mm	2	1	51/64	51106	57120
0.0945	2,400 mm	57,0	30,0	24,0	61063	68305
0.0960	2,440 mm	2	1	51/64	51041	57121
0.0980	2,490 mm	2	1	51/64	51040	57122
0.0984	2,500 mm	57,0	30,0	24,0	61013	68274
0.0995	2,530 mm	2-1/4	1-1/4	1	51039	57123
0.1015	2,580 mm	2-1/4	1-1/4	1	51038	57124
0.1024	2,600 mm	57,0	30,0	24,0	61064	68306
0.1040	2,640 mm	2-1/4	1-1/4	1	51037	57125
0.1063	2,700 mm	61,0	33,0	26,0	61065	68307
0.1065	2,710 mm	2-1/4	1-1/4	1	51036	57126
0.1094	2,780 mm	2-1/4	1-1/4	1	51107	57127
0.1100	2,790 mm	2-1/4	1-1/4	1	51035	57128
0.1102	2,800 mm	61,0	33,0	26,0	61066	68308
0.1110	2,820 mm	2-1/4	1-1/4	1	51034	57129
0.1130	2,870 mm	2-1/4	1-1/4	1	51033	57130
0.1142	2,900 mm	61,0	33,0	26,0	61067	68309
0.1160	2,950 mm	2-1/4	1-1/4	1	51032	57131
0.1181	3,000 mm	61,0	33,0	26,0	61015	68275
0.1200	3,050 mm	2-1/4	1-1/4	1	51031	57132
0.1220	3,100 mm	65,0	36,0	28,0	61068	68310
0.1250	3,180 mm	2-1/4	1-1/4	1	51108	57133
0.1260	3,200 mm	65,0	36,0	28,0	61069	68311
0.1285	3,260 mm	2-1/4	1-1/4	1	51030	57134
0.1299	3,300 mm	65,0	36,0	28,0	61070	68312
0.1339	3,400 mm	70,0	39,0	31,0	61071	68313
0.1360	3,450 mm	2-1/2	1-3/8	1-7/64	51029	57135
0.1378	3,500 mm	70,0	39,0	31,0	61017	68276
0.1405	3,570 mm	2-1/2	1-3/8	1-7/64	51028	57136
0.1406	3,570 mm	2-1/2	1-3/8	1-7/64	51109	57137
0.1417	3,600 mm	70,0	39,0	31,0	61072	68314
0.1440	3,660 mm	2-1/2	1-3/8	1-7/64	51027	57138
0.1457	3,700 mm	70,0	39,0	31,0	61073	68315
0.1470	3,730 mm	2-1/2	1-3/8	1-7/64	51026	57139
0.1495	3,800 mm	2-1/2	1-3/8	1-7/64	51025	57140
0.1496	3,800 mm	75,0	43,0	34,0	61074	68316
0.1520	3,860 mm	2-1/2	1-3/8	1-7/64	51024	57141

continued on next page

2 Flute Drills • Metric: DIN 338

Pictured:
Series 101 Drill Set



101
METRIC SERIES

CONTINUED

DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.1535	3,900 mm	75,0	43,0	34,0	61075	68317
0.1540	3,910 mm	2-1/2	1-3/8	1-7/64	51023	57142
0.1562	3,970 mm	2-1/2	1-3/8	1-7/64	51110	57143
0.1570	3,990 mm	2-1/2	1-3/8	1-7/64	51022	57144
0.1575	4,000 mm	75,0	43,0	34,0	61019	68277
0.1590	4,040 mm	2-1/2	1-3/8	1-7/64	51021	57145
0.1610	4,090 mm	2-1/2	1-3/8	1-7/64	51020	57146
0.1614	4,100 mm	75,0	43,0	34,0	61076	68318
0.1654	4,200 mm	75,0	43,0	34,0	61077	68319
0.1660	4,220 mm	2-3/4	1-5/8	1-19/64	51019	57147
0.1693	4,300 mm	80,0	47,0	37,0	61078	68320
0.1695	4,310 mm	2-3/4	1-5/8	1-19/64	51018	57148
0.1719	4,370 mm	2-3/4	1-5/8	1-19/64	51111	57149
0.1730	4,390 mm	2-3/4	1-5/8	1-19/64	51017	57150
0.1732	4,400 mm	80,0	47,0	37,0	61079	68321
0.1770	4,500 mm	2-3/4	1-5/8	1-19/64	51016	57151
0.1772	4,500 mm	80,0	47,0	37,0	61021	68278
0.1800	4,570 mm	2-3/4	1-5/8	1-19/64	51015	57152
0.1811	4,600 mm	80,0	47,0	37,0	61080	68322
0.1820	4,620 mm	2-3/4	1-5/8	1-19/64	51014	57153
0.1850	4,700 mm	80,0	47,0	37,0	61081	68323
0.1850	4,700 mm	2-3/4	1-5/8	1-19/64	51013	57154
0.1875	4,760 mm	2-3/4	1-5/8	1-19/64	51112	57155
0.1890	4,800 mm	86,0	52,0	41,0	61082	68324
0.1890	4,800 mm	2-3/4	1-5/8	1-19/64	51012	57156
0.1910	4,850 mm	2-3/4	1-5/8	1-19/64	51011	57157
0.1929	4,900 mm	86,0	52,0	41,0	61083	68325
0.1935	4,910 mm	2-3/4	1-5/8	1-19/64	51010	57158
0.1960	4,980 mm	3	1-3/4	1-13/32	51009	57159
0.1969	5,000 mm	86,0	52,0	41,0	61023	68279
0.1990	5,050 mm	3	1-3/4	1-13/32	51008	57160
0.2008	5,010 mm	86,0	52,0	41,0	61084	68326
0.2010	5,110 mm	3	1-3/4	1-13/32	51007	57161
0.2031	5,160 mm	3	1-3/4	1-13/32	51113	57162
0.2040	5,180 mm	3	1-3/4	1-13/32	51006	57163
0.2047	5,200 mm	86,0	52,0	41,0	61085	68327
0.2055	5,220 mm	3	1-3/4	1-13/32	51005	57164
0.2087	5,300 mm	86,0	52,0	41,0	61086	68328
0.2090	5,310 mm	3	1-3/4	1-13/32	51004	57165
0.2126	5,400 mm	93,0	57,0	45,0	61087	68329
0.2130	5,410 mm	3	1-3/4	1-13/32	51003	57166
0.2165	5,500 mm	93,0	57,0	1-13/32	61025	68280
0.2188	5,560 mm	3	1-3/4	1-13/32	51114	57167
0.2205	5,600 mm	93,0	57,0	45,0	61088	68330

continued on next page

TOLERANCES (mm)

DC = +0,0000/–0,0127

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

2 Flute Drills • Metric: DIN 338

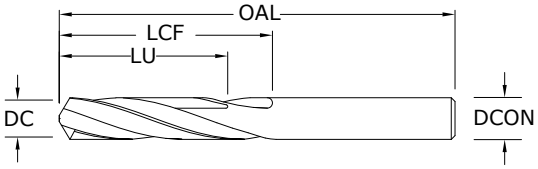
CONTINUED

DECIMAL DC/DCON	METRIC DC/DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.2210	5,610 mm	3	1-3/4	1-13/32	51002	57168
0.2244	5,700 mm	93,0	57,0	45,0	61089	68331
0.2280	5,790 mm	3	1-3/4	1-13/32	51001	57169
0.2283	5,800 mm	93,0	57,0	45,0	61090	68332
0.2323	5,900 mm	93,0	57,0	45,0	61091	68333
0.2340	5,940 mm	3-1/4	2	1-39/64	51201	57170
0.2344	5,950 mm	3-1/4	2	1-39/64	51115	57171
0.2362	6,000 mm	93,0	57,0	45,0	61027	68281
0.2380	6,050 mm	3-1/4	2	1-39/64	51202	57172
0.2402	6,100 mm	101,0	63,0	50,0	61092	68334
0.2420	6,150 mm	3-1/4	2	1-39/64	51203	57173
0.2441	6,200 mm	101,0	63,0	50,0	61093	68335
0.2460	6,250 mm	3-1/4	2	1-39/64	51204	57174
0.2480	6,300 mm	101,0	63,0	50,0	61094	68336
0.2500	6,350 mm	3-1/4	2	1-39/64	51116	57176
0.2520	6,400 mm	101,0	63,0	50,0	61095	68337
0.2559	6,500 mm	101,0	63,0	50,0	61029	68282
0.2570	6,530 mm	3-1/4	2	1-39/64	51206	57177
0.2598	6,600 mm	101,0	63,0	50,0	61096	68338
0.2610	6,630 mm	3-1/2	2-1/8	1-45/64	51207	57178
0.2638	6,700 mm	101,0	63,0	50,0	61097	68339
0.2656	6,750 mm	3-1/2	2-1/8	1-45/64	51117	57179
0.2660	6,760 mm	3-1/2	2-1/8	1-45/64	51208	57180
0.2677	6,800 mm	109,0	69,0	55,0	61098	68340
0.2717	6,900 mm	109,0	69,0	55,0	61099	68341
0.2720	6,910 mm	3-1/2	2-1/8	1-45/64	51209	57181
0.2756	7,000 mm	109,0	69,0	55,0	61031	68283
0.2770	7,040 mm	3-1/2	2-1/8	1-45/64	51210	57182
0.2795	7,100 mm	109,0	69,0	55,0	61100	68342
0.2810	7,140 mm	3-1/2	2-1/8	1-45/64	51211	57183
0.2812	7,140 mm	3-1/2	2-1/8	1-45/64	51118	57184
0.2835	7,200 mm	109,0	69,0	55,0	61101	68343
0.2874	7,300 mm	109,0	69,0	55,0	61102	68344
0.2900	7,370 mm	3-1/2	2-1/8	1-45/64	51212	57185
0.2913	7,400 mm	109,0	69,0	55,0	61103	68345
0.2950	7,490 mm	3-3/4	2-3/8	1-29/32	51213	57186
0.2953	7,500 mm	109,0	69,0	55,0	61033	68284
0.2969	7,540 mm	3-3/4	2-3/8	1-29/32	51119	57187
0.2992	7,600 mm	117,0	75,0	60,0	61104	68346
0.3020	7,670 mm	3-3/4	2-3/8	1-29/32	51214	57188
0.3031	7,700 mm	117,0	75,0	60,0	61105	68347
0.3071	7,800 mm	117,0	75,0	60,0	61106	68348
0.3110	7,900 mm	117,0	75,0	60,0	61107	68349
0.3125	7,940 mm	3-3/4	2-3/8	1-29/32	51120	57189
0.3150	8,000 mm	117,0	75,0	60,0	61035	68285
0.3160	8,030 mm	3-3/4	2-3/8	1-29/32	51215	57190
0.3189	8,100 mm	117,0	75,0	60,0	61108	68350
0.3228	8,200 mm	117,0	75,0	60,0	61109	68351
0.3230	8,200 mm	3-3/4	2-3/8	1-29/32	51216	57191
0.3268	8,300 mm	117,0	75,0	60,0	61110	68352
0.3281	8,330 mm	4	2-1/2	2	51121	57192
0.3307	8,400 mm	117,0	75,0	60,0	61111	68353
0.3320	8,430 mm	4	2-1/2	2	51217	57193
0.3346	8,500 mm	117,0	75,0	60,0	61037	68286

continued on next page

2 Flute Drills • Metric: DIN 338

Pictured:
Series 101 Drill Set



101
METRIC SERIES

CONTINUED

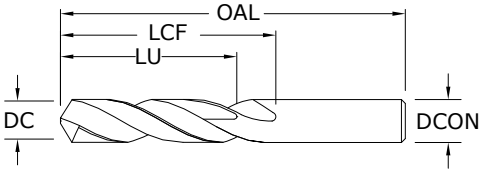
DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.3386	8,600 mm	125,0	81,0	64,0	61112	68354
0.3390	8,610 mm	4	2-1/2	2	51218	57194
0.3425	8,700 mm	125,0	81,0	64,0	61113	68355
0.3438	8,730 mm	4	2-1/2	2	51122	57195
0.3465	8,800 mm	125,0	81,0	64,0	61114	68356
0.3480	8,840 mm	4	2-1/2	2	51219	57196
0.3504	8,900 mm	125,0	81,0	64,0	61115	68357
0.3543	9,000 mm	125,0	81,0	64,0	61039	68287
0.3580	9,090 mm	4-1/4	2-3/4	2-13/64	51220	57197
0.3583	9,100 mm	125,0	81,0	64,0	61116	68358
0.3594	9,130 mm	4-1/4	2-3/4	2-13/64	51123	57198
0.3622	9,200 mm	125,0	81,0	64,0	61117	68359
0.3661	9,300 mm	125,0	81,0	64,0	61118	68360
0.3680	9,350 mm	4-1/4	2-3/4	2-13/64	51221	57199
0.3701	9,400 mm	125,0	81,0	64,0	61119	68361
0.3740	9,500 mm	125,0	81,0	64,0	61041	68288
0.3750	9,530 mm	4-1/4	2-3/4	2-13/64	51124	57200
0.3770	9,580 mm	4-1/4	2-3/4	2-13/64	51222	57201
0.3780	9,600 mm	133,0	87,0	69,0	61120	68362
0.3819	9,700 mm	133,0	87,0	69,0	61121	68363
0.3858	9,800 mm	133,0	87,0	69,0	61122	68364
0.3860	9,800 mm	4-1/2	2-7/8	2-19/64	51223	57202
0.3898	9,00 mm	133,0	87,0	69,0	61123	68365
0.3906	9,920 mm	4-1/2	2-7/8	2-19/64	51125	57203
0.3937	10,000 mm	133,0	87,0	69,0	61043	68289
0.3970	10,080 mm	4-1/2	2-7/8	2-19/64	51224	57204
0.4016	10,010 mm	133,0	87,0	69,0	61124	68366
0.4040	10,260 mm	4-1/2	2-7/8	2-19/64	51225	57205
0.4062	10,320 mm	4-1/2	2-7/8	2-19/64	51126	57206
0.4130	10,490 mm	4-1/2	2-7/8	2-19/64	51226	57207
0.4134	10,500 mm	133,0	87,0	69,0	61045	68290
0.4219	10,720 mm	4-1/2	2-7/8	2-19/64	51127	57208
0.4331	11,000 mm	142,0	94,0	75,0	61047	68291
0.4375	11,110 mm	4-1/2	2-7/8	2-19/64	51128	57209
0.4528	11,500 mm	142,0	94,0	75,0	61049	68292
0.4531	11,510 mm	4-3/4	3	2-13/32	51129	57210
0.4688	11,910 mm	4-3/4	3	2-13/32	51130	57211
0.4724	12,000 mm	151,0	101,0	80,0	61051	68293
0.4844	12,300 mm	4-3/4	3	2-13/32	51131	57212
0.5000	12,700 mm	4-3/4	3	2-13/32	51132	57213
*Series 101 Set					61175	57351

TOLERANCES (mm)

DC = +0,0000/–0,0127

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

Short Length Self Centering Drills • DIN 6539



108M Plus
METRIC SERIES

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,000/–0,010
DCON = h_6

>3–6 DIAMETER
DC = +0,000/–0,012
DCON = h_6

>6–10 DIAMETER
DC = +0,000/–0,015
DCON = h_6

>10–16 DIAMETER
DC = +0,000/–0,018
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

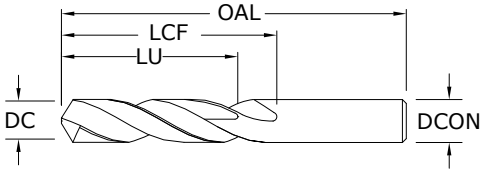
		mm			EDP NO,	
DECIMAL DC/DCON	METRIC DC/DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	UNCOATED	Ti-NAMITE-A (AlTiN)
0.0197	0,500 mm	20,0	3,0	–	62001	68643
0.0217	0,550 mm	21,0	3,5	–	62003	68644
0.0236	0,600 mm	21,0	3,5	–	62005	68645
0.0256	0,650 mm	22,0	4,0	–	62007	68646
0.0276	0,700 mm	23,0	4,5	–	62009	68647
0.0295	0,750 mm	23,0	4,5	–	62011	68648
0.0315	0,800 mm	24,0	5,0	–	62013	68649
0.0335	0,850 mm	24,0	5,0	–	62015	68650
0.0354	0,900 mm	25,0	5,5	4,0	62017	68651
0.0374	0,950 mm	25,0	5,5	4,0	62019	68652
0.0394	1,000 mm	26,0	6,0	4,7	62021	68653
0.0413	1,050 mm	26,0	6,0	4,7	62023	68654
0.0433	1,100 mm	28,0	7,0	5,4	62025	68655
0.0453	1,150 mm	28,0	7,0	5,4	62027	68656
0.0472	1,200 mm	30,0	8,0	6,0	62029	68657
0.0492	1,250 mm	30,0	8,0	6,0	62031	68658
0.0512	1,300 mm	30,0	8,0	6,0	62033	68659
0.0531	1,350 mm	32,0	9,0	7,0	62035	68660
0.0551	1,400 mm	32,0	9,0	7,0	62037	68661
0.0571	1,450 mm	32,0	9,0	7,0	62039	68662
0.0591	1,500 mm	32,0	9,0	7,0	62041	68663
0.0630	1,600 mm	34,0	10,0	7,0	62043	68664
0.0669	1,700 mm	34,0	10,0	7,0	62045	68665
0.0709	1,800 mm	36,0	11,0	8,0	62047	68666
0.0748	1,900 mm	36,0	11,0	8,0	62049	68667
0.0748	2,000 mm	38,0	12,0	9,0	62051	68668
0.0827	2,100 mm	38,0	12,0	9,0	62053	68669
0.0866	2,200 mm	40,0	13,0	10,0	62055	68670
0.0906	2,300 mm	40,0	13,0	10,0	62057	68671
0.0945	2,400 mm	43,0	14,0	11,0	62059	68672
0.0984	2,500 mm	43,0	14,0	11,0	62061	68673
0.1024	2,600 mm	43,0	14,0	11,0	62063	68674
0.1063	2,700 mm	46,0	16,0	12,0	62065	68675
0.1102	2,800 mm	46,0	16,0	12,0	62067	68676

continued on next page

Short Length Self Centering Drills • DIN 6539

108M Plus

METRIC SERIES



CONTINUED

DECIMAL DC/DCON	METRIC DC/DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	Ti-NAMITE-A (AlTiN)
0.1142	2,900 mm	46,0	16,0	12,0	62069	68677
0.1181	3,000 mm	46,0	16,0	12,0	62071	68678
0.1220	3,100 mm	49,0	18,0	14,0	62073	68679
0.1260	3,200 mm	49,0	18,0	14,0	62075	68680
0.1299	3,300 mm	49,0	18,0	14,0	62077	68681
0.1339	3,400 mm	52,0	20,0	15,0	62079	68682
0.1378	3,500 mm	52,0	20,0	15,0	62081	68683
0.1417	3,600 mm	52,0	20,0	15,0	62083	68684
0.1457	3,700 mm	52,0	20,0	15,0	62085	68685
0.1496	3,800 mm	55,0	22,0	17,0	62087	68686
0.1535	3,900 mm	55,0	22,0	17,0	62089	68687
0.1575	4,000 mm	55,0	22,0	17,0	62091	68688
0.1614	4,100 mm	55,0	22,0	17,0	62093	68689
0.1654	4,200 mm	55,0	22,0	17,0	62095	68690
0.1693	4,300 mm	58,0	24,0	18,0	62097	68691
0.1732	4,400 mm	58,0	24,0	18,0	62099	68692
0.1772	4,500 mm	58,0	24,0	18,0	62101	68693
0.1811	4,600 mm	58,0	24,0	18,0	62103	68694
0.1850	4,700 mm	58,0	24,0	18,0	62105	68695
0.1890	4,800 mm	62,0	26,0	20,0	62107	68696
0.1929	4,900 mm	62,0	26,0	20,0	62109	68697
0.1969	5,000 mm	62,0	26,0	20,0	62111	68698
0.2008	5,100 mm	62,0	26,0	20,0	62113	68699
0.2047	5,200 mm	62,0	26,0	20,0	62115	68700
0.2087	5,300 mm	62,0	26,0	20,0	62117	68701
0.2126	5,400 mm	66,0	28,0	21,0	62119	68702
0.2165	5,500 mm	66,0	28,0	21,0	62121	68703
0.2205	5,600 mm	66,0	28,0	21,0	62123	68704
0.2244	5,700 mm	66,0	28,0	21,0	62125	68705
0.2283	5,800 mm	66,0	28,0	21,0	62127	68706
0.2323	5,900 mm	66,0	28,0	21,0	62129	68707
0.2362	6,000 mm	66,0	28,0	21,0	62131	68708

continued on next page

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,000/–0,010
DCON = h_6

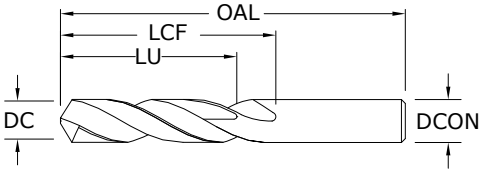
>3–6 DIAMETER
DC = +0,000/–0,012
DCON = h_6

>6–10 DIAMETER
DC = +0,000/–0,015
DCON = h_6

>10–16 DIAMETER
DC = +0,000/–0,018
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

Short Length Self Centering Drills • DIN 6539



108M Plus
METRIC SERIES

CONTINUED

TOLERANCES (mm)

≤3 DIAMETER
DC = +0,000/–0,010
DCON = h_6

>3–6 DIAMETER
DC = +0,000/–0,012
DCON = h_6

>6–10 DIAMETER
DC = +0,000/–0,015
DCON = h_6

>10–16 DIAMETER
DC = +0,000/–0,018
DCON = h_6

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

		mm			EDP NO,	
DECIMAL DC/DCON	METRIC DC/DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	UNCOATED	Ti-NAMITE-A (AlTiN)
0.2402	6,100 mm	70,0	31,0	23,0	62133	68709
0.2441	6,200 mm	70,0	31,0	23,0	62135	68710
0.2480	6,300 mm	70,0	31,0	23,0	62137	68711
0.2520	6,400 mm	70,0	31,0	23,0	62139	68712
0.2559	6,500 mm	70,0	31,0	23,0	62141	68713
0.2598	6,800 mm	70,0	31,0	23,0	62142	68603
0.2756	7,000 mm	74,0	34,0	25,0	62143	68718
0.2953	7,500 mm	74,0	34,0	25,0	62145	68723
0.3071	7,800 mm	79,0	37,0	27,0	62146	68604
0.3150	8,000 mm	79,0	37,0	27,0	62147	68728
0.3346	8,500 mm	79,0	37,0	27,0	62149	68733
0.3543	9,000 mm	84,0	40,0	29,0	62151	68738
0.3740	9,500 mm	84,0	40,0	29,0	62153	68743
0.3858	9,800 mm	89,0	43,0	31,0	62154	68606
0.3937	10,000 mm	89,0	43,0	31,0	62155	68748
0.4016	10,200 mm	89,0	43,0	31,0	62156	68607
0.4134	10,500 mm	89,0	43,0	31,0	62066	68753
0.4331	11,000 mm	95,0	47,0	33,0	62157	68758
0.4528	11,500 mm	95,0	47,0	33,0	62084	68763
0.4646	11,800 mm	102,0	51,0	35,0	62158	68608
0.4724	12,000 mm	102,0	51,0	35,0	62159	68768
0.4921	12,500 mm	102,0	51,0	35,0	62102	68773
0.5118	13,000 mm	102,0	51,0	35,0	62112	68778
0.5433	13,800 mm	107,0	54,0	37,0	62164	68609
0.5512	14,000 mm	107,0	54,0	37,0	62116	68780
0.5709	14,500 mm	111,0	56,0	38,0	62166	68611
0.5827	14,800 mm	111,0	56,0	38,0	62167	68612
0.5906	15,000 mm	111,0	56,0	38,0	62168	68613
0.6221	15,800 mm	115,0	58,0	38,0	62170	68614
0.6299	16,000 mm	115,0	58,0	38,0	62171	68616

2 Flute Drills
Short Length Self Centering Drills • DIN 6539

	Series 101M, 108M Metric	Hardness	Vc (m/min)		DC • mm 1	3	6	8	10	12	16
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	81	RPM	25690	8563	4282	3211	2569	2141	1606
			(65-97)	Fr	0.014	0.041	0.082	0.109	0.136	0.163	0.218
				Feed (mm/min)	350	350	350	350	350	350	350
		≤ 300 Bhn or ≤ 32 HRc	38	RPM	12118	4039	2020	1515	1212	1010	757
			(30-46)	Fr	0.012	0.036	0.072	0.096	0.120	0.144	0.191
				Feed (mm/min)	145	145	145	145	145	145	145
		≤ 425 Bhn or ≤ 45 HRc	26	RPM	8240	2747	1373	1030	824	687	515
			(21-31)	Fr	0.007	0.020	0.040	0.053	0.067	0.080	0.107
				Feed (mm/min)	55	55	55	55	55	55	55
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	70	RPM	22297	7432	3716	2787	2230	1858	1394
			(56-84)	Fr	0.012	0.036	0.073	0.097	0.121	0.145	0.194
				Feed (mm/min)	270	270	270	270	270	270	270
		≤ 375 Bhn or ≤ 40 HRc	44	RPM	14057	4686	2343	1757	1406	1171	879
			(35-53)	Fr	0.012	0.036	0.073	0.097	0.121	0.145	0.194
				Feed (mm/min)	170	170	170	170	170	170	170
		≤ 425 Bhn or ≤ 45 HRc	18	RPM	5816	1939	969	727	582	485	364
			(15-22)	Fr	0.005	0.015	0.030	0.040	0.050	0.060	0.080
				Feed (mm/min)	29	29	29	29	29	29	29
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 250 Bhn or ≤ 24 HRc	26	RPM	8240	2747	1373	1030	824	687	515
			(21-31)	Fr	0.007	0.020	0.040	0.053	0.067	0.080	0.107
				Feed (mm/min)	55	55	55	55	55	55	55
		≤ 375 Bhn or ≤ 40 HRc	17	RPM	5332	1777	889	666	533	444	333
			(13-20)	Fr	0.003	0.010	0.020	0.027	0.034	0.041	0.054
				Feed (mm/min)	18	18	18	18	18	18	18
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F 440F	≤ 250 Bhn or ≤ 24 HRc	64	RPM	20358	6786	3393	2545	2036	1696	1272
			(51-77)	Fr	0.010	0.029	0.059	0.079	0.098	0.118	0.157
				Feed (mm/min)	200	200	200	200	200	200	200
		≤ 330 Bhn or ≤ 36 HRc	34	RPM	10664	3555	1777	1333	1066	889	666
			(27-40)	Fr	0.006	0.017	0.034	0.045	0.056	0.068	0.090
				Feed (mm/min)	60	60	60	60	60	60	60
	STAINLESS STEELS (DIFFICULT) 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	20	RPM	6301	2100	1050	788	630	525	394
			(16-24)	Fr	0.007	0.021	0.043	0.057	0.071	0.086	0.114
				Feed (mm/min)	45	45	45	45	45	45	45
		≤ 375 Bhn or ≤ 40 HRc	17	RPM	5332	1777	889	666	533	444	333
			(13-20)	Fr	0.007	0.020	0.039	0.053	0.066	0.079	0.105
				Feed (mm/min)	35	35	35	35	35	35	35
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	85	RPM	27144	9048	4524	3393	2714	2262	1696
			(68-102)	Fr	0.016	0.049	0.097	0.130	0.162	0.195	0.259
				Feed (mm/min)	440	440	440	440	440	440	440
		≤ 330 Bhn or ≤ 36 HRc	76	RPM	24235	8078	4039	3029	2424	2020	1515
			(61-91)	Fr	0.017	0.050	0.099	0.132	0.165	0.198	0.264
				Feed (mm/min)	400	400	400	400	400	400	400

continued on next page

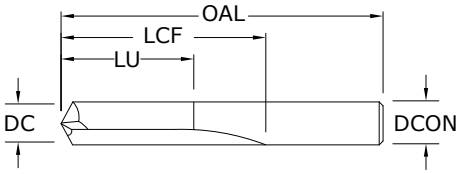
2 Flute Drills
Short Length Self Centering Drills • DIN 6539

	Series 101M, 108M Metric	Hardness	Vc (m/min)		DC • mm 1	3	6	8	10	12	16
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 80 Bhn or ≤ 47 HRb	165	RPM	52348	17449	8725	6544	5235	4362	3272
			(132-198)	Fr	0.020	0.060	0.120	0.160	0.200	0.240	0.319
				Feed (mm/min)	1045	1045	1045	1045	1045	1045	1045
		≤ 150 Bhn or ≤ 88 HRb	139	RPM	44108	14703	7351	5514	4411	3676	2757
			(111-166)	Fr	0.020	0.060	0.120	0.160	0.200	0.239	0.319
				Feed (mm/min)	880	880	880	880	880	880	880
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	58	RPM	18419	6140	3070	2302	1842	1535	1151
			(46-69)	Fr	0.010	0.030	0.060	0.080	0.100	0.121	0.161
				Feed (mm/min)	185	185	185	185	185	185	185
		≤ 200 Bhn or ≤ 23 HRc	53	RPM	16965	5655	2827	2121	1696	1414	1060
			(43-64)	Fr	0.010	0.030	0.060	0.080	0.100	0.120	0.160
				Feed (mm/min)	170	170	170	170	170	170	170
	PLASTICS Polycarbonate, PVC		152	RPM	48471	16157	8078	6059	4847	4039	3029
			(122-183)	Fr	0.020	0.060	0.120	0.160	0.200	0.240	0.320
				Feed (mm/min)	970	970	970	970	970	970	970
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy 800, Monel 400, Rene, Waspaloy	≤ 220 Bhn or ≤ 19 HRc	12	RPM	3878	1293	646	485	388	323	242
			(10-15)	Fr	0.006	0.019	0.039	0.052	0.064	0.077	0.103
				Feed (mm/min)	25	25	25	25	25	25	25
		≤ 320 Bhn or ≤ 34 HRc	8	RPM	2424	808	404	303	242	202	151
			(6-9)	Fr	0.006	0.019	0.037	0.050	0.062	0.074	0.099
				Feed (mm/min)	15	15	15	15	15	15	15
		≤ 425 Bhn or ≤ 45 HRc	6	RPM	1939	646	323	242	194	162	121
			(5-7)	Fr	0.005	0.015	0.031	0.041	0.052	0.062	0.083
				Feed (mm/min)	10	10	10	10	10	10	10
	TITANIUM ALLOYS (DIFFICULT) Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V	≤ 275 Bhn or ≤ 28 HRc	26	RPM	8240	2747	1373	1030	824	687	515
			(21-31)	Fr	0.013	0.040	0.080	0.107	0.133	0.160	0.214
				Feed (mm/min)	110	110	110	110	110	110	110
		≤ 350 Bhn or ≤ 38 HRc	20	RPM	6301	2100	1050	788	630	525	394
			(16-24)	Fr	0.007	0.021	0.043	0.057	0.071	0.086	0.114
				Feed (mm/min)	45	45	45	45	45	45	45
		≤ 440 Bhn or ≤ 47 HRc	17	RPM	5332	1777	889	666	533	444	333
			(13-20)	Fr	0.007	0.020	0.039	0.053	0.066	0.079	0.105
				Feed (mm/min)	35	35	35	35	35	35	35
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	12	RPM	3878	1293	646	485	388	323	242
			(10-15)	Fr	0.003	0.009	0.019	0.025	0.031	0.037	0.050
				Feed (mm/min)	12	12	12	12	12	12	12

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
reduce speed and feed 30 percent when using uncoated drills
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Straight Flute Drills • Metric: DIN 6539

106
METRIC SERIES



DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	Ti-NAMITE-A (AlTiN)
0.0394	1,000 mm	26,0	6,0	4,5	66001	66002
0.0400	1,020 mm	1-1/2	1/2	13/32	56060	56269
0.0410	1,040 mm	1-1/2	1/2	13/32	56059	56268
0.0420	1,070 mm	1-1/2	1/2	13/32	56058	56267
0.0430	1,090 mm	1-1/2	1/2	13/32	56057	56266
0.0465	1,180 mm	1-1/2	1/2	13/32	56056	56265
0.0469	1,190 mm	1-1/2	1/2	13/32	56103	56135
0.0520	1,320 mm	1-1/2	1/2	13/32	56055	56264
0.0550	1,400 mm	1-1/2	1/2	13/32	56054	56263
0.0591	1,500 mm	32,0	9,0	7,0	66003	66004
0.0595	1,510 mm	1-1/2	1/2	13/32	56053	56262
0.0625	1,590 mm	1-1/2	5/8	1/2	56104	56136
0.0635	1,610 mm	1-11/16	11/16	35/64	56052	56261
0.0670	1,700 mm	1-11/16	11/16	35/64	56051	56260
0.0700	1,780 mm	1-11/16	11/16	35/64	56050	56259
0.0730	1,850 mm	1-11/16	11/16	35/64	56049	56258
0.0760	1,930 mm	1-11/16	11/16	35/64	56048	56257
0.0781	1,980 mm	1-11/16	11/16	35/64	56105	56137
0.0785	1,990 mm	1-3/4	3/4	39/64	56047	56256
0.0787	2,000 mm	38,0	12,0	9,0	66005	66006
0.0810	2,060 mm	1-3/4	3/4	39/64	56046	56255
0.0820	2,080 mm	1-3/4	3/4	39/64	56045	56254
0.0860	2,180 mm	1-3/4	3/4	39/64	56044	56253
0.0890	2,260 mm	1-3/4	3/4	39/64	56043	56252
0.0935	2,370 mm	1-3/4	3/4	39/64	56042	56251
0.0938	2,380 mm	1-3/4	3/4	39/64	56106	56138
0.0960	2,440 mm	1-13/16	13/16	21/32	56041	56250
0.0980	2,490 mm	1-13/16	13/16	21/32	56040	56249
0.0984	2,500 mm	43,0	14,0	11,0	66007	66008
0.0995	2,530 mm	1-13/16	13/16	21/32	56039	56248
0.1015	2,580 mm	1-13/16	13/16	21/32	56038	56247
0.1040	2,640 mm	1-13/16	13/16	21/32	56037	56246
0.1065	2,710 mm	1-13/16	13/16	21/32	56036	56245
0.1094	2,780 mm	1-13/16	13/16	21/32	56107	56139
0.1100	2,790 mm	1-7/8	7/8	45/64	56035	56244
0.1110	2,820 mm	1-7/8	7/8	45/64	56034	56243

continued on next page

TOLERANCES (mm)

DC = +0,0000/–0,0127
DCON = h_6

STEELS
CAST IRON
HARDENED STEELS

Straight Flute Drills • Metric: DIN 6539

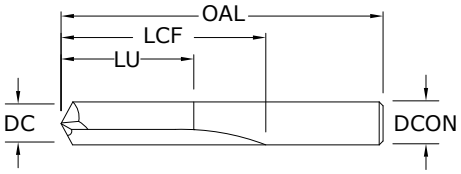
CONTINUED

DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.1130	2,870 mm	1-7/8	7/8	45/64	56033	56242
0.1160	2,950 mm	1-7/8	7/8	45/64	56032	56241
0.1181	3,000 mm	46,0	16,0	12,0	66009	66010
0.1200	3,050 mm	1-7/8	7/8	45/64	56031	56240
0.1250	3,180 mm	1-7/8	7/8	45/64	56108	56140
0.1285	3,260 mm	1-15/16	15/16	3/4	56030	56239
0.1360	3,450 mm	1-15/16	15/16	3/4	56029	56238
0.1378	3,500 mm	52,0	20,0	15,0	66011	66012
0.1405	3,570 mm	1-15/16	15/16	3/4	56028	56237
0.1406	3,570 mm	1-15/16	15/16	3/4	56109	56141
0.1440	3,660 mm	2-1/16	1	51/64	56027	56236
0.1470	3,730 mm	2-1/16	1	51/64	56026	56235
0.1495	3,800 mm	2-1/16	1	51/64	56025	56234
0.1520	3,860 mm	2-1/16	1	51/64	56024	56233
0.1540	3,910 mm	2-1/16	1	51/64	56023	56232
0.1562	3,970 mm	2-1/16	1	51/64	56110	56142
0.1570	3,990 mm	2-1/8	1-1/16	55/64	56022	56231
0.1575	4,000 mm	55,0	22,0	17,0	66013	66014
0.1590	4,040 mm	2-1/8	1-1/16	55/64	56021	56230
0.1610	4,090 mm	2-1/8	1-1/16	55/64	56020	56229
0.1660	4,220 mm	2-1/8	1-1/16	55/64	56019	56228
0.1695	4,310 mm	2-1/8	1-1/16	55/64	56018	56227
0.1719	4,370 mm	2-1/8	1-1/16	55/64	56111	56143
0.1730	4,390 mm	2-3/16	1-1/8	29/32	56017	56226
0.1770	4,500 mm	2-3/16	1-1/8	29/32	56016	56225
0.1772	4,500 mm	58,0	24,0	18,0	66015	66016
0.1800	4,570 mm	2-3/16	1-1/8	29/32	56015	56224
0.1820	4,620 mm	2-3/16	1-1/8	29/32	56014	56223
0.1850	4,700 mm	2-3/16	1-1/8	29/32	56013	56222
0.1875	4,760 mm	2-3/16	1-1/8	29/32	56112	56144
0.1890	4,800 mm	2-3/16	1-1/8	29/32	56012	56221
0.1910	4,850 mm	2-3/16	1-1/8	29/32	56011	56220
0.1935	4,910 mm	2-3/16	1-1/8	29/32	56010	56219
0.1960	4,980 mm	2-1/4	1-3/16	61/64	56009	56218
0.1969	5,000 mm	62,0	26,0	20,0	66017	66018
0.1990	5,050 mm	2-1/4	1-3/16	61/64	56008	56217
0.2010	5,110 mm	2-1/4	1-3/16	61/64	56007	56216
0.2031	5,160 mm	2-1/4	1-3/16	61/64	56113	56145
0.2040	5,180 mm	2-3/8	1-1/4	1	56006	56215
0.2055	5,220 mm	2-3/8	1-1/4	1	56005	56214
0.2090	5,310 mm	2-3/8	1-1/4	1	56004	56213
0.2130	5,410 mm	2-3/8	1-1/4	1	56003	56212
0.2165	5,500 mm	66,0	28,0	21,0	66019	66020
0.2188	5,560 mm	2-3/8	1-1/4	1	56114	56146
0.2210	5,610 mm	2-7/16	1-5/16	1-3/64	56002	56211
0.2280	5,790 mm	2-7/16	1-5/16	1-3/64	56001	56210

continued on next page

Straight Flute Drills • Metric: DIN 6539

106
METRIC SERIES



DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.2344	5,950 mm	2-7/16	1-5/16	1-3/64	56115	56147
0.2362	6,000 mm	66,0	28,0	21,0	66021	66045
0.2500	6,350 mm	2-1/2	1-3/8	1-7/64	56116	56148
0.2559	6,500 mm	70,0	31,0	23,0	66022	66046
0.2656	6,750 mm	2-5/8	1-7/16	1-7/64	56117	56149
0.2756	7,000 mm	74,0	34,0	25,0	66023	66024
0.2812	7,140 mm	2-11/16	1-1/2	1-13/64	56118	56150
0.2953	7,500 mm	74,0	34,0	25,0	66025	66026
0.2969	7,540 mm	2-3/4	1-9/16	1-1/4	56119	56151
0.3125	7,940 mm	2-13/16	1-5/8	1-19/64	56120	56152
0.3150	8,000 mm	79,0	37,0	27,0	66027	66028
0.3281	8,330 mm	2-15/16	1-11/16	1-23/64	56121	56153
0.3346	8,500 mm	79,0	37,0	27,0	66029	66030
0.3438	8,730 mm	3	1-11/16	1-23/64	56122	56154
0.3543	9,000 mm	84,0	40,0	29,0	66031	66032
0.3594	9,130 mm	3-1/16	1-3/4	1-13/32	56123	56155
0.3740	9,500 mm	84,0	40,0	29,0	66033	66034
0.3750	9,530 mm	3-1/8	1-13/16	1-29/64	56124	56156
0.3906	9,920 mm	3-1/4	1-7/8	1-1/2	56125	56157
0.3937	10,000 mm	89,0	43,0	31,0	66035	66036
0.4062	10,320 mm	3-5/16	1-15/16	1-35/64	56126	56158
0.4134	10,500 mm	89,0	43,0	31,0	66037	66038
0.4219	10,720 mm	3-3/8	2	1-39/64	56127	56159
0.4331	11,000 mm	95,0	47,0	33,0	66039	66040
0.4375	11,110 mm	3-7/16	2-1/16	1-21/32	56128	56160
0.4528	11,500 mm	95,0	47,0	33,0	66041	66042
0.4531	11,510 mm	3-9/16	2-1/8	1-45/64	56129	56161
0.4688	11,910 mm	3-5/8	2-1/8	1-45/64	56130	56162
0.4724	12,000 mm	102,0	51,0	35,0	66043	66044
0.4844	12,300 mm	3-11/16	2-3/16	1-3/4	56131	56163
0.5000	12,700 mm	3-3/4	2-1/4	1-51/64	56132	56164

TOLERANCES (mm)

DC = +0,0000/–0,0127
DCON = h_6

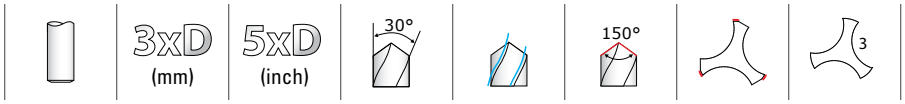
STEELS
CAST IRON
HARDENED STEELS

Straight Flute Drills

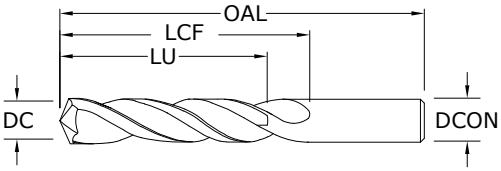
	Series 106M Metric	Hardness	Vc (m/min)		DC • mm 1	3	6	8	10	12
P	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 500 Bhn or ≤ 52 HRc	18	RPM	5816	1939	969	727	582	485
			(15-22)	Fr	0.006	0.018	0.035	0.047	0.058	0.070
				Feed (mm/min)	34	34	34	34	34	34
		≤ 615 Bhn or ≤ 58 HRc	15	RPM	4847	1616	808	606	485	404
			(12-18)	Fr	0.006	0.017	0.033	0.045	0.056	0.067
				Feed (mm/min)	27	27	27	27	27	27
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	76	RPM	24235	8078	4039	3029	2424	2020
			(61-91)	Fr	0.016	0.048	0.096	0.128	0.160	0.192
				Feed (mm/min)	395	395	395	395	395	395
		≤ 330 Bhn or ≤ 36 HRc	59	RPM	18904	6301	3151	2363	1890	1575
			(48-71)	Fr	0.016	0.048	0.096	0.128	0.160	0.192
				Feed (mm/min)	305	305	305	305	305	305
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 500 Bhn or ≤ 52 HRc	18	RPM	5816	1939	969	727	582	485
			(15-22)	Fr	0.006	0.018	0.035	0.047	0.058	0.070
				Feed (mm/min)	34	34	34	34	34	34
		≤ 615 Bhn or ≤ 58 HRc	15	RPM	4847	1616	808	606	485	404
			(12-18)	Fr	0.006	0.017	0.033	0.045	0.056	0.067
				Feed (mm/min)	27	27	27	27	27	27

Bhn (Brinell) HRc (Rockwell C)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
reduce speed and feed 30 percent when using uncoated drills
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

3 Flute Drills • Metric: DIN 6539



103
METRIC SERIES



DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.1065	2,710 mm	2-1/4	1-1/4	1	53036	58011
0.1094	2,780 mm	2-1/4	1-1/4	1	53107	58012
0.1100	2,790 mm	2-1/4	1-1/4	1	53035	58013
0.1110	2,820 mm	2-1/4	1-1/4	1	53034	58014
0.1130	2,870 mm	2-1/4	1-1/4	1	53033	58015
0.1160	2,950 mm	2-1/4	1-1/4	1	53032	58016
0.1181	3,000 mm	46,0	16,0	12,0	63000	68965
0.1200	3,050 mm	2-1/4	1-1/4	1	53031	58017
0.1220	3,100 mm	49,0	18,0	14,0	63044	68966
0.1250	3,180 mm	2-1/4	1-1/4	1	53108	58018
0.1260	3,200 mm	49,0	18,0	14,0	63045	68967
0.1285	3,260 mm	2-1/4	1-1/4	1	53030	58019
0.1299	3,300 mm	49,0	18,0	14,0	63001	68968
0.1339	3,400 mm	52,0	20,0	15,0	63046	68969
0.1360	3,450 mm	2-1/2	1-3/8	1-7/64	53029	58020
0.1378	3,500 mm	52,0	20,0	15,0	63002	68970
0.1405	3,570 mm	2-1/2	1-3/8	1-7/64	53028	58021
0.1406	3,570 mm	2-1/2	1-3/8	1-7/64	53109	58022
0.1417	3,600 mm	52,0	20,0	15,0	63047	68971
0.1440	3,660 mm	2-1/2	1-3/8	1-7/64	53027	58023
0.1457	3,700 mm	52,0	20,0	15,0	63003	68972
0.1470	3,730 mm	2-1/2	1-3/8	1-7/64	53026	58024
0.1495	3,800 mm	2-1/2	1-3/8	1-7/64	53025	58025
0.1496	3,800 mm	55,0	22,0	17,0	63048	68973
0.1520	3,860 mm	2-1/2	1-3/8	1-7/64	53024	58026
0.1535	3,900 mm	55,0	22,0	17,0	63049	68974
0.1540	3,910 mm	2-1/2	1-3/8	1-7/64	53023	58027
0.1562	3,970 mm	2-1/2	1-3/8	1-7/64	53110	58028
0.1570	3,990 mm	2-1/2	1-3/8	1-7/64	53022	58029
0.1575	4,000 mm	55,0	22,0	17,0	63004	68975
0.1590	4,040 mm	2-1/2	1-3/8	1-7/64	53021	58030
0.1610	4,090 mm	2-1/2	1-3/8	1-7/64	53020	58031
0.1614	4,100 mm	55,0	22,0	17,0	63050	68976
0.1654	4,200 mm	55,0	22,0	17,0	63005	68977
0.1660	4,220 mm	2-3/4	1-5/8	1-19/64	53019	58032
0.1693	4,300 mm	58,0	24,0	18,0	63051	68978
0.1695	4,310 mm	2-3/4	1-5/8	1-19/64	53018	58033
0.1719	4,370 mm	2-3/4	1-5/8	1-19/64	53111	58034
0.1730	4,390 mm	2-3/4	1-5/8	1-19/64	53017	58035
0.1732	4,400 mm	58,0	24,0	18,0	63052	68979

continued on next page

TOLERANCES (mm)

DC = +0,0000/–0,0127
DCON = h_6

- STEELS
- CAST IRON
- NON-FERROUS
- HARDENED STEELS

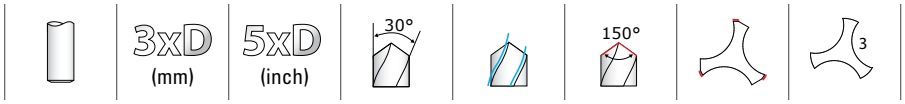
3 Flute Drills • Metric: DIN 6539

CONTINUED

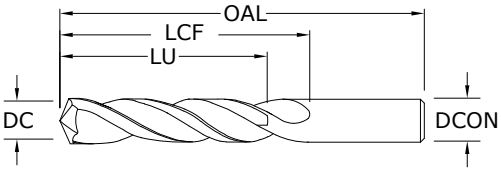
DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.1770	4,500 mm	2-3/4	1-5/8	1-19/64	53016	58036
0.1772	4,500 mm	58,0	24,0	18,0	63006	68980
0.1800	4,570 mm	2-3/4	1-5/18	1-19/64	53015	58037
0.1811	4,600 mm	58,0	24,0	18,0	63053	68981
0.1820	4,620 mm	2-3/4	1-5/8	1-19/64	53014	58038
0.1850	4,700 mm	2-3/4	1-5/8	1-19/64	53013	58039
0.1850	4,700 mm	58,0	24,0	18,0	63054	68982
0.1875	4,760 mm	2-3/4	1-5/8	1-19/64	53112	58040
0.1890	4,800 mm	2-3/4	1-5/8	1-19/64	53012	58041
0.1890	4,800 mm	62,0	26,0	20,0	63055	68983
0.1910	4,850 mm	2-3/4	1-5/8	1-19/64	53011	58042
0.1929	4,900 mm	62,0	26,0	20,0	63056	68984
0.1935	4,910 mm	2-3/4	1-5/8	1-19/64	53010	58043
0.1960	4,980 mm	3	1-3/4	1-13/32	53009	58044
0.1969	5,000 mm	62,0	26,0	20,0	63007	68985
0.1990	5,050 mm	3	1-3/4	1-13/32	53008	58045
0.2008	5,100 mm	62,0	26,0	20,0	63057	68986
0.2010	5,110 mm	3	1-3/4	1-13/32	53007	58046
0.2031	5,160 mm	3	1-3/4	1-13/32	53113	58047
0.2040	5,180 mm	3	1-3/4	1-13/32	53006	58048
0.2047	5,200 mm	62,0	26,0	20,0	63008	68987
0.2055	5,220 mm	3	1-3/4	1-13/32	53005	58049
0.2087	5,300 mm	62,0	26,0	20,0	63058	68988
0.2090	5,310 mm	3	1-3/4	1-13/32	53004	58050
0.2126	5,400 mm	66,0	28,0	21,0	63059	68989
0.2130	5,410 mm	3	1-3/4	1-13/32	53003	58051
0.2165	5,500 mm	66,0	28,0	21,0	63009	68990
0.2188	5,560 mm	3	1-3/4	1-13/32	53114	58052
0.2205	5,600 mm	66,0	28,0	21,0	63060	68991
0.2210	5,610 mm	3	1-3/4	1-13/32	53002	58053
0.2244	5,700 mm	66,0	28,0	21,0	63061	68992
0.2280	5,790 mm	3	1-3/4	1-13/32	53001	58054
0.2283	5,800 mm	66,0	28,0	21,0	63062	68993
0.2323	5,900 mm	66,0	28,0	21,0	63063	68994
0.2340	5,940 mm	3-1/4	2	1-39/64	53201	58055
0.2344	5,950 mm	3-1/4	2	1-39/64	53115	58056
0.2362	6,000 mm	66,0	28,0	21,0	63010	68995
0.2380	6,050 mm	3-1/4	2	1-39/64	53202	58057
0.2402	6,100 mm	70,0	31,0	23,0	63064	68996
0.2420	6,150 mm	3-1/4	2	1-39/64	53203	58058
0.2441	6,200 mm	70,0	31,0	23,0	63011	68997
0.2460	6,250 mm	3-1/4	2	1-39/64	53204	58059
0.2480	6,300 mm	70,0	31,0	23,0	63065	68998
0.2500	6,350 mm	3-1/4	2	1-39/64	53116	58061
0.2520	6,400 mm	70,0	31,0	23,0	63066	68999
0.2559	6,500 mm	70,0	31,0	23,0	63012	69000
0.2570	6,530 mm	3-1/4	2	1-39/64	53206	58062
0.2598	6,600 mm	70,0	31,0	23,0	63067	69001
0.2610	6,630 mm	3-1/2	2-1/8	1-45/64	53207	58063
0.2638	6,700 mm	70,0	31,0	23,0	63068	69002

continued on next page

3 Flute Drills • Metric: DIN 6539



103
METRIC SERIES



CONTINUED

DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.2656	6,750 mm	3-1/2	2-1/8	1-45/64	53117	58064
0.2660	6,760 mm	3-1/2	2-1/8	1-45/64	53208	58065
0.2677	6,800 mm	74,0	34,0	25,0	63013	69003
0.2717	6,900 mm	74,0	34,0	25,0	63069	69004
0.2720	6,910 mm	3-1/2	2-1/8	1-45/64	53209	58066
0.2756	7,000 mm	74,0	34,0	25,0	63014	69005
0.2770	7,040 mm	3-1/2	2-1/8	1-45/64	53210	58067
0.2795	7,100 mm	74,0	34,0	25,0	63070	69006
0.2810	7,140 mm	3-1/2	2-1/8	1-45/64	53211	58068
0.2812	7,140 mm	3-1/2	2-1/8	1-45/64	53118	58069
0.2835	7,200 mm	74,0	34,0	25,0	63015	69007
0.2874	7,300 mm	74,0	34,0	25,0	63071	69008
0.2900	7,370 mm	3-1/2	2-1/8	1-45/64	53212	58070
0.2913	7,400 mm	74,0	34,0	25,0	63072	69009
0.2950	7,490 mm	3-3/4	2-3/8	1-29/32	53213	58071
0.2953	7,500 mm	74,0	34,0	25,0	63016	69010
0.2969	7,540 mm	3-3/4	2-3/8	1-29/32	53119	58072
0.2992	7,600 mm	79,0	37,0	27,0	63073	69011
0.3020	7,670 mm	2-3/8	2-3/8	1-29/32	53214	58073
0.3031	7,700 mm	79,0	37,0	27,0	63074	69012
0.3071	7,800 mm	79,0	37,0	27,0	63075	69013
0.3110	7,900 mm	79,0	37,0	27,0	63076	69014
0.3125	7,940 mm	3-3/4	2-3/8	1-29/32	53120	58074
0.3150	8,000 mm	79,0	37,0	27,0	63017	69015
0.3160	8,030 mm	3-3/4	2-3/8	1-29/32	53215	58075
0.3189	8,100 mm	79,0	37,0	27,0	63077	69016
0.3228	8,200 mm	79,0	37,0	27,0	63018	69017
0.3230	8,200 mm	3-3/4	2-3/8	1-29/32	53216	58076
0.3268	8,300 mm	79,0	37,0	27,0	63078	69018
0.3281	8,330 mm	4	2-1/2	2	53121	58077
0.3307	8,400 mm	79,0	37,0	27,0	63019	69019
0.3320	8,430 mm	4	2-1/2	2	53217	58078
0.3346	8,500 mm	79,0	37,0	27,0	63020	69020
0.3386	8,600 mm	84,0	40,0	29,0	63021	69021
0.3390	8,610 mm	4	2-1/2	2	53218	58079
0.3425	8,700 mm	84,0	40,0	29,0	63079	69022
0.3438	8,730 mm	4	2-1/2	2	53122	58080
0.3465	8,800 mm	84,0	40,0	29,0	63022	69023
0.3480	8,840 mm	4	2-1/2	2	53219	58081
0.3504	8,900 mm	84,0	40,0	29,0	63080	69024
0.3543	9,000 mm	84,0	40,0	29,0	63023	69025
0.3580	9,090 mm	4-1/4	2-3/4	2-13/64	53220	58082

continued on next page

TOLERANCES (mm)

DC = +0,0000/–0,0127
DCON = h_6

- STEELS
- CAST IRON
- NON-FERROUS
- HARDENED STEELS

3 Flute Drills • Metric: DIN 6539

CONTINUED

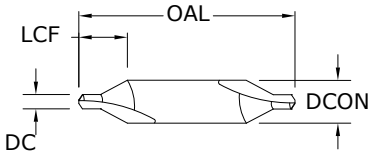
DECIMAL DC / DCON	METRIC DC / DCON	mm OVERALL LENGTH OAL	FLUTE LENGTH LCF	USABLE LENGTH LU	EDP NO. UNCOATED	EDP NO. Ti-NAMITE-A (AlTiN)
0.3583	9,100 mm	84,0	40,0	29,0	63081	69026
0.3594	9,130 mm	4-1/4	2-3/4	2-13/64	53123	58083
0.3622	9,200 mm	84,0	40,0	29,0	63024	69027
0.3661	9,300 mm	84,0	40,0	29,0	63082	69028
0.3680	9,350 mm	4-1/4	2-3/4	2-13/64	53221	58084
0.3701	9,400 mm	84,0	40,0	29,0	63083	69029
0.3740	9,500 mm	84,0	40,0	29,0	63025	69030
0.3750	9,530 mm	4-1/4	2-3/4	2-13/64	53124	58085
0.3770	9,580 mm	4-1/4	2-3/4	2-13/64	53222	58086
0.3780	9,600 mm	89,0	43,0	31,0	63084	69031
0.3819	9,700 mm	89,0	43,0	31,0	63085	69032
0.3858	9,800 mm	89,0	43,0	31,0	63086	69033
0.3860	9,800 mm	4-1/2	2-7/8	2-19/64	53223	58087
0.3898	9,900 mm	89,0	43,0	31,0	63087	69034
0.3906	9,920 mm	4-1/2	2-7/8	2-19/64	53125	58088
0.3937	10,000 mm	89,0	43,0	31,0	63026	69035
0.3970	10,080 mm	4-1/2	2-7/8	2-19/64	53224	58089
0.3976	10,100 mm	89,0	43,0	31,0	63088	69036
0.4016	10,200 mm	89,0	43,0	31,0	63027	69037
0.4040	10,260 mm	4-1/2	2-7/8	2-19/64	53225	58090
0.4062	10,320 mm	4-1/2	2-7/8	2-19/64	53126	58091
0.4094	10,400 mm	89,0	43,0	31,0	63028	69038
0.4130	10,490 mm	4-1/2	2-7/8	2-19/64	53226	58092
0.4134	10,500 mm	89,0	43,0	31,0	63029	69039
0.4213	10,700 mm	95,0	47,0	33,0	63030	69040
0.4219	10,720 mm	4-1/2	2-7/8	2-19/64	53127	58093
0.4252	10,800 mm	95,0	47,0	33,0	63031	69041
0.4331	11,000 mm	95,0	47,0	33,0	63032	69042
0.4375	11,110 mm	4-1/2	2-7/8	2-19/64	53128	58094
0.4528	11,500 mm	95,0	47,0	33,0	63033	69043
0.4531	11,510 mm	4-3/4	3	2-13/32	53129	58095
0.4688	11,910 mm	4-3/4	3	2-13/32	53130	58096
0.4724	12,000 mm	102,0	51,0	35,0	63034	69044
0.4844	12,300 mm	4-3/4	3	2-13/32	53131	58097
0.4921	12,500 mm	102,0	51,0	35,0	63035	69045
0.5000	12,700 mm	4-3/4	3	2-13/32	53132	58098
0.5039	12,800 mm	102,0	51,0	35,0	63036	69046
0.5118	13,000 mm	102,0	51,0	35,0	63089	69047
0.5156	13,100 mm	4-3/4	3	2-13/32	53135	58099
0.5157	13,100 mm	102,0	51,0	35,0	63037	69048
0.5315	13,500 mm	107,0	54,0	37,0	63090	69049
0.5512	14,000 mm	107,0	54,0	37,0	63038	69050
0.5625	14,290 mm	4-3/4	3	2-13/32	53136	58100
0.5630	14,300 mm	111,0	56,0	38,0	63039	69051
0.5709	14,500 mm	111,0	56,0	38,0	63040	69052
0.5906	15,000 mm	111,0	56,0	38,0	63091	69053
0.6250	15,880 mm	5-3/4	3-1/2	2-51/64	53133	58101
0.6875	17,460 mm	5-3/4	3-1/2	2-51/64	53137	58102
0.6890	17,500 mm	123,0	62,0	40,0	63041	69054
0.7500	19,050 mm	5-3/4	4-1/4	3 13/32	53134	58103
0.7677	19,500 mm	131,0	66,0	42,0	63042	69055
0.7874	20,000 mm	131,0	66,0	42,0	63043	69056

3 Flute Drills

	Series 103M Metric	Hardness	Vc (m/min)		DC • mm 3	6	10	12	16	20
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	90	RPM	9533	4766	2860	2383	1787	1430
			(72-108)	Fr	0.062	0.124	0.206	0.248	0.330	0.413
				Feed (mm/min)	590	590	590	590	590	590
		≤ 300 Bhn or ≤ 32 HRc	79	RPM	8402	4201	2520	2100	1575	1260
			(63-95)	Fr	0.055	0.110	0.183	0.219	0.292	0.365
				Feed (mm/min)	460	460	460	460	460	460
		≤ 425 Bhn or ≤ 45 HRc	46	RPM	4847	2424	1454	1212	909	727
			(37-55)	Fr	0.032	0.064	0.107	0.128	0.171	0.213
				Feed (mm/min)	155	155	155	155	155	155
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	70	RPM	7432	3716	2230	1858	1394	1115
			(56-84)	Fr	0.046	0.093	0.155	0.186	0.248	0.309
				Feed (mm/min)	345	345	345	345	345	345
		≤ 375 Bhn or ≤ 40 HRc	44	RPM	4686	2343	1406	1171	879	703
			(35-53)	Fr	0.046	0.092	0.153	0.184	0.245	0.306
				Feed (mm/min)	215	215	215	215	215	215
		≤ 450 Bhn or ≤ 48 HRc	35	RPM	3716	1858	1115	929	697	557
			(28-42)	Fr	0.012	0.024	0.040	0.048	0.065	0.081
				Feed (mm/min)	45	45	45	45	45	45
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 250 Bhn or ≤ 24 HRc	26	RPM	2747	1373	824	687	515	412
			(21-31)	Fr	0.031	0.062	0.103	0.124	0.165	0.206
				Feed (mm/min)	85	85	85	85	85	85
		≤ 375 Bhn or ≤ 40 HRc	20	RPM	2100	1050	630	525	394	315
			(16-24)	Fr	0.017	0.033	0.056	0.067	0.089	0.111
				Feed (mm/min)	35	35	35	35	35	35
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	76	RPM	8078	4039	2424	2020	1515	1212
			(61-91)	Fr	0.063	0.126	0.210	0.253	0.337	0.421
				Feed (mm/min)	510	510	510	510	510	510
		≤ 330 Bhn or ≤ 36 HRc	59	RPM	6301	3151	1890	1575	1181	945
			(48-71)	Fr	0.052	0.105	0.175	0.209	0.279	0.349
				Feed (mm/min)	330	330	330	330	330	330
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 80 Bhn or ≤ 47 HRb	165	RPM	17449	8725	5235	4362	3272	2617
			(132-198)	Fr	0.078	0.156	0.260	0.312	0.416	0.520
				Feed (mm/min)	1360	1360	1360	1360	1360	1360
		≤ 150 Bhn or ≤ 7 HRc	139	RPM	14703	7351	4411	3676	2757	2205
			(111-166)	Fr	0.078	0.156	0.261	0.313	0.417	0.521
				Feed (mm/min)	1150	1150	1150	1150	1150	1150
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	93	RPM	9856	4928	2957	2464	1848	1478
			(74-112)	Fr	0.047	0.094	0.157	0.189	0.252	0.315
				Feed (mm/min)	465	465	465	465	465	465
		≤ 200 Bhn or ≤ 23 HRc	49	RPM	5170	2585	1551	1293	969	776
			(39-59)	Fr	0.039	0.077	0.129	0.155	0.206	0.258
				Feed (mm/min)	200	200	200	200	200	200
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	15	RPM	1616	808	485	404	303	242
			(12-18)	Fr	0.015	0.031	0.052	0.062	0.083	0.103
				Feed (mm/min)	25	25	25	25	25	25

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
reduce speed and feed 30 percent when using uncoated drills
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Combined Drill & Countersink



301M
METRIC SERIES

TOLERANCES (mm)

DC = +0,076/–0,000
DCON = –0,0025/–0,0127

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

mm				EDP NO.	
DRILL DIAMETER DC	BODY DIAMETER DCON	OVERALL LENGTH OAL	FLUTE LENGTH LCF	UNCOATED	Ti-NAMITE-A (AlTiN)
0,5	3,15	25,0	7,1	67005	67035
0,8	3,15	25,0	7,1	67007	67037
1	3,15	31,5	8,3	67009	67039
1,25	3,15	31,5	9,9	67011	67041
1,6	4,0	35,5	12,7	67013	67043
2	5,0	40,0	14,7	67015	67045
2,5	6,3	45,0	15,9	67017	67047
3,15	8,0	50,0	19,4	67019	67049
4	10,0	56,0	21,4	67021	67051
5	12,5	63,0	23,0	67023	67053

Combined Drill & Countersink

	Series 301M Metric	Hardness	Vc (m/min)		DC • mm 1	1.6	2.5	4	5
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	81	RPM	8155	6422	4078	2569	2055
			(65-97)	Fr	0.017	0.022	0.034	0.054	0.068
				Feed (mm/min)	139	139	139	139	139
		≤ 300 Bhn or ≤ 32 HRc	38	RPM	3847	3029	1923	1212	969
			(30-46)	Fr	0.016	0.020	0.032	0.051	0.064
				Feed (mm/min)	62	62	62	62	62
		≤ 425 Bhn or ≤ 45 HRc	26	RPM	2616	2060	1308	824	659
			(21-31)	Fr	0.010	0.013	0.020	0.032	0.039
				Feed (mm/min)	26	26	26	26	26
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	70	RPM	7078	5574	3539	2230	1784
			(56-84)	Fr	0.016	0.020	0.032	0.051	0.063
				Feed (mm/min)	113	113	113	113	113
		≤ 375 Bhn or ≤ 40 HRc	44	RPM	4462	3514	2231	1406	1125
			(35-53)	Fr	0.015	0.019	0.030	0.048	0.060
				Feed (mm/min)	67	67	67	67	67
		≤ 425 Bhn or ≤ 45 HRc	18	RPM	1847	1454	923	582	465
			(15-22)	Fr	0.007	0.009	0.014	0.022	0.028
				Feed (mm/min)	13	13	13	13	13
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 250 Bhn or ≤ 24 HRc	26	RPM	2616	2060	1308	824	659
			(21-31)	Fr	0.009	0.012	0.018	0.029	0.036
				Feed (mm/min)	24	24	24	24	24
		≤ 375 Bhn or ≤ 40 HRc	17	RPM	1693	1333	846	533	427
			(13-20)	Fr	0.004	0.005	0.008	0.013	0.016
				Feed (mm/min)	7	7	7	7	7
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F 440F	≤ 250 Bhn or ≤ 24 HRc	64	RPM	6463	5089	3231	2036	1629
			(51-77)	Fr	0.012	0.015	0.024	0.038	0.048
				Feed (mm/min)	78	78	78	78	78
		≤ 330 Bhn or ≤ 36 HRc	34	RPM	3385	2666	1693	1066	853
			(27-40)	Fr	0.007	0.009	0.014	0.023	0.028
				Feed (mm/min)	24	24	24	24	24
	STAINLESS STEELS (DIFFICULT) 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	20	RPM	2000	1575	1000	630	504
			(16-24)	Fr	0.009	0.011	0.018	0.029	0.036
				Feed (mm/min)	18	18	18	18	18
		≤ 375 Bhn or ≤ 40 HRc	17	RPM	1693	1333	846	533	427
			(13-20)	Fr	0.008	0.011	0.017	0.026	0.033
				Feed (mm/min)	14	14	14	14	14
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	85	RPM	8617	6786	4309	2714	2171
			(68-102)	Fr	0.021	0.027	0.042	0.067	0.083
				Feed (mm/min)	181	181	181	181	181
		≤ 330 Bhn or ≤ 36 HRc	76	RPM	7694	6059	3847	2424	1939
			(61-91)	Fr	0.021	0.027	0.042	0.067	0.084
				Feed (mm/min)	162	162	162	162	162

continued on next page

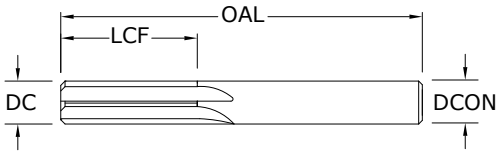
Combined Drill & Countersink

	Series 301M Metric	Hardness	Vc (m/min)		DC • mm 1	1.6	2.5	4	5
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 80 Bhn or ≤ 47 HRb	165	RPM	16619	13087	8309	5235	4188
			(132-198)	Fr	0.025	0.032	0.050	0.079	0.099
				Feed (mm/min)	415	415	415	415	415
		≤ 150 Bhn or ≤ 88 HRc	139	RPM	14003	11027	7001	4411	3529
			(111-166)	Fr	0.025	0.032	0.050	0.079	0.099
				Feed (mm/min)	350	350	350	350	350
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	58	RPM	5847	4605	2924	1842	1474
			(46-69)	Fr	0.012	0.015	0.024	0.038	0.048
				Feed (mm/min)	70	70	70	70	70
		≤ 200 Bhn or ≤ 23 HRc	53	RPM	5386	4241	2693	1696	1357
			(43-64)	Fr	0.012	0.015	0.024	0.038	0.048
				Feed (mm/min)	65	65	65	65	65
	PLASTICS Polycarbonate, PVC		152	RPM	15388	12118	7694	4847	3878
			(122-183)	Fr	0.025	0.032	0.050	0.079	0.099
				Feed (mm/min)	385	385	385	385	385
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy 800, Monel 400, Rene, Waspaloy	≤ 220 Bhn or ≤ 19 HRc	12	RPM	1231	969	616	388	310
			(10-15)	Fr	0.009	0.011	0.018	0.028	0.035
				Feed (mm/min)	11	11	11	11	11
		≤ 320 Bhn or ≤ 34 HRc	8	RPM	769	606	385	242	194
			(6-9)	Fr	0.008	0.010	0.016	0.025	0.031
				Feed (mm/min)	6	6	6	6	6
		≤ 425 Bhn or ≤ 45 HRc	6	RPM	616	485	308	194	155
			(5-7)	Fr	0.003	0.004	0.006	0.010	0.013
				Feed (mm/min)	2	2	2	2	2
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V	≤ 275 Bhn or ≤ 28 HRc	26	RPM	2616	2060	1308	824	659
			(21-31)	Fr	0.016	0.020	0.032	0.051	0.064
				Feed (mm/min)	42	42	42	42	42
		≤ 350 Bhn or ≤ 38 HRc	20	RPM	2000	1575	1000	630	504
			(16-24)	Fr	0.009	0.011	0.018	0.029	0.036
				Feed (mm/min)	18	18	18	18	18
		≤ 440 Bhn or ≤ 47 HRc	17	RPM	1693	1333	846	533	427
			(13-20)	Fr	0.008	0.011	0.017	0.026	0.033
				Feed (mm/min)	14	14	14	14	14
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	12	RPM	1231	969	616	388	310
			(10-15)	Fr	0.004	0.005	0.008	0.013	0.016
				Feed (mm/min)	5	5	5	5	5

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DCON x 3.14)
mm/min = Fr x rpm
reduce speed and feed 30 percent when using uncoated drills
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Straight Flute Reamer

201M
METRIC SERIES



mm					EDP NO.
CUTTING DIAMETER DC	SHANK DIAMETER DCON	MAXIMUM REAM LENGTH LCF	OVERALL LENGTH OAL	NO. OF FLUTES	UNCOATED
1,0	1,0	6,0	32,0	4	81001
1,5	1,5	9,5	38,0	4	81003
2,0	2,0	12,7	44,0	4	81005
2,5	2,5	12,7	50,0	4	81007
3,0	3,0	16,0	57,0	4	81009
3,5	3,5	19, 0	63,0	4	81011
4,0	4,0	19,0	63,0	4	81013
4,5	4,5	22,0	70,0	4	81015
5,0	5,0	25,0	75,0	4	81017
5,5	5,5	25,0	75,0	4	81019
6,0	6,0	25,0	75,0	4	81021
7,0	7,0	28,0	82,0	6	81023
8,0	8,0	28,0	82,0	6	81025
9,0	9,0	31,0	89,0	6	81027
10,0	10,0	31,0	89,0	6	81029

TOLERANCES (mm)

1–6 DIAMETER
DC = +0,008/–0,000

>6–10 DIAMETER
DC = +0,010/–0,000

- STEELS
- STAINLESS STEELS
- CAST IRON
- NON-FERROUS
- HIGH TEMP ALLOYS
- HARDENED STEELS

Straight Flute Reamer

	Series 201M Metric	Hardness	Vc (m/min)		DC • mm 1	2	3	4	6	8	10
P	CARBON STEELS 1018, 1040, 1080, 1090, 10L50, 1140, 1212, 12L15, 1525, 1536	≤ 175 Bhn or ≤ 7 HRc	46	RPM	14541	7271	4847	3635	2424	1818	1454
			(37-55)	Fr	0.028	0.056	0.085	0.113	0.169	0.226	0.282
				Feed (mm/min)	410	410	410	410	410	410	410
		≤ 300 Bhn or ≤ 32 HRc	23	RPM	7271	3635	2424	1818	1212	909	727
			(18-27)	Fr	0.025	0.050	0.074	0.099	0.149	0.198	0.248
				Feed (mm/min)	180	180	180	180	180	180	180
		≤ 425 Bhn or ≤ 45 HRc	17	RPM	5332	2666	1777	1333	889	666	533
			(13-20)	Fr	0.015	0.030	0.044	0.059	0.089	0.119	0.148
				Feed (mm/min)	79	79	79	79	79	79	79
	ALLOY STEELS 4140, 4150, 4320, 5120, 5150, 8630, 86L20, 50100	≤ 275 Bhn or ≤ 28 HRc	35	RPM	11148	5574	3716	2787	1858	1394	1115
			(28-42)	Fr	0.024	0.048	0.072	0.096	0.144	0.192	0.240
				Feed (mm/min)	268	268	268	268	268	268	268
		≤ 375 Bhn or ≤ 40 HRc	21	RPM	6786	3393	2262	1696	1131	848	679
			(17-26)	Fr	0.024	0.048	0.072	0.096	0.144	0.192	0.240
				Feed (mm/min)	163	163	163	163	163	163	163
		≤ 425 Bhn or ≤ 45 HRc	14	RPM	4362	2181	1454	1091	727	545	436
			(11-16)	Fr	0.015	0.030	0.045	0.060	0.089	0.119	0.149
				Feed (mm/min)	65	65	65	65	65	65	65
	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 250 Bhn or ≤ 24 HRc	12	RPM	3878	1939	1293	969	646	485	388
			(10-15)	Fr	0.015	0.031	0.046	0.062	0.093	0.124	0.155
				Feed (mm/min)	60	60	60	60	60	60	60
		≤ 375 Bhn or ≤ 40 HRc	8	RPM	2424	1212	808	606	404	303	242
			(6-9)	Fr	0.010	0.020	0.030	0.040	0.059	0.079	0.099
				Feed (mm/min)	24	24	24	24	24	24	24
M	STAINLESS STEELS (FREE MACHINING) 303, 416, 420F, 430F 440F	≤ 250 Bhn or ≤ 24 HRc	23	RPM	7271	3635	2424	1818	1212	909	727
			(18-27)	Fr	0.015	0.030	0.045	0.059	0.089	0.119	0.149
				Feed (mm/min)	108	108	108	108	108	108	108
		≤ 330 Bhn or ≤ 36 HRc	17	RPM	5332	2666	1777	1333	889	666	533
			(13-20)	Fr	0.012	0.024	0.036	0.048	0.072	0.096	0.120
				Feed (mm/min)	64	64	64	64	64	64	64
	STAINLESS STEELS (DIFFICULT) 304, 316, 321, 13-8 PH, 15-5PH, 17-4 PH, Custom 450	≤ 275 Bhn or ≤ 28 HRc	11	RPM	3393	1696	1131	848	565	424	339
			(9-13)	Fr	0.015	0.029	0.044	0.059	0.088	0.118	0.147
				Feed (mm/min)	50	50	50	50	50	50	50
		≤ 375 Bhn or ≤ 40 HRc	8	RPM	2424	1212	808	606	404	303	242
			(6-9)	Fr	0.010	0.020	0.030	0.040	0.059	0.079	0.099
				Feed (mm/min)	24	24	24	24	24	24	24

continued on next page

Straight Flute Reamer

	Series 201M Metric	Hardness	Vc (m/min)		DC • mm 1	2	3	4	6	8	10
K	CAST IRONS Gray, Malleable, Ductile	≤ 220 Bhn or ≤ 19 HRc	38	RPM	12118	6059	4039	3029	2020	1515	1212
			(30-46)	Fr	0.032	0.064	0.097	0.129	0.193	0.257	0.322
				Feed (mm/min)	390	390	390	390	390	390	390
		≤ 330 Bhn or ≤ 36 HRc	29	RPM	9209	4605	3070	2302	1535	1151	921
			(23-35)	Fr	0.032	0.064	0.096	0.128	0.192	0.256	0.320
				Feed (mm/min)	295	295	295	295	295	295	295
N	ALUMINUM ALLOYS 2017, 2024, 356, 6061, 7075	≤ 80 Bhn or ≤ 47 HRb	82	RPM	26174	13087	8725	6544	4362	3272	2617
			(66-99)	Fr	0.040	0.080	0.120	0.160	0.240	0.320	0.400
				Feed (mm/min)	1047	1047	1047	1047	1047	1047	1047
		≤ 150 Bhn or ≤ 88 HRb	70	RPM	22297	11148	7432	5574	3716	2787	2230
			(56-84)	Fr	0.040	0.080	0.120	0.160	0.240	0.320	0.400
				Feed (mm/min)	892	892	892	892	892	892	892
	COPPER ALLOYS Alum Bronze, C110, Muntz Brass	≤ 140 Bhn or ≤ 3 HRc	35	RPM	11148	5574	3716	2787	1858	1394	1115
			(28-42)	Fr	0.020	0.041	0.061	0.081	0.122	0.163	0.204
				Feed (mm/min)	227	227	227	227	227	227	227
		≤ 200 Bhn or ≤ 23 HRc	29	RPM	9209	4605	3070	2302	1535	1151	921
			(23-35)	Fr	0.020	0.041	0.061	0.082	0.122	0.163	0.204
				Feed (mm/min)	188	188	188	188	188	188	188

continued on next page

Straight Flute Reamer

	Series 201M Metric	Hardness	Vc (m/min)		DC • mm 1	2	3	4	6	8	10
S	HIGH TEMP ALLOYS (NICKEL, COBALT, IRON BASE) Inconel 601, 617, 625, Incoloy 800, Monel 400, Rene, Waspaloy	≤ 220 Bhn or ≤ 19 HRc	6	RPM	1939	969	646	485	323	242	194
			(5-7)	Fr	0.012	0.024	0.036	0.047	0.071	0.095	0.119
				Feed (mm/min)	23	23	23	23	23	23	23
		≤ 320 Bhn or ≤ 34 HRc	5	RPM	1454	727	485	364	242	182	145
			(4-5)	Fr	0.010	0.021	0.031	0.041	0.062	0.083	0.103
				Feed (mm/min)	15	15	15	15	15	15	15
		≤ 425 Bhn or ≤ 45 HRc	3	RPM	969	485	323	242	162	121	97
			(2-4)	Fr	0.006	0.012	0.019	0.025	0.037	0.050	0.062
				Feed (mm/min)	6	6	6	6	6	6	6
	TITANIUM ALLOYS Pure Titanium, Ti6Al4V, Ti6Al2Sn4Zr2Mo, Ti4Al4Mo2Sn0.5Si, Ti-6Al4V	≤ 275 Bhn or ≤ 28 HRc	14	RPM	4362	2181	1454	1091	727	545	436
			(11-16)	Fr	0.024	0.048	0.072	0.096	0.144	0.193	0.241
				Feed (mm/min)	105	105	105	105	105	105	105
		≤ 350 Bhn or ≤ 38 HRc	11	RPM	3393	1696	1131	848	565	424	339
			(9-13)	Fr	0.015	0.029	0.044	0.059	0.088	0.118	0.147
				Feed (mm/min)	50	50	50	50	50	50	50
		≤ 440 Bhn or ≤ 47 HRc	8	RPM	2424	1212	808	606	404	303	242
			(6-9)	Fr	0.010	0.020	0.030	0.040	0.059	0.079	0.099
				Feed (mm/min)	24	24	24	24	24	24	24
H	TOOL STEELS A2, D2, H13, L2, M2, P20, S7, T15, W2	≤ 475 Bhn or ≤ 50 HRc	6	RPM	1939	969	646	485	323	242	194
			(5-7)	Fr	0.006	0.012	0.019	0.025	0.037	0.050	0.062
				Feed (mm/min)	12	12	12	12	12	12	12
		≤ 655 Bhn or ≤ 60 HRc	4	RPM	1272	636	424	318	212	159	127
			(3-5)	Fr	0.006	0.013	0.019	0.025	0.038	0.050	0.063
				Feed (mm/min)	8	8	8	8	8	8	8

Bhn (Brinell) HRc (Rockwell C) HRb (Rockwell B)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
increase speed and feed 30 percent when using coated reamers
reduce speed and feed for materials harder than listed
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

SGS
Solid Carbide Tools

VALUE AT THE SPINDLE

Routers

Routing

HIGH PERFORMANCE ROUTERS	SERIES	DESCRIPTION	PAGE	S&F PAGE
Carbon Composite	20M-CCR	Multi-Flute Carbon Composite Metric	248	250
	20M-CCR-LHC	Multi-Flute Carbon Composite Left Hand Cut Metric	249	250
Coarse Cut Carbon Composite	31M-CCR	Multi-Flute Coarse Composite Metric	251	252
Compression	25M	Multi-Flute Compression Metric	253	254

GENERAL APPLICATION ROUTERS	SERIES	DESCRIPTION	PAGE	S&F PAGE
Up Cut	21M	2 Flute Up Cut Metric	255	257
Down Cut	22M	2 Flute Down Cut Metric	256	257

Speed & Feed Recommendations listed after each series

Ranurado

RANURADORES DE ALTO RENDIMIENTO	SERIE	DESCRIPCIÓN	PÁGINA	S&F PÁGINA
Compuesto de carbono	20M-CCR	Filo múltiple, compuesto de carbono, métrico	248	250
	20M-CCR-LHC	Filo múltiple, carbo composite corte hélice izquierda métrico	249	250
Compuesto de carbono de corte grueso	31M-CCR	Filo múltiple, compuesto grueso, métrico	251	252
Compresión	25M	Filo múltiple, compresión, métrico	253	254

RANURADORES DE USO GENERAL	SERIE	DESCRIPCIÓN	PÁGINA	S&F PÁGINA
Corte ascendente	21M	2 filos, corte ascendente, métrico	255	257
Corte descendente	22M	2 filos, corte descendente, métrico	256	257

Recomendaciones de velocidades y avances mostradas tras cada serie

Détourage

FRAISES A DETOURER HAUTE PERFORMANCE	SÈRIES	DESCRIPTION	PAGE	S&F PAGE
Composites carbone	20M-CCR	Multi-dents pour composites carbone (métrique)	248	250
	20M-CCR-LHC	Multi-dents carbon composite coupe à gauche (métrique)	249	250
Pour composites carbone coupe grossière	31M-CCR	Multi-dents pour composites grossiers (métrique)	251	252
Compression	25M	Multi-dents de compression (métrique)	253	254

FRAISES À DÉTOURER UNIVERSELLES	SÈRIES	DESCRIPTION	PAGE	S&F PAGE
Coupe ascendante	21M	2 dents coupe ascendante (métrique)	255	257
Coupe descendante	22M	2 dents coupe descendante (métrique)	256	257

Recommandations de vitesse et avance indiquées après chaque série

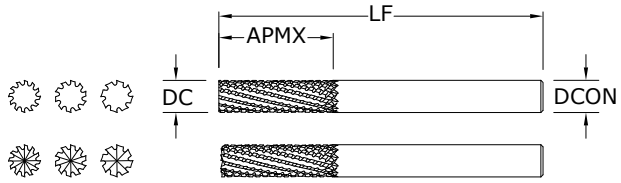
Konturenfräsen

HOCHLEISTUNGS-KONTURENFRÄSER	SERIE	BESCHREIBUNG	SEITE	S&F SEITE
Kohlefaserverbundwerkstoff	20M-CCR	Konturenfräser für Kohlefaserverbundwerkstoff	248	250
	20M-CCR-LHC	Mehrschneider Carbon Composite Links geschnittene metrisch	249	250
Grobschnitt Kohlefaserverbundwerkstoff	31M-CCR	Konturenfräser für Verbundkunststoff	251	252
Gegenläufiger Drall	25M	Gegenläufiger Konturenfräser	253	254

STANDARD-KONTURENFRÄSER	SERIE	BESCHREIBUNG	SEITE	S&F SEITE
Rechtsspirale	21M	VHM-Fräser mit 2 Schneiden (ziehend)	255	257
Linksspirale	22M	VHM-Fräser mit 2 Schneiden (drückend)	256	257

Empfehlungen für Drehzahl & Vorschub im Anhang zu jeder Serie

Carbon Composite



20M-CCR

METRIC SERIES

- Multi-flute design and positive geometry to shear with minimal pressure and delamination
- Unique clearance grind minimizes contact between tool diameter and workpiece eliminating friction
- Left hand flutes engineered to control the fibers within CFRP, preventing excessive fiber breakout
- Excels at trimming and profiling difficult and abrasive fiber filled plastics

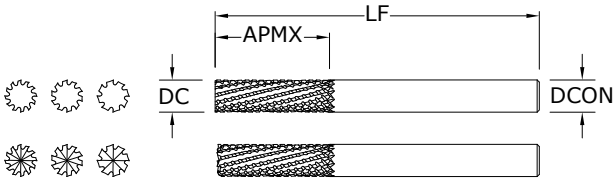
mm						EDP NO.		
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	NO. OF FLUTES	END STYLE	UNCOATED	Ti-NAMITE-B (TiB_2)	Di-NAMITE (Diamond)
2,0	6,0	38,0	3,0	5	End Cutting	82930	83100	83070
3,0	10,0	38,0	3,0	6	End Cutting	82931	83101	83071
4,0	12,0	50,0	4,0	7	End Cutting	82932	83102	83072
5,0	15,0	50,0	6,0	8	End Cutting	82933	83103	83073
6,0	25,0	63,0	6,0	8	No End Cutting	82966	83104	83027
6,0	25,0	63,0	6,0	8	End Cutting	82967	83105	83026
8,0	25,0	63,0	8,0	10	No End Cutting	82968	83106	83029
8,0	25,0	63,0	8,0	10	End Cutting	82969	83107	83028
10,0	28,0	63,0	10,0	12	No End Cutting	82970	83108	83042
10,0	28,0	63,0	10,0	12	End Cutting	82971	83109	83041
12,0	38,0	89,0	12,0	12	No End Cutting	82972	83110	83044
12,0	38,0	89,0	12,0	12	End Cutting	82973	83111	83043

TOLERANCES (mm)

DC = +0,000/–0,130
DCON = h_6

NON-FERROUS

Carbon Composite



20M-CCR-LHC

METRIC SERIES

TOLERANCES (mm)

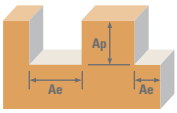
DC = +0,000/–0,130
DCON = h_6

NON-FERROUS

mm						EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	NO. OF FLUTES	END STYLE	UNCOATED	Di-NAMITE (Diamond)
6,0	25,0	63,0	6,0	8	No End Cutting	83220	83230
6,0	25,0	63,0	6,0	8	End Cutting	83221	83231
8,0	25,0	63,0	8,0	10	No End Cutting	83222	83232
8,0	25,0	63,0	8,0	10	End Cutting	83223	83233
10,0	28,0	63,0	10,0	12	No End Cutting	83224	83234
10,0	28,0	63,0	10,0	12	End Cutting	83225	83235

- Multi-flute design and positive geometry to shear with minimal pressure and delamination
- Unique clearance grind minimizes contact between tool diameter and workpiece eliminating friction
- Left hand flutes engineered to control the fibers within CFRP, preventing excessive fiber breakout
- Excels at trimming and profiling difficult and abrasive fiber filled plastics

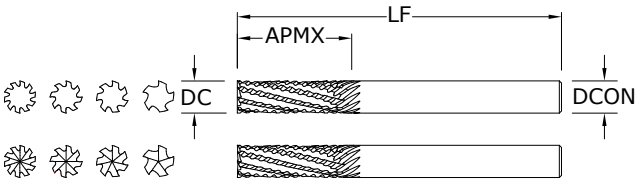
Carbon Composite



	Series 20M Metric		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	8	10	12
N	CFRP, AFRP (CARBON FIBER, ARAMID FIBER)	Slot	1	≤ 1	120 (96-164)	RPM	12722	6361	4771	3817	3181
						Fr	0.055	0.113	0.243	0.366	0.439
						Feed (mm/min)	700	720	1160	1395	1395
		Profile	≤ 0.5	≤ 1.5	150 (120-180)	RPM	15903	7951	5963	4771	3976
						Fr	0.055	0.113	0.243	0.366	0.439
						Feed (mm/min)	875	900	1450	1744	1744
		HSM	≤ 0.05	≤ 2	250 (200-300)	RPM	26504	13252	9939	7951	6626
						Fr	0.126	0.260	0.556	0.833	1.000
						Feed (mm/min)	3350	3450	5527	6625	6625
	GFRP (FIBERGLASS)	Slot	1	≤ 1	100 (80-120)	RPM	10602	5301	3976	3181	2650
						Fr	0.054	0.111	0.236	0.357	0.428
						Feed (mm/min)	570	587	940	1135	1135
		Profile	≤ 0.5	≤ 1.5	120 (96-164)	RPM	12722	6361	4771	3817	3181
						Fr	0.054	0.111	0.236	0.357	0.428
						Feed (mm/min)	684	704	1128	1362	1362
		HSM	≤ 0.05	≤ 2	200 (160-240)	RPM	21203	10602	7951	6361	5301
						Fr	0.124	0.261	0.557	1.011	1.213
						Feed (mm/min)	2629	2765	4430	6430	6430
	CARBON, GRAPHITE	Slot	1	≤ 1	145 (116-174)	RPM	15372	7686	5765	4612	3843
						Fr	0.069	0.152	0.323	0.482	0.579
						Feed (mm/min)	1061	1165	1860	2224	2224
		Profile	≤ 0.5	≤ 1.5	185 (148-222)	RPM	19613	9807	7355	5884	4903
						Fr	0.069	0.152	0.323	0.482	0.579
						Feed (mm/min)	1353	1486	2373	2838	2838
		HSM	≤ 0.05	≤ 2	300 (240-360)	RPM	31805	15903	11927	9542	7951
						Fr	0.159	0.348	0.740	1.109	1.331
						Feed (mm/min)	5057	5535	8820	10580	10580
	PLASTICS	Slot	1	≤ 1	245 (196-294)	RPM	25974	12987	9740	7792	6494
						Fr	0.069	0.150	0.319	0.477	0.572
						Feed (mm/min)	1792	1945	3107	3717	3717
		Profile	≤ 0.5	≤ 1.5	305 (244-366)	RPM	32335	16168	12126	9701	8084
						Fr	0.069	0.150	0.319	0.477	0.572
						Feed (mm/min)	2231	2421	3868	4627	4627
		HSM	≤ 0.05	≤ 2	505 (404-606)	RPM	53538	26769	20077	16062	13385
						Fr	0.159	0.344	0.732	1.097	1.316
						Feed (mm/min)	8513	9220	14690	17617	17617

HSM (high speed machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
adjust parameters based on resin type and fiber structure
reduce speed when overheating causes melting or damage to resin
reduce feed if delamination or fraying occur
finish cuts typically required reduced feed and cutting depths
rates shown are for use without coolant; rates may be increased with coolant
dust collection is vital when machining dry
diamond coating will increase tool life in graphite and composite materials
refer to the **KYOCERA SGS APEX** for complete technical information (www.kyocera-sgstool.com/apex)

Coarse Cut Carbon Composite



31M-CCR
METRIC SERIES

TOLERANCES (mm)

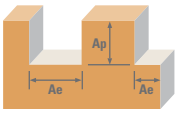
DC = +0,000/–0,130
DCON = h_6

NON-FERROUS

mm						EDP NO.		
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	NO. OF FLUTES	END STYLE	UNCOATED	Ti-NAMITE-B (TiB_2)	Di-NAMITE (Diamond)
6,0	25,0	63,0	6,0	5	End Cutting	82974	83200	82982
6,0	25,0	63,0	6,0	5	No End Cutting	82975	83201	82983
8,0	25,0	63,0	8,0	7	End Cutting	82976	83202	82984
8,0	25,0	63,0	8,0	7	No End Cutting	82977	83203	82985
10,0	28,0	63,0	10,0	8	End Cutting	82978	83204	82986
10,0	28,0	63,0	10,0	8	No End Cutting	82979	83205	82987
12,0	38,0	89,0	12,0	10	End Cutting	82980	83206	82988
12,0	38,0	89,0	12,0	10	No End Cutting	82981	83207	82989

- Fewer, deeper flutes to prevent clogging in heavy routing
- Unique clearance grind minimizes contact between tool diameter and workpiece eliminating friction
- Left hand flutes engineered to control the fibers within CFRP, preventing excessive fiber breakout
- Excels at trimming and profiling difficult and abrasive fiber filled plastics

Coarse Cut Carbon Composite

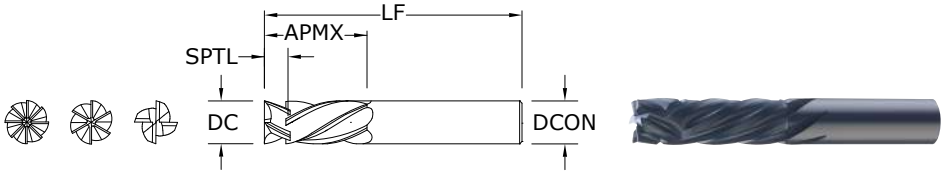


	Series 31M Metric		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12
N	CFRP, AFRP (CARBON FIBER, ARAMID FIBER)	Slot	1	≤ 1	120	RPM	6361	4771	3817	3181
					(96-164)	Fr	0.071	0.170	0.244	0.366
						Feed (mm/min)	450	810	930	1165
		Profile	≤ 0.5	≤ 1.5	150	RPM	7951	5963	4771	3976
					(120-180)	Fr	0.071	0.170	0.244	0.366
						Feed (mm/min)	563	1013	1163	1456
		HSM	≤ 0.05	≤ 2	250	RPM	13252	9939	7951	6626
					(200-300)	Fr	0.162	0.388	0.555	0.832
						Feed (mm/min)	2150	3860	4415	5515
	GFRP (FIBERGLASS)	Slot	1	≤ 1	100	RPM	5301	3976	3181	2650
					(80-120)	Fr	0.069	0.165	0.237	0.357
						Feed (mm/min)	365	655	755	945
		Profile	≤ 0.5	≤ 1.5	120	RPM	6361	4771	3817	3181
					(96-164)	Fr	0.069	0.165	0.237	0.357
						Feed (mm/min)	438	786	906	1134
		HSM	≤ 0.05	≤ 2	200	RPM	10602	7951	6361	5301
					(160-240)	Fr	0.163	0.390	0.557	0.834
						Feed (mm/min)	1725	3100	3540	4420
	CARBON, GRAPHITE	Slot	1	≤ 1	145	RPM	7686	5765	4612	3843
					(116-174)	Fr	0.095	0.226	0.321	0.483
						Feed (mm/min)	728	1300	1480	1855
		Profile	≤ 0.5	≤ 1.5	185	RPM	9807	7355	5884	4903
					(148-222)	Fr	0.095	0.226	0.321	0.483
						Feed (mm/min)	929	1659	1888	2367
		HSM	≤ 0.05	≤ 2	300	RPM	15903	11927	9542	7951
					(240-360)	Fr	0.217	0.517	0.739	1.111
						Feed (mm/min)	3450	6170	7050	8830
	PLASTICS	Slot	1	≤ 1	245	RPM	12987	9740	7792	6494
					(196-294)	Fr	0.094	0.223	0.318	0.477
						Feed (mm/min)	1215	2175	2475	3100
		Profile	≤ 0.5	≤ 1.5	305	RPM	16168	12126	9701	8084
					(244-366)	Fr	0.094	0.223	0.318	0.477
						Feed (mm/min)	1513	2708	3081	3859
		HSM	≤ 0.05	≤ 2	505	RPM	26769	20077	16062	13385
					(404-606)	Fr	0.215	0.512	0.731	1.098
						Feed (mm/min)	5760	10280	11745	14700

HSM (high speed machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fr x rpm
adjust parameters based on resin type and fiber structure
reduce speed when overheating causes melting or damage to resin
reduce feed if delamination or fraying occur
finish cuts typically required reduced feed and cutting depths
rates shown are for use without coolant; rates may be increased with coolant
dust collection is vital when machining dry
diamond coating will increase tool life in graphite and composite materials
refer to the **KYOCERA SGS APEX** for complete technical information
(www.kyocera-sgstool.com/apex)

Compression

SERIES 25
COMPRESSION ROUTER



25M
METRIC SERIES

TOLERANCES (mm)

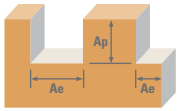
DC = +0,000/–0,080
DCON = h_6

NON-FERROUS

mm						EDP NO.	
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	SPLIT LENGTH SPTL	NO. OF FLUTES	UNCOATED	Di-NAMITE (Diamond)
6,0	25,0	63,0	6,0	4,10	4	82990	82991
8,0	25,0	63,0	8,0	5,58	4	82992	82993
10,0	28,0	63,0	10,0	7,05	6	82994	82995
12,0	38,0	89,0	12,0	8,60	8	82996	82997

- Compression-style helixes direct cutting forces inward, eliminating fiber breakout and delamination
- Primary/secondary relief grind for reduced friction and pressure
- Rigid, heavy core

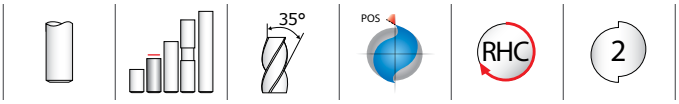
Compression

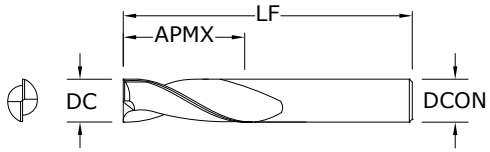


	Series 25M Metric		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 6	8	10	12
N	CFRP, AFRP (CARBON FIBER, ARAMID FIBER)	Profile	≤ 0.5	≤ 1.5	150	RPM	7951	5963	4771	3976
					(96-164)	Fz	0.040	0.065	0.075	0.100
						Feed (mm/min)	1272	1550	2147	3181
		HSM	≤ 0.05	≤ 2	250	RPM	13252	9939	7951	6626
					(200-300)	Fz	0.095	0.145	0.175	0.235
						Feed (mm/min)	5036	5765	8349	12457
	GFRP (FIBERGLASS)	Profile	≤ 0.5	≤ 1.5	120	RPM	6361	4771	3817	3181
					(96-164)	Fz	0.040	0.065	0.075	0.100
						Feed (mm/min)	1018	1240	1717	2544
		HSM	≤ 0.05	≤ 2	200	RPM	10602	7951	6361	5301
					(160-240)	Fz	0.095	0.145	0.175	0.235
						Feed (mm/min)	4029	4612	6679	9966
	CARBON, GRAPHITE	Profile	≤ 0.5	≤ 1.5	185	RPM	9807	7355	5884	4903
					(148-222)	Fz	0.050	0.080	0.095	0.125
						Feed (mm/min)	1961	2354	3354	4903
		HSM	≤ 0.05	≤ 2	300	RPM	15903	11927	9542	7951
					(240-360)	Fz	0.115	0.185	0.220	0.290
						Feed (mm/min)	7315	8826	12595	18447
	PLASTICS	Profile	≤ 0.5	≤ 1.5	305	RPM	16168	12126	9701	8084
					(244-366)	Fz	0.050	0.080	0.095	0.125
						Feed (mm/min)	3234	3880	5529	8084
		HSM	≤ 0.05	≤ 2	505	RPM	26769	20077	16062	13385
					(404-606)	Fz	0.115	0.185	0.220	0.290
						Feed (mm/min)	12314	14857	21201	31052
	MACHINABLE CERAMICS MACHINABLE GLASS	Profile	≤ 0.5	≤ 1.5	15	RPM	795	596	477	398
					(12-18)	Fz	0.020	0.035	0.045	0.050
						Feed (mm/min)	64	83	129	159
		HSM	≤ 0.05	≤ 2	25	RPM	1325	994	795	663
					(20-30)	Fz	0.045	0.075	0.085	0.115
						Feed (mm/min)	239	298	406	610

HSM (high speed machining)
rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x number of flutes x rpm
adjust parameters based on resin type and fiber structure
reduce speed when overheating causes melting or damage to resin
reduce feed if delamination or fraying occur
finish cuts typically required reduced feed and cutting depths
rates shown are for use without coolant; rates may be increased with coolant
dust collection is vital when machining dry
diamond coating will increase tool life in graphite and composite materials
refer to the **KYOCERA SGS APEX** for complete technical information
(www.kyocera-sgstool.com/apex)

Up Cut





21M
METRIC SERIES

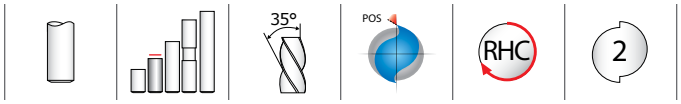
TOLERANCES (mm)

DC = +0,000/–0,080
DCON = h_6

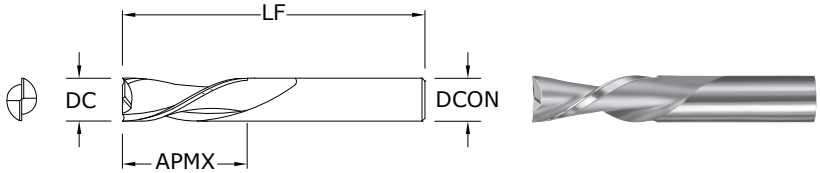
NON-FERROUS

mm				EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED
3,0	13,0	50,0	6,0	90101
4,0	16,0	63,0	6,0	90107
5,0	19,0	63,0	6,0	90109
6,0	25,0	63,0	6,0	90113
8,0	25,0	63,0	8,0	90121
10,0	31,0	75,0	10,0	90129
12,0	31,0	75,0	12,0	90137

Down Cut



22M
METRIC SERIES



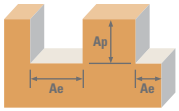
mm				EDP NO.
CUTTING DIAMETER DC	LENGTH OF CUT APMX	OVERALL LENGTH LF	SHANK DIAMETER DCON	UNCOATED
3,0	13,0	50,0	6,0	91101
4,0	16,0	63,0	6,0	91107
5,0	19,0	63,0	6,0	91109
6,0	25,0	63,0	6,0	91113
8,0	25,0	63,0	8,0	91121
10,0	31,0	75,0	10,0	91129
12,0	31,0	75,0	12,0	91137

TOLERANCES (mm)

DC = +0,000/–0,080
DCON = h_6

NON-FERROUS

Up Cut
Down Cut



	Series 21M, 22M Metric		Ae x DC	Ap x DC	Vc (m/min)		DC • mm 3	6	10	12	20
	HARDWOODS	Slot	1	≤ 1	470	RPM	49828	24914	14948	12457	7474
					(376-564)	Fz	0.020	0.040	0.065	0.075	0.115
						Feed (mm/min)	1993	1993	1943	1869	1719
		Profile	≤ 0.5	≤ 1.5	470	RPM	49828	24914	8155	4241	1509
					(376-564)	Fz	0.020	0.040	0.065	0.075	0.115
						Feed (mm/min)	1993	1993	1060	636	347
	SOFTWOODS	Slot	1	≤ 1	600	RPM	63610	31805	19083	15903	9542
					(480-720)	Fz	0.025	0.050	0.075	0.090	0.140
						Feed (mm/min)	3181	3181	2862	2862	2672
		Profile	≤ 0.5	≤ 1.5	600	RPM	63610	31805	19083	15903	303467
					(480-720)	Fz	0.025	0.050	0.075	0.090	0.140
						Feed (mm/min)	3181	3181	2862	2862	84971
	PLYWOODS	Slot	1	≤ 1	600	RPM	63610	31805	19083	15903	9542
					(480-720)	Fz	0.030	0.065	0.100	0.125	0.190
						Feed (mm/min)	3817	4135	3817	3976	3626
		Profile	≤ 0.5	≤ 1.5	600	RPM	63610	31805	19083	15903	303467
					(480-720)	Fz	0.030	0.065	0.100	0.125	0.190
						Feed (mm/min)	3817	4135	3817	3976	115318
N	PLASTICS	Slot	1	≤ 1	600	RPM	63610	31805	19083	15903	9542
					(480-720)	Fz	0.020	0.040	0.065	0.090	0.125
						Feed (mm/min)	2544	2544	2481	2862	2385
		Profile	≤ 0.5	≤ 1.5	600	RPM	63610	31805	19083	15903	9542
					(480-720)	Fz	0.020	0.040	0.065	0.090	0.125
						Feed (mm/min)	2544	2544	2481	2862	2385

rpm = (Vc x 1000) / (DC x 3.14)
mm/min = Fz x 2 x rpm

EDP Number Index

EDP NO.	PAGE
30000	307
30001	307
30002	307
30003	307
30004	307
30005	307
30006	307
30007	308
30008	308
30009	308
30010	308
30011	308
30012	308
30013	308
30014	308
30015	308
30016	308
30017	308
30018	309
30019	309
30020	309
30021	309
30022	309
30023	309
30024	309
30025	309
30026	309
30027	310
30028	310
30029	307
30030	310
30030	322
30031	311
30032	311
30033	311
30034	311
30035	311
30036	311
30037	311
30038	311
30039	311
30040	311
30041	311
30042	311
30043	311
30044	311
30045	311
30046	311
30047	311
30048	311
30049	311
30050	311
30051	311
30052	311
30053	311
30054	311
30055	312
30056	312
30057	312
30058	312
30059	312

EDP NO.	PAGE
30060	312
30061	312
30062	312
30063	312
30064	312
30065	312
30066	312
30067	312
30068	312
30069	311
30070	312
30070	323
30101	307
30102	311
30103	307
30104	311
30105	307
30106	311
30107	307
30108	311
30109	307
30110	311
30111	307
30112	311
30113	307
30114	311
30115	307
30116	311
30117	307
30118	311
30119	307
30120	311
30121	307
30122	311
30123	307
30124	311
30125	307
30126	311
30127	307
30128	311
30129	307
30130	311
30131	307
30132	311
30133	308
30134	311
30135	308
30136	311
30137	308
30138	311
30139	308
30140	311
30141	308
30142	311
30143	308
30144	311
30145	308
30146	311
30147	308
30148	311
30149	308

EDP NO.	PAGE
30150	312
30151	308
30152	312
30153	308
30154	312
30155	309
30156	312
30157	309
30158	312
30159	309
30160	312
30161	309
30162	312
30163	309
30164	312
30165	309
30166	312
30167	309
30168	312
30169	309
30170	312
30171	309
30172	312
30173	310
30174	312
30175	310
30176	312
30177	307
30178	311
30179	308
30180	309
30181	309
30182	310
30183	310
30184	311
30185	312
30186	312
30187	312
30188	312
30189	310
30189	322
30190	312
30190	323
30191	307
30192	307
30193	307
30194	307
30195	307
30196	307
30197	307
30198	307
30199	307
30300	307
30301	288
30302	291
30303	288
30304	291
30305	288
30306	291
30307	288
30308	291

EDP NO.	PAGE
30309	288
30310	291
30311	288
30312	291
30313	288
30314	291
30315	288
30316	291
30317	288
30318	291
30319	288
30320	291
30321	288
30322	291
30323	288
30324	291
30325	288
30326	291
30327	288
30328	291
30329	288
30330	291
30331	288
30332	291
30333	288
30334	291
30335	288
30336	291
30337	289
30338	291
30339	289
30340	291
30341	289
30342	291
30343	289
30344	291
30345	289
30346	291
30347	289
30348	292
30349	289
30350	292
30351	289
30352	292
30353	289
30354	292
30355	289
30356	292
30357	289
30358	292
30359	289
30360	292
30361	289
30362	292
30363	289
30364	292
30365	290
30366	292
30367	290
30368	292
30369	290

EDP NO.	PAGE
30370	292
30371	290
30372	292
30373	290
30374	292
30375	290
30376	292
30377	288
30378	291
30379	308
30380	309
30381	309
30382	310
30383	310
30384	311
30385	312
30386	312
30387	312
30388	312
30389	290
30389	322
30390	292
30390	323
30397	288
30398	288
30399	288
30400	288
30435	288
30436	288
30437	288
30438	288
30439	288
30440	288
30441	288
30442	288
30443	288
30444	288
30445	288
30446	288
30447	288
30448	288
30449	289
30450	289
30451	289
30452	289
30453	289
30454	289
30455	289
30456	289
30457	289
30458	289
30459	289
30460	289
30461	289
30462	289
30463	290
30464	290
30465	290
30466	290
30467	290
30468	290

EDP NO.	PAGE
30469	288
30470	290
30470	322
30471	291
30472	291
30473	291
30474	291
30475	291
30476	291
30477	291
30478	291
30479	291
30480	291
30481	291
30482	291
30483	291
30484	291
30485	291
30486	291
30487	291
30488	291
30489	291
30490	291
30491	291
30492	291
30493	291
30494	292
30495	292
30496	292
30497	292
30498	292
30499	292
30500	292
30501	301
30502	302
30503	301
30504	302
30505	301
30506	302
30507	301
30508	302
30509	301
30510	302
30511	301
30512	302
30513	301
30514	302
30515	301
30516	302
30517	301
30518	302
30519	301
30520	302
30521	301
30522	302
30523	301
30524	302
30525	301
30526	302
30527	301
30528	302

EDP NO.	PAGE
30529	301
30530	302
30531	301
30532	302
30533	301
30534	302
30535	301
30536	302
30537	301
30538	302
30539	301
30540	302
30541	301
30542	302
30543	301
30544	302
30545	301
30546	302
30547	301
30548	302
30549	301
30550	302
30551	301
30552	302
30553	301
30554	302
30555	301
30556	302
30557	301
30558	302
30559	301
30560	302
30561	301
30562	302
30563	301
30564	302
30565	301
30566	302
30567	301
30568	302
30569	301
30570	302
30571	301
30572	302
30573	301
30574	302
30575	301
30576	302
30577	301
30578	302
30589	301
30589	322
30590	302
30590	323
30591	292
30592	292
30593	292
30594	292
30595	292
30596	292
30597	292

EDP Number Index

EDP NO.	PAGE
30598	292
30599	291
30600	292
30600	323
30771	301
30772	301
30773	301
30774	301
30775	301
30776	301
30777	301
30778	301
30779	301
30780	301
30781	301
30782	301
30783	301
30784	301
30785	301
30786	301
30787	301
30788	301
30789	301
30790	301
30791	301
30792	301
30793	301
30794	301
30795	301
30796	301
30797	301
30798	301
30799	301
30800	301
30801	301
30802	301
30803	301
30804	301
30805	301
30806	301
30807	301
30808	301
30809	301
30810	301
30810	322
30811	301
30812	301
30813	301
30814	301
30815	301
30816	301
30817	301
30818	301
30819	301
30820	301
30821	301
30822	301
30823	301
30824	301
30825	301
30826	301
30827	301
30828	301
30829	301
30830	301
30831	301
30832	301
30833	301
30834	301
30835	301
30836	301
30837	301
30838	301
30839	301
30840	301
30841	301
30842	301
30843	301
30844	301
30845	301
30846	301
30847	301
30848	301
30849	301
30850	301
30850	322
30900	323
30944	323
31130	302
31131	302
31132	302
31133	302
31134	302
31135	302
31136	302
31137	302
31138	302
31139	302
31140	302
31141	302
31142	302
31143	302
31144	302
31145	302
31146	302
31147	302
31148	302
31149	302
31150	302
31151	302
31152	302
31153	302
31154	302
31155	302
31156	302
31157	302
31158	302
31159	302
31160	302
31161	302
31162	302
31163	302
31164	302
31165	302
31166	302
31167	302
31168	302
31169	302
31169	323
31170	317
31171	317
31172	317
31173	317
31174	317
31175	317
31176	317
31177	317
31178	317
31179	317
31180	317
31181	317
31182	317
31183	317
31184	317
31185	317
31186	317
31187	317
31188	317
31189	317
31190	317
31190	322
31217	318
31217	323
31218	318
31219	318
31220	318
31221	318
31222	318
31223	318
31224	318
31225	318
31226	318
31227	318
31228	318
31229	318
31230	318
31231	318
31232	318
31233	318
31234	318
31235	318
31236	318
31237	318
31238	307
31239	307
31240	307
31241	307
31242	307
31243	307
31244	307
31245	308
31246	308
31247	309
31248	309
31249	309
31250	309
31251	307
31252	307
31253	307
31254	307
31255	307
31256	307
31257	307
31258	308
31259	308
31260	309
31261	309
31262	309
31263	309
31357	323
31358	295
31359	295
31360	295
31361	295
31362	295
31363	295
31364	295
31365	295
31366	295
31367	295
31368	295
31369	295
31370	295
31401	317
31402	318
31403	317
31404	318
31405	317
31406	318
31407	317
31408	318
31409	317
31410	318
31411	317
31412	318
31413	317
31414	318
31415	317
31416	318
31417	317
31418	318
31419	317
31420	318
31421	317
31422	318
31423	317
31424	318
31425	317
31426	318
31427	317
31428	318
31429	317
31430	318
31431	317
31432	318
31433	317
31434	318
31435	317
31436	318
31437	317
31438	318
31439	317
31440	318
31441	317
31442	318
31443	317
31444	318
31445	317
31446	318
31447	317
31448	318
31449	317
31450	318
31451	317
31452	318
31453	317
31454	318
31455	317
31456	318
31457	317
31458	318
31459	317
31460	318
31461	317
31462	318
31463	317
31464	318
31465	317
31466	318
31467	317
31468	318
31469	317
31470	318
31471	317
31472	318
31473	317
31474	318
31475	317
31476	318
31477	317
31478	318
31479	317
31480	318
31481	317
31481	322
31482	318
31482	323
31489	317
31489	322
31490	318
31490	323
31581	322
31590	323
31601	307
31603	307
31605	307
31607	307
31609	307
31611	307
31613	307
31615	308
31617	308
31619	309
31621	309
31623	309
31625	309
31650	307
31651	307
31652	307
31653	307
31654	307
31655	307
31656	307
31657	308
31658	308
31659	309
31660	309
31661	309
31662	309
31701	295
31703	295
31705	295
31707	295
31709	295
31711	295
31713	295
31715	295
31717	295
31719	295
31721	295
31723	295
31725	295
31727	307
31728	307
31729	308
31730	308
31731	308
31732	309
31733	309
31734	309
31735	310
31736	310
31737	307
31738	307
31739	308
31740	308
31741	308
31742	309
31743	309
31744	309
31745	310
31746	310
31747	307
31748	307
31749	308
31763	308
31764	308
31765	309
31766	309
31767	309
31768	310
31769	310
31780	311
31781	311
31782	311
31783	311
31784	311
31785	312
31786	312
31787	312
31788	312
31789	312
31790	311
31791	311
31792	311
31793	311
31794	311
31795	312
31796	312
31797	312
31798	312
31799	312
31800	288
31802	288
31804	289
31806	289
31808	290
31810	288
31812	288
31814	289
31816	289
31817	290
31818	290
31819	290
31820	288
31821	289
31822	289
31823	290
31824	290
31825	288
31826	289
31827	289
31850	288
31851	288
31852	288
31853	289
31854	289
31855	289
31856	289
31857	290
31858	290
31859	290
31860	307
31861	307
31862	308
31863	308
31864	308

EDP Number Index

EDP NO.	PAGE
31865	309
31866	309
31867	309
31868	310
31869	310
31870	307
31871	307
31872	308
31873	308
31874	308
31875	309
31876	309
31877	309
31878	310
31879	310
31880	307
31881	307
31882	308
31883	308
31884	308
31885	309
31886	309
31887	309
31888	310
31889	310
31890	291
31891	291
31892	291
31893	291
31894	292
31895	292
31896	292
31897	292
31898	292
31899	292
31918	311
31919	311
31920	311
31921	311
31922	311
31923	312
31924	312
31925	312
31926	312
31927	312
31928	311
31929	311
31930	311
31931	311
31932	311
31933	312
31934	312
31935	312
31936	312
31937	312
31938	288
31939	288
31940	288
31941	289
31942	289
31943	289

EDP NO.	PAGE
31944	290
31945	290
31946	290
31947	290
31948	288
31949	288
31950	288
31951	289
31952	289
31953	289
31954	290
31955	290
31956	290
31957	290
31958	288
31959	288
31960	288
31961	289
31962	289
31963	289
31964	290
31965	290
31966	290
31967	290
31988	291
31989	291
31990	291
31991	291
31992	292
31993	292
31994	292
31995	292
31996	292
31997	292
32033	181
32034	181
32035	181
32036	181
32037	181
32038	181
32039	181
32040	181
32041	181
32042	181
32043	181
32044	181
32045	181
32046	181
32047	181
32048	181
32049	181
32053	181
32054	181
32055	181
32056	181
32057	181
32058	181
32059	181
32060	181
32061	181
32062	181

EDP NO.	PAGE
32063	181
32064	181
32065	181
32066	181
32067	181
32068	181
32069	181
32200	298
32201	298
32202	298
32203	298
32204	298
32205	298
32206	298
32207	298
32270	297
32271	297
32272	297
32273	297
32274	297
32275	297
32276	297
32277	297
32301	305
32303	305
32305	305
32307	305
32309	305
32311	305
32313	305
32315	305
32317	305
32319	305
32321	305
32323	305
32325	305
32327	305
32329	305
32333	305
32335	305
32337	305
32339	305
32341	305
32345	305
32346	305
32347	305
32348	305
32349	305
32350	305
32351	305
32352	305
32353	305
32354	305
32355	305
32356	305
32357	305
32358	305
32359	305
32360	305
32361	305
32362	305

EDP NO.	PAGE
32363	305
32364	305
32402	306
32404	306
32406	306
32408	306
32410	306
32412	306
32414	306
32416	306
32418	306
32420	306
32422	306
32424	306
32426	306
32428	306
32430	306
32434	306
32436	306
32438	306
32440	306
32442	306
32470	306
32471	306
32472	306
32473	306
32474	306
32475	306
32476	306
32477	306
32478	306
32479	306
32480	306
32481	306
32482	306
32483	306
32484	306
32485	306
32486	306
32487	306
32488	306
32489	306
32500	76
32501	76
32502	76
32503	76
32504	76
32505	76
32506	76
32569	74
32570	75
32571	75
32572	75
32573	74
32574	74
32575	75
32576	75
32577	75
32578	75
32579	75
32580	75

EDP NO.	PAGE
32581	75
32582	75
32583	75
32584	75
32585	75
32586	75
32587	75
32588	75
32589	75
32590	75
32591	74
32592	74
32593	74
32594	75
32595	75
32596	75
32597	75
32598	75
32599	75
32600	75
32601	75
32602	75
32603	75
32604	75
32605	75
32606	74
32607	74
32608	74
32609	74
32610	74
32611	74
32612	74
32613	74
32614	74
32615	74
32616	74
32619	74
32620	74
32621	74
32625	74
32626	74
32627	74
32628	74
32632	75
32633	75
32655	74
32656	74
32657	74
32658	74
32659	74
32660	74
32661	74
32662	74
32663	74
32664	75
32665	75
32666	75
32667	75
32668	75
32669	75
32670	75

EDP NO.	PAGE
32671	75
32672	74
32673	74
32674	74
32675	74
32676	74
32677	74
32678	75
32679	75
32680	75
32681	75
32682	75
32683	75
32685	75
32686	75
32687	75
32688	75
32689	75
32691	156
32692	156
32697	157
32698	157
32699	158
32700	156
32701	156
32702	156
32703	156
32704	156
32705	156
32706	156
32707	156
32708	156
32709	156
32710	157
32711	157
32712	157
32713	157
32714	157
32715	157
32716	157
32717	158
32718	158
32719	158
32720	158
32725	156
32726	156
32727	156
32728	156
32729	156
32730	156
32731	156
32732	156
32733	156
32734	156
32735	157
32736	157
32737	157
32738	157
32739	157
32740	157
32741	157

EDP NO.	PAGE
32742	158
32743	158
32744	158
32745	158
32751	156
32752	156
32753	156
32754	156
32755	156
32756	156
32757	156
32758	156
32759	156
32760	156
32761	153
32762	156
32763	156
32764	156
32765	156
32766	153
32767	156
32768	156
32769	156
32770	156
32771	157
32772	157
32773	157
32774	157
32775	157
32776	157
32777	157
32778	157
32779	157
32780	157
32781	157
32782	157
32783	157
32784	157
32785	157
32786	157
32787	157
32788	157
32789	157
32790	157
32791	157
32792	157
32793	157
32794	157
32795	157
32796	158
32797	158
32798	158
32799	158
32800	158
32801	158
32802	158
32803	158
32804	158
32805	158
32806	158
32807	158

EDP Number Index

EDP NO.	PAGE
32808	158
32809	158
32810	158
32815	156
32816	156
32817	156
32818	156
32819	156
32820	156
32821	156
32822	156
32823	156
32824	156
32825	153
32826	156
32827	156
32828	156
32829	156
32830	153
32831	156
32832	156
32833	156
32834	156
32835	157
32836	157
32837	157
32838	157
32839	157
32840	157
32841	157
32842	157
32843	157
32844	157
32845	157
32846	157
32847	157
32848	157
32849	157
32850	157
32851	157
32852	157
32853	157
32854	157
32855	157
32856	157
32857	157
32858	157
32859	157
32860	158
32861	158
32862	158
32863	158
32864	158
32865	158
32866	158
32867	158
32868	158
32869	158
32870	158
32871	158
32872	158
32873	158
32874	158
33101	307
33102	311
33103	308
33104	311
33105	308
33106	311
33107	308
33108	311
33109	309
33110	312
33111	309
33112	312
33113	309
33114	312
33115	310
33116	312
33117	310
33118	312
33121	307
33122	311
33123	308
33124	311
33125	308
33126	311
33127	308
33128	311
33129	309
33130	312
33131	309
33132	312
33133	309
33134	312
33135	310
33136	312
33137	310
33138	312
33141	307
33142	311
33143	307
33144	311
33301	288
33302	291
33303	288
33304	291
33305	289
33306	291
33307	289
33308	292
33309	289
33310	292
33311	289
33312	292
33313	290
33314	292
33315	290
33316	292
33317	290
33318	292
33321	288
33322	291
33323	288
33324	291
33325	289
33326	291
33327	289
33328	292
33329	289
33330	292
33331	290
33332	292
33333	290
33334	292
33335	290
33336	292
33337	290
33338	292
33341	288
33342	291
33343	288
33344	291
33345	111
33346	111
33347	111
33348	111
33349	111
33350	111
33351	111
33352	111
33353	111
33354	111
33360	130
33361	130
33390	162
33391	162
33392	162
33393	162
33394	162
33395	162
33396	162
33397	162
33398	162
33400	162
33401	162
33402	162
33403	162
33404	162
33406	162
33407	162
33408	162
33409	162
33410	162
33411	162
33412	162
33413	162
33415	162
33416	162
33417	162
33418	162
33419	162
33420	162
33421	162
33422	162
33423	162
33424	162
33450	162
33451	162
33452	162
33453	162
33454	162
33455	162
33456	162
33457	162
33458	162
33460	162
33461	162
33462	162
33463	162
33464	162
33466	162
33467	162
33468	162
33469	162
33470	162
33471	162
33472	162
33473	162
33475	162
33476	162
33477	162
33478	162
33479	162
33480	162
33481	162
33482	162
33483	162
33484	162
33500	163
33501	163
33502	163
33503	163
33504	163
33507	163
33508	163
33511	163
33513	163
33514	163
33515	163
33516	163
33517	163
33518	163
33519	163
33520	163
33521	163
33522	163
33523	163
33524	163
33525	163
33540	163
33541	163
33542	163
33543	163
33544	163
33547	163
33548	163
33551	163
33552	163
33553	163
33554	163
33555	163
33556	163
33557	163
33558	163
33559	163
33560	163
33561	163
33562	163
33563	163
33564	163
33565	163
34016	146
34017	146
34018	146
34019	146
34020	146
34021	146
34022	146
34023	146
34024	146
34025	146
34026	146
34027	146
34028	146
34029	146
34030	146
34031	146
34100	141
34101	141
34102	141
34103	141
34104*	141
34105*	141
34106*	141
34107*	141
34108*	141
34109*	141
34110*	141
34111*	141
34112	141
34113	141
34114	141
34115	141
34116*	141
34117*	141
34118*	141
34119*	141
34120*	141
34121*	141
34122*	141
34123*	141
34124	141
34125	141
34126	141
34127	141
34128*	141
34129*	141
34130*	141
34131*	141
34132*	141
34133*	141
34134*	141
34135*	141
34300	162
34301	162
34302	162
34303	162
34304	162
34305	162
34306	162
34307	162
34308	162
34309	162
34501	181
34502	181
34503	181
34504	181
34505	181
34506	181
34507	181
34508	181
34509	181
34510	181
34511	181
34512	181
34513	181
34514	181
34515	181
34516	181
34517	181
34518	181
34519	181
34520	181
34521	181
34522	181
34523	181
34524	181
34525	181
34526	181
34527	181
34528	181
34529	181
34530	181
34531	181
34532	181
34533	181
34534	181
34620	174
34621	174
34622	174
34623	174
34624	174
34625	174
34626	174
34627	174
34628	174
34630	176
34631	176
34632	176
34633	176
34634	176
34635	176
34636	176
34637	176
34638	176
34640	175
34641	175
34642	175
34643	175
34644	175
34645	175
34646	175
34647	175
34650	176
34651	176
34652	176
34653	176
34654	176
34655	176
34656	176
34657	176
34660	174
34661	174
34662	174
34663	174
34664	174
34665	174
34666	174
34667	174
34668	174
34669	176
34670	176
34671	176
34672	176
34673	176
34674	176
34675	176
34676	176
34677	176
34678	175
34679	175
34680	175
34681	175
34682	175
34683	175
34684	175
34685	175
34686	176
34687	176
34688	176
34689	176
34690	176
34691	176
34692	176
34693	176
34701	152

EDP Number Index

EDP NO.	PAGE
34702	152
34703	152
34704	152
34705	152
34706	152
34707	152
34708	152
34709	152
34710	152
34711	153
34712	153
34713	153
34714	154
34715	154
34716	154
34717	154
34718	154
34719	154
34720	154
34721	154
34722	155
34723	155
34724	155
34725	155
34726	155
34727	155
34728	152
34729	152
34730	152
34731	152
34732	152
34733	152
34734	152
34735	152
34736	152
34737	152
34738	153
34739	153
34740	153
34741	154
34742	154
34743	154
34744	154
34745	154
34746	154
34747	154
34748	154
34749	155
34750	155
34751	155
34752	155
34753	155
34754	155
34758	155
34760	130
34761	130
34762	133
34763	133
34765	155
34771	152
34772	152
34773	152
34774	152
34775	152
34776	152
34777	153
34778	153
34779	153
34780	153
34781	153
34782	154
34783	154
34784	154
34785	154
34786	155
34787	155
34789	155
34790	155
34791	155
34793	152
34794	152
34795	152
34796	152
34797	152
34798	152
34799	153
34800	153
34801	153
34802	153
34803	153
34804	154
34805	154
34806	154
34807	154
34808	155
34809	155
34811	155
34812	155
34813	155
34815	155
34816	155
34817	155
34818	155
34822	152
34823	152
34824	152
34825	152
34826	152
34827	153
34828	153
34830	153
34831	153
34832	154
34833	154
34834	154
34835	155
34857	152
34858	152
34859	152
34860	152
34861	152
34862	153
34863	153
34865	153
34866	153
34867	154
34868	154
34869	154
34870	155
34888	156
34889	156
34894	157
34895	157
34896	158
34916	160
34917	160
34918	160
34919	160
34920	160
34921	160
34922	160
34923	160
34924	160
34925	160
34926	160
34927	160
34928	160
34929	160
34930	160
34931	160
34932	160
34933	160
34934	160
34941	161
34942	161
34943	161
34944	161
34945	161
34946	161
34947	161
34948	161
34949	161
34950	161
34951	161
34952	161
34954	161
34955	161
34956	161
34972	160
34973	160
34974	160
34975	160
34976	160
34977	160
34978	160
34979	160
34980	160
34981	160
34982	160
34983	160
34984	160
34985	160
34986	160
34987	160
34988	160
34989	160
34990	160
35005	161
35006	161
35007	161
35008	161
35009	161
35010	161
35011	161
35012	161
35013	161
35014	161
35015	161
35016	161
35018	161
35019	161
35020	161
35100	84
35101	84
35102	84
35103	84
35104	84
35105	84
35106	85
35107	85
35108	85
35109	85
35110	85
35111	85
35112	84
35113	84
35114	84
35115	84
35116	84
35117	84
35118	84
35119	84
35120	84
35121	84
35122	84
35123	84
35124	84
35125	84
35126	84
35127	85
35128	85
35129	85
35130	85
35131	85
35132	85
35133	85
35134	85
35135	85
35136	85
35137	85
35138	85
35139	85
35140	85
35141	85
35150	84
35151	84
35152	84
35153	84
35154	84
35155	84
35156	84
35157	84
35158	84
35159	84
35160	84
35161	84
35180	85
35181	85
35182	85
35183	85
35184	85
35185	85
35186	85
35187	85
35188	85
35189	85
35190	85
35191	85
35220	86
35221	86
35222	86
35223	86
35224	86
35225	86
35226	86
35227	86
35228	86
35229	86
35230	86
35231	86
35273	296
35275	296
35277	296
35278	296
35279	296
35280	296
35281	296
35282	296
35283	296
35285	296
35287	296
35289	296
35291	296
35293	296
35295	296
35297	296
35300	296
35301	296
35302	296
35303	296
35304	296
35305	296
35306	296
35307	296
35308	296
35309	296
35310	296
35311	296
35312	296
35313	296
35314	296
35315	296
35473	319
35475	319
35477	319
35478	319
35479	319
35480	319
35481	319
35482	319
35483	319
35485	319
35487	319
35489	319
35491	319
35493	319
35495	319
35497	319
35500	319
35501	319
35502	319
35503	319
35504	319
35505	319
35506	319
35507	319
35508	319
35509	319
35510	319
35511	319
35512	319
35513	319
35514	319
35515	319
35575	152
35576	152
35577	152
35578	152
35579	152
35580	152
35581	152
35582	152
35583	152
35584	152
35585	152
35586	152
35587	152
35588	152
35589	152
35590	153
35591	153
35592	153
35593	153
35594	153
35595	153
35596	153
35597	153
35598	153
35599	153
35600	153
35601	153
35602	153
35603	153
35604	153
35605	153
35606	153
35607	153
35608	153
35609	153
35610	153
35611	153
35612	154
35613	154
35614	154
35615	154
35616	154
35617	154
35618	154
35619	154
35620	154
35621	154
35622	154
35623	154
35624	154
35625	154
35626	154
35627	154
35628	154
35629	154
35630	154
35631	154
35632	154
35633	155
35634	155
35635	155
35636	155
35637	155
35638	155
35639	155
35640	155
35641	155
35642	155
35643	155
35644	155
35645	155
35646	155
35647	155
35648	155
35649	155
35650	155
35651	155
35652	155
35653	155
35654	155
35665	152
35666	152
35667	152

EDP Number Index

EDP NO.	PAGE
35668	152
35669	152
35670	152
35671	152
35672	152
35673	152
35674	152
35675	152
35676	152
35677	152
35678	152
35679	152
35680	153
35681	153
35682	153
35683	153
35684	153
35685	153
35686	153
35687	153
35688	153
35689	153
35690	153
35691	153
35692	153
35693	153
35694	153
35695	153
35696	153
35697	153
35698	153
35699	153
35700	153
35701	153
35702	154
35703	154
35704	154
35705	154
35706	154
35707	154
35708	154
35709	154
35710	154
35711	154
35712	154
35713	154
35714	154
35715	154
35716	154
35717	154
35718	154
35719	154
35720	154
35721	154
35722	154
35723	155
35724	155
35725	155
35726	155
35727	155
35728	155
35729	155
35730	155
35731	155
35732	155
35733	155
35734	155
35735	155
35736	155
35737	155
35738	155
35739	155
35740	155
35741	155
35742	155
35743	155
35744	155
35787	156
35788	156
35789	159
35790	159
35791	156
35792	156
35793	159
35794	159
35795	156
35796	156
35797	159
35798	159
35799	159
35800	159
35801	159
35802	159
35803	157
35804	157
35805	159
35806	159
35809	158
35810	158
35811	158
35812	158
35813	159
35814	159
35815	159
35816	159
35817	159
35818	159
36106	320
36107	320
36108	320
36109	320
36110	320
36111	320
36112	320
36113	320
36114	320
36116	320
36117	320
36118	320
36120	320
36121	320
36122	320
36124	320
36125	320
36126	320
36128	320
36129	320
36130	320
36140	124
36141	124
36142	124
36143	124
36210	321
36211	321
36214	321
36218	321
36222	321
36224	321
36226	321
36230	321
36235	156
36236	156
36237	159
36238	159
36239	156
36240	156
36241	159
36242	159
36243	156
36244	156
36245	159
36246	159
36247	159
36248	159
36249	159
36250	159
36251	157
36252	157
36253	159
36254	159
36257	158
36258	158
36259	158
36260	158
36261	159
36262	159
36263	159
36264	159
36265	159
36266	159
36344	40
36345	40
36346	40
36347	40
36348	40
36349	40
36350	40
36351	40
36352	40
36353	40
36354	40
36355	40
36356	40
36357	40
36358	40
36359	40
36361	40
36370	37
36371	37
36372	37
36373	37
36374	38
36375	38
36376	38
36378	38
36380	38
36381	38
36383	39
36384	39
36385	39
36386	39
36387	39
36388	39
36389	39
36390	39
36391	39
36392	39
36393	39
36404	37
36406	37
36408	37
36410	37
36416	37
36418	37
36420	38
36422	38
36424	38
36426	38
36428	38
36430	38
36432	38
36436	38
36440	39
36442	39
36444	39
36447	41
36448	41
36449	41
36450	41
36452	41
36453	41
36454	41
36456	41
36457	41
36458	41
36460	41
36462	41
36463	41
36464	41
36466	41
36468	41
36469	41
36470	41
36472	41
36474	41
36475	41
36480	42
36482	42
36486	42
36500	42
36502	42
36504	42
36505	37
36506	37
36507	37
36508	37
36509	37
36511	38
36513	38
36515	38
36517	38
36519	39
36520	39
36530	38
36531	38
36532	38
36533	38
36534	38
36535	38
36536	39
36537	39
36538	39
36539	40
36540	40
36541	40
36542	40
36543	40
36544	40
36545	40
36546	40
36547	40
36555	51
36556	51
36557	51
36558	51
36559	51
36560	51
36561	51
36570	51
36571	51
36572	51
36573	51
36574	51
36575	51
36576	51
36577	51
36578	51
36590	40
36591	40
36592	40
36596	37
36597	38
36598	38
36599	37
36600	37
36601	37
36602	38
36603	38
36604	38
36605	38
36610	38
36611	38
36612	38
36613	38
36614	38
36615	38
36616	51
36617	51
36618	51
36620	103
36621	103
36622	103
36623	103
36624	103
36625	103
36626	103
36627	103
36628	103
36629	103
36630	103
36631	103
36632	103
36633	103
36634	103
36635	103
36636	103
36637	103
36638	103
36639	103
36640	103
36641	103
36701	38
36702	38
36704	38
36706	38
36707	38
36709	39
36710	39
36711	39
36712	39
36713	39
36714	39
36715	39
36716	39
36717	39
36718	39
36719	39
36722	37
36723	37
36724	38
36725	38
36727	38
36729	38
36731	38
36733	39
36736	38
36738	38
36740	38
36742	38
36744	39
36780	55
36781	55
36782	55
36783	55
36784	55
36785	55
36786	55
36787	55
36788	55
36789	55
36790	55
36791	55
36792	55
36793	55
36804	38
36805	38
36806	39
36807	39
36808	39
36809	39
36810	38
36811	38
36812	38
36813	38
36814	39
36815	39
36816	39
36817	39
36818	39
36819	39
36820	39
36821	39
36822	39
36823	39
36824	39
36825	39
36826	38
36827	38
36828	39
36829	39
36830	39
36846	40
36847	40
36848	40
36849	40
36850	40
36851	37
36852	37
36853	37
36854	37
36855	38
36856	38
36857	38
36858	38
36859	38
36860	39
36861	39

EDP Number Index

EDP NO.	PAGE
36862	39
36863	39
36864	38
36865	38
36866	38
36867	38
36868	39
36869	39
36870	39
36871	39
36872*	37
36873*	37
36874*	37
36875*	37
36876*	37
36877*	37
36878*	37
37000	57
37001	57
37002	57
37003	57
37004	57
37005	57
37006	57
37007	57
37008	57
37009	57
37010	57
37011	57
37012	58
37013	58
37014	58
37015	58
37016	58
37017	58
37018	58
37019	58
37020	59
37021	59
37022	59
37023	59
37024	59
37025	59
37026	59
37027	59
37028	59
37029	59
37030	59
37031	59
37032	59
37033	59
37034	59
37035	59
37036	59
37037	60
37038	60
37039	60
37040	60
37041	60
37042	59
37043	60
37044	60
37045	60
37046	60
37047	60
37048	60
37049	60
37050	60
37051	60
37052	60
37053	60
37054	60
37055	60
37056	60
37057	60
37058	60
37059	60
37060	60
37061	60
37062	60
37063	60
37064	60
37065	60
37066	60
37067	60
37068	60
37069	60
37070	60
37071	60
37072	60
37073	60
37074	60
37075	61
37076	61
37077	61
37078	61
37079	61
37080	61
37081	60
37082	61
37083	61
37084	61
37085	61
37086	61
37087	61
37088	61
37089	61
37090	61
37091	61
37092	61
37093	61
37094	61
37095	61
37096	61
37097	61
37098	61
37099	61
37100	61
37101	61
37102	61
37103	61
37104	61
37105	61
37106	61
37107	61
37108	61
37109	61
37110	61
37111	61
37112	61
37113	61
37114	61
37115	61
37116	62
37117	62
37118	62
37119	62
37120	62
37121	62
37122	62
37123	62
37124	62
37125	62
37126	62
37127	62
37128	62
37129	62
37130	62
37131	62
37132	62
37133	62
37133	63
37134	62
37134	63
37135	63
37135	63
37136	63
37136	63
37137	62
37138	62
37139	62
37140	62
37140	63
37141	62
37141	63
37142	63
37142	63
37143	63
37143	63
37144	63
37144	63
37145	63
37145	63
37146	63
37146	63
37147	63
37147	63
37148	63
37148	63
37149	63
37149	63
37150	63
37150	63
37151	63
37151	63
37152	63
37152	63
37153	63
37153	63
37154	63
37154	63
37155	63
37155	63
37156	63
37156	63
37157	63
37157	63
37160	59
37161	59
37162	59
37163	59
37164	59
37165	59
37166	59
37167	59
37174	59
37175	59
37180	57
37181	57
37182	57
37183	57
37184	57
37185	58
37186	58
37187	59
37188	59
37189	59
37190	60
37191	60
37192	60
37193	60
37194	60
37195	60
37196	60
37197	60
37198	60
37199	61
37200	61
37201	61
37202	60
37203	61
37204	61
37205	61
37206	61
37207	61
37208	61
37209	61
37210	61
37211	61
37212	61
37213	61
37214	62
37215	62
37216	62
37217	62
37217	63
37218	62
37219	62
37220	62
37221	62
37221	63
37222	62
37223	62
37224	62
37225	62
37226	62
37227	62
37228	62
37229	62
37230	62
37231	62
37232	62
37233	62
37234	62
37235	62
37236	62
37237	62
37260	60
37261	60
37262	60
37263	60
37264	60
37265	60
37266	60
37267	60
37268	61
37269	61
37270	61
37271	61
37272	61
37273	61
37274	61
37275	61
37276	61
37277	61
37278	61
37279	61
37280	61
37281	61
37282	61
37283	61
37284	61
37285	61
37286	61
37287	61
37288	62
37289	62
37290	62
37291	62
37292	62
37293	62
37294	62
37295	62
37296	62
37297	62
37298	62
37298	63
37299	62
37299	63
37300	63
37300	63
37301	63
37301	63
37302	63
37302	63
37303	63
37303	63
37304	63
37304	63
37305	63
37305	63
37306	63
37306	63
37307	63
37307	63
37308	63
37308	63
37320	59
37321	59
37322	59
37323	59
37324	60
37325	60
37330	59
37331	59
37332	59
37333	59
37334	59
37335	59
37337	59
37338	59
37339	59
37340	59
37341	60
37342	60
37343	60
37344	60
37345	60
37346	60
37348	60
37349	60
37350	60
37351	60
37352	60
37353	60
37354	60
37355	60
37356	60
37357	60
37359	60
37360	60
37361	60
37362	60
37390	133
37391	133
37394	57
37395	57
37396	57
37397	57
37398	57
37399	57
37400	57
37401	57
37402	57
37403	57
37404	57
37405	57
37406	57
37407	57
37408	57
37409	57
37410	57
37411	57
37412	57
37413	57
37414	57
37415	57
37416	57
37417	57
37418	57
37419	57
37420	57
37421	57
37422	58
37423	58
37424	58
37425	58
37426	58
37427	58
37428	58
37429	58
37430	58
37431	58
37432	58
37433	58
37434	58
37435	58
37436	58
37437	58
37438	58
37439	58
37440	58
37441	58
37446	58
37447	58
37448	58
37449	58
37450	58
37451	58
37452	58
37453	58
37454	58
37455	58
37456	58
37457	58
37458	58
37459	58

EDP Number Index

EDP NO.	PAGE
37460	58
37461	58
37462	58
37463	58
37464	58
37465	58
37466	58
37467	58
37468	58
37469	58
37470	59
37471	59
37472	59
37473	59
37474	59
37475	59
37476	59
37477	59
37478	59
37479	59
37480	59
37481	59
37482	59
37483	59
37484	59
37485	59
37486	59
37487	59
37488	59
37489	59
37490	59
37491	59
37492	59
37493	59
37494	59
37495	59
37496	59
37497	59
37498	59
37499	59
37500	59
37501	59
37502	59
37503	59
37504	59
37505	59
37506	60
37507	60
37508	60
37509	60
37510	60
37511	60
37512	60
37513	60
37514	60
37515	60
37516	60
37517	60
37518	60
37519	60
37520	60

EDP NO.	PAGE
37521	60
37522	60
37523	60
37524	60
37525	60
37526	60
37527	60
37528	60
37529	60
37530	60
37531	60
37532	60
37533	60
37534	60
37535	60
37536	60
37537	60
37538	60
37539	60
37540	60
37541	60
37542	60
37543	60
37544	60
37545	60
37546	60
37547	60
37548	60
37549	60
37550	60
37551	60
37552	60
37553	60
37554	60
37555	60
37556	60
37557	60
37558	60
37559	60
37560	60
37561	60
37562	61
37563	61
37564	61
37565	61
37566	61
37567	61
37568	61
37569	61
37570	61
37571	61
37572	61
37573	61
37574	61
37575	61
37576	61
37577	61
37578	61
37579	61
37580	61
37581	61

EDP NO.	PAGE
37582	61
37583	61
37584	61
37585	61
37586	61
37587	61
37588	61
37589	61
37590	61
37591	61
37592	61
37593	61
37594	61
37595	61
37596	61
37597	61
37598	61
37599	61
37600	61
37601	61
37602	61
37603	61
37604	61
37605	61
37606	61
37607	61
37608	61
37609	61
37610	61
37611	61
37612	61
37613	61
37614	61
37615	61
37616	61
37617	61
37618	61
37619	61
37620	61
37621	61
37622	61
37623	61
37624	61
37625	61
37626	62
37627	62
37628	62
37629	62
37630	62
37631	62
37632	62
37633	62
37634	62
37635	62
37636	62
37637	62
37638	62
37639	62
37640	62
37641	62
37642	62

EDP NO.	PAGE
37643	62
37644	62
37645	62
37646	62
37647	62
37648	62
37649	62
37650	62
37651	62
37652	62
37653	62
37654	62
37655	62
37656	62
37657	62
37658	62
37659	62
37660	62
37661	62
37662	62
37663	62
37664	62
37665	62
37666	62
37667	62
37668	62
37669	62
37670	62
37671	62
37672	62
37673	62
37674	62
37675	62
37676	62
37677	62
37678	62
37679	62
37680	62
37681	62
37682	62
37683	62
37684	62
37685	62
37686	62
37687	62
37688	62
37689	62
37690	63
37691	63
37692	63
37693	63
37694	63
37695	63
37696	63
37697	63
37698	63
37699	63
37700	63
37701	63
37702	63
37703	63

EDP NO.	PAGE
37704	63
37705	63
37706	63
37707	63
37708	63
37709	63
37710	63
37711	63
37712	63
37713	63
37714	63
37715	63
37716	63
37717	63
37718	63
37719	63
37720	63
37721	63
37722	63
37723	63
37724	63
37725	63
37726	63
37727	63
37728	63
37729	63
37730	63
37731	63
37732	63
37733	63
37734	63
37735	63
37736	63
37737	63
37738	63
37739	63
37740	63
37741	63
37742	63
37743	63
37744	63
37745	63
37746	63
37747	63
37748	63
37749	63
37750	63
37751	63
37752	63
37753	63
37754	64
37755	64
37756	64
37757	64
37758	64
37759	64
37760	64
37761	64
37762	64
37763	64
37764	64

EDP NO.	PAGE
37765	64
37766	64
37767	64
37768	64
37769	64
37770	64
37771	64
37772	64
37773	64
37774	64
37775	64
37776	64
37777	64
37778	64
37779	64
37780	64
37781	64
37782	64
37783	64
37784	64
37785	64
37786	64
37787	64
37788	64
37789	64
37790	64
37791	64
37792	64
37793	64
37794	64
37795	64
37796	64
37797	64
37798	64
37799	64
37800	64
37801	64
37806	64
37807	64
37808	64
37809	64
37810	64
37811	64
37812	64
37813	64
37814	64
37815	64
37816	64
37817	64
37818	64
37819	64
37820	64
37821	64
37822	64
37823	64
37824	64
37825	64
37826	64
37827	64
37828	64
37829	64

EDP NO.	PAGE
37830	64
37831	64
37832	64
37833	64
37834	64
37835	64
37836	64
37837	64
37838	64
37839	64
37840	64
37841	64
37842	64
37843	64
37844	64
37845	64
37846	64
37847	64
37848	64
37849	64
37850	64
37851	64
37852	64
37853	64
37854	64
37855	64
37856	64
37857	64
37858	64
37859	64
37860	64
37861	64
37862	64
37863	64
37864	64
37865	64
37866	64
37867	64
37868	64
37869	64
37870	64
37871	64
37872	64
37873	64
37874	65
37875	65
37876	65
37877	65
37878	65
37879	65
37880	65
37881	65
37882	65
37883	65
37884	65
37885	65
37886	65
37887	65
37888	65
37889	65
37890	65

EDP Number Index

EDP NO.	PAGE
37891	65
37892	65
37893	65
37894	65
37895	65
37896	65
37897	65
37898	65
37899	65
37900	65
37901	65
37902	65
37903	65
37904	65
37905	65
37906	65
37907	65
37908	65
37909	65
37910	65
37911	65
37912	65
37913	65
37914	65
37915	65
37916	65
37917	65
37918	65
37919	65
37920	65
37921	65
37922	65
37923	65
37924	65
37925	65
37926	65
37927	65
37928	65
37929	65
37930	65
37931	65
37932	65
37933	65
37934	65
37935	65
37936	65
37937	65
37938	65
37939	65
37940	65
37941	65
37942	65
37943	65
37944	65
37945	65
37946	65
37947	65
37948	65
37949	65
37950	65
37951	65

EDP NO.	PAGE
37952	65
37953	65
37954	65
37955	65
37956	65
37957	65
37958	65
37959	65
37960	65
37961	65
37962	65
37963	65
37964	65
37965	65
37966	65
37967	65
37968	65
37969	65
37970	65
37971	65
37972	65
37973	65
37974	65
37975	65
37976	65
37977	65
37978	65
37979	65
37980	65
37981	65
37982	65
37983	65
37984	65
37985	65
37986	57
37987	57
37988	57
37989	57
37990	64
37991	64
37992	64
37993	64
37994	65
37995	65
37996	65
37997	65
38001	307
38002	307
38003	307
38004	307
38009	307
38010	307
38011	307
38012	307
38013	307
38014	307
38019	308
38020	308
38021	308
38022	308
38023	308

EDP NO.	PAGE
38024	308
38025	308
38026	308
38031	308
38032	308
38033	308
38034	308
38035	308
38036	308
38037	308
38038	308
38045	308
38046	308
38047	308
38048	308
38049	308
38050	308
38051	308
38052	308
38059	309
38060	309
38061	309
38062	309
38063	309
38064	309
38065	309
38066	309
38067	309
38068	309
38073	309
38074	309
38075	309
38076	309
38077	309
38078	309
38079	309
38080	309
38081	309
38082	309
38083	309
38084	309
38087	310
38088	310
38089	310
38090	310
38091	310
38092	310
38093	310
38094	310
38095	310
38096	310
38097	310
38098	310
38099	310
38100	310
38101	310
38102	310
38103	310
38104	310
38105	310
38106	310

EDP NO.	PAGE
38107	310
38108	310
38109	310
38110	310
38111	310
38112	310
38113	310
38114	310
38115	307
38116	307
38117	307
38118	307
38119	307
38120	308
38121	308
38122	308
38123	308
38124	308
38125	308
38126	308
38127	308
38128	308
38129	308
38130	308
38131	308
38132	309
38133	309
38134	309
38135	309
38136	309
38137	309
38138	309
38139	309
38140	309
38141	309
38142	309
38143	310
38144	310
38145	310
38146	310
38147	310
38148	310
38149	310
38150	310
38151	310
38152	310
38153	310
38154	310
38155	310
38156	310
38157	307
38158	307
38159	307
38160	307
38161	307
38162	308
38163	308
38164	308
38165	308
38166	308
38167	308

EDP NO.	PAGE
38168	308
38169	308
38170	308
38171	308
38172	308
38173	308
38174	309
38175	309
38176	309
38177	309
38178	309
38179	309
38180	309
38181	309
38182	309
38183	309
38184	309
38185	310
38186	310
38187	310
38188	310
38189	310
38190	310
38191	310
38192	310
38193	310
38194	310
38195	310
38196	310
38197	310
38198	310
38201	288
38202	288
38203	288
38204	288
38209	288
38210	288
38211	288
38212	288
38213	288
38214	288
38219	288
38220	288
38221	288
38222	288
38223	288
38224	288
38225	288
38226	288
38231	289
38232	289
38233	289
38234	289
38235	289
38236	289
38237	289
38238	289
38245	289
38246	289
38247	289
38248	289

EDP NO.	PAGE
38249	289
38250	289
38251	289
38252	289
38259	289
38260	289
38261	289
38262	289
38263	289
38264	289
38265	289
38266	289
38267	289
38268	289
38273	290
38274	290
38275	290
38276	290
38277	290
38278	290
38279	290
38280	290
38281	290
38282	290
38283	290
38284	290
38287	290
38288	290
38289	290
38290	290
38291	290
38292	290
38293	290
38294	290
38295	290
38296	290
38297	290
38298	290
38299	290
38300	290
38301	290
38302	290
38303	290
38304	290
38305	290
38306	290
38307	290
38308	290
38309	290
38310	290
38311	290
38312	290
38313	290
38314	290
38315	288
38316	288
38317	288
38318	288
38319	288
38320	288
38321	288

EDP NO.	PAGE
38322	288
38323	288
38324	289
38325	289
38326	289
38327	289
38328	289
38329	289
38330	289
38331	289
38332	289
38333	289
38334	289
38335	289
38336	289
38337	290
38338	290
38339	290
38340	290
38341	290
38342	290
38343	290
38344	290
38345	290
38346	290
38347	290
38348	290
38349	290
38350	290
38351	290
38352	290
38353	290
38354	290
38355	290
38356	290
38357	288
38358	288
38359	288
38360	288
38361	288
38362	288
38363	288
38364	288
38365	288
38366	289
38367	289
38368	289
38369	289
38370	289
38371	289
38372	289
38373	289
38374	289
38375	289
38376	289
38377	289
38378	289
38379	290
38380	290
38381	290
38382	290

EDP Number Index

EDP NO.	PAGE
38383	290
38384	290
38385	290
38386	290
38387	290
38388	290
38389	290
38390	290
38391	290
38392	290
38393	290
38394	290
38395	290
38396	290
38397	290
38398	290
38490	42
38492	42
38496	42
38500	57
38501	57
38502	57
38503	58
38504	58
38505	58
38506	59
38507	59
38508	60
38509	61
38510	62
38511	63
38511	63
38512	59
38513	59
38514	60
38515	61
38516	62
38517	63
38517	63
38518	60
38519	60
38520	61
38521	61
38522	62
38523	62
38524	63
38524	63
38525	57
38526	57
38527	57
38528	57
38529	58
38530	58
38531	58
38532	59
38533	59
38534	59
38535	59
38536	59
38537	59
38538	60

EDP NO.	PAGE
38539	60
38540	60
38541	60
38542	60
38543	60
38544	60
38545	60
38546	60
38547	60
38548	60
38549	60
38550	60
38551	61
38552	61
38553	61
38554	61
38555	61
38556	61
38557	61
38558	61
38559	61
38560	61
38561	61
38562	61
38563	62
38564	62
38565	62
38566	62
38567	62
38568	62
38569	62
38569	63
38570	63
38570	63
38571	63
38571	63
38572	63
38572	63
38573	63
38573	63
38574	63
38574	63
38575	63
38575	63
38576	63
38576	63
38577	63
38577	63
38578	59
38579	59
38580	59
38581	59
38582	59
38583	60
38584	60
38585	60
38586	60
38587	60
38588	60
38589	60
38590	60

EDP NO.	PAGE
38591	60
38592	60
38593	60
38594	60
38595	60
38596	61
38597	61
38598	61
38599	61
38600	61
38601	61
38602	61
38603	61
38604	61
38605	61
38606	61
38607	61
38608	62
38609	62
38610	62
38611	62
38612	62
38613	62
38614	62
38614	63
38615	63
38615	63
38616	63
38616	63
38617	63
38617	63
38618	63
38618	63
38619	63
38619	63
38620	63
38620	63
38621	63
38621	63
38622	63
38622	63
38623	60
38624	60
38625	60
38626	60
38627	60
38628	60
38629	61
38630	61
38631	61
38632	61
38633	61
38634	61
38635	61
38636	61
38637	61
38638	61
38639	61
38640	61
38641	61
38642	61

EDP NO.	PAGE
38643	61
38644	61
38645	61
38646	61
38647	62
38648	62
38649	62
38650	62
38651	62
38652	62
38653	62
38654	62
38655	62
38655	63
38656	62
38656	63
38657	63
38657	63
38658	63
38658	63
38659	63
38659	63
38660	63
38660	63
38661	63
38661	63
38662	63
38662	63
38663	63
38663	63
38664	63
38664	63
38700	57
38701	57
38702	57
38703	57
38704	57
38705	57
38706	57
38707	57
38708	57
38709	58
38710	58
38711	58
38712	58
38713	58
38714	58
38715	58
38716	58
38717	59
38718	59
38719	59
38720	59
38721	59
38722	59
38723	59
38724	59
38725	59
38726	60
38727	60
38729	60

EDP NO.	PAGE
38730	60
38731	60
38732	60
38733	61
38734	61
38735	61
38736	61
38770	57
38771	57
38772	57
38773	57
38774	57
38775	57
38776	57
38777	57
38778	57
38779	57
38780	57
38781	57
38782	57
38783	57
38784	57
38785	57
38786	57
38787	57
38788	57
38789	57
38792	58
38793	58
38794	58
38795	58
38798	58
38799	58
38800	58
38801	58
38802	58
38803	58
38804	58
38805	58
38806	58
38807	58
38808	58
38809	58
38810	58
38811	58
38812	58
38813	58
38814	58
38815	58
38816	59
38817	59
38818	59
38819	59
38820	59
38821	59
38822	59
38823	59
38824	59
38825	59
38826	59
38827	59

EDP NO.	PAGE
38828	59
38829	59
38830	59
38831	59
38832	60
38833	60
38834	60
38835	60
38836	60
38837	60
38838	60
38839	60
38840	60
38841	60
38842	60
38843	60
38844	60
38845	60
38846	60
38847	60
38848	60
38849	60
38850	60
38851	60
38852	60
38853	60
38854	60
38855	60
38856	61
38857	61
38858	61
38859	61
38860	61
38861	61
38862	61
38863	61
38864	61
38865	61
38866	61
38867	61
38868	62
38869	62
38870	62
38871	62
38872	62
38873	62
38874	62
38875	62
38876	62
38877	62
38878	62
38879	62
38880	63
38880	63
38881	63
38881	63
38882	63
38882	63
38883	63
38883	63
38884	63

EDP NO.	PAGE
38884	63
38885	63
38885	63
39001	307
39002	311
39003	307
39004	311
39005	307
39006	311
39007	307
39008	311
39009	307
39010	311
39011	307
39012	311
39013	307
39014	311
39015	307
39016	311
39017	307
39018	311
39019	307
39020	311
39021	307
39022	311
39023	307
39024	311
39025	307
39026	311
39027	307
39028	311
39029	307
39030	311
39031	307
39032	311
39033	308
39034	311
39035	308
39036	311
39037	308
39038	311
39039	308
39040	311
39041	308
39042	311
39043	308
39044	311
39045	308
39046	311
39047	308
39048	311
39049	308
39050	312
39051	308
39052	312
39053	308
39054	312
39055	309
39056	312
39057	309
39058	312

EDP Number Index

EDP NO.	PAGE
39059	309
39060	312
39061	309
39062	312
39063	309
39064	312
39065	309
39066	312
39067	309
39068	312
39069	309
39070	312
39071	309
39072	312
39073	310
39074	312
39075	310
39076	312
39077	307
39078	311
39089	310
39089	322
39090	312
39090	323
39101	307
39103	307
39105	307
39107	307
39109	307
39111	307
39113	307
39115	307
39117	307
39119	307
39121	307
39123	307
39125	307
39127	307
39129	307
39131	307
39133	308
39135	308
39137	308
39139	308
39141	308
39143	308
39145	308
39147	308
39149	308
39151	308
39153	308
39155	309
39157	309
39159	309
39161	309
39163	309
39165	309
39167	309
39169	309
39171	309
39173	310

EDP NO.	PAGE
39175	310
39177	307
39179	308
39180	309
39189	310
39189	322
39301	288
39303	288
39305	288
39307	288
39309	288
39311	288
39313	288
39315	288
39317	288
39319	288
39321	288
39323	288
39325	288
39327	288
39329	288
39331	288
39333	288
39335	288
39337	289
39339	289
39341	289
39343	289
39345	289
39347	289
39349	289
39351	289
39353	289
39355	289
39357	289
39359	289
39361	289
39363	289
39365	290
39367	290
39369	290
39371	290
39373	290
39375	290
39377	288
39389	290
39389	322
39501	288
39503	288
39505	288
39507	288
39509	288
39511	288
39513	288
39515	288
39517	288
39519	288
39521	288
39523	288
39525	288
39527	288

EDP NO.	PAGE
39529	288
39531	288
39533	288
39535	288
39537	289
39539	289
39541	289
39543	289
39545	289
39547	289
39549	289
39551	289
39553	289
39555	289
39557	289
39559	289
39561	289
39563	289
39565	290
39567	290
39569	290
39571	290
39573	290
39575	290
39577	288
39589	290
39589	322
39601	317
39602	318
39603	317
39604	318
39605	317
39606	318
39607	317
39608	318
39609	317
39610	318
39611	317
39612	318
39613	317
39614	318
39615	317
39616	318
39617	317
39618	318
39619	317
39620	318
39621	317
39622	318
39623	317
39624	318
39625	317
39626	318
39627	317
39628	318
39629	317
39630	318
39631	317
39632	318
39633	317
39634	318

EDP NO.	PAGE
39635	317
39636	318
39637	317
39638	318
39639	317
39640	318
39641	317
39641	322
39642	318
39642	323
39692	323
39701	301
39703	301
39705	301
39707	301
39709	301
39711	301
39713	301
39715	301
39717	301
39719	301
39721	301
39723	301
39725	301
39727	301
39729	301
39731	301
39733	301
39735	301
39737	301
39739	301
39741	301
39743	301
39745	301
39747	301
39749	301
39751	301
39753	301
39755	301
39757	301
39759	301
39761	301
39763	301
39765	301
39767	301
39769	301
39771	301
39773	301
39775	301
39777	301
39789	301
39789	322
39800	30
39801	30
39802	30
39803	30
39804	30
39805	30
39806	30
39807	30
39808	30

EDP NO.	PAGE
39809	30
39810	30
39811	30
39812	30
39813	30
39814	30
39815	30
39816	30
39817	30
39818	30
39819	30
39820	30
39821	30
39822	30
39823	30
39824	30
39825	30
39826	30
39827	30
39828	30
39829	30
39830	30
39831	30
39832	30
39833	30
39834	30
39835	30
39836	30
39837	30
39838	30
39839	30
39840	30
39841	30
39842	30
39843	30
39844	30
39845	30
39846	30
39847	30
39848	30
39849	30
39850	30
39851	30
39852	30
39853	30
39854	30
39855	30
39856	30
39857	30
39858	30
39859	30
39860	30
39861	30
39862	30
39863	30
39864	30
39865	30
39866	30
39867	30
39868	30
39869	30

EDP NO.	PAGE
39870	30
39871	30
39872	30
39873	30
39874	30
39875	30
39876	30
39877	30
39878	30
39879	30
39880	30
39881	30
39882	30
39883	30
39884	30
39885	30
39886	31
39887	31
39888	31
39889	31
39890	31
39891	31
39892	31
39893	31
39894	31
39895	31
39896	31
39897	31
39898	31
39899	31
39900	31
39901	31
39902	31
39903	31
39904	31
39905	31
39906	31
39907	31
39908	31
39909	31
39910	31
39911	31
39912	31
39913	31
40000	313
40001	313
40002	313
40003	313
40004	313
40005	313
40006	313
40007	313
40008	313
40009	314
40010	314
40011	314
40012	314
40014	314
40015	314
40016	314
40017	314

EDP NO.	PAGE
40018	314
40019	314
40020	314
40021	314
40022	314
40023	314
40024	314
40025	314
40026	314
40028	314
40029	314
40030	314
40031	314
40032	315
40033	315
40035	315
40036	315
40037	315
40038	315
40039	315
40040	315
40041	315
40105	313
40106	316
40109	313
40110	316
40113	313
40114	316
40117	313
40118	316
40121	313
40122	316
40125	313
40126	316
40129	313
40130	316
40133	313
40134	316
40137	313
40138	316
40141	313
40142	316
40145	314
40146	316
40149	314
40150	316
40153	314
40154	316
40157	314
40158	316
40161	314
40162	316
40165	314
40166	316
40169	315
40170	316
40173	315
40174	316
40177	315
40178	316
40181	315

EDP Number Index

EDP NO.	PAGE
40182	316
40185	315
40186	316
40305	293
40306	294
40309	293
40310	294
40313	293
40314	294
40317	293
40318	294
40321	293
40322	294
40325	293
40326	294
40329	293
40330	294
40333	293
40334	294
40337	293
40338	294
40341	293
40342	294
40345	293
40346	294
40349	293
40350	294
40353	293
40354	294
40357	293
40358	294
40361	293
40362	294
40365	293
40366	294
40369	293
40370	294
40373	293
40374	294
40377	293
40378	294
40381	293
40382	294
40385	293
40386	294
40505	303
40506	304
40509	303
40510	304
40513	303
40514	304
40517	303
40518	304
40521	303
40522	304
40525	303
40526	304
40529	303
40530	304
40533	303
40534	304

EDP NO.	PAGE
40537	303
40538	304
40541	303
40542	304
40545	303
40546	304
40549	303
40550	304
40553	303
40554	304
40557	303
40558	304
40561	303
40562	304
40565	303
40566	304
40569	303
40570	304
40573	303
40574	304
40577	303
40578	304
40581	303
40582	304
40585	303
40586	304
41405	317
41406	318
41409	317
41410	318
41413	317
41414	318
41417	317
41418	318
41421	317
41422	318
41425	317
41426	318
41429	317
41430	318
41433	317
41434	318
41437	317
41438	318
41441	317
41442	318
41445	317
41446	318
41449	317
41450	318
41453	317
41454	318
41457	317
41458	318
41461	317
41462	318
41465	317
41466	318
41605	313
41609	313
41613	313

EDP NO.	PAGE
41617	313
41621	313
41625	313
41629	313
41633	313
41637	313
41641	313
41645	314
41649	314
41653	314
41657	314
41661	314
41665	314
41705	295
41709	295
41713	295
41717	295
41721	295
41725	295
41729	295
41733	295
41737	295
41741	295
41745	295
41749	295
41753	295
41757	295
41761	295
41765	295
42606	79
42607	79
42608	79
42609	79
42610	79
42611	79
42612	79
42613	79
42614	79
42615	79
42616	79
42617	80
42618	80
42619	80
42620	80
42621	81
42622	79
42623	79
42624	80
42625	80
42626	80
42627	80
42628	80
42630	80
42631	80
42632	80
42633	80
42648	80
42649	80
42650	80
42651	81
42652	81

EDP NO.	PAGE
42653	81
42654	81
42655	81
42656	80
42657	80
42658	80
42659	80
42660	79
42661	79
42662	79
42663	79
42664	79
42665	79
42666	79
42667	79
42668	79
42669	79
42670	79
42671	79
42672	79
42673	79
42674	79
42675	79
42676	79
42677	79
42678	79
42679	79
42680	79
42681	79
42682	79
42683	79
42684	79
42685	80
42686	80
42687	80
42688	80
42689	80
42690	80
42691	80
42692	80
42693	80
42694	80
42695	80
42696	80
42697	80
42698	80
42699	80
42700	80
42701	81
42702	81
42703	81
42704	81
42705	81
42706	168
42707	168
42708	168
42709	168
42710	169
42711	169
42712	53
42713	53

EDP NO.	PAGE
42714	53
42715	53
42716	53
42717	53
42718	46
42719	46
42721	46
42722	46
42723	46
42731	48
42732	48
42733	48
42734	48
42735	48
42736	48
42737	48
42738	48
42739	48
42750	81
42751	81
42752	81
42753	81
42754	81
42755	81
43101	313
43102	316
43103	313
43104	316
43105	314
43106	316
43107	313
43108	316
43115	314
43116	316
43125	314
43126	316
43135	315
43136	316
43145	315
43146	316
43155	315
43156	316
43165	315
43166	316
43175	315
43176	316
43185	315
43186	316
43195	315
43196	316
43301	293
43302	294
43303	293
43304	294
43305	293
43306	294
43307	293
43308	294
43315	293
43316	294
43325	293

EDP NO.	PAGE
43326	294
43335	293
43336	294
43345	293
43346	294
43355	293
43356	294
43365	293
43366	294
43375	293
43376	294
43385	293
43386	294
43395	293
43396	294
43445	114
43446	114
43447	114
43448	114
43449	114
43450	114
43451	114
43452	114
43453	114
43470	114
43471	114
43472	114
43473	114
43474	114
43475	114
43476	114
43477	114
43478	114
43479	114
43480	114
43481	114
43482	114
43483	114
43484	114
43485	114
43486	114
43487	114
43488	114
43489	114
43490	114
43491	114
43492	114
43493	114
43494	114
43495	114
43496	114
43497	114
43501	303
43502	304
43503	303
43504	304
43505	303
43506	304
43507	303
43508	304
43515	303

EDP NO.	PAGE
43516	304
43525	303
43526	304
43535	303
43536	304
43545	303
43546	304
43555	303
43556	304
43565	303
43566	304
43575	303
43576	304
43585	303
43586	304
43595	303
43596	304
43900	300
43901	300
43902	300
43903	300
43904	300
43905	300
43906	300
43907	300
43908	300
43909	300
43910	299
43911	299
43912	299
43913	299
43914	299
43915	299
43916	299
43917	299
43918	299
43919	299
43950	299
43951	299
43952	299
43953	299
43954	299
43955	299
43956	299
43957	299
43958	299
43959	299
44298	172
44299	172
44300	172
44301	172
44302	172
44303	172
44304	172
44305	172
44306	172
44307	172
44308	172
44309	172
44505	181
44506	181

EDP Number Index

EDP NO.	PAGE
44509	181
44510	181
44513	181
44514	181
44517	181
44518	181
44521	181
44522	181
44525	181
44526	181
44529	181
44530	181
44533	181
44534	181
44537	181
44538	181
44541	181
44542	181
44545	181
44546	181
44550	178
44551	178
44552	178
44553	178
44554	178
44555	178
44556	178
44557	178
44558	178
44559	178
44560	178
44561	178
44562	178
44563	178
44564	178
44565	178
44566	178
44570	179
44571	179
44572	179
44573	179
44574	179
44575	179
44576	179
44577	179
44578	179
44579	179
44580	179
44581	179
44582	179
44583	179
44584	179
44585	179
44586	179
44587	178
44588	178
44589	178
44590	178
44591	178
44592	178
44593	178

EDP NO.	PAGE
44594	178
44595	178
44596	178
44597	178
44598	179
44599	179
44600	179
44601	179
44602	179
44603	179
44604	179
44605	179
44606	179
44607	179
44608	179
44609	178
44610	178
44611	178
44612	178
44613	178
44614	178
44615	179
44616	179
44617	179
44618	179
44619	179
44620	179
44627	148
44628	148
44629	148
44630	148
44631	148
44634	148
44635	148
44636	148
44637	148
44638	148
44639	148
44641	148
44642	148
44643	148
44701	165
44702	165
44703	165
44705	165
44708	166
44711	166
44714	167
44715	165
44716	165
44717	165
44719	165
44722	166
44725	166
44728	167
44731	167
44732	165
44733	166
44734	166
44735	166
44736	166

EDP NO.	PAGE
44737	167
44738	168
44739	169
44740	169
44741	168
44745	148
44746	148
44747	148
44748	148
44749	148
44750	148
44751	148
44752	148
44753	148
44754	148
44755	148
44756	148
44757	148
44758	148
44759	148
44760	148
44761	148
44762	148
44763	148
44764	148
44765	148
44766	148
44767	148
44768	148
44769	168
44770	168
44771	168
44772	168
44773	168
44774	168
44775	168
44776	168
44777	168
44778	168
44779	168
44780	168
44781	168
44782	168
44783	168
44784	168
44785	169
44786	169
44787	169
44788	169
44789	168
44790	168
44791	168
44792	168
44793	168
44794	168
44795	168
44796	168
44797	168
44798	168
44799	168
44800	168

EDP NO.	PAGE
44801	168
44802	168
44803	168
44804	168
44805	169
44806	169
44807	169
44808	169
44814	166
44815	166
44816	166
44817	166
44818	166
44819	166
44820	166
44821	166
44822	167
44823	167
44824	167
44826	166
44827	166
44828	166
44829	166
44830	167
44831	167
44832	168
44833	168
44834	168
44835	169
44836	169
44837	169
44838	169
44839	168
44840	169
44841	169
44842	165
44843	165
44844	165
44845	165
44846	165
44847	165
44848	165
44849	165
44850	165
44851	165
44852	165
44853	165
44854	165
44855	165
44856	165
44857	165
44858	165
44859	166
44860	166
44861	166
44862	166
44863	166
44864	166
44865	166
44866	166
44867	166

EDP NO.	PAGE
44868	166
44869	166
44870	166
44871	166
44872	166
44873	166
44874	166
44875	166
44876	166
44877	166
44878	167
44879	167
44880	167
44881	167
44882	167
44883	167
44884	167
44885	167
44886	167
44890	165
44891	165
44892	165
44893	165
44894	165
44895	165
44896	165
44897	166
44898	166
44899	169
44900	166
44901	167
44902	165
44916	170
44917	171
44918	171
44919	170
44920	171
44921	171
44922	170
44923	171
44924	171
44925	170
44926	171
44927	171
44928	170
44929	171
44930	171
44931	170
44932	171
44933	171
44934	170
44935	171
44936	171
44937	170
44938	171
44939	171
44940	170
44941	171
44942	171
44943	170
44944	171

EDP NO.	PAGE
44945	171
44950	168
44951	168
44952	168
44953	168
44954	168
44955	168
44956	168
44957	168
44958	168
44959	168
44960	168
44961	169
44962	169
44963	169
44964	169
44965	169
44966	169
44967	169
44968	169
44969	169
44970	169
44971	169
44972	169
44973	169
44974	169
44975	143
44976	143
44977	143
44978	143
44979	143
44980*	143
44981*	143
44982*	143
44983*	143
44984*	143
44985*	143
44986*	143
44987*	143
44990	143
44991	143
44992	143
44993*	143
44994*	143
44995*	143
44996*	143
44997*	143
44998	143
44999	143
45000	143
45001	143
45002*	143
45003*	143
45004*	143
45005	144
45006	144
45007	144
45008	144
45009	144
45010	144
45011	144

EDP NO.	PAGE
45012	144
45013	144
45014	144
45015	144
45016	144
45017	144
45018	144
45019	144
45020*	143
45021*	143
45022*	143
45023*	143
45024*	143
45025*	143
45100	89
45101	89
45102	89
45103	89
45104	89
45105	89
45106	90
45107	90
45108	90
45109	90
45110	90
45111	90
45112	89
45113	89
45114	89
45115	89
45116	89
45117	89
45118	89
45119	89
45120	89
45121	89
45122	89
45123	89
45124	89
45125	89
45126	89
45127	90
45128	90
45129	90
45130	90
45131	90
45132	90
45133	90
45134	90
45135	90
45136	90
45137	90
45138	90
45139	90
45140	90
45141	90
45150	89
45170	89
45171	89
45172	89
45173	89

EDP Number Index

EDP NO.	PAGE
45174	89
45175	89
45176	89
45177	89
45178	89
45179	89
45180	89
45181	89
45182	89
45183	89
45184	89
45185	89
45186	89
45187	90
45188	90
45189	90
45190	90
45191	90
45192	90
45193	90
45194	90
45195	90
45196	90
45197	90
45198	90
45199	90
45200	90
45201	90
45202	90
45203	90
45204	91
45205	91
45206	91
45207	91
45208	91
45209	91
45210	91
45211	91
45212	91
45213	91
45214	91
45215	91
45277	296
45279	296
45281	296
45283	296
45285	296
45287	296
45289	296
45291	296
45293	296
45295	296
45297	296
45299	296
45477	319
45478	319
45479	319
45480	319
45481	319
45482	319
45483	319

EDP NO.	PAGE
45484	319
45485	319
45486	319
45487	319
45488	319
45489	319
45490	319
45491	319
45492	319
45493	319
45494	319
45495	319
45496	319
45497	319
45498	319
45499	319
45500	319
45700	109
45701	109
45702	109
45703	109
45704	109
45705	109
45706	109
45707	109
45708	109
45709	109
45710	109
45711	109
45712	109
45713	109
45714	109
45715	109
45716	109
45717	109
45718	150
45719	150
45720	150
45721	150
45722	150
45723	150
45724	150
45725	150
45726	150
45727	150
45728	150
45729	150
45730	150
45731	150
45732	150
45733	150
45734	150
45735	150
46106	320
46107	320
46108	320
46109	320
46110	320
46111	320
46112	320
46113	320

EDP NO.	PAGE
46114	320
46116	320
46117	320
46118	320
46120	320
46121	320
46122	320
46128	320
46129	320
46130	320
46131	320
46132	320
46133	320
46140	124
46141	124
46142	124
46143	124
46145	124
46147	124
46206	321
46208	321
46210	321
46211	321
46212	321
46214	321
46216	321
46218	321
46220	321
46222	321
46228	321
46230	321
46232	321
46233	321
46343	47
46344	47
46345	47
46346	47
46347	47
46348	47
46349	47
46350	47
46351	47
46354	47
46355	47
46356	47
46357	45
46358	45
46359	45
46360	45
46362	45
46364	45
46366	45
46368	46
46370	46
46372	46
46374	46
46376	46
46450	53
46451	53
46452	53
46453	53

EDP NO.	PAGE
46454	53
46455	53
46456	53
46457	53
46458	53
46459	53
46460	53
46461	53
46462	53
46463	53
46464	53
46465	53
46466	53
46467	53
46468	53
46469	53
46470	53
46471	53
46472	53
46473	53
46474	53
46475	53
46476	53
46477	53
46478	53
46479	53
46480	53
46481	53
46482	53
46483	53
46493	45
46494	46
46495	46
46497	46
46498	46
46506	46
46507	46
46508	46
46509	46
46510	46
46518	47
46519	47
46520	47
46521	47
46522	47
46560	55
46561	55
46562	55
46563	55
46564	55
46565	55
46566	55
46567	55
46568	55
46620	106
46621	106
46622	106
46623	106
46624	106
46625	106
46626	106

EDP NO.	PAGE
46627	106
46628	106
46629	106
46630	106
46631	106
46632	106
46633	106
46634	106
46635	106
46636	106
46637	106
46638	106
46639	106
46640	106
46641	106
46642	106
46643	106
46644	106
46645	106
46646	106
46647	106
46648	106
46649	106
46650	106
46651	106
46652	106
46653	106
46654	106
46655	106
46656	106
46657	106
46658	106
46659	106
46660	106
46821	48
46822	48
46823	48
46824	48
46825	48
46826	48
46827	48
46828	48
46829	48
46830	48
46831	48
46832	48
46833	48
46834	48
46835	48
46836	48
46837	48
46838	48
46839	48
46840	48
46841	48
46849*	45
46850*	45
46851	45
46852	45
46853	45
46854	45

EDP NO.	PAGE
46855	45
46856	45
46857	45
46858	45
46859	45
46860	45
46861	45
46862	46
46863	46
46864	46
46865	46
46866	46
46867	46
46868	46
46869	46
46873*	45
46874*	45
46880	45
46881	45
46882	45
46884	45
46886	45
46887	45
46889	45
46890	45
46891	45
46893	45
46894	46
46895	46
46896	46
46898	46
46899	46
46900	46
46903	46
46904	46
46905	46
46909	45
46910	45
46911	45
46912	46
46913	46
46914	46
46915	46
46916	46
46917	46
46918	46
46919	46
46920	46
46921	46
46922	46
46923	46
46924	46
46925	46
46926	46
46927	46
46928	48
46929	48
46930	48
46931	48
46932	48
46933	48

EDP NO.	PAGE
46934	48
46935	48
46936	48
46937	48
46938	48
46939	48
46940	48
46941	48
46942	48
46943	48
46944	46
46945	46
46946	46
47000	68
47001	68
47002	68
47003	68
47004	68
47005	68
47006	68
47007	68
47008	68
47009	68
47010	68
47011	68
47012	68
47013	68
47014	68
47015	68
47016	68
47017	69
47018	69
47019	69
47020	69
47021	69
47022	69
47023	69
47024	68
47025	69
47026	69
47027	69
47028	69
47029	69
47030	69
47031	69
47032	69
47033	69
47034	69
47035	69
47036	69
47037	69
47038	69
47039	69
47040	69
47041	69
47042	69
47043	69
47044	69
47045	69
47046	69
47047	69

EDP Number Index

EDP NO.	PAGE
47048	69
47049	69
47050	69
47051	69
47052	69
47053	69
47054	69
47055	70
47056	70
47057	70
47058	70
47059	70
47060	70
47061	69
47062	69
47063	70
47064	70
47065	70
47066	70
47067	70
47068	70
47069	69
47070	69
47071	70
47072	70
47073	70
47074	70
47075	70
47076	70
47077	70
47078	70
47079	70
47080	70
47081	70
47082	70
47083	70
47084	70
47085	70
47086	70
47087	70
47088	70
47089	70
47090	70
47091	70
47092	70
47093	70
47094	70
47095	70
47096	70
47097	70
47098	68
47099	68
47100	68
47101	68
47102	68
47103	68
47104	68
47105	68
47106	68
47107	68
47108	69

EDP NO.	PAGE
47109	69
47110	69
47111	69
47120	68
47121	68
47122	68
47123	68
47124	68
47125	69
47126	69
47127	69
47128	69
47129	69
47130	69
47131	69
47132	69
47133	69
47134	69
47135	69
47136	69
47137	69
47138	70
47139	70
47140	69
47141	70
47142	70
47143	70
47144	70
47145	70
47146	70
47147	70
47148	70
47160	69
47161	69
47162	69
47163	69
47164	69
47165	69
47166	69
47167	69
47168	69
47169	69
47170	69
47171	69
47172	69
47173	69
47480	68
47481	68
47482	68
47483	68
47484	68
47485	68
47486	68
47487	68
47488	68
47489	68
47490	68
47491	68
47492	68
47493	68
47494	68

EDP NO.	PAGE
47495	68
47496	68
47497	68
47498	68
47499	68
47500	68
47501	68
47502	68
47503	68
47504	68
47505	68
47506	68
47507	68
47508	68
47509	68
47510	68
47511	68
47512	68
47513	68
47514	68
47515	68
47516	68
47517	68
47518	68
47519	68
47520	68
47521	68
47522	68
47523	68
47524	68
47525	68
47526	68
47527	68
47528	68
47529	68
47530	68
47531	68
47532	69
47533	69
47534	69
47535	69
47536	69
47537	69
47538	69
47539	69
47540	69
47541	69
47542	69
47543	69
47544	69
47545	69
47546	69
47547	69
47548	69
47549	69
47550	69
47551	69
47552	69
47553	69
47554	69
47555	69

EDP NO.	PAGE
47556	69
47557	69
47558	69
47559	69
47560	69
47561	69
47562	69
47563	69
47564	69
47565	69
47566	69
47567	69
47568	69
47569	69
47570	69
47571	69
47572	69
47573	69
47574	69
47575	69
47576	69
47577	69
47578	69
47579	69
47580	69
47581	69
47582	69
47583	69
47584	70
47585	70
47586	70
47587	70
47588	70
47589	70
47590	70
47591	70
47592	70
47593	70
47594	70
47595	70
47596	70
47597	70
47598	70
47599	70
47600	70
47601	70
47602	70
47603	70
47604	70
47605	70
47606	70
47607	70
47608	70
47609	70
47610	70
47611	70
47612	70
47613	70
47614	70
47615	70
47616	70

EDP NO.	PAGE
47617	70
47618	70
47619	70
47620	70
47621	70
47622	70
47623	70
47624	70
47625	70
47626	70
47627	70
47628	70
47629	70
47630	70
47631	70
47632	70
47633	70
47634	70
47635	70
47636	71
47637	71
47638	71
47639	71
47640	71
47641	71
47642	71
47643	71
47644	71
47645	71
47646	71
47647	71
47648	71
47649	71
47650	71
47651	71
47652	71
47653	71
47654	71
47655	71
47656	71
47657	71
47658	71
47659	71
47660	71
47661	71
47662	71
47663	71
47664	71
47665	71
47666	71
47667	71
47668	71
47669	71
47670	71
47671	71
47672	71
47673	71
47674	71
47675	71
47676	71
47677	71

EDP NO.	PAGE
47678	71
47679	71
47680	71
47681	71
47682	71
47683	71
47684	71
47685	71
47686	71
47687	71
47688	71
47689	71
47690	71
47691	71
47692	71
47693	71
47694	71
47695	71
47696	71
47697	71
47698	71
47699	71
47700	71
47701	71
47702	71
47703	71
47704	71
47705	71
47706	71
47707	71
47708	71
47709	71
47710	71
47711	71
47712	71
47713	71
47714	71
47715	71
47716	71
47717	71
47718	71
47719	71
47720	71
47721	71
47722	71
47723	71
47724	71
47725	71
47726	71
47727	71
47728	71
47729	71
47730	71
47731	71
47732	71
47733	71
47734	71
47735	71
47736	71
47737	71
47738	71

EDP NO.	PAGE
47739	71
47740	71
47741	71
47742	71
47743	71
47744	71
47745	71
47746	71
47747	71
47748	71
47749	71
47750	71
47751	71
47752	71
47753	71
47754	71
47755	71
47756	71
47757	71
47758	71
47759	71
47760	71
47761	71
47762	71
47763	71
47764	71
47765	71
47766	71
47767	71
47768	71
47769	71
47770	71
47771	71
47772	71
47773	71
47774	71
47775	71
47776	71
47777	71
47778	71
47779	71
47780	71
47781	71
47782	71
47783	71
47784	71
47785	71
47786	71
47787	71
47788	71
47789	71
47790	71
47791	71
47800	34
47801	34
47802	34
47803	34
47804	34
47805	34
47806	34
47807	34

EDP Number Index

EDP NO.	PAGE
47808	34
47809	34
47810	34
47811	34
47812	34
47813	34
47814	34
47815	34
47816	34
47817	34
47818	34
47819	34
47820	34
47821	34
47822	34
47823	34
47824	34
47825	34
47828	34
47829	34
47830	34
47831	34
47832	34
47833	34
47834	34
47835	34
47836	34
47837	34
47838	34
47839	34
47840	34
47841	34
47842	34
47843	34
47844	34
47845	34
47846	34
47847	34
48000	68
48001	68
48002	68
48003	68
48004	68
48005	68
48006	68
48007	68
48008	68
48009	68
48010	68
48011	68
48012	69
48013	69
48014	69
48015	69
48016	69
48017	69
48018	69
48019	69
48020	69
48021	70
48022	70

EDP NO.	PAGE
48023	70
48024	70
48025	70
48026	70
48027	70
48028	70
48029	68
48030	69
48031	69
48032	69
48033	69
48034	69
48035	69
48036	69
48037	69
48038	69
48039	69
48040	69
48041	69
48042	69
48043	70
48044	70
48045	70
48046	70
48047	70
48048	70
48049	70
48050	70
48051	70
48052	70
48053	70
48054	70
48055	70
48056	69
48057	69
48058	69
48059	69
48060	69
48061	70
48062	70
48063	70
48064	70
48065	70
48066	70
48067	70
48068	70
48070	69
48071	69
48500	313
48501	313
48502	313
48503	313
48504	313
48505	313
48506	313
48507	313
48508	313
48509	313
48510	314
48511	314
48512	314

EDP NO.	PAGE
48513	314
48514	314
48515	314
48516	315
48517	315
48518	315
48519	315
48520	315
48522	313
48523	313
48524	313
48525	313
48526	313
48527	313
48528	313
48529	313
48530	313
48531	313
48532	314
48533	314
48534	314
48535	314
48536	314
48537	314
48538	315
48539	315
48540	315
48541	315
48542	315
48543	313
48544	313
48545	313
48546	313
48547	313
48548	313
48549	313
48550	313
48551	313
48552	313
48553	314
48554	314
48555	314
48556	314
48557	314
48558	314
48559	315
48560	315
48561	315
48562	315
48563	315
48607	316
48608	316
48609	316
48610	316
48611	316
48612	316
48613	316
48614	316
48615	316
48616	316
48617	316

EDP NO.	PAGE
48618	316
48619	316
48620	316
48621	316
48622	316
48623	316
48624	316
48625	316
48626	316
48627	316
48671	293
48672	293
48673	293
48674	293
48675	293
48676	293
48677	293
48678	293
48679	293
48680	293
48681	293
48682	293
48683	293
48684	293
48685	293
48686	293
48687	293
48688	293
48689	293
48690	293
48691	293
48735	294
48736	294
48737	294
48738	294
48739	294
48740	294
48741	294
48742	294
48743	294
48744	294
48745	294
48746	294
48747	294
48748	294
48749	294
48750	294
48751	294
48752	294
48753	294
48754	294
48755	294
48799	303
48800	303
48801	303
48802	303
48803	303
48804	303
48805	303
48806	303
48807	303

EDP NO.	PAGE
48808	303
48809	303
48810	303
48811	303
48812	303
48813	303
48814	303
48815	303
48816	303
48817	303
48818	303
48819	303
48863	304
48864	304
48865	304
48866	304
48867	304
48868	304
48869	304
48870	304
48871	304
48872	304
48873	304
48874	304
48875	304
48876	304
48877	304
48878	304
48879	304
48880	304
48881	304
48882	304
48883	304
48884	317
48885	317
48886	317
48887	317
48888	317
48889	317
48890	317
48891	317
48892	317
48893	317
48894	317
48895	317
48896	317
48897	317
48898	317
48899	317
48905	317
48906	317
48907	317
48908	317
48909	317
48910	317
48911	317
48912	317
48913	317
48914	317
48915	317
48916	317

EDP NO.	PAGE
48917	317
48918	317
48919	317
48920	317
48926	317
48927	317
48928	317
48929	317
48930	317
48931	317
48932	317
48933	317
48934	317
48935	317
48936	317
48937	317
48938	317
48939	317
48940	317
48941	317
48989	318
48990	318
48991	318
48992	318
48993	318
48994	318
48995	318
48996	318
48997	318
48998	318
48999	318
49000	318
49001	318
49002	318
49003	318
49004	318
49136	313
49137	313
49138	313
49139	313
49140	313
49141	313
49142	313
49143	313
49144	313
49145	313
49146	314
49147	314
49148	314
49149	314
49150	314
49151	314
49157	313
49158	313
49159	313
49160	313
49161	313
49162	313
49163	313
49164	313
49165	313

EDP NO.	PAGE
49166	313
49167	314
49168	314
49169	314
49170	314
49171	314
49172	314
49178	313
49179	313
49180	313
49181	313
49182	313
49183	313
49184	313
49185	313
49186	313
49187	313
49188	314
49189	314
49190	314
49191	314
49192	314
49193	314
49304	295
49305	295
49306	295
49307	295
49308	295
49309	295
49310	295
49311	295
49312	295
49313	295
49314	295
49315	295
49316	295
49317	295
49318	295
49319	295
49388	313
49389	313
49390	314
49391	313
49392	314
49393	314
49394	315
49395	315
49396	315
49397	315
49398	315
49399	315
49400	315
49401	313
49402	313
49403	314
49404	313
49405	314
49406	314
49407	315
49408	315
49409	315

EDP Number Index

EDP NO.	PAGE
49410	315
49411	315
49412	315
49413	315
49414	313
49415	313
49416	314
49417	313
49418	314
49419	314
49420	315
49421	315
49422	315
49423	315
49424	315
49425	315
49426	315
49453	293
49454	293
49455	293
49456	293
49457	293
49458	293
49459	293
49460	293
49461	293
49462	293
49463	293
49464	293
49465	293
49492	303
49493	303
49494	303
49495	303
49496	303
49497	303
49498	303
49499	303
49500	303
49501	303
49502	303
49503	303
49504	303
49531	316
49532	316
49533	316
49534	316
49535	316
49536	316
49537	316
49538	316
49539	316
49540	316
49541	316
49542	316
49543	316
49570	294
49571	294
49572	294
49573	294
49574	294
49575	294
49576	294
49577	294
49578	294
49579	294
49580	294
49581	294
49582	294
49609	304
49610	304
49611	304
49612	304
49613	304
49614	304
49615	304
49616	304
49617	304
49618	304
49619	304
49620	304
49621	304
49642	300
49643	300
49644	300
49645	300
49646	300
49647	300
49648	300
49649	300
49650	300
49651	300
49663	181
49664	181
49665	181
49666	181
49667	181
49668	181
49669	181
49670	181
49671	181
49672	181
49673	181
49674	181
49675	181
49676	181
49677	181
49678	181
49679	181
49680	181
49681	181
49682	181
49683	181
49684	181
49829	296
49830	296
49831	296
49832	296
49833	296
49834	296
49835	296
49836	296
49837	296
49838	296
49839	296
49840	296
50000	240
50001	240
50002	240
50003	240
50004	240
50005	240
50006	240
50007	240
50008	240
50009	240
50010	240
50011	240
50012	240
50013	240
50014	240
50015	240
50016	240
50017	240
50018	240
50019	240
50020	240
50021	240
50022	240
50023	240
50024	240
50025	240
50026	240
50027	240
50028	240
50029	240
50030	240
50031	240
51001	343
51002	343
51003	342
51004	342
51005	342
51006	342
51007	342
51008	342
51009	342
51010	342
51011	342
51012	342
51013	342
51014	342
51015	342
51016	342
51017	342
51018	342
51019	342
51020	342
51021	342
51022	342
51023	342
51024	341
51025	341
51026	341
51027	341
51028	341
51029	341
51030	341
51031	341
51032	341
51033	341
51034	341
51035	341
51036	341
51037	341
51038	341
51039	341
51040	341
51041	341
51042	341
51043	341
51044	341
51045	341
51046	341
51047	341
51048	341
51049	341
51050	341
51051	341
51052	340
51053	340
51054	340
51055	340
51056	340
51057	340
51058	340
51059	340
51060	340
51061	340
51062	340
51063	340
51064	340
51065	340
51066	340
51067	340
51068	340
51069	340
51070	340
51071	340
51072	340
51073	340
51074	340
51075	340
51076	340
51077	340
51078	340
51079	340
51080	340
51101	340
51102	340
51103	340
51104	340
51105	341
51106	341
51107	341
51108	341
51109	341
51110	342
51111	342
51112	342
51113	342
51114	342
51115	343
51116	343
51117	343
51118	343
51119	343
51120	343
51121	343
51122	344
51123	344
51124	344
51125	344
51126	344
51127	344
51128	344
51129	344
51130	344
51131	344
51132	344
51201	343
51202	343
51203	343
51204	343
51206	343
51207	343
51208	343
51209	343
51210	343
51211	343
51212	343
51213	343
51214	343
51215	343
51216	343
51217	343
51218	344
51219	344
51220	344
51221	344
51222	344
51223	344
51224	344
51225	344
51226	344
51269*	242
51270*	242
51271*	242
51272*	242
51273	242
51274	242
51275	242
51276	242
51277	242
51278	242
51279	243
51330	242
51331	243
51332	243
51333	243
51334	243
51335	243
51336	243
51337	243
51338	243
51339	243
51340	244
51341	244
51342	244
51343	244
51344	244
51345	244
51346	244
51347	245
51348	245
51349	245
51350	245
51351	245
51352	245
51353	245
51354	245
51355	246
51356	246
51357	246
51358	246
51359	246
51360	246
51361	247
51362	247
51363	247
51364	247
51365	247
51366	247
51367	247
51368	247
51369	247
51370	247
51371	247
51372	247
51373	247
51374	247
51375	247
51506	253
51507	253
51508	254
51509	254
51510	254
51511	254
51512	254
51513	254
51514	254
51515	255
51516	255
51517	255
51518	255
51519	255
51520	255
51521	255
51522	255
51523	255
51524	255
51525	256
51526	256
51527	256
51528	256
51529	256
51530	256
51531	256
51532	257
51533	257
51534	257
51535	257
51536	257
51537	257
51538	257
51539	257
51540	257
51541	257
51542	257
51543	257
51544	257
51545	257
51580	252
51581	252
51582	253
51583	253
51584	253
51585	253
51586	253
51587	253
51588	253
51589	253
51590	254
51591	254
51592	257
51593	257
51594	257
51595	257
51596	257
51601	244
51602	244
51603	244
51604	244
51606	244
51607	244
51608	245
51609	245
51610	245
51611	245
51612	245
51613	245
51614	245
51615	245
51616	245
51617	245
51618	246
51619	246

EDP Number Index

EDP NO.	PAGE
51620	246
51621	246
51622	246
51752*	242
51753	242
51754	242
51755	242
51756	242
51757	242
51758	242
51759	242
51760	243
51761	243
51762	243
51763	243
51764	243
51765	243
51766	243
51767	243
51768	243
51769	243
51770	243
51771	243
51772	243
51773	243
51774	243
51775	243
51776	243
51777	243
51778	244
51779	244
51780	244
51781	244
51782	244
51783	247
51784	247
51785	247
51786	247
51787	247
51788	247
51789	247
51790	247
51791	247
51792	247
52300*	252
52301*	252
52302*	252
52303*	252
52304*	252
52305	252
52306	252
52307	252
52308	252
52309	252
52310	252
52311	252
52312	252
52313	252
52314	252
52315	252
52316	252
52317	253
52318	253
52319	253
52321	253
52322	253
52323	253
52324	253
52325	253
52326	253
52327	253
52328	253
52329	253
52330	253
52331	253
52332	253
52333	253
52334	253
52335	254
52336	254
52337	254
52338	254
52339	254
52340	254
52341	254
52342	254
52343	255
52344	255
52345	255
52346	255
52347	255
52348	255
52349	255
52350	255
52351	256
52352	256
52353	256
52354	256
52355	257
52356	257
52357	257
52358	257
52359	257
52360	257
53001	357
53002	357
53003	357
53004	357
53005	357
53006	357
53007	357
53008	357
53009	357
53010	357
53011	357
53012	357
53013	357
53014	357
53015	357
53016	357
53017	356
53018	356
53019	356
53020	356
53021	356
53022	356
53023	356
53024	356
53025	356
53026	356
53027	356
53028	356
53029	356
53030	356
53031	356
53032	356
53033	356
53034	356
53035	356
53036	356
53107	356
53108	356
53109	356
53110	356
53111	356
53112	357
53113	357
53114	357
53115	357
53116	357
53117	358
53118	358
53119	358
53120	358
53121	358
53122	358
53123	359
53124	359
53125	359
53126	359
53127	359
53128	359
53129	359
53130	359
53131	359
53132	359
53133	359
53134	359
53135	359
53136	359
53137	359
53201	357
53202	357
53203	357
53204	357
53206	357
53207	357
53208	358
53209	358
53210	358
53211	358
53212	358
53213	358
53214	358
53215	358
53216	358
53217	358
53218	358
53219	358
53220	358
53221	359
53222	359
53223	359
53224	359
53225	359
53226	359
54600	231
54601	231
54602	231
54603	231
54604	231
54605	231
54606	231
54607	231
54608	231
54609	232
54610	232
54611	232
54612	232
54613	232
54614	232
54615	232
54616	232
54617	233
54618	233
54619	233
54620	233
54621	233
54622	233
54623	233
54624	233
54625	233
54626	234
54627	234
54628	234
54629	234
54630	234
54631	234
54632	234
54633	234
54634	234
54635	234
54700	231
54701	231
54702	231
54703	231
54704	231
54705	231
54706	231
54707	231
54708	231
54709	232
54710	232
54711	232
54712	232
54713	232
54714	232
54715	232
54716	232
54717	233
54718	233
54719	233
54720	233
54721	233
54722	233
54723	233
54724	233
54725	233
54726	234
54727	234
54728	234
54729	234
54730	234
54731	234
54732	234
54733	234
54734	234
54735	234
54800	235
54801	235
54802	235
54803	235
54804	235
54805	235
54806	235
54807	235
54808	235
54809	236
54810	236
54811	236
54812	236
54813	236
54814	236
54815	236
54816	236
54817	237
54818	237
54819	237
54820	237
54821	237
54822	237
54823	237
54824	237
54825	237
54826	237
54827	238
54828	238
54829	238
54830	238
54831	238
54832	238
54833	238
54834	238
54835	238
55000	235
55001	235
55002	235
55003	235
55004	235
55005	235
55006	235
55007	235
55008	235
55009	236
55010	236
55011	236
55012	236
55013	236
55014	236
55015	236
55016	236
55017	237
55018	237
55019	237
55020	237
55021	237
55022	237
55023	237
55024	237
55025	237
55026	237
55027	238
55028	238
55029	238
55030	238
55031	238
55032	238
55033	238
55034	238
55035	238
55160	226
55161	226
55162	226
55163	226
55164	226
55165	226
55166	226
55167	226
55168	226
55169	227
55170	227
55171	227
55172	227
55173	227
55174	227
55175	227
55176	227
55177	227
55178	227
55179	227
55180	228
55181	228
55182	228
55183	228
55184	228
55185	228
55186	228
55187	229
55188	229
55189	229
55190	229
55191	229
55192	229
55193	229
55194	229
55195	229
56001	353
56002	353
56003	353
56004	353
56005	353
56006	353
56007	353
56008	353
56009	353
56010	353
56011	353
56012	353
56013	353
56014	353
56015	353
56016	353
56017	353
56018	353
56019	353
56020	353
56021	353
56022	353
56023	353
56024	353
56025	353
56026	353
56027	353
56028	353
56029	353
56030	353
56031	353
56032	353
56033	353
56034	352
56035	352
56036	352
56037	352
56038	352
56039	352
56040	352
56041	352
56042	352
56043	352
56044	352
56045	352
56046	352
56047	352
56048	352
56049	352
56050	352
56051	352

EDP Number Index

EDP NO.	PAGE
56052	352
56053	352
56054	352
56055	352
56056	352
56057	352
56058	352
56059	352
56060	352
56103	352
56104	352
56105	352
56106	352
56107	352
56108	353
56109	353
56110	353
56111	353
56112	353
56113	353
56114	353
56115	354
56116	354
56117	354
56118	354
56119	354
56120	354
56121	354
56122	354
56123	354
56124	354
56125	354
56126	354
56127	354
56128	354
56129	354
56130	354
56131	354
56132	354
56135	352
56136	352
56137	352
56138	352
56139	352
56140	353
56141	353
56142	353
56143	353
56144	353
56145	353
56146	353
56147	354
56148	354
56149	354
56150	354
56151	354
56152	354
56153	354
56154	354
56155	354
56156	354
56157	354
56158	354
56159	354
56160	354
56161	354
56162	354
56163	354
56164	354
56210	353
56211	353
56212	353
56213	353
56214	353
56215	353
56216	353
56217	353
56218	353
56219	353
56220	353
56221	353
56222	353
56223	353
56224	353
56225	353
56226	353
56227	353
56228	353
56229	353
56230	353
56231	353
56232	353
56233	353
56234	353
56235	353
56236	353
56237	353
56238	353
56239	353
56240	353
56241	353
56242	353
56243	352
56244	352
56245	352
56246	352
56247	352
56248	352
56249	352
56250	352
56251	352
56252	352
56253	352
56254	352
56255	352
56256	352
56257	352
56258	352
56259	352
56260	352
56261	352
56262	352
56263	352
56264	352
56265	352
56266	352
56267	352
56268	352
56269	352
56400	196
56401	196
56402	196
56403	196
56404	196
56405	196
56406	196
56407	196
56408	196
56409	196
56410	197
56411	197
56412	197
56413	197
56414	197
56415	197
56416	197
56417	197
56418	197
56419	197
56420	197
56421	197
56422	197
56423	197
56424	198
56425	198
56426	198
56427	198
56428	198
56429	198
56430	198
56431	198
56432	198
56433	198
56434	198
56435	198
56436	199
56437	199
56438	199
56439	199
56440	199
56441	199
56442	199
56443	199
56444	199
56445	199
56446	200
56447	200
56448	200
56449	200
56450	200
56451	200
56452	200
56453	200
56454	200
56455	200
56456	200
56457	201
56458	201
56459	201
56460	201
56461	201
56462	201
56463	201
56464	201
56465	201
56466	201
56467	201
56468	201
56469	201
56470	201
56471	201
56472	202
56473	202
56474	202
56475	202
56476	202
56477	202
56478	202
56479	202
56480	202
56481	203
56482	203
56483	203
56484	203
56485	203
56486	203
56487	203
56488	203
56489	203
56490	203
56491	204
56492	204
56493	204
56494	204
56495	204
56496	204
56497	204
56498	205
56499	205
56500	205
56501	205
56502	205
56503	205
56504	205
56505	205
56506	205
56507	205
56508	206
56509	206
56510	206
56511	206
56512	206
56513	206
56514	206
56515	206
56516	207
56517	207
56518	207
56519	207
56520	207
56521	207
56522	207
56523	207
56524	207
56525	207
56526	208
56527	208
56528	208
56529	208
56530	208
56531	208
56532	208
56533	208
56534	209
56535	209
56536	209
56537	209
56538	209
56539	209
56540	209
56541	209
56542	209
56543	209
56800	214
56801	214
56802	214
56803	214
56804	214
56805	214
56806	214
56807	214
56808	214
56809	215
56810	215
56811	215
56812	215
56813	215
56814	215
56815	215
56816	215
56817	215
56818	215
56819	216
56820	216
56821	216
56822	216
56823	216
56824	216
56825	216
56826	217
56827	217
56828	217
56829	217
56830	217
56831	217
56832	217
56833	217
56834	217
56835	217
56836	218
56837	218
56838	218
56839	218
56840	218
56841	218
56842	218
56843	218
56844	218
56845	219
56846	219
56847	219
56848	219
56849	219
56850	219
56851	219
56852	219
56853	219
56854	219
56855	220
56856	220
56857	220
56858	220
56859	220
56860	220
56861	220
56862	221
56863	221
56864	221
56865	221
56866	221
56867	221
56868	221
56869	221
56870	221
56871	221
57005	362
57006	362
57007	362
57008	362
57009	362
57010	362
57011	362
57012	362
57015	362
57016	362
57017	362
57018	362
57019	362
57020	362
57021	362
57022	362
57075	362
57076	340
57077	340
57078	340
57079	340
57080	340
57081	340
57082	340
57083	340
57084	340
57085	340
57086	340
57087	340
57088	340
57089	340
57090	340
57091	340
57092	340
57093	340
57094	340
57095	340
57096	340
57097	340
57098	340
57099	340
57100	340
57101	340
57102	340
57103	340
57104	340
57105	340
57106	340
57107	340
57108	340
57109	341
57110	341
57111	341
57112	341
57113	341
57114	341
57115	341
57116	341
57117	341
57118	341
57119	341
57120	341
57121	341
57122	341
57123	341
57124	341
57125	341
57126	341
57127	341
57128	341
57129	341
57130	341
57131	341
57132	341
57133	341
57134	341
57135	341
57136	341
57137	341
57138	341
57139	341
57140	341

EDP Number Index

EDP NO.	PAGE
57141	341
57142	342
57143	342
57144	342
57145	342
57146	342
57147	342
57148	342
57149	342
57150	342
57151	342
57152	342
57153	342
57154	342
57155	342
57156	342
57157	342
57158	342
57159	342
57160	342
57161	342
57162	342
57163	342
57164	342
57165	342
57166	342
57167	342
57168	343
57169	343
57170	343
57171	343
57172	343
57173	343
57174	343
57176	343
57177	343
57178	343
57179	343
57180	343
57181	343
57182	343
57183	343
57184	343
57185	343
57186	343
57187	343
57188	343
57189	343
57190	343
57191	343
57192	343
57193	343
57194	344
57195	344
57196	344
57197	344
57198	344
57199	344
57200	344
57201	344
57202	344

EDP NO.	PAGE
57203	344
57204	344
57205	344
57206	344
57207	344
57208	344
57209	344
57210	344
57211	344
57212	344
57213	344
57351	344
58011	356
58012	356
58013	356
58014	356
58015	356
58016	356
58017	356
58018	356
58019	356
58020	356
58021	356
58022	356
58023	356
58024	356
58025	356
58026	356
58027	356
58028	356
58029	356
58030	356
58031	356
58032	356
58033	356
58034	356
58035	356
58036	357
58037	357
58038	357
58039	357
58040	357
58041	357
58042	357
58043	357
58044	357
58045	357
58046	357
58047	357
58048	357
58049	357
58050	357
58051	357
58052	357
58053	357
58054	357
58055	357
58056	357
58057	357
58058	357
58059	357

EDP NO.	PAGE
58061	357
58062	357
58063	357
58064	358
58065	358
58066	358
58067	358
58068	358
58069	358
58070	358
58071	358
58072	358
58073	358
58074	358
58075	358
58076	358
58077	358
58078	358
58079	358
58080	358
58081	358
58082	358
58083	359
58084	359
58085	359
58086	359
58087	359
58088	359
58089	359
58090	359
58091	359
58092	359
58093	359
58094	359
58095	359
58096	359
58097	359
58098	359
58099	359
58100	359
58101	359
58102	359
58103	359
58480	271
58481	271
58482	271
58483	271
58484	271
58485	271
58486	271
58487	271
58488	271
58489	271
58490	271
58491	271
58492	271
58493	271
58494	272
58495	272
58496	272
58497	272

EDP NO.	PAGE
58498	272
58499	272
58500	272
58501	272
58502	272
58503	272
58504	272
58505	272
58506	272
58507	272
58508	272
58509	272
58510	272
58511	273
58512	273
58513	273
58514	273
58515	273
58516	273
58517	273
58518	273
58519	273
58520	273
58521	273
58522	273
58523	274
58524	274
58525	274
58526	274
58527	274
58528	274
58529	274
58530	274
58531	274
58532	274
58533	275
58534	275
58535	275
58536	275
58537	275
58538	275
58539	275
58540	275
58541	275
58542	275
58543	275
58544	275
58545	275
58546	275
58547	275
58548	275
58549	275
58550	275
58551	275
58552	275
58553	275
58800	262
58801	262
58802	262
58803	262
58804	262

EDP NO.	PAGE
58805	262
58806	262
58807	262
58808	262
58809	262
58810	262
58811	262
58812	262
58813	262
58814	262
58815	262
58816	262
58817	263
58818	263
58819	263
58820	263
58821	263
58822	263
58823	263
58824	263
58825	263
58826	263
58827	263
58828	263
58829	263
58830	264
58831	264
58832	264
58833	264
58834	264
58835	264
58836	264
58837	264
58838	264
58839	264
58840	265
58841	265
58842	265
58843	265
58844	265
58845	265
58846	265
58847	265
58848	265
58849	265
58850	265
58851	265
58852	265
58853	265
58854	265
58855	265
58856	265
58857	265
58858	265
58859	266
58860	266
58861	266
58862	266
58863	266
58864	266
58865	266

EDP NO.	PAGE
58866	267
58867	267
58868	267
58869	267
58870	267
58871	267
58872	267
58873	267
58874	267
58875	267
58876	267
58877	267
58878	267
58879	267
58880	267
58881	267
58882	267
58883	267
58884	267
58885	267
58886	268
58887	268
58888	268
58889	268
58890	268
58891	268
58892	268
58893	268
58894	268
58895	268
58896	269
58897	269
58898	269
58899	269
58900	269
58901	269
58902	269
58903	269
58904	269
58905	269
58906	269
58907	269
58908	269
58909	269
58910	270
58911	270
58912	270
58913	270
58914	270
58915	270
58916	270
58917	270
58918	270
58919	270
58920	270
58921	270
58922	270
58923	270
58924	270
58925	270
58926	270

EDP NO.	PAGE
58927	270
58928	270
58929	270
58930	270
58931	270
61001	340
61003	340
61005	340
61007	340
61009	340
61011	341
61013	341
61015	341
61017	341
61019	342
61021	342
61023	342
61025	342
61027	343
61029	343
61031	343
61033	343
61035	343
61037	343
61039	344
61041	344
61043	344
61045	344
61047	344
61049	344
61051	344
61052	340
61053	340
61054	340
61055	340
61056	340
61057	340
61058	341
61059	341
61060	341
61061	341
61062	341
61063	341
61064	341
61065	341
61066	341
61067	341
61068	341
61069	341
61070	341
61071	341
61072	341
61073	341
61074	341
61075	342
61076	342
61077	342
61078	342
61079	342
61080	342
61081	342

EDP Number Index

EDP NO.	PAGE
61082	342
61083	342
61084	342
61085	342
61086	342
61087	342
61088	342
61089	343
61090	343
61091	343
61092	343
61093	343
61094	343
61095	343
61096	343
61097	343
61098	343
61099	343
61100	343
61101	343
61102	343
61103	343
61104	343
61105	343
61106	343
61107	343
61108	343
61109	343
61110	343
61111	343
61112	344
61113	344
61114	344
61115	344
61116	344
61117	344
61118	344
61119	344
61120	344
61121	344
61122	344
61123	344
61124	344
61175	344
62001	345
62003	345
62005	345
62007	345
62009	345
62011	345
62013	345
62015	345
62017	345
62019	345
62021	345
62023	345
62025	345
62027	345
62029	345
62031	345
62033	345

EDP NO.	PAGE
62035	345
62037	345
62039	345
62041	345
62043	345
62045	345
62047	345
62049	345
62051	345
62053	345
62055	345
62057	345
62059	345
62061	345
62063	345
62065	345
62066	347
62067	345
62069	346
62071	346
62073	346
62075	346
62077	346
62079	346
62081	346
62083	346
62084	347
62085	346
62087	346
62089	346
62091	346
62093	346
62095	346
62097	346
62099	346
62101	346
62102	347
62103	346
62105	346
62107	346
62109	346
62111	346
62112	347
62113	346
62115	346
62116	347
62117	346
62119	346
62121	346
62123	346
62125	346
62127	346
62129	346
62131	346
62133	347
62135	347
62137	347
62139	347
62141	347
62142	347
62143	347

EDP NO.	PAGE
62145	347
62146	347
62147	347
62149	347
62151	347
62153	347
62154	347
62155	347
62156	347
62157	347
62158	347
62159	347
62164	347
62166	347
62167	347
62168	347
62170	347
62171	347
63000	356
63001	356
63002	356
63003	356
63004	356
63005	356
63006	357
63007	357
63008	357
63009	357
63010	357
63011	357
63012	357
63013	358
63014	358
63015	358
63016	358
63017	358
63018	358
63019	358
63020	358
63021	358
63022	358
63023	358
63024	359
63025	359
63026	359
63027	359
63028	359
63029	359
63030	359
63031	359
63032	359
63033	359
63034	359
63035	359
63036	359
63037	359
63038	359
63039	359
63040	359
63041	359
63042	359

EDP NO.	PAGE
63043	359
63044	356
63045	356
63046	356
63047	356
63048	356
63049	356
63050	356
63051	356
63052	356
63053	357
63054	357
63055	357
63056	357
63057	357
63058	357
63059	357
63060	357
63061	357
63062	357
63063	357
63064	357
63065	357
63066	357
63067	357
63068	357
63069	358
63070	358
63071	358
63072	358
63073	358
63074	358
63075	358
63076	358
63077	358
63078	358
63079	358
63080	358
63081	359
63082	359
63083	359
63084	359
63085	359
63086	359
63087	359
63088	359
63089	359
63090	359
63091	359
63155	242
63156	242
63157	242
63158	243
63159	243
63160	243
63161	243
63162	243
63163	243
63164	243
63165	243
63166	243

EDP NO.	PAGE
63167	243
63168	243
63169	244
63170	244
63171	244
63172	244
63173	244
63174	244
63175	244
63176	244
63177	245
63178	245
63179	245
63180	245
63181	245
63182	245
63183	245
63184	245
63185	245
63186	245
63187	245
63188	246
63189	246
63190	246
63191	246
63192	246
63193	246
63194	246
63195	247
63196	247
63197	247
63198	247
63199	247
63200	247
63201	247
63202	247
63203	247
63204	247
63205	247
63206	247
63207	247
63208	247
63209	247
63210	247
63211	247
63212	247
63213	244
63741	242
63742	243
63743	243
63744	243
63745	243
63746	243
63747	243
63748	243
63749	244
63750	244
63751	244
63752	244
63753	244
63754	244

EDP NO.	PAGE
63755	244
63756	244
63757	244
63758	244
63759	244
63760	245
63761	245
63762	245
63763	245
63764	245
63765	245
63766	245
63767	245
63768	245
63769	245
63770	245
63771	245
63772	245
63773	245
63774	245
63775	245
63776	245
63777	246
63778	246
63779	246
63780	246
63781	246
63782	246
63783	246
63784	246
63785	246
63786	246
63787	246
63788	246
63789	246
63790	246
63791	246
63792	246
63793	246
63794	246
64100	252
64101	252
64102	252
64103	252
64104	253
64105	253
64106	253
64107	253
64108	253
64109	253
64110	253
64111	253
64112	253
64113	253
64114	253
64115	253
64116	253
64117	253
64118	253
64119	253
64120	253

EDP NO.	PAGE
64121	253
64122	253
64123	254
64124	254
64125	254
64126	254
64127	254
64128	254
64129	254
64130	254
64131	254
64132	254
64133	254
64134	254
64135	254
64136	254
64137	254
64138	254
64139	254
64140	254
64141	254
64142	255
64143	255
64144	255
64145	255
64146	255
64147	255
64148	255
64149	255
64150	255
64151	255
64152	255
64153	255
64154	255
64155	255
64156	255
64157	255
64158	255
64159	255
64160	255
64161	255
64162	255
64163	255
64164	255
64165	255
64166	255
64167	255
64168	255
64169	255
64170	256
64171	256
64172	256
64173	256
64174	256
64175	256
64176	256
64177	256
64178	256
64179	256
64180	256
64181	256

EDP Number Index

EDP NO.	PAGE
64182	256
64183	256
64184	256
64185	256
64186	256
64187	256
64188	256
64189	256
64190	256
64191	256
64192	256
64193	256
64194	256
64195	257
64196	257
64197	257
64198	257
64199	257
64200	257
64201	257
64202	257
64203	257
64204	257
64205	257
64206	257
64207	257
64208	257
64209	257
64210	257
64211	257
64212	257
64500*	242
64501*	242
64502*	242
64503*	242
64504*	242
64505*	242
64506*	242
64507*	242
64508*	242
64509*	242
64510*	242
64511	242
64512	242
64513	247
64514	247
64515	247
64520*	252
64521*	252
64522*	252
64523*	252
64524*	252
64525*	252
64526*	252
64527*	252
64528*	252
64529*	252
64530*	252
64531	252
64532	252
64533	257

EDP NO.	PAGE
64534	257
64535	257
64600	231
64601	231
64602	231
64603	231
64604	231
64605	231
64606	231
64607	231
64608	231
64609	231
64610	231
64611	231
64612	231
64613	231
64614	231
64615	231
64616	231
64617	231
64618	231
64619	231
64620	231
64621	231
64622	231
64623	231
64624	231
64625	231
64626	231
64627	232
64628	232
64629	232
64630	232
64631	232
64632	232
64633	232
64634	232
64635	232
64636	232
64637	232
64638	232
64639	232
64640	232
64641	232
64642	232
64643	232
64644	232
64645	232
64646	232
64647	232
64648	232
64649	232
64650	232
64651	232
64652	232
64653	232
64654	232
64655	233
64656	233
64657	233
64658	233

EDP NO.	PAGE
64659	233
64660	233
64661	233
64662	233
64663	233
64664	233
64665	233
64666	233
64667	233
64668	233
64669	233
64670	233
64671	233
64672	233
64673	233
64674	233
64675	233
64676	233
64677	233
64678	233
64679	233
64680	233
64681	233
64682	233
64683	233
64684	233
64685	233
64686	233
64687	233
64688	233
64689	233
64690	234
64691	234
64692	234
64693	234
64694	234
64695	234
64696	234
64697	234
64698	234
64699	234
64700	234
64701	234
64702	234
64800	235
64801	235
64802	235
64803	235
64804	235
64805	235
64806	235
64807	235
64808	235
64809	235
64810	235
64811	235
64812	235
64813	235
64814	235
64815	235
64816	235

EDP NO.	PAGE
64817	235
64818	235
64819	235
64820	235
64821	235
64822	235
64823	235
64824	235
64825	235
64826	235
64827	236
64828	236
64829	236
64830	236
64831	236
64832	236
64833	236
64834	236
64835	236
64836	236
64837	236
64838	236
64839	236
64840	236
64841	236
64842	236
64843	236
64844	236
64845	236
64846	236
64847	236
64848	236
64849	236
64850	236
64851	236
64852	236
64853	236
64854	236
64855	237
64856	237
64857	237
64858	237
64859	237
64860	237
64861	237
64862	237
64863	237
64864	237
64865	237
64866	237
64867	237
64868	237
64869	237
64870	237
64871	237
64872	237
64873	237
64874	237
64875	237
64876	237
64877	237

EDP NO.	PAGE
64878	237
64879	237
64880	237
64881	237
64882	237
64883	237
64884	237
64885	237
64886	237
64887	237
64888	237
64889	237
64890	237
64891	238
64892	238
64893	238
64894	238
64895	238
64896	238
64897	238
64898	238
64899	238
64900	238
64901	238
64902	238
65000	235
65001	235
65002	235
65003	235
65004	235
65005	235
65006	235
65007	235
65008	235
65009	235
65010	235
65011	235
65012	235
65013	235
65014	235
65015	235
65016	235
65017	235
65018	235
65019	235
65020	235
65021	235
65022	235
65023	235
65024	235
65025	235
65026	235
65027	236
65028	236
65029	236
65030	236
65031	236
65032	236
65033	236
65034	236
65035	236

EDP NO.	PAGE
65036	236
65037	236
65038	236
65039	236
65040	236
65041	236
65042	236
65043	236
65044	236
65045	236
65046	236
65047	236
65048	236
65049	236
65050	236
65051	236
65052	236
65053	236
65054	236
65055	237
65056	237
65057	237
65058	237
65059	237
65060	237
65061	237
65062	237
65063	237
65064	237
65065	237
65066	237
65067	237
65068	237
65069	237
65070	237
65071	237
65072	237
65073	237
65074	237
65075	237
65076	237
65077	237
65078	237
65079	237
65080	237
65081	237
65082	237
65083	237
65084	237
65085	237
65086	237
65087	237
65088	237
65089	237
65090	237
65091	238
65092	238
65093	238
65094	238
65095	238
65096	238

EDP NO.	PAGE
65097	238
65098	238
65099	238
65100	238
65101	238
65102	238
65160	226
65161	226
65162	226
65163	226
65164	226
65165	226
65166	226
65167	226
65168	226
65169	226
65170	226
65171	226
65172	226
65173	226
65174	226
65175	226
65176	226
65177	226
65178	226
65179	226
65180	226
65181	226
65182	226
65183	226
65184	226
65185	226
65186	226
65187	227
65188	227
65189	227
65190	227
65191	227
65192	227
65193	227
65194	227
65195	227
65196	227
65197	227
65198	227
65199	227
65200	227
65201	227
65202	227
65203	227
65204	227
65205	227
65206	227
65207	227
65208	227
65209	227
65210	227
65211	227
65212	227
65213	227
65214	227

EDP Number Index

EDP NO.	PAGE
65215	227
65216	227
65217	227
65218	227
65219	227
65220	227
65221	227
65222	228
65223	228
65224	228
65225	228
65226	228
65227	228
65228	228
65229	228
65230	228
65231	228
65232	228
65233	228
65234	228
65235	228
65236	228
65237	228
65238	228
65239	228
65240	228
65241	228
65242	228
65243	228
65244	228
65245	228
65246	228
65247	228
65248	228
65249	228
65250	228
65251	229
65252	229
65253	229
65254	229
65255	229
65256	229
65257	229
65258	229
65259	229
65260	229
65261	229
65262	229
66001	352
66002	352
66003	352
66004	352
66005	352
66006	352
66007	352
66008	352
66009	353
66010	353
66011	353
66012	353
66013	353

EDP NO.	PAGE
66014	353
66015	353
66016	353
66017	353
66018	353
66019	353
66020	353
66021	354
66022	354
66023	354
66024	354
66025	354
66026	354
66027	354
66028	354
66029	354
66030	354
66031	354
66032	354
66033	354
66034	354
66035	354
66036	354
66037	354
66038	354
66039	354
66040	354
66041	354
66042	354
66043	354
66044	354
66045	354
66046	354
66400	196
66401	196
66402	196
66403	196
66404	196
66405	196
66406	196
66407	196
66408	196
66409	196
66410	196
66411	196
66412	196
66413	196
66414	196
66415	196
66416	196
66417	196
66418	196
66419	196
66420	196
66421	196
66422	196
66423	196
66424	196
66425	196
66426	196
66427	196

EDP NO.	PAGE
66428	196
66429	196
66430	196
66431	196
66432	196
66433	196
66434	197
66435	197
66436	197
66437	197
66438	197
66439	197
66440	197
66441	197
66442	197
66443	197
66444	197
66445	197
66446	197
66447	197
66448	197
66449	197
66450	197
66451	197
66452	197
66453	197
66454	197
66455	197
66456	197
66457	197
66458	197
66459	197
66460	197
66461	197
66462	197
66463	197
66464	197
66465	197
66466	197
66467	197
66468	197
66469	197
66470	197
66471	197
66472	197
66473	197
66474	198
66475	198
66476	198
66477	198
66478	198
66479	198
66480	198
66481	198
66482	198
66483	198
66484	198
66485	198
66486	198
66487	198
66488	198

EDP NO.	PAGE
66489	198
66490	198
66491	198
66492	198
66493	198
66494	198
66495	198
66496	198
66497	198
66498	198
66499	198
66500	198
66501	198
66502	198
66503	199
66504	199
66505	199
66506	199
66507	199
66508	199
66509	199
66510	199
66511	199
66512	199
66513	199
66514	199
66515	199
66516	199
66517	199
66518	199
66519	199
66520	199
66521	199
66522	199
66523	199
66524	199
66525	199
66526	199
66527	199
66528	199
66529	199
66530	199
66531	199
66532	199
66533	199
66534	199
66535	199
66536	200
66537	200
66538	200
66539	200
66540	200
66541	200
66542	200
66543	200
66544	200
66545	200
66546	200
66547	200
66548	200
66549	200

EDP NO.	PAGE
66550	200
66551	200
66552	200
66553	200
66554	200
66555	200
66556	200
66557	200
66558	200
66559	200
66560	200
66561	200
66562	200
66563	200
66564	200
66565	200
66566	200
66567	200
66568	201
66569	201
66570	201
66571	201
66572	201
66573	201
66574	201
66575	201
66576	201
66577	201
66578	201
66579	201
66580	201
66581	201
66582	201
66583	201
66584	201
66585	201
66586	201
66587	201
66588	201
66589	201
66590	201
66591	201
66592	201
66593	201
66594	201
66595	201
66596	201
66597	201
66598	201
66599	201
66600	201
66601	201
66602	201
66603	201
66604	201
66605	201
66606	202
66607	202
66608	202
66609	202
66610	202

EDP NO.	PAGE
66611	202
66612	202
66613	202
66614	202
66615	202
66616	202
66617	202
66618	202
66619	202
66620	202
66621	202
66622	202
66623	202
66624	202
66625	202
66626	202
66627	202
66628	202
66629	202
66630	202
66631	202
66632	202
66633	203
66634	203
66635	203
66636	203
66637	203
66638	203
66639	203
66640	203
66641	203
66642	203
66643	203
66644	203
66645	203
66646	203
66647	203
66648	203
66649	203
66650	203
66651	203
66652	203
66653	203
66654	203
66655	203
66656	203
66657	203
66658	203
66659	203
66660	203
66661	203
66662	203
66663	203
66664	203
66665	203
66666	203
66667	204
66668	204
66669	204
66670	204
66671	204

EDP NO.	PAGE
66672	204
66673	204
66674	204
66675	204
66676	204
66677	204
66678	204
66679	204
66680	204
66681	204
66682	204
66683	204
66684	204
66685	204
66686	204
66687	204
66688	204
66689	204
66690	204
66691	204
66692	204
66693	204
66694	205
66695	205
66696	205
66697	205
66698	205
66699	205
66700	205
66701	205
66702	205
66703	205
66704	205
66705	205
66706	205
66707	205
66708	205
66709	206
66710	206
66711	206
66712	206
66713	206
66714	206
66715	206
66716	206
66717	206
66718	206
66719	206
66720	206
66721	206
66722	206
66723	206
66724	206
66725	206
66726	206
66727	206
66728	206
66729	206
66730	206
66731	206
66732	206

EDP Number Index

EDP NO.	PAGE
66733	206
66734	206
66735	207
66736	207
66737	207
66738	207
66739	207
66740	207
66741	207
66742	207
66743	207
66744	207
66745	207
66746	207
66747	207
66748	207
66749	207
66750	207
66751	207
66752	207
66753	207
66754	207
66755	207
66756	207
66757	207
66758	207
66759	207
66760	207
66761	207
66762	207
66763	207
66764	207
66765	207
66766	207
66767	208
66768	208
66769	208
66770	208
66771	208
66772	208
66773	208
66774	208
66775	208
66776	208
66777	208
66778	208
66779	208
66780	208
66781	208
66782	208
66783	208
66784	208
66785	208
66786	208
66787	208
66788	208
66789	208
66790	208
66791	208
66792	208
66793	209
66794	209
66795	209
66796	209
66797	209
66798	209
66799	209
66800	209
66801	209
66802	209
66803	209
66804	209
66805	209
66806	209
66807	209
66808	209
66809	209
66810	209
66811	209
67005	363
67007	363
67009	363
67011	363
67013	363
67015	363
67017	363
67019	363
67021	363
67023	363
67035	363
67037	363
67039	363
67041	363
67043	363
67045	363
67047	363
67049	363
67051	363
67053	363
67060	271
67061	271
67062	271
67063	271
67064	271
67065	271
67066	271
67067	271
67068	271
67069	271
67070	271
67071	271
67072	271
67073	271
67074	271
67075	271
67076	271
67077	271
67078	271
67079	271
67080	271
67081	271
67082	271
67083	271
67084	272
67085	272
67086	272
67087	272
67088	272
67089	272
67090	272
67091	272
67094	272
67095	272
67096	272
67097	272
67098	272
67099	272
67100	272
67101	272
67102	272
67103	272
67104	272
67105	272
67106	272
67107	273
67108	273
67109	273
67110	273
67111	273
67112	273
67113	273
67114	273
67115	273
67116	273
67117	273
67118	273
67119	273
67120	273
67121	273
67122	273
67123	273
67124	273
67125	273
67126	273
67127	273
67128	273
67129	273
67130	273
67131	273
67132	273
67133	273
67134	273
67135	273
67136	273
67137	273
67138	273
67139	273
67140	273
67141	274
67142	274
67143	274
67144	274
67145	274
67146	274
67147	274
67148	274
67149	274
67150	274
67151	274
67152	274
67153	274
67154	274
67155	274
67156	274
67157	274
67158	274
67159	274
67160	274
67161	274
67162	274
67163	274
67164	274
67165	274
67166	274
67167	274
67168	274
67169	275
67170	275
67171	275
67172	275
67173	275
67174	275
67175	275
67176	275
67177	275
67178	275
67179	275
67180	275
67181	275
67182	275
67183	275
67184	275
67185	275
67600	231
67601	231
67602	231
67603	231
67604	231
67605	231
67606	231
67607	231
67608	231
67609	231
67610	231
67611	231
67612	231
67613	231
67614	231
67615	231
67616	231
67617	231
67618	231
67619	231
67620	231
67621	231
67622	231
67623	231
67624	231
67625	231
67626	231
67627	232
67628	232
67629	232
67630	232
67631	232
67632	232
67633	232
67634	232
67635	232
67636	232
67637	232
67638	232
67639	232
67640	232
67641	232
67642	232
67643	232
67644	232
67645	232
67646	232
67647	232
67648	232
67649	232
67650	232
67651	232
67652	232
67653	232
67654	232
67655	233
67656	233
67657	233
67658	233
67659	233
67660	233
67661	233
67662	233
67663	233
67664	233
67665	233
67666	233
67667	233
67668	233
67669	233
67670	233
67671	233
67672	233
67673	233
67674	233
67675	233
67676	233
67677	233
67678	233
67679	233
67680	233
67681	233
67682	233
67683	233
67684	233
67685	233
67686	233
67687	233
67688	233
67689	233
67690	234
67691	234
67692	234
67693	234
67694	234
67695	234
67696	234
67697	234
67698	234
67699	234
67700	234
67701	234
67702	234
67705	262
67706	262
67707	262
67708	262
67709	262
67710	262
67711	262
67712	262
67713	262
67714	262
67715	262
67716	262
67717	262
67718	262
67719	262
67720	262
67721	262
67724	262
67725	262
67726	263
67727	263
67728	263
67729	263
67730	263
67731	263
67732	263
67733	263
67734	263
67735	263
67736	263
67737	263
67738	263
67739	263
67740	263
67741	263
67742	263
67743	263
67744	263
67745	263
67746	263
67747	263
67748	263
67749	263
67750	263
67751	263
67752	263
67753	263
67754	263
67755	263
67756	263
67757	263
67758	263
67759	264
67760	264
67761	264
67762	264
67763	264
67764	264
67765	264
67766	264
67767	264
67768	264
67769	264
67770	264
67771	264
67772	264
67773	264
67774	264
67775	264
67776	264
67777	264
67778	264
67779	264
67780	264
67781	264
67782	264
67783	264
67784	264
67785	265
67786	265
67787	265
67788	265
67789	265
67790	265
67791	265
67792	265
67793	265
67794	265
67795	265
67796	265
67797	265
67798	265
67799	265
67800	265
67801	265
67802	265
67803	265
67804	265
67805	265
67806	265
67807	265

EDP Number Index

EDP NO.	PAGE
67808	265
67809	265
67810	266
67811	266
67812	266
67813	266
67814	266
67815	266
67816	267
67817	267
67818	267
67819	267
67820	267
67821	267
67822	267
67823	267
67824	267
67825	267
67826	267
67827	267
67828	267
67829	267
67830	267
67831	267
67832	267
67835	267
67836	267
67837	267
67838	267
67839	267
67840	268
67841	268
67842	268
67843	268
67844	268
67845	268
67846	268
67847	268
67848	268
67849	268
67850	268
67851	268
67852	268
67853	268
67854	268
67855	268
67856	268
67857	268
67858	268
67859	268
67860	268
67861	268
67862	268
67863	268
67864	268
67865	268
67866	268
67867	268
67868	268
67869	268
67870	268
67871	268
67872	269
67873	269
67874	269
67875	269
67876	269
67877	269
67878	269
67879	269
67880	269
67881	269
67882	269
67883	269
67884	269
67885	269
67886	269
67887	269
67888	269
67889	269
67890	269
67891	269
67892	269
67893	269
67894	269
67895	269
67896	269
67897	269
67898	269
67899	269
67900	269
67901	269
67902	269
67903	269
67904	269
67905	269
67906	269
67907	269
67908	270
67909	270
67910	270
67911	270
67912	270
67913	270
67914	270
67915	270
67916	270
67917	270
67918	270
67919	270
67920	270
67921	270
67922	270
67923	270
67924	270
67925	270
67926	270
68268	340
68269	340
68270	340
68271	340
68272	340
68273	341
68274	341
68275	341
68276	341
68277	342
68278	342
68279	342
68280	342
68281	343
68282	343
68283	343
68284	343
68285	343
68286	343
68287	344
68288	344
68289	344
68290	344
68291	344
68292	344
68293	344
68294	340
68295	340
68296	340
68297	340
68298	340
68299	340
68300	341
68301	341
68302	341
68303	341
68304	341
68305	341
68306	341
68307	341
68308	341
68309	341
68310	341
68311	341
68312	341
68313	341
68314	341
68315	341
68316	341
68317	342
68318	342
68319	342
68320	342
68321	342
68322	342
68323	342
68324	342
68325	342
68326	342
68327	342
68328	342
68329	342
68330	342
68331	343
68332	343
68333	343
68334	343
68335	343
68336	343
68337	343
68338	343
68339	343
68340	343
68341	343
68342	343
68343	343
68344	343
68345	343
68346	343
68347	343
68348	343
68349	343
68350	343
68351	343
68352	343
68353	343
68354	344
68355	344
68356	344
68357	344
68358	344
68359	344
68360	344
68361	344
68362	344
68363	344
68364	344
68365	344
68366	344
68603	347
68604	347
68606	347
68607	347
68608	347
68609	347
68611	347
68612	347
68613	347
68614	347
68616	347
68643	345
68644	345
68645	345
68646	345
68647	345
68648	345
68649	345
68650	345
68651	345
68652	345
68653	345
68654	345
68655	345
68656	345
68657	345
68658	345
68659	345
68660	345
68661	345
68662	345
68663	345
68664	345
68665	345
68666	345
68667	345
68668	345
68669	345
68670	345
68671	345
68672	345
68673	345
68674	345
68675	345
68676	345
68677	346
68678	346
68679	346
68680	346
68681	346
68682	346
68683	346
68684	346
68685	346
68686	346
68687	346
68688	346
68689	346
68690	346
68691	346
68692	346
68693	346
68694	346
68695	346
68696	346
68697	346
68698	346
68699	346
68700	346
68701	346
68702	346
68703	346
68704	346
68705	346
68706	346
68707	346
68708	346
68709	347
68710	347
68711	347
68712	347
68713	347
68718	347
68723	347
68728	347
68733	347
68738	347
68743	347
68748	347
68753	347
68758	347
68763	347
68768	347
68773	347
68778	347
68780	347
68965	356
68966	356
68967	356
68968	356
68969	356
68970	356
68971	356
68972	356
68973	356
68974	356
68975	356
68976	356
68977	356
68978	356
68979	356
68980	357
68981	357
68982	357
68983	357
68984	357
68985	357
68986	357
68987	357
68988	357
68989	357
68990	357
68991	357
68992	357
68993	357
68994	357
68995	357
68996	357
68997	357
68998	357
68999	357
69000	357
69001	357
69002	357
69003	358
69004	358
69005	358
69006	358
69007	358
69008	358
69009	358
69010	358
69011	358
69012	358
69013	358
69014	358
69015	358
69016	358
69017	358
69018	358
69019	358
69020	358
69021	358
69022	358
69023	358
69024	358
69025	358
69026	359
69027	359
69028	359
69029	359
69030	359
69031	359
69032	359
69033	359
69034	359
69035	359
69036	359
69037	359
69038	359
69039	359
69040	359
69041	359
69042	359
69043	359
69044	359
69045	359
69046	359
69047	359
69048	359
69049	359
69050	359
69051	359
69052	359
69053	359
69054	359
69055	359
69056	359
69120	214
69121	214
69122	214
69123	214
69124	214
69125	214
69126	214
69127	214
69128	214
69129	214
69130	214
69131	214
69132	214
69133	214
69134	214
69135	214
69136	214
69137	214
69138	214
69139	214
69140	214
69141	214
69142	214

EDP Number Index

EDP NO.	PAGE
69143	214
69144	214
69145	214
69146	214
69147	215
69148	215
69149	215
69150	215
69151	215
69152	215
69153	215
69154	215
69155	215
69156	215
69157	215
69158	215
69159	215
69160	215
69161	215
69162	215
69163	215
69164	215
69165	215
69166	215
69167	215
69168	215
69169	215
69170	215
69171	215
69172	215
69173	215
69174	215
69175	215
69176	215
69177	215
69178	215
69179	215
69180	215
69181	216
69182	216
69183	216
69184	216
69185	216
69186	216
69187	216
69188	216
69189	216
69190	216
69191	216
69192	216
69193	216
69194	216
69195	216
69196	216
69197	216
69198	216
69199	216
69200	216
69201	216
69202	216
69203	216

EDP NO.	PAGE
69204	216
69205	216
69206	216
69207	216
69208	216
69209	216
69210	217
69211	217
69212	217
69213	217
69214	217
69215	217
69216	217
69217	217
69218	217
69219	217
69220	217
69221	217
69222	217
69223	218
69224	218
69225	218
69226	218
69227	218
69228	218
69229	218
69230	218
69231	218
69232	218
69233	218
69234	218
69235	218
69236	218
69237	218
69238	218
69239	218
69240	218
69241	218
69242	218
69243	218
69244	218
69245	218
69246	218
69247	218
69248	218
69249	218
69250	219
69251	219
69252	219
69253	219
69254	219
69255	219
69256	219
69257	219
69258	219
69259	219
69260	219
69261	219
69262	219
69263	219
69264	219

EDP NO.	PAGE
69265	219
69266	219
69267	219
69268	219
69269	219
69270	219
69271	219
69272	219
69273	219
69274	219
69275	219
69276	219
69277	219
69278	219
69279	219
69280	219
69281	219
69282	219
69283	219
69284	220
69285	220
69286	220
69287	220
69288	220
69289	220
69290	220
69291	220
69292	220
69293	220
69294	220
69295	220
69296	220
69297	220
69298	220
69299	220
69300	220
69301	220
69302	220
69303	220
69304	220
69305	220
69306	220
69307	220
69308	220
69309	220
69310	220
69311	220
69312	220
69313	221
69314	221
69315	221
69316	221
69317	221
69318	221
69319	221
69320	221
69321	221
69322	221
69323	221
69324	221
69325	221

EDP NO.	PAGE
70003	378
70004	378
70005	378
70006	378
70007	378
70008	378
70009	378
70010	378
70011	378
70012	378
70013	378
70014	378
70015	378
70016	378
70017	378
70018	378
70019	378
70020	378
70021	378
70022	378
70023	378
70024	378
70025	378
70026	378
70027	378
70028	378
70029	378
70030	378
70031	378
70032	378
70441	118
70442	118
70444	118
70445	118
70447	118
70448	118
70450	118
70451	118
70453	118
70454	118
70456	118
70457	118
70459	118
70460	118
70462	118
70463	118
70465	118
70466	118
70468	118
70469	118
70470	117
70471	117
70472	117
70473	117
70474	117
70475	117
70476	117
70477	117
70478	117
70479	117
70480	117

EDP NO.	PAGE
70481	117
70482	117
70483	117
70484	117
70485	117
70486	117
70487	117
70488	117
70489	117
70527	120
70529	120
70531	120
70533	120
70535	120
70537	120
70539	120
70540	120
70542	120
70544	120
70546	120
70548	120
70550	120
70551	120
70552	120
70553	120
70554	120
70555	120
70556	120
70557	120
70558	120
70559	120
70560	120
70561	120
70562	120
70563	120
72930	390
72947	390
72948	390
72949	390
72950	390
72951	390
72952	390
72953	390
72954	394
72955	394
72956	394
72957	394
72958	394
72959	394
72960	394
72961	394
72962	394
72963	394
72964	394
72965	394
72966	394
72967	394
72968	394
72969	394
72970	397
72971	397

EDP NO.	PAGE
72972	397
72973	397
72974	397
72975	397
72976	397
72977	397
72978	127
72979	127
72980	127
72981	127
72982	127
72983	127
72984	127
72985	127
73012	390
73013	390
73014	390
73026	390
73027	390
73028	390
73029	390
73041	390
73070	391
73071	391
73072	391
73073	391
73074	391
73075	391
73078	391
73079	391
73080	391
73081	391
73082	391
73083	391
74001	368
74004	368
74007	368
74010	368
74013	368
74016	368
74019	368
74022	368
74025	371
74028	371
74031	371
74034	371
74037	371
74040	371
74043	371
74046	371
74049	374
74052	374
74055	374
74058	374
74061	374
74064	374
74067	374
74070	374
74101	368
74104	368
74107	368

EDP NO.	PAGE
74110	368
74113	368
74116	368
74119	368
74122	368
74125	371
74128	371
74131	371
74134	371
74137	371
74140	371
74143	371
74146	371
74149	374
74152	374
74155	374
74158	374
74161	374
74164	374
74167	374
74170	374
74201	368
74204	368
74207	368
74210	368
74213	368
74216	368
74219	368
74222	368
74225	371
74228	371
74231	371
74234	371
74237	371
74240	371
74243	371
74246	371
74249	374
74252	374
74255	374
74258	374
74261	374
74264	374
74267	374
74270	374
74300	98
74301	98
74302	98
74303	98
74304	98
74305	98
74306	98
74307	98
74308	98
74309	98
74310	98
74311	98
74316	98
74317	98
74318	98
74319	98

EDP Number Index

EDP NO.	PAGE
74320	98
74321	98
74322	98
74323	98
74324	98
74325	98
74326	98
74327	98
74332	98
74333	98
74334	98
74335	98
74336	98
74337	98
74338	98
74339	98
74340	98
74341	98
74342	98
74343	98
74348	98
74349	98
74350	98
74351	98
74352	98
74353	98
74354	98
74355	98
74356	98
74357	98
74358	98
74359	98
74360	98
74361	98
74362	98
74363	98
74364	98
74365	98
74366	98
74367	98
74368	98
74369	98
74370	98
74371	98
74372	98
74373	98
74374	98
74375	98
74376	98
74377	98
74378	98
74379	98
74380	98
74381	98
74382	98
74383	98
74384	98
74385	98
74386	98
74387	98
74388	98
74389	98
74390	98
74391	98
74392	98
74393	98
74394	98
74395	98
74396	98
74397	98
74398	98
74399	98
74400	98
74401	98
74402	98
74403	98
74404	98
74405	98
74406	98
74407	98
74408	98
74409	98
74410	98
74411	98
74412	98
74413	98
74414	98
74415	98
74416	98
74417	98
74418	98
74419	98
74420	98
74421	98
74422	98
74423	98
74424	98
74425	98
74426	98
74427	98
74428	98
74429	98
74430	98
74431	98
74432	98
74433	98
74434	98
74435	98
74436	98
74437	98
74438	98
74439	98
74440	98
74441	98
74442	98
74443	98
74444	99
74445	99
74446	99
74447	99
74448	99
74449	99
74450	99
74451	99
74452	99
74453	99
74454	99
74455	99
74456	99
74457	99
74458	99
74459	99
74460	99
74461	99
74462	99
74463	99
74464	99
74465	99
74466	99
74467	99
74468	99
74469	99
74470	99
74471	99
74472	99
74473	99
74474	99
74475	99
74476	99
74477	99
74478	99
74479	99
74480	99
74481	99
74482	99
74483	99
74484	99
74485	99
74486	99
74487	99
74488	99
74489	99
74490	99
74491	99
74492	99
74493	99
74494	99
74495	99
74496	99
74497	99
74498	99
74499	99
74500	99
74501	99
74502	99
74503	99
74504	99
74505	99
74506	99
74507	99
74508	99
74509	99
74510	99
74511	99
74512	99
74513	99
74514	99
74515	99
74516	99
74517	99
74518	99
74519	99
74520	99
74521	99
74522	99
74523	99
74524	99
74525	99
74526	99
74527	99
74528	100
74529	100
74530	100
74531	100
74532	100
74533	100
74534	100
74535	100
74536	100
74537	100
74538	100
74539	100
74540	100
74541	100
74542	100
74543	100
74544	100
74545	100
74546	100
74547	100
74548	100
74549	100
74550	100
74551	100
74552	100
74553	100
74554	100
74555	100
74556	100
74557	100
74558	100
74559	100
74560	100
74561	100
74562	100
74563	100
74564	100
74565	100
74566	100
74567	100
74568	100
74569	100
74570	100
74571	100
74572	100
74573	100
74574	100
74575	100
74576	100
74577	100
74578	100
74579	100
74580	100
74581	100
74582	100
74583	100
74584	100
74585	100
74586	100
74587	100
74588	100
74589	100
74590	100
74591	100
74592	100
74593	100
74594	100
74595	100
74596	100
74597	100
74598	100
74599	100
74600	98
74601	98
74602	98
74603	98
74604	99
74605	99
74606	99
74607	99
74608	99
74609	99
74610	99
74611	99
74612	99
74613	99
74614	99
74615	99
74616	99
74617	99
74618	99
74619	99
74620	99
74621	99
74622	99
74623	99
74624	99
74625	99
74626	99
74627	99
74628	99
74629	99
74630	99
74631	99
74632	99
74633	99
74634	99
74635	99
74636	99
74637	99
74638	99
74639	99
74640	99
74641	99
74642	99
74643	99
74644	99
74645	99
74646	99
74647	99
74648	99
74649	99
74650	99
74651	99
74652	99
74653	99
74654	99
74655	99
74656	100
74657	100
74658	100
74659	100
74660	100
74661	100
74662	100
74663	100
74664	100
74665	100
74666	100
74667	100
74668	100
74669	100
74670	100
74671	100
74672	98
74673	98
74674	98
74675	98
74676	98
74677	98
74678	98
74679	98
74680	98
74681	98
74682	98
74683	98
74684	98
74685	98
74686	98
74687	98
74688	99
74689	99
74690	99
74691	99
74692	99
74693	99
74694	99
74695	99
74696	99
74697	99
74698	99
74699	99
74700	99
74701	99
74702	99
74703	99
74704	99
74705	99
74706	99
74707	99
74708	99
74709	99
74710	99
74711	99
74712	99
74713	99
74714	99
74715	99
74716	99
74717	99
74718	99
74719	99
74720	99
74721	99
74722	99
74723	99
74724	99
74725	99
74726	99
74727	99
74728	99
74729	99
74730	99
74731	99
74732	99
74733	99
74734	99
74735	99
74736	99
74737	99
74738	99
74739	99
74740	99
74741	99
74742	99
74743	99
74744	99
74745	99
74746	99
74747	99
74748	99
74749	99
74750	99
74751	99
74752	99
74753	99
74754	99

EDP Number Index

EDP NO.	PAGE
74755	99
74756	99
74757	99
74758	99
74759	99
74760	99
74761	99
74762	99
74763	99
74764	99
74765	99
74766	99
74767	99
74768	99
74769	99
74770	99
74771	99
74772	99
74773	99
74774	99
74775	99
74776	99
74777	99
74778	99
74779	99
74780	99
74781	99
74782	99
74783	99
74784	99
74785	99
74786	99
74787	99
74788	99
74789	99
74790	99
74791	99
74792	99
74793	99
74794	99
74795	99
74796	99
74797	99
74798	99
74799	99
74800	99
74801	99
74802	99
74803	99
74804	99
74805	99
74806	99
74807	99
74808	99
74809	99
74810	99
74811	99
74812	99
74813	99
74814	99
74815	99

EDP NO.	PAGE
74816	99
74817	99
74818	99
74819	99
74820	99
74821	99
74822	99
74823	99
74824	100
74825	100
74826	100
74827	100
74828	100
74829	100
74830	100
74831	100
74832	100
74833	100
74834	100
74835	100
74836	100
74837	100
74838	100
74839	100
74840	100
74841	100
74842	100
74843	100
74844	100
74845	100
74846	100
74847	100
74848	100
74849	100
74850	100
74851	100
74852	100
74853	100
74854	100
74855	100
74856	100
74857	100
74858	100
74859	100
74860	100
74861	100
74862	100
74863	100
74864	100
74865	100
74866	100
74867	100
74868	100
74869	100
74870	100
74871	100
74872	100
74873	100
74874	100
74875	100
74876	100

EDP NO.	PAGE
74877	100
74878	100
74879	100
74880	100
74881	100
74882	100
74883	100
74884	100
74885	100
74886	100
74887	100
74888	100
74889	100
74890	100
74891	100
74892	100
74893	100
74894	100
74895	100
74896	100
74897	100
74898	100
74899	100
74900	100
74901	100
74902	100
74903	100
74904	100
74905	100
74906	100
74907	100
74908	100
74909	100
74910	100
74911	100
77100	94
77101	94
77102	94
77103	94
77104	94
77105	94
77106	94
77107	94
77108	94
77109	94
77110	94
77111	94
77112	94
77113	94
77114	94
77115	94
77116	94
77117	94
77118	94
77119	94
77120	94
77121	94
77122	94
77123	94
77124	94
77125	94

EDP NO.	PAGE
77126	94
77127	94
77128	94
77129	94
77130	94
77131	94
77132	94
77133	94
77134	94
77135	94
77136	94
77137	94
77138	94
77139	94
77140	94
77141	94
77142	94
77143	94
77144	94
77145	94
77146	94
77147	94
77148	94
77149	94
77150	94
77151	94
77152	94
77153	94
77154	94
77155	94
77156	94
77157	94
77158	94
77159	94
77160	94
77161	94
77162	94
77163	94
77164	94
77165	94
77166	94
77167	94
77168	94
77169	94
77170	94
77171	94
77172	94
77173	94
77174	94
77175	94
77176	94
77177	94
77178	94
77179	94
77180	94
77181	94
77182	94
77183	94
77184	94
77185	94
77186	94

EDP NO.	PAGE
77187	94
77188	94
77189	94
77190	94
77191	94
77192	94
77193	94
77194	94
77195	94
77196	94
77197	94
77198	94
77199	94
77200	94
77201	94
77202	94
77203	94
77204	94
77205	94
77206	94
77207	94
77208	94
77209	94
77210	94
77211	94
77212	94
77213	94
77214	94
77215	94
77216	94
77217	94
77218	94
77219	94
77220	95
77221	95
77222	95
77223	95
77224	95
77225	95
77226	95
77227	95
77228	95
77229	95
77230	95
77231	95
77232	95
77233	95
77234	95
77235	95
77236	95
77237	95
77238	95
77239	95
77240	95
77241	95
77242	95
77243	95
77244	95
77245	95
77246	95
77247	95

EDP NO.	PAGE
77248	95
77249	95
77250	95
77251	95
77252	95
77253	95
77254	95
77255	95
77256	95
77257	95
77258	95
77259	95
77260	95
77261	95
77262	95
77263	95
77264	95
77265	95
77266	95
77267	95
77268	95
77269	95
77270	95
77271	95
77272	95
77273	95
77274	95
77275	95
77276	95
77277	95
77278	95
77279	95
77280	95
77281	95
77282	95
77283	95
77284	95
77285	95
77286	95
77287	95
77288	95
77289	95
77290	95
77291	95
77292	95
77293	95
77294	95
77295	95
77296	95
77297	95
77298	95
77299	95
77300	95
77301	95
77302	95
77303	95
77304	95
77305	95
77306	95
77307	95
77308	95

EDP NO.	PAGE
77309	95
77310	95
77311	95
77312	95
77313	95
77314	95
77315	95
77316	95
77317	95
77318	95
77319	95
77320	95
77321	95
77322	95
77323	95
77324	95
77325	95
77326	95
77327	95
77328	95
77329	95
77330	95
77331	95
77332	95
77333	95
77334	95
77335	95
77336	95
77337	95
77338	95
77339	95
77340	94
77341	94
77342	94
77343	94
77344	94
77345	94
77346	94
77347	94
77348	94
77349	94
77350	94
77351	94
77352	94
77353	94
77354	94
77355	94
77356	94
77357	94
77358	94
77359	94
77360	94
77361	94
77362	94
77363	94
77364	94
77365	94
77366	94
77367	94
77368	94
77369	94

EDP Number Index

EDP NO.	PAGE
77370	94
77371	94
77372	94
77373	94
77374	94
77375	94
77376	94
77377	94
77378	94
77379	94
77380	94
77381	94
77382	94
77383	94
77384	94
77385	94
77386	94
77387	94
77388	95
77389	95
77390	95
77391	95
77392	95
77393	95
77394	95
77395	95
77396	95
77397	95
77398	95
77399	95
77400	95
77401	95
77402	95
77403	95
77404	95
77405	95
77406	95
77407	95
77408	95
77409	95
77410	95
77411	95
77412	95
77413	95
77414	95
77415	95
77416	95
77417	95
77418	95
77419	95
77420	95
77421	95
77422	95

EDP NO.	PAGE
77423	95
77424	95
77425	95
77426	95
77427	95
77428	95
77429	95
77430	95
77431	95
77432	95
77433	95
77434	95
77435	95
77436	95
77437	95
77438	95
77439	95
77440	95
77441	95
77442	95
77443	95
77444	95
77445	95
77446	95
77447	95
77448	95
77449	95
77450	95
77451	95
77452	95
77453	95
77454	95
77455	95
77456	95
77457	95
77458	95
77459	95
77460	95
77461	95
77462	95
77463	95
77464	95
77465	95
77466	95
77467	95
77468	95
77469	95
77470	95
77471	95
77472	95
77473	95
77474	95
77475	95

EDP NO.	PAGE
77476	95
77477	95
77478	95
77479	95
77480	95
77481	95
77482	95
77483	95
77484	95
77485	95
77486	95
77487	95
77488	95
77489	95
77490	95
77491	95
77492	95
77493	95
77494	95
77495	95
77496	95
77497	95
77498	95
77499	95
77500	95
77501	95
77502	95
77503	95
77504	95
77505	95
77506	95
77507	95
81001	382
81003	382
81005	382
81007	382
81009	382
81011	382
81013	382
81015	382
81017	382
81019	382
81021	382
81023	382
81025	382
81027	382
81029	382
82930	390
82931	390
82932	390
82933	390
82966	390
82967	390

EDP NO.	PAGE
82968	390
82969	390
82970	390
82971	390
82972	390
82973	390
82974	394
82975	394
82976	394
82977	394
82978	394
82979	394
82980	394
82981	394
82982	394
82983	394
82984	394
82985	394
82986	394
82987	394
82988	394
82989	394
82990	397
82991	397
82992	397
82993	397
82994	397
82995	397
82996	397
82997	397
83026	390
83027	390
83028	390
83029	390
83041	390
83042	390
83043	390
83044	390
83056	127
83057	127
83058	127
83059	127
83060	127
83061	127
83062	127
83063	127
83064	127
83065	127
83070	390
83071	390
83072	390
83073	390
83100	390

EDP NO.	PAGE
83101	390
83102	390
83103	390
83104	390
83105	390
83106	390
83107	390
83108	390
83109	390
83110	390
83111	390
83200	394
83201	394
83202	394
83203	394
83204	394
83205	394
83206	394
83207	394
83220	391
83221	391
83222	391
83223	391
83224	391
83225	391
83230	391
83231	391
83232	391
83233	391
83234	391
83235	391
90001	400
90005	400
90009	400
90013	400
90017	400
90021	400
90025	400
90029	400
90033	400
90037	400
90041	400
90045	400
90049	400
90053	400
90101	400
90107	400
90109	400
90113	400
90121	400
90129	400
90137	400
91001	401

EDP NO.	PAGE
91005	401
91009	401
91013	401
91017	401
91021	401
91025	401
91029	401
91033	401
91037	401
91041	401
91045	401
91049	401
91053	401
91101	401
91107	401
91109	401
91113	401
91121	401
91129	401
91137	401
91235	184
91236	184
91237	184
91238	184
91239	184
91240	184
91241	184
91242	184
91243	184
91244	184
91245	184
91246	184
91247	184
91248	184
91250	184
91251	184
91252	184
91253	184
91254	184
91255	184
91256	184
91257	184
91258	184
91259	184
91260	184
91261	184
91262	184
91263	184
91266	288
91267	291
91268	307
91269	311
91270	288

EDP NO.	PAGE
91271	291
91272	307
91273	311
91274	288
91275	291
91276	307
91277	311
91278	288
91279	291
91280	307
91281	311
91282	289
91283	291
91284	308
91285	311
91286	289
91287	292
91288	308
91289	311
91290	289
91291	292
91292	309
91293	312
91349	122
91350	122
91351	122
91352	122
91353	122
91354	122
91355	122
91356	122
91357	122
91358	122
91359	122
91360	122
91361	122
93272	122
93273	122
93274	122
93275	122
93276	122
93277	122
93278	122
93279	122
93280	122
93281	122
93282	122

KSPT Reference Information

ISO h6 SPECIFICATIONS					
DIAMETER	+	–	DIAMETER	+	–
≥ 1/8 - 3/16	0.00000	–0.00032	≤ 3	0,000	0,006
> 3/16 - 7/16	0.00000	–0.00035	> 3 - 6	0,000	0,008
> 7/16 - 5/8	0.00000	–0.00043	> 6 - 10	0,000	0,009
> 5/8 - 1	0.00000	–0.00051	> 10 - 18	0,000	0,011
> 1 - 1-1/4	0.00000	–0.00063	> 18 - 25	0,000	0,013

MACHINING FORMULAS

INCH FORMULAS	METRIC FORMULAS
sfm = rpm x .262 x cutting diameter	m/min = (3.14 x cutting diameter x rpm) / 1000
rpm = sfm x 3.82 / cutting diameter	rpm = (1000 x m / min) / (3.14 x cutting diameter)
feed (inches per tooth) = ipm / (number of teeth x rpm)	feed (mm per tooth) = millimeters per minute / (number of teeth x rpm)
feed (inches / minute) = inches per tooth x number of teeth x rpm	feed (mm/minute) = feed per tooth x number of teeth x rpm
feed (inches / minute) = ipr x rpm	feed (mm/minute) = mmr x rpm
feed (inches / revolution) = ipm / rpm	feed (mm per revolution) = mmr / rpm
cusp height = (tool diameter / 2) – $\sqrt{(\text{tool diameter}^2 - \text{pitch}^2) / 4}$	cusp height = (tool diameter / 2) – $\sqrt{(\text{tool diameter}^2 - \text{pitch}^2) / 4}$
pitch = $\sqrt{4 \times (\text{cusp height} \times \text{tool diameter}) - 4 \times (\text{cusp height}^2)}$	pitch = $\sqrt{4 \times (\text{cusp height} \times \text{tool diameter}) - 4 \times (\text{cusp height}^2)}$
mrr – milling – (in^3/min) = width of cut x depth of cut x ipm	mrr – milling – (cm^3/min) = (width of cut x depth of cut x mm/min) / 1000
cutting time – drilling – (minutes) = length / ipm	cutting time – drilling – (minutes) = length / mm/min

sfm	surface feet per minute
rpm	revolutions per minute
ipm	feed rate in inches per minutes
ipr	inches per revolution
mmr	millimeters per revolution
mm/min	feed rate in millimeters per minute
mrr	material removal rate on flat surface

GENERAL FORMULAS

coolant pressure: 1 Bar = 14.5 Pounds per Square Inch (PSI)

calculation of coolant pressure: Pounds Per Square Inch (PSI) = (Horsepower of Pump x 1.460) / Gallons per Minute (GPM)

1 Liter = 0.254 Gallons

inch = millimeters / 25.4 millimeters = inch x 25.4

inch tap drill sizes = major diameter – ((1.299 x % of thread) / threads per inch)

metric tap drill sizes = major diameter – (1.082 x pitch x % of thread)

inch thread forming drill size: maximum diameter = basic major diameter – (3/8 x number of threads per inch)

inch thread forming drill size: minimum diameter = basic major diameter – (1/2 x number of threads per inch)

metric thread forming drill size: maximum diameter = basic major diameter – (.375 x pitch)

metric thread forming drill size: minimum diameter = basic major diameter – (.500 x pitch)

Decimal Equivalents

Fraction • Number • Letter • Metric Sizes

INCH	METRIC	DECIMAL EQUIVALENT
–	0,10	0.0039
–	0,20	0.0079
–	0,25	0.0098
–	0,30	0.0118
#80	0,34	0.0135
–	0,35	0.0138
#79	0,37	0.0145
1/64	0,40	0.0156
#78	0,41	0.0160
–	0,45	0.0177
#77	0,46	0.0180
–	0,50	0.0197
#76	0,51	0.0200
#75	0,53	0.0210
–	0,55	0.0217
#74	0,57	0.0225
–	0,60	0.0236
#73	0,61	0.0240
#72	0,64	0.0250
–	0,65	0.0256
#71	0,66	0.0260
–	0,70	0.0276
#70	0,71	0.0280
#69	0,74	0.0292
–	0,75	0.0295
#68	0,79	0.0310
1/32	0,79	0.0313
–	0,80	0.0315
#67	0,81	0.0320
#66	0,84	0.0330
–	0,85	0.0335
#65	0,89	0.0350
–	0,90	0.0354
#64	0,91	0.0360
#63	0,94	0.0370
–	0,95	0.0374
#62	0,97	0.0380
#61	0,99	0.0390
–	1,00	0.0394
#60	1,02	0.0400
#59	1,04	0.0410
–	1,05	0.0413
#58	1,07	0.0420
#57	1,09	0.0430
–	1,10	0.0433
–	1,15	0.0453
#56	1,18	0.0465
3/64	1,19	0.0469
–	1,20	0.0472
–	1,25	0.0492
–	1,30	0.0512
#55	1,32	0.0520
–	1,35	0.0531
#54	1,40	0.0550
#53	1,51	0.0595
–	1,55	0.0610
1/16	1,59	0.0625

INCH	METRIC	DECIMAL EQUIVALENT
–	1,60	0.0630
#52	1,61	0.0635
–	1,65	0.0650
#51	1,70	0.0669
–	1,75	0.0689
#50	1,78	0.0700
–	1,80	0.0709
#49	1,85	0.0728
–	1,90	0.0748
#48	1,93	0.0760
–	1,95	0.0768
5/64	1,98	0.0781
#47	1,99	0.0785
–	2,00	0.0787
–	2,05	0.0807
#46	2,06	0.0810
#45	2,08	0.0820
–	2,10	0.0827
–	2,15	0.0846
#44	2,18	0.0860
–	2,20	0.0866
–	2,25	0.0886
#43	2,26	0.0890
–	2,30	0.0906
–	2,35	0.0925
#42	2,37	0.0935
3/32	2,38	0.0938
–	2,40	0.0945
#41	2,44	0.0960
–	2,45	0.0965
#40	2,50	0.0984
#39	2,53	0.0995
#38	2,58	0.1015
–	2,60	0.1024
#37	2,64	0.1040
–	2,70	0.1063
#36	2,71	0.1065
–	2,75	0.1083
7/64	2,78	0.1094
#35	2,79	0.1100
–	2,80	0.1102
#34	2,82	0.1110
#33	2,87	0.1130
–	2,90	0.1142
#32	2,95	0.1160
–	3,00	0.1181
#31	3,05	0.1200
–	3,10	0.1220
1/8	3,18	0.1250
–	3,20	0.1260
–	3,25	0.1280
#30	3,26	0.1285
–	3,30	0.1299
–	3,40	0.1339
#29	3,45	0.1360
–	3,50	0.1378
#28	3,57	0.1405

INCH	METRIC	DECIMAL EQUIVALENT
9/64	3,57	0.1406
–	3,60	0.1417
#27	3,66	0.1440
–	3,70	0.1457
#26	3,73	0.1470
–	3,75	0.1476
#25	3,80	0.1495
–	3,80	0.1496
#24	3,86	0.1520
–	3,90	0.1535
#23	3,91	0.1540
5/32	3,97	0.1562
#22	3,99	0.1570
–	4,00	0.1575
#21	4,04	0.1590
#20	4,09	0.1610
–	4,10	0.1614
–	4,20	0.1654
#19	4,22	0.1660
–	4,25	0.1673
–	4,30	0.1693
#18	4,31	0.1695
11/64	4,37	0.1719
#17	4,39	0.1730
–	4,40	0.1732
#16	4,50	0.1770
–	4,50	0.1772
#15	4,57	0.1800
–	4,60	0.1811
#14	4,62	0.1820
#13	4,70	0.1850
–	4,75	0.1870
3/16	4,76	0.1875
#12	4,80	0.1890
#11	4,85	0.1910
–	4,90	0.1929
#10	4,91	0.1935
#9	4,98	0.1960
–	5,00	0.1969
#8	5,05	0.1990
–	5,10	0.2008
#7	5,11	0.2010
13/64	5,16	0.2031
#6	5,18	0.2040
–	5,20	0.2047
#5	5,22	0.2055
–	5,25	0.2067
–	5,3	0.2087
#4	5,31	0.2090
–	5,40	0.2126
#3	5,41	0.2130
–	5,50	0.2165
7/32	5,56	0.2188
–	5,60	0.2205
#2	5,61	0.2210
–	5,70	0.2244
–	5,75	0.2264

INCH	METRIC	DECIMAL EQUIVALENT
#1	5,79	0.2280
–	5,80	0.2283
–	5,90	0.2323
A	5,94	0.2340
15/64	5,95	0.2344
–	6,00	0.2362
B	6,05	0.2380
–	6,10	0.2402
C	6,15	0.2420
–	6,20	0.2441
D	6,25	0.2461
–	6,30	0.2480
E	6,35	0.2500
1/4	6,35	0.2500
–	6,40	0.2520
–	6,50	0.2559
F	6,53	0.2570
–	6,60	0.2598
G	6,63	0.2610
–	6,70	0.2638
17/64	6,75	0.2656
H	6,76	0.2660
–	6,80	0.2677
–	6,90	0.2717
I	6,91	0.2720
–	7,00	0.2756
J	7,04	0.2770
–	7,10	0.2795
K	7,14	0.2810
9/32	7,14	0.2812
–	7,20	0.2835
–	7,25	0.2854
–	7,30	0.2874
L	7,37	0.2900
–	7,40	0.2913
M	7,49	0.2950
–	7,50	0.2953
19/64	7,54	0.2969
–	7,60	0.2992
N	7,67	0.3020
–	7,70	0.3031
–	7,75	0.3051
–	7,80	0.3071
–	7,90	0.3110
5/16	7,94	0.3125
–	8,00	0.3150
O	8,03	0.3160
–	8,10	0.3189
–	8,20	0.3228
P	8,20	0.3230
–	8,25	0.3248
–	8,30	0.3268
21/64	8,33	0.3281
–	8,40	0.3307
Q	8,43	0.3320
–	8,50	0.3346
–	8,60	0.3386

INCH	METRIC	DECIMAL EQUIVALENT
R	8,61	0.3390
–	8,70	0.3425
11/32	8,73	0.3438
–	8,75	0.3445
–	8,80	0.3465
S	8,84	0.3480
–	8,90	0.3504
–	9,00	0.3543
T	9,09	0.3580
–	9,10	0.3583
23/64	9,13	0.3594
–	9,20	0.3622
–	9,25	0.3642
–	9,30	0.3661
U	9,35	0.3680
–	9,40	0.3701
–	9,50	0.3740
3/8	9,53	0.3750
V	9,56	0.3770
–	9,60	0.3780
–	9,70	0.3819
–	9,75	0.3839
W	9,80	0.3858
–	9,90	0.3898
25/64	9,92	0.3906
–	10,00	0.3937
X	10,08	0.3970
–	10,10	0.3976
–	10,20	0.4016
Y	10,26	0.4040
–	10,30	0.4055
13/32	10,32	0.4062
–	10,40	0.4094
Z	10,49	0.4130
–	10,50	0.4134
–	10,60	0.4173
–	10,70	0.4213
27/64	10,72	0.4219
–	10,80	0.4252
–	10,90	0.4291
–	11,00	0.4331
–	11,10	0.4370
7/16	11,11	0.4375
–	11,20	0.4409
–	11,30	0.4449
–	11,40	0.4488
–	11,50	0.4528
29/64	11,51	0.4531
–	11,60	0.4567
–	11,70	0.4606
–	11,80	0.4646
–	11,90	0.4685
15/32	11,91	0.4688
–	12,00	0.4724
31/64	12,30	0.4844
–	12,50	0.4921
1/2	12,70	0.5000

INCH	METRIC	DECIMAL EQUIVALENT
–	13,00	0.5118
33/64	13,10	0.5156
17/32	13,49	0.5312
–	13,50	0.5315
35/64	13,89	0.5469
–	14,00	0.5512
9/16	14,29	0.5625
–	14,50	0.5709
37/64	14,68	0.5781
–	15,00	0.5906
19/32	15,08	0.5938
39/64	15,48	0.6094
–	15,50	0.6102
5/8	15,88	0.6250
–	16,00	0.6299
41/64	16,27	0.6406
–	16,50	0.6496
21/32	16,67	0.6562
–	17,00	0.6693
43/64	17,07	0.6719
11/16	17,46	0.6875
–	17,50	0.6890
45/64	17,86	0.7031
–	18,00	0.7087
23/32	18,26	0.7188
–	18,50	0.7283
47/64	18,65	0.7344
–	19,00	0.7480
3/4	19,05	0.7500
49/64	19,45	0.7656
–	19,50	0.7677
25/32	19,84	0.7812
–	20,00	0.7874
51/64	20,24	0.7969
–	20,50	0.8071
13/16	20,64	0.8125
–	21,00	0.8268
53/64	21,03	0.8281
27/32	21,43	0.8438
–	21,50	0.8465
55/64	21,84	0.8594
–	22,00	0.8661
7/8	22,23	0.8750
–	22,50	0.8858
57/64	22,62	0.8906
–	23,00	0.9055
29/32	23,02	0.9062
59/64	23,42	0.9219
–	23,50	0.9252
15/16	23,81	0.9375
–	24,00	0.9449
61/64	24,21	0.9531
–	24,50	0.9646
31/32	24,61	0.9688
–	25,00	0.9843
63/64	25,00	0.9844
1	25,40	1.0000

Hardness Conversion Chart

ROCKWELL HARDNESS (HRb)	ROCKWELL HARDNESS (HRc)	BRINELL HARDNESS (HB)	VICKERS HARDNESS (HV)	TENSILE STRENGTH (N/mm2)	PSI (1000lb/in2)
67	–	121	122	401	58
70	–	126	127	432	63
73	–	132	132	448	65
75	–	136	137	455	66
77	–	140	143	463	67
80	–	147	150	479	69
82	–	153	156	494	72
84	–	159	163	525	76
86	–	165	171	540	78
89	–	177	178	556	81
91	–	186	188	602	88
93	–	197	196	632	92
96	–	216	212	664	97
97	–	223	218	695	101
98	21	230	234	756	110
–	22	236	241	772	112
–	23	242	247	787	114
–	24	248	255	818	118
–	25	254	261	849	123
–	27	266	269	865	125
–	28	272	275	895	130
–	29	278	284	911	132
–	30	284	292	942	136
–	31	293	300	973	141
–	32	302	308	988	143
–	33	310	318	1019	147
–	34	319	327	1050	152
–	35	328	337	1096	159
–	37	345	349	1127	163
–	38	353	359	1158	168
–	39	362	370	1189	172
–	40	370	381	1235	179
–	41	381	395	1266	183
–	42	391	408	1312	190
–	44	411	422	1359	197
–	45	422	437	1420	206
–	46	433	452	1467	212
–	48	455	470	1513	219
–	50	479	497	1559	226
–	51	485	517	1621	235
–	52	497	532	1668	241
–	54	–	573	1729	250
–	56	–	609	1807	262
–	57	–	630	1884	273
–	59	–	670	1961	284
–	60	–	698	2039	295
–	61	–	725	–	–
–	62	–	740	–	–
–	63	–	780	–	–
–	64	–	812	–	–
–	65	–	847	–	–
–	66	–	885	–	–
–	67	–	926	–	–
–	68	–	971	–	–

Conversions from each scale are approximate

DOGA® | USINAGE

usinage-outils@doga.fr

+33 1 30 66 41 41

8, avenue Gutenberg - CS 50510
78317 Maurepas Cedex - FRANCE

© DOGA | DOC.**10513**.07/26

Nous travaillons constamment à l'amélioration de nos produits. De ce fait, les dimensions et indications portées dans cette brochure peuvent parfois ne pas correspondre aux dernières exécutions. De convention expresse, nos ventes sont faites sous bénéfice de réserve de propriété (les dispositions de la loi du 12/05/1980 trouvent donc toute leur application).